

The effectiveness of the monetary transmission mechanism channel in Turkey

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Abstract

This study investigates on which channels the monetary transmission mechanism works effectively. In this context, quarterly data for the period 2005-2017 is used for Turkey and the variables used to determine the efficiency of the monetary transmission mechanism are analyzed by the VAR method. The obtained results indicate that the loans and reserves have a more effective role on the inflation as a channel of the monetary transmission mechanism. According to the long run results, while the exchange rate and reserves channel have a negative effect on the real GDP, it is revealed that loans have a positive effect on the real GDP in the long run stabilization.

Keywords: monetary transmission mechanism, credit channel, inflation, monetary policy

Introduction

Until the end of the 1960s, effective fiscal policies that were widely applied in global economies, large budget deficits that became chronic, tax practices and decision-making and failures in the implementation of these decisions in a timely manner have been replaced by monetary policies in recent years. In this period, both economists and politicians have argued that monetary policy is more effective in sustaining economic growth and stabilizing inflation. This situation has led monetary policy to become the center of macroeconomic policies. However, the expansionary monetary policies implemented in the beginning of the 1970s in the fight against the oil crises caused countries to both move away from their economic targets and to be dragged into an inflationary process. These developments in the period 1970-1980

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led to the change of the mission of central banks and to shifting priority towards price stability.

In this process, factors such as the effects of the applied policy on the real economy and the occurrence of these effects affect the success rate of the decisions taken by Central Banks for price stability. The most effective means of transferring the monetary policies implemented by central banks in the shortest time and in the most effective way to the real markets are the most effective tools in this process. In fact, this situation makes the monetary transmission mechanism the most important part of the monetary policy in the process of the effect of monetary shocks on the real economy. This situation has led to an increase in researches on the monetary transmission mechanism, which reflects the relationship between monetary policy and real economy, especially after the 1980s.

In the general studies, it is emphasized that different instruments such as exchange rates, loans and asset prices are used in the transmission mechanism. However, factors such as the financial structure of the countries, macroeconomic indicators, socio-cultural factors, cyclical structure, and global economic indicators change the effectiveness of the instruments used and their effects on the country's economy. The main purpose of this study is to highlight the monetary transmission mechanism channels in Turkey and to contribute to the increase of awareness on the subject. The study consists in 6 sections. In the next section, the transmission channels and their processes in the monetary transmission mechanism discussed in the third section, there is a short literature review; in the fourth section, the data set and the method used in the research are discussed and the model to be tested in the research is formed. In the fifth section, the results of the analysis are discussed and in the sixth (and final section), an overview of the findings is provided.

1. Monetary transfer mechanism and channels used in the transfer process

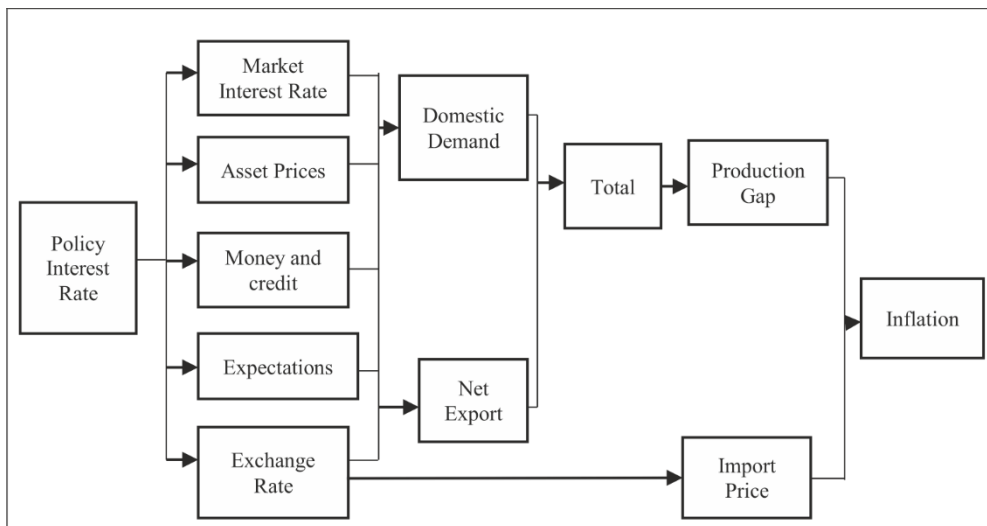
The monetary transmission mechanism is a process that reflects the relationship between monetary policy and real economy. In other words, the monetary transmission mechanism is a mechanism that shows the effects of monetary changes on the total demand and the total output level and the tools used by monetary changes. It can be said that the monetary transmission mechanism consists in merging the two processes in general. The first of these processes is the process of transfer of changes in monetary policies (market interest rates, exchange rate etc.) to financial markets. The second is the process of changes in the financial market and the effects at the production and inflation levels (Çiçek, 2005).

It is not possible to talk about a consensus on the functioning of the monetary transmission mechanism in the economic literature. In the course of time, various views were argued. While Keynesians tried to explain the effect of money on the real economy with structural models created by consumer and firm behaviors, monetarists opposed these views and stated that money had other effects than the

general level of prices on the real economy. These economists, led by M. Friedman in the 1960s, argued that the monetary policy could affect the total demand not only by interest rate and investment expenditures but by many different channels. Moreover, monetarists argued that the real interest rates on borrowing and investment decisions are not real interest rates, and that nominal interest rates are not true indicators of real interest rates.

Monetarists have tried to explain the impact of monetary policy on the real economy with the help of the reduced evidence models, which aim to measure the effect of one on the other. According to these economists, changes in the stock of money affect the real economy by changing interest rates and borrowing costs in the short term and by changing the current and expected prices of domestic and foreign assets. For this reason, monetarists consider that the disclosure of monetary transmission mechanism by Keynesian IS-LM model is rather shallow and limited. In the framework of these discussions, it is possible to summarize the general operation of the monetary transmission mechanism with the help of Figure 1.

Figure 1. Monetary transfer mechanism



Source: Pétursson, 2001, p. 63.

Central Bank interest rate decisions affect long-term interest rates, liquidity in the financial system, the amount of money and bank loans, exchange rates, other asset prices and, finally, market expectations about the future development of all these variables. All this, in turn, affects the consumption and investment decisions of individuals and firms, thus bringing together aggregate demand and inflation as shown in Figure 1.

The studies conducted within the framework of these discussions have revealed that it is not possible to determine the effects of the monetary policy practices on the real economy and the channels through which these effects are achieved. In fact, some studies have concluded that the transmission channels affect each other in various ways and that, in some cases, they complement each other. In this study, considering the distinction of Mishkin (1995), interest rate channel, credit channel and asset prices are considered as channel transmission mechanism channels.

1.1. Interest rate channel

According to the traditional Keynesian interest rate channel, the increase in the short-term nominal interest rate as a result of the implemented monetary policy leads primarily to an increase in long-term nominal interest rates. The reason for this resides in the explanations about the maturity structure of the expectations hypothesis. These movements in nominal interest rates cause movements in real interest rates in order to adjust the nominal prices to the changes in the market. In this period, companies see real borrowing costs in all areas and reduce investment expenditures. Similarly, households facing high real borrowing costs also reduce their consumption, particularly in housing, automobiles and other durable consumer goods. This reduces total production and employment. The traditional interest rate channel plays a key role for the monetary transmission mechanism in the basic Keynesian IS-LM model. The view of the monetary transfer mechanism of the traditional Keynesian IS-LM model can be shown as follows.



An important feature of the interest rate transmission channel is the emphasis on the real interest rate rather than the nominal interest rate affecting the consumption and investment decisions. The big impact on expenditure is often indicated by the long-term real interest rate. Price stickiness is a key role. Thus, the expansionary monetary policy, which cuts short-term nominal interest rates, also reduces the short-term real interest rate (Mishkin, 1996).

1.2. Credit channel

It can be said that monetary policy practices affect the real economy by using two different credit channels, namely bank loan channel and balance sheet channel. The study of Kashyap and Stein (1997), based on the study of Roosa (1951) emphasizes that the bank lending channel is the renewed version of Blinder and Stiglitz (1983)'s theory of loanable funds, while Bernanke and Blinder (1988)'s IS-LM are expanded. From this lending perspective, banks not only export liabilities (bank deposits) that contribute to large monetary aggregates, but also play a special

role in the economy by using assets (bank loans) that hold the presence of a small number of close substitutes. In other words, the theories and models of the bank lending channel emphasize that, for many banks, especially small-scale banks, deposits constitute the main source of funding for lending, and that bank loans are also the main source of funds for investment periods of small and medium-sized firms. For this reason, open market operations leading to a contraction in the supply of bank reserves and, then, to a contraction in bank deposits have led to a decrease in the lending tendencies of the banks, in particular deposits, which in turn lead to a decrease in the investment expenditures of the firms, which are mainly related to bank loans. Financial market imperfections faced by banks and firms following monetary tightening have led to a decline in production and employment, in general.

Bernanke and Gertler (1995) describe a broader credit channel and balance sheet channel, where financial market imperfections also play a key role. Bernanke and Gertler emphasize that the cost of a firm's loan is elevated in the period when the balance sheet balance is impaired, regardless of whether the loan is borrowed from banks or from another external source, under disruptive financial market conditions. The monetary policy has two effects on the firm's balance sheet. The first one is the direct effect of the increase in interest rates as the firm increases the payments to be made in order to fulfill its floating rate debts. The other is the indirect effect of the increase in interest rates as the company's long-lived assets decrease its capital value. Therefore, the increase in the short-term interest rate as a result of the policy implemented not only reduces the expenditures on the traditional interest channel but also deepens the level of production and employment decrease by increasing the capital cost of each firm through the balance sheet channel.

1.3. Asset prices channel

The asset prices channel is highlighted by the theory of q -investment of Tobin (1969) and the life-cycle theory of Ando and Modigliani (1963). Tobin's q measures the ratio of the stock exchange value of a firm to the substitution cost of the physical capital owned by that firm. When other conditions are fixed, the increase in short-term nominal interest rates as a result of the policies implemented makes the borrowing instruments more attractive than the shareholders in the eyes of investors. Therefore, after the monetary tightening, the balance between the securities markets should be partially restored with a decline in stock prices. Each firm with a lower q value should export more new shares to finance new investment projects. Under these circumstances, investment decisions become costlier for firms. As a matter of fact, the decrease in q value is reflected not only in the marginal profitability of all firms, but also in the form of loss of production and employment. Meanwhile, Ando and Modigliani's consumption cycle theory gives a role to income as well as wealth as key determinants of consumer spending. Therefore, this theory also defines a monetary transmission channel: if stock prices fall after a monetary tightening,

household financial prosperity decreases, thus leading to a decline in consumption, production and employment.

According to Meltzer (1995), movements in asset prices, beyond those only reflected in interest rates, also play a central role in the monetarist depictions of the transmission mechanism. Indeed, monetarist criticisms of the traditional Keynesian model begin by questioning the view that the full pressure of the monetary policy actions is fully summarized by movements in short-term nominal interest rates. Monetarists emphasize that monetary policy actions affect prices in a wide variety of markets for financial assets and durable goods at the same time. Accordingly, monetary policy affects prices especially in stocks and real estate markets. The price movements of these assets have a significant welfare effect affecting the entire real economy through spending, production and employment.

2. Literature review

To examine the bank lending channel in the US, Bernanke ve Blinder (1988) extended the standard IS-LM framework by including bank lending markets in the model. Bernanke ve Blinder (1992) examined the monetary transmission mechanisms in the United States and concluded that monetary policy partially worked by influencing the composition of bank assets. Lawrence *et al.* (1998) found that the effects of an unexpected monetary policy shock were fully transferred to output, consumption and investment in a period of eighteen months. Peersman ve Smets (2001) found that an unexpected monetary tightening tended to increase in real terms in the exchange rate and a temporary decline in output in the euro area. They conclude that, following the decline in gross domestic product, prices are still sluggish and fall below zero in a few quarters. In his study, Jimborean (2009) tried to enrich the information on the monetary policy mechanism in the new member states of the EU with empirical evidence on the impact of monetary policy on bank loans. The GMM method was used in the study. The study is based on private bank balance sheets and includes the commercial banks of 10 European Union countries. In the model, total loans, monetary policy indicator, money market rates, real GDP, inflation and bank characteristics (such as size) were used as variables. The data is annual and covers the period between 1996 and 2006. As a result of the study, the existence of a bank credit channel through small banks has been empirically proven. Sun *et al.* (2010) analyzed the impact of monetary policy on banks' balance sheets in their study for China. They applied the VECM method to explain the transmission mechanism of monetary policy in China. Monthly data were used in the study which covers the period between 1996 and 2006. The VECM model includes M2, growth rate, industrial production, stock index, rifle, export, import, exchange rate reserve, total deposits, total loans and securities. Empirical findings indicate the existence of a bank credit channel in the Chinese economy.

Studies on the monetary transmission mechanism to Turkey and worldwide summary information on the studies undertaken in the recent period associated with this issue are presented in Table 1.

Table 1. Literature review

Saraçoğlu and Köse (1999)	VAR, 1980-1996	Turkey	The findings show that the exchange rate has a direct effect on the money supply and that inflation affects the money supply process over the exchange rate and interest rate.
Gündüz (2001)	VAR, 1986:01-1998:10	Turkey	The findings suggest that securities portfolios and bank loans react more rapidly than deposits after tight monetary policy implementation.
Başçı <i>et al.</i> , (2008)	Studies After the February 2001 Crisis	Turkey	Due to the prudent fiscal policy and the beginning of the inflation targeting regime under the floating exchange rate, the dominant effect of the exchange rate channel tends to decrease in the post-crisis period, while the interest rate and the credit channel have a more visible effect on the economic activity.
Büyükakın <i>et al.</i> , (2009)	VAR, 1990:01-2007:09	Turkey	The findings show that the exchange rate plays an important role in explaining inflation and the exchange rate is functioning effectively in the operation of monetary transmission mechanism.
Örnek (2009)	VAR, 1990-2006	Turkey	According to empirical evidence, the traditional interest rate channel and exchange rate channel is active in Turkey. On the other hand, stock price and bank credit channels do not yield statistically significant results.
Duran <i>et al.</i> , (2012)	GMM, 2005:01-2009:12	Turkey	The empirical results show that the increases in policy rates have decreased in stock prices and the government bond yields have increased with longer maturities.
Cambazoğlu and Karaalp (2012)	VAR, 2003:01-2010:08	Turkey	Empirical evidence shows that the effective exchange rate channel that results in Turkey.
Atgür and Altay (2017)	VAR, 2002:Q1-2016:Q4	Turkey, Mexico	According to the obtained results, the exchange rate channel of monetary transmission mechanism is partially

		and Indonesia	effective in Turkey, while in Mexico and Indonesia, it is not effective.
Kaya and Belke (2017)	VAR, 2003:01- 2016:12	Turkey	Results Show that exchange rate channel was not effective in the respective period in Turkey.
Papadamou <i>et al.</i> (2015)	PVAR, 1998-2010	Developing Countries	The empirical results show that the monetary transmission mechanism operates through the interest channel.
Vo and Nguyen (2017)	VAR, 2003:1- 2012:12	Vietnam	The empirical findings of the study proved that the transmission mechanism in the Vietnamese economy was operating through the interest rate channel.
Endut <i>et al.</i> (2018)	SVAR, 1959:Q3- 2012:Q4	USA	While the credit channel of the bank is more important during the 1959:Q3-1984:Q1 period, interest rate channel plays an important role in the transfer of policy shocks in 1984:Q2-2012:Q4 period.
Afrin (2017)	SVAR, 2003:06- 2014:02	Bangladesh	As a result of the study, it was found that the exchange rate channel was not effective in communicating monetary policy in order to influence the general level of prices. Monetary policy plays an important role in influencing the overall level of prices, and bank loans are not functional in this process.
Salachas <i>et al.</i> (2017)	GMM, 2001-2013	USA, UK, Germany, France, Italy and Japan	While empirical findings indicate the existence of an effective bank credit channel before the global financial crisis of 2007-2009, empirical findings proved that the bank lending channel did not exist after the 2007 financial crisis.
Migliorelli and Brunelli (2017)	GMM, 2008-2013	EU	In a study in which European Union member countries were divided into two groups as north-east and south-west, it proved that bank loans were available in both regions.
Heryán and Tzeremes (2017)	GMM, 1997-2012	EU	As a result of the tests conducted, it has been shown that the bank's credit channel is affected by the short-term interest rate and the changes in M2.

Source: own representation.

According to the empirical literature review on the monetary transmission mechanism, there are many studies on the special channels of the monetary transmission mechanism. Different econometric methods were applied in these

studies. The most prominent result in the literature review is the effect of the transmission mechanism on the real economy through the credit channel. Although the results of the studies differ from country to country and period, it is observed that the variables used in the studies are generally similar but include some differences according to the method and purpose used.

3. Data set, methodology and model

3.1. Data set

The data used in the study were taken from IMF Financial Statistics and Central Bank of the Republic of Turkey (CBRT). The data set is quarterly and covers the period 2005Q4-2017Q1.

Table 2. Variable descriptions

Variable	Definition
Real GDP	GDP
Cpi	Consumer price index
Exr	Exchange rate
Loans	Total Bank Loans
Reserves	Central Bank Foreign Exchange Reserve

Source: own representation.

3.2. Methodology and model

The VAR model is one of the methods used to estimate a few variables with a single model (Stock and Watson, 2003). The VAR model expands univariate autoregression, which is a vector of time series variables to multiple time series variables. If the number of lags in each equation is the same and is equal to p , then, the equation system is called VAR (p). The VAR model was first introduced by Sims (1980) and has been developing since then. VAR models for causal inferences are known as structural models.

In this study, a widely used VAR model was used to analyze the monetary transmission mechanism. The VAR model can be explained by the following equation:

$$Z_t = A(L)Z_{t-1} + B(L)X_t + u_t$$

Here, the $A(L)$ and $B(L)$ lag operators are polynomial matrices for L . Z_t is a vector of internal variables, X_t is a vector of exogenous variables, and u_t is a vector

of error terms. The basic model includes the price index, gross domestic product and reserves. It can be explained by the following equation.

$$Z_t = [Y_t \ P_t \ R_t]$$

As Required Reserve Ratio is an important policy instrument for the Central Bank, the reserves were used as a policy variable in the analysis.

4. Empirical findings

Table 3 shows autocorrelation LM test statistic and heteroscedasticity, indicating that the inverse unit roots are within the circle to determine the stability conditions of the VAR model.

Table 3. VAR model stability conditions

Autocorrelation		
Lag	LM-stat	p-value
1	17.67868	0.8610
2	19.78021	0.7661
3	23.82382	0.5412
1	17.67868	0.8610
2	19.78021	0.7661
3	23.82382	0.5412
1	17.67868	0.8610
2	19.78021	0.7661
3	23.82382	0.5412
1	17.67868	0.8610
2	19.78021	0.7661
3	23.82382	0.5412
heteroscedasticity		
	Chi-sq	p-value
	465.7832	0.2938

Source: own calculations.

Table 4. Unit root tests

Variables	ADF				Phillips-Perron				
	Constant		Constant and Trend		Constant		Constant and Trend		
	t-statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	
RealGDP	-1.762	-2.935	-2.362	-3.524	-3.164	-2.928	-4.712	-3.513	
CPI	-0.743	-2.939	-3.080	-3.537	-0.072	-2.928	-3.565	-3.513	
Exr	1.781	-2.928	-1.362	-3.513	2.437	-2.928	-1.066	-3.513	
Loans	-1.960	-2.930	-3.225	-3.518	-2.024	-2.928	-2.566	-3.513	
Reserves	-1.935	-2.930	-1.405	-3.516	-2.593	-2.928	-1.518	-3.513	
First Difference	t-statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	
	RealGDP	-2.807	-2.935	-22.011	-3.518	-9.189	-2.930	-8.791	-3.516
	CPI	-5.473	-2.939	-5.401	-3.530	-9.856	-2.930	-9.576	-3.516
Exr	-5.930	-2.930	-6.562	-3.516	-5.930	-2.930	-6.824	-3.516	
Loans	-4.152	-2.948	-5.055	-3.544	-4.256	-2.930	-4.739	-3.516	
Reserves	-4.811	-2.930	-5.074	-3.516	-4.710	-2.930	-4.934	-3.516	
KPSS									
Variables	Constant		Constant and Trend		Constant		Constant and Trend		
	LM-stat	Critical Value (5%)	t-statistic	Critical Value (5%)	LM-stat	Critical Value (5%)	t-statistic	Critical Value (5%)	
	RealGDP	0.690	0.463	0.167	0.146	0.127	0.463	0.123	0.146
CPI	0.880	0.463	0.112	0.146	0.397	0.463	0.398	0.146	
Exr	0.809	0.463	0.209	0.146	0.546	0.463	0.065	0.146	
Loans	0.880	0.463	0.112	0.146	0.254	0.463	0.070	0.146	
Reserves	0.770	0.463	0.116	0.146	0.519	0.463	0.082	0.146	

Note: Lag length selection for ADF is based on Schwarz Information Criteria (SIC), Spectral Estimation Method for Phillips-Perron and KPSS is Bartlett Kernel and Bandwidth is Newey West.

Accordingly, it was determined that the characteristic polynomial roots of the modulus were within the unit circle, the autocorrelation problem disappeared, and the H_0 hypothesis indicated that there is no heteroscedasticity. Therefore, it is determined that the reverse unit roots are inside the circle, there is no problem of autocorrelation and there is no problem of heteroscedasticity and the length of the lag which meets the stability model of VAR model is 3ⁱ. The H_0 hypothesis has no

ⁱ Although LR, FPE, SC and HQ were determined to have a lag length of 2, it was concluded that this lag length did not meet the stability conditions. Therefore, it is determined that VAR

cointegration, and the Trace / Maximum Eigenvalue Statistics should be checked to determine the appropriate model selection and the number of vectors.

Table 5. Unconstrained cointegration rank tests

Rank (r)	Trace Statistics			Maximum eigenvalue Statistics		
	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
None (r=0)	115.935 H_0 reject	114.094 H_0 reject	153.113 H_0 reject	36.260 H_0 reject	36.228 H_0 reject	69.7825 H_0 reject
At most 1 (r=1)	79.67520 H_0 reject	77.866 H_0 reject	83.3311 H_0 reject	30.247 H_0 reject	30.099 H_0 reject	30.8922 H_0 reject
At most 2 (r=2)	49.42742 H_0 reject	47.766 H_0 reject	52.4389 H_0 reject	26.972 H_0 reject	26.920 H_0 reject	26.9504 H_0 reject
At most 3 (r=3)	22.45524 H_0 reject	20.846 H_0 reject	25.4884 H_0 reject	16.558 H_0 reject	16.475 H_0 reject	18.2956 H_0 reject
At most 4 (r=4)	5.897159 H_0 accept	4.3710 H_0 reject	7.19281 H_0 accept	5.8971 H_0 accept	4.3710 H_0 reject	7.19281 H_0 accept

Source: own calculations.

The results obtained in Table 5 show that Model 2 is selected to be constant at the 5% meaning level of the Trace and Maximum Eigenvalue values, and there are maximum four cointegration relationships between the variables.

Table 6. Long term cointegration analysis results

Real GDP	Cpi	Exr	Loans	Reserves	C
1.000000	1.940544 (0.29771) [6.518]**	0.170222 (0.02964) [5.742]***	-0.462510 (0.06265) [7.382]***	0.117020 (0.06144) [1.904]*	-0.000950 (0.00013) [7.307]***

Values in parentheses show standard errors, and values in square brackets indicate t-statistics. ***, **, * 1%, 5%, 10% respectively.

Source: own calculations.

(3) is the most suitable model which provides the stability conditions of the VAR model starting from the maximum lag length.

When the long-term cointegration relationship between the variables is examined, it is concluded that the exchange rate, inflation and reserves have a statistically significant and negative effect on the real gross domestic product, while loans have a significant and positive effect on the real GDP.

In the interpretation of the short term analysis findings, first of all, applying the weak exogenous test in order to see what vector error correction model (VECM) works on provides important information about whether the short term imbalances will work on the variables in the model. Therefore, a weak exogenous test was applied for the variables before the short term forecast.

Table 7. Weak exogenous test

Variables	Chi-square(4)	Probability
Real GDP	49.74692	0.000000
Cpi	14.63456	0.005522
Exr	12.09696	0.016645
Loans	0.032104	0.857801
Reserves	16.79402	0.002119

Source: own calculations.

H_0 hypothesis is set up as variables are weak exogenous and H_0 hypothesis is rejected for real gross domestic product, inflation, exchange rate and reserves. Therefore, short-term imbalances are corrected in the model through these variables and short-term behaviors of the variables need to be modeled. So VECM can be estimated here. VECM estimation results are presented in Table 8.

Table 8. VECM findings

Error Correction	D(Real GDP,2)	D(Cpi,2)	D(Exr,2)	D(Reserves,2)
Cointegration Equation 1	0.035919 (0.00428) [8.38472]	-0.001217 (0.00160) [-0.76062]	0.039158 (0.01348) [2.90548]	-0.009089 (0.00496) [-1.83145]
Cointegration Equation 2	-0.010388 (0.00423) [-2.45766]	0.004255 (0.00158) [2.69500]	0.020870 (0.01330) [1.56938]	-0.019280 (0.00490) [-3.93749]
Cointegration Equation 3	-0.003084 (0.00426) [-0.72429]	0.005857 (0.00159) [3.68213]	-0.029781 (0.01340) [-2.22284]	0.010185 (0.00493) [2.06464]
Cointegration Equation 4	-0.004240 (0.00413) [-1.02747]	-0.000362 (0.00154) [-0.23491]	0.029432 (0.01298) [2.26714]	0.006675 (0.00478) [1.39649]

Source: own calculations.

When the results of the short-term cointegration model were examined, it was determined that the error correction coefficient was not only significant in the fourth equation but that the error correction coefficient was significant in the other equations. In other words, the selected model and the term reveal the short-term relationship between the variables. For example, real GDP plays a role in establishing long-term equilibrium by 3.6%, inflation by 0.4% and exchange rate by 3%.

4.1. Impulse response analysis results

The graphs in the first lines in Figure 2 show the course of the response of the real GDP to one-unit standard error in the variables. The fact that one-unit standard error in inflation and exchange rate affects the real GDP in the first 4 terms, while the exchange rate one-unit standard error affects the real GDP in 2 terms in a negative manner...the statement does not seem to end. In addition, the effect of loans on real GDP emerged after 1 period and has a positive effect until 2 periods and this effect was negative after the 3rd period. It is seen that the effect of reserves on real GDP emerged at the end of 2 periods and this positive effect only lasted for 1 period and this effect followed a fluctuating course.

The graphs in the second lines show the response of inflation to one-unit standard error in variables. Overall, real GDP, exchange rate, loans and reserves indicate a positive response by inflation. When the graphs in the third line are analyzed, it is concluded that the exchange rate reacts positively to a unit standard error effect in real GDP, inflation, loans and reserves, but the response to exchange rate is quite low. According to the graphs in the fourth line, while there is a positive response of credits to a unit standard error effect in real GDP, inflation and reserves show a positive reaction against exchange rates only after the 3rd and 6th periods and this reaction is negative in other periods.

When the graphs in the fifth line are analyzed, it is observed that the 1st period reserves of a one-unit standard error effect on real GDP and loans have a positive response and it follows a volatile course in the following periods. It is concluded that the reserves have a negative reaction to a unit standard error effect in inflation and exchange rate.

Figure 2. Impulse response results



Source: own calculations.

Table 9. Variance decomposition results

Real GDP Variance Decompos	P.	S.E.	Real GDP	CPI	EXR	LOANS	RESERVES
1		0.04	100.0	0.000	0.000	0.00	0.000
2		0.04	91.02	1.127	7.763	0.08	0.001
3		0.05	86.04	5.938	5.150	1.87	0.988
4		0.05	82.72	9.239	5.080	1.79	1.168
5		0.06	79.61	8.260	4.661	5.50	1.958
6		0.06	78.59	8.195	5.318	5.95	1.931
7		0.07	77.84	10.11	4.356	5.77	1.911
8		0.07	76.02	11.83	4.669	5.61	1.859
9		0.08	76.44	10.63	4.322	6.41	2.188

10	0.08	75.78	10.62	4.774	6.65	2.160
CPI						
Variance Decompos Period	S.E.	D(LRGDP)	D(LCPI)	D(EXR)	D(LLOANS)	D(LRESERVES)
1	0.01	11.70	88.29	0.000	0.00	0.000
2	0.01	15.10	76.66	0.208	7.95	0.063
3	0.01	14.40	72.46	0.185	10.27	2.669
4	0.01	12.32	66.25	1.332	16.23	3.855
5	0.01	10.51	61.44	1.137	21.94	4.952
6	0.02	10.13	61.91	1.491	21.37	5.085
7	0.02	10.99	62.42	1.302	20.60	4.677
8	0.02	9.94	64.03	1.211	20.15	4.644
9	0.02	9.17	63.06	1.492	21.51	4.748
10	0.02	9.08	62.89	1.616	21.75	4.641
EXR						
Variance Decompos Period	S.E.	D(LRGDP)	D(LCPI)	D(EXR)	D(LLOANS)	D(LRESERVES)
1	0.09	0.81	0.12	99.05	0.00	0.000
2	0.12	3.03	12.86	68.12	15.92	0.038
3	0.14	2.32	28.50	55.78	12.83	0.548
4	0.16	2.03	33.92	47.36	12.75	3.922
5	0.16	2.06	36.91	43.88	11.86	5.262
6	0.17	2.28	38.76	42.31	11.42	5.211
7	0.17	2.28	40.55	40.87	11.05	5.220
8	0.17	2.21	41.77	39.93	10.90	5.167
9	0.17	2.14	42.18	39.19	11.47	4.992
10	0.18	2.33	42.61	38.12	11.94	4.979
LOANS						
Variance Decompos Period	S.E.	D(LRGDP)	D(LCPI)	D(EXR)	D(LLOANS)	D(LRESERVES)
1	0.02	18.11	3.09	3.70	75.08	0.000
2	0.02	13.81	5.29	5.85	72.83	2.202
3	0.03	11.81	9.44	4.10	65.43	9.193
4	0.04	10.99	12.97	4.53	61.36	10.135
5	0.04	10.58	18.94	4.05	56.06	10.341
6	0.04	9.71	23.22	3.75	53.63	9.669
7	0.04	8.95	26.95	3.42	51.71	8.951
8	0.05	8.72	30.49	3.27	49.31	8.193
9	0.05	8.41	33.77	3.07	47.01	7.719
10	0.05	7.74	36.31	2.94	45.30	7.689
RESERVES						
Variance	S.E.	D(LRGDP)	D(LCPI)	D(EXR)	D(LLOANS)	D(LRESERVES)

Decompos Period						
1	0.03	2.57	3.58	25.37	5.15	63.308
2	0.04	1.91	12.77	21.24	4.69	59.371
3	0.04	1.40	26.42	26.04	3.55	42.570
4	0.05	1.28	24.36	24.46	7.13	42.750
5	0.05	2.00	23.55	23.10	6.82	44.500
6	0.05	2.57	23.23	22.76	7.50	43.911
7	0.05	2.47	22.39	22.35	9.69	43.081
8	0.05	3.07	21.84	21.92	10.00	43.161
9	0.05	3.32	21.62	22.08	9.92	43.042
10	0.05	3.62	21.45	22.39	9.88	42.642

Source: own calculations.

The variance decomposition refers to the decomposition of the variance of the predictive error in the variables according to the internal variables. Variance decomposition shows the percentage of changes in the other variables and the percentage of the variance stemming from the variable itself (Enders, 2014).

In Table 9, variance decomposition was performed by taking into consideration 10 terms for each variable. For example, according to the results of variance decomposition for real GDP, the change in real GDP can be explained in the 1st period, whereas in the fifth period, 79.6% by itself, 8.2% by inflation, 4.6% by exchange rate, 5.5% by loans and 1.95% are explained by reserves. On the other hand, 43.8% of the changes in exchange rates in the fifth period is explained by itself while 36.9% is explained by inflation, 11.8% by loans, 5.2% by reserves and 2% by real GDP. According to the result of the variance decomposition related to inflation, it is concluded that 61.4% by itself and 21.9% by the loans. Therefore, it is concluded that the loans have a strong effect on the disclosure of inflation.

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Conclusions

The monetary transmission mechanism demonstrates the effects of monetary policy on macroeconomic variables and through which channels this effect occurred. The studies emphasized that the monetary transmission mechanism should reflect the changes in the money markets to the real markets without any change in the general level of prices. For this reason, monetary policy instruments should be correctly identified and used for an efficient and useful monetary transmission mechanism. The data set used covers the period 2005-2017 and, within the scope of

VAR model, impulse-response functions are obtained and findings of variables are revealed by VAR decomposition method. The results show that the exchange rate and credit channels in Turkey play an important role in the monetary transmission mechanism. However, it is observed that the efficiency of the reserves in the transmission mechanism is relatively low compared to these variables. Considering the efficiency of the transmission channel related to inflation, it is revealed that loans and reserves play a more important role in this activity. While determining the effect of exchange rate and reserves on real GDP in the long-term transmission mechanism, it is revealed that loans have a positive effect on real GDP in long-term equilibrium. Therefore, the banking sector plays an important role in terms of efficiency and efficiency of the transmission mechanism and the effectiveness of this channel affects the banking sector in terms of the monetary policy implemented. In this way, banks emerge as an important actor of the transmission mechanism through the loans they use. For this reason, especially in determining the variables used by the central bank as a policy tool, it is important to take into account the fluctuations in the exchange rate, the reserves it holds, and the status of the loans before intervening.

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