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## THE EFFECT OF MACROECONOMIC VARIABLES ON NON-PERFORMING LOANS IN TURKISH BANKING SECTOR

İlhami KARAHANOĞLU\*  
Harun ERCAN \*\*

### Abstract

Non-performing loans are one of the most important data which is used to determine efficiency of the banks as well as the health of the banking sector and the financial crisis effects. In this study, the relationship between the non-performing loans in Turkish banking sector and the macro economic variables which point out the general economic condition as stock exchange index over biggest 100 companies (BIST100), currency values as EUR and USD and the industry production index (SUE) over the years between 2005 and 2015 is analysed. It was seen that there is causal relationships between those variables with non-performing loans which is measured as non-performing loans / total loans.

**Keywords:** Non-performing Loans, BIST100, SUE, VAR.

### 1. Introduction

The nonperforming loans and their patterns are not only the issue of the banks itself as a measure of the performance and profitability also it is central concern of the regulatory bodies as well as the policy makers which would be accepted as a general sign for the current state of the economy (Reinhard and Rogoff,2010). Such variable is one of the basic indicators for the economic crisis as well.

In the literature it is seen that in the most of the studies which aimed at determining the indicator of non-performing loans, those indicators are classified into two main groups as the internal and external factors (Louzis et all, 2011). External factors have been seen as macro-economic variables such as currencies, real interest rates or unemployment rates or the indexes (Podpiera and Weill, 2008), whereas internal factors are seen as bank specific factor like size, profitability or cost efficiency measurements (Berge and Boye, 2007)

There are also other interesting researches which are concentrated on the internal process to determine the non-performing loan factors. Li et all (2007) in their research scrutinized the incentive contracts and managerial efforts. They have found that such incentive and efforts would decrease the non-performing loans significantly.

When the Turkish economical history is investigated through the big economic crisis which were reinforced by the deteriorations of the banks in years 1999 and 2001, it is seen that such crisis were reinforced with the non-performing loans.

In this research, the relationship between the nonperforming loan and macro-economic variables such as currencies, stock exchange index, and industrial production index were investigated and VAR methodology is used to enlighten the direction of the relationship. Moreover the shock effect of each of those variables on non-performing loans are also analysed by impulse response functions.

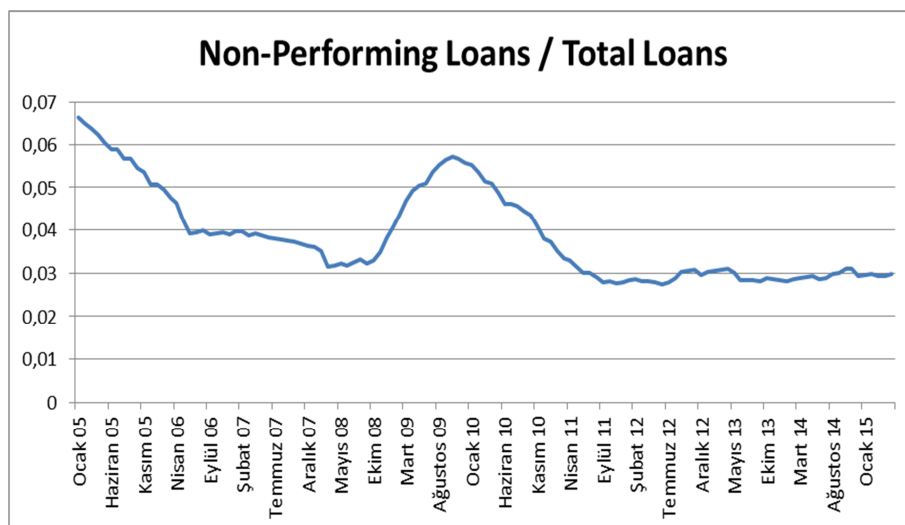
### 2. Literature Review

Non-performing loans can be defined as the corruption of the payment relationship between the bank and the borrower which might cause the delays in payments and also the loss (Golin and Delhaise,2000). Non-performing loans have always been the main research points of the different scholars. Louzis et all (2011) in their study concentrated on the nonperforming loans in Greece and make a comparison between different loan classes. In their research, they built and macroeconomic model and put the return on equity, solvency ratio, in efficiency, size, leverage as a the determinant of the non-performing loans. Klein (2013) in his study built more macroeconomic model and stated that the unemployment rate and GDP growth could be the most important determinants of the nonperforming loans. Messai (2013) in their research divided the nonperforming loans determinants as micro and macro factors in which the macroeconomic variables are emphasized as the rate of growth of GDP, unemployment rate and real interest

\* Dr., T. Kalkınma Bankası, Expert. İlhami.Karahanoglu@kalkinma.com.tr

\*\* T. Kalkınma Bankası, Expert. Harun.Ercan@kalkinma.com.tr

rate with respect to specific variables opted for the return on assets, the change in loans and the loan loss reserves to total loans ratio. Pasha and Kemraj (2012) stated that the nonperforming loans are generally driven by macroeconomic factors like interest rate and GDP.



This graphic is illustrating that Non-performing Loans / Total Loans Ratio has shown a dramatic decrease since 2005 with an exception in the years when the Mortgage Crisis occurred. The ratio starting almost 7% has decreased till 3% in 2008. The curve peaked in October 2009 by reaching 5.7%. Yücememis and Sozer (2010) emphasized in their paper that NPL/Loans ratio during the crisis periods, the ratio shows a rise. This graph also proves this theory. Sahbaz and Inkaya (2014) explained the peak as a reflection of the increasing NPL of the SMEs. Since 2010 the ratio has decreased to the level before crisis. The curve stayed stable and fixed around 3% in the last 4 years.

Yücememis and Sozer (2010) studied and compared NPLs in Turkish banking sector during crisis period. It is suggested that the NPL ratio in the system is a leading indicator in terms of the general state of the economy. They found out that after the reforms in 2001 crisis in Turkey, the rate of non-accruing loans in Turkey has raised in a limited level during the crises in 2008 compared to the crises in 2001 can be seen as a positive improvement.

Janvisloo et al. (2013) studied effects of macroeconomics shocks and stability on Malaysian banking system using a Structural Vector Autoregressive (SVAR) model for the period of 1997-2012. His findings suggested that the demand and supply shock have negative and monetary shock has positive effects on NPL ratio.

Abadi et al. (2014) researched the dynamics of Non-Performing Loan (NPL) in Indonesian banking system. They employed 6 macroeconomic variables that influence the NPL such as BI (Bank Indonesia) rate as proxy of interest rate, CPI, nominal exchange rate, import, M2 and the Industrial Production Index (IPX) on monthly basis from January 2003 to December 2013 by using Vector Error Correction Model (VECM) and took impulse response function (IRF) and variance decomposition to examined the sensitivity and to analyse dominant variables.

Islamoglu (2015) analysed the correlation between non-performing loan ratios of banks and macroeconomic factors (commercial loan interest rates and public debt stock/GDP ratios) and tried to determine lag length during 2002-2013 period. He fund out that non-performing loan ratio can be changed by those macroeconomic variables.

Belgrave et al. (2012) studied the sensitivity of NPLs to shocks by using panel VAR methods in six industries in Barbados. The results suggest that there is some degree of heterogeneity in the response of NPL to these shocks.

Babouček and Jančar (2005), by employing unrestricted VAR model, researched transmission involving a set of macroeconomic variables describing the development of the Czech economy and the functioning of its credit channel. In their study, it was found out that banking sector's stability is compatible both with price stability and with economic growth and the loans have showed endurance to shocks.

Arslan and Yaprakli (2008) investigated the relationship between bank credits and inflation by employing Johansen cointegration analysis and error correction model between 1983 and 2007. Their findings supported that bank credits are negatively affected by inflation, but inflation is positively affected

by bank credits in the long run. They also found out by using Granger causality tests that bi-directional causality between bank credits and inflation exists.

Škarica (2014) analysed the determinants of the changes in the non-performing loan (NPL) ratio using a fixed effects estimator for seven Central and Eastern European (CEE) countries between markets. The analyses resulted that high levels of NPLs are caused by the economic slowdown, which is evident from statistically significant and economically large coefficients on GDP, unemployment and the inflation rate.

Amediku (2006) employed a VAR methodology to stress test the Ghanaian banking system by using quarterly data from 1995 -2005. It forecasts the effects in some macroeconomic variables on the NPL ratio of the banking industry. An adverse output shock and an increase in inflation raise the banks' NPL ratio.

Klein (2013) analysed non-performing loans (NPLs) in Central, Eastern and South - Eastern Europe (CESEE) in the period of 1998–2011. As a result of this study NPLs were found to be effected by macroeconomic conditions, such as GDP growth, unemployment, and inflation. This research also explains that from the banking system to the real economy there are feedback effects.

Espinoza and Prasad (2010) analysed 80 banks in the Gulf Cooperative Council region by a dynamic panel estimation over 1995–2008. They found that the NPL ratio got worse as economic growth becomes lower and interest rates and risk aversion increase. By using a VAR model they observed the feedback effect of increasing NPLs on growth. The results of panel VAR suggest that there could be a strong, albeit short-lived feedback effect from losses in banks' balance sheets on economic activity, with a semi-elasticity of around 0.4.

İslamoglu (2015) again in his research has associated the stock exchange index with nonperforming loans. In his research he has found a significant relationship between those variables including other macroeconomic determinants like GDP and Public Debt Stocks.

### 3. Research Data and Methodology

In this research the relationship between the non-performing loans and related macroeconomic variables for the period between 2005 January and 2015 may is analyzed. All the variables which were chosen were readily available starting from the year 2005, that's reason of choosing that period. The time series variables were taken from the Central Bank of Turkey (TCMB), Turkish Statistical Institution (TUIK) and Turkish Banking Supervisory Body (BDDK). All analysis was done by e-views 8 software.

In this study as a non-performing loan measure, the ratio of non-performing loans over total loans was used. As related variables, the currencies (EUR and USD), the Istanbul stock exchange index over the biggest 100 companies called BIST100 index and the industrial production index called as SUE were accepted. Through the literature, it was easily seen that such variables are used frequently. Moreover to overcome stationary problem, by following the literature and past research, the logarithmic return of cross currencies USD/TRY, EUR/TRY and industrial production index of Turkey, the Istanbul stock exchange bist100 index and the non-performing loans / total loans were taken. Industrial production index and nonperforming loans are published monthly. In order to have a coherent variables, USD, EUR and BIST100 Index variables are taken as the last day value of the each month.

Under the circumstance that the variables are not well known whether to be external or internal, the VAR models are used. VAR models are the combination of the time series models with one variable and concurrent equation models. The VAR methodology which is developed by Sims, is generally preferred when to analyze all the variables together as a systematic way. In financial or macroeconomic models there is a dynamic feedback. It is not well known whether any time series which is abundant in the system is not connected with any other trend of another time series in the system. When such a symmetric interaction is the subject, the VAR methodology is preferred.

Every variable in the model is the function of the other variables as well its own lags in the system. If we can show it as a matrix form; it could be seen as;

$$\begin{array}{rcll}
 \text{Intak\_al} & C(1) & \alpha(1,1) & \alpha(1,2) & \dots & \text{Intak\_al}(-1) & \varepsilon(1) \\
 \text{SUE} & C(2) & \alpha(2,1) & \alpha(2,2) & \dots & \text{SUE}(-1) & \varepsilon(2) \\
 \text{USD} & = C(3) + \alpha(3,1) & \alpha(3,2) & \dots & + & \text{USD}(-1) & + \varepsilon(3) \\
 \text{EUR} & C(4) & \alpha(4,1) & \alpha(4,2) & \dots & \text{EUR}(-1) & \varepsilon(4) \\
 \text{BIST100} & C(5) & \alpha(5,1) & \alpha(5,2) & \dots & \text{BIST100}(-1) & \varepsilon(5)
 \end{array}$$

Formula(1): The VAR Equation of the Model

In that equation, Intak\_al denotes the logarithmic change of nonperforming loans over total loans ratio, SUE industrial production index, USD and EUR are the exchange rate over Turkish lira, BIST100 is the

Istanbul stock exchange index over the biggest 100 companies. The  $\alpha$  values denotes the lag operators and also the  $\varepsilon$ 's are error terms coming from the linear regression equation.

The VAR methodology is also used to test the causality between the variables. However in for doing such a test all the variables are required to be stationary. In order to do so, as explained above we have used the well-known method as logarithmic change. So in the research all the variables logarithmic changes were used which can be formulated as  $\ln(X_t / X_{t-1})$ . VAR models can predict dynamic internal relationships without the strong assumptions, so the research don't have to indicate whether and variable is internal or external. Moreover VAR models can be used for measuring the effects of simultaneous shocks. VAR models also concentrates on the error terms and measures the stationary of shocks by measuring what happens as one variables error term has a one unit shock.

#### 4.Results

In this research in order test whether all the series are stationary, the dickey fuller augmented test is applied. The results are given below as;

	t-Statistic	Prob.*
Null Hypothesis: USD has a unit root	-9.905005	0.0000
Null Hypothesis: EUR has a unit root	-10.04911	0.0000
Null Hypothesis: BIST100 has a unit root	-10.35269	0.0000
Null Hypothesis: SUE has a unit root	-6.596195	0.0000
Null Hypothesis: Lntak_al has a unit root	-3.122557	0.0275

Table 1: The Unit Root Test for the variables and The System

It can be easily seen that all the series don't have unit root with 5% percentage significance.

After the stationary series are obtained in order to apply the VAR models we have to find the number of lag. When we apply the entire test to find the optimal lag number; we have decided that the 2nd lag is the most optimal one;

Table 2: The Determination of The Optimal Lag Structure

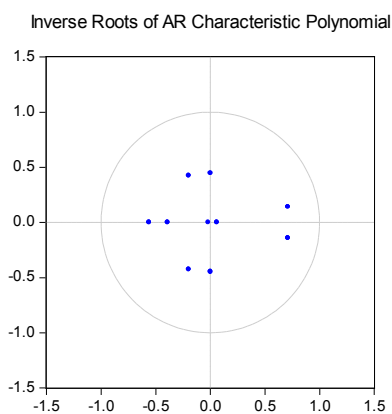
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1167.997	NA	1.35e-15	-20.05168	-19.93299*	-20.00350
1	1212.393	84.19944	9.64e-16	-20.38609	-19.67396	-20.09701*
2	<b>1248.942</b>	<b>66.16582</b>	<b>7.92e-16*</b>	<b>-20.58521*</b>	<b>-19.27963</b>	<b>-20.05522</b>
3	1264.982	27.65413	9.30e-16	-20.43072	-18.53169	-19.65982
4	1279.229	23.33603	1.13e-15	-20.24533	-17.75285	-19.23352
5	1295.192	24.77039	1.35e-15	-20.08952	-17.00360	-18.83681
6	1327.667	47.59227*	1.22e-15	-20.21839	-16.53903	-18.72478

VAR Residual Serial Correlation LM Tests  
 Sample: 2005M02 2015M05  
 Included observations: 122

Lags	LM-Stat	Prob
1	26.89946	0.3609
2	31.20088	0.1825
3	23.11175	0.5710
4	28.28054	0.2951
5	18.59252	0.8162
6	45.30817	0.0077
7	39.27957	0.0345
8	27.29721	0.3412
9	34.15502	0.1046
10	26.13726	0.4003
11	25.18861	0.4518
12	38.21097	0.0441

Probs from chi-square with 25 df.

Table 3: Autocorelaiton Test



After the determination of long term relationship, we need to find the direction of that relationship which will be done by Granger Causality test. The results are given below

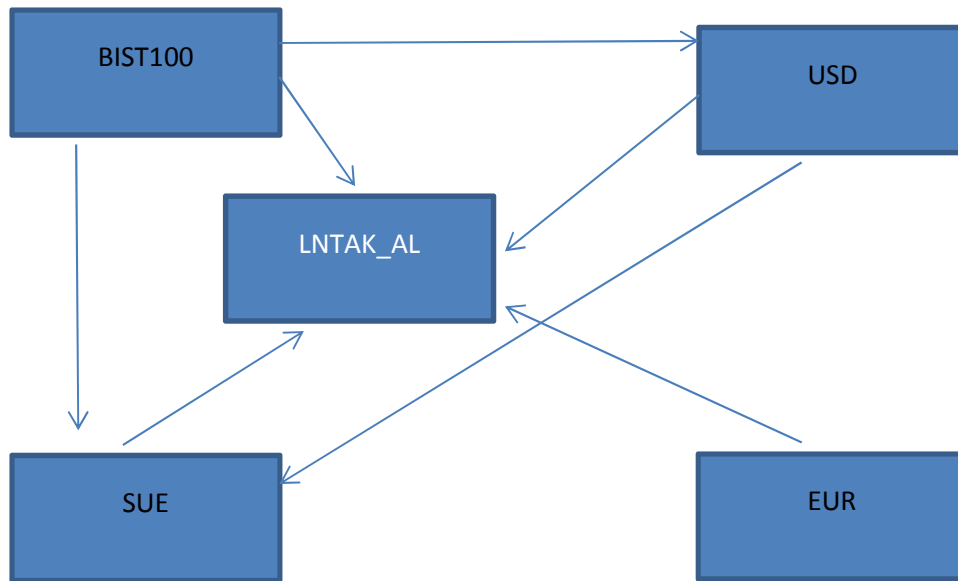
Pairwise Granger Causality Tests

Sample: 2005M02 2015M05

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
USD does not Granger Cause LNTAK_AL_KRED	122	15.1804	1.E-06
LNTAK_AL_KRED does not Granger Cause USD		0.36490	0.6951
SUE does not Granger Cause LNTAK_AL_KRED	122	3.03337	0.0520
LNTAK_AL_KRED does not Granger Cause SUE		1.41943	0.2460
BIST100 does not Granger Cause LNTAK_AL_KRED	122	9.38264	0.0002
LNTAK_AL_KRED does not Granger Cause BIST100		1.62454	0.2014
EUR does not Granger Cause LNTAK_AL_KRED	122	5.34894	0.0060
LNTAK_AL_KRED does not Granger Cause EUR		0.20053	0.8186
SUE does not Granger Cause USD	122	0.85711	0.4270
USD does not Granger Cause SUE		4.30063	0.0158
BIST100 does not Granger Cause USD	122	3.40675	0.0365
USD does not Granger Cause BIST100		1.14769	0.3209
EUR does not Granger Cause USD	122	1.65655	0.1952
USD does not Granger Cause EUR		0.15528	0.8563
BIST100 does not Granger Cause SUE	122	7.42937	0.0009
SUE does not Granger Cause BIST100		1.29911	0.2767
EUR does not Granger Cause SUE	122	1.45793	0.2369
SUE does not Granger Cause EUR		0.30673	0.7364
EUR does not Granger Cause BIST100	122	0.42954	0.6518
BIST100 does not Granger Cause EUR		1.51338	0.2244

Table 5: Results of Granger Causality Test



Graph 1: The Schematic Description of Granger Causality Tests

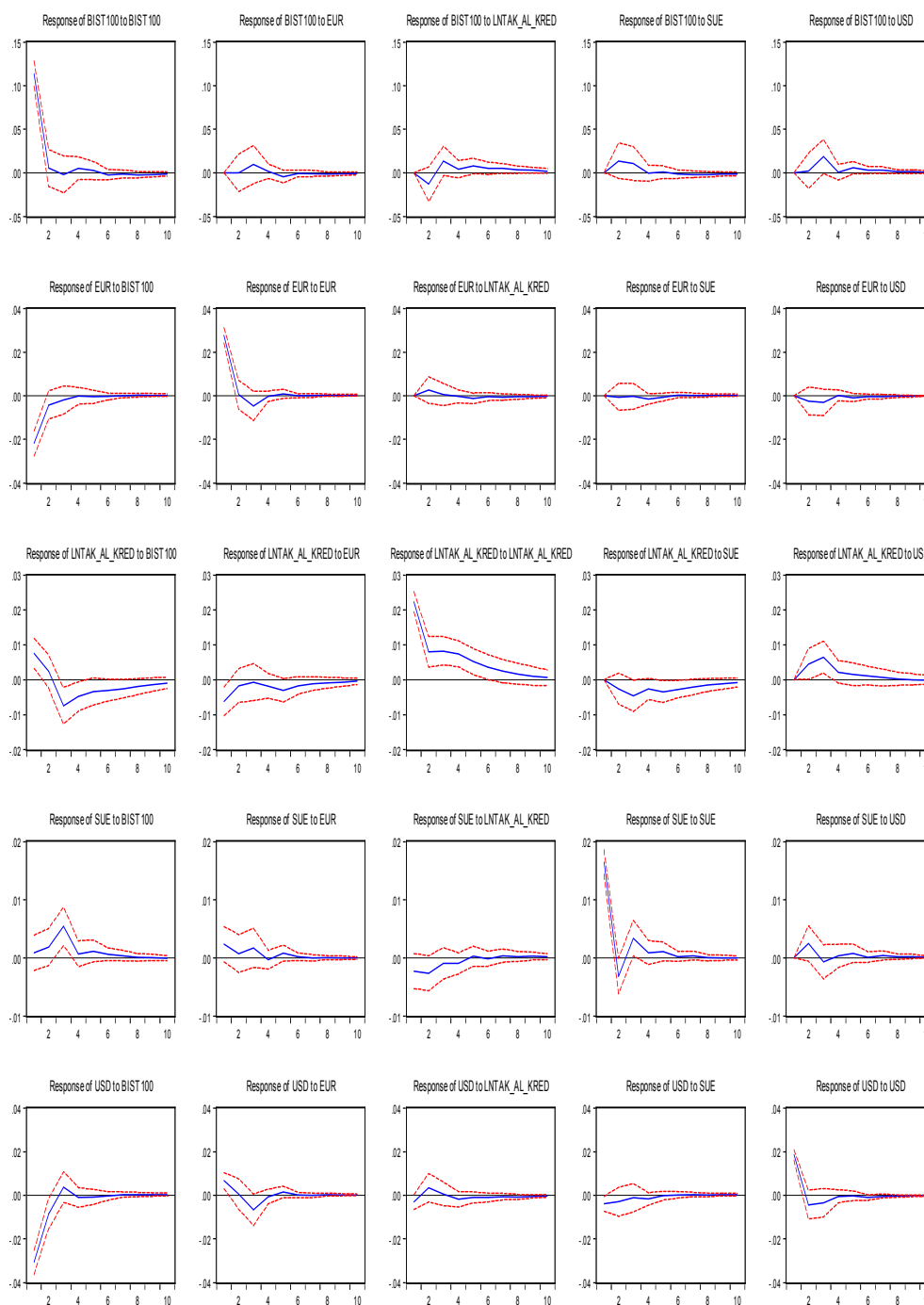
When we look at the granger causality test results it will be seen that there is a granger causality relationship between the USD/TRY and EUR /TRY (USD, EUR) return, industrial production index (SUE), and as far as Istanbul stock exchange index (BIST100) with non-performing loans (lnTAK\_AL). Moreover there is also causal relationship between USD and SUE. BIST 100 is also granger causality for USD and SUE. Those results are economically and financially very logical.

In turkey there is a very strong saving gap which causes to finance investment with the foreign sources. As a result, either directly the industries are using currency based credits, or the payment or the availability of the credits depends on the foreign currency level and interest rates. The results which can be seen upstairs are coherent with the general economic condition which is defined here. BIST100 index is granger causality of nonperforming loans which can be coming from two sources. At first, such indexes shows the general condition of the economy, If those indexes goes bad, that means the economy under crisis or having a great problem to supply sources to the investors. Secondly, any firm which is quoted to the stock exchange is bounded with the sources coming from the investors. If the index goes down, that means those investors would not contribute to the companies which might cause the companies in to financial distress as well as limits their ability to make payments for their loans.

In this research in order to show the effects of other variables on nonperforming credit, the response impulse functions were also estimated and results were given at graph 2. In the graph on second layer first panel; BIST100 index shows very complex effects on nonperforming credit. Although a shock on bist100 index would increase the non-performing loan for first period the effect becomes negative quickly and keeps on negative for a very long time.

Again in the graph third layer second panel; when there is a shock in EUR, the effect directly comes up negative and again it lasts for 5-6 quarter period with decreasing power as well. If there is shock in industrial production index (SUE), the nonperforming credits becomes negatively affected and this effect lasts for 5-6 quarter with decreasing effect. If there is shock in USD values, nonperforming loans increasing suddenly but this effect disappears in 4th and 5th period.

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



Graph 2: Response Impulse Functions

## 5. Conclusions and Discussion

In this research, for the periods 2005 January to 2015 may, by using the monthly values, the effects of the macroeconomic variables (cross currency exchanges EUR, USD; industrial production index SUE, Istanbul stock exchange index over the biggest 100 company BIST100) to the logarithmic change of the nonperforming loan ratio. And also the granger causality test is used to determine the relationship and also the direction of that relationship. The co-integration analysis shows that there is long term relationship between those variables. By means of granger causality test, it was possible to detect the direction of those relationships. There is one way relationship between the logarithmic change of USD, EUR, SUE and BIST100 with non-performing over total loan ratio with almost %5 significance. This was the main motive of this study to reach such a point.

As a macroeconomic variable, foreign exchange rates relative values are one of the most interesting and volatile data for the developing countries. In Turkey, as a country where the saving gap is negative, the investments need the external support whose currency will be generally EUR or USD. So, generally domestic



companies whose market is based upon the Turkish lira and the finance is based upon foreign currencies are always very sensitive to the changes in those values. Banks, coming from the stipulation of BDDK regulations, have to keep their currency positions in predetermined limits (net currency position / capital  $<+-%20$ ). As a result, generally they deploy credits based upon the currencies of their funding. However companies in Turkey don't have such stipulations and they carry a quite big open currency position which makes the companies very sensitive to foreign currency values. Any jump of the currency value or increase in the volatility of the currency market generally cause problem from the liability side of the companies which increases the financial burden. Hence, the companies would find themselves in a condition where they are not able to pay their loans to the banks back. The result of this study is very parallel to that reality which states the relationship between currency change and nonperforming loans in banks.

Moreover; when the companies are in financial distress, their production amount decreased which results the problems of paying back the loans to the banks. Such relationship has also seen in that research clearly.

In addition, the companies use the stock exchange whenever they need extra financial sources as a direct investment or in order to get loans with long term and better conditions. They use their stock performance or values as a confirmation of their financial strength. Under the case where the company's stock value is low or showing very poor performance, it would have a problem to fund their investment or liquidity as well as funding problem also they can be in financial distress. Such condition would trigger the case that the banks would not be able to pay back their loans. In that research the findings support that process.

When the profit margins of the banks are considered as a long term investment, any loose or any problem coming from the defaulted credits would be extremely problematic. Moreover when the financing or liquidity GAP is thought, any problem coming from the cash flows of the credits could have an devastating effects on banks health for short and as well as long term. Such problems could not only affect the sector but also with contiguous effect it might cause whole economic problem as well as financial distress. Understanding such relationship and controlling the nonperforming loans are extremely vital for the banks as well as for the policy makers and supervisory bodies. The economy history of turkey is full of those cases in which the economic crisis and also the effect of economic crisis were triggered with nonperforming loans like year in 1994 and 2001.

From the internal and external investors and creditors view, increase in the non-performing loans would accept as either a warning for a crisis or inefficient credit management of the bank. Such a case would decrease the profit and as well as the efficiency of the banks.

In that point, it is extremely vital to monitor control and manage the nonperforming credits in micro and macro level. In macro level, to understand which variables are effective on non-performing loans and how it changes with time could be the most useful tools. In macro level, the precautions to decrease non-performing loans with the improving internal systems, to predict the effects of non-performing loans liquidity and capital adequacy as well as profitability are the well-known methods to control and manage the nonperforming loans. As a result, a strong credit risk management system which is feed by the internal and external data and processes with micro and macro level analysis is unavoidable for the banks. Such analysis would be extremely vital to reinforce the systems which are described above.

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