The Monetary Transmission Mechanism and the Effectiveness of the Credit Channel: The Case of Turkey

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Abstract: In this study, the monetary transmission mechanism and the effectiveness of the credit channel have been analyzed. According to the analysis results, the most important instrument in the applications of the monetary policy in Turkey is variable interest rates. Interest rates are the most significant main effectives for all other variables and they influence the total deposit, the total credits and the size of the total security. While an increase in deposits raise the size of loanable fund by banks,an increase in credits influences the industrial production index positively. It has been concluded that an increase in industrial production depends on the volume of the banks' credit, whilst has been is determined that credits mostly depend on loanable funds and deposits held by banks. When the first 2 periods are disregarded, it was determined that the bank lending channel has been operating in Turkey.

Keywords: monetary policy, credit channel, error correction model, Turkey

Parasal Aktarım Mekanizması ve Kredi Kanalı Etkinliği: Türkiye Örneği

Öz: Bu çalışmada Türkiye'de parasal aktarım mekanizması ve kredi kanalının etkinliği analiz edilmiştir. 2006Q01–2011Q03 dönemlerinin dikkate alındığı analizlerde Hata Düzeltme Modelinden yararlanılmıştır.

Analiz sonuçlarına göre Türkiye'de para politikası uygulamalarında en önemli araç değişken faiz oranlarıdır. Faiz oranları diğer tüm değişkenlerin de en anlamlı ana etkileyicisi olup, toplam mevduatı, toplam kredileri, toplam menkul kıymet büyüklüğünü etkilemektedir. Mevduatlarda yaşanan artış bankalarca kredi olarak verilebilir fon büyüklüğünü arttırırken, kredilerde

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yaşanan bir artış sanayi üretim endeksini pozitif yönde etkilemektedir. Kredilerin çoğunlukla bankaların ellerinde bulunan borç verilebilir fonlara ve mevduatlara bağlı olduğu belirlenirken, sanayi üretimindeki artışın bankaların kredi hacmine de bağlı olduğu sonucuna ulaşılmıştır. İlk 2 dönem göz ardı edildiğinde, Türkiye'de banka kredi kanalının işlediği tespit edilmiştir. Faizlerde gerçekleştirilen bir birimlik şok şiddetleri farklı olmakla birlikte mevduatlarda, kredilerde ve menkul kıymet büyüklüklerinde artışa neden olmaktadır. Kredilere bir birimlik şok verilmesi halinde TEFE ve sanayi üretim endeksi artmaktadır.

Anahtar Kelimeler: Para Politikası, Kredi kanalı, Hata Düzeltme Modeli, Türkiye

INTRODUCTION

The executives in economy administration basically apply to two methods in order to coordinate economic activities; monetary policy and fiscal policy. Monetary policies are implemented by the central banks and fiscal policies by the means of governments. Among these policies, the monetary policies are quite effective method to control economic instruments. The authority owners influence total product in economy by changing the monetary policies which they are applying. Monetary transmission mechanism is important in determining the timing for policies applied and in proving their effectiveness. It is categorized in an economy under the titles of the channels of monetary transmission mechanism, interest channel, exchange rate channel, other asset prices channel and credit channel. From them, the credit channel is divided into two subdivisions: bank lending channels and balance sheet channels(Mishkin,1995: 3-10).

Nowadays, monetary policies applied by the central banks focus on three basic strategies: monetary targeting, exchange rate targeting and inflation targeting. Implicit monetary targeting program has been followed in Turkey which aims at international financial liberalization and at controlling the reserves within the integration movements with that. With this program, the Central Bank aimed at controlling money aggregates and loan supply. From the program in question, the aims could not be achieved. And in 1990, explicit monetary targeting was put into practice for the first time and the Central Bank aimed at controlling the size of its balance sheet by the means of that program.

When coming to 2000s, the exchange rate targeting was again put into practice in order to reduce inflation that was progressing in high rates. However, crises experienced in 2000 and 2001 prevented the implementation of said strategy.Therefore, the "*transition to the Strong Economy Program"* was enabled and free-floating regime was adopted.It was attempted to provide

removal of the political affects from the applications of monetary policies by amending the Central Bank Act and by providing goal and instrument independence of the bank. Implicit inflation targeting regime based on price stability was adopted in place of the exchange rate targeting regime since 2002. And since 2006, explicit inflation regime that was regulated between 2002 and 2005 has been adopted and the targets for 3 years were started to be shared with public opinion (TCMB, 2014a; TCMB, 2014b).

In recent years, especially the warning expressions of political authorities and of the Central Bank Management and the obligations to make additional provisions imposed on banks that raised the rates of credit increase over the certain rates show the importance of subject. This case is also significant to understand whether or not the size of credit is a necessary argument to be observed regularly by the implementers of monetary policy, and to reveal how the interests influence other sizes. In this study, it is aimed to analyzethe monetary transmission mechanism and the effectiveness of the credit channel in Turkey by taking the periods2006Q1-2011Q3 as reference Vector Error Correction Model (VECM) has been used in analysis.

MONETARY TRANSMISSION MECHANISM

Theoretical studies related to the monetary transmission mechanism were developed by Keynes and acquired a different dimension with Tobin and developed some more with the Monetarist Approaches. In the Keynesian Approach, financial assets are put to forefront asan alternative to money.It is claimed that in case of an augmentation of currency in circulation in an economy, thepurchases of financial assets would increase and that depending on these purchases, interests would decrease and that the economic actors would finally keep money in liquid form in an atmosphere of low interest. In this context, instruments of monetary policy in monetary transmission mechanism affect the monetary base and the money supply, and interest rates change depending on the changes in money supply, and as a result of this situation, investments and finally quantity of output (product) are determined(Ünsal, 2005: 480-489).

In the Keynesian analysis, monetary policies influence aggregate demand with only one interest rate (bond yield). Therefore, effectiveness of monetary policies only depends on interest elasticity of money demand. However, the said shortage in transmission mechanism acquired a new dimension with Tobin's(1969) Portfolio Balance Approach. In this Approach, it is supposed that not only bonds but also a basket of portfolio consisting of different kinds of financial assets are held by economic actors. Thus, the asset is distributed among different financial assets. In this context, in case of any change in money stock by Central Bank, there might be some failures in the portfolio of economic decision-making units. Here at this point, economic decision-making

units will adjust financial assets as well as real assets and shall reach to a new portfolio balance.

The Monetarist Approach differs from Neoclassical one because of the function applied to interest rates within a transmission process. In the Monetarist Approach, nominal interest rates are composed of real interest rates plus inflation. Because the inflation premium is also included in interest rates in the long term, interest rates have an important function in the transmission of monetary policies (Goodfriendand King, 1997: 8).The most important difference between Keynesian approach and Monetarist approach within the transmission process of monetary policies is caused by the elasticity of substitution between money and other financial assets and between money and real assets.In the Keynesian view, while the money's elasticity of substitution with other financial assets was perfect, its elasticity of substitution with real assets was zero. And in monetarist approach, there is a substitution opportunity between money and real assets. That is, the changes in the amount of money directly affect expenditures. Therefore, it is supposed that transmission mechanism is from money stock to expenditures.

In case of the application of contractionary monetary policy in an economy, bank lending channels runs as follows(Özatay, 2011:220-225);

- Contractionarypolicy
- Decline in the Bank Deposits
- Decline in the Loanable Funds
- Contraction in Aggregate Demand
- Decline in the Product.

There are two terms to be effective for Bank Lending Channel (Kashyap*et al.*, 1993: 82-96):

No perfect substitution opportunity between bank credit and securities: In case of any perfect substitution between those two items which are on the side of the assets of bank balance sheets, the credit channel loses its effectiveness. Banks shall show response by adjusting their securities in assets, in case of using a monetary policy that will reduce credit volume. Accordingly, if banks responded to the application of a contractionary monetary policy by selling their securities in assets, contractionary monetary policy could not achieve its objective.

No perfect substitution opportunity between bank credit and nonbank sources: Against financial needs, the companies have opportunities to meet their needs by the means of bank credit or by borrowing from capital markets. However, for the effective operation of credit channel, companies should not borrow from other sources of loan, excepting the banks. In case of the existence of alternative source of financing, bank lending channel loses its effectiveness.

LITERATURE

Bank lending channel topic entered into the literature first with the study of Bernanke and Blinder (1988). In this study, the effects of monetary policies in the USA economy on bank balance sheets were inquired and the effectiveness of credit channel was tested. According to theanalysis results, it was determined that contractionary monetary policies reduced the loan supply and the existence of credit channel was found.

Kashyap*et al.* (1993), it was found that bank credit shares in company balance sheets reduced during the periods in which contractionary monetary policy was being applied, however commercial paper shares increased. Bernanke and Gertler (1995) defined monetary transmission mechanism itself as a "*Black Box*" suggested that the credit channel is not only the argument of the monetary transmission mechanism, but also is an augmenting and enlarging argument. According to the analyses, it is concluded that balance sheet and bank lending channel play an important role in housing market and that a successful monetary transmission mechanism should include the balance sheet channel and credit channel.Izak (1998) empirically analyzed the relations between interest rates, aggregate loans and output and found significant causalities among them. Kashyap and Stein (2000) studied the existence of bank lending channel and as a result of analyses;they reached to the conclusions supporting the existence of credit channel by using the data of the period's 1976Q01–1993Q2.

Kishan and Opiela (2000) studied whether or not there exist any bank lending channel in the USA monetary policy and determined the operability of credit channel. In this study, banks are categorized according to the capital leverage ratios and asset volume, and the effect of change was observed in loan supply. It is also seen that the small capital banks have difficulty to reach the alternative sources of finance and for this reason; they are affected by the applications of monetary much more.

Bacchetta and Ballabriga (2000) studied the effects of the applications of monetary policies on loan supply with reference to the data from the USA and 13 European Countries. According to the results of analysis, it is concluded that applications of monetary policies influence the loan supply of the banks.

İnan (2001) studied the credit channel of the monetary transmission mechanism in Turkey and whether or not this channel is functioning efficiently. As a result of study, it was found that there is a backdrop for the operation of credit channel in Turkey, that any factor did not develop to prevent the operation of the credit channel and that the crises in Turkey generally tended to convert into the liquidity crisis and thatcreated opportunity for the operation of credit channel. It is also mentioned as a result of study that behaviors of national banks' credit allocation did not influenced so much from monetary policies

because of their establishment basis and that there were some structures preventing the operation of credit channel in private sector.

Çavuşoğlu (2002) analyzed lending behavior of 58 deposit money banks in the Turkish Banking System. According to the results of analysis, it is concluded that there was no credit channel in the base period.

Hornikova*et al.* (2005) analyzed of possible spontaneous euroization in the Czech economy. After a brief general introduction of the issue of currency substitution it specifically discusses two things. First, the transmission channels of potential spontaneous euroization, through which the process could possibly complicate the implementation of domestic monetary policy. Second, it analyses the degree of euroization. Among the transmission channels, attention is paid to interest rate and exchange rate channels. The circumstances under which the transmission would be sub-optimal are discussed. Besides the impact on the monetary policy transmission, another risk of progressive spontaneous euroization is seen in the shift of the exchange rate risk from bigger to smaller enterprises in the economy.

Ferreira (2007) found that credit channel had an important role in monetary policies in Portugal and in the member countries of European Monetary Union. However, it is seen that the effectiveness of the credit channel depended on the bank's performance and strategies. Matousek and Sarantis (2009) examined the effects of monetary transmission on the bank lending channel in 8 EU countries. It is observed that credit channel interactions of monetary policy changes differ according to the banks' volume and size and to their capital and liquidation structures and ownership. They realized that, although in different magnitudes, the sizes and liquidity positions of banks caused them to give different response to the changes in monetary policies, according to the results of analysis in which the existence of bank lending channel has been identified.

De Mello and Pisu (2009) concluded in Brazil that the monetary policy affected the banks' lending interest rate. The effect in question increases deposits and provides re-equilibration of the loan/credit market.

Erdoğan and Beşballı (2009) discussed the operability of bank lending channel in Turkey.As a result of analysis in which the VAR method was used, they concluded that the credit channel is operating even though partly.

DATA AND METHOD

Data

In this study,monthly data of January 2006 and March 2011 periods were used. In our model, domestic interest rate as an indicator of politics, industrialproduction index in respect to its designation of production level of the country in real terms and wholesale price index were used.To observe the effect created by the policies applied on banks, the data on Credit Volume of Banking Sector, Security Volume of Banking Sector and Total Deposit Volume of Banks

have been included in analysis. Data that are point at issue are explained by the means of following Table1.

Table1.Key to variables

Variables	Description
DIRSA	DomesticInterest Rate
LCREDSA	Credit Volume of BankingSector
LDEPSA	Deposit Volume of BankingSector
LSECSA	Security Volume of BankingSector
LWPISA	WholesalePrice Index
LIPI	IndustrialProduction Index

Data on Domestic Interest Rate was obtained from the website of DPT (State Planning Organization). The data in question are originating from the undersecretariat of treasury. The data on industrial production index and wholesale price index were obtained from TUIK (Turkish Statistical Institution).The data on banks' total credit volume, total deposit volume and total security volume were compiled from the Electronic Data Delivery System of the TCMB (The Central Bank of the Republic of Turkey).

Because the industrial production index from data in question is seasonally adjusted, any transaction was not carried out. Other data were seasonally adjusted by the means of CensusX12 method and used in analyses.For the estimation model, other than interest rate,logarithmic forms of variables were used. Package program in E-Views 7.0 version was used in analyses.

Method

The VAR model is used in the cases in which it could not be understood whether or not the variables in macroeconomic models are internal or external. The VAR system was developed by Sims (1980) and it is a method which is frequently applied in examining monetary transmission mechanisms.

A standard VAR model with two variables and one lag length is expressed with following notation (Enders, 2010:297):

$$y_t = b_{10} - b_{12}z_t + \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \varepsilon_{yt}$$
$$z_t = b_{20} - b_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{12}z_{t-1} + \varepsilon_{zt} \quad (1)$$

It is supposed that in equations, y_t and z_t are stationary and, ε_{zt} and ε_{yt} arewhite noise together with σ_z and σ_y standard deviations and that ε_{zt} and ε_{yt} are error terms.

VAR method is applied in the cases in which it is not understood whether or not a probable trend followed by a time series is different from or whether or not it is related-unrelated to any probable trend followed by another time series.

The variables considered in models must be stationary to create significant relationship between variables.Stationarity does not depend on constant mean, constant variance and the time in which covariance between two values examined.It only depends on difference between two time values. Economic shocks may leave temporary impacts on variables as well as creating lasting impacts. Series may show trend or seasonality features with these shocks. Here's the series showing such features are not stationary (Berber and Artan, 2004: 11).

Dickey and Fuller (1981) added Augmented Dickey Fuller Test to the literature in order to understand whether or not series are stationary. Notation of the ADF test is as follows:

$$\Delta Y_t = \infty_0 + \infty_1 Y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta Y_t = \infty_0 + \infty_1 trend + \infty_2 Y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-1} + \varepsilon_t \quad (3)$$

In the equations above, the Y expresses the variable mentioned in stationary test, Δ: the first difference operator, and ε:the error terms. The hypothesis in ADF unit root test made;

$H_0 : \alpha_1 = 0$

$H_1 : \alpha_1 < 0$

Rejection of H_0hypothesis means that the Y is stationary.

Variance decomposition constitutes the other dimension of our analyses. Variance decomposition gives us information about the sources of shocks in variables itself and in other variables. It provides us to find what percentages of these shocks are due to itself and what percentages are due to other variables.If most of the variationsoccur due to variable itself, it is called as external variable. Variance decomposition also provides information about the degree of inter-variable relationships (Enders, 2010: 313).

It depends on that variables used in estimation models must be stationary to be subject of VAR model. Non-stationary variables are changed into stationary with operation for taking difference. However, operation for taking difference causes data/information loss in variables. In this context, with the co-integration method, the existence of a long-term relationship between variables can be

determined, on the one hand, and data loss depending on operation for taking difference can be prevented, on the other hand.

$$x_{1t} = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + e_t$$

$$e_t = x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t} \quad (4)$$

In case the non-stationary variables included in the equation above are equally integrated, it is supposed that the relationship between variables is stationary.Variables having a long term of relationship between each other are expressed as co-integrated. The situation in which variables gravitate towards balance in the course of time is also named as error correction.

Engle and Granger (1987) stated in their studies that there exist functioning error correction models for every integrated model. In this case, being co-integrated for error correction mechanism is an essential condition. Error correction models examine short term imbalances between variables.

For a model of this mechanism with three variables and without any lags, expression of the sample equation is as follows:

$$\begin{aligned}\Delta x_{1t} &= \alpha_{x1}(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t}) + \varepsilon_{x1t} \\ \Delta x_{2t} &= \alpha_{x2}(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t}) + \varepsilon_{x2t} \\ \Delta x_{3t} &= \alpha_{x3}(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t}) + \varepsilon_{x3t}\end{aligned} \quad (5)$$

$(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t})$ characterizes long term balance deviations.

α coefficient in each equations is named as error correction or adjustment coefficient.Error terms have the feature of white noise. β coefficients are the long term balance coefficients. If there would be n variablein model, an error correction equation will constitute for each variable.

A VAR model in which the difference of variables is taken and the error correction term is added is as follows;

$$\begin{aligned}\Delta x_{1t} &= \alpha_{x1}(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t}) + \sum \alpha_{11}(i)\Delta x_{1t} + \sum \alpha_{12}(i)\Delta x_{2t} + \sum \alpha_{13}(i)\Delta x_{3t} + \varepsilon_{x1t} \\ \Delta x_{2t} &= \alpha_{x2}(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t}) + \sum \alpha_{21}(i)\Delta x_{1t} + \sum \alpha_{22}(i)\Delta x_{2t} + \sum \alpha_{23}(i)\Delta x_{3t} + \varepsilon_{x2t} \\ \Delta x_{3t} &= \alpha_{x3}(x_{1t} - \beta_1 - \beta_2 x_{2t} - \beta_3 x_{3t}) + \sum \alpha_{31}(i)\Delta x_{1t} + \sum \alpha_{32}(i)\Delta x_{2t} + \sum \alpha_{33}(i)\Delta x_{3t} + \varepsilon_{x3t}\end{aligned} \quad (6)$$

Indication of n-variable model in the form of closed matrix is as follows:

$$\Delta y_t = \alpha + \Pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + ... + \Gamma_{p-1} \Delta y_{p+1} + \varepsilon_t \quad (7)$$

The model above is called as Vector Error Correction model.

Johansen (1988) suggested two different likelihood ratios in revealing the cointegration relationship. One is the Maximum Eigenvalue Test the other one is Trace Test. Existence of maximum r cointegration vector in the Maximum Eigenvalue Test is tested against an alternative hypothesis expressing the existence ofr+1cointegration vector. And in the Trace Test, the existence of maximum r cointegration vector test is tested against an alternative hypothesis expressing the existence ofr+1cointegration vector.

EMPIRICAL RESULTS

In the VAR model estimations, it is required to determine the stationary of variables to be tested. As a result of analyses, it was found that variables were of stationary in the level and in the first differences. Table 2 seen that all the variables became stationary when taking their second order differences I(2).

Table2.Augmented Dickey-Fuller test of unit root

Variable	ADF Test Statistic	Critical Value	Likelihood	Order of Stationarity
DIRSA	-0.736085	-2.602794	0.3937	I(1)
LCREDSA	3.074316	-2.603423	0.9993	I(1)
LDEPSA	6.976711	-2.602794	1.0000	I(1)
LSECSA	3.699732	-2.602794	0.9999	I(1)
LWPISA	2.759294	-2.603423	0.9984	I(1)
LIPI	0.481991	-2.602794	0.8164	I(1)

Variable	ADF Test Statistic	Critical Value	Likelihood	Order of Stationarity
D(DIRSA,2)	-6.902328	-2.606163	0.0000	I(0)
D(LCREDSA,2)	-10.78555	-4.118444	0.0000	I(0)
D(LDEPSA,2	-	-	0.0000	I(0)

)	6.003217	2.607686		
D(LSECSA,2)	-11.52361	-4.121303	0.0000	I(0)
D(LWPISA,2)	-8.166606	-2.604746	0.0000	I(0)
D(LIPI,2)	-10.17035	-2.612033	0.0000	I(0)

When considering the parameters in Table2, it is also required in VAR Model to take the second order differences of variables and to include them in analyses.

Existence of a long-term relationship between variables to be used in analyses is determined by a method developed by Johansen (1988).Before that method, it is required to determine the lag number and the lag interval.In orderto determine the lag number and the lag interval, the VAR model was applied to our data sets with levels.

Changes obtained when the lag interval is determined as 1:1, 1:2, 1:3 are included in Table 3.

Table3.Lag intervals

Lag Intervals	1 : 1	1 : 2	1 : 3
AkaikeInformationCriterion	-23.53069	-23.94455	-23.61862
SchwarzInformationCriterion	-22.08973	-21.24540	-19.63936

When the lag interval is selected as to be 1:1,Akaike Information Criterion and Schwarz Information Criterion take the lowest value in the mean. Therefore, lag interval would be preferred as 1:1.Analysis results related to the lag length are as in Table4.

Table4.Lag lengths

Internal Variables: DIRSA LCREDSA LDEPSA LSECSA LWPISA LIPI

Sample: 2006M01 2011M03

Number of Observation: 55

Lag	LogL	LR	FPE	AIC	SC	HQ
0	299.1806	NA	9.44e-13	-10.66111	-10.44213	-10.57643
1	723.2052	740.1157	7.09e-19	-24.77110	-23.23822	-24.17832
2	761.8903	59.08278	6.74e-19	-24.86874	-22.02198	-23.76787
3	790.1647	37.01377	1.01e-18	-24.58781	-20.42715	-22.97885
4	821.4368	34.11495	1.54e-18	-24.41588	-18.94134	-22.29883
5	875.1325	46.86170	1.29e-18	-25.05936	-18.27093	-22.43422
6	936.2071	39.97611	1.18e-18	-25.97117	-17.86884	-22.83793
7	1050.981	50.08329	3.02e-19	-28.83568	-19.41947	-25.19436

8	1362.418	67.94992*	3.33e-22*	-38.85158*	-28.12147*	-34.70216*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Lag intervals for Table4 has been determined to be eight.Also because the Schwarz Information Criterion is used when making the study of the stationary of data, the same criterion was used to determine the lag number in the VAR model.

When the lag number obtained was applied to the Cointegration test, the results in Table5 were obtained.

Table5.Cointegration test results using the Johansen procedure

Null Hypothesis	Alternative Hypothesis	Eigenvalue	Trace Statistic	%5' Critical Value	Likelihood
r=0 *	r=1	0.595895	131.7332	95.75366	0.0000
r ≤ 1 *	r=2	0.412094	76.46219	69.81889	0.0134
r ≤ 2	r=3	0.349833	44.05969	47.85613	0.1087
r ≤3	r=4	0.169019	17.79764	29.79707	0.5811
r ≤4	r=5	0.087909	6.503626	15.49471	0.6360
r ≤ 5	r=6	0.014495	0.890675	3.841466	0.3453

*(**) showing that therelevant hypothesis is rejected at 5%(1%) significance level. r, expresses the number of cointegration vector.

According to the Table5, it is seen that the trace statistic of two results among the results was greater than %5 criterion. It is understood in both results marked with an asterisk that H_0 hypothesis has been rejected. According to this, there are 2 cointegrated vectors.

In analyzing impulse-response functions, sequencing of variables in model gains importance. Sequencing is made by considering prior economic information, causality relationship and statistical criterions(Gertlerand Gilchrist,1993: 53; Bernanke andGertler, 1995: 30).Method developed by Pesaran and Shin (1998) suggesting a method which is not affected by the sequencing of variables in model must be considered in creating the impulse-response functions.

In variance decomposition, the variables have been included in analyses with the sequencing of D2DIRSA, D2LDEPSA, D2LSECSA, D2LCREDSA,

D2LIPI and D2LWPISA. In this sequencing, influence order of variables in the applications of monetary policies was considered. Any change in instrument variable in the operation of transmission mechanism is carried to the general economy and finally affects production and inflation.Making policies vary according to the changes and to the response given by economic actors.

The Table of Variance Decomposition has been constituted for 10 periods (**Appendix 1**). Most of the changes in the variances of variables can only be explained in their way in the first months. While 100% of variance changes of interest rate are explained by itself, 69% in the 10^{th} month is explained by itself and 10% mostly by the deposits. Thus, it can be seen that the most explanatory variable in the variable of interest rate is the deposit. When we examined the variance of the variable of deposit, it is seen that its relationship with interest rate was mutual. In deposit variance, the most significant percentage of change in the decomposition of the 10^{th} period is 19.53% change in interest. In the decomposition of the variance of securities, the most significant percentage of change is in interest and it is 33.33%. In the decomposition of the variance of credit, again the most significant percentage of change in the 10^{th} month has occurred in interest and its rate is 7.7%. The most significant changes in industrial production index and in wholesale price index have been again in interest and their rates are 16.59% and 7.4%, respectively. As it is understood from here, the main instrument variable in monetary policy is interest rates. In this context, interest rates are the most significant main effects in all other variables, on the one hand. The most significant percentage at the second level in the variance decomposition of credits has been in deposit with 4.62%. This finding represents that the credits mostly depend on loanable funds and deposits held by the banks. The most significant percentage at the second level in the variance decomposition of industrial production index is in credits with 8.97%. That means that an increase in industrial production depends on the credit volume of banks.

According to the findings above, variance decomposition verifies the sequence of instruments of the monetary policy.Interest rates have an impact on market and directly affect total deposit, total credits and total securities. While an increase in deposits raises the size of loanable funds, an increase in credits also affects industrial production index positively.

When the figures of impulse-response functions (**Appendix2**) are examined, it is seen on all thefigures that there is a sharp break in the 2^{nd} period. Total number of observation is 63. When we made a calculation based on ten-period slices, the two-period slice would correspond to 12.6 number of observation a month. The sharpest break here was experienced in the first month of 2006. Starting the regime of explicit inflation targeting at the beginning of 2006 in Turkey is crucial to explain the break in question.In the new regime, it was

faced with a series of supply shocks which emerged with a change in the economic actors' perception of interest and inflation targeting exceeded the harmonic interval.

When the first 2 periods are disregarded, analysis results refer to the existence ofbank lending channel in Turkey. Accordingly a one unit shock in interests caused an increase in deposits and credits and in the sizes of securities. When y-axis of the graphs is examined, it is seen that the magnitudes of increases were different.Like in the variance decomposition, the deposit gave the greatest response once again. Deposit is followed by credits and securities. In this context, in case of giving one unit shock to the credits, Wholesale Price Index and industrial production index increase. Increase in credits raises domestic consumption and this situation causes an increase in Wholesale Price Index as well as industrial production index.

On the other hand, a break in industrial production index in Figure 4 similar to the 2nd period is also remarkable. 4th period corresponds to the 2008 global financial crisis whose effects is felt globally. This effect reveals in industrial production index as a rapid decline. Despite all the negativity, it is concluded with the examination of variance decomposition and impulse-response functions on VECM that bank lending channel is operating in the period 2006M1-2011M3.

Bank's perception of cost offunding completely changed with the explicit inflation targeting. Now the banks calculate their costs mainly in terms of cost of funding. However, weighted average cost offunding was started in the near future and it was initiated to givethe figures related to the concerning amounts on the website of TCMB by the 10th month of 2011.

CONCLUSION AND DISCUSSION

In this study, the monetary transmission mechanism and the effectiveness of the credit channel between the periods 2006Q01–2011Q03 in Turkey have been discussed. An analysis results in which Vector Error Correction Model was used is summarized below.According to the ADF test results, variables usedin analyses were determined to be second order stationary. Necessary tests have been performed to find the optimal lag length, and 8th lag length has been considered, according to the test results. Johansen cointegration test results represented that trace statistic of two results was greater than %5' criterion.

In both results, H_0 hypothesis has been rejected and it was determined that there were 2 cointegrated vectors. According to the analyses results of variance decomposition, main instrument in monetary policy is interest rates.

Interest rates are also the most significant main effectives for all other variables. On the other hand, the most significant percentage at the second level in the variance decomposition of credits has been in deposit.This finding represents that the credits mostly depend on loanable funds and deposits held by

the banks. Similarly, the most significant percentage at the second level in the variance decomposition of industrial production index is of the credit variable. Accordingly, an increase in industrial production depends on credit volume of the banks. The findings in question indicate that the variance decomposition verifies the sequence of instruments of the monetary policy.Interest rates have an impact on market and affect total deposit, total credits and total securities. While an increase in deposits raises the size of loanable funds, an increase in credits also affects industrial production index positively.

When the first 2 periods are disregarded in analyzing impulse-response functions, it was found that bank lending channel was operating in Turkey. In this context, a one unit shock in interests may cause an increase in deposits and credits and in the sizes of securities together with different magnitudes. Like in the variance decomposition, the deposit gave the greatest response once again. Deposit is followed by credits and the sizes of securities.

Similarly, in case of giving one unit shock to the credits, Wholesale Price Index and industrial production index give response by increasing. Increase in credits raises domestic consumption and this causes an increase in Wholesale Price Index as well as industrial production index.

In case of considering weighted average cost of funding as an effective variable of interest, a result which is truer and more consistent to economic and financial logic can be obtained in the next studies. However, because the near-time data reduces the number of observation, doing such a study in the next few decades grows difficult.

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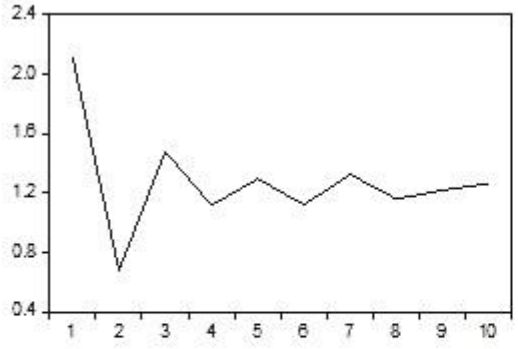
Appendix1.Results of variance decomposition

D2DIRSA's VarianceDecomposition							
Period	S.E.	D2DIRSA	D2LDEPSA	D2LSECSA	D2LCREDSA	D2LIPI	D2LWPISA
1	1.796249	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.189288	69.92019	9.551800	6.534491	1.954996	3.175771	8.862753
3	2.449260	69.01153	8.254307	5.280208	3.391303	3.880044	10.18261
4	2.830069	66.80640	11.80802	5.011301	2.596298	2.913576	10.86441
5	2.992532	65.76768	10.72728	4.862492	4.338494	4.453058	9.851005
6	3.168991	65.75210	11.86059	5.564165	3.895750	4.134964	8.792437
7	3.354317	67.19299	10.93193	5.064633	4.192216	4.146014	8.472224
8	3.479665	67.93628	10.39464	5.509368	4.045453	4.124577	7.989680
9	3.633883	68.12104	10.44692	5.528600	4.100417	4.316509	7.486506
10	3.761640	69.15071	10.02816	5.366525	4.107666	4.197477	7.149465
D2LDEPSA's VarianceDecomposition							
Period	S.E.	D2DIRSA	D2LDEPSA	D2LSECSA	D2LCREDSA	D2LIPI	D2LWPISA
1	0.017763	1.101681	98.89832	0.000000	0.000000	0.000000	0.000000
2	0.024612	16.82590	66.41388	5.486905	2.899409	2.374296	5.999607
3	0.028376	15.80853	53.62898	4.645247	12.50141	3.845076	9.570758
4	0.029147	15.15975	54.46233	4.426129	12.49565	3.677308	9.778837
5	0.031003	15.51940	48.14903	7.731485	14.62239	4.230084	9.747612
6	0.032955	18.10962	43.25732	6.925855	15.17921	4.599238	11.92875
7	0.033621	17.88939	42.74491	6.795335	15.07540	4.737462	12.75749
8	0.034620	18.17744	40.76772	8.231684	15.27560	4.601697	12.94586
9	0.035984	19.23889	38.23310	7.738301	15.80271	5.190583	13.79641
10	0.036847	19.53056	37.03977	7.671142	15.88760	5.239521	14.63142
D2LSECSA's VarianceDecomposition							
Period	S.E.	D2DIRSA	D2LDEPSA	D2LSECSA	D2LCREDSA	D2LIPI	D2LWPISA
1	0.024354	3.365284	44.31695	52.31777	0.000000	0.000000	0.000000
2	0.032632	27.33338	24.81033	29.61858	3.908453	10.09916	4.230092
3	0.036838	28.17690	22.70912	26.80234	4.962811	9.914400	7.434441
4	0.039235	25.59172	24.55837	29.86480	4.439170	8.748019	6.797917
5	0.043148	30.57362	21.33413	25.01887	5.468642	11.46780	6.136932
6	0.046466	31.40462	20.05121	23.61078	5.466892	10.83270	8.633796
7	0.047900	30.98783	20.26789	24.68731	5.232553	10.49461	8.329800
8	0.050680	32.56926	20.11845	22.87704	5.432383	10.93078	8.072091
9	0.052913	33.35360	19.21596	22.27547	5.375762	10.86250	8.916708
10	0.054626	33.33729	19.27405	22.56398	5.371110	10.69394	8.759626

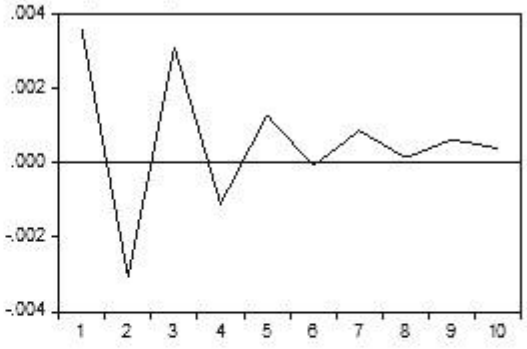
D2LCREDSA's VarianceDecomposition							
Period	S.E.	D2DIRSA	D2LDEPSA	D2LSECSA	D2LCREDSA	D2LIPI	D2LWPISA
1	0.013813	0.186541	13.39361	0.015829	86.40402	0.000000	0.000000
2	0.017430	12.22227	11.04725	0.346093	70.34766	0.357222	5.679512
3	0.020923	8.509516	9.011660	0.247041	77.18372	0.289756	4.758307
4	0.022145	8.993007	8.583506	0.229258	77.32408	0.361521	4.508629
5	0.024766	8.204615	6.892885	0.342485	79.40002	0.522157	4.637836
6	0.026518	8.517833	6.097076	0.298944	79.90269	0.455810	4.727647
7	0.028067	7.896816	5.875858	0.299157	80.83132	0.413651	4.683197
8	0.029628	7.991987	5.295886	0.313168	81.46234	0.374855	4.561760
9	0.031282	7.862264	4.916987	0.292622	81.85728	0.379516	4.691333
10	0.032573	7.711642	4.626802	0.280036	82.36881	0.350019	4.662692
D2LIPI's VarianceDecomposition							
Period	S.E.	D2DIRSA	D2LDEPSA	D2LSECSA	D2LCREDSA	D2LIPI	D2LWPISA
1	0.130065	12.81646	2.041049	1.815230	7.824677	75.50259	0.000000
2	0.142680	14.76623	3.287252	6.415753	8.813091	66.65294	0.064737
3	0.171972	15.91348	3.477672	6.029873	7.395089	67.07840	0.105491
4	0.187477	14.92344	3.475025	5.582116	9.260929	66.64510	0.113398
5	0.205844	16.24298	3.810755	7.093637	8.451902	64.29100	0.109724
6	0.220606	16.50896	3.765929	6.783931	8.872501	63.76198	0.306693
7	0.235541	15.99382	4.050293	6.795009	8.888025	63.99257	0.280285
8	0.248452	16.68235	3.928063	7.075762	8.892844	63.15308	0.267899
9	0.261647	16.59951	4.114819	7.065720	8.934242	63.00720	0.278514
10	0.273529	16.59828	4.148647	7.024953	8.976725	62.99649	0.254896
D2LWPISA's VarianceDecomposition							
Period	S.E.	D2DIRSA	D2LDEPSA	D2LSECSA	D2LCREDSA	D2LIPI	D2LWPISA
1	0.014814	17.91624	0.081962	0.006519	1.436159	0.087370	80.47175
2	0.016891	14.00099	3.175777	2.727631	1.707370	0.556476	77.83176
3	0.018503	11.71232	6.219962	2.597527	1.603357	1.649255	76.21757
4	0.020668	10.87437	5.929142	2.728495	1.364365	1.330345	77.77328
5	0.022225	10.07393	5.162970	2.537674	1.302614	1.176008	79.74681
6	0.023651	8.910165	4.770039	2.255135	1.632822	1.772715	80.65912
7	0.024774	8.587434	4.481395	2.274079	1.490040	1.635461	81.53159
8	0.026265	8.242607	3.988067	2.100320	1.325930	1.529647	82.81343
9	0.027359	7.651756	3.678943	2.016363	1.345244	1.648473	83.65922
10	0.028383	7.410961	3.418664	1.945612	1.256893	1.603841	84.36403

Appendix2.Impulse-response functions

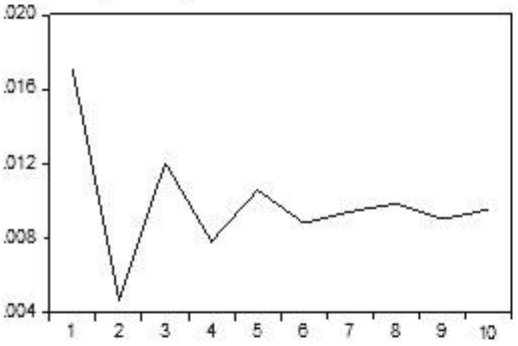
Graphic 1 Response of interest to a one unit shock to interest



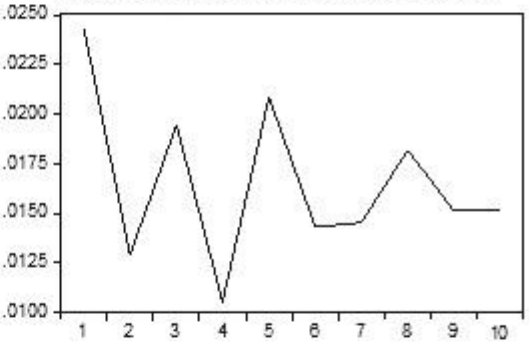
Graphic 2 Response of credits to a one unit shock to interest



Graphic 3 Response of deposit to a one unit shock to interest



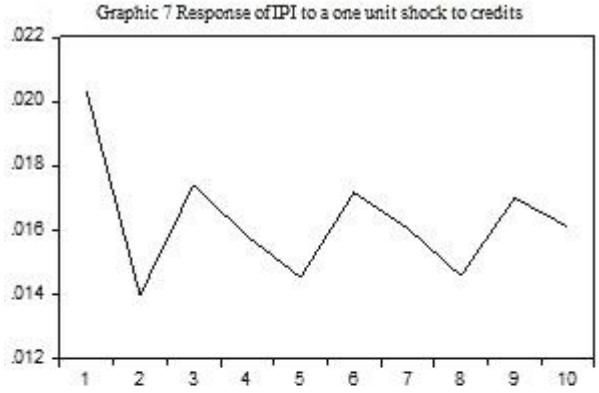
Graphic 4 Response of IPI to a one unit shock to interest



Graphic 5 Response of security to a one unit shock to interest

Graphic 6 Response or WPI to a one unit shock to interest

Graphic 7 Response ofIPI to a one unit shock to credits



Graphic 8 Response ofWPI to a one unit shock to credits