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Doktora Tezi olarak sunduğum "Interactions Between Non-Performing Loans And Macroeconomic Variables" adlı çalışmanın, tarafımdan, akademik kurallara ve etik değerlere uygun olarak yazıldığını ve yararlandığım eserlerin kaynakçada gösterilenlerden oluştuğunu, bunlara atıf yapılarak yararlanılmış olduğunu belirtir ve bunu onurumla doğrularım.

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ABSTRACT

In recent years, financial institutions such as the commercial banks have a central role in financial stability as much as governmental institutions like central banks. At this point, although the main role of banks is financial intermediation, this role has recently been evolved towards the financial stability provider or vice versa. From this point of view it is observed that the health of banking system became a crucial issue for an economy. However, as clearly seen in the latest 2008 global financial crisis, financial systems are subjected to instability and crisis that create huge costs to society. It is observed that the main source of the financial crisis emerges from the asset side of the banks' balance sheets. Asset quality and credit risk gain more importance in this context. At this point, the questions have been arisen that what the main macro determinants of credit risk are and also whether the potential of the credit risk is to cause a macroeconomic crisis or not.

From this point of view, in this research, it has been taken to road in order to improve the understanding of the relevance of credit risk with the macroeconomic fluctuations and its interconnections by the key macroeconomic variables such as growth, unemployment and inflation. VAR methodology is used to analyze the determinants of NPLs and to identify the feedback effects of NPLs on macroeconomy and also Panel VAR methodology is used to analyze the OECD data. Research data are consisted of NPLs Ratio, Credit Volume, GDP Growth, Unemployment and Inflation between 1999 and 2016.

Findings suggest that a shock to NPL growth and credit volume have implications on economic activity. Especially the bank credit volume's impact on GDP growth, inflation and unemployment consist the key findings, while the Panel VAR and VAR models also suggest that a deterioration in asset quality leads to a decline in credit and vice versa. It is also suggested that stronger economic activity accompanied by higher GDP growth and lower inflation have a positive impact on asset quality and credit expansion of banking sector. Notably, GDP growth leads to decline in NPLs and to increase in credit volume, while inflation has a role accelerating the NPLs growth and

credit volume decline. These impacts on NPLs and credit volume feeds back the economy negatively.

ÖZET

Son yıllarda, ticari bankalar gibi finansal kurumlar, merkez bankaları gibi devlet kurumları kadar finansal istikrarda da merkezi bir role sahiptir. Bu noktada, bankaların ana rolü finansal aracılık olmasına rağmen, bu rol son zamanlarda finansal istikrar sağlayıcıya doğru veya tam tersi yönde gelişmiştir. Bu açıdan bankacılık sisteminin sağlığı bir ekonomi için çok önemli bir konu haline geldiği görülmektedir. Ancak, en son 2008 küresel finansal krizinde açıkça görüldüğü üzere, finansal sistemler istikrarsızlığa ve topluma büyük maliyetler yaratan krize maruz kalmaktadır. Finansal krizin asıl kaynağının bankaların bilanço aktiflerinden kaynaklandığı görülmektedir. Varlık kalitesi ve kredi riski bu bağlamda daha fazla önem kazanmaktadır. Bu noktada, kredi riskinin temel makro belirleyicilerinin ne olduğu ve ayrıca kredi riskinin makroekonomik krize neden olma potansiyelinin olup olmadığı sorusu ortaya çıkmıştır.

Bu açıdan bakıldığında, bu araştırmada, kredi riskinin makroekonomik dalgalanmalarla ilişkisinin ve büyüme, işsizlik ve enflasyon gibi temel makroekonomik değişkenlerle bağlantısının anlaşılmasını geliştirmek amacıyla yola çıkılmıştır. Takipteki alacakların belirleyicilerini analiz etmek ve takipteki alacakların makroekonomi üzerindeki geri bildirim etkilerini belirlemek için VAR metodolojisi ve ayrıca OECD verilerini analiz etmek için Panel VAR metodolojisi kullanılmıştır. Araştırma verileri, 1999-2016 yılları arasında Takibe Giden Alacaklar Oranı, Kredi Hacmi, GSYİH Büyümesi, İşsizlik ve Enflasyondan oluşmaktadır.

Bulgular, takipteki alacakların büyümesindeki bir şokun ve kredi hacminin ekonomik aktivite üzerinde etkilerinin olduğunu göstermektedir. Özellikle banka kredisi hacminin GSYİH büyümesi, enflasyonu ve işsizlik üzerindeki etkisi kilit bulguları oluştururken, Panel VAR ve VAR modelleri de varlık kalitesindeki bozulmanın kredilerde düşüşe yol açtığını göstermektedir. Ayrıca, daha yüksek GSYİH büyümesi ve düşük enflasyonun eşlik ettiği daha güçlü ekonomik koşulların, bankacılık sektörünün aktif kalitesi ve kredi genişlemesinde olumlu bir etkisi olduğu öne sürülmektedir. Özellikle, GSYH büyümesi TGA'nın düşmesine ve kredi hacminin artmasına yol açarken, enflasyonun TGA'nın büyümesini ve kredi hacmindeki düşüşü hızlandıran bir

rolü vardır. Takipteki alacaklar ve kredi hacmi üzerindeki bu etkiler ekonomiyi olumsuz yönde beslemektedir.

Anahtar Kelimeler: Kredi Riski, Takipteki alacaklar, makroekonomi, VAR, Panel VAR

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BRSA	Banking Regulation and Supervision Agency
CBRT	Central Bank of the Republic of Turkey
CPI	Consumer Price Index
CRVOL	Credit Volume of the Banking Sector
GDP	Gross Domestic Product
IAS	International Accounting Standards
IFRS	International Financial Reporting Standards
KGF	Kredi Garanti Fonu (Credit Quarentee Fund)
NPLs	Non-Performing Loans
NPLR	Non-Performing Loans Ratio
ROE	Return on Equity
ROA	Return on Asset
SDIF	Saving Deposit Insurance Fund
TL	Turkish Lira
UNEMP	Unemployment Rate

1. INTRODUCTION

In all countries both developed and developing, the authorities focused on the promotion of financial stability in order to increase economic activity and welfare since the last century. In this scope, financial institutions especially the commercial banks have a central role in financial stability as much as governmental institutions like central banks. At this point although the main role of banks is financial intermediation, this role has recently been evolved towards the financial stability provider or vice versa. From this point of view health of banking system is a crucial issue for an economy.

However, financial systems are subjected to instability and crisis that create huge costs to society as clearly seen in the latest 2008 global financial crisis. Main source of the financial crisis emerge from the asset side of the banks' balance sheet. As a result of poor risk management practices, the asset quality deteriorates with the increase in non-performing Loans. When we ignore the asymmetric information problem which is the one of the main reasons what lies behind the NPLs hence deteriorating asset quality, the changing conditions that worsen the debt-paying capacity of the borrower and causing NPLs, constitutes one of the issues of this study. It is considered that NPLs constitutes an impediment to economic activity, especially for countries which rely mostly on bank loans financing. High level of NPLs resulting from changing conditions reduce profitability of banks, weakens the banks' reserves, increase funding costs, decrease capital adequacy and narrow the credit supply and also ultimately impact GDP growth negatively.

This situation, similarly the functioning of the 'credit channel' theory of monetary policy transmission mechanism, causes to narrow the credit volume of the banks and affects the real economy negatively. The basis of the traditional credit channel approach of the monetary transmission mechanism is the change in credit supply of banks in response of monetary policy shocks. The tightening monetary policy may also cause a contraction in the credit supply by means of a reduction in demand deposits and reserve volume, as well as the capital losses to be caused by credit losses that will arise due to the change in the asset prices. In order to meet the capital needs that will emerge after the losses in the loan portfolio, banks will reduce lending activities which is the least costly

way of maintaining the capital adequacy compared with the external financing cost. Businesses and individuals that need credit in order to maintain their activities will cut down on spending and hence aggregate demand because they can get less credit. With in the scope of credit channel approach of monetary transmission mechanism, this research is based on considering that NPLs will have the same effect on the economy by reducing the loanable fund capacity and capital adequacy of banks. Additionally, effects of NPLs is considered to be bigger in developing countries such as Turkey which is suffering from inadequate capital stock and also having underdeveloped equity markets.

There are two preconditions for the impact of the narrowing credit supply in response of tightening monetary policy actions on the real sector. First one is that the banks should narrow the credit supply when the liquidity shortage created by the change in the monetary policy arises. The second one is based on sources which can be obtained from bank loans and capital markets should not be full substitutes in terms of borrowers. Developing countries such as Turkey and yet in terms of being a country of limited access to capital markets, both conditions are valid. Economies such as Turkey which have less effective money and capital markets and where the main financing source of the reel sector investments is the bank loans, are more vulnerable to credit risk. The growth of the developing countries that suffers from inadequate capital stock, have been financed mainly by bank loans. This situation entails the efficient operation of the credit markets in order to sustain the healthiness of the entire economy.

The importance of credit risk has increased and the asset quality of the banking sector has become one of the main financial soundness indicators especially after the 2008 global financial crisis. At this point, the questions have been arisen that what are the main macro determinants of credit risk and also whether the potential of the credit risk is to cause a macroeconomic crisis or not. In another words, the question of what this study sought answers is that do credit volume and credit risk measured with NPLs have an effect on economy's performance or not ? Many researches have conducted studies in this area in order to find responses these questions. The main difference of this survey, from the literature, is including the OECD and Turkey's data modelled separately and comparing them.

While most of the studies in the literature focus on finding the determinants of the NPLs or measuring only the effects of the NPLs on macroeconomics, the aim of this study

is to find the basic macro determinants of the NPLs and to investigate the effects of credit risk on macroeconomic conditions. In particular, it is thought that growth and unemployment will be affected by the credit contraction which will arise as a result of the increase in NPLs. Additionally, it is considered that a similar result will arise to the results of the credit channel of the monetary transmission mechanism. Moving from this point of view, in this study statistical researches on the Turkey and OECD countries data are conducted separately. It is considered that investigating Turkey and OECD data and also comparing them will produce more accurate results for analysis and policy inference.

With the study on OECD countries, it is aimed to measure the overall impact of credit risk on macro indicators, regardless of the level of development of countries' money and capital markets, geographical and regional impacts and the effects of different economic dynamics. At this point, one of the main questions of this study is how credit risk affects the general economic conditions regardless of the country-specific conditions.

In previous studies, the effects of NPLs and credit volume on macroeconomics have been studied for some countries or regions. For countries with different dynamics such as OECD countries, no study has been conducted. It was not analyzed how the NPLs affects macro structure of any economy regardless of the factors such as the economic size of countries, different geographies and having different economic structures. In this research, the findings of previous research results are tested on OECD countries for generalization and are compared with an emerging country. The biggest contribution of this study will be two separate investigations that allows the comparison on OECD countries and Turkey. Main difference of this research is that a comparison with OECD and an emerging economy that have never been conducted a study in this research area. Another contribution is the measurement of whether a similar result to the results of the credit channel of the the monetary transmission mechanism arises or not. Additionally, most of the studies are based on annual data sets. In this study, however, the observation interval was limited by using quarterly data in the estimation of this relationship. So larger data set and a higher degree of freedom were used to estimate the relationship. At the same time, an analysis with the Turkey's annual data was conducted and the results were compared with the Panel VAR analysis results.

In this research, VAR methodology is used to analyze the determinants of NPLs and to identify the feedback effects of NPLs on macroeconomy, as well as Panel VAR methodology to analyze OECD data.

From this point of view, the fact that the macroeconomic crisis generation potential of the credit risk are not adequately researched in these countries is the most important source of motivation for this study. The scope of the study is two-way and the first one is to find the macro determinants of the credit risk and the second one is to measure the potential impacts of the credit risk on macroeconomic variables.

The rest of the paper is organized as follows. Section two summarizes the literature containing experimental studies on the relationship between credit risk and macroeconomics. It also introduced the loan classification, causes and consequences of NPLs. Section three describes the hypothesis which is comprising the idea behind the research. Section four introduces data, variables and methodology. Section five presents and discusses the empirical findings of VAR and PVAR models together with Granger causality, impulse response and variance decomposition results. Section six includes the conclusion and contribution of the study.

2.   LITERATURE REVIEW

2.1 Research Background

Friedman (1968) explains the main goals of economic policy: high employment, stable prices, and rapid growth. Snowdon and Vane (2005) define the successful economy as an economy that has low unemployment and inflation with steady and sustained economic growth. With the consensus of most economists, it is accepted that downturn period of these main indicators (bust period in business cyle) is defined as an economic crisis that is a situation in which an economy severely deteriorates.

Although the origins of the studies on the theories of crisis dates back to the 19th century, it is not possible to talk about financial crises in the sense that we know today. Therefore, at first the theories of the crisis were developed to explain the real economic crises. On the other hand, in the period from the beginning of the 1940s to until the early 1970s, prevailing growth conjuncture created a laziness in studies of the crisis theories. However, in the early 1970s, due to the collapse of the Bretton Woods system and the impact of the oil shocks, the conjuncture changed the direction again and the debates on the theories of the crisis were again showed an increase. With the intensification of financial globalization and liberalization activities in the 1970s, financial crises began to come into view in many countries. An issue, agreed upon, is that the main driver of the economic crises across the globe are financial crises arising as a result of financial liberalization at the last few decades. Mishkin (1994), within the asymmetric information theory framework, describes the financial crisis as a state that arises as a result of the inability of financial markets to function efficiently and unable to efficiently channel funds to those who have the most productive investment opportunities. Dell'Ariccia et. al. (2013) found that almost a third of booms occurs around financial liberalization practices and also emprical studies conducted by Kaminsky and Reinhart, (1999) show that crises arise after the financial liberalization policies. As a consequence of this change in the economy, discussions, and studies including the financial crisis, its types and its causes have been carried out in literature more than the real economic crisis theories. Laeven and Valencia (2012) identify 147 banking crises and also 218 currency crises and 66 sovereign crises across the globe over the period 1970–2011.

Crises are handled within the framework of the business cycles by most of economists. Business cycles, using today, were described and analyzed by Burns and Mitchell (1946) in their book, Measuring Business Cycles. Generally accepted description of the business cycle consists of the boom and bust cycle which implies the phases of economic growth and decline. Economy management of every country is trying to smooth this boom and bust period by balancing growth, unemployment and inflation with the purpose of reaching sustainable welfare.

Max Wirth, in his Geschichte der Handelskrisen (1858), was one of the first economist making a classification of crises as credit crises, capital crises, crises of speculation, etc (Schumpeter, 1954). Considered as the "explorer of conjuncture", additionally Juglar is one of the first economists to reach conclusions about the existence of some regular fluctuations in economic activities based on observations on economic data. Schumpeter describes Juglar as the founding father of business cycle theory, because of his studies defining periodicity of crises and with his attribution of the cause of crises to the preceding prosperities. In his first edition of book in 1862, Juglar dwelled on speculation. He focused on the relationship of credit, prices and speculation in the second edition, (Besomi, 2009). Schumpeter, who made the first classification on the duration of the fluctuations and also considered the duration and sectoral difference, have defined the fluctuations as Kitchin, Jugler, Kuznets and Kontradiev fluctuations. Kindleberger (1978), likewise Schumpeter, categorized and explained the cycles. The first one which is based on the business inventories' fluctuations is Kitchin cycle of 34 months. The second one is Juglar cycle of 7-8 years, related to business investment in fixed assets. Third is the Kuznets cycle of twenty years, based on population changes and the rise and fall in the construction of housing. Final one is the Kondratieff cycle, arising with the major inventions such as the railroad and the automobile.

Burns and Mitchell (1946) defined the business cycle as a type of fluctuation that emerges in the several economic activities at the same time and spreads to general economic activities. Kindleberger (1978) distinguishes the business cycle that involves a full cycle including downturn and upturn period of the economy, and boom and bust analysis that interested in only the initial a downturn and final upswing period. Kindleberger (1978) and Minsky (1970) defines the financial crisis as an event including

asset prices decline, collapse of financial institutions, deflation, foreign exchange market problems or coexistence of these events.

Reinhart and Rogoff (2009) classified the types of crises into two groups: "Inflation, Currency Crashes, and Debasement" based on quantitative definitions and "Banking Crises and External and Domestic Default" based on events. Currency crises are distinguished as a currency crash and a currency debasement. They define currency crash as an annual depreciation above 15 percent of a currency versus an anchor currency. Currency debasement means a reduction in metallic content of coins in circulation over %5 and also new currency replacement instead of a much depreciated currency in circulation. They classify the banking crisis according to events realizing in asset or liability side. In the liability side, bank run is a factor creating a banking crisis while the asset quality is another factor constituting banking crisis. They emphasize that non-performing loans can be used to mark the onset of the banking crisis.

Definitions, causes and consequations are differentiating according to the theories trying to explain crises or business cycles. Mainstream economic theories and economists approach the crisis from their own theoretical window.

Crises were considered to be incidental and have secondary importance by classical economists who focused on long-term general principles of economics. Crises in the eyes of classical economists (generally industrial crises) are incidental accidents that occurred during the development of capital accumulation as the main phenomenon. It is the same for the neo-classical school established at the end of the 19th century. The crisis can only arise coincidentally, independently of the nature and functioning of a capitalist economy. In this context, Ricardo has considered the crisis of 1816, the first accepted crisis by historians, as a coincidental event. Because the value of production is equal to the value of the distributed income and that is equal to the purchasing power. In this case, the crisis is a coincidental phenomenon based on Say law (Ricardo, 1821). In summary, according to the classic model, the economy will always be balanced at full employment. In the case of a temporary deviation from the full employment level, the economy will come to a point of full employment equilibrium with an automatic mechanism.

In the Keynesian business cycle theory where the source of economic fluctuations depends on expectations, the driving power of the business cycles is the changes in

expected sales and profits in the future. In Keynesian view, while business cycles stems from internal causes, the main determinant is the instability of total demand. Changes in expectations lead to changes in the amount of investment and then investment change with the multiplier effect lead to the changes in national income, disposable income and total expenditures. Keynes describes the crisis as an event that is often unforeseeable and often violent and sudden by economic agents in an environment of rising conjuncture. The crisis arises from the disappearance of the difference between the discounted return of capital and the interest rate. According to Keynes, this depends on the credit supply, not on the demand for savings. Therefore, a completely monetary phenomenon can become an instrument of an economic policy. As a result, the credit supply, which should fall, will rise on the contrary. Keynes thus has considered the ability of entrepereneurs to manage investments without causing crisis as controversial (Keynes, 1936).

In the monetarist approach, Friedman and Schwartz (1963) consider banking panics as a source of financial crises due to the fact that major source of contractions in the money supply has lead to serious contractions in economic activity. Monetarist view of fluctuations or business cycles is purely based on increase and/or decrease in the money supply.

Kindleberger (1978) says that theories such as Keynesian, monetarist and also Hansen-Hicks' analysis of IS-LM are incomplete due to the fact that they exclude the instability of expectations, speculation, and credit theory.

In his Monetary Theory and Trade Cycle book, Hayek, one of the prominent representatives of the Austrian school, says that the primary cause of cyclical fluctuations must be sought in changes in the volume of money (Hayek, 1933). According to Hayek, the reason for the emergence of economic fluctuations is connected to the banking and credit system. In this context, the expansion of the money supply, which is seen as an increase in the credit volume of banks, reduces the monetary interest rate below the equilibrium level. This increases investments. Thus the production of capital goods increases since the sources of production shift from consumer goods to those producing capital goods. Due to the increase in the expenditures on capital goods, the factor revenues increase the demands and hence the prices of the consumer goods. Increasing of these prices lead to a crisis by reversing the resource allocation process leaving an

excess unused capital goods produced. Hayek (1933) emphasizes that, under the existing credit organization that is referring credit creation of commercial banks, monetary fluctuations shall inevitably occur.

According to Schumpeter, with the help of entrepreneurs and investments, it is the innovation that puts the economy in the process of economic evolution. Innovations emerge in clumps and spread out starting from entrepreneurs who succeed in breaking the circuit with the help of credits and playing the key role. The implementation and dissemination of profit-creating innovations imply to the period of expansion. But with the generalization of innovation, profit opportunity disappear and then crisis and depression stems (Schumpeter, 1939). In the Schmpeter's cycle model, although the economic instability is connected to the functioning of the money and credit system, the entrepreneurial class, which is the distinctive feature of the system, comes to the fore.

The rational expectations hypothesis, developed by J. R. Muth, led to the emergence of two different schools of economics to explain the business cycle theories. Although the basic assumptions of the new Classical and New Keynesian approach regarding the functioning of the economy were completely different from each other, the rational expectations hypothesis was accepted in both theoretical approaches. Another assumption of the new classical school is the assumption of market clearance or equilibrium price. In the new classic approach, fluctuations will be occured as a result of the unexpected shocks. However the effect of fluctuations stemming from unexpected shocks on the prices shall be predicted in the next period and market clearing mechanism shall ensure the equilibrium in the economy. In the new Keynesian, the economy shall be reached to its former state with delay, because the wages are fixed during the contract periods.

In the real business cycle approach, which is frequently used to explain business cycles in recent years, fluctuations in the real variables stem from the technological changes that affect productivity. As the prices are flexible in the short term, a monetary shock is not to affect the investment demand and labor supply that will mobilize the mechanism.

The impact of monetary factors on business cycles constitutes an important distinction in business cycle theories. While Keynesian, Monetarist and New Keynesian schools have a significant relationship between monetary factors and production, the

reasons for fluctuations in the Real Business Cycle Theory are external shocks. King & Plosser (1984) make a distinction between "internal money", composed of bank deposits, and "external money" controlled by the monetary authority. Within the real business cycle theory, they suggest that internal money reflects a much more cyclical relation than external Money. Minsky (1975) supposed that the increases in the supply of credit in expansion phase and the decline in the supply of credit in a downturn period led to fragility and increased the probability of a financial crisis. Minsky model is in line with the tradition of the classical economists, comprising John Stuart Mill, Alfred Marshall, Knut Wicksell, and Irving Fisher, who also focused on the instability in the supply of credit (Kindleberger and Aliber, 2005).

Literature on currency crises quite extensive according to other types of crises. Most of the researches conducted to explain the occurrence of post-1980 crises are focused on different aspects of the economic crisis. Currency crisis is mainly categorized by three different models that play a leading role in the economic literature: First-generation crisis models (Canonical Model), second generation crisis models and the third generation crisis models. Studies on currency crisis to explain and predict, have begun with Krugman's (1979) pioneering work. First-generation models explain the collapse of a fixed exchange rate regime accompanied by a fiscal deficit in Krugman (1979) and Flood and Garber (1984).

In the second generation of currency crisis models, which came up after the European Money Crisis, what lies behind the currency crisis is the sudden changes in expectations regarding the sustainability of macroeconomic policies. The interaction between the expectations of economic agents and actual policy results is taken as the basis and it is stated that this interaction will lead to self-feeding crises. As a result, the second-generation crisis model is linked to inconsistencies in government policies that make it impossible to maintain a fixed exchange rate in the long run. Alejandro, (1983) and Kaminsky and Reinhart, (1999) suggest that most of the currency crises occur with the financial crisis. In the light of such studies and also the Asian crisis, emerged in 1997, which could not be explained by the first and second generation crisis models, crises have been considered as a result of the fragility of the financial sector. Thus, third-generation models that emphasize the balance-sheet effects associated with devaluations have arisen. The banks and firms' exposure to credit risk and liquidity shocks that is stemming from

the currency and maturity mismatch, consist of the underlying phenomenon of these models.

Since the beginning of the 19th century, economic cycles constitute the common point of most of the analyzes in furtherance of understanding the mechanism and the dynamics of crisis. However, Gertler (1988) emphises that there is a traditional view attributing a central role to credit-market frictions in the propagation of cyclical fluctuations in macroeconomics, beginning with Fisher and Keynes. In this view, deterioration in credit markets, rising in insolvency and bankruptcies, increasing debt overhang problem, decline in asset prices, and bank failures are not the results but also the main factors collapsing the economy (Bernanke, Gertler and Gilchrist, 1999). As mentioned before, after the 1970's, financial crisis dominates the scene and money and credit volume play a central role in financial crisis. Mankiw (1986) found that a rise in interest rate can cause a big decrease in lending and also a possible collapse in the market. Mishkin (1994) examines the nature of financial crises from the perspective of the asymmetric information. The information asymmetry, leading lenders to an adverse selection problem, creates a disruption in financial markets that adversely affects aggregate economic activity. According to Mishkin (1994), market interest rates are driven up sufficiently because of increased demand for credit or because of a decline in the money supply, the adverse selection problem might dramatically increase. Thus there will be an important decline in lending activities, which in turn leads to a decline in investment and economic activity.

Beginning from Friedman and Schwartz's studies in 1963, many economist's studies, such as Romer and Romer (1989) and also Bernanke and Blinder (1992), have revealed that monetary policy actions have an effect on real output for two years or more. At this point the question is how monetary policy affects the output and how the transmission mechanism works? and also what happens in the economy after a change in monetary policy? Looking for answers to these questions, Bernanke (1983) examines the effects of the financial crisis of the 1930s on the path of output as a complementary analysis to Friedman and Schwartz approach. Bernanke (1983), focusing on credit related issues of the financial sector, describes that problems in financial markets creating declines in the amount of financial intermediation undertaken by banks, will lead to a reduction in lending to borrowers having profitable investment opportunities and result

in a contraction of economic activity. Departing from this point of view, studying on bank lending channel of monetary transmission mechanism, Bernanke and Blinder (1988) suggest that the credit channel, by rising transactions demand for money, makes monetary policy more expansionary than conventional models. In later stages, Bernanke and Gertler (1989, 1995) studied the credit channel with the idea that the monetary policy transmission mechanism would produce healthier results with the inclusion of the banking sector. As a result of contractionary monetary policy action, bank credit dependent expenditures shall decline and thus aggregate demand must decline (Bernanke and Blinder, 1992). Bernanke and Gertler (1995) suggests two mechanism to explain the relationship between monetary policy and the external finance premium: the balance sheet channel and the bank lending channel. The external finance premium, reflecting imperfections in the credit markets, is defined as the difference between the opportunity cost of the internal funds of a firm and the cost of the external funds. According to the credit channel view, a change in monetary policy leads to change in external finance premium. As a result of tightening policy, rising external finance premium shall increase the cost of borrowing and, consequently, borrowing-dependent parties will receive less credit and this shall reduce spending and aggregate demand (Bernanke and Gertler (1995). Bernanke and Gertler (1995) describe the two mechanisms for credit channel; the first one is the balance sheet channel that stresses the potential impact of changes in monetary policy on borrowers' financial figures, including net worth, cash flow and liquid assets. The second is the bank lending channel that focuses on the potential impact of monetary policy actions on the supply of loans. There are two preconditions for the functioning of the bank credit channel. The first one is that the banks respond to the contractionary monetary policy by decreasing the credits, and the second is the fact that the capital market securities is not a complete substitute for bank credit. These channels become effective with the decreases in the loanable funds capacity of banks which is arising as a result of decline in reserves and decline in their capital stemming from an increase in NPLs and Loan loss. Additionally, adverse selection and moral hazard in the credit market leads to banks credit rationing. Banks choose to decrease credit volume instead of providing credit with a higher interest rate (Yay, 2012). In this context, because of the fact that credits are the core financing source for the companies and private individuals, healthy functioning of bank credit channel is critical for the real economy.

Brooks (2007), Cengiz (2007), Cengiz and Duman (2008), Erdoğan and Beşballı (2009), Belke and Kaya's (2011) studies show that credit channel of the monetary transmission mechanism is effective in Turkey. Also VAR analysis of Uğur, Sancar and Polat (2016) suggest that bank credit channel is effective and bank credits have an effect on industrial production and inflation in Turkey.

As a result banks have an important role in the investment climate in an economy. Therefore, efficient operation of financial systems, especially credit markets, for the funding viable investment projects of the firms and funding consumer purchases have substantial importance to maintain and improve economic activity. Access to financial resources for all parties especially SMEs and start-ups are important in terms of sustainable growth and development. The dependency on bank credits is so high especially in the developing countries that have not enough capital accumulation and an efficient securities markets to meet funding needs of businesses with equity. Indeed, bank loans are the most important source of funds for business activity, and that there is no perfect substitute for business loans such as commercial papers or other sources of funds especially in countries where financial system is dominated by commercial banks.

With the understanding of the importance of the financial sector for the economies in the 20th century, various international organizations emerged to contribute to financial stability. International Monetary Fund (IMF) and Bank for International Settlements (BIS) are among the most important ones in terms of their goals. While the IMF's main goal is to ensure the stability of the international monetary and financial system, BIS interested in to serve central banks in their pursuit of monetary and financial stability, to foster international cooperation in those areas and to act as a bank for central banks. At this point, BIS has an important role in banking sector with the Basel Committee of on Banking Supervision of BIS developing global regulatory standards for banks in order to improve supervision practices. Basel committee provides recommendations on banking regulations in regards to capital risk, credit risk, market risk and operational risk. The Basel Committee issued first standards in 1998 as known Basel I which is including standards for measuring and assessing the capital adequacy. Afterwards Basel II standards in 2004 and Basel III in 2017 in response to the financial crisis of 2008 has been published. The purpose of these regulations is to ensure that banks have enough capital on account to meet obligations. Basel standards determine risk management standards on

how banks can calculate their risk that causes problems within the capital adequacy and also determine which ratios the banks should have to prevent them from being damaged. Setting the standards regarding the healthy functioning of the banking sector is important to ensure realizing BIS's main goals concerning about monetary and financial stability and hence not the creation of a financial crisis. However, the adequacy of such types of standards and compliance to them are extremely critical to achieve the objectives. On the other hand, financial innovations make the arrangements inadequate and leave behind the regulation and supervision authorites.

Global financial crisis of 2008, once again, showed that financial distress mostly arises from banking sector which does not manage risks well as a result of inadequate regulation and supervision. At this point, the importance of risk management in banking sector is obvious. What lies behind the banking sector problems which causes crises is that it's risks affecting asset quality such as market risk, interest rate risk, operational risk, credit risk etc. The most important one of these risks are credit risk mostly stemming from bad loans (Non-Performing Loans). Credit risk refers to the probability of loss due to a borrower's failure to make payments on any type of debt and generally measured by non-performing loans. Even though it is a rough measure, Non-Performing Loans are the main factor defining the asset quality of the banks especially for commercial ones. The ratio of NPLs which is generally used as a proxy for asset quality of banks is an essential part of sound banking. Managing the credit risk well, and having low level of NPLs are crucial for having sound banking sector.

Resolving the NPLs issue may also enhance the efficiency of monetary policy transmission by extending loanable fund capacity and sensitivity of the banks to monetary actions.

From this point of view the purpose of this study is to define the relationship between the NPL's of the banking sector and macroeconomic variables. The objective of this research is two-sided. One of them is to investigate the macroeconomic determinants of Non-Performing Loans and the second is to measure the feedback effects of NPL's on macroeconomic variables by using VAR and panel vector autoregressive (PVAR) models.

2.2 Loans Classification In Turkey

Regulation On The Procedures And Principles of Loan Classification and Provisions To Be Set Aside (*Published by BRSA in Official Gazette Nr. 29750 dated June 22, 2016.*) classify the loans provided by banks in 5 groups. The classification made in this legislation is briefly summarized below.

Group One: Loans In Standard Structure

Group Two: Loans Under Close Monitoring

Group Three: Loans With Limited Recovery

Group Four: Loans with Suspicious Recovery

Group Five: Loans Classified as Loss

Group Three, Four and Five constitute the loans in the follow up and also banks report the loans in these groups as NPLs.

The group one refers the loans for which payments are made on terms. Group two consists of the loans under close monitoring. That loans are extended to any natural persons and legal entities holding a creditable financing structure, do not presently face any problems in respect of principal or interest payments but which require close monitoring due to reasons such as observation of negative trends in debtors' payment capability or cash flow positions or expectations for occurrence of such things or the fact that credit users face substantial financial risks.

Group Three includes loans for which debtors have suffered deterioration in their creditworthiness and credits have suffered weakness consequently or for which recovery of principal and interest or both delays for more than ninety days from their terms or due dates provided that this is no more than one hundred eighty days.

Group Four includes the loans with suspicious recovery. Repayment or liquidation of that loans is not considered likely and also delay of recovery of principal or interest of these loans or both from respective terms or due dates exceeds one hundred eighty days provided that this delay is not longer than one year. Debtors are recognized to have

suffered substantial deterioration and weakness in respect of their creditworthiness but which are still not considered having a nature of loss because of the contribution expected to be made by means such as mergers, opportunities for securing new financing or capital expansion to debtors' creditworthiness and capability of recovering credits.

Group Five includes loans and other receivables having the nature of a loss. It is firmly believed that recovery for these loans is not possible or for which recovery of principal or interest or both delays for more than one year from respective terms or due dates.

All the loans classified as Groups Three, Four and Five pursuant to the regulation are considered non-performing loans in Turkey.

2.3 Causes of Non-performing Loans

NPL arises when the borrower can not fulfill its obligations arising from borrowing. There are basically some different reasons causing NPLs for individuals and institutions. When we analyze the literature, unemployment appears to be the most important factor in losing their solvency for individuals. However, although unemployment is a strong reason for individuals' insolvency, it is not expected that unemployment will be a determinant for NPLs of the banking sector because the share of individual loans in the overall loan volume and in NPLs is low. In addition, more qualified and low risk profile individuals demand individual loans from banks, (Boczar, 1978). Nevertheless banks use more advanced customer risk analysis systems for personal loans than the commercial borrowers in order to mitigate information aysmmetries and adverse selection problems. For this reson the effects of unemployment are temporary and does not have a major impact on the banking sector NPLs.

The factors that cause the businesses to lose solvency can be splitted into two groups as internal and external. The internal or in other words company-specific reasons consist of the companies' own dynamics such as lack of awereness in financial issues and risk management causing poor management, poor corporate governance and also weak organizational structure, poor business strategy, inadequate cash flow, high leverage, low liquidty, low profitability, unexpected weakness in sales etc, (Danilov, 2014), (Novak and

Sajter, 2007), (Kenney et. al., 2016) and (Bello, 2011). Because of the unsustainable financial debts created by problems in accessing credit markets due to a lack of sound accounting a large majority of problematic institutional loans consist of micro-enterprises and SMEs.

In some cases, because principal agent problem arising from ownership and control structure or moral hazard problem, managers are eager to take excessive risks in order to serve their own benefit via managerial incentives not those of the corporates, (Kenney et. al. , 2016). Citci and Inci (2016) suggest that the career concern of a manager may lead him to take excessive risk and make an investment decision even if the investments produce negative NPV. Managerial incentives may make managers overconfident and lead to underestimate risks. Excessive risk-taking without managing the risks means beginning of the end and so in most cases, inability to manage risks emerges the main cause of corporate failure, (Rose-Ackerman, 1991). The managerial incentives leading to excessive risk-taking in the financial sector and fraudulent behavior is one of the factors that is triggering the corporate failure and the economic and financial crisis, (Stiglitz, 2010).

In addition to these reasons, for corporates there are so many special cases causing to disrupt cash flows leading to insolvency.

The external factors or in other words macroeconomic factors consist of the change in general economic conditions which play a crucial role over the company-specific factors, (Higson et. al., 2007), (Issah and Antwi, 2017). Change in GDP, unemployment, inflation, interest rates and exchange rates, etc. affect the companies' cash flow that creating some constraints on its ability to finance working capital investments which are required to meet the business's short-term duties and obligations. When we look at the previous works, it is seen that corporate failure arises more likely during the economic downturn periods, (Kenney et. al., 2016).

In addition to the factors mentioned above, banks' risk appetite, loan classification and accounting practices affect the level of NPLs in the overall banking industry, (Baudino et. al. 2018). Especially differences in loan classification policies of banks create change in the level of NPLs to some extent within the context of the banking regulation. The source of the differences is that the credit restructuring practices which

allows decreasing loan loss provision expenses of banks. As can be seen from the part of Loans Classification in Turkey that Turkish banking legislation provides flexibility to banks in the classification of borrowers within the context of the regulation and allows them to make decisions about restructuring or follow-up to be made as a result of their own evaluations. This flexibility of practice may lead banks to the differentiation in the classification of a certain client as an NPL and the others as a performing one.

At the same time another main driver of NPLs' increase and thus credit risk is poor management practice of the banks emerging from forbearance lending process and losing credit standards in upturns period, (Homar et. al., 2015), (De Juan, 2003), (Honohan, 1997). Similarly to the corporate clients, principal-agent problem plays a crucial role in losing standards as a result of short-termism. Thus, banks can make concessions to their sustainable asset quality in order to enlarge the asset size, market share and share price in the short term. As a result, the banks are financing the boom period by ignoring the information asymmetry problem and also the risk management standards. When the footstep of the bust period begins to come, credit risk management gains huge importance and banks try to take precautions by cutting down on lending activities as a first action in order to maintain their asset quality. These precautions also create extra NPLs by narrowing access to the credit which is resulting in more failure in businesses.

Fraud may be said as an another reason for NPLs, (Gitau and Samson, 2016). However, fraud is not expected to have much effect on NPLs in Turkey. The fraudsters in the banking area could constitute from both internal (employees) and external sources (mainly borrowers). In order to prevent internal fraud incidents, the regulatory authority in Turkey has made it compulsory to implement a number of measures including tight internal control and audit process mechanisms In accordance with the regulations, every type of banking transactions in every step especially credit transactions including allocation, utilization and monitoring must have been conducted by a maker and also be

controlled by a checker. All processes and transactions are strictly controlled and reported within the scope of process inspections, which are mandatory for banks every year according to BRSA's regulations.

When it comes to external fraud incidents that are related to the credit transactions, the banks use various precautions including credit bureau records, information records of

Risk Center of Central Bank, internal intelligence reports in order to prevent these incidents. The credit bureau provides very serious and healthy pieces informations about the firms and individuals including partners / guarantors of the borrower company, group companies, check usage and bad check information, credit limits, credit risk amounts, repayment records, collateral information, external credit scores, etc. to the banks. Since check usage is the most common way of trading in Turkey, cross-check account usage, soundnesses of the receivables based on the check are the most important information provided by the credit bureau in order to prevent fraud. In addition, trade registry records and the trade registry gazette also provide information as open access sources. All the banks use the internal tools in order to measure the reliability of the information provided by the customer and check it. In this context, bad credits arising from fraud incidents are very limited compared with the overall NPLs.

2.4 Consequences of Non-performing Loans

The performance of the financial sector in developing countries mostly depends on the performance of commercial banks which are the main financial funding institutions. Non-performing Loans are one of the most important factors affecting the performance of the banks by increasing the loan loss provision expenses, write-offs and reducing the profitability, capital adequacy and also at the end of the day narrowing the capacity to make loans by the banks (Constancio, 2017). In addition to higher provisioning needs which lower the banks' profitability, increasing the cost of human resources for follow up and management the NPLs reduce also profitability, (Erdoğdu, 2015), (Ekinci, 2016). NPLs increase the banks' resource costs, which in turn lead to an increase in interest rates. Likewise, NPLs also create a reputation risk for banks that can be left in trouble. Additionally, if the NPLs' problem grow at a level that will discredit the bank's capital adequacy, the BRSA may stop the bank's lending activities or revocate the banking license according to banking law in force.

Because of the increasing NPLs, narrowing the loanable fund capacity of the banks and increasing in interest rates cause difficulties in access to the credit market for corporates and individuals. Credit channel narrowed by NPLs reduces the loanable fund capacity of the banks in two ways. One of them is that it increases in provisioning which

decrease directly the loanable funds capacity, second one is avoidence of granting credit facilities of credit officers. In other words, as the NPLs increase, degree of risk aversion of the banks increases dramatically, which is translated into a tightening of credit conditions. A negative impact of credit risk on bank lending behavior, with regard to both credit risk measures: the non-performing loans and the loan loss provision ratio (Cucinelli, 2015).

Deterioration in asset quality, with the extraordinary increase in the NPLs, downgrade the banks' credit rating and rise their CDS spreads and also worsen the source side of the bank's balance sheet by narrowing the securitizability of a bank's portfolio (Alexandros, 2010), (Jassaud and Kang, 2015). When especially the deposits are accompanied by a decrease, increasing NPLs results in substantial problems for the banks as seen in 2008.

As a result of the poor management practice of credit risk in rapid growth period of credits, the loss at the bank's balance sheet and inability to carry out its activities reveal the potential to create a serious crisis on the economies (Gavin and Hausman, 1996), (Kaminsky and Reinhart, (1999). In addition to the importance of the robust financials for the banks, reputation risk also have crucial importance in terms of carrying out its activities within healthy conditions.

The sound functioning of the banks and thus the healthy operation of the credit market is of great importance to all economies, especially the emerging ones (Mishkin, 2001). The effective functioning of the credit market, in terms of availability of investment financing for corporates and the financing of household spending, are critical to ensure that the economy is healthy, especially in the growth of gross domestic product and the reduction of unemployment. However, for a country, in the exit phase of a period of crisis, the soundness of the lending activity has the feature of being an important tool to achieve a full recovery in macroeconomic conditions, (Antoshin et. al., 2017).

2.5 Management of Non-performing Loans

The key issue in the NPL's management is to keep it at a low level that will not disrupt the bank's capital adequacy and asset quality. The banks use various

methodologies primarily preventive to achieve this goal in the remedial management process. Sound credit evaluation or selection of borrower and granting process as well as monitoring practices are substantial parts of the preventive process. On the other hand overall robust risk management framework including the process of risk identification, measurement, mitigation, monitoring and governance constitutes the main skeleton of the asset quality management of the banks. The banks adopting a strong credit culture backed by robust credit policy, procedure and risk classification models can keep the asset quality deterioration at a minimum. Early warning mechanisms and watch lists allowing to banks taking an early actions is the most important part of NPLs management, (European Central Bank, 2017).

Another critical issue in NPLs management is embedding a sound NPLs strategy including tactical and operational actions into the entire organization. The strategy should include clear time-bound reduction targets, regular review and independent monitoring, actions to be taken on a segmented portfolio basis and also customer types, staffing, and resources (any necessary changes in organizational structure), budget, required technical infrastructure and analytical capabilities (IMF, 2017).

One of the most common methods in remedial management is to keep the problematic assets in the balance sheet by restructuring and postponing. This method provides banks save time in order to spread the loan loss provision expenses to the next periods and also allows them to keep asset size, profitability and capital adequacy for a certain period. The handicap of this methodology is that the restructured loans hold by banks might have a high migration level into non-performing loans and also cause inadequate provisioning of NPLs, (Baudino and Yun, 2017).

As a last resort, by taking over the company's shares or immovable assets such as real estates or facilities etc., closing the credit account namely arranging an asset swap aggreement is the another one of the NPLs reduction strategies, (Manaligod, 2005). This leaves banks with assets that should sell. These assets do not generate revenues, even produce costs such as property tax and at the same time also decreases the liquidity and thus loanable fund capacity of the banks.

Another approach is the write-offs which allow the banks to clean their balance sheets through removing problematic assets from the balance sheet entirely, (Baudino and

Yun, 2017). The final approach is asset sales to asset management companies, (Klingebiel, 2000). Unlike write-offs, asset sales generate some cash and revenues and also decrease the provisions. Both approaches facilitates the removal of impaired/problematic assets from the balance sheet. Although the asset sales create some revenues, both produce huge costs to banks, (Jassaud and Kang, 2015).

Monetary or financial regulation authorities adopt various policies in order to facilitate decrease or removal of problematic assets from banks' balance sheet such as loan restructuring facility. Besides, the government takes some precautive actions regarding credit markets in order to stimulate economic activities in Turkey. In recent years, main tool which is using in order to achieve this goal is the credit quarantee mechanism provided by Credit Quarentee Fund which was founded to aim of efficient operation of the credit market and to ease tradespeople's access to financing. At the beginning of the 2017, Credit Quarentee Fund which gives guarantee to bank loans for the sake of companies, launched a guarantee package as collateral to bank loans amounting 250 billion Turkish Liras. Compared to the banking sector, the amount of the guarantee of the KGF was 11 percent of the total credit volume at the end of 2018 according to Weakly Bulletin of KGF.

Until 2018, like the most of the developed and developing countries and also Turkey, under IAS 39, provisions have operated on an incurred loss model, where impairments have to be recognized only after the credit begin to become problematic within the backward-looking approach. In Turkey, pursuant to regulations based on IAS 39, banks classified and managed their problematic assets until 2018.

In 2018 International Financial Reporting Standard 9 (IFRS 9) replaced with International Accounting Standard 39 (IAS 39). IFRS 9 makes revolutionary changes in classification, measurement, and impairment calculation and reporting of loans. The forward-looking interpretation prescribed by IFRS 9 requires an "expected loss" approach, where provisions have to be made against possible not just probable losses.

Loan loss provision levels are expected to increase substantially under IFRS 9 versus IAS 39 especially in an economic downturn period, (Seitz et. al., 2018). This might increase the capital requirements of the banks. At the same time, the level of NPLs

depends on banks' loan loss provisioning policies, since higher provisions make the asset sales easier.

Besides some facilitating regulations, some challenging regulations impede the resolution of TGAs such as concordatum and bankruptcy suspension. Inadequacy and abuse of these regulations are among the factors that enhance the NPLs problem.

As a result, efficient information flow from credit bureaus and the existence of asset management companies, awareness of the importance of the credit risk and finally sound regulation and supervision on credit risk framework have crucial importance in terms of management of problematic loans.

2.6 Banking Industry In Turkey

The first negative signals of the financial crisis are primarily arise from the real and banking sector balance sheets' asset side in the form of liquidity shortage or solvency problem, (Diamod and Rajan, 2005). The credit mechanism that is expected to be used as an accelerator of recovering economic activity during the exit phase of the crisis is not used effectively due to the poor lending capacity of the banks.

Turkey experienced a severe banking and economic crisises during 2000 and 2001. In November 2000, domestic and foreign banks started to close their interbank credit lines to vulnerable Turkish banks, after concerns about the health of the banking sector have increased sharply. In those days, interbank rate jumped to 873%, interbank credit market dried up, and hence liquidity crisis occurred. Consequently, in November 2000, Demirbank, a private mid-size bank, was not able to borrow anymore in the interbank market and was taken over by the Savings Deposit Insurance Fund (SDIF), a government body that is responsible for ensuring savings deposits and also restructuring banks if necessary. (Akyüz and Boratov, 2003). The IMF assisted Turkey with a financial package of USD 10.5bn, which helps to calm the markets and stop the decline in reserves. The turmoil in November was followed by a political crisis in early 2001. Again, trust in the sustainability of the stability program disappeared and a currency crisis came on the stage, as both foreign and domestic investors initiate a speculative attack against the Turkish lira.

Before the 2001 crisis period, a disinflation program containing tight fiscal and monetary policies by linking liquidity expansion to foreign currency inflows has adopted with a pre-determined exchange rate regime as a nominal anchor. With the disinflation program, banks reduced deposit and lending rates and also increased their exposure to fixed-rate treasury securities during this period. Because of the fact that the real appreciation of the TL arising from the pre-determined exchange rate was lowering the cost of funding, some banks had borrowed in foreign currency terms with short maturity and also supplied TL credit with a long maturity. The banking sector, whose asset and liability structure have deteriorated, has become fragile against exchange rate risk, interest risk, and market risk. As a consequence, capital losses as a results of the decline in the value of government securities arising from an increase in interest rates and the sharp increase in exchange rate with change in exchange rate regime led a majority of the banks to collapse in 2001. However, the crises created a serious contraction in the private sector. This situation deteriorated the asset quality of the banking sector via an increase in NPLs.

In this respect, Turkish Lira depreciated by 40%, in February 2001. As of end of the year 2001, credit volume decreased by 26 percent, interest rates rose, domestic spending declined, imports decreased by 25 percent and GDP shrank by 9.4 percent. Additionally, the urban unemployment rate increased from 8 percent in 2000 to 13 percent in 2001. Under these conditions, since failed banks were recalling credit provided to the real sector while the domestic market was shrinking, many companies have been left in trouble and could not paid their loans. Therefore NPLs that have already rising trend, increased up to 13.2% in the third quarter of 2002.

In Turkey, 23 small banks failed between 1997 and 2016. Twelve of them have been taken over by the SDIF before the 2001 financial crisis in Turkey. Nineteen of them have been taken over by the Turkey's SDIF from 1999 through 2003. While some of these were sold together, others were liquidated by canceling banking permits. The failed banks left behind approximately $ 54 billion in costs to society and also approximately 30,000 unemployed bankers.

After the crisis, in May 2001, the banking sector restructuring program was announced in order to create a robust banking system and removing the destruction

created by the crisis in the sector. In summary, program was including ; (1) Restructuring of public banks in terms of financial and operational, (2) Resolve of the problematic banks taken over by SDIF, (3) Ensuring that private banks affected by crisis negatively have a healthy structure, (4) Making regulatory legislation that will increase the supervision of the banking sector and bring it into a competitive structure.

In summary, within the scope of the restructuring progress after the crisis period ;

- State-owned banks were financially and operationally restructured

- Private banks were restructured and their capital structure was strengthened

- Resolution of the banks taken over by SDIF was completed Through Transfer, Merger, Sales and Liquidation

- Private sector companies' debt amounting over the USD 6 billion was restructured.

- Asset Management Companies were established

- Banking regulation was renewed and Internal Audit and Risk Management System was established

Actions taken with the Program of the Transition to Strong Economy which was announced in May 2001 and supported by the new IMF stand-by and by World Bank credits have curbed the crisis.

By making the balance sheet of the banks strong, these restructuring process has overachieved and has diminished the impact of the 2008 global financial crisis in Turkey. While the GDP growth rate was realized as 0.8 in 2008 due to the global financial crisis, the economic growth contracted by 4.7 percent in 2009. The strong asset and capital structure of the banking sector reduced the fragility of the economy and the impact of the crisis on the Turkish banking sector remained limited despite an increase in NPLs. In this period, the credit to deposit ratio decreased because of the risk-averse approach of the banking sector. Besides, due to the shrinking of access to the international credit market, liquidity has decreased and also the total assets of the banking sector have been diminished on a USD basis. Thanks to the increase in domestic demand beginning from

the end of 2009, the economy started to recover and the credit volume of the banking sector increased. Growth in domestic demand in the post-crisis period has been lead to GDP growth process to Turkey up to 2018. In this period, the banking sector has been continued to preserve profitability and capital adequacy.

By 2018, the emergence of political and geopolitical risks, fiscal discipline problems, current account deficit and especially structural problems have been caused to skyrocket the exchange rates and interest rates. In the current period, which is not included in the analysis due to lack of sufficient and healthy data, it is seen that the debt-paying capacity of the borrowers deteriorated because of the rising exchange rates, high-interest rates and reduction in demand. This situation worsens the asset quality of the banking sector and leads the banks to liquidity problems.

2.7 Overview of NPL

Despite the fact that the loans provided to the private sector by the banks are very limited in that period in Turkey, NPLs have started to increase at the beginning of 2001 and it have risen from the level of 9% to 13% via the impact of the 2001 local economic crisis in the middle of 2002. For example, while the total credits to total assets ratio of open to public 10 private commercial banks in 2001 were 23.4% and total government debt securities + money market assets to total assets ratio were approximately 32%, these ratios were 29.1% and 25.5% respectively at the end of 2002. At the same period, the non-performing loans to total loans ratio of these 10 banks were 33.2% in 2001 and 9.7% in 2002. When it comes to 2016 figures, total credits to total assets ratio of open to public 10 private commercial banks were approximately 65% and the non-performing loans to total loans ratio of these 10 banks were 3.7%. These figures show us that as public sector borrowing needs decreased and economic indicators rebounded, the banks' balance sheet structure changed and turned out to be the main financier of growth by financing the private sector and individuals spending. In addition to the recovering macroeconomic conditions, it can be seen that via the renewed banking regulation and established risk management systems mentioned above make it easy to manage credit risk efficiently for banking sector. As a result of these precautions after the 2001 crisis term, banking sector figures has been started to improve together with the macroeconomic figures.

Nevertheless, as can be seen in the Figure two, after the 2000 and 2001 crises periods, NPLs of the banking sector have been started to decline.

The effects of the 2008 global financial crisis in Turkey have been very limited due to the strong capital structure of the banking sector and very limited mortgage loans. However similar to the 2001 local economic crisis results, also in 2008 it can be seen that there was an increase in NPLs because of the global financial crisis affecting the real economy through wealth effects and investment and employment dynamics.

Figure 1. Non-performing loans to total gross loans (%)-World

Source: International Monetary Fund, Global Financial Stability Report.
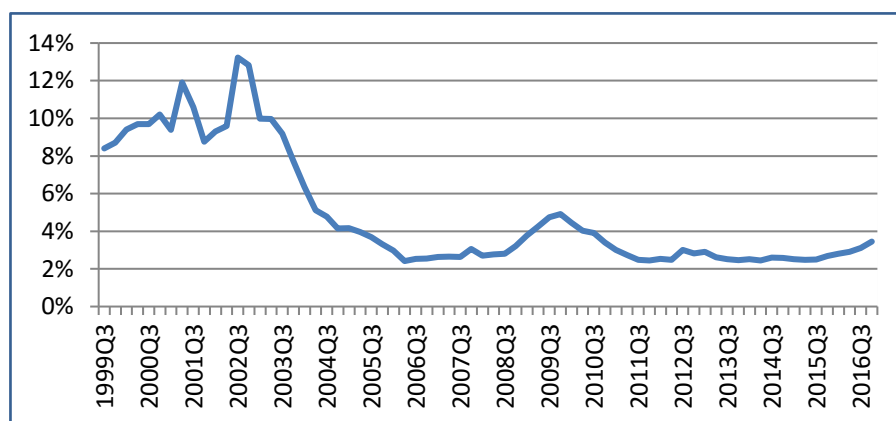
Figure 2. Non-performing loans to total gross loans (%)-Turkey

Source: Risk Center Banks Association of Turkey and CBRT

2.7.1 Sectoral breakdown of NPLs

The ratio of problematic loans varies significantly across sectors. NPLs sectoral distribution table, Sectoral NPLs table and Figures are presented in Table 13, Table 14 and Figure 3 respectively. CBRT's sectoral classification is used instead of NACE Codes since lack of data classified in NACE Codes.

As of at the end of 2016, 33,6 percent of total banking sector NPLs come from personal loans while the personal loans are 24,8 percent of the total credit volume of the banking sector. Substantial part of Personal loans' NPLs comes from consumer loans (18,3%) and credit cards (13,6%) while vehicle loans (0,3%) and mortgages loans' share (0,3%) are so low. In 2009 after the global financial crisis, GDP decreased in proportion to 4,7% and also the unemployment rate increased 3% percent reaching 14% in Turkey. It is considered that these figures especially rising unemployment leads to increase the NPLs for the personal loans. While the NPLs ratio of the personal loans was 4,2% in 2008, it reached to 7,7% in 2009 with global financial crisis effects. Problematic personal loans covered the 30,7% and 39,6 of NPLs of the banking sector in 2008 and 2009 respectively. Over the same period, NPLs of the personal loans is 4,7 percent, although the average NPLs of the personal loans from 1999/Q3 to 2016/Q4 is 3,1 percent.

In commercial loans, the main sectors comprising the NPLs are the construction and real estate development industry and also wholesale/retail sales, brokery, motor vehicle maintenance services sector (henceforth trade sector). Their shares are the 10 percent and 18,6 percent of NPLs at the end of 2016 respectively. While the share of the construction sector in total loans is 8.7%, it constitutes 10% of non-performing loans. However, at the end of 2016, considering the credit volume of the construction sector, the sector's NPLs to total sectoral loans is 15%.

CBRT reports the commercial loans of the banking sector by classifying to 31 sectors. When the NPLs ratio is calculated for each sector, the fifteen sectors listed below are observed to have NPLs ratio above average as can be seen in Table 13.

- Construction,
- Education,
- Electrical and Optical Equipments Industry,

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- Extraction of Mine (Energy Non-producing),

- Extraction of Mine (Energy Producing),

- Leather and Leather Products Manufacturing,

- Machinery and Equipment Manufacturing,

- Non-classified Manufacturing Industry,

- Other Non-metallic Mineral Industry,

- Private Employer (Individuals),

- Rubber and Plastic Products Manufacturing,

- Textile and Textile Products Manufacturing,

- Transportation Vehicles Industry,

- Wholesale and Retail Sales, Brokery,

- Motor Vehicle Maintenance Services,

- Wood and Wood Products Manufacturing

2.8 Previous Studies

Several studies analyze the interrelationship between NPLs and macroeconomic variables late at the end of the 20th century. However, the number of investigations related to NPLs and macroeconomic variables dramatically carried out after the 2008 Global Financial Crisis caused by mortgage loans. Studies in the literature can be separated into two groups that are two-sided studies and one-sided studies. Some of the studies were specifically focused on the mutual relationship between NPLs and macroeconomic variables, while the others investigated the macroeconomic determinants of the NPLs.

Most of the recent studies that are using different country samples with different time-period find that higher NPLs tend to reduce the GDP growth while increasing unemployment.

2.8.1 Two-sided Studies

Two-sided literature comprises from the investigations of the interrelationship between NPLs and macroeconomic variables. What distinguishes two-sided literature from one-way/sided studies is that researches contain findings related to macroeconomic variables affecting NPLs.

A summary of the two-sided studies is presented in the table below.

Table 1. Summary of the Main Literature

Author/s	Data	Methodology	Results in Brief
Nkusu, M. (2011).	Annual data from 1998 to 2009 for a sample of 26 advanced economies.	- Single-equation Panel Regression - Panel VAR	NPLs has a big influence on macroeconomic performance in the long run. GDP growth and unemployment cause a downward phase in banking sector and additionally banking sector distress feed back the economic activity negatively.
Espinoza, R., & Prasad, A. (2010).	Annual data from 1995 to 2008 on around 80 banks in the GCC region.	- Difference and system GMM - VAR	NPL goes worse while the economy is on the decline phase and interest rates and risk aversion increase. There is a strong but short-lived influence from NPLs to economic activity.
Klein, N. (2013).	Annual data from 1998 to 2011 covers the ten largest banks in each of the 16 CESEE countries	- Dynamic Panel Regression - Panel VAR	There is a big interaction between unemployment, inflation and GDP growth and NPLs. Increase in NPLs has a spectacular effect on credit, real GDP growth, unemployment and inflation.
De Bock, R., & Demyanets, A. (2012).	Annual data from 25 emerging markets from 1996 to 2010.	- Dynamic Panel Regression - Structural Panel VAR	Main drivers of NPLs are GDP growth, credit growth and exchange rates in 25 emerging countries. GDP growth rate diminishes when NPL's increases.
Saka B. (2010),	Annual data of Turkey from 1986 to 2008	- Multiple Regression	There is a negative relationship between NPLs and domestic credit provided to the private sector and investments.
Şahbaz, N. (2010).	Quarterly Data of Turkey from	- VAR	Total private consumption expenditures are tent to decrease in the following two periods, after the shock

	1998 to 2009.		of NPLs. Rising in NPLs has a positive effect on credit volume for the first two quarters and also a negative effect after the first two quarter.
Erdoğdu, A. (2016).	Quarterly Data from 1998Q1 to 2015Q3 for Turkey.	- OLS	NPLs impress the economy negatively and vice versa.
Jordan, A., & Tucker, C. (2013).	Quarterly data from 2002Q3 to 2011Q4 for Bahamas	- OLS Regression - VECM	There is a reduction in NPLs with economic growth and there is an important feedback effect from NPLs to output even it is small.
Konstantakis, K. N., Michaelides, P. G., & Vouldis, A. T. (2016).	Quarterly data from 2001–2015 for Greece	VECM	Increase in NPLs affects economic activity negatively which accelerates rising in NPLs once again.
Inaba, N., Kozu, T., Sekine, T., & Nagahata, T. (2005).	Data between 1993 – 2000 for Japan	-System GMM estimation -Error Correction	Increase in NPLs was responded to deterioration in firm`s balance sheets caused by collapse of land prices. Growth in NPLs induced a deterioration in economic activity.
Filip, B. F. (2015).	Annual data for Romania and EU from 2000 to 2012	- OLS Regression - Pearson Correlation Analysis	There is an inverse correlation between NPLs and real GDP growth and also there is an inverse relationship between NPLs and unemployment rate and inflation rate.
Riley, G. (2013).	Annual data for ECCU over the period 1995-2013	-OLS Regression - Bayesian Panel VAR	Banks are losing their quality of the loans due to a positive growth shock of NPLs and higher lending rates. Rising NPLs induces a dramatic distortion in economic activity.
Beaton, K., Myrvoda, A., & Thompson, S. (2016).	Quarterly data of 34 banks and six ECCU countries in the period of	-Dynamic Panel Regression -Panel VAR	Bank-specific and macro economic factors affects the NPLs' level. Rising NPLs declines the credit volume and deterioration in asset quality has a potential

	1996Q1- 2015Q4	negative effect on the economy especially for the CPI.

Nkusu (2011) who demonstrated a relationship between non-performing loans and macroeconomic performance, investigated the macroeconomic determinants of NPLs in panel regression and also investigated the feedback effects of NPLs on macroeconomic determinants in a panel vector autoregressive model. He found that a significant growth in NPLs has a big influence on macroeconomic performance in the long run in his study which covers annual data from 1998 to 2009 for a sample of 26 advanced economies. He also found that there is an auto-correlation in NPLs for the next four periods following the sharp increase. His analysis suggesting that GDP growth and unemployment cause a downward phase in the banking sector and additionally banking sector distress feeds back the economic activity negatively (Nkusu, 2011). The findings are also in line with the results of the study were conducted to investigate the relationship between NPLs and macroeconomic variables by Epinoza and Prasad (2010). They analyzed approximately 80 banks between 1995 to 2008. They specified that NPL goes worse while economy is on the decline phase and interest rates and risk aversion increase. When it comes to feedback effect they found that a strong but short-lived influence from NPLs to economic activity by using VAR model (Espinoza and Prasad, 2010).

Another spectacular investigation completed by using Dynamic panel regression and PVAR methodology based on the non-performing loans (NPLs) in Central, Eastern and South-Eastern Europe was conducted by Klein (2013). The data used in this study was an annual frequency for 1998-2011, including the analysis of 10 largest banks in each of the 16 countries. It is strongly stressed that there is a big interaction between macroeconomic conditions such as; unemployment, inflation and GDP growth and NPLs. Additionally according to analysis, he also came up with the assertion that growing in NPLs has a spectacular effect on credit (as a share of GDP), real GDP growth, unemployment and inflation in the periods ahead based on the feedback from the banking system to the real economy.

De Bock & Demyanets (2012) conducted a study in order to assess the vulnerability of emerging markets and banking sector in terms of asset quality in 25 emerging countries

including Turkey. Their findings reveal that the main drivers of NPLs are GDP growth, Credit growth and exchange rates in 25 emerging countries. Additionally, it was suggested that GDP growth rate diminishes when NPLs increase.

Saka (2010) has done a similar study and he analyzed the effects of NPLs on macroeconomic variables in Turkey by means of regression methodology between the years of 1986 and 2008. The striking point from the study was a negative relationship between NPLs and domestic credit provided to the private sector and investments.

Sahbaz (2010) investigated the interaction between NPL and parameters affecting NPL ratio such as; banking sector volume of domestic credit growth rate, real GDP growth rate, total private consumption expenditures growth rate and total fixed capital expenditures growth rate by using VAR methodology and Granger causality test. She found that total private consumption expenditures tend to decrease in the following two periods when NPLs have an emergent shock. In addition, it is mentioned that rising in NPLs has a positive changing on domestic credit provided by banking sector for the first two quarters and a negative changing after the first two quarters.

Erdoğdu (2016) used the OLS (Ordinary least squares) method in order to find an interrelation between NPLs and macroeconomic variables between 1998Q1 to 2015Q3. In the study, it was underlined that NPLs impress the economy negatively (Erdogdu, 2016).

Jordan and Tucker (2013) made an investigation to find out the influence of economic output and other variables on nonperforming loans in the Bahamas by using a vector error correction (VEC) model. They were also looking for an answer if there is a feedback response from nonperforming loans to economic growth at the time period from September 2002 to December 2011. They emphasized that there is a reduction in nonperforming loans with economic growth and there is an important feedback effect from nonperforming loans to output even it is small.

Konstantakis et. al. (2016) perform a study to detect factors of non-performing loans based on Greek banking sector by utilizing data in the time period 2001–2015. It is examined that macroeconomic and financial factors directly play role in non-performing

loans. Increasing in NPLs affects economic activity negatively which accelerates rising in NPLs once again.

Another similar study associated with non-performing loans and performance of the real economy in Japan were completed by Inaba et al. (2005). It was examined that increasing in NPLs was responded to deterioration in firm`s balance sheets caused by collapse of land prices. Growth in NPLs induced a deterioration in economic activity via distortion in the banking industry arising from inefficient resource allocation practices created by credit crunch and forbearance lending.

Filip (2015) completed a study of interrelationship between NPLs and macroeconomic factors and feedback effects of NPLs based on economy of Romania and EU countries. It is found that there is an inverse proportion between NPLs and real GDP growth and also there is an inverse relationship between NPLs and unemployment rate and inflation rate. With regards to the feedback of NPLs, together with the inflation rate and the unemployment rate, on the growth of real GDP, shows an important negative influence of these loans as a reflection of globalization.

Riley (2013) investigates the relationship between NPLs and macroeconomic performance in the Eastern Caribbean Currency Union (ECCU). According to study, banks are losing their quality of the loans due to a positive growth shock of NPLs and higher lending rates. It is also mentioned that banks with high risk and less efficiency deal with higher NPLs rate, while other gainfully banks have lower NPLs. It is suggested that rising NPLs induces a dramatic distortion in economic activity.

Another study associated with Eastern Caribbean Currency Union (ECCU) were completed in order to analyze the determinants of NPLs by Beaton et. al. (2016). It was suggested that bank-specific and macro economic factors affect the NPLs' level of the banks. It was illustrated that rising NPLs declines the credit volume and deterioration in asset quality has a potentially negative effect on the economy especially for the CPI.

2.8.2 One-Sided Studies

Literature on the determinant of NPLs is quite extensive. Most of the studies on the determinants of non-performing loans focus on the macroeconomic conditions, which are likely to affect the borrowers' capacity to repay their loans. Relatively, a small proportion of these studies are related to the bank specific determinants of NPLs. Studies focusing on bank-specific determinants of NPL are not included in the literature review section. Most of the these types of researches focus on management quality, asset size, ROE, ROA, credit growth, credit process, loan loss provision, loan monitoring process, etc.

Recent studies related to the macroeconomic determinants of NPLs are summarized in this section.

Vatansever and Hepşen (2013) conduct a research to analyze the interaction between macroeconomic variables, bank-level factors and ratio of NPLs in Turkey by using linear models and co-integration analysis. They specifically discussed in detail that some parameters play a significant role in increasing ratio of NPLs while other have no real impact on ratio of NPLs. To illustrate that, debt ratio, GDP of Turkey, consumer price index, real sector confidence index, exchange rate of Dollar and Euro with Turkish lira cannot be explained if they have a real influence on NPLs ratio. However, they found that while industrial production index and BIST 100 index affect NPLs ratio negatively, unemployment rate, return on equity and capital adequacy ratio are highly responsible for a positive change in NPL ratio.

Eren (2011) investigated NPLs based on Turkish banking sector and the macroeconomic indicators on annual data from 2004 to 2010. He conducted a macro stress test for the Turkish banking sector employing VAR methodology and concluded that increasing ratio on NPL after eight quarters is bound up with an unexpected increase in GDP, real effective exchange rate and imports. In order to this, an unexpected rise in nominal interest rate also induces an increase in NPL ratio with the maximum after six quarters.

Karahanoğlu and Ercan (2015) focused on the Turkish banking sector, and they specifically analyzed the relationship between NPls and macroeconomic variables during the period of 2005 and 2015. Their conclusion proved a relation between NPLs and

macroeconomic variables (BIST 100 index, industrial production index and currency rates in USD and EUR).

Abdioğlu and Aytekin (2016) conduct a study in order to determine the factors affecting the NPLs ratio, using System-GMM and Difference GMM, after the 2001 local financial crisis in Turkey. They found that lagged value of NPLs, net interest margin, capital adequacy and solvency ratio have negative effects, while interest applied to loans, loans/deposits ratio, inefficiency and operating efficiency have positive effects on NPLs.

In another study realized in Turkey, Us (2016) investigated how global crisis plays a role in the determinants of NPLs by means of panel estimation techniques. He observed that non-performing loans were oriented by bank-specific variables until the global crisis, but afterwards macroeconomic and policy-related variables involved in changing on NPLs. He also mentioned that NPLs may be reduced by robust economic activity, tight monetary policy and reinforce fiscal balances.

Macit and Keçeli (2012) focused on the participation banks in Turkey in order to analyze the micro and macro factors of NPLs ratio. According to their results, slowdown in GDP and rising unemployment increases the NPL ratio. They did not find any proof that exchange rate and inflation have any effect on increase in NPL.

Tanasković and Jandrić (2015) investigated how macroeconomic and institutional determinants make a change in the growth of NPLs based on CEEC and SEE countries with the date cover 2006 to 2013. They demonstrated a negative relationship between increasing in GDP and NPL ratio, while foreign currency loan ratio and level of exchange rate are directly involved in rising of NPL. While the inflation rate was not statistically insignificant parameter in this research, financial market level of development considered statistically significant parameter related increase in NPLs.

Louzis et. al. (2012) made a research on determinants of non-performing loans by dividing loans into three groups as consumer, business and mortgage loans in the Greek banking sector by using dynamic panel data methods. Not surprisingly, NPLs ratio in the Greece is under influence of GDP, unemployment, and interest rates.

Bofondi and Ropele (2011) focused on the macroeconomic determinants related quality of bank loans in Italy for last 20 years by measuring the ratio of the flow of bad loans. It is found that new bad loans ratio arising from households lending negatively was affected by GDP Growth rate and house prices and also was positively affected by unemployment rate and the short-term nominal interest rate. Increase in unemployment and the slowdown in durables consumption increases new bad loans ratio for firms after the financial crisis.

Beck et al. (2013), by using a novel panel data set, analyzes the macroeconomic determinants of nonperforming loans across 75 countries during the past decade. According to their dynamic panel estimates, real GDP growth, share prices, the exchange rate, and the lending interest rate are found to significantly affect NPL ratios.

Škarica (2013) analyzes the determinants of the changes in non-performing loans ratio in seven Central and Eastern European (CEE) countries. By using fixed effects estimator between Q3:2007 and Q3:2012, they found that the primary cause of high levels of NPLs is an economic slowdown, unemployment and inflation rate. And also Jakubík and Reininger (2013) research the macroeconomic model for nonperforming loans (NPLs) for the Central, Eastern and Southeastern European (CESEE) countries. They suggest that there is an inverse relationship between NPLs and GDP growth and the stock index. And also credit growth and change in exchange rate affect NPLs level.

Bonilla (2016) analyzed macroeconomic determinants of non-performing loans in Spain and Italy. Unemployment, salary, and GDP are found main determinants of NPLs.

Curak et al. (2013) made an investigation to find macroeconomic and bank-specific determinants of NPLs with preferred GMM estimator for dynamic models on sample of 69 banks in 10 Southeastern EU countries covering the period 2003-2010. Results of the study show that poor economic growth, excessive inflation and higher interest rate caused an increase in NPLs. Also Bank size, ROA and solvency are also the factors on the NPLs rate.

Approximately one year later from the Curak et al.'s (2013) study, Erdinç and Abazi (2014) studied the determinants of loan losses in static and dynamic panel models based on macro-financial variables and bank specific variables in 20 emerging European

countries during between 2000 and 2011. In line with the Curak et al.'s findings, they concluded that GDP growth rate and inflation have an effect on NPLs level. Makri et al. (2014) made a similar investigation that is based on basis of micro and macro factors affecting NPLs of Eurozone's banking systems between 2000 and 2008. They demonstrated an interrelation between NPLs and major macroeconomic variables such as GDP, unemployment, public debt and also bank-specific factors such as capital adequacy ratio, rate of NPLs of the previous years, return on equity (ROE).

In another study made for the banking system of Eurozone members, Anastasiou et al. (2016) assayed what might cause to amount of non-performing loans for the period of 2003Q3-2012Q3. Higher NPLs were observed in the areas where the macroeconomic conditions such as; unemployment, interest, growth rate and GDP are worse. Size of banks and their management are also associated with amount of NPLs. The researchers have completed another study, in this instance, using GMM and quarterly data of Eurozone banks in the period 1990-2015 Anastasiou et al. (2016). They observed that unemployment and growth are another two determinant caused change on NPLs.

Roman and Bilan (2015) made an investigation to examine the influence of macroeconomic factors on non-performing loans based on EU countries. GDP growth, unemployment rate and domestic bank credit were found to affect on the NPLs.

Adebola et al. (2011) analyzed NPLs of Islamic banks in Malaysia for the time period of 2007-2009. Autoregressive distributed lag (ARDL) cointegration technique of Shin (1999) and Pesaran et al. (2001) was preferred in testing for cointegration in order to illustrate effects of macroeconomic variables covered production index, interest rate and producer price index. Two long run relationship was found among the variables and point out that interest rate plays an indispensable role in long run impact of NPLs.

Farhan et al. (2012) conducted an analysis to find economic determinants of NPLs in Pakistan. The study resulted that while energy crisis, interest rate, unemployment, inflation and exchange rate positively affect the ratio of NPLs, GDP growth has a negative impact in Pakistani banking sector. Weak performance of energy sectors and bad economy are the key determinants on non-performing loans In Pakistan.

Ahmad and Bashir (2013), similar to Farhan et al.'s (2012) study, aim to analyze how macroeconomic variables play role in changing of NPLs by using OLS methodology and time series data of NPLs for the period 1990-2011in Pakistan. They focused on nine macroeconomic variables and while six (GDP growth, interest rate, inflation rate, CPI, exports and industrial production) of them are important and directly related in NPLs , the other three of them (unemployment, real effective exchange rate and FDI) were not found to related to NPLs. Also Badar and Javid (2013) found a weak short run relationship between NPLs and inflation and exchange rate in their study covering Pakistani Data within the period 2002-2011. In another study detecting the determinants of credit risk (NPL) of commercial banks in Pakistan within the period of 2007-2013 was conducted by Kasana and Naveed (2016). It is suggested that loan loss provision, capital adequacy ratio and GDP Growth ratio have a positive effect on NPLs while ROA, size and growth in advance have negative effect on credit risk. However, it is also suggested that an increase in interest rate has no impact on credit risk of commercial banks of Pakistan.

Belaid (2014) made a similar study, distinctly by dividing determinants of NPLs into three groups; bank-specific variables, macroeconomic and firm-specific factors. The study concluded that while GDP growth has a positive effect on loan quality, on the other hand, interest rate has a negative effect.

Messai and Jouini (2013) examined macro level and bank-specific determinants of NPLs based on 85 banks located in the Italy, Greece and Spain covering the period of 2004-2008. It was found in the study that the NPLs are affected by the growth rate of GDP and the profitability of banks' assets negatively and also affected by the unemployment rate, the loan loss reserves to total loans and the real interest rate positively.

In a study made by Khemraj and Pasha (2009), panel dataset was used as a method to investigate the determinants of NPLs in the Guyanese banking sector. It was shown that NPLs are influenced positively by the real effective exchange rate and additionally NPLs vary negatively with the growth rate of GDP.

Festic and Bekö's (2008) projected the determinants of NPLs depending on five European Countries, and they came up with the idea that increasing NPLs ratio is affiliated to slowdown in economic activity, rising in real estate rates and growing credit

to the private sector. Moreover, increasing direct foreign investment has a significant positive impact on NPL ratios.

Muntean (2014) used the data covering 107 countries in order to investigate the determinants of non-performing loans for the period 2000-2012. Economic growth, unemployment rate, exchange rate and lending interest rate were the main factors affecting the NPL ratio from his study.

Swamy (2012) preferred panel data techniques to analyze the effect of macroeconomic factors on NPLs in the period 1997-2009. He suggested that large banks that are technologically equipped and have much better risk management procedures have less risk on the level of NPLs compared to smaller banks. It is also found that lending rates do not have effect on NPLs.

Kauko (2012) tried to find causes that end up with deterioration of bank credit quality during the recent financial crisis in a cross-national sample. A rapid credit growth in 2000-2005 was seemed to be responsible for amount of NPLs when coexisting with the current account deficit.

Another similar study has been done by Prasanna(2014) in India in order to analyze the determinants of non-performing loans in the periods of 2000-2012. The researcher found that while higher growth rate in savings and GDP is directly related to lower NPLs, higher interest and inflation rates induce an increase in non-performing loans.

Saba et al. (2012) aimed to find macro and firm level factors that have an influence on NPLs in the US within the period 1985-2010. They concluded that interest rate, total loans and real GDP per capita are related to the ratio of NPLs.

Vithessonthi (2016) analyzed the relationship between bank credit growth and NPL in Japan in the period 1993-2013 by using panel OLS and two-step GMM regressions. He determined that bank credit growth has a positive impact on NPL especially at the beginning of global financial crisis of 2007, but the effect turns to negative after the crisis.

Clichici and Colesnicova (2014) analyzed the effect of macro level factors on NPLs in Moldova. They concluded that reduction in GDP, exports and remittances and increase

in unemployment cause a rise in NPLs. They could not find a link between NPLs and private indebtedness.

Diaconaşu et al. (2014) studied the macroeconomic variables' effect on NPLs based on Central and Eastern European markets. It is found in the study that NPLs are responsive for GDP Growth, unemployment and private indebtedness.

Shingjergji (2013) focused on how macroeconomic variables affect the NPLs by using regression methodology in the Albanian Banking Sector. He concluded that base interest rate, foreign exchange rate, GDP growth have a positive relationship with the NPLs while inflation rate has negative relationship with the NPLs. Most of the research in this area reveal that when GDP growth, NPLs will decrease due to the increase in income of the borrowers. However on the contrary to results of the literature, Shingjergji (2013)'s findings suggest that NPLs increase when GDP growth rate rise. Another investigation based on Albanian banking system has done by Kurti (2016) in order to investigate macroeconomic variables on NPLs. He found a positive interaction between GDP growth, lending interest rate, exchange rate and NPLs in line with the Shingjergji (2013)'s findings. There was also a negative relationship between inflation rate and NPLs.

Hess et al. (2008) investigated what might cause the credit losses in Australia and New Zealand. It is found that increase in credit losses is directly associated with poor macroeconomic conditions and equity market. Additionally, loan losses increases in direct proportion to bank loan growth.

Natham and Nahid (2015) conducted a research on determinants of NPLs in Tanzania. According to results of the study, GDP, interest rate, economic condition, bank`s loan supervision capacity influence the ratio of NPLs. Also it is mentioned that concentration on lending has no impact on rising ratio of NPLs.

Mondal (2016) conducted a research on macroeconomic factors that have an impact on NPLs for the 22 commercial banks running in Bangladesh. GDP and unemployment were found to have a positive relationship with NPLs, while inflation and interest rate have a negative relationship.

Caporale et al. (2013) investigated the causes of NPLs in terms of macroeconomic and financial determinants by using Structured VAR approach and to understand if loans growth in banks are associated with increase in the non-performing loans during the applied contractionary economic policy in Italia. It is found that permanent shock to NPLs in the expanding phase of credit phase has a significant role on the NPLs for the corporates. However relationship does not valid for household loan's NPLs.

Donath et al. (2014) analyzed the effect of macroeconomic variables on the level of NPLs in Romania and Baltic countries. The study suggested that increase in real GDP causes a reduction in NPLs and also there is a positive correlation between the unemployment rate and the NPLs. In addition, lending interest rate and inflation rate are not necessarily important compared other determinants, but still have positive correlation with NPLs.

Morakinyo and Sibanda (2016) tried to find what the main determinants of NPLs could be by applying dynamic panel model focused on economic of Mexico, Indonesia, Nigeria and Turkey. They put forward that ROA, quick ratio, capital requirements show an important and negative interaction with NPLs. In addition, it is mentioned that nominal exchange rate, growth in money supply, bank credit volume, lending interest rate have positive and very important effect on NPLs.

Ghosh (2015) reviewed determinants of non-performing loans for each commercial banks and savings institution among 50 US states including District of Colombia by applying fixed effects and dynamic GMM estimations in the period from 1984-2013. He suggested that higher capitalization, liquidity risk, bigger cost inefficiency, weak credit quality and size of banking sector cause a rise in the level of NPLs, however, greater bank profitability downscales the level of NPLs. In addition to this, it is observed that there is always a drop in the level of NPLs with greater state real GDP, personal income growth and alteration in state housing price index, while there is a significant increment with inflation, unemployment rate and US public debt.

Love and Ariss (2013) worked on macro-financial linkages in Egypt by preferring the multivariate and PVAR approach for the period 1993-2010. The researchers proposed that increase in capital inflows and GDP upgrade bank loan portfolio quality. On the other hand, lending rates might be an obstacle for portfolio quality.

Fofack (2005) investigate the determinants of NPLs specifically during the economic and banking crisis in Sub-Sharan Africa in the 1990s. He revealed that there is an obvious and casual relationship between economic growths, exchange rate, interest rate, interest margins, interbank loans and NPLs.

Collins and Wanjau (2011)in their study, focused on the influences of interest rates spread on the NPLs in Kenya. In brief, it is found that interest rate enhances non-performing assets in banks.

Borén (2016) analyzed the how capital imports are associated with NPLs by using a panel data set in 22 EU countries during the European crisis in the period 2001-2004. The study suggests that there is a negative interaction between capital imports and NPLs.

Chaibi & Ftiti (2015) examined the main macroeconomic and bank-specific factors affecting NPLs in the German and French economies. Except for the bank-specific variables, it is found that macroeconomic variables such as GDP growth, interest rate, unemployment rate, and exchange rate, have an impact on NPLs in both countries.

3.   HYPOTHESIS

As mentioned before, within the scope of credit channel approach of monetary transmission mechanism, this research considers that NPLs will have the same effect on the economy by reducing the loanable fund capacity and capital adequacy of banks. The problematic loans, considering that will have a similar effect with the occurrance of narrowing of the credit channel arising as a result of tightening monetary policy, are expected to have an impact on the macroeconomic conditions of each country regardless of size, composition and also dynamics of the economy. OECD countries are analyzed to test this suggestion. Besides, in this research, in developing countries such as Turkey which is suffering from inadequate capital stock and also underdeveloped equity markets, this impact mentioned above on the economy is considered to be bigger. Moreover, it is considered that asset quality deterioration of the banking sector will have a potential of crisis creation.

In emerging countries like Turkey where money and capital markets are not developed and also have savings gap or do not have sufficient capital accumulation, bank credits are so important in order to finance reel sector investments. In this respect, the sound banking sector and the efficient operation of the credit channel are becoming extremely critical in terms of macro balances such as growth, unemployment and inflation. Previous studies of Uğur et. al. (2016) show that a bank credit channel is effective and bank credits have an effect on industrial production and inflation in Turkey.

Deteriorating asset quality of the banks have two major effects on the credit supply channel; one of them is narrowing loanable funds due to the provision expenses and the second is the risk-averse approach of the credit extension authorities (Cucinelli, 2015) and (Hou & Dickinson, 2007). The main focus in this study is that NPLs have an effect on the macroeconomic variables by narrowing down the credit volume of the banking industry. The expected path is as follows:
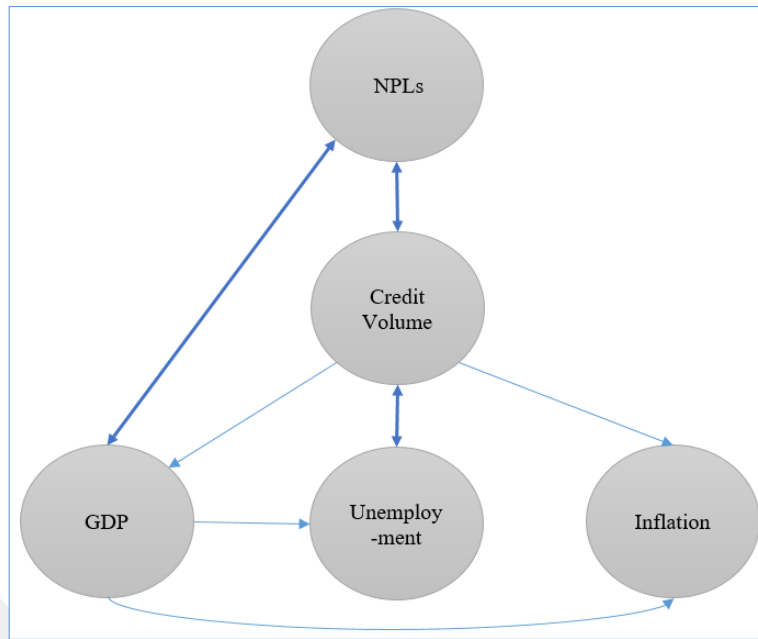
NPLs ↑→ Credit Volume ↓ → Output↓ Employment ↓ Inflation ↑

Figure 3. Supposed Relations

The hypothesis is that there is a relationship or interaction between credit risk represented by NPL ratio and macroeconomic variables, especially GDP growth, unemployment, inflatioın and credit volume of the banking sector. In summary, it is considered that credit risk through credit volume has an impact on key macroeconomic variables.

The research hypothesis can be summarized as below ;

H_1 Null Hypothesis: Macroeconomic variables have an effect on the NPLs of the banks

H_2 Null Hypothesis: NPLs, via credit volume, has an effect on the key macroeconomic variables such as GDP, Unemployment and Inflation.

In order to investigate the hypothesis, VAR and Panel VAR analysis are applied to 5 key variables.

4. DATA, VARIABLES AND METHODOLOGY

Because of the fact that it is a developing country that has experienced multiple crises in the period covered in the study, Turkey is analyzed. Additionally, OECD countries are included the analysis because of the diversity of the economies. In order to measure the crisis creation potential of the asset quality of the banking sector, a data set covering at least one crisis period was preferred.

The data period of this research covers the two crises terms as local financial crisis in November 2000 and February 2001 and global financial crisis in 2008. In terms of their effects, the 2001 local financial crisis has a greater importance for Turkey when it is compared with the 2008 global financial crisis. Political instability and uncertainties, macroeconomic vulnerabilities, high current account and fiscal deficit, large public debt, high inflation, weak financial system, collapse of foreign investors' and creditors' confidence have been lead Turkey to financial crisis in February 2001.

The selection of variables for this study is based on theory and previous empirical works. All data were gathered from official data providers like Central Bank and Turkish Statistical Institute. Write-offs and bad debt sales of the banks creates some constraints in the NPL data and analysis.

Quarterly data cover the 70 observations of NPL Ratio from 1999Q3 to 2016Q4 and macroeconomic variables listed below. The data consist of the change of all variables (in other words first difference of the variables).

Although there is no doubt about availability and reliability of the NPLs data, it is important to highlight a few data limitations arising from the write-offs and roll-over bad debt or debt restructuring applications of the banks. This may create bias on the results, however regardless of the limitations, it is believed that the data could be helpful to better understand the transmission channels of credit risk. In addition, neither Turkish Statistical Institute nor any other data collector store the data including write-offs and the resutructured amount of credits of the banks.

On December 12, 2016, TURKSTAT changed the method of calculation of GDP. With this change, the base year has changed, and the fixed prices have been replaced by the chained volume index (Bakış, 2018). While Turkstat gave its annual GDP series retrospectively, it did not calculate and provide the quarterly data. In addition to this, the credit volume and especially the problematic loan data have become unhealthy, via the implementation of loan extension policy through the KGF guarantees since the first quarter of 2017. Also the BRSA has made changes in credit classification and problematic loan accounting in 2018. These changes in practice created unrecoverable problems to calculate quarterly GDP data and NPLs of the banking sector. For these reasons, in order to avoid spurious results, research is conducted with the data between 1999 to 2016 which is considered to be healthier.

Table 2. List of Data for Turkey

	Data	Sources
1	NPL Ratio	CBRT (Central Bank) and Risk Center of Banking Association of Turkey
2	GDP Growth Rate	Turkish Statistical Institute
3	Unemployment Rate	Turkish Statistical Institute
4	Consumer Price Index	Turkish Statistical Institute
5	Credit Volume	Central Bank

4.1 Definitions of The Data

I. NPL ratio (NPLs)

NPLs represent the credit risk in that research. The definition of NPLs vary across countries. Currently no standard is applied universally to classify loans, the most sizable asset on many banks' balance sheets. As a corollary, no common definition of non-performing loans exists.(Bholat et. al. 2016). On the other hand, according to the New Capital Accord of Basel II, introduced in 2007, NPLs are those whose interest and principal payments are past due for more than 90 days or for which there is a good reason to consider that these payments will never be made in full, Scardovi (2016).

Similarly, Financial Soundness Indicators Guide of IMF describes a loan as nonperforming when payments of interest and/or principal are past due by 90 days or more, or interest payments equal to 90 days or more have been capitalized, refinanced, or

delayed by agreement, or payments are less than 90 days overdue, but there are other reasons—such as a borrower filing for bankruptcy—to doubt that payments will be made in full (IMF 2006). As described below, Turkey's loan classification and NPL definition is consistent with the IMF's definition.

As a generally accepted principle, a bank loan is considered non-performing when more than 90 days pass without the borrower paying the agreed installments or interest. NPLs are affected by both macroeconomic and bank specific (microeconomic) factors (Scardovi, 2016). From this theoretical point of view main reasons of NPLs can be separated into two categories: one of them is firm or bank-specific issues and the second comes from macroeconomic conditions. As mentioned above, this study is interested in investigating macroeconomic reasons creating NPLs and its feedback effects on the economy. The NPL ratio is calculated as the percentage of bad loans over the total loans.

II.   GDP Growth Rate (GDP or GDP_GR)

GDP is considered by economists to be the most important measure of the economy's current health. Besides, growth rate is also a measure of economic performance in a certain period. It indicates how economy performs in that period. If GDP growth is negative at least in two consecutive quarters, it can be said that an economy goes in a recession period. This implies that consumption falls and employment shall decline and also financial crisis may arise in an economy. With Adam Smith's approach, considering the per capita income as an indicator of the productivity of the workforce, real GDP can be regarded as an indicator of wealth independently from distribution problems. From this point of view, GDP and its growth are so crucial for the wealth of countries. As well as other indicators such as unemployment and inflation, GDP has a central role in measuring the business cycles, (Stock and Watson, 1999). The question of which this study sought answers is that do credit volume and indirectly NPLs have an effect on economy's performance or not ? For this reason, GDP growth rate is used as a main parameter in order to measure the effects of bank credits and NPLs on the economic fluctuations or business cycle.

GDP growth rate is linked to non-performing loans at most of the researches done in this area such as Nkusu (2011), Klein (2013), Eren (2011), Şahbaz (2010), Espinoza

and Prasad (2010) etc. In this investigation Seasonally and Calendar Adjusted GDP Index (2009=100) is used in calculation of GDP Growth rate.

III.   Unemployment Rate (Unemp)

Another key macro variable that is indicating an economy's health is unemployment level. Unemployment produces huge costs to society and the economy. In addition to crucial social problems, loss of income for individuals, loss of tax for government, wastage of human capital are among these costs, (Feldstein, 1978). The reaction of unemployment to a contractionary monetary policy action is an increase in its level (Bernanke and Blinder, 1992) and (Christiano et. al., 1994). Many researches, similar to the above, show that fluctuations in output of an economy arising as a result of contractionary monetary policy, effect the employment level and also an unemployment cycle is accompanied to these fluctuations. In this context, unemployment consists of another crucial main parameter in this study in order to measure of effects of bank credit volume and NPLs on an economy.

In this research, unemployment rate which is having different definitions in practice, is used as the percentage of total unemployed people to the labor force. It was used by Nkusu (2011), Messai and Jouini (2013), Macit and Keçeli (2012), Muntean (2014), Anastasiou et al. (2016), Roman and Bilan (2015), Clichici and Colesnicova (2014), Diaconaşu et al. (2014), Farhan et al. (2012), Mondal (2016), Donath et al. (2014), Ghosh (2015), Klein (2013), Filip (2015), Vatansever and Hepşen (2013), Louzis et. al. (2012), Škarica (2013), Bonilla (2016), Makri et al. (2014), Ahmad and Bashir (2013) on their researches as a parameter.

IV.   Consumer Price Index (CPI or INF)

General price level (Inflation) is an important part of macroeconomic analysis, especially where explicit inflation targets are a key element for the stability of the monetary policy that is the main role of central banks. It is an important parameter enough to be the main objective of the central banks in order to ensure financial stability and to help manage economic fluctuations, (IMF). Albeit, in the global financial crisis experienced in 2008 and it was understood that inflation was not sufficient goal for central banks, Woodford (2011) points that inflation targeting, as a clear nominal anchor, may

be flexibly used to compensate financial stability concerns. Because of the fact that inflation or inflation targeting are the prevailing ground for conducting monetary policy, whether the factors affecting the monetary policy via the credit channel have an impact or not on inflation is analyzed in this study.

CPI is used as an indicator of inflation in this study. Consumer Price Index were used by Vatansever and Hepşen (2013), Ahmad and Bashir (2013) and Beaton et. al. (2016) and also Producer Price Index was used by Adebolaa et al. (2011). However inflation as a parameter was used by most of the researcher like Macit and Keçeli (2012), Badar and Javid (2013), Prasanna (2014), Curak et al. (2013) Farhan et al. (2012), Shingjergji (2013), Kurti (2016), Mondal (2016), Donath et al. (2014), Ghosh (2015), Klein (2013), Filip (2015), Beaton et. al. (2016), Tanasković and Jandrić (2015), Škarica (2013), Erdinç and Abazi (2014) and Ahmad and Bashir (2013).

V. Credit Volume (CRVOL)

Bernanke (1983) argued that financial problems at the beginning 1930's distorted the effectiveness of the credit granting process and thus resultant higher cost of credit and decline in availability of credit pull down the aggregate demand. While Christiano, Motto and Rostagno (2007) are suggesting that credit growth must have a role as an independent target of monetary policy, Bernanke and Gertler (2001), in terms of the classical view, emphasise that monetary policy should not react to asset prices. Bernanke (1983), Gertler (1988), Mankiw (1986), (Bernanke and Blinder, 1992) Bernanke and Gertler (1989, 1995), etc. researchers examined and found that the credit market has an impact on macroeconomics. Bernanke, Gertler and Gilchrist (1996 & 1999), argued that credit-market frictions resulting from reduction of lending activities of banks will have a role as a financial accelerator and also may considerably broaden the real and nominal fluctuations of the economy. Measuring the bank credit volume's behaviour on key macro financials within the framework of monetary transmission mechanism is a crucial issue of this research. For this reason, bank credit volume and NPLs are used as the main parameters in order to measure the impact on financial fluctuations.

Credit volume consists of all cash credits including NPLs of the banking sector. Credit volume as a parameter was used by Festic and Bekö (2008), Kauko (2012), Vithessonthi (2016), Roman and Bilan (2015), Morakinyo and Sibanda (2016), Saka

(2010), Şahbaz (2010), Hess et al. (2008) and also Klein (2013) and Anastasiou et al. (2016) used the credit / GDP.

4.2 OECD Data

In the OECD data analysis, 29 of the 36 OECD countries' data which are available, have been used to modeling. Annual data set, consisting of 18 years between 1999-2016 with 522 observations, covers the GDP growth rate (GDP_GR), unemployment rate (UNEMP), inflation rate (INF), credit volume to GDP (CRVOL) and non-performing loans ratio (NPLR / NPLs). Data are obtained from the World Bank and the Bank for International Settlements.

The OECD countries whose data are available and included in this study are listed below.

Table 3. List of Data for OECD Countries

Included	Excluded
Australia	Luxembourg
Austria	New Zealand
Belgium	Estonia
Canada	Latvia
Chile	Lithuania
Czech Republic	Slovak Republic
Denmark	Slovenia
Finland	
France	
Germany	
Greece	
Hungary	
Iceland	
Ireland	
Israel	
Italy	
Japan	
Korea Republic	
Mexico	
Netherlands	
Norway	
Poland	

Portugal
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States

The countries that are not included in the study due to lack of data constitute 3 per thousand of the OECD according to 2016 GDP figures.

4.3 Methodology

In this study, Vector Autoregressive Model with cointegration, Granger Causality analysis, variance decomposition, impulse response function are used to examine the interrelationship between the NPL and macroeconomic variables.

A vector autoregression, or VAR, is a system of ordinary least-squares regressions, in which each of a set of variables is regressed on lagged values of both itself and the other variables in the set. VARs have been proved to be a convenient method of summarizing the dynamic relationships among variables (Bernanke and Gethler, 1995).

Eviews 7 tool is used as a research instrument. A significance level of 0.05 and 0.10 are both used in this study in order to disprove or reject the null hypothesis.

4.3.1 Test of Robustness

In order to generalize and improve the prediction power and also comparison with the findings related to Turkey, a research with the OECD countries' data are conducted in addition to VAR analysis of the Turkey's data. Panel VAR approach is applied to the analysis of the OECD data. Also Granger causality, variance decomposition and impulse response analysis are carried aout for 522 observations of the 29 countries. Findings are presented at the section 7.

5.   EMPRICAL FINDINGS

Findings related to VAR and Panel VAR analysis are presented in this section respectively. Findings of these research are consistent with the findings of the previous studies that are carried out on different countries and covering the studies of Nkusu, (2011), Espinoza and Prasad (2010), Erdoğdu (2016), Jordan and Tucker (2013), Konstantakis et. al. (2016), Inaba et. al. (2005), Riley (2013), Beaton et. al. (2016). However, findings related to unemployment are contradicted with the findings of the studies carried out by Klein (2013), Filip (2015). They suggest that there is an inverse relationship between NPLs and unemployment and also NPLs have a substantial effect on unemployment. The main difference is that there are weak relationship between unemployment and credit volume and also unemployment and NPLs in Turkey stands out as the emergence of a clearer this relationship in OECD countries. In addition, NPLs effect on change in credit volume and change in GDP growth are bigger in Turkey than the OECD as a result of high credit dependency. Main difference of the research consist of the comparison of the OECD and Turkey analysis that produce different findings between OECD and Turkey's results. Striking results showing a difference are detailed in the following comparison section.

5.1 Empirical Findings Of VAR Analysis (TURKEY)

Empirical tests are used in this section in order to analyze the macro determinants of NPLs and also to detect interaction between NPLs and macroeconomic variables, consist of the Vector Autoregressive Models (VAR) which is comprising Granger Causality, variance decomposition and also impulse response analysis. Statistical methodology and the test results' are summarized in this section and result tables are presented at the end of study.

5.1.1 Descriptive Statistics

Descriptive statistics of all variables are presented in Table 1 which shows the average, median, minimum value, maximum value, standard deviation, kurtosis of the variables described in Table 4.

Three crisis terms within the data period affect the positive and negative values of the parameters and volatility and so standard deviation. Especially the crisis of 2001 has been created a crucial change in macroeconomic parameters and banking sector data. The volatility in the data created by crisis makes it easier to find a relationship between parameters.

Descriptive statistics reveal that the change in NPLs is negative on average at -0.009 due to the decreasing trend of NPLs in data period. The standard deviations of NPLs and Unemployment are higher than the other parameters used in the VAR model because the range between minimum and maximum values are high. In the period of the analysis, it is observed that the change in NPLs has reached to the maximum level after the 2001 crisis period with the deterioration of macroeconomic indicators. One of the main reasons for the high level of NPLs' volatility is high correlation with change in credit volume which has strong relationship with GDP.

Table 4. Descriptive Statistics

	CPI	CRVOL	GDP	NPLR	UNEMP
Mean	0.039153	0.072467	0.012461	-0.009048	-1.37E+13
Median	0.024042	0.058867	0.015758	-0.004784	0.042572
Maximum	0.195424	0.290079	0.056200	0.379562	0.359246
Minimum	-0.003266	-0.095848	-0.051554	-0.220749	-9.62E+14
Std. Dev.	0.041498	0.063935	0.023345	0.108998	1.15E+14
Skewness	1.970878	0.540753	-0.856496	0.733864	-8.186238
Kurtosis	6.490673	4.620785	3.872937	4.444430	68.01449
Jarque-Bera	80.85655	11.07342	10.78106	12.36842	13110.25
Probability	0.000000	0.003939	0.004560	0.002062	0.000000
Sum	2.740720	5.072714	0.872252	-0.633341	-9.62E+14
Sum Sq. Dev.	0.118824	0.282051	0.037604	0.819766	9.13E+29
Observations	70	70	70	70	70

5.1.2 Augmented Dickey-Fuller Test

The stability of the data to be used should be tested before proceeding to the VAR analysis, which is used to determine the relationship between variables, the direction and degree of this relationship, and the long-term and short-term status. The Augmented

Dickey-Fuller test has been used for testing this step. In this technique, in order to test the unit root property of the X_t series ;

$$\Delta X_t = \beta_0 + \beta_{1t} + \alpha X_{t-1} + \sum_{i=1}^{n} \delta \Delta X_{t-1} + \varepsilon_t \qquad (1)$$

regression equation is used. Where ;

$\Delta \rightarrow$ is the difference operator

$t \rightarrow$ is the time trend

$\varepsilon t \rightarrow$ is the error term

$Xt \rightarrow$ is the series to be used

$n \rightarrow$ is the lag length of the dependent variable determined by the Akaike information criterion in order to remove autoregressive (successive dependency) of error terms.

In this test H_0: $p \leq 0.05$ Series is non-stationary.

H_1: $p > 0.05$ Series is stationary.

Fundamentally, the ADF test is based on the prediction of the "α" parameter in the above regression equation and on the statistical significance of this parameter. If t-statistic of this parameter is significant and negative, H_0 is rejected.

Test results (see Table 5) figures out that all variables don't have unit root because of the fact that all variables are in the first difference level. At the same time Figure 1 indicates whether all variables of the VAR model are stationary or not is presented below.

Inverse Roots of AR Characteristic Polynomial
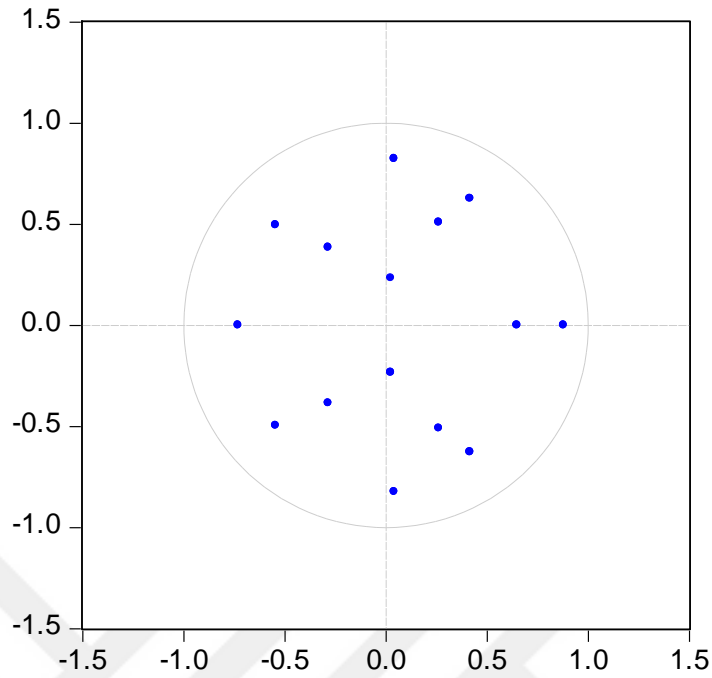
Figure 4. AR Roots Figure

Table 5. Augmented Dickey-Fuller Test Results

Series	t-Statistic	Critical Value at %5	Prob.
NPL Ratio	-6,637311	-1,945596	0,0000
GDP Growth Rate	-3,115625	-1,945745	0,0023
Unemployment Rate	-2,646893	-1,945823	0,0088
Consumer Price Index*	-4,209478	-2,910019	0,0014
Credit Volume*	-6,360809	-2,904198	0,0000

* They shows Level + intercept results while others shows level results only.

The variables of estimated VAR are stationary if all roots lie inside the unit circle Lütkepohl (2005).

5.1.3 Vector Autoregressive Model

We prefer the VAR model in order to analyze the mutual interaction between NPLs and key macroeconomic varibles and also avoid restrictive assumptions of linear models.

Vector autoregressive model which was introduced by C.Sims in 1980 provides a flexible and easily applicable methodology for analyzing financial and economic time series.

Mutual interaction of variables strongly affects the consistency of analysis and makes it difficult to determine undisputedly dependent and independent variables in macroeconomic models. VAR models produce much healthier results than structural models in determining dynamic relationships between macroeconomic variables because it does not come from a classical economic theory, (Zivot & Wang 2006). Therefore, it does not require the external or internal distinction of the variables. In this aspect the VAR model is different from the classical OLS method. Besides, in the VAR model, the predictions for future are more powerful because of the fact that the lagged values of the internal variables take place as exogenous variables. VAR test results are presented at the Table 6 in appendix.

Lag length of the VAR model was selected by using statistical criteria such as the AIC, HQ, FPE or SIC. The VAR model includes 3 lags of all variables. Lag Lenght Criteria is presented in Table 6.

The Vector autoregressive (VAR) model is a multi-dimensional time series prediction model that includes the lagged values of all variables included in the model. Fundamentally along with being a predictive model, it allows structural analysis. Especially in macroeconomic analysis, it is often used in practice in situations where the internal-external variable in the simultaneous equation system can not be distinguished clearly. In other words, there is no definite internal-external distinction between variables in this model.

In the two time series in the form of Yt and Xt, if the change of Yt series over time is in interaction with the current and past values of Yt and Xt series and at the same time, if also the change of Xt series over time is in interaction with the current and past values of Yt and Xt series, the VAR model can be written as follows;

$$Y_t = \beta_{10} + \sum_{i=1}^{n} \beta_{1i} Y_{t-i} + \sum_{i=1}^{n} \beta_{12i} X_{t-i} + u_{1t} \qquad (2)$$

$$X_t = \beta_{20} + \sum_{i=1}^{n} \beta_{21i} Y_{t-i} + \sum_{i=1}^{n} \beta_{22i} X_{t-1} + u_{2t} \qquad (3)$$

Where ; β_{i0} is the constant term, β_{ijk} is the parameter for k-lags of variable j in equation i, U_{it} is the error term and n is the number of lags. Generally in VAR models, difference variables are used. The main reason for this is that the difference variables greatly reduce the "superious regression" problem.

There is a need for analysis of impulse-response, variance decomposition, cointegration and causality in order to use the VAR model in a structural analysis.

In this case because of the fact that it is not meaningful to comment on the coefficients of the VAR model, only by using the results of the four analyses mentioned above, it can be made inferences related to the power and direction of the interaction and also short-term and long-term equilibrium level. Essentially, the main purpose of using the VAR model is to test the hypothesis about the relationship between variables.

Autocorrelation, normality and heteroscedasticity tests for error terms were also conducted in order to determine whether the created VAR model has a problem in terms of structural. As a result of the LM test made to determine whether the error terms of the predicted model are related to one another, as can be seen in the following Table 5, between 12 lags, there is no autocorrelation at all the lags except that 1., 2. and 9. lags. As a result, the assumption of error terms which do not have autocorrelation is provided.

Table 6. VAR Residual Serial Correlation LM Tests

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 1999Q3 2016Q4
Included observations: 67

Lags	LM-Stat	Prob
1	45.75983	0.0068
2	41.12225	0.0223
3	21.81749	0.6463

4	27.09503	0.3512
5	20.22734	0.7348
6	18.91578	0.8011
7	16.43365	0.9013
8	20.98900	0.6932
9	38.71637	0.0393
10	26.94200	0.3588
11	28.69079	0.2770
12	26.33097	0.3901

Probs from chi-square with 25 df.

According to the result of the Chi-sq test (Table 7) made for detection to related with whether the error terms showed heteroskedasticity, it was seen that the error terms did not show heteroskedasticity, that is, the assumption of constant variance.

Table 7. VAR Residual Heteroskedasticity Tests

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Sample: 1999Q3 2016Q4
Included observations: 67

Joint test:

Chi-sq	Df	Prob.
496.958 7	450	0.0623

For the test of the assumption of the normal distribution of errors, which is another assumption, Jargue-Bera analysis was performed and it is understood that the assumption of normality in all components is provided according to the probability values as can be seen in Table 8.

Table 8. VAR Residual Normality Tests

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 1999Q3 2016Q4
Included observations: 67

Component	Jarque-Bera	Df	Prob.
1	1.638841	2	0.4407
2	2.975166	2	0.2259
3	3.617818	2	0.1638
4	1.372345	2	0.5035
5	2.443807	2	0.2947
Joint	12.04798	10	0.2819

5.1.4 Granger Causality Test

VAR Granger causality test is the most valid test used to determine the direction of the relationship between variables statistically. In this study, the direction of the relationship between the variables in the short term is tested by using Granger causality test in VAR framework. Granger causality is normally tested in the context of linear regression models via the following equations;

$$Y_t = \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{i-1}^{m} \beta_i X_{t-i} + \varepsilon_{1t} \tag{4}$$

$$X_t = \sum_{i=1}^{m} \theta_i X_{t-i} + \sum_{i-1}^{m} \gamma_i Y_{t-i} + \varepsilon_{2t} \tag{5}$$

Where $\alpha_i, \beta_i, \theta_i, \gamma_i$ are the coefficients of the models, m is the maximum number of lagged observations and $\varepsilon_{1t}, \varepsilon_{2t}$ are the residuals (prediction errors) for each time series.

Null and alternative hypothesis are generated as follows :

$H_0: \sum_{i=1}^{n} \beta_i = 0 \qquad x_t$ does not casue to y_t.

$H_1: \sum_{i=1}^{n} \beta_i \neq 0 \qquad x_t$ cause to y_t.

if P value < Significance level, then Null hypothesis will be rejected.

if P value > Significance level, then Null hypothesis cannot be rejected.

According to results of the Granger Causality test ; when we accept the significance level as 0.05, as it is shown in Table 9.1 ; there is a Granger causality from CRVOL, CPI and GDP to NPLs. In other words, it is clear that CRVOL, CPI and GDP are the causes of NPLs. Also shown in Table 9.1 there is a bidirectional causality between GDP and NPLs (GDP↔NPLs) as we expect. 1) As noted in the theoretical section of the study, and in line with the hypothesis, the empirical results that these three macroeconomic indicators were influential on the NPL were reached by the first test. However, it is clear that the increase in credit volume has a positive effect on the NPL due to the adverse selection problem as expected (Islam & Nishiyama (2017)). An increase in inflation will create an increase in nominal interest rates through the Fisher Effect, hence rising interest rates will create a drop in loan volume arising from contraction in loan demand and also credit requests rejection. Additionally, increases in interest payments reduce the profits and the cash flows of firms by resulting in the output, inventories and investment to decline and also this creates additional NPLs.

Reduction in inflation will cause demand explosion in countries such as Turkey which its economy depends on domestic demand. This situation will increase the credit volume when we consider the savings gap. Hence naturally the increase in the loan volume will have an effect on the NPLs due to the adverse selection problem. At this point, the increase in loan volume will naturally increase the GDP growth based on consumption. For this reason, a two-way relationship between growth and NPL is an expected situation.

Change in GDP growth rate Granger causes a change in credit volume at the 0.0014 probability level and also if we accept the significance level as 0.10, then change in NPLs Granger cause to credit volume at the 0.0557 probability level in line with the hypothesis. Determination of a causality relation from GDP growth to credit volume is one of the common observations in developing and having savings gap countries. It is clear that credit volume will tend to increase in line with GDP growth in such countries based on the increase in consumption and therefore the volume of production. However due to the fragility of the economy, in a downturn period, banks are implementing risk-averse policies and also not willing to increase their exposure. At this point also a causality from the NPL increase to the credit volume has been identified but the strength, acceptability and impact of this causality are weaker according to the relation between growth and

credit volume. The main reason for this situation is that the negative effects of NPLs on the risk appetite of the banks are limited level especially in the upturns period (Cucinelli, 2015). Although the causality is weaker, overall test results depicting us that there is bidirectional relationship between credit volume and NPLs are in line with the hypothesis.

Change in credit volume and unemployment Granger cause to CPI at the 0.000 and 0.0003 probability level respectively and also if we accept the significance level as 0.10, then change in NPLs Granger cause to CPI at the 0.0641 probability level. It is observed that there is a strong causality relationship from credit volume and unemployment to inflation. The direction and strength of this relationship show us a typical characteristic of developing economies which depends on credit market, as consumption will increase when credit demand and volume increase, which in turn will stimulate up the general level of prices together with demand. Parallel to these results, it is a known fact of the economy that general level of prices will increase/decrease according to increase/decrease in aggregate demand created by the unemployment change.

In this part of the analysis, the existence of a non-strong relationship with the general level of prices from the NPLs has also been identified. In line with the hypothesis, the effects and the causality of NPLs on general price level are limited according to other parameters. The primary causality expected at this point in the direction of the hypothesis is between credit volume and inflation, as mentioned above. NPLs have an effect on inflation via the change in credit volume.

Change in credit volume Granger cause to GDP growth rate at the 0.0061 probability level. If it is accepted a significance level 0.10, then GDP growth rate Granger cause to unemployment at 0.061 probability level. Although the strength of the causality is weak, test results show that there is a causality from GDP growth rate to unemployment. As is known, one of the most important sources of growth in Turkey is domestic consumption. The fact that domestic consumption and production are predominantly dependent on imported inputs reveals a strong relationship between growth and imports (Gerni at. Al. 2008 & Ilıkkan Özgür 2015). The decline in growth arising from the shrinking consumption of imported goods may not have a serious effect on unemployment. For the same reasons, the increase in growth rates may not reduce unemployment to the same extent.

Finally, in line with the hypothesis, test results indicate that there is a two-way relationship between change in credit volume and the GDP growth rate.

Granger Causality test results in detail are presented in the Table 9 in appendix. In addition a shortlist of test results is presented below (Table 9).

Table 9. Granger Causality Test Results

Null Hypothesis (Obs : 67)	Chi-sq	Prob.
CRVOL does not Granger Cause NPLR	8.739924	**0.0330**
INF does not Granger Cause NPLR	10.05146	**0.0181**
GDP does not Granger Cause NPLR	19.03633	**0.0003**
UNEMP does not Granger Cause NPLR	1.119412	0.7724
NPLR does not Granger Cause CRVOL	7.572819	**0.0557**
INF does not Granger Cause CRVOL	3.522426	0.3179
GDP does not Granger Cause CRVOL	15.59810	**0.0014**
UNEMP does not Granger Cause CRVOL	5.189136	0.1585
NPLR does not Granger Cause INF	7.257072	**0.0641**
CRVOL does not Granger Cause INF	28.69621	**0.0000**
GDP does not Granger Cause INF	3.754639	0.2892
UNEMP does not Granger Cause INF	19.03241	**0.0003**
NPLR does not Granger Cause GDP	3.973776	0.2643
CRVOL does not Granger Cause GDP	12.40481	**0.0061**
INF does not Granger Cause GDP	1.915980	0.5900
UNEMP does not Granger Cause GDP	0.601882	0.8960
NPLR does not Granger Cause UNEMP	1.447647	0.6944
CRVOL does not Granger Cause UNEMP	0.753608	0.8605
INF does not Granger Cause UNEMP	4.959471	0.1748
GDP does not Granger Cause UNEMP	7.365314	**0.0611**
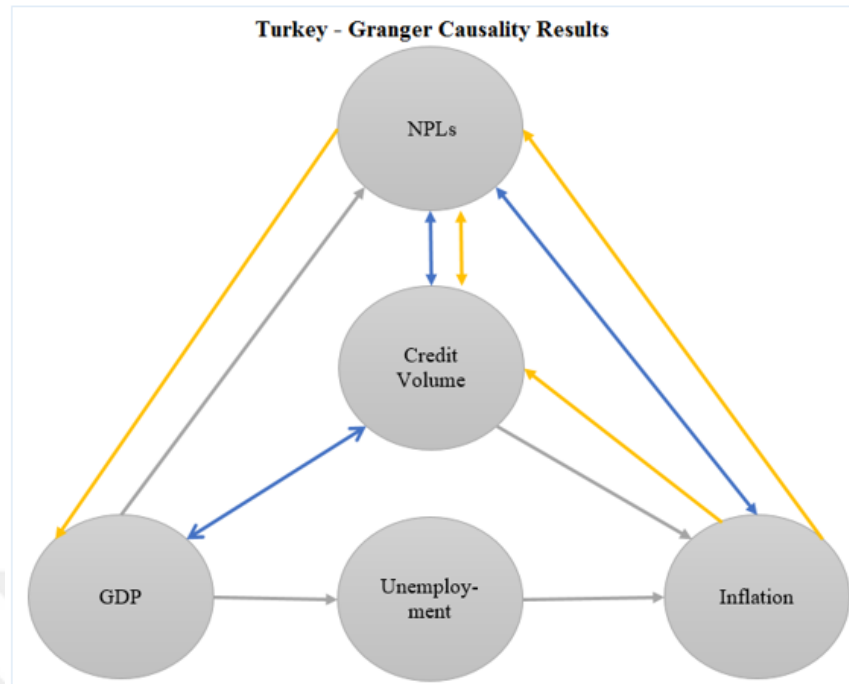
Figure 5. Causality Relations

5.1.5 Variance Decomposition

VAR's impulse responses and variance decomposition analysis reveal whether changes in the value of a given variable have a positive or negative effect on other variables in the system, or how long it would take for the effect of that variable to work through the system Brooks (2008).

Variance decomposition gives the proportion of the movements in the dependent variables that are due to their 'own' shocks, versus shocks to the other variables. A shock to the ith variable will directly affect that variable of course, but it will also be transmitted to all of the other variables in the system through the dynamic structure of the VAR. Variance decompositions determine how much of the s-step-ahead forecast error variance of a given variable is explained by innovations to each explanatory variable for s = 1, 2, . .Brooks (2008)

The test results indicate that in the short run most of the variations in variables is due to own shock. However as the lagged variables' effects start, the percentage of the effect of other shocks increases over time.

The own shock of NPLs in the first quarter accounts for 100% of variance of NPLs and this impact declines beginning from the second quarter up to 60% in the 8th period. Beginning from the second quarter, the other varibles' effects begin, so GDP shocks account for %22 of the variance of NPL. At the end of the 10th period, credit volume, CPI, GDP growth rate and unemployment shocks together account for only 40% of the variance of NPLs and also its own shock accounts for 60%. Parallel to the results obtained from the Granger causality test, analysis for variance decomposition also emerged in a way that shows the economically expected results. As a matter of fact, when a unit shock to the NPLs is given, all of the changes in the first period can be explained by the NPLs data of the previous term. However it is revealed that credit volume, inflation, growth and unemployment have an effect on the change in NPLs in the following periods. According to these results, in accordance with the empirical literature, while NPLs' own lags are the main factor in the short term, it is understood that in the long run, respectively GDP growth, credit volume, inflation and even unemployment slightly are the other factors having effect on NPLs. When evaluated together with GDP results, a bidirectional relationship between NPLs and GDP growth and also credit volume are observed. Another issue drawing attention at this point is that the effects are stabilized approximately at the end of the 7th quarter, in other words approaching to the equilibrium level.

Consistent with the results of the causality, the variance decomposition results of credit volume show that in the first period about 8% of the change due to a unit shock to credit volume was explained by the NPLs, while approximately 92% was explained by the credit volume itself. In the following periods, Growth, inflation and unemployment are the variables that accounted for explanatory power in addition to the increase in NPL's explanatory power as expected. In the long run (10th period), while its own shock accounts for 61% of variance of credit volume, NPLs, CPI, GDP growth rate and unemployment accounts respectively for 11.2%, 3,67%, 13,69% and 10.4% of variance of credit volume. Here, the explanatory level varied until the seventh quarter, but after this period, it approached to the equilibrium and stabilized.

In the next step, a unit shock has been applied to inflation, and 96% of the change at the end of the first period is explained by the inflation itself. The variable explaining a large part of the remaining 4% in the same period is the credit volume. However, in this step, from the 2nd period onwards, the effect of inflation itself has declined while the effects of loan volume, NPL, unemployment and then GDP growth have been revealed. The shocks of NPLs and credit volume together account for approximately 48% (NPLs 9.6% and credit volume 38.2%) of variance of CPI in the 5th period while its own shock accounts for only 44.4% of variance of CPI. The long-run equilibrium in this step of the analysis has been arisen after the fourth period.

Similarly, when a unit of shock is applied to GDP growth, 94% of the change has been explained by itself while the main variable explaining the remaining 6% was the NPL. At this point, the secondary explanatory of the change in GDP growth after the 2nd period is loan volume, followed by NPL, unemployment and inflation. At the same time which constitutes the main element of the hypothesis, these results demonstrate that in Turkey, GDP growth has been particularly based on credit growth. NPLs and credit volume shocks together account for approximately 25.5% (NPLs 7.6% and credit volume 17.9%) of variance of GDP growth rate in 10th period while its own shock accounts for 69% of variance of GDP. The long-run equilibrium was captured after the 7th period in this analysis.

As a final analysis of variance decomposition, a unit shock on unemployment has been applied. The results (as expected) show that at the end of the first period, 95% of the change is explained by itself, while the GDP growth and NPLs have been limited with explaining the change in the first period. According to these results, the change in unemployment is explained firstly by unemployment itself and it is seen that in the following periods, after the growth, the inflation and the NPL are taking place as other factors in explaining the change. NPLs and credit volume shocks together account for approximately 9.7 % (NPLs 5.85% and credit volume 3.85%) of variance of unemployment in 10th period while its own shock accounts for 73.4% of variance of unemployment.

When we summarize all the results of this analysis, it can be seen that the other variables used in the analysis in explaining the changes in the dependent variable have an

effect parallel with the power and direction of the causality relation. Variance Decomposition table is presented at the Table 10 in appendix.

To some extent, impulse responses and variance decompositions offer very similar information Brooks (2008).

5.1.6 Impulse Response Analysis

While the variance decomposition can be used to determine which variable has the greatest effect on any variable, the impulse response function helps determine whether the variable with the highest impact on the shocked variable can be used as a policy tool or not.

Granger-causality test may not tell us the complete story about the interactions between the variables of a system. In applied work, it is often of interest to know the response of one variable to an impulse in another variable in a system that involves some further variables as well. Thus, one would like to investigate the impulse response relationship between two variables in a higher dimensional system (Lütkepohl (2005)).

Impulse responses trace out the responsiveness of the dependent variables in the VAR when a unit standard deviation shock is given to the error terms or in other words each variable. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted (Brooks (2008)).

Against a one standard deviation shock applied to NPLs, again with the first effect of NPLs being positive, a declining trend has been observed until the 4th quarter and after 4th quarter the reaction has been approached the long term equilibrium value. As expected, however, the response of credit volume has been started in a negative direction, but this negativity has lost after the 6th period and started to approach balance value. The reaction of inflation has started in a similar way to the unemployment response, and after the 6th period under volatility conditions, it began to approach its equilibrium value. When we look at the reaction of the growth, negative reaction as expected has been obtained in parallel with the reaction of the credit volume in the first period.

Against one standard deviation shock given to credit volume, the strongest response has been given by the credit volume. This positive response has gradually decreased and

also has shown a tendency towards the equilibrium value after a small negative response at the 4th period. However, the response of the NPL has been positive-negative-positive and volatile until the fourth quarter and also after the fourth quarter it has begun to approach the equilibrium value. Although the Inflation and unemployment has also shown a volatile response as expected level and has begun to approach the balance after the 4th period. Here, it has been seen that the main important response to shock of the credit volume is on the GDP growth, that a negative and sharp reaction is given up to the second quarter, then the positive reaction lasts until the fourth period. Finally the balance value has been reached after the fourth period, in other words the reaction has lost its effect. Thus, the hypothesis that change in credit volume has an impact on GDP is confirmed as albeit statistically significant although the effects of the shocks to credit volume are surprisingly small.

Impact of inflation to one standard deviation shock applied to inflation is positive and strong for the first quarter, but this stronger response declines after the 4th period and it approaches the equilibrium and becomes ineffective.

As expected in this analysis and as can be seen in other analysis results, the response of NPL, credit volume and growth to shock to inflation has remained at a minor level. Nevertheless, the main response to inflation has been given by unemployment in the form of strong and volatile reactions as positive-negative-positive up to the fourth quarter. However, after the 4th period, the influence of the reaction gradually has been decreased and approached to the equilibrium.

Main response to one standard deviation shock applied to GDP growth comes from its own lagged values. The positive starting reaction has been gradually decreased and has become stable after the fourth period with a minor negativity. While their directions differ, the responses of credit volume and the NPLs are similar in size. This is an overlap with other analysis results. However, as in the other parameters, the response of these two parameters has stabilized from the 4th period and has approached the equilibrium value. These results point to a dependence on the economic conditions and the borrowers' ability to repay their loans.

The response of unemployment against to shock of GDP growth has been shown quite volatile and it has approached the stability level from the 6th period. Similar to

unemployment, also inflation has been reacted volatility albeit minor responses and begun to approach equilibrium from 6th quarter.

When a one standard deviation shock is applied to the unemployment parameter, the sharpest and most volatile response have come from its own lagged variables as expected. At this point, the shift to equilibrium has begun from the sixth period. As a result of this shock, responses of GDP growth, inflation, NPLs and credit volume are very limited and minor. Similar results have been achieved in previous analyzes on unemployment. Hence it has been revealed that the relationship and interaction of the unemployment variable with other variables is limited.

According to the results of the impulse response analysis, it is observed that some parameters are less, some are more responsive, the reactions are sometimes negative and sometimes positive. It is also observed that the main responses are usually given in the first four periods, and that these reactions are largely due to the lagged effect of the parameter itself. However, the responsiveness are gradually diminishing and approaching equilibrium in the long run.

At this point, the information given to us by impulse response analysis that is supporting the results of the VAR, causality and variance decomposition analysis confirms the validity and consistency of the hypothesis. The fact that the parameters interact primarily and effectively with their lagged values is also an indicator that the VAR methodology is the right choice in modeling.

In summary, all tests and models conducted in this study have demonstrated that there is a relationship and interaction between NPL and Loan volume and main macroeconomic variables, as mentioned in the hypothesis. The different analysis and tests applied at this point have also provided information on the impact, direction and duration of these interactions.

Impulse Response table is presented at the Table 11 in appendix.

5.2 Empirical Findings Of Panel VAR Analysis (OECD)

Empirical tests used in this section in order to analyze the hypothesis of the research consist of the Panel Vector Autoregressive Models (PVAR) which is comprising Granger Causality, variance decomposition and also impulse response analysis. Statistical methodology and the test results are summarized in this section and the result's tables are presented in appendix.

5.2.1 Descriptive Statistics

Descriptive statistics of all variables are presented at the Table-10 which shows summary statistics of total sample used in VAR analysis for OECD data. Annual data consist of the 29 countries of the 36 OECD members and its 522 obsevations covering the 18 years. Mean of the GDP growth is 2.28, credit volume to GDP is 87.64, NPLs ratio is 4.1, inflation is 2,7 and the unemployment is 7.2. Almost for all parameters, the standard deviation of the data set are very high due to the fact that figures of the countries in terms of income, markets, level of development etc. are not homogeneous. The member countries of the OECD span the globe, from North and South America to Europe and Asia-Pacific. OECD includes many of the world's most advanced countries but also emerging countries like Mexico, Chile and Turkey. However the homogeneity of the countries is not a requirement or a precondition for this analysis.

Table 10. Descriptive Statistics

	GDP_GR	UNEMP	INF	CRVOL	NPLR
Mean	2.283314	7.233881	2.720711	87.64215	4.104050
Median	2.306532	6.090000	2.203521	85.80000	2.500000
Maximum	25.55727	27.47000	64.86748	312.0190	36.64744
Minimum	-9.132494	1.870000	-4.479938	8.600000	0.081808
Std. Dev.	2.928838	4.371961	5.260646	41.06217	5.180276
Skewness	0.478998	2.180681	8.085429	0.701035	3.158692
Kurtosis	11.75657	8.736700	82.92202	4.799852	15.31959
Jarque-Bera	1687.696	1129.504	144616.3	113.2146	4169.078
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	1191.890	3776.086	1420.211	45749.20	2142.314
Sum Sq. Dev.	4469.187	9958.415	14418.36	878459.0	13981.17
Observations	522	522	522	522	522

5.2.2 Panel Unit Root Test

In order to achieve accurate and consistent results in the analysis of time series data, these series must be stationary. For this reason, when studying with the time series data, it is needed to check the order of integration of the variables. In order to detect the stationarity of the series and the verify the property of the data, Levin, Lin & Chu (2002) panel unit root test is applied at level forms of each series. The results of the unit root test are reported in Table 11.

Levin Lin Chu test suggest a more powerful panel unit root test than individual unit root tests for each cross-section. The Levin Lin Chu test is based on the following equation (6):

$$\Delta y_{it} = \rho y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \quad m = 1,2,3 \tag{6}$$

with d_{mt} indicating the vector of deterministic variables and α_{mi} the corresponding vector of coefficients for model m = 1, 2, 3 (Baltagi, 2005). The Levin Lin Chu test is based on the t-statistic of the pooled fixed-effect estimator $\hat{\rho}$.

Null and alternative hypothesis for Levin Lin Chu test are ;

H_0: series contains a unit root
H_1: series is stationary

If a variable contains a unit root, then it is non-stationary, and unless it combines with other non-stationary series to form a stationary cointegration relationship, then regressions involving the series can falsely imply the existence of a meaningful economic relationship (Harris & Sollis, 2003).

The null hypothesis of a unit root is rejected for all variables at the significance level of 0.05. The test is carried out at the level and intercept form for the unemployment and credit volume variables. Results are presented at the Table 11.

Table 11. Panel Unit Root Test

| | Levin, Lin & Chu Test | |
| | Level | |
Variables	Statistic	Prob.
GDP Gr.	-9.04486	0.0000
UNEMP*	-3.994	0.0000
INF	-7.38955	0.0000
CRVOL*	-3.92904	0.0000
NPLs	-5.83177	0.0000

* These parameters are tested in Level & intercept.

5.2.3 Panel VAR

In this study, a Panel VAR is applied to 5 variables on the data of 29 OECD countries with annual frequency over the period 1999-2016.

The Panel VAR methodology, used in analysis, is developed by Holtz-Eakin et al. (1988) by extending the traditional VAR model introduced by Sims (1980). Panel VAR model is built with the same logic of standard VAR model which treats all the variables in the system as endogenous, with the cross-sectional dimension. It is a much more powerful tool to address interesting policy questions in macroeconomics. The Panel VAR model has advantages over individual country VAR analysis. The first one is degrees of freedom in analyzing a panel of countries. Moreover, as the panel approach captures heterogeneity at the country level, it can be better modeled the spillovers from one country to another.

General form of the Panel VAR model can be expressed as follows:

$$Y_{it} = A_0 + A_1 Y_{it-1} + A_2 Y_{it-2} + \cdots + A_j Y_{it-j} + BX_{it} + \mu_i + \lambda_t + \varepsilon_{it} \tag{7}$$

Where ; Y_{it} is a vector of each i with a number of j lags. X_{it} is a vector of the exogenous variables and ε_{it} denotes the error term. μ_i accounts for the unobservable country characteristics and λ_t accounts for any global shocks that may affect all countries in the same way.

5.2.4 Granger Causality Test Results

The Granger causality test is carried out within the PVAR framework in order to detect the direction of the causality between variables. The direction of causality appears in line with the hypothesis and the previous analysis related Turkey's data.

As shown in the table 12, all of the p-values are smaller than 0.05 for GDP growth except unemployment. Hence, using a 5% significance level, the non-causality null hypothesis can be rejected for the CRVOL, INF and NPLs. In other words, on the basis of this test causal relation from Credit Volume, Inflation and NPLs to GDP can be diagnosed. The results indicate that there is a casuality relationship between NPLs, Credit volume and GDP growth rate in line with the the hypothesis.

As expected within the framework of generally accepted macroeconomic theories, there is a causality from GDP growth to unemployment. Also a casual relationship from credit volume to unemployment is another important result in terms of the hypothesis. This OECD result is different from the findings related to Turkey's analysis. It is considered that this difference arises from the high labor market flexibility of developed countries within the OECD. When credit volume narrows in a country, investments also narrow resulting from the less employment.

Another conceptual finding is bidirectional causality between inflation and unemployment. Although there are different evaluations in the literature and theory, it is generally accepted that there is a relationship between unemployment and inflation.

As expected, all of the p-values are smaller than 0.05 for NPLs. GDP, unemployment, inflation, credit volume granger cause to NPLs. Similarly, all of the p-values are smaller than 0.05 for inflation. In other words, there is a causality from all variables to inflation.

There is weak evidence of Granger-causality only from NPLs to CRVOL alike Turkey's results because the p-value of the related test is at least less than 10%. In the results in Turkey's data, it is also found that there is a causal relation from GDP to credit volume. As mentioned before, it is considered that the difference in the results arising

from the banks in Turkey which are implementing a risk-averse approach by decreasing their exposures in downturn period.
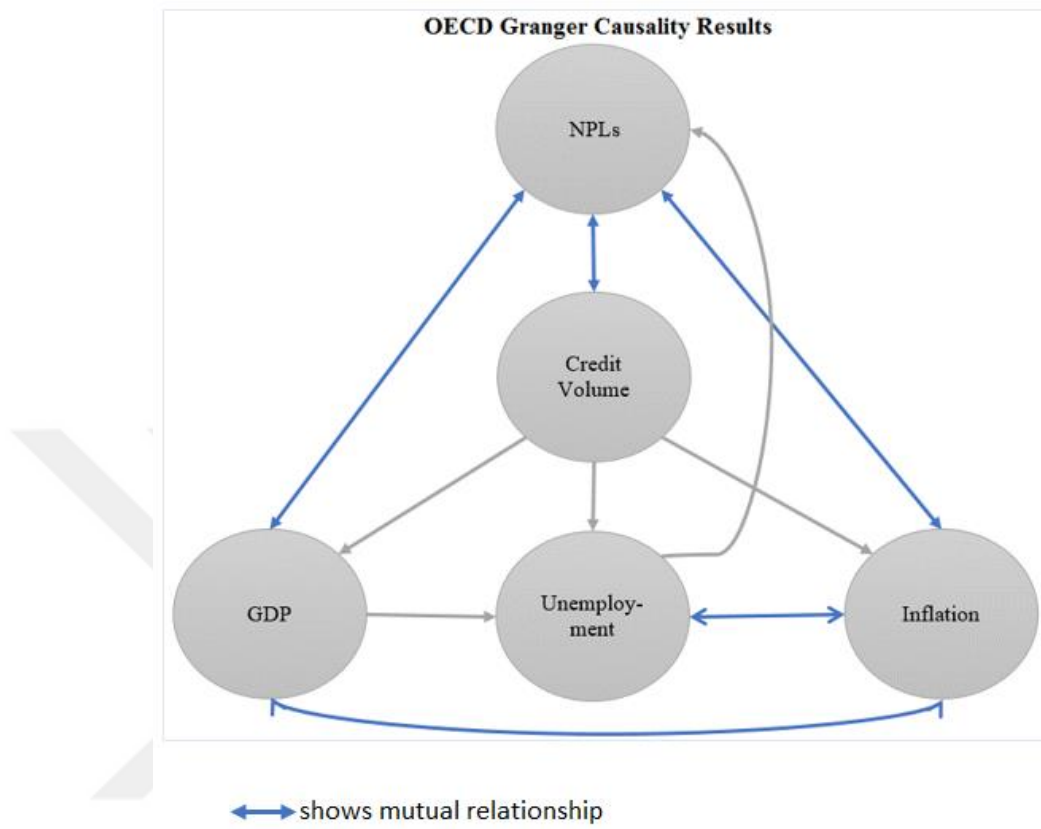
Figure 6. Causality Relations

Table 12. Granger Causality Test Results of PVAR Model

Null Hypothesis (Obs : 406)	Chi-sq	Prob.
UNEMP does not Grenger Cause GDP_GR	2.117247	0.7142
CRVOL does not Grenger Cause GDP_GR	14.57498	**0.0057**
INF does not Grenger Cause GDP_GR	99.91938	**0.0000**
NPLR does not Grenger Cause GDP_GR	16.26984	**0.0027**
GDP_GR does not Grenger Cause UNEMP	16.34340	**0.0026**
CRVOL does not Grenger Cause UNEMP	23.88227	**0.0001**
INF does not Grenger Cause UNEMP	50.12282	**0.0000**
NPLR does not Grenger Cause UNEMP	4.202523	0.3793
GDP_GR does not Grenger Cause CRVOL	7.127082	0.1293
UNEMP does not Grenger Cause CRVOL	3.451898	0.4852
INF does not Grenger Cause CRVOL	1.025402	0.9059
NPLR does not Grenger Cause CRVOL	9.076801	**0.0592**
GDP_GR does not Grenger Cause INF	32.96504	**0.0000**
UNEMP does not Grenger Cause INF	9.862919	**0.0428**
CRVOL does not Grenger Cause INF	31.20443	**0.0000**
NPLR does not Grenger Cause INF	15.58160	**0.0036**
GDP_GR does not Grenger Cause NPLR	22.91090	**0.0001**
UNEMP does not Grenger Cause NPLR	11.64996	**0.0202**
CRVOL does not Grenger Cause NPLR	140.2658	**0.0000**
INF does not Grenger Cause NPLR	84.58323	**0.0000**

5.2.5 Variance Decomposition Results

Forecast error variance decomposition is a useful tool to uncover interrelationships among the variables in the VAR system. The forecast error variance decomposition tells us the proportion of the movements in a sequence due to its "own" shocks versus shocks to the other variable (Enders, 2015). The results of the variance decomposition analysis are presented at the Table 24 and Figure 7 in appendix.

The percentage of the errors that is attributable to own shocks is 100% for the case of GDP growth in the first period. From beginning, the second period inflation accounts for approximately 15% of the change and begining from five period credit volume accounts for approximately 7% of errors. Although the NPLs have an effect on the GDP, it accounts only for 3% of the forecast error variance of GDP growth up to tenth period.

Moreover, only small fractions (less than 10%) of the forecast error variances of GDP growth are accounted for by innovations in the other variables of the system.

The own shock of unemployment rate in the first period accounts for 84%, while GDP growth accounts for %16 in the first period and the approximately 22% of errors beginning from the second period. For long term forecasts, 12% and 7% of the error variance is accounted for credit volume and inflation, respectively.

Approximately 97% of the forecast error variance of credit volume is accounted for own innovations in the first period, while about 7% is accounted for NPLs in the long-run.

The own shock of inflation in the first quarter accounts for 94% of error variance of its own and this impact declines beginning from the second quarter up to 64% up to the 10th period. In the long term, GDP growth accounts for approximately 24% of error variance of inflation and 7.3% of the error variance is accounted for credit volume in the long-run. For any forecast period, NPLs contribute less than 1% to the forecast error variance of inflation.

For NPLs, 88.6% of the 1-period forecast error variance is accounted for own innovations. In the long-term 23%, 20% and 9% of the forecast error variance are accounted for GDP growth, credit volume and inflation respectively, while its own shock decreases up to 45%.

5.2.6 Impulse Response Analysis

The results of the impulse response analysis are presented at the Figure 8 in appendix.

Shocks to GDP growth affect the other variables in the system contemporaneously. The response of GDP growth to its own shocks is very high in the first two periods. After an initial jump, there is a sharp decline in the responses which are insignificantly different from zero after five periods. The response of unemployment and NPLs to the shock to GDP growth are negative for all period of the analysis as expected. In line with the literature, results show that as the GDP growth rate increase in a one standard deviation amount, unemployment decreases about 0.7 percentage points. Additionally NPLs

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decrease in response to GDP growth because of the fact that rising in both household and corporate incomes enhance the debt paying capacity. One percentage point increase in GDP growth leads to a decrease in approximately one percentage point in NPLs. Credit volume is seen to decrease in response to shock to GDP growth for the first two periods and then begins to increase and turns positive in the third period as expected. Due to the economic growth increases the financing needs of all parties for investment and consumption expenditures, demand for credit also increases. As a result of shock to GDP growth, responses of inflation are positive and volatile. Economic growth leads to an increase in wealth. Due to the an increase in wealth, the spending and also demand increases. In this context demand-pull inflation with wealth effect may arise.

In line with the Granger causality test results which is showing that there is no causality from unemployment to GDP Growth and credit volume, GDP Growth and credit volume do not react significantly to unemployment shock and also it is negligible. The responses of unemployment to its own shocks are the largest one for all periods. Although there is no causality from unemployment to inflation, for the first three periods of impulse response analysis, inflation reacts negatively in response to unemployment shock. It may be considered that loss in job leads to less demand and causes a reduction in general price level indirectly. The impulse response functions imply that unemployment shock sluggishly increases the NPLs. Considering with together the causality from the unemployment to NPLs, it can be said that unemployment decreases the debt paying capacity of all parties especially households.

The response of GDP growth to the credit volume shock is sluggishly positive for the first four period and then it turns negative and stabilizes in the 8th period by losing its effects. In parallel with the Garanger causality test results, impulse response analysis reveals that one standard deviation increase in credit volume results in 0.2 increase in average at the 2nd and 3rd period and also 0.5 decreases in 5th to 6th period. Although the decrease in GDP growth in response to credit volume increase is an unexpected result, because of the fact that the data period includes a global financial crisis affecting the biggest economies within the OECD, after the following a large increase in credit volume accompanied by GDP growth phase, most of the economies confronted an economic downsizing. For this reason, a credit volume increase was followed by a decrease in GDP.

Unemployment and NPLs follow a similar paths in response to a standard deviation increase in credit volume. Beginning from the third period, the credit volume shock causes an increase in the unemployment and NPLs in line with the Granger causality results. In accordance with the previous studies such as Gatti et. al. (2009) and Feldman (2013), it is expected that unemployment will decrease when credit volume increases. However an inverse relation found in impulse response analysis may be caused by the credit volume data format. The "credit volume to GDP" is used as a parameter representing the banking sector credit volume in this analysis. Due to the fact that decrease in GDP which is a phenomenon that causes an increase in unemployment, takes place as a denominator in the parameter, credit volume increase may be arisen from GDP decline. In this case, an increase in unemployment may not arise in response to credit volume increase but to response to GDP decrease.

Credit volume shock causes a sluggish increase in GDP growth for the first three periods and then beginning from the 4th period effect of the shock turns negative up to the 8th period. Growth in credit volume is expected to contribute to GDP growth as it increases consumption and investment expenditures. The findings suggest that the increase in loan volume contributes to GDP growth albeit at a low level. In parallel with the beginning of the increase in non-performing loans, appearing in the decline in GDP is considered as an important result.

Credit volume shows the biggest response to its own shock, increase in credit volume feeds the credit volume for all periods in also a decreasing level. In response to an increase in credit volume, inflation begins to increase in third period as a result of the increase in expenditures.

A shock to inflation causes declining in GDP and credit volume and also an increase in unemployment and NPLs. The biggest impact of the inflation shock arises in credit volume mostly because of the cost of borrowing increase.

In response to shock of the NPLs, GDP growth reacts weakly negative up to third period and decrease at a low level. A shock to NPLs causes a dramatic decrease in credit volume, while contributing to inflation increase in a low level. Additionally, NPLs increase in response to its own shock.

When the results of the NPLs and Credit volume are taken into account together, it is suggested that increasing credit volume causes problematic loans and this leads to a decrease in both credit volume and GDP and also increases in unemployment and inflation.

In summary, results of the impulse response analysis suggest that a shock to NPLs and credit volume have effects on economic activity and the credit cycle. A deterioration in the asset quality of the banks has a negative effect on economic performance.

5.3 Comparison Of The Models

In this study, three separate analysis are conducted with VAR models. The first analysis is carried out with time series data covering the years between 1999-2016 of Turkey. The second analysis is conducted by panel data of OECD countries. The last model also consists of the Turkey's annual time series data. In this section, pros and cons of VAR and Panel VAR are discussed and also additionally empirical findings of these analyses are compared.

5.3.1 Analyses To Be Compared and Comparison Conditions

This comparison covers the results of the panel VAR analysis conducted with OECD data and two VAR analyses conducted with the quarterly and yearly data of Turkey. In this analysis, considering the advantages listed below, Panel VAR results conducted with the OECD data were taken as the basis and the results of VAR obtained with data of Turkey were compared with PVAR of the OECD.

Panel data sets for economic research possess several major advantages over conventional cross-sectional or time-series data sets (e.g., Hsiao (1985a, 1995, 2000)). Panel data usually give the researcher a large number of data points, increasing the degrees of freedom and reducing the collinearity among explanatory variables – hence improving the efficiency of econometric estimates. (Hsiao, 2003)

The main advantages of panel data analysis which reduces the disadvantages of time series analysis by combining with the cross-sectional analysis method can be listed as follows;

- ✓ More accurate inference of model parameters. Panel data usually contain more degrees of freedom and more sample variability than cross-sectional data which may be viewed as a panel with $T = 1$, or time series data which is a panel with $N = 1$, hence improving the efficiency of econometric estimates (Hsiao et al. 1995).
- ✓ Panel data suggests that individuals, firms, states or countries are heterogeneous. Time-series and cross-section studies not controlling this heterogeneity run the risk of obtaining biased results (Baltagi, 2005).
- ✓ Panel data gives more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency (Baltagi, 2005).
- ✓ Panel data are better able to study the dynamics of adjustment(Baltagi, 2005).
- ✓ Panel data are better able to identify and measure effects that are simply not detectable in pure cross-section or pure time-series data(Baltagi, 2005).
- ✓ Panel data models allow us to construct and test more complicated behavioral models than purely cross-section or time-series data(Baltagi, 2005).

5.3.2 Comparison of The Findings

In the light of the econometric analysis presented above in detail, within the framework of the hypothesis general findings based on PVAR and VAR models' results and the differences in findings are presented below. The most important factor that stands out in a comparative analysis of impulse response is the emergence of the responses in much shorter duration and short-lived, in Turkey according to the OECD countries.
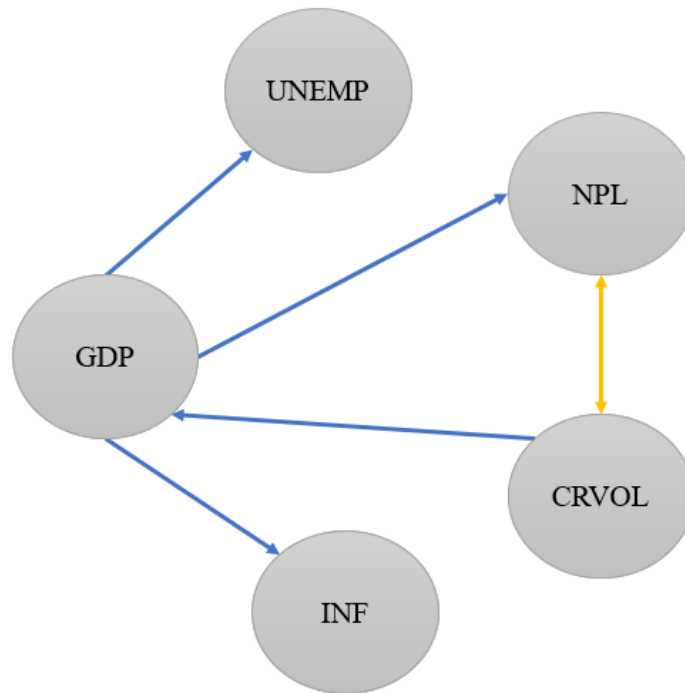
Figure 7. Common Findings

Credit Volume & NPLs

There is a mutual and strong causality relationship between credit volume and NPLs. Despite the lack of causality from credit volume to NPLs in the analysis of Turkey conducted with annual data, results of the OECD analysis and the quarterly data of Turkey clearly show this relationship. Considering mutual relationship, it is highly probable that an increase in credit volume will cause an increase in the NPLs due to the adverse selection problem. Similarly NPLs will cause a decrease in the loanable fund capacity and credit volume as a result of increasing risk aversion. These mutual effects can also be clearly monitored through the impulse response analysis results. When variance decomposition results are reviewed, it is seen that the biggest impact on the change in credit volume within the model comes from the NPLs. Similarly, in all three VAR analysis, the largest contribution to change in NPLs except its own shock come from credit volume after the GDP growth. In summary, all analysis results revealed a strong relationship and a mutual interaction between credit volume and NPLs.

Credit Volume – NPLs & GDP Growth

In the OECD results and Turkey results of quarterly data, it is found that there is Granger causality from credit volume to GDP. At this point, variance decomposition and impulse response analysis results show that credit volume has an impact on GDP within the model. In OECD countries, credit volume cause an increase in GDP growth rate for a certain period and then creates a downturn. The results of the Turkey's data indicate that credit volume has a slightly negative effect on GDP for a certain period. Because of the fact that credit growth in Turkey is accompanied by a rapid increase in NPL's, NPLs affect the credit volume directly and also GDP growth indirectly, while the effects of the NPLs on the credit volume in OECD countries arise delay.

In the PVAR analysis of OECD and Turkey's VAR results of quarterly data, it is found that there is Granger causality from GDP Growth to NPLs. However OECD and Turkey's annual data results show that there is a granger causality from NPLs to GDP growth, because of the delayed effect of NPLs formation. When impulse response analysis is reviewed, it is seen that NPLs cause a slight decrease in GDP growth. As can be seen from the variance decomposition results, this direct effect of NPLs on GDP growth is limited.

Credit Volume - NPLs & Unemployment

In all three models in the analysis, it is found that there is no significant granger causality from unemployment to credit volume. However, only in the analysis conducted with OECD data, a significant causality from credit volume to unemployment is identified. When the impulse response function is examined, it is observed that there is an simultaneous increase in unemployment to increase in NPLs after a certain period in response to credit volume shock. Although there is no direct causality from NPLs to unemployment, it is noteworthy that this increase is simultaneous with the increase in NPLs. Although it is thought that bankrupted companies, the main source of NPLs, create additional unemployment, the results do not show a direct effect of NPLs on unemployment and do not support this assumption. Results of the three models indicate that there are no significant Granger causality from NPLs to unemployment. However, unlike Turkey's results, results of OECD data show that there is a Granger causality from unemployment to NPLs. One of the most important reasons that this effect does not

clearly emerge in Turkey, is that the share of the retail loans in total loans of banking sector is low. Considering the Granger causality results together with the impulse response results, it can be said that unemployment causes the non-payment of loans.

After the effects of GDP growth, the biggest change in unemployment comes from the credit volume according to variance decomposition results of OECD data.

Credit Volume – NPLs & Inflation

According to PVAR and VAR results of OECD and Turkey's quarterly data, there is a granger causality from credit volume to inflation. This is because, the available money resources for spending increase with the credit expansion and then the demand for products and services can increase, and consequently the prices. Impulse response results from these three VAR analysis exhibit clearly this relation that is showing the increase of inflation in response to credit volume shock. Although there is no granger causality from inflation to credit volume in the results of OECD and Turkey's quarterly data, the results of the yearly data analysis of Turkey capture this causality relationship. On the other hand, impulse response results of the PVAR analysis of OECD and VAR analysis of Turkey's yearly data show that inflation has a negative effect on the credit volume. Because of the fact that the rising inflation rate leads to an increase in the cost of credits, demand for credits decreases. In addition, inflation also lowers the collateral value for further credits and creates scarcity of long term funds with reasonable interest rates and also hardens access to bank credits.

When it comes to the relationship between inflation and NPLs, Granger causality test results of VAR and PVAR analyses show that there are mutual causality relationship between them. While the response of the inflation to an NPLs shock is limited to a slight increase at the initial periods, NPLs' responses to a shock of inflation exhibit an increase. Inflation diminishes the collateral value and increases the cost of outstanding credits especially the variable interest rate ones. Additionally, it increases the principal value of the FX-denominated credits via the domestic currency depreciation. For these reasons, inflation can worsen the debt-paying capacity of all borrowers except the fixed-rate domestic currency borrowers.

5.3.3 Robustness Check

The robustness check is conducted in order to test the hypothesis by reviewing two alternative countries within OECD. One of them is Mexico which is similar to Turkey in terms of economic classification as a developing country. Another one is the Hungary that is a European Union member country. Mexico, Hungary and Turkey are classified upper middle income countries according to United Nations World Economic Situation and Prospects 2014. However, World bank classified Hungary as a high income country while Mexico and Turkey are classified middle income countries. Mexico is preferred because it shows similar characteristics to Turkey in terms of variables such as population and economic size, GDP per capita and budget balance. Hungary is included in comparison because of the fact that Hungary is a member country of European Union that is the biggest foreign trade partner of the Turkey.

Mexico's financial inclusion level is low according to Turkey and Hungary. According to a Bank of Mexico survey of established companies, their main sources of financing are suppliers and then commercial banks.

On the other hand, Hungarian companies that have less domestic bank credit dependency is relying on internal financing for investments in the higher proportion than the European Union average. According to IMF Country Report, large non-financial manufacturing companies, often foreign-owned exporters, have access to foreign or intra-group financing in Hungary. Therefore, EU funds, including generous advance payments and grants, may have eased the dependency on bank credit in order to finance investments of Hungarian companies, which was confirmed in a survey by the European Investmen Bank (EIB, 2017). For the reasons stated above, bank credit dependency of Hungarian and Mexican economics especially in GDP growth is low level compared with Turkey.

In the light of given information on compared countries that have different characteristics, VAR analyses are performed for these three countries using the annual data set and the results are outlined in terms of their impact on macro financials. When the Granger causality test results are analyzed, causality from credit volume to GDP has not been determined in the Hungary and Mexico unlike Turkey and OECD results. However only in Mexico, causality from credit volume to inflation are found similar to Turkey and OECD. Although there are low level of credit dependency in Mexico and

Hungary, variance decomposition results are in line with the overall OECD results. Approximately 7% and 4% of the forecast error variance of GDP growth are accounted for by credit volume in mexico and Hungary respectively, while the impact of credit volume on GDP growth is about 17% on average in Turkey. Similarly, forecast error variance of inflation are accounted for by credit volume in proportion 14% and 17% in Mexico and Hungary respectively, while the impact of credit volume on the variance of inflation is about 36% on average in Turkey.

When it comes to impulse response analyses, the responses GDP growth to the credit volume shock is weakly positive for the first two period and then it turns negative and stabilize at the 5th period by losing its effects in both Mexico and Hungary. By comparison, Turkey's results show the negative impact on GDP growth up to 5th period due to accompanied by rapid increase in NPLs unlike the other two countries. Although there are no Granger Causality from credit volume to unemployment, the responses of unemployment to credit volume shock are negative for the first three period both Mexico and Hungary, different from Turkey. In Mexico and Turkey, in parallel with the Granger Causality test results, credit volume shock creates an increase on inflation. However within the third period, this impact turns negative in Mexico and reduces inflation different from Turkey.

In summary, by comparison, it can can be said that bank credit volume have a more important role on GDP and inflation in Turkey. However, although the effect intensity is different, Mexica's results shows more similarity to Turkey in terms of GDP and inflation dynamics.

6. CONCLUSION AND POLICY IMPLICATIONS

In this research, it has been taken to road in order to improve the understanding of the relevance of credit risk with the macroeconomic fluctuations and its interconnections by the key macroeconomic variables such as; growth, unemployment and inflation. For this purpose, an analysis of OECD data with panel VAR is conducted and addedly two different analyses of Turkey with VAR. OECD analysis of Panel VAR with yearly data and quarterly data analysis of the Turkey consist of the base of this research. Yearly model of Turkey are used to supplement to the the OECD analysis and also quarterly analysis of Turkey. The results are consistent with the hypothesis and also contribute to current literature by narrowing the gap of the comperative analysis of the role of the credit risk between emerging market and OECD economies.

The results of the impulse response of Panel VAR analysis reveal that the findings are consistent with the hypothesis and expectations that credit risk through credit volume has an impact on key macroeconomic variables. Results of impulse response functions of panel VAR suggest that a shock to NPL growth and credit volume have implications on economic activity and the credit cycle. Especially the bank credit volume's impact on GDP growth, inflation and unemployment consist the key findings, while the Panel VAR and VAR models also suggest that a deterioration in asset quality leads to a decline in credit and vice versa. Findings reveal that the rising NPLs create credit market frictions that is affecting loanable funds capacity from several points consisting decrease in capital adequacy, increase in risk aversion and increase in cost of funding and monitoring of loans. These effects in the short term are much more explicit in Turkey, a developing country. It is observed that NPLs caused a contraction in credit volume, similar to the effects of the contractionary monetary policy defined by credit channel of the transmission mechanism. In the short run, this situation in particular effects the economic performance through changes in GDP. According to variance decomposition results, it is found that the effect of overall NPLs on macroeconomic performance is somewhat lower due to the fact that NPLs explains about 2 percent of GDP growth over the analysis period. However, impact of credit volume on GDP growth is higher than NPLs, as it explains about 5 percent of GDP growth on average within the analysis period. In Turkey, where

the dynamics of the macroeconomy are more dependent on bank loans, approximately 17 percent of change in GDP growth on average are explained by bank credit volume, while non-performing loans explain the 7 percent of GDP growth. At the same time, while the NPLs explain the only 3 percent of change in credit volume in OECD, in Turkey this ratio is about 11%. This means NPLs have a bigger effect on credit volume in Turkey than OECD.

On the other hand, it is also found that the macroeconomic performance also has a significant effect on asset quality and the credit volume of the banking sector. Variance decomposition and impulse response results of Panel VAR also suggests significant implications of economic activity on NPL growth that is emphasizing the importance of economic indicators to the healthiness of the banking sector. According to findings, it is suggested that stronger economic activity accompanied by higher GDP growth and lower inflation have a positive impact on asset quality and credit expansion of banking sector. Notably, GDP growth leads to decline in NPLs and increase in credit volume, while inflation has a role accelerating the NPLs growth and credit volume decline. These impacts on NPLs and credit volume feeds back the economy negatively. Besides, especially the positive relationship between credit volume and inflation was found to be significant in terms of monetary policy.

The sustainable reduction of NPLs and to keep it at a low level in the overall banking sector's balance sheet are beneficial to the economy from a macroprudential perspective. Results suggest that countries like Turkey which does not have efficient equity market are more credit-driven. As the credit dependency rise, NPLs become more important for the soundness of economics. It is obvious that the monetary and banking authorities in emerging markets should be more aware of the credit market importance the stability of macroeconomy.

It is not easy to summarize and generalize the results of this analysis because of the fact that there are too many reasons of business cycles and macro fluctuations. Modeling the all fundamental and possible determinants of fluctuations with together for an economy seems unlikely due to data limitations, changing conditions and parameters and also rapid structural changes in the financial markets. In this research's main constraint is that the analysis carried out with a macro view. The research models provide a basis for

future researches. Extended investigations for different time periods with different parameters may also show whether the results hold true. In addition, the effects of credit dependency and credit risk on the key sectors that contribute to the growth of the economy may need to be analyzed in order to maintain economic activity.

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APPENDIX

VAR ESTIMATES FOR TURKEY

Table 13. Lag Length Criteria

VAR Lag Order Selection Criteria
Endogenous variables: NPLR CRVOL CPI GDP UNEMP
Exogenous variables: C
Sample: 1999Q3 2016Q4
Included observations: 66

Lag	LogL	LR	FPE	AIC	SC	HQ
0	468.6789	NA	5.44e-13	-14.05088	-13.88499	-13.98533
1	524.3735	101.2630	2.15e-13	-14.98102	-13.98572*	-14.58773
2	567.3830	71.68240	1.26e-13	-15.52676	-13.70204	-14.80573*
3	597.0174	44.90064*	1.13e-13*	-15.66719	-13.01307	-14.61842
4	624.1552	37.00613	1.14e-13	-15.73198*	-12.24843	-14.35546

* 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

Table 14. VAR Results

Vector Autoregression Estimates
Sample (adjusted): 2000Q2 2016Q4
Included observations: 67 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	NPLR	CRVOL	CPI	GDP	UNEMP
NPLR(-1)	0.166817	0.163137	0.037511	-0.043722	0.006142
	(0.13700)	(0.08564)	(0.02750)	(0.03444)	(0.19489)
	[1.21764]	[1.90483]	[1.36391]	[-1.26961]	[0.03151]
NPLR(-2)	0.024052	-0.106990	0.047232	-0.014075	0.165312
	(0.13034)	(0.08148)	(0.02617)	(0.03276)	(0.18542)
	[0.18453]	[-1.31306]	[1.80510]	[-0.42960]	[0.89158]
NPLR(-3)	-0.041844	-0.092205	0.001605	-0.042484	-0.159930
	(0.12603)	(0.07879)	(0.02530)	(0.03168)	(0.17929)
	[-0.33200]	[-1.17028]	[0.06344]	[-1.34098]	[-0.89203]
CRVOL(-1)	0.425559	0.204436	0.233821	-0.192359	0.241763
	(0.21872)	(0.13673)	(0.04391)	(0.05498)	(0.31113)
	[1.94568]	[1.49518]	[5.32529]	[-3.49876]	[0.77704]
CRVOL(-2)	-0.566169	-0.104491	-0.025142	0.035190	0.056455
	(0.26592)	(0.16623)	(0.05338)	(0.06684)	(0.37827)
	[-2.12913]	[-0.62858]	[-0.47098]	[0.52646]	[0.14924]
CRVOL(-3)	-0.141471	-0.028610	0.030987	-0.066124	0.121544
	(0.27017)	(0.16890)	(0.05424)	(0.06791)	(0.38433)
	[-0.52363]	[-0.16940]	[0.57133]	[-0.97366]	[0.31625]
CPI(-1)	-1.242097	0.534001	0.393846	0.034713	1.202461
	(0.68033)	(0.42530)	(0.13657)	(0.17101)	(0.96778)
	[-1.82573]	[1.25560]	[2.88375]	[0.20299]	[1.24249]
CPI(-2)	-0.427775	0.064737	0.013660	-0.123983	-2.019237
	(0.64443)	(0.40286)	(0.12937)	(0.16199)	(0.91672)
	[-0.66380]	[0.16069]	[0.10559]	[-0.76538]	[-2.20267]
CPI(-3)	1.468404	-0.114349	0.266692	0.149646	0.861209
	(0.49738)	(0.31093)	(0.09985)	(0.12502)	(0.70753)
	[2.95228]	[-0.36777]	[2.67099]	[1.19693]	[1.21720]

GDP(-1)	-2.283966	0.709164	-0.181649	0.164900	-0.925619
	(0.55433)	(0.34653)	(0.11128)	(0.13934)	(0.78855)
	[-4.12020]	[2.04645]	[-1.63234]	[1.18343]	[-1.17382]
GDP(-2)	-0.475702	0.354009	0.007122	-0.173183	-1.884619
	(0.63109)	(0.39452)	(0.12669)	(0.15864)	(0.89774)
	[-0.75377]	[0.89732]	[0.05622]	[-1.09170]	[-2.09929]
GDP(-3)	-0.679388	1.177366	0.095604	0.050982	-0.771132
	(0.56816)	(0.35517)	(0.11406)	(0.14282)	(0.80822)
	[-1.19578]	[3.31490]	[0.83822]	[0.35698]	[-0.95412]
UNEMP(-1)	0.034116	0.088879	0.037196	-0.002857	-0.301712
	(0.09344)	(0.05841)	(0.01876)	(0.02349)	(0.13293)
	[0.36510]	[1.52152]	[1.98291]	[-0.12164]	[-2.26979]
UNEMP(-2)	0.065651	0.108731	-0.054150	0.014424	-0.397987
	(0.08823)	(0.05515)	(0.01771)	(0.02218)	(0.12550)
	[0.74413]	[1.97145]	[-3.05740]	[0.65039]	[-3.17114]
UNEMP(-3)	-0.051511	0.003281	-0.001154	-0.004764	-0.234685
	(0.10110)	(0.06320)	(0.02030)	(0.02541)	(0.14382)
	[-0.50951]	[0.05192]	[-0.05684]	[-0.18747]	[-1.63185]
C	0.057631	0.016112	-0.006075	0.024853	0.056667
	(0.03193)	(0.01996)	(0.00641)	(0.00803)	(0.04542)
	[1.80488]	[0.80718]	[-0.94770]	[3.09641]	[1.24756]
R-squared	0.485148	0.416468	0.797640	0.311631	0.413430
Adj. R-squared	0.333721	0.244841	0.738122	0.109169	0.240910
Sum sq. resids	0.407683	0.159319	0.016429	0.025760	0.824975
S.E. equation	0.089408	0.055892	0.017948	0.022474	0.127185
F-statistic	3.203838	2.426586	13.40174	1.539209	2.396414
Log likelihood	75.84668	107.3226	183.4290	168.3631	52.23380
Akaike AIC	-1.786468	-2.726048	-4.997881	-4.548152	-1.081606
Schwarz SC	-1.259974	-2.199554	-4.471387	-4.021658	-0.555112
Mean dependent	-0.009055	0.071062	0.034345	0.012777	0.023071
S.D. dependent	0.109534	0.064318	0.035073	0.023811	0.145978

Determinant resid covariance (dof adj.)	5.15E-14
Determinant resid covariance	1.31E-14
Log likelihood	595.3962
Akaike information criterion	-15.38496
Schwarz criterion	-12.75249

Table 15. Granger Causality Test Results

VAR Granger Causality/Block Exogeneity Wald Tests
Sample: 1999Q3 2016Q4
Included observations: 67

Dependent variable: NPLR

Excluded	Chi-sq	df	Prob.
CRVOL	8.739924	3	0.0330
CPI	10.05146	3	0.0181
GDP	19.03633	3	0.0003
UNEMP	1.119412	3	0.7724
All	41.37149	12	0.0000

Dependent variable: CRVOL

Excluded	Chi-sq	df	Prob.
NPLR	7.572819	3	0.0557
CPI	3.522426	3	0.3179
GDP	15.59810	3	0.0014
UNEMP	5.189136	3	0.1585
All	32.07459	12	0.0013

Dependent variable: CPI

Excluded	Chi-sq	df	Prob.
NPLR	7.257072	3	0.0641
CRVOL	28.69621	3	0.0000
GDP	3.754639	3	0.2892
UNEMP	19.03241	3	0.0003
All	65.23365	12	0.0000

Dependent variable: GDP

Excluded	Chi-sq	df	Prob.
NPLR	3.973776	3	0.2643
CRVOL	12.40481	3	0.0061
CPI	1.915980	3	0.5900
UNEMP	0.601882	3	0.8960

All	21.06414	12	0.0494

Dependent variable: UNEMP

Excluded	Chi-sq	df	Prob.
NPLR	1.447647	3	0.6944
CRVOL	0.753608	3	0.8605
CPI	4.959471	3	0.1748
GDP	7.365314	3	0.0611
All	21.53817	12	0.0430

Table 16. Variance Decomposition

Variance Decomposition of NPLR:

Period	S.E.	NPLR	CRVOL	CPI	GDP	UNEMP
1	0.089408	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.107660	71.94661	2.579053	3.308534	22.01229	0.153506
3	0.113867	67.95644	4.628732	4.841729	22.02272	0.550383
4	0.117899	63.41200	6.315886	6.710922	22.86800	0.693195
5	0.118923	62.32861	7.352990	6.814003	22.80997	0.694426
6	0.121254	62.02389	7.445645	6.614583	22.11030	1.805581
7	0.123439	60.17581	7.869032	6.484203	22.45146	3.019498
8	0.123583	60.05628	7.858764	6.484304	22.48903	3.111625
9	0.123755	59.93925	8.018186	6.466675	22.46485	3.111043
10	0.123941	59.76463	7.994086	6.456035	22.43154	3.353717

Variance Decomposition of CRVOL:

Period	S.E.	NPLR	CRVOL	CPI	GDP	UNEMP
1	0.055892	8.389268	91.61073	0.000000	0.000000	0.000000
2	0.060784	8.266016	81.48322	2.150385	4.831946	3.268438
3	0.063379	8.934458	74.96227	2.794272	4.499493	8.809511
4	0.067501	10.13548	66.21198	2.580420	12.65325	8.418865
5	0.070415	9.710569	63.56494	2.930158	13.01569	10.77865
6	0.071121	11.29979	62.32793	2.973893	12.79257	10.60581
7	0.071905	11.22912	61.03406	3.598405	13.76242	10.37600
8	0.072127	11.23159	60.90529	3.659797	13.74303	10.46029
9	0.072336	11.21598	61.02963	3.660843	13.67462	10.41893
10	0.072359	11.22089	60.99783	3.677552	13.69066	10.41307

Variance Decomposition of CPI:

Period	S.E.	NPLR	CRVOL	CPI	GDP	UNEMP
1	0.017948	0.407239	3.196782	96.39598	0.000000	0.000000
2	0.024421	0.249981	31.54527	60.75925	3.899137	3.546358
3	0.028557	8.957430	36.57288	47.52016	2.871382	4.078144
4	0.030266	9.644124	38.22211	44.46509	2.851701	4.816978
5	0.031197	9.104455	37.15826	44.24204	3.846479	5.648766
6	0.031660	8.855156	36.08085	45.36939	4.207724	5.486881
7	0.032012	8.661823	35.94511	45.46344	4.116711	5.812912
8	0.032386	8.476723	36.00577	45.58568	4.146177	5.785645
9	0.032801	8.277746	35.89100	45.87584	4.088507	5.866916
10	0.033100	8.173478	36.15325	45.67370	4.060812	5.938762

Variance Decomposition of GDP:

Period	S.E.	NPLR	CRVOL	CPI	GDP	UNEMP
1	0.022474	5.954087	0.052422	0.188801	93.80469	0.000000
2	0.024955	5.247543	16.31904	0.184842	78.22854	0.020038

3	0.025846	6.835484	16.64401	1.169057	75.31867	0.032784
4	0.026649	7.225089	16.23950	1.620866	71.83496	3.079591
5	0.026747	7.179261	16.19970	1.801195	71.59742	3.222427
6	0.027026	7.125966	17.69673	1.796733	70.12755	3.253021
7	0.027134	7.602815	17.62028	1.857431	69.57080	3.348678
8	0.027172	7.581562	17.61514	1.921394	69.48967	3.392236
9	0.027236	7.640313	17.78220	1.924012	69.25385	3.399620
10	0.027284	7.666078	17.90250	1.933985	69.02348	3.473955

Variance Decomposition of UNEMP:

Period	S.E.	NPLR	CRVOL	CPI	GDP	UNEMP
1	0.127185	1.569719	0.526552	0.030004	3.369411	94.50431
2	0.136476	1.698030	2.416027	2.491493	3.848200	89.54625
3	0.151496	5.184269	4.048425	6.156366	8.171603	76.43934
4	0.152468	5.133413	4.271296	6.338304	8.088183	76.16880
5	0.162321	5.533450	3.903287	6.014346	9.384233	75.16468
6	0.162809	5.502455	3.980393	6.140894	9.629012	74.74725
7	0.165161	5.689953	3.889763	6.724716	9.966493	73.72907
8	0.165603	5.679544	3.875467	6.700124	9.937250	73.80761
9	0.167011	5.869709	3.838438	6.805099	9.952431	73.53432
10	0.167178	5.858840	3.850076	6.864698	10.01464	73.41174

Cholesky Ordering: NPLR CRVOL CPI GDP UNEMP
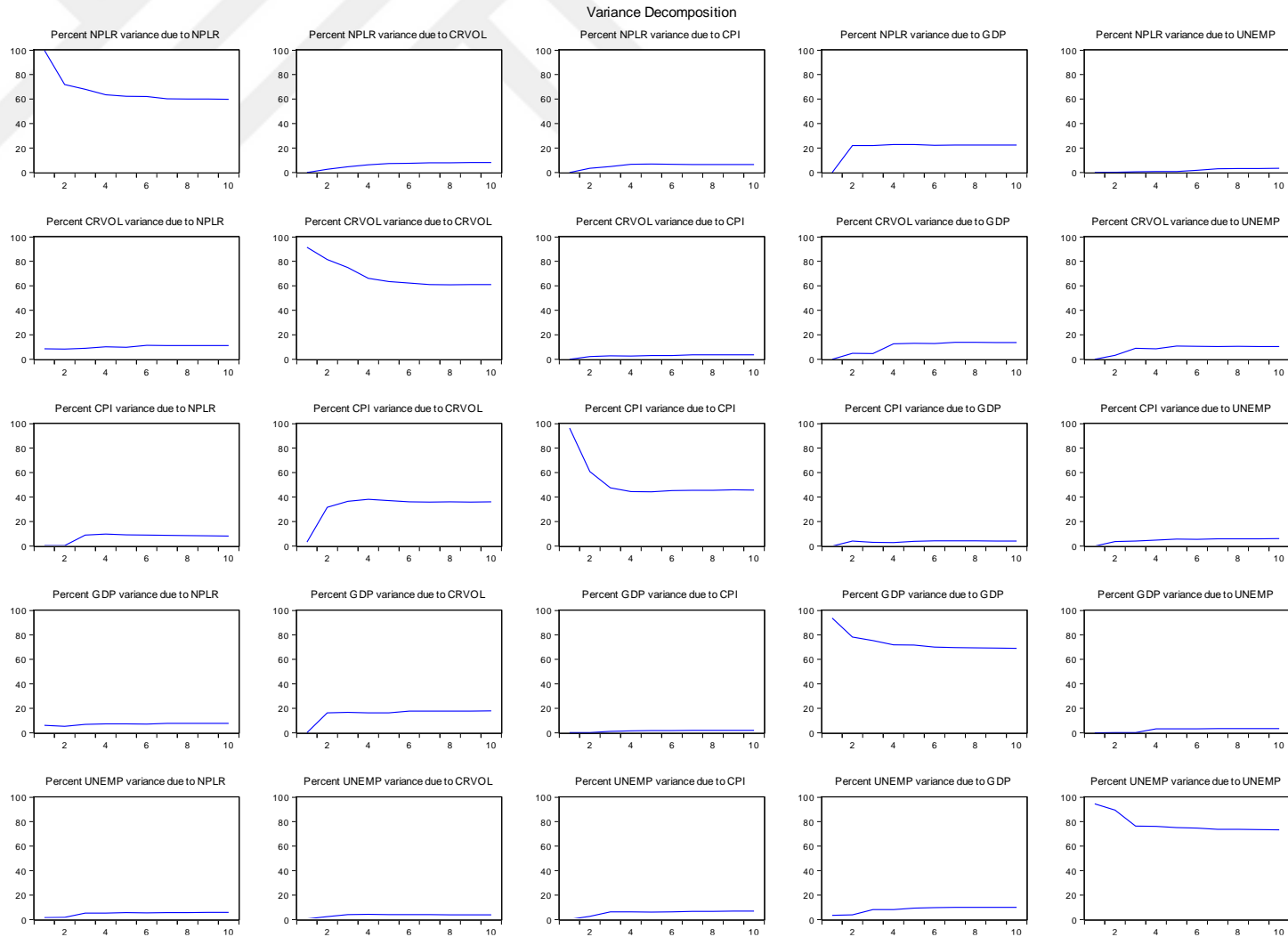
Figure 8. Variance Decomposition Figures of VAR

Variance Decomposition

Figure 9. Impulse Response Analysis of VAR

Response to Cholesky One S.D. Innovations ± 2 S.E.
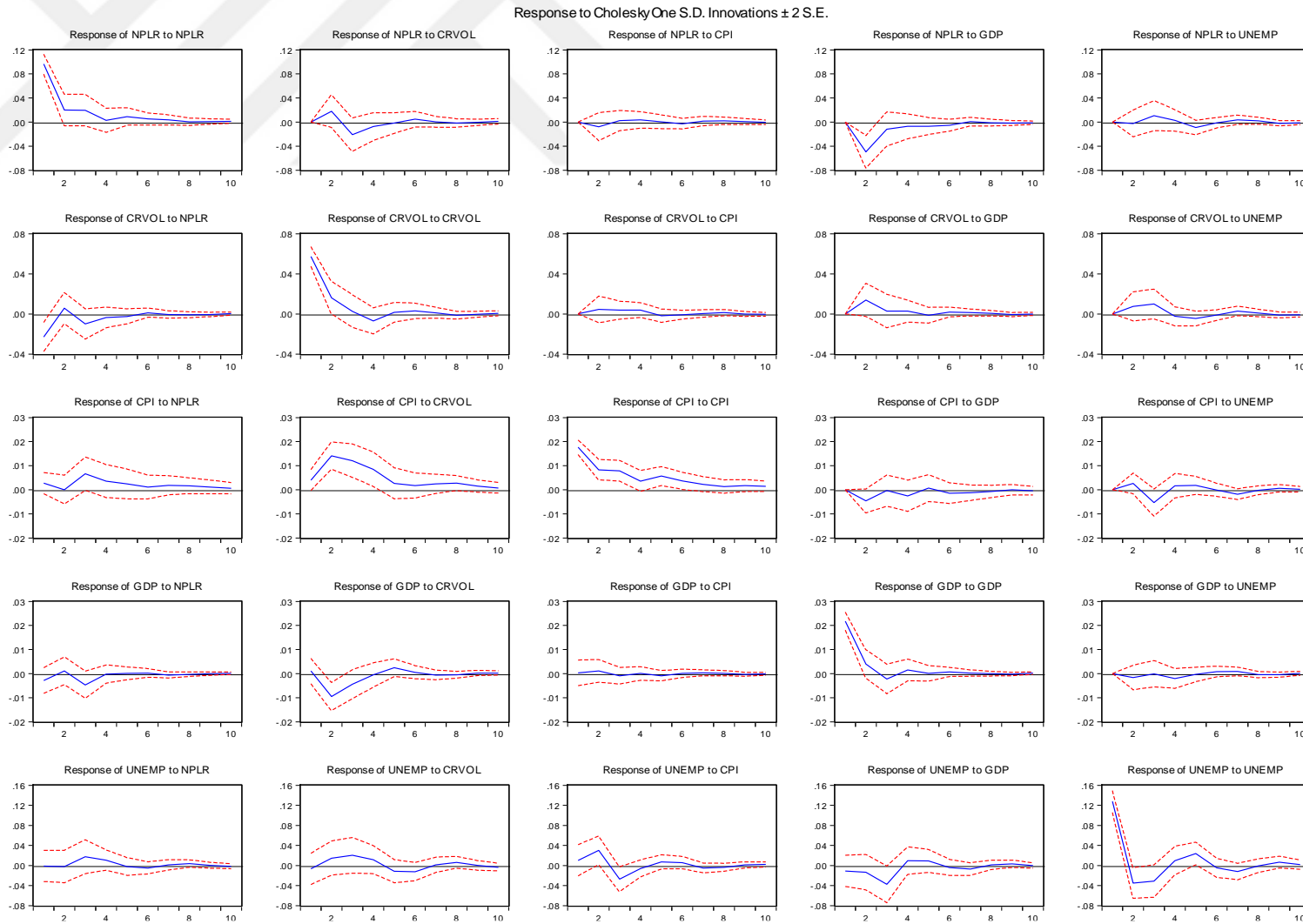
Table 17. Gross Credit Volume - Sectoral Distribution

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Agriculture, Hunting, Forestry	3,6	6,4	3,7	3,6	4,5	4,1	3,5	3,5	3,9	3,7	3,7	3,8	4,3	3,9	3,3	3,3	3,5	4,1
Chemistry and Chem. Prod. and Synt. Fiber Ind.	3,1	2,8	3,0	3,3	3,1	2,9	2,4	1,9	1,7	1,6	1,4	1,3	1,5	1,5	1,5	1,5	1,5	1,3
Construction	9,5	8,1	7,5	6,9	5,5	4,7	4,9	4,8	5,9	6,8	6,9	6,5	6,6	6,9	7,0	7,3	8,0	8,7
Def. and Pub. Adm. and Comp. Soc.Sec.Adm.	0,1	0,0	0,0	0,7	0,7	1,4	1,3	0,7	0,9	1,1	1,0	1,1	0,9	0,9	0,8	1,9	1,7	2,0
Education	0,1	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,2	0,3	0,3	0,3	0,4	0,4
Electric Gas and Water Resources	1,0	2,0	6,9	7,1	5,3	4,0	2,8	3,8	2,8	3,5	4,0	4,0	4,9	5,0	5,3	5,3	5,9	6,9
Electrical and Optical Equipments Industry	3,8	3,6	2,8	2,0	1,7	1,6	1,4	1,2	1,2	1,1	1,0	1,1	1,0	1,0	0,9	0,8	0,8	0,7
Extraction of Mine (Energy Non-producing)	0,8	1,2	0,4	0,4	0,4	0,5	0,4	0,5	0,4	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,7	0,6
Extraction of Mine (Energy Producing)	0,8	1,3	1,0	0,8	0,9	1,1	0,9	0,6	0,8	0,8	0,7	0,6	0,7	0,8	0,7	0,6	0,7	0,6
Financial Intermediation	4,2	3,7	3,5	4,4	5,2	5,6	5,0	4,5	5,3	4,8	4,9	5,2	4,7	4,8	4,7	4,8	4,9	2,9
Fishing	0,1	0,1	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Food, Beverage and Tabacco Manufacturing	11,4	8,3	7,5	7,1	7,0	5,7	5,5	4,1	4,1	3,9	3,7	3,9	3,8	3,7	3,4	3,4	3,3	3,1
Health and Social Services	0,3	0,3	0,7	0,3	0,3	0,4	0,6	1,0	1,0	0,9	0,9	0,8	0,8	0,8	0,7	0,7	0,8	0,8
Hotels and Restaurants (Tourism)	3,3	3,0	2,5	2,2	2,1	2,2	2,3	2,5	2,2	2,5	2,7	2,5	2,8	2,7	2,5	2,9	3,0	3,3
International Organizations	0,1	0,2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Leather and Leather Products Manufacturing	0,9	0,8	0,6	0,4	0,4	0,4	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Machinery and Equipment Manufacturing	2,7	2,6	3,3	2,9	2,3	2,6	2,4	2,7	2,3	2,2	1,7	1,6	1,7	1,6	1,3	1,2	1,2	1,0
Metal Industry and Finished Metal Production	4,9	4,3	5,6	4,5	4,2	4,3	4,0	4,0	4,0	4,3	4,0	4,2	4,2	3,8	3,6	3,4	3,2	3,1
Non-classified Manufacturing Industry	1,6	1,3	1,2	1,1	0,9	1,3	1,3	1,4	1,3	1,1	1,0	1,0	1,3	1,1	0,9	0,9	0,8	0,8
Nuclear Fuel Refinery and Petr.and Coal Products	0,6	1,6	2,2	3,7	2,5	1,9	1,5	1,6	1,0	1,7	2,1	1,8	1,3	0,9	0,8	0,8	1,0	0,7
Other Non-metallic Mineral Industry	2,6	2,5	3,5	3,1	2,6	2,8	2,9	2,0	1,7	1,8	1,7	1,6	1,5	1,6	1,5	1,5	1,4	1,4
Other Social and Personal Services	2,8	4,0	1,7	2,6	2,6	2,4	2,7	2,5	3,3	3,4	3,7	3,3	2,9	2,8	2,5	1,8	1,9	1,8
Paper Raw Mat. and Paper Products Printing Ind.	2,2	2,0	2,0	2,0	1,5	1,1	0,9	0,8	0,8	1,0	0,8	0,8	0,8	0,7	0,6	0,5	0,5	0,5
Personal Loans	NA	NA	NA	NA	10,1	14,8	20,3	20,8	24,2	23,2	25,4	26,4	24,1	24,9	27,8	26,5	23,3	24,8
Private Employer (Individuals)	0,2	0,4	0,1	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Real Estate Brokery, Rental and Operating Activities	1,6	1,4	4,1	4,8	2,8	2,8	2,5	2,2	2,1	2,6	2,6	3,0	3,6	3,5	3,3	4,1	4,8	4,9
Rubber and Plastic Products Manufacturing	1,2	1,1	1,2	1,1	1,1	1,3	1,2	1,2	1,1	1,0	1,0	1,0	1,2	1,2	1,2	1,1	1,3	1,3
Textile and Textile Products Manufacturing	16,2	14,5	12,4	12,6	11,3	9,2	6,9	5,3	4,6	4,0	3,4	3,5	3,6	3,4	3,4	3,5	3,3	3,3

Transportation Vehicles Industry	3,4	3,1	3,6	4,3	3,5	3,4	2,6	2,5	2,6	2,6	2,3	2,1	2,0	1,7	1,7	1,7	1,5	1,1
Transportation, Storage and Telecommunication	3,5	5,4	8,7	6,7	6,2	4,3	4,2	5,8	5,9	5,8	5,7	5,0	5,8	5,6	5,5	5,0	5,9	5,4
W.sale&Retail Sales, Mot. Veh. Main. Serv.	12,7	12,8	9,8	10,8	10,5	12,3	14,4	17,0	13,9	13,2	12,4	12,4	12,7	13,7	13,6	13,8	14,0	13,9
Wood and Wood Products Manufacturing	0,8	0,9	0,3	0,3	0,4	0,5	0,5	0,5	0,4	0,4	0,3	0,3	0,4	0,4	0,4	0,4	0,4	0,3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 18. NPLs - Sectoral Distribution

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Agriculture, Hunting, Forestry	3,7	2,1	2,5	2,5	3,7	4,7	3,6	4,2	4,1	4,9	4,4	5,2	5,0	4,5	4,5	3,8	3,0	3,3
Chemistry and Chem. Prod. and Synt. Fiber Ind.	2,0	1,6	2,6	1,8	3,3	4,4	3,7	3,7	3,0	1,9	1,5	1,4	1,2	1,1	1,1	1,0	0,8	0,6
Construction	6,5	11,6	9,0	6,4	5,0	5,6	6,3	7,5	4,6	5,4	5,9	6,4	8,4	8,2	10,7	10,6	9,4	10,0
Def. and Pub. Adm. and Comp. Soc.Sec.Adm.	0,0	0,0	0,0	0,0	0,0	0,3	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,1
Education	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,6
Electric Gas and Water Resources	0,1	0,5	0,5	0,1	0,2	0,3	0,1	0,3	0,1	0,1	0,2	0,2	0,2	0,2	0,2	1,7	2,2	1,9
Electrical and Optical Equipments Industry	3,2	2,0	1,6	1,9	1,8	2,2	2,3	2,1	2,3	1,9	1,2	1,1	1,9	1,5	0,8	1,0	1,0	0,9
Extraction of Mine (Energy Non-producing)	0,6	1,4	1,4	0,5	0,8	0,8	0,7	0,5	0,3	0,4	0,3	0,3	0,4	0,4	0,6	1,0	0,8	0,8
Extraction of Mine (Energy Producing)	0,2	1,2	0,9	0,3	0,6	0,8	0,7	0,6	0,3	0,2	0,2	0,3	0,3	0,3	0,6	0,8	1,3	0,7
Financial Intermediation	1,2	2,8	2,0	2,9	2,3	2,4	1,7	1,2	0,8	0,3	0,2	0,2	0,2	0,1	0,2	0,3	0,6	0,4
Fishing	0,3	0,3	0,2	0,1	0,2	0,1	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Food, Beverage and Tabacco Manufacturing	12,6	8,3	7,3	8,6	9,5	8,2	6,2	6,1	6,3	5,3	3,7	3,5	3,8	3,7	3,6	3,2	2,6	2,9
Health and Social Services	0,4	0,1	0,2	0,1	0,1	0,2	0,4	0,6	0,6	0,4	0,4	0,4	0,4	1,1	0,8	0,7	0,6	0,6
Hotels and Restaurants (Tourism)	3,0	4,2	5,8	3,1	3,6	3,1	2,1	2,3	1,7	2,0	1,7	1,9	1,8	2,7	3,1	3,4	3,5	3,3
International Organizations	0,0	0,1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Leather and Leather Products Manufacturing	1,3	1,7	3,2	1,1	1,1	1,9	1,9	1,4	0,8	0,4	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,2
Machinery and Equipment Manufacturing	2,5	2,7	2,1	2,8	2,8	2,8	3,6	2,2	1,6	1,4	1,1	1,0	0,9	0,8	0,8	0,7	0,9	1,1
Metal Industry and Finished Metal Production	2,0	3,2	5,8	5,7	5,0	4,2	3,3	1,5	1,5	1,6	2,0	2,0	2,2	2,0	2,0	1,7	1,7	2,8
Non-classified Manufacturing Industry	0,5	0,3	0,7	1,1	0,8	0,5	0,8	1,2	1,2	1,3	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0
Nuclear Fuel Refinery and Petr.and Coal Products	0,4	1,2	0,1	0,1	0,3	0,4	0,3	0,4	0,6	0,4	0,6	0,5	0,5	0,4	0,3	0,3	0,5	0,5
Other Non-metallic Mineral Industry	1,3	2,1	4,1	4,1	5,2	8,2	3,5	1,3	0,7	1,2	1,3	1,2	1,2	1,0	1,0	3,4	2,8	2,4
Other Social and Personal Services	0,4	2,2	2,3	2,6	2,6	3,0	2,7	4,0	3,2	2,3	2,8	2,1	1,4	1,5	1,4	1,5	1,7	1,6
Paper Raw Mat. and Paper Products Printing Ind.	3,3	2,0	3,7	1,8	3,1	2,5	2,4	1,8	1,7	1,1	1,1	1,3	1,1	0,8	0,6	0,4	0,3	0,4
Personal Loans	NA	NA	NA	NA	0,2	0,7	4,8	9,2	25,2	30,7	39,6	37,5	36,6	35,7	36,1	35,3	36,4	33,6
Private Employer (Individuals)	0,1	0,0	0,1	0,0	0,0	0,1	0,2	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,2	0,2
Real Estate Brokery, Rental and Operating Activities	0,8	0,8	0,9	3,7	2,2	5,1	4,3	3,0	1,8	1,5	1,5	1,5	1,5	4,2	1,6	1,9	1,6	1,7
Rubber and Plastic Products Manufacturing	0,6	0,7	0,9	1,2	0,9	0,8	1,2	2,1	1,5	1,7	1,2	1,3	1,1	0,8	0,9	0,8	1,0	1,3
Textile and Textile Products Manufacturing	34,0	28,4	20,9	18,5	18,3	18,0	21,0	23,3	17,5	12,7	8,2	7,7	7,9	6,5	5,5	4,3	3,9	3,8
Transportation Vehicles Industry	4,7	3,0	0,8	2,4	2,0	0,6	0,3	0,4	0,3	0,5	1,0	2,1	3,0	2,9	3,4	2,6	1,4	1,4

Transportation, Storage and Telecommunication	4,0	6,6	11,1	3,8	2,8	2,2	4,4	3,0	2,3	3,1	3,0	2,9	3,0	3,2	3,4	2,6	2,6	3,0
W.sale&Retail Sales, Mot. Veh. Main. Serv.	8,9	7,4	8,1	22,1	20,8	15,4	16,7	15,4	15,3	16,7	14,7	15,5	13,9	14,0	15,1	15,2	17,4	18,6
Wood and Wood Products Manufacturing	1,2	1,3	1,1	0,6	0,7	0,4	0,3	0,2	0,3	0,4	0,3	0,3	0,3	0,4	0,3	0,3	0,3	0,3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 19. Sectoral NPLs

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Agriculture, Hunting, Forestry	8,2	3,0	5,9	8,7	6,3	4,7	3,4	3,1	3,2	4,2	6,0	4,7	2,9	3,3	3,4	3,0	2,3	2,7
Chemistry and Chem. Prod. and Synt. Fiber Ind.	5,1	5,3	7,8	7,1	8,3	6,4	5,2	5,1	5,3	3,7	5,5	3,7	2,0	2,1	1,7	1,8	1,4	1,7
Construction	5,5	13,4	10,4	11,9	7,0	4,9	4,3	4,0	2,4	2,6	4,2	3,4	3,1	3,3	3,7	3,7	3,1	4,0
Def. and Pub. Adm. and Comp. Soc.Sec.Adm.	4,9	6,4	0,1	0,0	0,2	0,8	0,2	0,3	0,4	0,2	0,3	0,2	0,1	0,1	0,1	0,0	0,0	0,2
Education	17,9	5,6	2,6	6,2	3,5	1,4	1,4	1,0	1,3	2,0	2,2	1,7	1,1	1,1	0,6	0,7	1,2	5,2
Electric Gas and Water Resources	0,8	2,4	0,6	0,3	0,2	0,3	0,2	0,2	0,1	0,1	0,2	0,1	0,1	0,1	0,1	0,8	1,0	0,9
Electrical and Optical Equipments Industry	6,8	5,1	5,0	12,1	8,1	5,6	5,5	4,4	5,8	5,5	5,6	3,5	4,8	4,2	2,3	3,1	3,3	4,4
Extraction of Mine (Energy Non-producing)	6,6	11,2	29,8	14,7	15,8	7,6	6,9	2,3	1,7	2,5	3,1	2,1	1,8	2,0	3,0	4,6	3,2	4,1
Extraction of Mine (Energy Producing)	2,5	8,3	8,4	4,3	5,3	3,0	2,6	2,5	1,3	0,9	1,3	1,6	1,1	1,0	2,2	3,3	5,0	4,3
Financial Intermediation	2,3	6,9	4,9	8,4	3,4	1,8	1,2	0,7	0,5	0,2	0,2	0,1	0,1	0,1	0,1	0,2	0,3	0,5
Fishing	29,4	51,9	55,4	23,1	24,6	6,4	11,9	6,9	5,0	4,3	6,2	5,7	3,6	4,5	3,7	3,2	2,8	2,4
Food, Beverage and Tabacco Manufacturing	8,9	9,3	8,5	15,7	10,6	5,9	3,8	3,8	4,7	4,4	5,0	3,1	2,4	2,8	2,6	2,4	2,2	3,2
Health and Social Services	10,3	3,1	2,0	6,1	3,0	1,8	1,9	1,5	2,0	1,3	2,4	1,7	1,1	4,0	2,6	2,5	2,1	2,6
Hotels and Restaurants (Tourism)	7,2	12,8	20,2	17,9	13,1	5,9	3,1	2,4	2,4	2,6	3,1	2,5	1,5	2,8	3,0	3,0	3,1	3,4
International Organizations	0,1	3,6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Leather and Leather Products Manufacturing	11,3	19,9	51,0	34,7	21,9	19,3	18,9	12,5	10,8	5,6	9,0	5,3	3,6	3,3	2,2	2,2	2,5	4,7
Machinery and Equipment Manufacturing	7,4	9,7	5,5	12,5	9,7	4,4	5,0	2,1	2,1	2,1	3,1	2,2	1,4	1,4	1,5	1,6	2,1	3,6
Metal Industry and Finished Metal Production	3,2	6,9	9,0	16,1	9,3	4,1	2,7	0,9	1,1	1,2	2,5	1,6	1,3	1,5	1,3	1,3	1,4	3,1
Non-classified Manufacturing Industry	2,3	2,0	5,1	12,9	6,5	1,6	1,9	2,3	2,9	3,7	6,2	4,2	2,3	2,6	2,7	2,9	3,3	4,3
Nuclear Fuel Refinery and Petr.and Coal Products	5,4	6,9	0,5	0,3	0,9	0,9	0,7	0,6	1,9	0,8	1,4	0,9	0,9	1,3	1,0	1,1	1,4	2,4
Other Non-metallic Mineral Industry	3,9	7,8	10,1	16,9	15,1	12,3	4,1	1,6	1,2	2,1	3,6	2,7	1,9	1,9	1,7	6,1	5,2	6,1
Other Social and Personal Services	1,1	5,1	12,2	12,9	7,4	5,1	3,3	4,1	3,0	2,2	3,7	2,2	1,2	1,5	1,4	2,1	2,5	3,1
Paper Raw Mat. and Paper Products Printing Ind.	12,1	9,3	16,5	12,1	16,1	9,7	8,7	5,6	6,6	3,4	6,7	6,0	3,5	3,4	2,3	1,9	1,7	2,8
Personal Loans	NA	NA	NA	NA	0,2	0,2	0,8	1,1	3,2	4,2	7,7	4,8	3,7	4,0	3,2	3,4	4,2	4,7
Private Employer (Individuals)	2,4	0,3	13,2	1,4	2,3	2,0	5,9	3,4	3,2	5,3	6,2	5,7	3,5	4,9	4,0	8,0	10,7	10,2
Real Estate Brokery, Rental and Operating Activities	3,9	5,4	1,9	9,9	6,0	7,6	5,8	3,4	2,6	1,8	2,9	1,8	1,0	3,3	1,1	1,2	0,9	1,2
Rubber and Plastic Products Manufacturing	3,6	6,2	6,9	14,5	6,3	2,6	3,3	4,6	4,1	5,7	6,1	4,3	2,3	2,0	1,8	1,8	2,0	3,5
Textile and Textile Products Manufacturing	16,8	18,2	14,7	18,8	12,5	8,1	10,0	11,2	11,7	10,1	11,9	7,5	5,4	5,3	4,0	3,2	3,1	3,9
Transportation Vehicles Industry	11,1	8,9	1,9	7,1	4,3	0,7	0,4	0,4	0,3	0,6	2,1	3,5	3,8	4,7	5,0	3,9	2,6	4,3

Transportation, Storage and Telecommunication	9,4	11,4	11,3	7,3	3,6	2,1	3,4	1,3	1,2	1,7	2,5	2,0	1,3	1,6	1,5	1,3	1,2	1,9
W.sale&Retail Sales, Mot. Veh. Main. Serv.	5,6	5,4	7,3	26,1	15,5	5,2	3,9	2,3	3,3	4,0	5,8	4,3	2,7	2,9	2,7	2,8	3,3	4,6
Wood and Wood Products Manufacturing	13,0	14,4	29,4	23,7	12,9	3,0	2,2	1,2	2,3	2,7	4,9	3,0	2,2	2,4	2,1	1,9	2,3	3,5

Figure 10. Change in NPLs
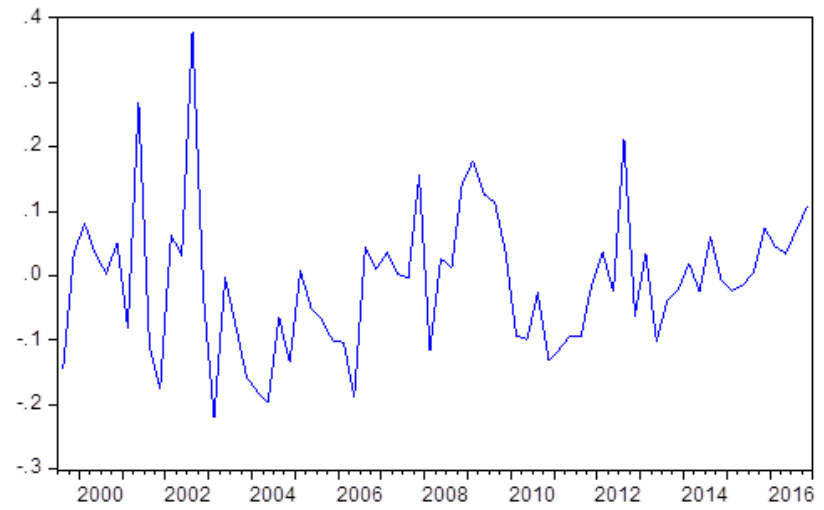
Figure 11. Sectoral NPLs

1.a Agriculture, Hunting, Forestry
Average : 5,04

1b. Chemistry and Chemical Products and Synthetic Fiber Industry
Averag

1c. Construction
Average : 5,22

1d. Defense and Public Admin. and Compulsory Social Security Admin.
Average : 0,62

1e. Education
Average : 3,26

1f. Electric Gas and Water Resources
Average : 0,42

1g. Electrical and Optical Equipments Industry
Average : 5,10

1h. Extraction of Mine (Energy Non-producing)
Average : 7,0

1i. Extraction of Mine (Energy Producing)
Average : 3,18

1j. Financial Intermediation

Average : 2,16

1k. Fishing

Average : 14,0

1l. Food, Beverage and Tabacco Manufacturing

Average : 5,87

1m. Health and Social Services

Average : 3,17

1n. Hotels and Restaurants (Tourism)

Average : 6,1

1o. International Organizations

1p. Leather and Leather Products Manufacturing

Average : 12,0

1q. Machinery and Equipment Manufacturing

Average : 4,4

1r. Metal Industry and Finished Metal Production

Average : 3,8
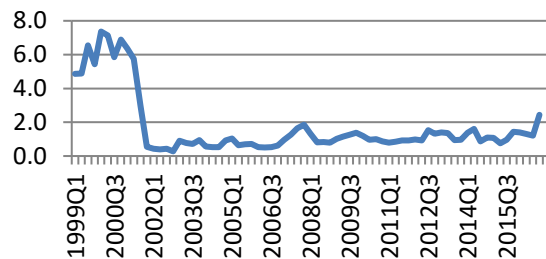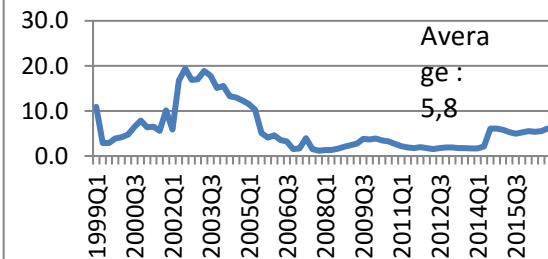
123

1s. Non-classified Manufacturing Industry

Average :

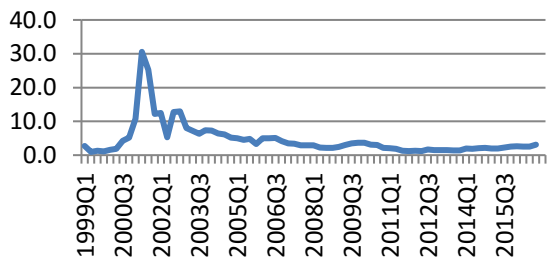## 1t. Nuclear Fuel Refinery and Petroleum and Coal Products

1u. Other Non-metallic Mineral Industry

Average : 5,8

1v. Other Social and Personal Services

1w. Paper Raw Materials and Paper Products Printing Industry
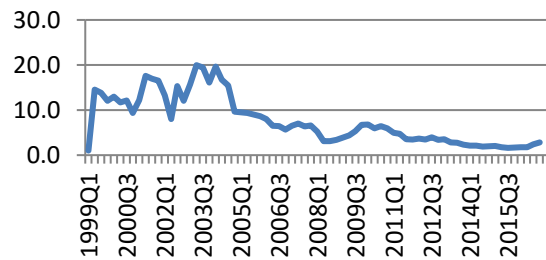
1x. Personal Loans
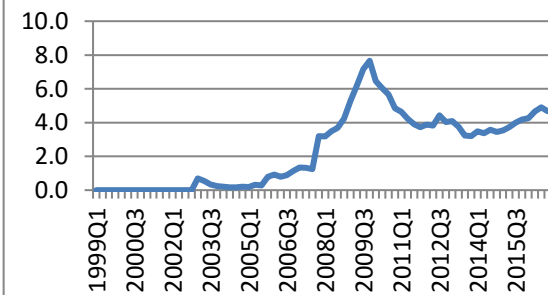
1y. Private Employer (Individuals)
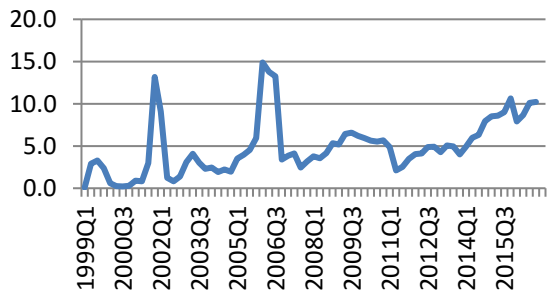
1z. Real Estate Brokery, Rental and Operating Activities

1aa. Rubber and Plastic Products Manufacturing

124

1ab. Textile and Textile Products Manufacturing

Average :

1ac. Transportation Vehicles Industry

1ad. Transportation, Storage and Telecommunication

1ae. Wholesale and Retail Sales, Brokery, Motor Vehicle Maintenance Services
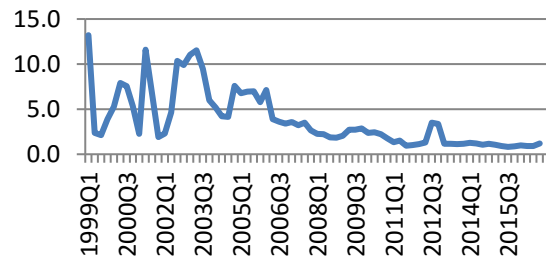
1af. Wood and Wood Products Manufacturing
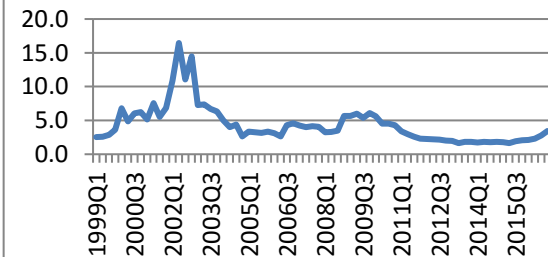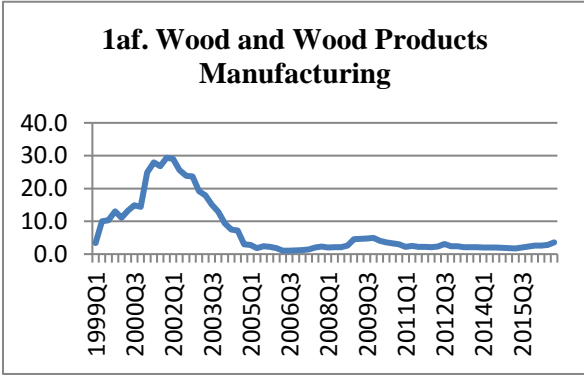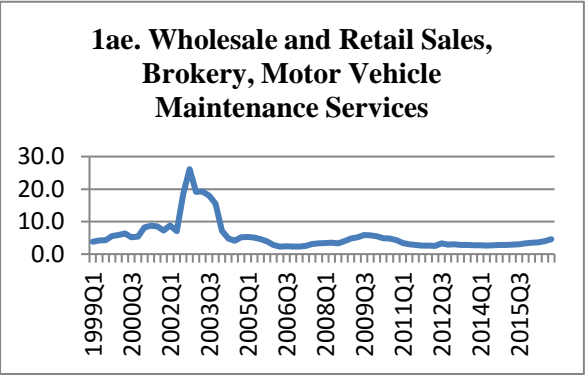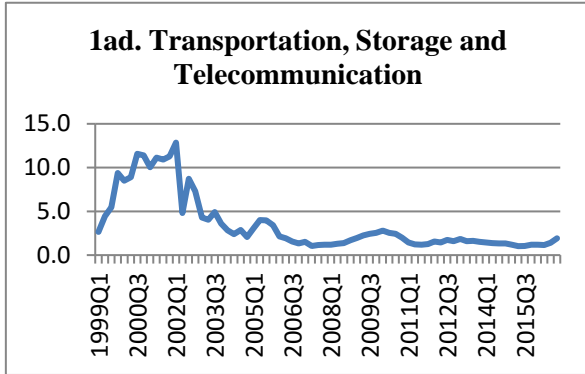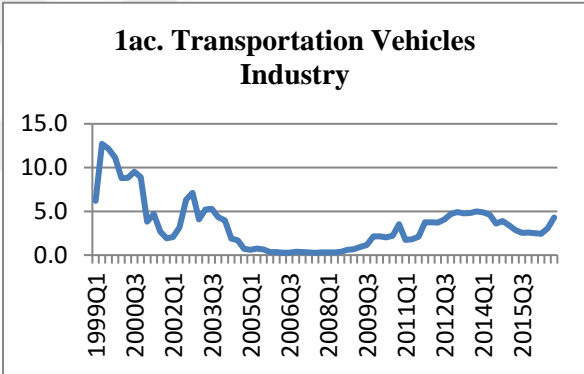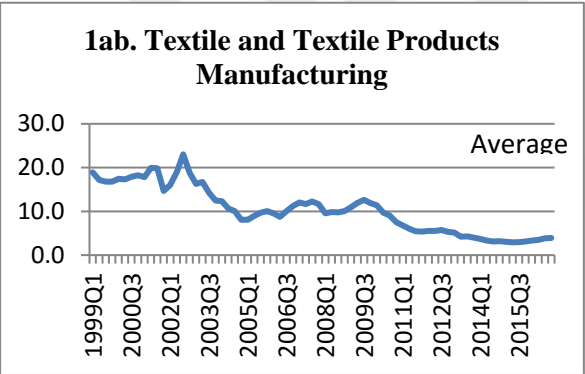
PANEL VAR ESTIMATES FOR OECD DATA

Table 20. Lag Length Criteria

VAR Lag Order Selection Criteria
Endogenous variables: GDP_GR UNEMP CRVOL INF NPLR
Exogenous variables: C
Sample: 1999 2016
Included observations: 290

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4623.087	NA	50046199	31.91784	31.98112	31.94319
1	-3142.695	2899.528	2189.211	21.88065	22.26030	22.03276
2	-2997.823	278.7536	957.9023	21.05395	21.74996*	21.33281
3	-2959.633	72.16523	874.9455	20.96299	21.97537	21.36860
4	-2880.743	146.3536	603.7853*	20.59133*	21.92008	21.12370*
5	-2859.941	37.87501	622.2306	20.62028	22.26540	21.27940
6	-2839.783	36.00617	644.4456	20.65368	22.61516	21.43955
7	-2816.673	40.48245	654.4276	20.66671	22.94457	21.57933
8	-2793.609	39.60658*	665.2815	20.68006	23.27429	21.71944

* 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

Table 21. Panel VAR Results

Vector Autoregression Estimates
Sample (adjusted): 2003 2016
Included observations: 406 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	GDP_GR	UNEMP	CRVOL	INF	NPLR
GDP_GR(-1)	0.453120	-0.091316	0.429791	0.134118	-0.033976
	(0.05776)	(0.02287)	(0.17635)	(0.03769)	(0.02732)
	[7.84439]	[-3.99224]	[2.43716]	[3.55837]	[-1.24381]
GDP_GR(-2)	-0.001973	0.044184	-0.000656	-0.056530	-0.065277
	(0.06984)	(0.02766)	(0.21322)	(0.04557)	(0.03303)
	[-0.02825]	[1.59763]	[-0.00308]	[-1.24045]	[-1.97642]
GDP_GR(-3)	0.111259	-0.008401	-0.126774	0.038205	0.006824
	(0.06187)	(0.02450)	(0.18890)	(0.04037)	(0.02926)
	[1.79814]	[-0.34287]	[-0.67111]	[0.94628]	[0.23323]
GDP_GR(-4)	0.127739	0.000374	-0.035784	0.109312	-0.066824
	(0.04818)	(0.01908)	(0.14709)	(0.03144)	(0.02278)
	[2.65132]	[0.01959]	[-0.24328]	[3.47715]	[-2.93297]
UNEMP(-1)	-0.012386	1.484719	-0.229197	-0.139585	0.214910
	(0.13903)	(0.05505)	(0.42446)	(0.09072)	(0.06575)
	[-0.08908]	[26.9680]	[-0.53997]	[-1.53864]	[3.26868]
UNEMP(-2)	0.165999	-0.579046	1.073000	0.151866	-0.318890
	(0.24407)	(0.09665)	(0.74513)	(0.15925)	(0.11542)
	[0.68013]	[-5.99136]	[1.44003]	[0.95361]	[-2.76290]
UNEMP(-3)	-0.128002	0.093495	-1.289478	0.087420	0.133047
	(0.24465)	(0.09688)	(0.74690)	(0.15963)	(0.11569)
	[-0.52321]	[0.96509]	[-1.72645]	[0.54763]	[1.15000]
UNEMP(-4)	-0.050800	-0.035658	0.431585	-0.164132	-0.007733
	(0.14600)	(0.05781)	(0.44574)	(0.09527)	(0.06904)
	[-0.34794]	[-0.61677]	[0.96825]	[-1.72286]	[-0.11200]
CRVOL(-1)	0.028528	-0.003547	1.697454	-0.008319	0.011884
	(0.01671)	(0.00662)	(0.05101)	(0.01090)	(0.00790)
	[1.70748]	[-0.53615]	[33.2788]	[-0.76307]	[1.50411]
CRVOL(-2)	-0.024372	0.006743	-1.108984	0.003311	-0.071063
	(0.03208)	(0.01270)	(0.09794)	(0.02093)	(0.01517)
	[-0.75971]	[0.53084]	[-11.3229]	[0.15816]	[-4.68415]
CRVOL(-3)	-0.043118	0.021563	0.529007	0.054355	0.151524

	(0.03241)	(0.01283)	(0.09895)	(0.02115)	(0.01533)
	[-1.33036]	[1.68012]	[5.34628]	[2.57019]	[9.88610]
CRVOL(-4)	0.035070	-0.023380	-0.148625	-0.052790	-0.090711
	(0.01725)	(0.00683)	(0.05266)	(0.01126)	(0.00816)
	[2.03302]	[-3.42278]	[-2.82218]	[-4.69005]	[-11.1200]
INF(-1)	-0.733109	0.206418	-0.180980	0.353421	0.301321
	(0.07379)	(0.02922)	(0.22529)	(0.04815)	(0.03490)
	[-9.93462]	[7.06401]	[-0.80333]	[7.33994]	[8.63467]
INF(-2)	0.444560	-0.134572	0.041674	0.122959	-0.152122
	(0.08557)	(0.03388)	(0.26124)	(0.05583)	(0.04047)
	[5.19530]	[-3.97152]	[0.15952]	[2.20221]	[-3.75931]
INF(-3)	-0.052270	0.040612	-0.075715	-0.006434	-0.062957
	(0.08477)	(0.03357)	(0.25880)	(0.05531)	(0.04009)
	[-0.61660]	[1.20983]	[-0.29256]	[-0.11631]	[-1.57045]
INF(-4)	0.094582	-0.031479	0.091821	0.030419	0.034994
	(0.05934)	(0.02350)	(0.18118)	(0.03872)	(0.02806)
	[1.59378]	[-1.33958]	[0.50681]	[0.78557]	[1.24695]
NPLR(-1)	-0.255923	0.023188	-0.210408	0.046413	1.376854
	(0.08054)	(0.03189)	(0.24588)	(0.05255)	(0.03809)
	[-3.17761]	[0.72707]	[-0.85572]	[0.88319]	[36.1505]
NPLR(-2)	0.373051	-0.055935	-0.086852	0.034665	-0.415053
	(0.10544)	(0.04175)	(0.32190)	(0.06880)	(0.04986)
	[3.53803]	[-1.33967]	[-0.26981]	[0.50385]	[-8.32399]
NPLR(-3)	0.001924	0.026756	0.069466	-0.201466	-0.068750
	(0.08214)	(0.03252)	(0.25076)	(0.05359)	(0.03884)
	[0.02342]	[0.82262]	[0.27702]	[-3.75907]	[-1.76998]
NPLR(-4)	-0.068749	0.022138	-0.090917	0.117087	0.071310
	(0.06384)	(0.02528)	(0.19489)	(0.04165)	(0.03019)
	[-1.07697]	[0.87577]	[-0.46651]	[2.81102]	[2.36224]
C	1.316966	-0.003176	4.389494	1.055866	-0.094122
	(0.47178)	(0.18682)	(1.44033)	(0.30784)	(0.22310)
	[2.79147]	[-0.01700]	[3.04756]	[3.42993]	[-0.42188]
R-squared	0.443986	0.962011	0.973678	0.654248	0.956847
Adj. R-squared	0.415102	0.960037	0.972310	0.636286	0.954605
Sum sq. Resids	2053.397	321.9801	19138.68	874.2522	459.2024
S.E. equation	2.309437	0.914501	7.050593	1.506912	1.092123
F-statistic	15.37144	487.4692	712.0646	36.42567	426.8391
Log likelihood	-905.1312	-529.0208	-1358.271	-731.7932	-601.0861

Akaike AIC	4.562223	2.709462	6.794439	3.708341	3.064463
Schwarz SC	4.769448	2.916687	7.001664	3.915566	3.271688
Mean dependent	2.060435	7.308887	92.03363	2.117528	3.946729
S.D. dependent	3.019716	4.574623	42.37066	2.498666	5.125899

Determinant resid covariance (dof adj.)	410.1631
Determinant resid covariance	314.5069
Log likelihood	-4047.899
Akaike information criterion	20.45763
Schwarz criterion	21.49376

Table 22. Variance Decomposition of Panel VAR

Variance Decomposition of GDP_GR:

Period	S.E.	GDP_GR	UNEMP	CRVOL	INF	NPLR
1	2.309437	100.0000	0.000000	0.000000	0.000000	0.000000
2	2.718043	83.07153	0.156269	0.396073	15.43922	0.936901
3	2.766075	80.54959	0.571938	1.334910	16.38496	1.158602
4	2.798282	80.26728	1.085683	1.304721	16.20686	1.135461
5	2.908568	77.89530	1.082947	4.673855	15.00595	1.341948
6	2.957805	75.58623	1.113614	7.202374	14.54288	1.554898
7	2.974830	74.73971	1.116608	7.626231	14.49025	2.027195
8	2.987493	74.11025	1.120269	7.593734	14.55392	2.621826
9	2.998367	73.57477	1.130530	7.545527	14.55341	3.195764
10	3.009121	73.13899	1.159023	7.528802	14.51217	3.661011

Variance Decomposition of UNEMP:

Period	S.E.	GDP_GR	UNEMP	CRVOL	INF	NPLR
1	0.914501	16.05218	83.94782	0.000000	0.000000	0.000000
2	1.693432	21.75035	75.04513	0.010185	3.174526	0.019815
3	2.301768	22.37008	71.70140	0.048993	5.829984	0.049546
4	2.786636	22.90574	69.35640	0.141987	7.528691	0.067182
5	3.203722	23.35160	66.74562	1.589132	8.253376	0.060279
6	3.565368	23.00047	64.32712	4.331195	8.291749	0.049475
7	3.868578	22.20452	62.61882	7.163617	7.968875	0.044169
8	4.115698	21.42808	61.47049	9.492344	7.558158	0.050924
9	4.311130	20.78095	60.70448	11.24544	7.201162	0.067962
10	4.459205	20.25551	60.26908	12.45107	6.934141	0.090192

Variance Decomposition of CRVOL:

Period	S.E.	GDP_GR	UNEMP	CRVOL	INF	NPLR
1	7.050593	2.686161	0.033956	97.27988	0.000000	0.000000
2	13.78055	1.096241	0.093563	98.74980	0.035762	0.024637
3	18.57758	0.603748	0.053618	98.74130	0.362666	0.238667
4	22.13340	0.435189	0.080932	97.83344	0.898706	0.751732
5	25.08134	0.355437	0.084040	96.75031	1.308749	1.501468
6	27.50909	0.409287	0.070497	95.47038	1.624022	2.425812
7	29.45271	0.659704	0.065080	93.73530	1.996056	3.543858
8	31.04041	1.037500	0.071699	91.60014	2.444793	4.845870
9	32.38450	1.530472	0.091280	89.19620	2.915152	6.266894
10	33.54923	2.180184	0.123993	86.56427	3.391738	7.739818

Variance Decomposition of INF:

Period	S.E.	GDP_GR	UNEMP	CRVOL	INF	NPLR
1	1.506912	3.619477	1.931841	0.058461	94.39022	0.000000
2	1.668352	10.41517	2.793638	0.119996	86.58941	0.081790
3	1.696779	11.36730	3.025243	0.227198	85.07116	0.309097
4	1.737682	11.17453	2.913789	3.403820	82.12537	0.382498

5	1.805586	15.35894	2.736092	5.241938	76.23857	0.424467
6	1.860370	19.18288	2.624429	5.377883	72.21619	0.598625
7	1.885419	20.59529	2.629301	5.279466	70.73108	0.764861
8	1.907514	21.94511	2.722376	5.222947	69.30446	0.805110
9	1.941190	23.31249	2.916051	5.924471	67.06756	0.779432
10	1.975604	23.85735	3.157584	7.353078	64.87490	0.757090

Variance Decomposition of NPLR:

Period	S.E.	GDP_GR	UNEMP	CRVOL	INF	NPLR
1	1.092123	10.04885	1.312164	0.000482	0.036004	88.60250
2	1.942547	11.52327	2.607706	0.249088	4.523084	81.09685
3	2.675720	12.49787	2.742332	1.004780	7.541236	76.21378
4	3.273936	15.15587	2.757090	0.704665	8.936412	72.44596
5	3.847165	19.33842	2.483947	2.583443	9.680536	65.91365
6	4.386316	21.22478	2.213997	7.251570	10.08077	59.22888
7	4.828327	22.00531	2.089354	11.68299	9.926961	54.29538
8	5.185835	22.70389	2.032625	15.19865	9.598543	50.46629
9	5.473694	23.28587	1.978021	18.00499	9.303446	47.42767
10	5.686991	23.61776	1.916981	20.07326	9.109654	45.28234

Cholesky Ordering: GDP_GR UNEMP CRVOL INF NPLR
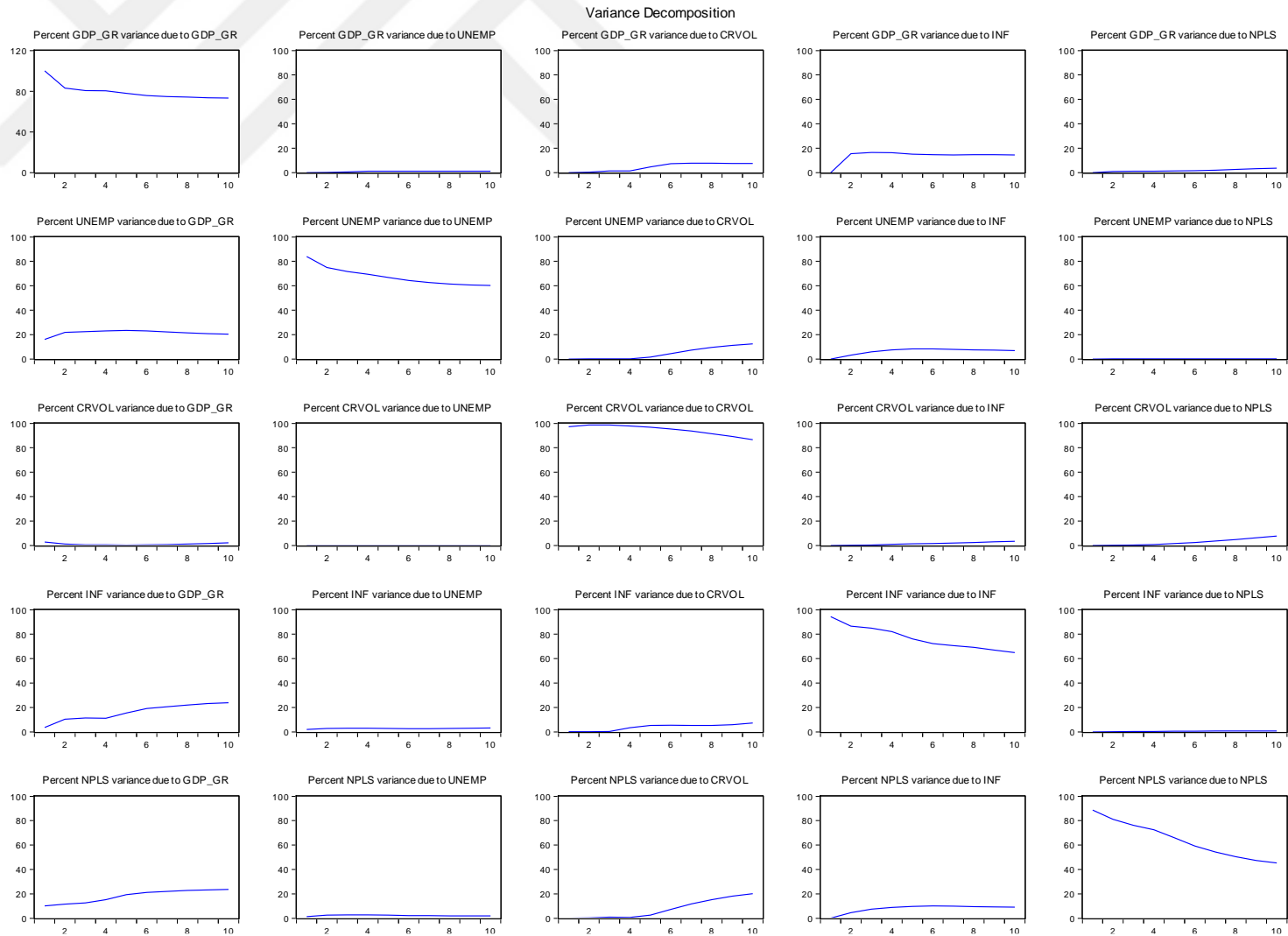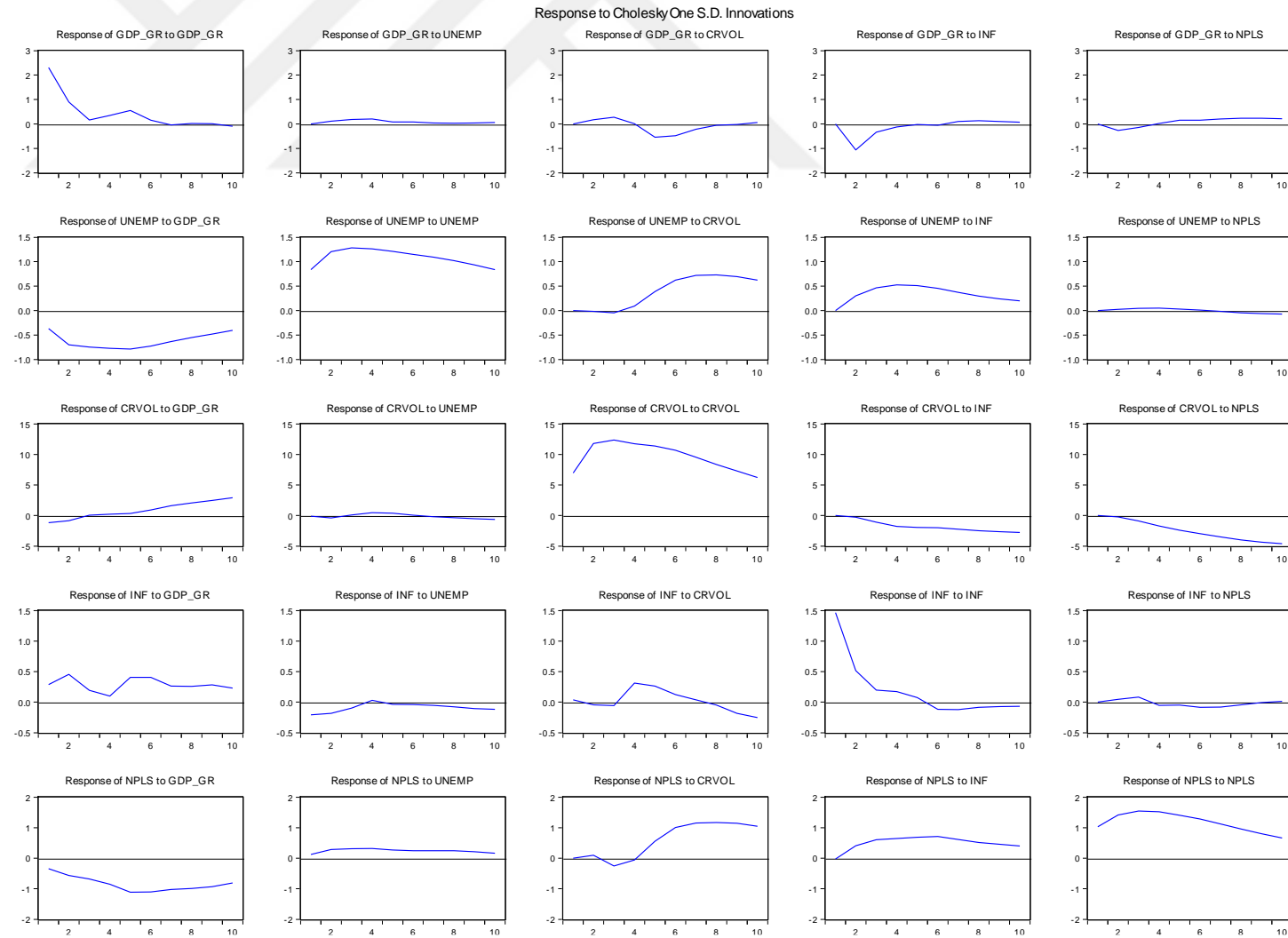
Figure 12. Variance Decomposition of Panel VAR

Variance Decomposition

Figure 13. Impulse Response Analysis of Panel VAR

Response to Cholesky One S.D. Innovations

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VAR FIGURES FOR TURKEY's YEARLY DATA

Table 23. Granger Causality Test Results

| Null Hypothesis	(Obs : 406)	Prob.
UNEMP does not Grenger Cause GDP_GR		0.4910
CRVOL does not Grenger Cause GDP_GR		0.7509
INF does not Grenger Cause GDP_GR		0.0755
NPLR does not Grenger Cause GDP_GR		**0.0228**
GDP_GR does not Grenger Cause UNEMP		0.2522
CRVOL does not Grenger Cause UNEMP		0.5323
INF does not Grenger Cause UNEMP		0.2349
NPLR does not Grenger Cause UNEMP		0.0857
GDP_GR does not Grenger Cause CRVOL		0.8077
UNEMP does not Grenger Cause CRVOL		0.3648
INF does not Grenger Cause CRVOL		**0.0042**
NPLR does not Grenger Cause CRVOL		**0.0150**
GDP_GR does not Grenger Cause INF		0.8567
UNEMP does not Grenger Cause INF		0.9328
CRVOL does not Grenger Cause INF		0.9850
NPLR does not Grenger Cause INF		0.4841
GDP_GR does not Grenger Cause NPLR		0.3545
UNEMP does not Grenger Cause NPLR		0.8156
CRVOL does not Grenger Cause NPLR		0.7485
INF does not Grenger Cause NPLR		**0.0000**

Figure 14. Variance Decomposition Results

Variance Decomposition
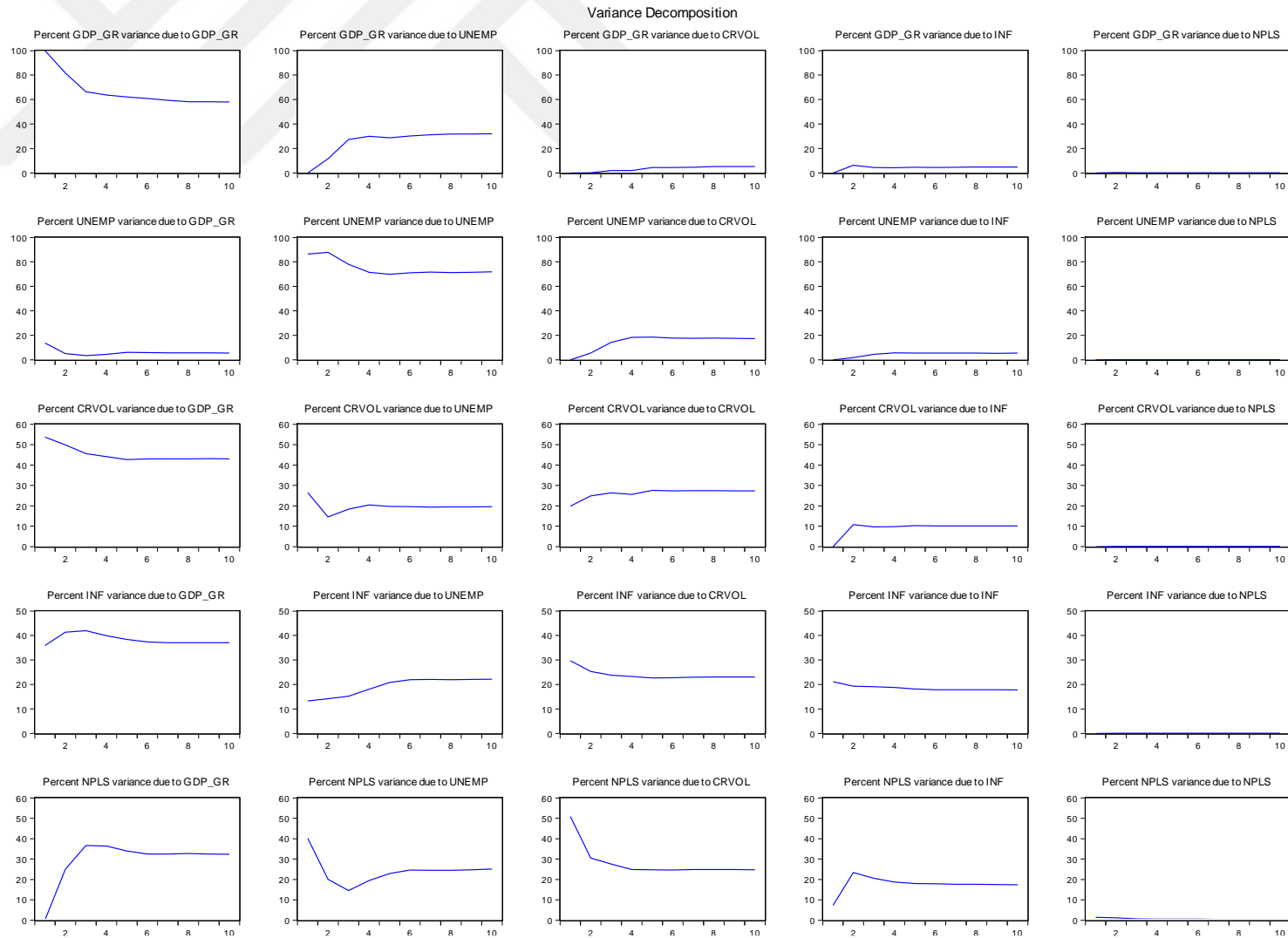
Figure 15. Impulse Response Results

Response to Cholesky One S.D. Innovations ± 2 S.E.
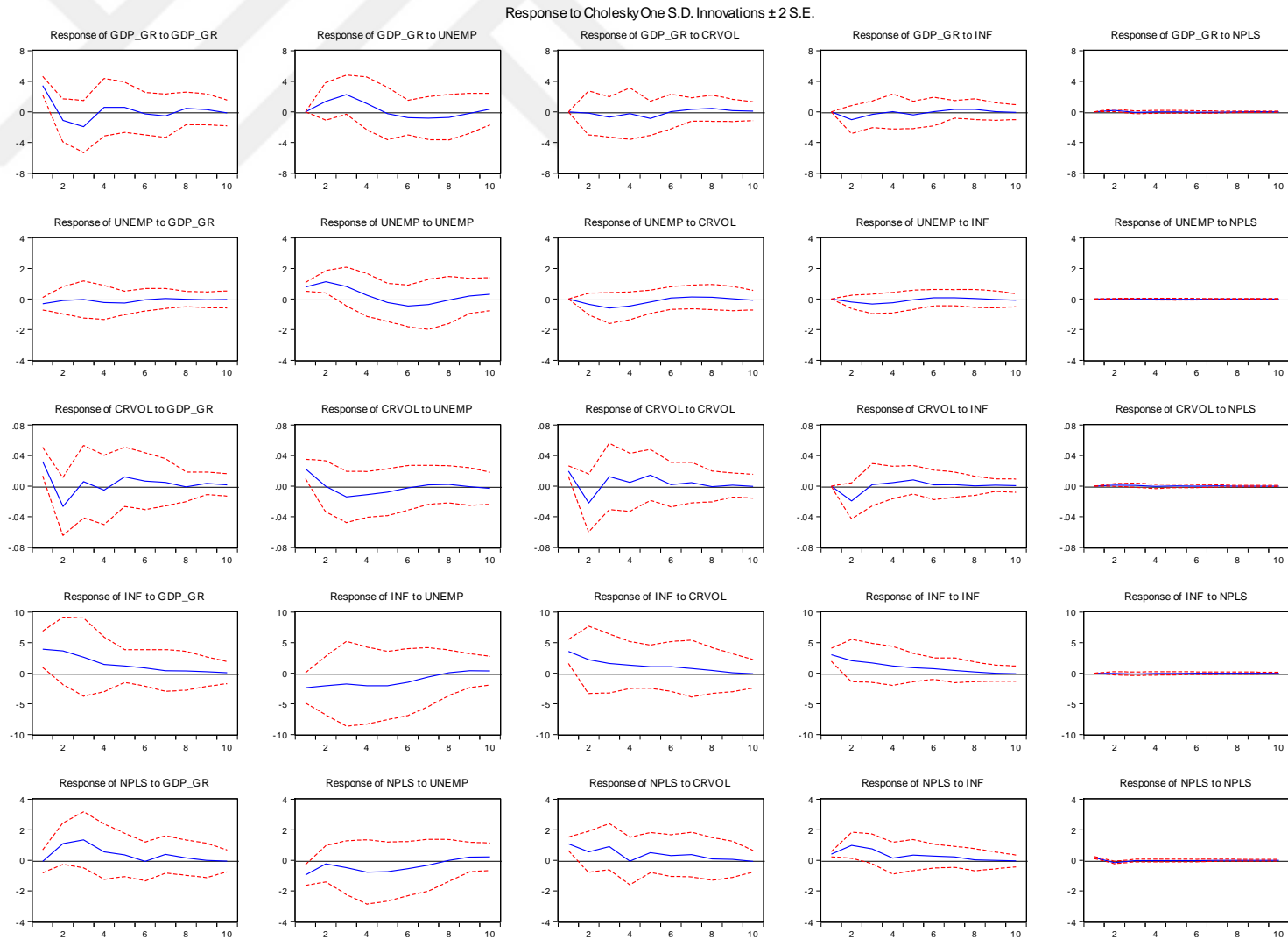
Table 24. Granger Causality Test Results

Null Hypothesis	Mexico	Hungary
	Prob.	
CRVOL does not Granger Cause NPLR	**0.0098**	**0.0064**
INF does not Granger Cause NPLR	0.1730	0.4481
GDP does not Granger Cause NPLR	**0.0209**	0.1451
UNEMP does not Granger Cause NPLR	**0.0197**	0.2209
NPLR does not Granger Cause CRVOL	0.7734	0.8415
INF does not Granger Cause CRVOL	0.6323	0.1126
GDP does not Granger Cause CRVOL	0.0772	0.3387
UNEMP does not Granger Cause CRVOL	0.3070	0.5935
NPLR does not Granger Cause INF	0.2686	0.5299
CRVOL does not Granger Cause INF	**0.0153**	0.7632
GDP does not Granger Cause INF	0.9130	0.7646
UNEMP does not Granger Cause INF	**0.0078**	0.9189
NPLR does not Granger Cause GDP	0.6455	**0.0089**
CRVOL does not Granger Cause GDP	0.5258	0.7421
INF does not Granger Cause GDP	0.8375	0.5828
UNEMP does not Granger Cause GDP	**0.0118**	**0.0005**
NPLR does not Granger Cause UNEMP	0.2064	**0.0005**
CRVOL does not Granger Cause UNEMP	0.1574	0.4861
INF does not Granger Cause UNEMP	0.8524	0.1165
GDP does not Granger Cause UNEMP	0.2826	0.3537

Figure 16. Impulse Response Results of Mexico

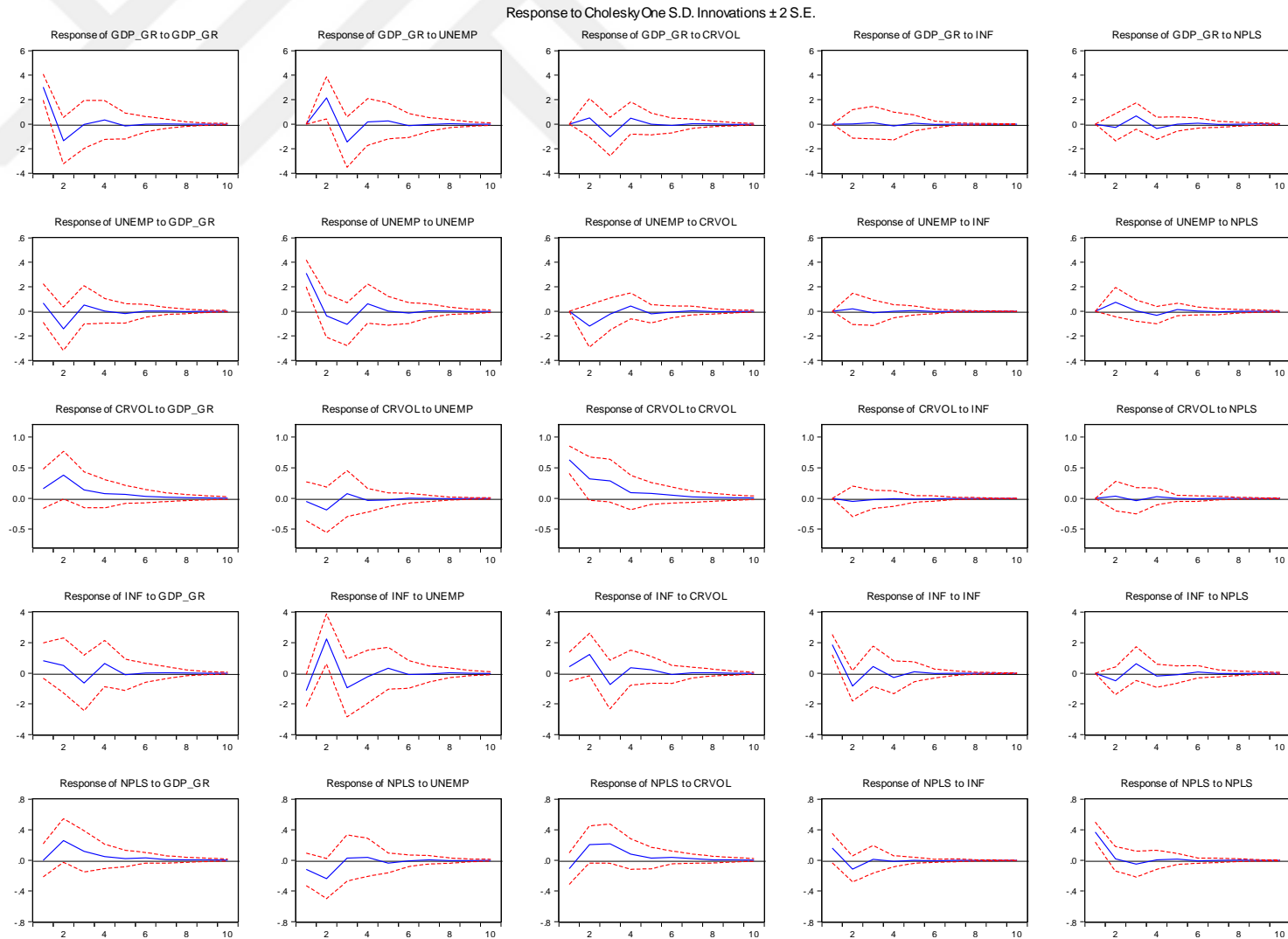Response to Cholesky One S.D. Innovations ± 2 S.E.

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Figure 17. Variance Decomposition Results of Mexico
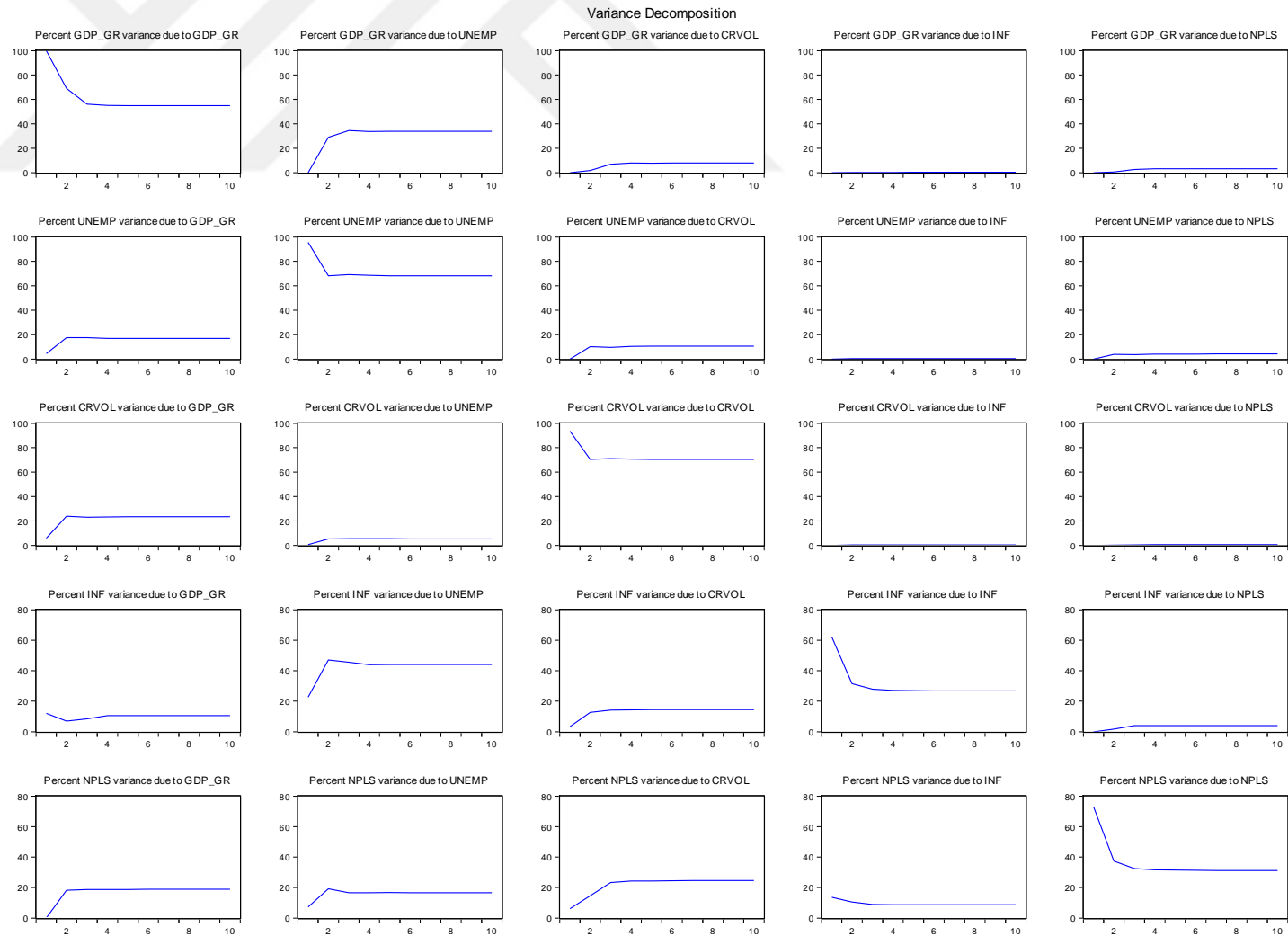
Figure 18. Impulse Response Results of Hungary

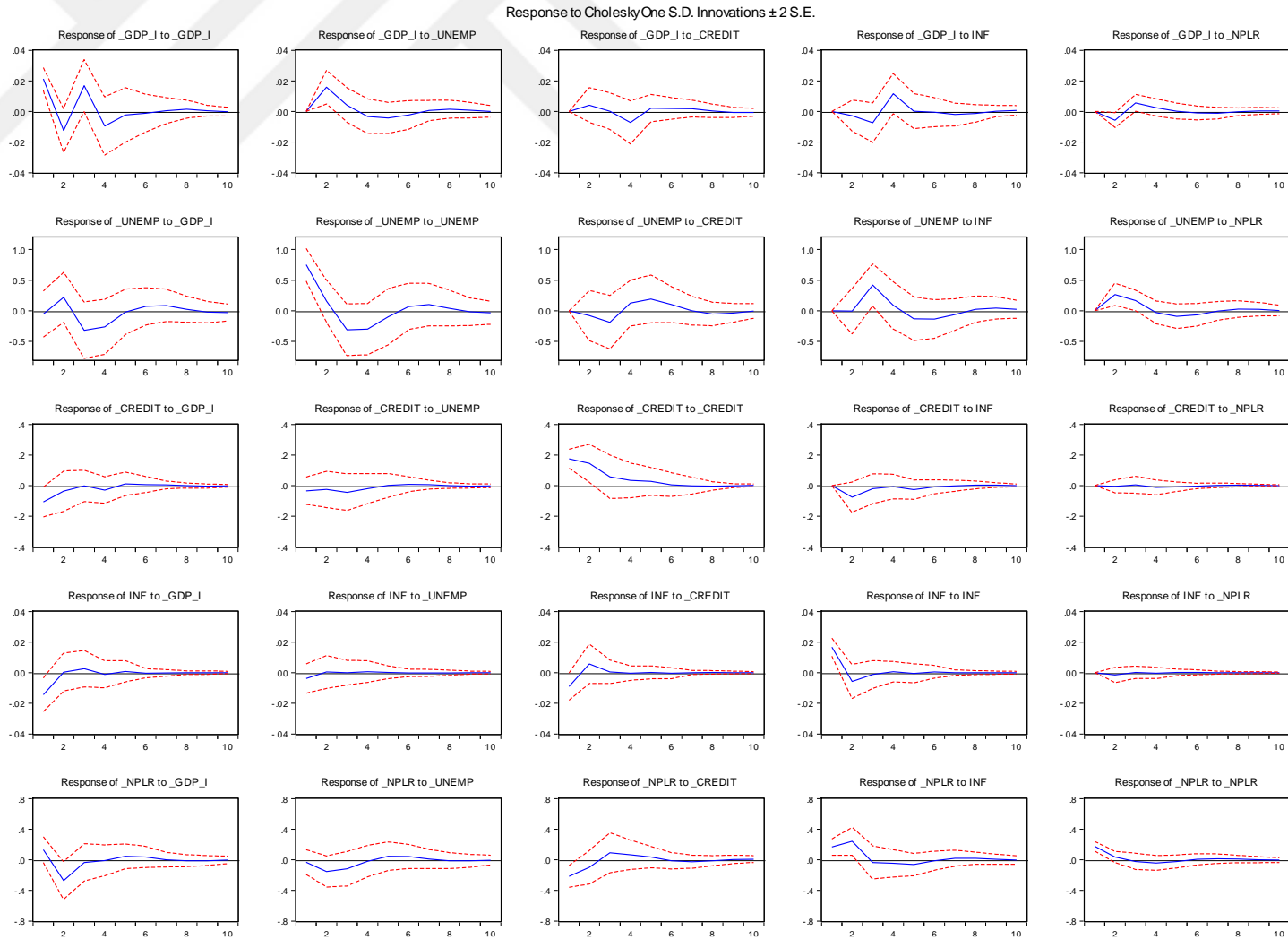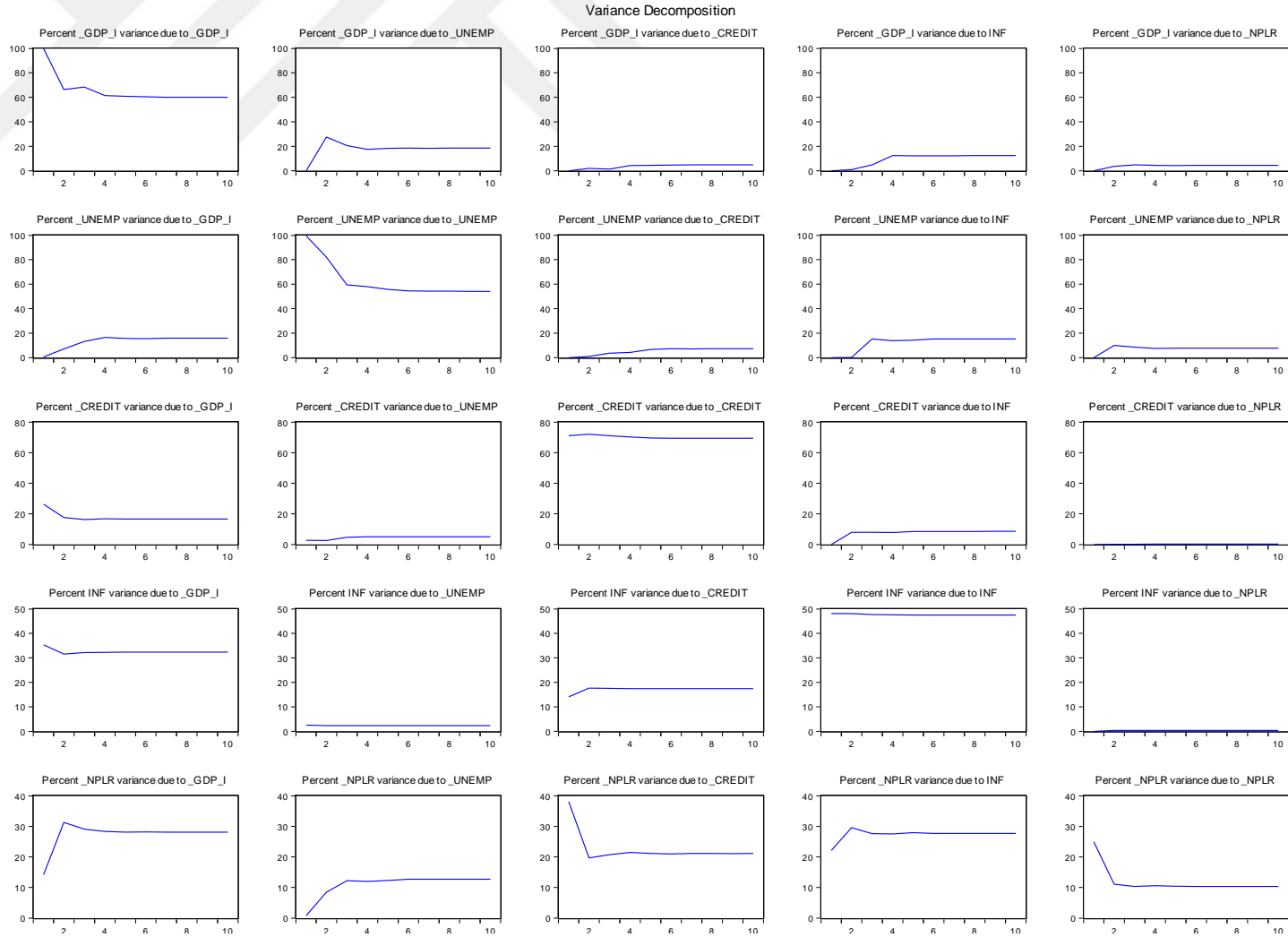Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure 19. Variance Decomposition Results of Hungary

Variance Decomposition

CURRICULUM VITAE

Fatih İNAN, born in 1979, graduated from Atatürk University Business Administration School in 2002. Then he received MSc degree in Financial Economics from Doğuş University in 2012. Fatih, beginning to work in the banking sector in 2004, currently has been working at Vakıf Participation Bank as a Head of Financial Analysis and Credit Risk Analytics.