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FX VOLATILITY, FINANCIAL STABILITY AND MACROPRUDENTIAL POLICIES, CASE FOR TURKEY

MASTER'S THESIS

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PREFACE

I would like to thank Prof. Haluk LEVENT for his assistance during the process and my friend Kemal SIMSEK for his valuable contributrion.

This thesis is dedicated to my life partner and eminent wife, Hulya, and my little son Hamza who has already cheer up our home.

Istanbul, July 2018 Abdulkadir DOGAN

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ABBREVIATIONS

AR :Autoregression

ARCH :Autoregressive Conditional Heteroscedasticity

ARMA :Autoregressive Moving Average

BIS :Bank for International Settlements

BOE :Bank of England

BoJ :Bank of Japan

CBRT :Central Bank of Republic of Turkey

CCB :Countercyclical Capital Buffers

CLRM :Classical Linear Regression Model

DLLP :Dynamic Loan Loss Provisioning

DTR :Debt to Income Ratio

ECB :European Central Bank

E-GARCH :Exponential Generalized Autoregressive Conditional Heteroscedasticity

EM :Emerging Markets

FED :Federal Reserve Bank of America

FOMC :Federal Open Market Committee

FX :Foreign Exchange

GARCH :Generalized Autoregressive Conditional Heteroscedasticity

GDP :Gross Domestic Product

LCR :Liquidity Coverage Ratio

LTV :Loan to Value Ratio

MA	:Moving Average
OLS	:Ordinary Least Squares
QE	:Quantitative Easing
ROC	:Reserve Option Coefficient
ROM	:Reserve Option Mechanism
T-GARCH	:Threshold Generalized Autoregressive Conditional Heteroscedasticity

RÉSUMÉ

Cette étude est un bref aperçu des efforts de relance économique qui ont commencé avec la crise financière mondiale en 2008 et continuent à la lumière du jour. Les politiques macroprudentielles appliquées dans les pays développés et en développement ont été examinées en détail. On a tenté d'expliquer dans quelles méthodes ces politiques assureraient la stabilité financière en Turquie. La principale question dans cette étude est d'examiner si les politiques macroprudentielles sont efficaces pour contribuer à la stabilité financière en réduisant la volatilité des changes ou non.

En convertissant progressivement sa politique traditionnelle en régime de ciblage complet de l'inflation et en adoptant comme objectif principal la stabilité des prix en 2006, la Banque centrale de la République de Turquie (CBRT) a réalisé avec les crises que la politique monétaire ignorait la stabilité financière et seule la stabilité des prix peut également être risquée pour les objectifs d'inflation. Il a été entendu que la stabilité financière est une condition préalable à la réalisation de la stabilité des prix et que les objectifs de la politique monétaire ont ensuite été revus. Afin de réduire l'effet négatif des entrées de capitaux sur les marchés financiers, de nouveaux paquets de politiques économiques ont été mis en œuvre pendant la période de crise. À cet égard, le CBRT a développé des outils de politique monétaire non conventionnels à côté des outils conventionnels. Ces politiques ont généralement été appelées politiques macroprudentielles. La seule cible - une politique d'outil (stabilité des prix - taux d'intérêt à court terme) a été abandonnée et une nouvelle combinaison d'instruments de politique monétaire (structurelle et cyclique) prenant en compte les prix et la stabilité financière a été mise en œuvre par CBRT. Grâce à cette combinaison de politiques, de nouveaux objectifs intermédiaires et intermédiaires ont été déterminés et la mise en œuvre des politiques monétaires a été revue.

Deux variables fondamentales suivies par le CBRT comme indicateur principal de la stabilité financière ont été la volatilité du taux de change et les taux de croissance du crédit. Ces deux canaux ont une importance supplémentaire pour la CBRT puisqu'ils ont tous deux indirectement affecté la stabilité des prix. Dans cette

étude, les politiques macroprudentielles visant à prévenir la volatilité des taux de change et leur contribution au maintien de la stabilité financière auront été tentées d'expliquer.

Dans le papier, premièrement, les modèles économétriques qui sont utilisés pour modéliser les fluctuations de taux de change sont introduits. Ce sont les modèles ARCH (Autoregressive Conditional Heteroscedasticity) et GARCH (Auto-régression conditionnelle hétérotéductible généralisée) les plus fondamentaux. La principale différence qui sépare ces modèles de la méthode des moindres carrés ordinaires (MCO) est fondée sur les hypothèses formulées par le deuxième modèle sur la variance du terme d'erreur. Dans la méthode des moindres carrés ordinaires, la variance du terme d'erreur est supposée constante et supposée être une structure qui ne change pas avec le temps. Mais il est inévitable que le regroupement de la volatilité et l'évolution de la variance (hétéroscédasticité) soient élevés dans des séries chronologiques à haute fréquence telles que le taux de change, les stocks. Pour cette raison, les études empiriques de l'étude ont été examinées avec les modèles ARCH et GARCH en tenant compte de la structure changeante de la variance.

La deuxième partie de l'étude est consacrée aux politiques macroprudentielles appliquées à l'échelle mondiale, dans les pays développés et en développement. En général, des instruments de politique similaires ont été introduits, mais certains pays ont leurs propres applications spécifiques. Principalement les politiques macroprudentielles sont liées aux prêts et à la réglementation du capital. Les sanctions basées sur l'effet de levier, les règles de liquidité et les mesures visant à améliorer la structure du capital sont les plus connues. Différents types de mise en œuvre des politiques dans ces pays ont été expliqués en détail.

Dans le chapitre suivant qui constitue l'objectif fondamental de cette thèse, des études et des indicateurs sont décrits pour assurer la stabilité financière en Turquie. Les deux principaux indicateurs de stabilité financière suivis par la Banque centrale, l'expansion du crédit et la volatilité des taux de change ont été examinés en détail. Il a été conclu que la stabilité financière est une condition préalable à la stabilité des prix. Il a été entendu qu'un système financier dans lequel les fluctuations des taux de change sont stables et où les taux de croissance du crédit sont conformes aux principes économiques contribuera à la fois à la stabilité financière et à la stabilité des prix.

Les politiques monétaires non conventionnelles (politiques macroprudentielles) mises en œuvre en Turquie sont activement utilisées par la Banque centrale au cours de la période après 2010. Parmi elles; Le corridor de taux d'intérêt asymétrique, le mécanisme d'option de réserve, la gestion de la liquidité avec les réserves requises basées sur la maturité et l'effet de levier sont les outils fondamentaux. Le corridor de taux d'intérêt asymétrique est un outil flexible qui permet à la Banque centrale d'influencer quotidiennement les taux d'intérêt sur le marché interbancaire sans modifier le taux directeur. Avec la crise mondiale, la largeur du corridor a commencé à fonctionner comme un outil de politique monétaire, bien qu'il ait été utilisé auparavant pas semblable à cette fonction. Pendant la période où les entrées de capitaux augmentent, la sous-bande du corridor est réduite et les entrées de capitaux à court terme sont dissuadées, tandis que la bande supérieure du corridor augmente et la hausse implicite des intérêts intervient dans les périodes où l'appétit diminue.

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Dans la gestion de la liquidité, il est prévu que le corridor de taux d'intérêt et les réserves requises soient traités comme des outils politiques complémentaires. Ce système, appelé aussi policy mix, est un système dans lequel plusieurs outils sont désactivés en même temps car il peut parfois être impossible d'atteindre plusieurs cibles avec un seul outil politique. Lorsque les entrées de capitaux se sont accélérées,

la Banque centrale, qui veut alléger la pression sur le taux de change, a élargi le corridor à la baisse, ce qui se traduit par une baisse des taux d'intérêt du marché. Cependant, bien que le taux de volatilité du taux de change ait été réduit, l'utilisation de prêts à taux d'intérêt relativement bas a augmenté. La Banque centrale, qui veut alléger la pression sur la monnaie dans un environnement, a réduit les taux d'intérêt d'une part et augmenté les réserves obligatoires d'autre part, limitant ainsi l'utilisation du crédit des banques.

Le mécanisme d'option de réserve (ROM) est un mécanisme flexible qui permet à la Banque centrale d'ajuster la livre turque et la liquidité en devises sur le marché sans intervenir directement dans les fluctuations des taux de change. Fondamentalement, ROM peut être exprimée comme la capacité de mettre en place les réserves requises en devises étrangères et en or, qui devraient être conservées dans les comptes de la Banque centrale. Le coefficient indiquant le montant de FX ou d'or à fixer par unité de lire turque est le coefficient d'option de réserve (ROC). La chose la plus importante qui distingue le ROM des autres applications de la politique monétaire est que le ROM n'est pas une nécessité mais une question de choix. Chaque banque et institution financière a le droit d'utiliser ou de ne pas utiliser le service ROM en résolvant son propre problème d'optimisation. Les variables qu'ils utilisent pour résoudre ce problème d'optimisation sont la livre turque et les frais de change et les prévisions de taux de change concernant le chiffre d'affaires futur. Les banques utiliseront cette facilité jusqu'à ce que le coefficient qui en résulte soit égal au RCR déterminé par la Banque centrale. Les valeurs de seuil ROC sont des valeurs de référence qui rendent les banques indifférentes à l'utilisation des ressources ROM. La Banque centrale est en mesure de retirer les liquidités en devises du marché en modifiant les taux de RDC ou en injectant des devises sur le marché. La principale différence avec l'intervention directe sur les marchés des changes est qu'elle ne donne pas un signal négatif sous la forme d'une intervention sur le marché et qu'elle contrôle la liquidité en devises sans modifier les réserves de la Banque centrale. Dans ce contexte, le ROM peut être considéré comme un stabilisateur automatique.

D'autre part, les changements dans la structure des ratios de réserves obligatoires ont à la fois renforcé la structure du capital des banques et des institutions financières et rendu la composition de l'emprunt plus structurée. La structure d'emprunt à long terme a été encouragée en augmentant les ratios de

réserves obligatoires des passifs à court terme au moyen de l'obligation de constituer des réserves en fonction de la demande d'échéance. En outre, en choisissant un ratio de réserves obligatoires lié positivement avec la part des passifs étrangers dans le passif total basé sur l'application de l'exigence de réserve basée sur l'effet de levier et la qualité des actifs du secteur a été essayé d'être augmenté.

La dernière partie de l'étude est consacrée aux analyses empiriques. La modélisation de la volatilité des taux de change et la question de savoir si les politiques macroprudentielles appliquées sont efficaces pour réduire cette volatilité et contribuer à la stabilité financière constituent le problème de la thèse. En ce sens, la volatilité du taux de change est estimée avec les modèles ARCH et GARCH. La raison de préférer ces modèles à la méthode des moindres carrés ordinaires (MCO) est que les estimateurs OLS supposent que les termes d'erreur présentent un modèle de variance constant. Cependant, la variance des produits tels que les actions, les marchés des changes et les marchés obligataires, qui sont acceptés comme des données fréquentes, varie et présente un regroupement de la volatilité. Pour cette raison, les modèles ARCH et GARCH sont préférés à la méthode OLS.

Les résultats obtenus à partir du modèle montrent que le problème de l'hétéroscédasticité persiste même s'il est stationnaire. Cependant, on observe que les estimateurs produits dans les constructions ARCH et GARCH ont éliminé à la fois l'hétéroscédasticité et le problème d'autocorrélation. De plus, lorsque le modèle de retour FX est estimé, la méthode E-GARCH donne le meilleur résultat et une prévision précise. Des études antérieures qui se concentrent sur les politiques macroprudentielles et la volatilité des changes, utilisaient généralement les modèles de base ARCH et GARCH. Ainsi, cette étude montre que, pour la période 2010 - 2018, la méthode E-GARCH donne le meilleur résultat pour prévoir la volatilité des changes. Des politiques macroprudentielles mises en œuvre, il a été établi que le ROM est un moyen efficace de réduire la volatilité durant la période de liquidité mondiale vers les pays en développement entre 2010 et 2013. Cependant, lorsque le même jeu de données est étendu jusqu'en 2018, il donne des résultats différents. Le coefficient ROM est insignifiant, c'est-à-dire qu'aucun effet pour réduire la volatilité n'est observé. La principale raison de cela lorsque la condition de liquidité mondiale est contractée, ROM perd son efficacité à réduire la volatilité du FX. La baisse de l'appétit pour le risque conduit les investisseurs à sécuriser les instruments

d'investissement dans leur ensemble, réduisant ainsi l'efficacité des politiques dans les pays en développement.

ABSTRACT

This study is a brief review of the economic recovery efforts that started with the global financial crisis in 2008 and continue to daylight. Macroprudential policies applied in both developed and developing countries have been examined in detail. It has been tried to explain in which methods these policies will provide financial stability in Turkey. The main question in this study is to examine whether macroprudential policies are effective to contribute the financial stability by reducing the FX volatility or not.

By converting its traditional policy into full inflation targeting regime gradually and adopting the price stability as the primary objective in 2006, the Central Bank of the Republic of Turkey (CBRT), has realized with the crises that monetary policy that ignoring the financial stability and focusing only on price stability may be risked for the inflation targets as well. It has been understood that financial stability is a prerequisite to achieve the price stability and then monetary policy targets have been redesigned. To reduce the adverse effect of the capital inflows on financial markets, some new economic policy packages have been implemented during the crises period. In this regard, the CBRT has developed some unconventional monetary policy tools beside the conventional ones. These policies have generally been called as macroprudential policies. The one target – one tool policy (price stability – short term interest rates) has been left and a new monetary policy tool combination (structural and cyclical) which taken into consideration both price and financial stability have been implemented by CBRT. With this policy mix, new ultimate and intermediate targets have been determined and implementation of monetary policies was reviewed.

Two fundamental variables followed by the CBRT as the main indicator for financial stability has been exchange rate volatility and credit growth rates. These two channels have an extra importance for the CBRT since they have both indirectly affected the price stability as well. In this study, macroprudential policies to prevent exchange rate volatility and their contribution to maintain financial stability will have been tried to explain.

In the paper, firstly, econometric models which are used to model exchange rate fluctuations are introduced. These are the most fundamental ARCH (Autoregressive Conditional Heteroscedasticity) and GARCH (Generalized Autoregressive Conditional Heteroscedasticity) models. The main difference that separates these models from the Ordinary Least Squares (OLS) method is based on the assumptions made by the second model on the variance of the error term. In the ordinary least squares method, the variance of the error term is assumed to be constant and assumed to be a structure that does not change over time. But it is inevitable that volatility clustering and changing variance (heteroscedasticity) are high in time series with high frequency such as exchange rate, stocks. For this reason, the empirical studies in the study were examined with ARCH and GARCH models taking into account the changing variance structure.

The second part of the study is devoted to macroprudential policies applied globally, in developed and developing countries. In general, similar policy instruments have been introduced, but some countries have their own specific applications. Mainly macroprudential policies are related to loans and capital regulation. Leverage-based sanctions, liquidity regulations and measures to improve capital structure are the best known of these. Different trypes of policy implementation in these countries were explained in detail.

In the next chapter which constitutes the basic objective of this thesis, studies and indicators are described for ensuring financial stability in Turkey. The two main indicators of financial stability followed by the Central Bank, credit expansion and exchange rate volatility have been examined in detail. It was concluded that financial stability is a prerequisite for price stability. It has been understood that a financial system in which exchange rate movements are stable and credit growth rates are in line with economic principles will contribute to both financial and price stability.

Unconventional monetary policies (macroprudential policies) implemented in Turkey is actively used by the Central Bank in the period after 2010. Among them; asymmetric interest rate corridor, reserve option mechanism, liquidity management with required reserves based on maturity and leverage are the fundamental tools. The asymmetric interest rate corridor is a flexible tool that allows the Central Bank to influence the interest rates on the interbank market on a daily basis without changing the policy rate. With the global crisis, the corridor's width

began to function as a monetary policy tool, although it was used before not similar to this function. In the period when capital inflows are increasing, corridor sub-band is extended downward and short-term capital inflows are deterred, while corridor upper band is increased and implicit interest hike is made in periods when risk appetite decreases.

In liquidity management, it is aimed that the interest rate corridor and the required reserves are treated as complementary policy tools. This system, which is also called the policy mix, is a system in which several tools are deactivated at the same time since it may sometimes be impossible to reach several targets with only one policy tool. When the capital inflows accelerated, the Central Bank, which wants to ease the pressure on the exchange rate, has widened corridor downwards, and results in a decline in the market interest rates. However, although the rate of exchange rate volatility has been reduced, the use of loans with relatively low interest rate have increased. The Central Bank, which wants to ease the pressure on the currency in an environment, has reduced interest rates on one hand and increased the required reserves on the other, thus restricting the credit utilization of the banks.

The Reserve Option Mechanism (ROM) is a flexible mechanism that allows the Central Bank to adjust the Turkish Lira and foreign exchange liquidity in the market without directly intervening in exchange rate fluctuations. Basically, ROM can be expressed as the ability to set up the required reserves as foreign currency and gold, that should be held in the Central Bank accounts. Coefficient indicating how much FX or gold is to be set per unit of Turkish Lira is the Reserve Option Coefficient (ROC). The most important thing that distinguishes ROM from other monetary policy applications is that ROM is not a necessity but a matter of choice. Each bank and financial institution has the right to use or not to use the ROM facility by solving its own optimization problem. The variables that they use when solving this optimization problem are Turkish Lira and Foreign Exchange costs and exchange rate expectations regarding future turnover. The banks will use this facility until the resulting coefficient is equal to the ROC determined by the Central Bank. Threshold ROC values are benchmark values that leave banks indifferent for using ROM facilities. The Central Bank is able to withdraw foreign currency liquidity from the market by changing the ROC rates or inject foreign exchange into the market. The main difference of this from direct foreign exchange intervention is that it does

not give a negative signal in the form of intervention to the market and control the foreign currency liquidity without making a change in the reserves of the Central Bank. In this context, the ROM can be thought of as an automatic stabilizer.

On the other hand, changes in the structure of required reserve ratios both strengthened the capital structure of banks and financial institutions and made the composition of borrowing a more healthy structure. Long-term borrowing structure was encouraged by increasing the required reserve ratios of short-term liabilities through the reserve requirement based on maturity application. In addition, by choosing a positively related required reserve ratio with share of foreign liabilities in the total liability based on the leverage-based reserve requirement application and the asset quality of the sector was tried to be increased.

The last part of the study is devoted to empirical analyzes. The modeling of the exchange rate volatility and whether the applied macro-prudential policies are effective to reduce this volatility and contribute to financial stability constitute the problem of the thesis. In this sense, exchange rate volatility is estimated with ARCH and GARCH models. The reason for preferring these models instead of the ordinary least squares (OLS) method is that the OLS estimators assume that the error terms exhibit a constant variance pattern. However, the variance of products such as stocks, foreign exchange and bond markets, which are accepted as frequent data, is varying and exhibits a volatility clustering. For this reason, the ARCH and GARCH models are preferred to the OLS method.

Results obtained from the model show that the problem of heteroscedasticity persists even if it is stationary. However, it is observed that the estimators produced in the ARCH and GARCH constructs have removed both the heteroscedasticity and the autocorrelation problem. Furthermore, when the FX return pattern is estimated, E-GARCH method is giving the best result and accurate forecast. Previous studies which are focusing on the macroprudential policies and FX volatility, generally used the basic ARCH and GARCH models. Thus this study brings that, for the period 2010 – 2018, E-GARCH method is giving the best result to forecast FX volatility. From the macroprudential policies implemented, it was founded that ROM is an effective way to reduce volatility in the period of global liquidity moving to developing countries between 2010 and 2013. However, when the same model dataset is expanded until 2018, it is giving different results. The ROM coefficient is

insignificant, i.e. no effect to reduce the volatility is observed. The main reason for that when the global liquidity condition is being contracted, ROM is loosing its effectiveness to reduce FX volatility. The decline in risk appetite leads investors to secure investment instruments as a whole, reducing the effectiveness of policies in developing countries.

ÖZET

Bu çalışma, 2008 küresel finansal kriziyle başlayan ve günümüze kadar devam eden ekonomik toparlanma çalışmalarının özet bir incelemesidir. Hem gelişmiş hem de gelişmekte olan ülkelerde uygulanan makroihtiyati politikalar detaylı olarak incelenmiştir. Uygulanan bu politikaların finansal istikrarı hangi yöntemlerle sağlayacağı açıklanmaya çalışılmıştır. Çalışmadaki ana sorunsal ise Türkiye'de uygulanan makroihtiyati politikaların, döviz kuru oynaklığını düşürerek finansal istikrara bir katkı sağlayıp sağlamadığının test edilmesidir.

2006 yılında enflasyon hedeflemesi rejimine geçerek fiyat istikrarını temel amaç olarak benimseyen Türkiye Cumhuriyet Merkez Bankası (TCMB), krizle birlikte fiyat istikrarına odaklanıp finansal istikrarı göz ardı eden para politikalarının enflasyon hedeflerini de riske attığını fark etmiştir. Finansal istikrarın fiyat istikrarına ulaşmada bir ön koşul olduğu anlaşılmış ve para politikası amaçları bu kapsamda yeniden dizayn edilmiştir. Küresel kriz boyunca yaşanan yüksek sermaye girişlerinin finansal piyasalar üzerindeki olumsuz etkilerini sınırlamak amacıyla bir dizi ekonomi politikasını uygulamaya konulmuştur. Bu kapsamda kriz süresince TCMB, geleneksel politikaların yanı sıra bir dizi geleneksel olmayan para politikası araçları geliştirmiştir. Bu politikalara genel olarak makro-ihtiyati politikalar adı verilmektedir. Tek amaç – tek araç (fiyat istikrarı – kısa vadeli faiz oranları) politikası terk edilmiş, hem fiyat istikrarı hem de finansal istikrar amaçlarını gerçekleştirmek amacıyla yeni bir araç bileşeni (döngüsel ve yapısal) uygulamaya konulmuştur. Bu politika karmasıyla, yeni nihai ve ara hedefler belirlenmiş, para politikası uygulamaları bu kapsamda yeniden gözden geçirilmiştir.

TCMB'nin, finansal istikrarın öncü göstergesi olarak takip ettiği iki temel değişken döviz kuru oynaklığı ve kredilerin büyüme hızıdır. Ayrıca bu iki kanal, fiyat istikrarını da dolaylı şekilde etkilemesi nedeniyle de TCMB açısından ayrı bir öneme sahiptir. Bu çalışmada, küresel kriz sonrasında döviz kuru oynaklığını önlemede kullanılan makro-ihtiyati politikalar ile bu politikaların finansal istikrarı sağlamada ne gibi katkıları olduğu açıklanmaya çalışılmıştır.

Çalışmada ilk olarak kur oynaklığını modellemek için kullanılan ekonometrik modeller tanıtılmıştır. Bunların en temeli ARCH (Otoregresif Koşullu Değişen Varyans) ve GARCH (Kapsamlı Otoregresif Koşullu Değişen Varyans) modelleridir. Bu modelleri sıradan en küçük kareler yönteminden ayıran temel fark ikincisinin hata teriminin varyansı üzerine yaptığı varsayımlara dayanmaktadır. Sıradan en küçük kareler yönteminde, hata teriminin varyansı sabit kabul edilmiş ve zaman içinde değişim göstermeyen bir yapıda olduğu varsayılmıştır. Fakat kur, hisse senedi gibi sıklığı yüksek olan zaman serilerinde oynaklık kümelenmesi ve değişen varyans olması kaçınılmazdır. Bu nedenle çalışmadaki ampirik incelemeler, değişen varyans yapısını da dikkate alan ARCH ve GARCH modelleriyle incelenmiştir.

Çalışmanın ikinci bölümü küresel ölçekte, gelişmiş ve gelişmekte olan ülkelerde uygulanan makroihtiyati politikalara ayrılmıştır. Genel olarak birbirine benzer politika araçları devreye sokulmuş olsa da, bazı ülkelerin kendine özgü uygulamaları da bulunmaktadır. Temelde makroihtiyati politikalar krediler ve sermaye düzenlemelerine ilişkindir. Kaldıraca dayalı yaptırımlar, likidite düzenlemeleri ve sermaye yapısını iyileştirmeye yönelik tedbirler bunların en bilinenleridir.

Tezin temel konusunu teşkil eden bir sonraki bölümde, Türkiye'de finansal istikrarın sağlanması için yapılan çalışmalar ve göstergeler açıklanmıştır. Merkez Bankası'nın finansal istikrar için takip ettiği iki temel gösterge olan kredi genişlemesi ve döviz kuru oynaklığı detaylı olarak incelenmiştir. Fiyat istikrarının sağlanabilmesi için finansal istikrarın bir ön koşul olduğu sonucuna ulaşılmıştır. Döviz kuru hareketlerinin istikrarlı, kredi büyüme hızlarının ekonomik temellerle uyumlu olduğu bir finansal sistemin hem finansal istikrarı sağlayacağı hem de fiyat istikrarına katkı sağlayacağı anlaşılmıştır.

Türkiye özelinde uygulanan geleneksel olmayan para politikaları (makroihtiyati politikalar) 2010 sonrası dönemde Merkez Bankası tarafından aktif olarak kullanılmaktadır. Bunların başında; asimetrik faiz koridoru, Rezerv Opsiyonu Mekanizması, vadeye ve kaldıraca dayalı zorunlu karşılıklar ile likidite yönetimi gelmektedir. Asimetrik faiz koridoru, Merkez Bankasına politika faizini değiştirmeden bankalararası piyasadaki faizleri günlük bazda etkilemeye imkan tanıyan esnek bir araçtır. Daha önce de kullanılmakla birlikte, küresel krizle

birlikte koridorun genişliği bir para politikası aracı işlevi görmeye başlamıştır. Sermaye girişlerinin arttığı dönemde koridorun alt bandı aşağı yönlü genişletilip kısa vadeli sermaye girişleri caydırılırken, risk iştahının düştüğü dönemlerde koridorun üst bandı arttırılarak örtülü faiz artışı yapılmaktadır.

Likidite yönetiminde, faiz koridoru ve zorunlu karşılıkların birbirini tamamlayıcı nitelikte işlem görmesi amaçlanmıştır. Politika karması olarak da adlandırılan bu sistem, tek bir değişkenle birden fazla amaca ulaşılamayacağı için birkaç aracın aynı anda devreye alınması şeklindedir. Sermaye girişlerinin hızlandığı dönemde kurdaki değerlenme baskısını hafifletmek isteyen Merkez Bankası koridoru aşağı yönlü genişlettiği anda piyasa faizlerinde bir düşüş meydana gelmektedir. Bununla birlikte kur oynaklığı düşürülmüş fakat görece düşük faiz sonucu kredi kullanımı ve büyüme hızı yükselmiştir. Böyel bir ortamda kurdaki baskıyı hafifletmek isteyen Merkez Bankası bir yandan faizleri indirirken, diğer yandan da zorunlu karşılıkları arttırmış ve bankaların kredi kullandırmasını kısıtlamıştır.

Rezerv Opsiyonu Mekanizması (ROM), Merkez Bankasına kur oynaklığına doğrudan müdahale etmeden piyasadaki Türk Lirası ve Döviz likiditesini ayarlama imkanı veren esnek bir mekanizmadır. Temel olarak ROM, bankalara Merkez Bankası nezdinde tutmakla yükümlü oldukları zorunlu karşılıklarını döviz ve altın olarak tesis edebilme imkanı tanınması şeklinde ifade edilebilir. Birim Türk Lirası başına ne kadar döviz ya da altın tesis edileceğini gösteren katsayı ise Rezerv Opsiyon Katsayısıdır (ROK). ROM'u diğer para politikası uygulamalarından ayıran en önemli nokta ise ROM'un bir zorunluluk değil bir tercih meselesi olmasıdır. Her banka ve finansal kurum kendi optimizasyon problemini çözerek ROM imkanını kullanma ya da kullanmama hakkına sahiptir. Bu optimizasyon sorununu çözerken kullandıkları değişkenler ise Türk Lirası ve Döviz maliyetleri ile gelecek döneme ilişkin kur beklentisidir. Elde edilen sonuçtaki katsayı Merkez Bankası tarafından belirlenen ROK'a eşit olana dek bankalar bu imkanı kullanacaklardır. Eşik ROK değeri bankaları, ROM imkanını kullanıp kullanmama konusunda kayıtsız bırakan referans değerdir. Merkez Bankası ROK oranlarını değiştirerek piyasadan döviz likiditesini çekebilmekte ya da piyasaya döviz enjekte edebilmektedir. Bunun doğrudan döviz müdahalesinden temel farkı ise hem piyasaya kur müdahalesi şeklinde olumsuz

bir sinyal verilememesi, hem de Merkez Bankası rezervlerinde bir değişiklik yaratmadan döviz likiditesinin kontrol edilmesidir. Bu kapsamda ROM bir otomatik istikrarlandırıcı şeklinde düşünülebilir.

Diğer taraftan zorunlu karşılık oranlarının yapısındaki değişiklikler hem banka ve finansal kurumların sermaye yapısını güçlendirmiş hem de borçlanma kompozisyonlarını daha sağlıklı bir yapıya kavuşturmuştur. Vadeye dayalı zorunlu karşılık uygulaması ile kısa vadeli yükümlülüklerin zorunlu karşılık oranları yükselitlerek daha uzun vadeli borçlanma yapısı teşvik edilmiştir. Buna ek olarak kaldıraca dayalı zorunlu karşılık uygulaması ile yurtdışı borçların toplam yükümlülük içindeki payı ile doğru orantılı bir zorunlu karşılık oranı belirlenip, sektörün aktif kalitesi arttırılmaya çalışılmıştır.

Çalışmanın son bölümü ampirik analizlere ayrılmıştır. Döviz kuru oynaklığının modellenmesi ve uygulanan makroihtiyati politikaların bu oynaklığı düşürerek finansal istikrara katkı sağlayıp sağlamayacağı tezin sorunsalını teşkil etmektedir. Bu anlamda, kur oynaklığı ARCH ve GARCH modelleriyle tahmin edilmiştir. Sıradan en küçük kareler (SEK) yöntemi yerine bu modellerin tercih edilmesindeki neden, SEK tahmincilerinin hata terimlerinin sabit bir varyans örüntüsü sergilediğini varsaymasıdır. Fakat sık veri olarak kabul edilen hisse senedi, döviz ve bono piyasası gibi ürünlerin varyansı değişken yapıda olup oynaklık kümesi sergilemektedir. Bu nedenle ARCH ve GARCH modelleri SEK yöntemine tercih edilmiştir.

Model sonuçlarından elde edilen bulgular, kur verisi durağan hale getirilse dahi değişen varyans sorunun devam ettiğini göstermektedir. Fakat ARCH ve GARCH yapısında üretilen tahmincilerin hem değişen varyans hem de otokorelasyon problemini ortadan kaldırdığı gözlenmiştir. Buna ek olarak E-GARCH yönteminin doğru tahmincileri üretmede en etkili yöntem olduğu bulunmuştur. Makroihtiyati politikaların kur oynaklığı ve finansal istikrarla ilişkisini inceleyen çalışmalar genelde ARCH ve GARCH ana modellerini kullanmışlardır. Uygulanan makroihtiyati politikalardan ROM, 2010-2013 yılları arasındaki küresel likiditenin gelişmekte olan ülkelere hareket ettiği dönemde oynaklığı düşürmede etkili bir uygulama olduğunu göstermiştir. Fakat aynı model veri seti genişletilerek 2018 yılına kadar uzatıldığında farklı sonuç vermektedir. ROM katsayısı anlamsız çıkmakta, yani oynaklığı düşürücü bir etkisi

gözlemlenmemektedir. Bunun muhtemel nedeni, risk iştahındaki düşüşün yatırımcıları bir bütün halinde güvenli yatırım araçlarına yöneltmesi, gelişmekte olan ülkelerdeki politkaların etkinliğini düşürmektedir.

INTRODUCTION

Starting from 2008 in developed countries and then spillover to emerging economies gradually, the global financial crises, has been one of the most controversial economic concerns for the recent years and probably will be for the next decades. Default problems at the subprime mortgages in US have been accepted as the initial point triggering the crises. Starting in a small part of the financial markets, these defaults has been rapidly expand to the other borrowing/lending instruments, banking sector and finally to the whole financial system. At the beginning of the crises; firms that too big to fail and recessions in the overall economies have increased the uncertainty, triggered the volatility in pricing decision and alleviated the conventional relationship between macroeconomic variables. During this period where the traditional methods were insufficient to reach the solution, countries dealing with crises have started to implement an unprecedented monetary and fiscal policy.

Being at the top among the countries suffering from crises, the US, has implemented a new set of economic policy packages to reduce the adverse effects of the crises and to start the recovery. The most apparent and effective one for the emerging economies has been the quantitative easing (QE) policies which have been done through buying treasury bills and mortgage backed securities from the market. The US central bank, Federal Reserve or FED, has determined its QE policies targets as state dependent rather than time and has stated that “Unless inflation has been rise up above %2, until the unemployment rate has been reduced to below %6, FED will proceed to funding the markets” (FOMC decision dated on January 25th 2012). QE policies which have been started by developed economies central banks such as US, British and Japan; have resulted in a huge amount of capital flows to the emerging economies that have relatively higher yields and capital returns.

Through the fifth year of the crises, on May 2013, the statement by FED as the unemployment rates has been converging pre-crises level, improvement in employment condition has been witnessed and hence QE policies can be tapered in the following year had a shocked on the emerging market economies especially whom have huge amount of current account deficit and need external financing. It

has been started a capital outflow from the EM, deterioration in current account and exchange rates (FX) have followed this collapse.

Turkey is one of the countries, which mentioned above and then called in literature as the “Fragile Five” which has a high current account deficit and inflation, and needing external financing to achieve the investment and growth target (for the rest, see the Morgan Stanley global outlook, August 1th 2013). Turkey has experienced a massive amount of capital inflow, increase in credit growth ratio, and a huge appreciation in exchange rates during the QE between 2009 and 2012. The statement by FED as the QE policies will have been tapered gradually and then the interest rates has been risen up, has started a capital outflow from Turkey, FX and current account deterioration.

In this study, we will briefly explain how Turkey and other emerging economies deal with quantitative easing and tapering policies to prevent from adverse effects of capital inflow and outflow. After giving the previous studies in the literature, we will try to explain firstly which models we are using to predict the volatility in the market. Then it will be explained briefly the macroprudential policies and applications throughout the world. Lastly we will focus on the policy applications and their contributions to financial stability in Turkey with empirical results.

LITERATURE REVIEW

Uncertainty and volatility are the main notions mentioned frequently in researches due to their effects on the forecasting economic variables accurately or with the minimum error. Volatility, due to being accepted as one of the fundamental indicator of the risk in financial markets, should be measured correctly to forecast models and the risk indicators accurately, as well.

Although volatility had been modeled under the normal distribution assumption in conventional econometric models, insufficiency of this assumption has been realized over time. It has been seen that financial time series like exchange rates and stocks don't have the normal distribution and have fat tail with kurtosis around the mean[1] (Unal, 2009). In addition, in modeling the exchange rates, it has been understood that volatility isn't constant and change over time[2] (Hsieh, 1988). In this stage, Engle[3] (1982) was developed a new model considering changing variance in financial time series, called ARCH (Autoregressive Conditional Heteroscedasticity) to forecast these nonstationary financial models. To be accepted as the milestone in literature, this model has frequently cited and become one of the most used volatility forecasting model on these days. By improving Engle study, Bollerslev[4] (1986) was developed the GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model. Although today these two models are mainly used in order to estimate the volatility, there are other versions of those models considering the changes in the structure of time series as EGARCH (Exponential Generalized Autoregressive Conditional Heteroscedasticity) and TGARCH (Threshold Generalized Autoregressive Conditional Heteroscedasticity).

Besides theoretical outline, there is a comprehensive literature for the application of exchange rate volatility. Obstfeld – Rogoff[5] (1998), by deepening the study in 1995-1996, has worked on the exchange rate volatility. They found out that exchange rate volatility has a cost on their welfare function via consumption decision

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[2] David Hsieh (1988), Implications of Nonlinear Dynamics for Financial Risk Management
[3] Robert.F.Engel (1982), "Autoregressive Conditional Heteroskedasticity With Estimates Of Variance Of United Kingdom Inflation", Econometrica
[4] Tim Bollerslev (1986); Generalized Autoregressive Conditional Heteroscedasticity Model
[5] Kenneth Rogoff (1999), Perspectives on Exchange Rate Volatility

since it has created an uncertainty for the future. Devereux – Engel[6] (2003) has studied on the behavior of price and exchange rates for the implementation of monetary policy in the open economies. In their findings, different from the Obstfeld – Rogoff, incidence of the exchange rate volatility on the price and consumption decision has been highly correlated with the exchange rate regime. They reached out that if the goods and services are bought and sold in the prices of domestic country, it may be have an effect on the welfare; otherwise the results will be the same as in the fixed exchange rate regime.

Giannellis – Papadopoulos (2011), in the European Union, has analyzed reasons of the exchange rate volatility against EUR for the countries whom are not a member of monetary union. It was found that interest rate spreads were the main reason for the volatility in exchange rates, and also other monetary and financial indicators (GDP growth, return in stocks) were highly correlated with exchange rate volatility. Grossmann et al[7] (2014), in the research for dynamics of the exchange rates; has examined the relations between real GDP, reserves, interest rates, stocks and exchange rates. The findings of the research were that exchange rate volatility has been affected from those of four explanatory variables significantly, and this interaction was more apparent in developing countries than in the developed ones. Morana (2007) analyzed the macroeconomic causes of FX volatility and found that; output and inflation was highly but money supply increase was lowly results in FX volatility.

By examining the correlations between FX volatility and FX regimes, Kocenda – Valacy[8] (2006), showed that interest rate differentials raised the FX volatility and conversion from fixed to flexible FX regimes has an extra contribution to those volatilities. Berganza – Broto[9] (2012); in their study which examining the relations of inflation targeting, FX interventions, and exchange rate volatility in emerging markets, reached that although inflation targeting decreases the stability of FX, it is more effective in reducing the FX volatility compared to alternative

[6] Michael B.Devereux and Charles Engels (2003), Monetary Policy in the Open Economy Revisited: Price Setting and Exchange Rate Flexibility
[7] Grossmann et al (2014), Dynamics of Exchange Rate Volatility
[8] Evžen Kočenda and Juraj Valachy,2006, Exchange rate volatility and regime change
[9] Juan Carlos Berganza and Carmen Broto, 2012, Flexible inflation targets, forex interventions and exchange rate volatility in emerging countries

regimes. Ganguly – Breuer[10] (2010) and Zapatero (1995) worked on FX volatility; the formers resulted that big parts of FX volatility comes from relative price differentiation, and the latter one found that asset prices are the reasons of FX volatility.

Çağlayan – Dayıoğlu[11] (2009) tried to forecast FX volatility with ARCH methods and compared the results with alternative estimations. They found out that Asymmetric Conditional Heteroscedasticity models were fitter than the symmetric one in the process of volatility forecasting.

Despite the fact that the literature on macroprudential policy has been relatively new, it has been gaining a density since the global financial crises. Of all these, Galati – Moessner[12] (2011) are one of the most prominent one who have analyzed the macroprudential policy comprehensively in terms of tools and effectiveness. Beside them, Borio[13] (2013) examined the macroprudential policies in financial regulation and auditing, he showed that financial stability and macroprudential policy work cooperatively. Clement[14] (2010) focused on the origins of macroprudential term and its evolution over time. Despite the term has been created in 70s, it has been used to describe the indebtedness of the country, financial innovations and effectiveness, achievements of systematically important financial institutions throughout the time.

Crockett[15] (2000) claimed that while reaching the financial stability, the cooperation of macro and microprudential policies increased the efficiency. Perotti – Suarez[16] (2010) suggested that sanctions on liquidity risk could be worked as a macroprudential policy to retract the bank for risk accumulation. Lim et al[17] (2011) analyzed the efficiency of time and tools in the implementation of macroprudential

[10] Srideep Ganguly and Janice Breuer, Nominal exchange rate volatility, relative price volatility, and the real exchange rate, Journal of International Money and Finance, 2010, vol. 29, issue 5, 840-856
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[12] Gabriele Galati and Richhild Moessner (2011), Macroprudential policy – a literature review, BIS Working paper
[13] Claudio Borio (2013), Macroprudential Policies: What have we learnt? BIS Working Paper
[14] Piet Clement (2010) The term "macroprudential": origins and evolution, BIS Working Papers
[15] Crockett.A, 2000, Marrying the macro and microprudential dimensions of financial stability, BIS
[16] Enrico Perotti and Javier Suarez (2010); Liquidity Risk Charges as a Primary Macroprudential Tool, DSF Policy Paper Series
[17] C. Lim, F. Columba, A. Costa, P. Kongsamut, A. Otani, M. Saiyid, T. Wezel, and X. Wu (2011); Macroprudential Policy: What Instruments and How to Use Them? Lessons from Country Experiences; IMF Working Papers

tools and tried to find that which tools are effective at the appropriate time. Jeanne[18] (2014) emphasized the international coordination of macroprudential policy and dependency, by warning that unless measures taken this may start a capital war. Farhi - Werning[19] (2013) examined the macroprudential policy effectiveness in case of nominal rigidities in goods and money market and reached out that due to creation of demand externalities, those policies will be ineffective.

For the contribution of Turkish authors to literature in FX volatility and macroprudential policies in addition to financial stability, Central Bank working papers and research notes are beneficial. Among them, A.Hakan Kara (2012)[20] reached that new policy instruments are effective to reduce current account deficit and to achieve a soft landing in macro financial risks. During the global financial crises, macroprudential policies, especially counter cyclical ones, have been used to effectively for a soft landing of the economy. Aysan et al (2014)[21] found out that gross capital flows to Turkey have become less sensitive to global banking activities. Moreover, they reached that macroprudential policies appear successful to reduce the effects of volatile short term capital flows on macro outlook. Oduncu et al (2013)[22] got that ROM is significant in lessening the volatility of Turkish lira in the period analyzed between 2011 and 2013. Therefore, in addition to being an effective policy tool in increasing the FX reserves of CBRT and supporting liquidity management of the banking system, ROM contributes to the financial stability of Turkey through limiting the adverse effects of excess capital flow volatility.

Alper, Kara and Yorukoglu (2012)[23] found that ROM can be used as a useful mechanism for macroeconomic and financial stability purposes. ROM stands out compared to other similar instruments in that it can reduce the negative reflections of capital inflows on exchange rates and FX loans on a limited or no impact of TL interest rates. Oduncu, Ermisoglu and Polat (2013)[24] reached out the new monetary policy framework have a significant contribution to decrease in the volatility of

[18] Olivier Jeanne, Macroprudential Policies in a Global Perspective NBER Working Paper No. 19967 Issued in March 2014
[19] Emmanuel Farhi and Iván Werning (2013) ; A Theory Of Macroprudential Policies In The Presence Of Nomınal Rigidities, Nber Working Paper Series
[20] Küresel kriz sonrası para politikası, A.Hakan Kara, 2012, www.tcmb.gov.tr
[21] Macroprudential policies as buffer against volatile cross-border capital flows, Aysan et al, 2014, www.tcmb.gov.tr
[22] Reserve Options Mechanism and FX Volatility, Oduncu et al, 2013, www.tcmb.gov.tr
[23] Rezerv Opsiyonu Mekanizması, Alper – Kara – Yorukoglu, 2012, www.tcmb.gov.tr
[24] The Effect of CBRT's New Policy Mix on the Volatility of Credit Growth, Oduncu – Ermisoglu – Polat,2013, www.tcmb.gov.tr

credit growth. Therefore, it can be said that new monetary policy framework of CBRT contributes to financial stability in Turkey by lessening the credit growth volatility. Akcelik et al (2013)[25] found that new policy instruments and applications are effective to increase the resilience of the financial system against external shocks. This mechanism gives a flexibility to monetary authority to differentiate and manage the domestic and foreign liquidity in the market.

[25] The Turkish Approach to Capital Flow Volatility, Akcelik et al, 2013, www.tcmb.gov.tr

CHAPTER 1

1. VOLATILITY MODELS AND THEIR FEATURES

Volatility or the movement of the variances up and downward during the time is one of the fundamental issues of financial time series. Financial instruments which can give opportunity to investors in case of estimating not only the direction but also the size of movement like exchange rates, stocks, equity and options in the market have a contrary structure against the classical econometric assumptions. In the classical forecasting methodology, (the OLS methods that includes the Gaussian assumption), variance is constant throughout the time (homoscedastic). If this assumption is violated, then the variance assumed to be heteroskedastic and should be adjusted for OLS estimation to be efficient.

The financial time series is a little bit different from the classical time series in this manner. The estimation in the stationary time series by assuming the mean and the variance don't change as the time change is no longer valid in the financial time series. When the high frequency financial time series like FX, bond, bill and stocks have been analyzed, it is understood that those series have some characteristic features. Those are as follows;

a) **Co-movement:** the term used to describe the relationship for the financial instruments operated in the market like FX, stock and bills. The direction of the relation can either be positive or negative. For instance, the opposite direction between the rates for benchmark government bonds and stock, or same trend between government bond rate and exchange rate shows co-movement.
b) **Volatility Clustering:** As one of the basic characteristic of the financial time series, the volatility clustering means that the big movement has followed by big movement like the small one followed by the small movements. Since lots of the technic analyzes tries to capture the trend, the

previous moving average and volatility affects the following trends in a clustering way. If the estimation is made only for cross-section, this will not be the case, which is the feature comes from high frequency and time series itself.

c) **Fat Tail:** The series having normal distribution has a symmetric and equal distribution around the mean. This feature converts into outliers from the mean and have a high kurtosis above the mean in the financial time series. The outlier has rare in the normal distribution; however, in the high frequency data there are lots of outliers and those lifted the mean above the sample. The volatility clustering is the main reason of the fat tail and leptokurtic shape of the financial time series.

d) **Long Memory:** It is used to describe the situation that even if in high frequency and long time series, the two end points at each side can have autocorrelation. This is actually a unit root problem and can be corrected.

Before passing from the financial time series having the above features to the volatility models, it can be useful to give the basic set ups for those series. These are autocorrelation, moving average, stationary series and unit root problem which are closely related with time series models.

1.1 Autoregression (AR), Moving Average (MA) and Autoregressive Moving Average (ARMA)

The econometrics, in the mean of forecasting methods, is divided into three parts. As the first one, the cross section analyzes produces estimation by assuming variables are random and independent from time. On the other hand, the time series models get the forecasting results of the variables in terms of their values throughout the time. By considering both time and cross-section features of variables at the same time, the panel methodology produces results of random variables at different time, meaning that it combines the time and cross-section dimensions.

Autoregression and moving average models are the two fundamental topics in the time series analyzes. They are used as benchmark to develop advanced time series forecasting and built up new estimation models.

1.1.1 Autoregression (AR)

Composing of the basic econometric forecasting methodology, the classical linear regression model (CLLM) have some assumptions on the dependent variable, mean and the variance of the model in the process of getting results through ordinary least square (OLS) method. One of the most important one among these, the error terms are independent or serially uncorrelated with each other. At the same time, mean and the variance of the error term are constant and time independent. As a formulation;

$$Y_t = \beta_1 + \beta_2 X_t + u_t \quad (1)$$

$$E(u_t) = 0, \text{Var}(u_t) = \sigma^2, E(u_t u_{t+s}) = 0, \text{Cov}(u_t u_{t+s}) = 0 \quad (2)$$

The models and the equation above describe a basic regression with one explanatory variable and its error terms features, respectively. But these assumptions are not valid for every situation. While analyzing their time dimension for some variables, it is realized that their error terms are correlated. These types of models are called autoregressive models. In these models E (ut us) ≠ 0 and other characteristics of error terms are as follows;

$$Y_t = \rho Y_{t-1} + \varepsilon_t \quad \text{or} \quad u_t = \rho u_{t-1} + \varepsilon_t \quad (3)$$

$$E(\varepsilon_t) = 0, \text{Var}(\varepsilon_t) = \sigma^2, \text{Cov}(\varepsilon_t, \varepsilon_{t+s}) = 0 \quad (4)$$

The equation (3) shows that the dependent variable or error terms in the first equation (u_t) are not random from now on. In contrast, (Y_t) and (u_t) are a function of their former values. The (ε_t) in the same equation represents the random error term and includes all of the assumptions for CLLM. The identities at (4) describe the features of this error term and this type of errors called as white noise in econometric and engineering literature. The equation (3) is called Markov's first degree autoregressive AR (1) process.

The error term can be an estimation of all its previous values and in this case it said it is autoregressed with the number of lag operators (n). One important point here is that the autocorrelation term ρ is strictly lower than 1 in absolute value ($|\rho| < 1$). In the case of $|\rho| = 1$, the variance of ut goes to infinity and there is no way to make an estimation. Additionally, when $|\rho| < 1$, the models become stationary meaning its mean and variance don't change over time.

1.1.2 Moving Average (MA)

The dependent variable in autoregressive process formulized as a function of its lag values. Beside this, it is possible to formulize Y_t with its past values and error terms weighted averages. Analyze the models below:

$$Y_t = \mu + \beta_0 u_t + \beta_1 u_{t-1} + \beta_2 u_{t-2} + \ldots + \beta_q u_{t-q} \quad (5)$$

The model above showing that dependent variable consists of u_t's q degrees of average lag values. These error terms are white noise with zero mean and constant variance. Since Y_t's lag values are a function of u_t's, in here there is a moving average. Every lag takes a new value by dropping the last observation from the sample. This process is called q's degree of moving average and symbolized as MA (q). In here some Gaussian assumption in OLS estimation are violated. The most important one assuming error term and dependent variables are independent and their covariance is zero (Cov (Y_t u_t) = 0). As it can be seen from the model, Cov (Y_t u_t) = 0 is not valid so longer and change with respect to autocorrelation terms.

1.1.3 Autoregressive Moving Average (ARMA)

Like dependent variable is being consisted of independent variables, as we mentioned above, it can be a function of error term or its own lag values. On the other hand, Y_t may be modelled as a combination of those lag variables like below.

$$Y_t = \sum_{t=1}^{n} \rho Y_{t-1} + \sum_{j=1}^{m} \beta u_{j-1} \quad (6)$$

The equation above is called as autoregressive moving average model with "n, m" degree and symbolized as ARMA (n, m). Furthermore, this model represents a stationary time series. The mean, variance and the covariance of the Y_t is time independent. But this can't be applicable in every time and everywhere. If an ARMA (n,m) series is not stationary and if cointegration problem can be solved by differencing ARMA "d" times, in that case this model called as d'th degree cointegrated ARMA models and shown as ARIMA (n,d,m).

1.2 Stationary Series and Unit Root Problem

Being stationary means, in a time series model mean and the variance don't change throughout the time and the covariance depends on the time difference between the variables rather than the estimation time (Damodar N. Guajarati Basic Econometrics, Fourth Edition, 2004, p797-800). Indeed the importance of the stationarity for estimation is deeper than its description. If a time series is non-stationary, it is not only violate the Gauss-Markov assumptions, but also can't be generalized for more forecasting. In this situation, either the results based on regression or forecasts are valid only for the existing sample, not for all. But this is a disaster for the models, since the main objective is estimating explanatory variables movement and making general forecast for the future by basing upon to existing sample.

$$Y_t = \rho Y_{t-1} + \varepsilon_t \qquad (7)$$

When $\rho = 1$, the equation (7) has unit root and non-stationary. $Y_t = Y_{t-1} + \varepsilon_t$ known in literature as random walk and one of the most prominent unit root series. When $0 < \rho < 1$, these series are stationary and converges its mean over the time. If a unit root is detected in a time series, it makes almost impossible to get an accurate result from the regression. There are some fundamental tests to detect whether a time series have a unit root or not. The most prominent one is Dicky – Fuller tests, additional to Phillips – Perron tests (Damodar N. Guajarati Basic Econometrics, Fourth Edition, 2004, p815). In Dicky – Fuller tests (also in augmented Dicky – Fuller tests). For the threshold value on hypothesis, we are using tau statistics. Null

hypothesis is based on "there is a unit root in times series". If the ρ value in the regression is greater than tau statistics in absolute value, we can reject the null hypothesis and can say that time series is stationary (there is no unit root)

If a time series is non stationary or has a unit root, it should be made stationary to make forecasting. One of the basic methods to do so, taking difference and making upward and downward movements a trend since it represents the real picture. The question of how many times a series differenced to become stationary is the same with at which degree a series cointegrated and related programs like E-view, Stata, R- Studio can easily solve this problem.

1.3 Autoregressive Conditional Heteroscedasticity (ARCH) Models

The CLLM assumes that the variance of the model is constant, if not; by converting it can be made constant. However Engle developed a new model which estimates the volatility of inflation in U.K. This is Autoregressive Conditional Heteroscedasticity (ARCH) model. As it can be inferred from its name, ARCH, is a model with heteroskedastic variance and that variance is being consisted of an autoregressive process.

Financial time series is not stationary in its raw format and become stationary by taking difference. However, even its differenced and stationary variables have volatility clustering structure. For this reason, estimating these variables with ARCH models produces robust results. To do so, Engle[26] offers the following model:

$$y_t = \alpha y_{t-1} + \varepsilon_t \quad (8)$$

$$y_t = \varepsilon_t y_{t-1} \text{ or } y_t = \varepsilon_t x_{t-1} \quad (9)$$

$$y_t = \varepsilon_t h_t^{1/2} \quad \text{and} \quad h_t = \beta_0 + \beta_1 y^2_{t-1} \quad (10)$$

The number (8) is a basic AR (1). The error term ε_t in this model is white noise with E (ε_t) = 0 and Var (ε_t) = σ^2. While conditional mean of Y_t is αy_{t-1}, its unconditional mean is zero. The equation (9) shows how the variance can be

[26] Robert F.Engle (1982); Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation, Econometrica

modelled. In the first part of (9) variance is a function of its lag values, whereas in the second it is determined by an exogenous variable x_{t-1}. (for $y_t = \varepsilon_t\, y_{t-1}$ Var $(y_t) = \sigma^2\, y^2_{t-1}$ and for $y_t = \varepsilon_t\, x_{t-1}$ Var $(y_t) = \sigma^2\, x^2_{t-1}$). All these variances are conditional and unconditional variances are zero. The model in (10) Autoregressive Conditional Heteroscedasticity (ARCH) model with Var $(\varepsilon_t) = 1$ and E $(\varepsilon_t) = 0$. In here y_t is a proportional with exogenous variable h_t which is related with lag values of y_t. The variance of Y_t is h_t and it has a polynomic structure (Var $(y_t) = h_t = \beta_0 + \beta 1\, y^2_{t-1}$).

In order to understand whether there is an ARCH effect in a model, Engle offers a way similar to white test in OLS estimation. In terms of that:

$$Y_t = \beta_1 + \beta_2\, X_{2t} + \cdots + \beta_k X_{kt} + u_t \tag{11}$$

$$u_t \sim N[0\ ,\ \alpha_0 + \alpha_1 u^2_{t-1}] \tag{12}$$

The model above in (11) shows that the dependent variable Y_t is determined by explanatory variables X_{ts} and random error term u_t. As it can be inferred from (12), u_t has a normal distribution with zero mean and $\alpha_0 + \alpha_1 u^2_{t-1}$ variance. The main point here is that the error term doesn't have a constant variance. The variance changes with respect to its lag values square. To see until where the lag process continues and whether there is an ARCH effect, the following model is offered.

$$\text{Var}\,(u_t) = \sigma^2_t = \alpha_0 + \alpha_1 u^2_{t-1} + \alpha_2 u^2_{t-2} + \alpha_3 u^2_{t-3} + \ldots + \alpha_n u^2_{t-n} \tag{13}$$

What is difference from the normal white test here is that the explanatory variables for variance are square lag values of u_t rather than x_t. Whether there is an ARCH process here can be found through F or Chi-Square test in OLS estimation. The null hypothesis is $\alpha_1 = \alpha_2 = \alpha_3 = \ldots\ldots = \alpha_n = 0$ against the alternative hypothesis claiming all these values aren't zero at the same time. If the F or other test statistic is significant for an interval, in that case we can reject the null hypothesis. And this gives us Var $(u_t) = \alpha_0$. Hence it can be said that variance isn't determined by its lag values or any other explanatory variables, it has a constant value and doesn't follow an ARCH process.

1.4 Generalized Autoregressive Conditional Heteroscedasticity (GARCH) Models

The ARCH model developed by Engel (1982) showed that variance, different from the CLRM, is constant in its unconditional form whereas it has a square proportion with its lag values in conditional form. ARCH models doesn't take variance as a constant measure of explanatory variables, rather it models variance and made assumption for that.

It is Bollerslev (1986) whom generalizing the model developed by Engle and gaining the literature in 1986. In the model named as Generalized Autoregressive Conditional Heteroscedasticity (GARCH), Bollerslev (1986), similar to way of converting AR process to ARMA, added some small new tool to ARCH model to evolve it into GARCH. The raw form of the model is below:

$$\sigma^2_t = \alpha_0 + \alpha_1 u^2_{t-1} + \alpha_2 \sigma^2_{t-1} \quad (14)$$

The model in (14) is a general demonstration of GARCH. According to that model, the variance of the model is not only determined by the square lag values of error term but also its own lag values square. This is a GARCH (1, 1) model and can be generalized in terms of lag operators in error and variance terms as GARCH (p, q). Being in a similar structure and the logic with ARCH, at GARCH there is an ARMA process. Beside this, in order to be stationary, the sum of absolute value of the error and variance coefficients should be strictly less than 1.

1.5 Threshold Generalized Autoregressive Conditional Heteroscedasticity (TGARCH) Models

The threshold GARCH[27] is a special type of GARCH designed to test whether the effects of shock on volatility is symmetric or not.

[27] Zakoian, J. M. (1990). Threshold Heteroscedastic Models. CREST, INSEE, Paris

$$\sigma^2_t = \omega + \alpha_1 u^2_{t-1} + \alpha_2 D_{t-1} u^2_{t-1} + \beta\, \sigma^2_{t-1} \quad (15)$$

$$D_{t-1} = \begin{cases} 1 & u_{t-1} < 0 \\ 0 & u_{t-1} \geq 0 \end{cases} \quad (16)$$

Equation (15) added a new assumption to GARCH (1,1). As a dummy variable, D_{t-1} takes 0 and 1 in the model. In here $D_{t-1} = 0$ represents the benchmark point for further assumption. If the coefficient of $D_{t-1,}$ (α_2), becomes significant, the effect of negative shocks is $\alpha_1 + \alpha_2$ whereas the coefficient for positive ones is α_1. This gives us if the coefficient of dummy variable is significant; the positive and negative shocks affect the volatility in asymmetric way.

1.6 Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) Models

The restriction on GARCH models to produce positive variances and whether new shock having an asymmetric effect on variance is a controversial issue. To solve this problem, Nelson[28] developed the exponential GARCH model. In his model analyzing the return of assets in 1991, Nelson offers the following model:

$$\varepsilon_t = z_t\, h_t^{1/2} \text{ and } E(z_t) = 0 \text{ , } Var(z_t) = 1 \quad (17)$$

$$\ln(\sigma^2_t) = \alpha_t + \sum \beta_k\, g(z_{t-k}) \text{ and } \beta_1 = 1 \quad (18)$$

$$g(z_t) = \theta z_t + \gamma\, [|z_t| - E(|z_t|)] \quad (19)$$

Having standard GARCH features in (17), the variance is made positive for all its values by logarithmic transformation in (18). Equation (19) is designed to reach the ultimate goal. According to Nelson (1991), although there is no

[28] Daniel B.Nelson, " Conditional Heteroscedasticity in Asset Returns: A New Approach" Econometrica, 1991

asymmetrical effect for $\theta=0$, it is there for $\theta<0$. Moreover, when $\gamma=0$ and $\theta<0$, z_t makes variance negative while making shocks positive. In (19), θ measures the direction of shocks to variance and γ measure big this shock is.

CHAPTER 2

2. MACROPRUDENTIAL POLICIES IMPLEMENTED THEREAFTER 2008 GLOBAL FINANCIAL CRISES

Starting from after 80's, financial liberalism has reached low inflation-stable growth targets over time. When the facility brought by liberalism as accessing credits combined with global saving, growth and interest rate imbalances; this created bubbles in the asset markets. By this way, it is also being understood gradually that low inflation can't be a stability indicator by itself and global economies should also take into consideration the financial stability as well. Before the financial crises, there is neither a structure checking systemic risk in the system as a whole, nor a barrier mechanism preventing institution from excess borrowing. It was too late to take preventive measures when the high leveraged and mutually dependent firms became the systemically important financial institutions.

Credit tightening starting in 2007 in the global markets gave the signal of possible financial crises which can be faced in the following years. "How much credit conditions were eased" or "how much collaterals were trustful" and "in what degree the global economies were dependent to each other" couldn't be realized before the crises. These problems could be understood with the crises and made it mandatory to build a new era in the financial system.

The reasons that brought the financial crises starting in 2008 and losing its strength at the end of 2015 were multidimensional. The first one, which also mentioned by Bernanke (2005)[29], was "global saving glut". 2002-2007 years period in global economies could be called positive growth and expansion period. East Asian, Latin American and Russian Crises end up and it was started an effective recovery period in these economies. In this period, the countries giving current account surplus like Russia, Saudi Arabia, China, Japan and Germany directed their excess savings to U.S., which has more financial instruments and developed financial markets compared to rest of the world.

[29] Ben S Bernanke: The global saving glut and the US current account deficit

Having approximately the 40% percent of the worlds' securities, the US financial market asset prices has gone up rapidly and the interest rates has fallen in this period. With the decreasing rates on borrowings, demand for mortgages increased and this creates a bubble both in the mortgage (real estate) and securities markets. The Federal Reserve (FED) increased the rates on June 2006, to restrict the increasing demand and also to maintain the price stability. This will be the last rate hike for FED during the following decade.

Before the crises, there was no clear and common view on asset price bubbles which is the joint factor of the monetary policy and financial stability. In the traditional DSGE models, asset prices perceived as an exogenous factor that fits the inflation and output gap. However, changes in the interest rates have a high possibility to boom the asset price bubbles and hence asset prices should be considered as endogenous variables. As Bernanke[30] mentioned in his previous speeches, there was an illusion before the crises that stability in the prices and output gap could maintain financial stability by decreasing the possibility of asset price bubbles.

The second factors that pave the way for the crises were the defaults in the subprime mortgage markets. This fact, which can be seen as the trigger point of crises for the U.S. financial markets, has deepen with the increasing demand of household sector to the mortgages and further borrowings of financial sectors who used this mortgage credits as collateral. During the stable period 2002-2007, the prerequisites for credits were eased and asymmetric information expanded steadily. Since it didn't apply the right credit risk weightings for the households whether it has ability to pay or not, in case of default, the price of mortgage used as collateral in the balance sheet of banks had dropped dramatically. This fact brought a sharp decline in the return of banks which used these mortgages as collateral and with the bankruptcy of Lehman Brothers on 15 September 2008, crises converts into a global problem.

[30] Monetary Policy since the Onset of the Crisis, 2012, Jackson Hole, Wyoming

Academic studies[31] (Crockett (2000), Acemoglu (2015), Huang (2009)) researching the reasons of the crises with market and academic backgrounds agreed on the following criteria while have some different views on small points.

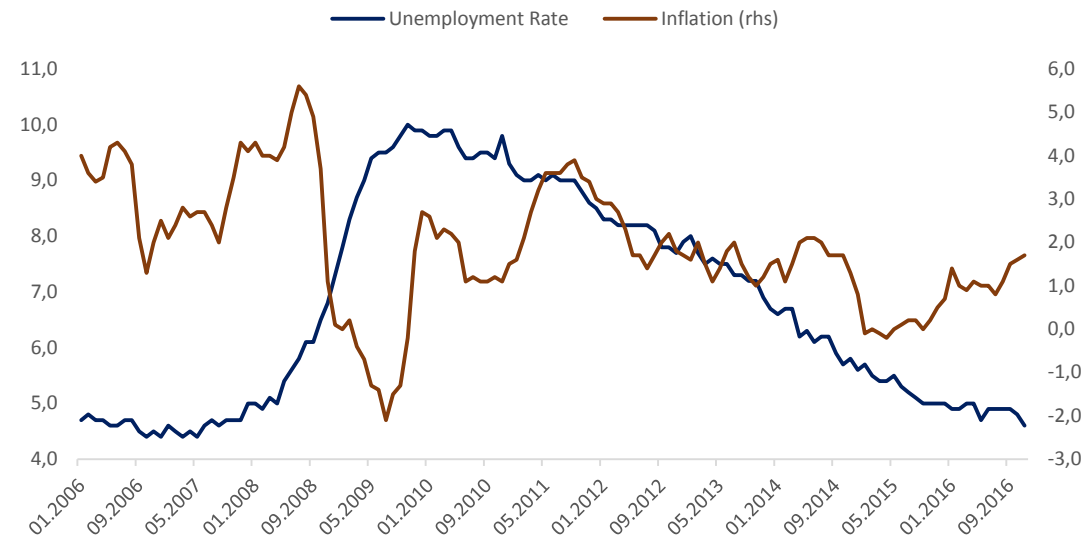
- Systemic risk made crises as a global phenomena
- Financial stability may results in financial instabilities
- Insufficient usage of asymmetric information and risk facts may create irrecoverable costs in financial system
- Even it may necessary to take measures in institutional base, it may be insufficient for the financial system. To do so, a mechanism should be build up to monitor the system as a whole
- It is necessary to create a system to regulate banks and financial institution that also take into consideration systemic risk as well as capital and reserves which works as a buffer during the contraction period
- In addition to above, under the same regulations, data bases should be made more efficient and worked more carefully while collecting information
- Furthermore, capital inflows should also be investigated in a strategic way. Internalization of the external shocks through capital and price mechanism may made the system more fragile
- State guarantee may trigger decision makers' inefficient, careless and casual behaviors. Hence, it should be prevented from subsidizing the costs and close support for the institutions which are too big to fail
- One of the most important targets of the new system should be restriction of the spread of a contraction in the banking system to the real economy. In order to achieve this, banking or other borrowing tools which may create systemic risks should be taken under control in the first phase.

[31] Xin Huang (2009), A framework for assessing the systemic risk of major financial institutions - Acemoglu (2015), Systemic Risk and Stability in Financial Networks

- Macroprudential tools may not be enough to restrict the systemic risks by itself. In this process, they ought to be implemented together with other monetary and fiscal policy tools.

After the crises, a new era has started to remove the problems above and alleviate the ruin of the crises. Beside the quantitative easing policies of the advanced economies, it was prepared a new policy outlook which minimizes the adverse effects of capital mobility and starts the recovery process. Unconventional monetary policies and macroprudential tools directed this new decade. Unconventional monetary policies brought both a new perspective to the transmission mechanism of money and low interest rates made it mandatory to revise the price and portfolio decisions.

Graph 1: US Unemployment vs Inflation during the crises



Source: FED

As it can be seen at Graph 1, with the intensification of global financial crises in 2008, inflation rates dropped even negative levels while unemployment rate went up above 9%. During QE period, unemployment level gradually decreased below 5% whereas inflation restricted till 2%. These levels are satisfactory for FED and triggered it to start a new period for Monetary Policy Stance.

With the global financial crises, new regulative and supervisory institutions have been established to make financial system and tools stronger. Financial Stability Oversight Counsel in U.S. and European Systemic Risk Board

in Europe are the examples of these institutions. In addition to these, there are also some mechanisms which are closely being followed by these regulatory institutions and sometimes are built up by them. The first one is early warning system which gives signal about the crises before it happen and prevent system to not to convert risks into crises. Being constructed with macro stress tests, early warning systems are in such a structure which can give signals when factors rise up above or drop below the threshold points determined by authorities. In this way, it can be interfered to the fragilities as early as possible and prevent risks from expanding the system.

In the following pages, it will be first defined the macroprudential policies and be mentioned the policies implemented, generally. Then, it will be examined macroprudential policies applied by countries from different parts of the world.

2.1 MACROPRUDENTIAL TOOLS AND IMPLEMENTATIONS

It is mostly probable to confront with different description of macroprudential policies in literature. According to the first one, macroprudential policies are such policies which use prudential tools to prevent the complexity in the core financial services and restrict the systemic risk that can spread to the real economy (2010 Seul Summit, G-20). From a different perspective, macroprudential policies can be defined as such tools which are targeting the robustness and security of payment and financial systems (Galati – Moessner, 2011). Furthermore, macroprudential policies can be seen as institutional restructuring of financial system (Tamara Lothian, 2012). Almost all views from both academic and real side agree on a fundamental fact that macroprudential policies are used either to lessen systemic risk or to wipe out it all from the system. In this manner, systemic risk is type of a risk which can threaten the stability of financial system and has a probability to spread the whole economy at the same time (Favara – Ratrovski, 2012). According to a different description; systemic risk is a contagion risk of price decrease and stress created by financial shocks (Perotti – Suarez, 2009).

Although the goals of monetary policies can vary; (price stability, monetary-exchange rate-output target) ultimate goal of macroprudential policy collected on a basic point. This is, generally, to maintain the stability of financial system. Even though financial stability is the ultimate goal of the macroprudential policy, it can also be targeted intermediate goals while reaching ultimate one. While doing so, it is aimed to hold such gains till contractionary period by building up a counter-cyclical mechanism during expansionary times. Furthermore, macroprudential policies also targeted to annihilate some systemic risks such as panic selling, financial linkages and mutual dependence created by market failures especially externalities. In a narrow sense, macroprudential policies are a mechanism restricting risks and decreasing the costs of systemic risks. The primary objective when building the macroprudential tools to restrict systemic risks is that those tools should be in an early warning structure. Unless this is accomplished, then those tools should either restrict the effect or abolish it all.

Compared to conventional monetary policies, macroprudential policies have both pros and cons. One of the biggest advantages of macroprudential tools is that capital regulation in conventional policy takes into consideration the source of the threat whether it is a local or international. However this is not same as in unconventional policies. Macroprudential tools without considering the source of the problem focus on either the subjects are affected or has a contribution to the financial stability at the end. In addition to this point, partial implementation like capital regulation may expose financial institution to a systemic risk that can transmit to whole economy. A bank, which subjected to a capital regulation or restriction, may trigger a price decrease or a recession by starting a credit crunch in the financial system. Additional advantage of macroprudential policies is that they can be implemented target oriented and in a flexible manner. It can be intervened to the core areas without affecting the whole system. Beside these pros, the basic drawback of macroprudential policies is that their implementation is new and the outputs may not be estimated.

It is mostly probable to encounter with different classification of macroprudential policies in literature which are implemented after 2008 crises. One of them is categorized it in terms of time and cross section, the other one has

defined it as procyclical or countercyclical and the last one used the term structural and cyclical for that classifications. In this part, these classifications are consolidated and it will be used structural and cyclical terms in the section which focus on the policies implemented in Turkey. It is meant by “time”, a cyclicality phenomenon, which defines risk taking position during the expansionary periods and risk aversive behaviors in the contraction term. Liquidity, maturity, currency mismatches, credit volumes are some examples of time dimension. Cross section means, on the other hand, expansion/contraction or stress that is realized in a certain and specific point of a time. For implemented policies, to be cyclical or not, is about whether they are related with time or economic trend.

In the following sections, it will be defined the Basel III framework and will be mentioned the macroprudential policies implemented after the crises.

2.1.1 Basel III

Created by BIS (Bank for International Settlements), Basel II criteria gave sufficient flexibility for capital adequacy to the Central Banks or other regulatory institutions before the global financial crises. Especially the regulations on minimum capital adequacy ratios and operational risk additional to Basel I brought significant facilities for institution to evaluate their own risk structures.

The resilience of the financial institutions in the advanced economy against a global shock has been started to be questioned after the financial crises in 2008 due to their complex liquidity and debt structure. In this stage, BIS intervened and introduced Basel III which is targeting a healthier financial system structure, by adding some reforms on Basel II.

Basel III, even though it brought comprehensive reforms, is not an implementation to abolish the Basel II. It is better to defined Basel III as a new system able to solve the problems that the former one is insufficient to do so or development of the Basel II in order to solve the current troubles after 2008.

Basel III has brought some innovations to redefined and restructure the risk systems of banking. The most prominent one is enhancing the capital adequacy for both quality and quantity. Moreover, it is targeted to build up capital

adequacy in a dynamic structure that can work as either procyclical or countercyclical rather than a static one serves same in every situation. Furthermore, it has been seen the lack side of Basel II to apply same sanctions for the all institutions in the system. By filling this gap, it is aimed to have stronger capital and liquidity structures for strategically important financial institutions compared to average ones. Although some implementations in Basel III still haven't been defined in Turkish Financial System, building the infrastructure and adaptation process to the global standards will realized over time. There is the brief summary of reforms brought by the Basel III below.

2.1.2 Liquidity Regulations

It has been done some changes and additions in the definition of liquidity in Basel III. The primary ones are Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR). LCR is a regulation to make liquid asset in the banks in such a capacity and quality that they can cover all the outflows and drawings in a month. NSFR, on the other hand, targets to reach a healthy funding capacity in the long run. The fundamental goal here is to convert current funding ratios into a stable funding over time. And this necessitates a structural change in the whole balance sheet of the banks, especially targeting to make asset side more stable.

2.1.3 Regulations on Owner's Equity

Regulations on owner's equity are more detailed to regulations on liquidity. Within this context, the definition of common equity is developed and regulation in this definition is linked to a program. Common equity represents the capital that has covering capacity for defaults or huge losses. Some items from this capital (investments having low probability to default) is subtracted in 20% constantly each year starting from 2014 and reached 100% at the end of 2019 (Basel III 2017 BIS report). Ratio for common equity is designed 4% for 2014 and 4,5% for the following years. Moreover Tier 1 Capital, also including

common equity, will be started as 4,5% in 2013 and increased to 5,5% in 2014 and then 6% for the following years[32].

Capital Conservation Buffers are also in this context. By starting in 2016 with 0,625% and risen up as starting amount (0,625), it will be planned to reach 2,5% by 2019 (Basel III BIS 2017 report). Hence, it is targeted to reach the sum of Common Equity and Capital Buffers to 7% at the end of 2019 (Basel III BIS 2017 report). Furthermore, it will be evolved to a capital structure considering the cyclicality. This structure can be implemented when authorities think credit growth rates reached a point that may create systemic risks. Within this context, it is planned to put 2-2,5% additional capital requirements for such financial institutions whose credit growth rates above threshold points.

2.1.4 Regulations on Leverages

It will be evolved to a new leverage structure without risk basis and considering off balance sheet activities. It is planned to make owner's equity at least 3% of the sum of assets and off balance sheet items in this framework. With this way, items like shadow banking, which has default risk but not been in the balance sheet, are included to leverage.

2.1.5 Loan to Value Ratio

Loan to Value Ratio (LTV) defines use of credits to get a stock or real estate in case of loaning till a ratio of asset determined by the authorities before as the threshold for that value. The contribution of owner's equity for the value can be adjusted by changing the ratio with respect to value. LTV limits are designed to restrict overheating in the economy by decreasing the effects of leverage. In most of the countries, those ratios are adjusted in terms of the value of assets. However, it is either put an exemption on some fields or subsidize by governments in some

[32] Basel Committee on Banking Supervision, Basel III Monitoring Report 2017, BIS

countries in order to facilitate first home buying or support social home projects. Indeed, LTV limits can be functioned as a macroprudential policy tools to adjust credit growth. To be used in a countercyclical way makes this tool also flexible. In the periods in economies experiencing overheating and increase in credit growth rates, such concerns are easily be controlled by lessening LTV limits and decreasing the credit contribution in the value of asset. This tool is implemented in Turkey and East Asia successfully and continued to apply today. In Turkey, LTV limits are lessened to accord credit growth rates with GDP growth targets. In 2010, to prevent from asset price bubbles and credit over growth, it brought a new risk weighting standards basing on LTV limits in Bulgaria and Poland. In China, it is being gone to a differentiation since it is an exception in matching population dynamics and home sales. China banks which give credits in a low ratio for first home buyers, dropped the LTV limits from 80% to 70% for first home buyers, 50% to second home buyers and prohibit it for the third home buyers after the over credit growth in real estate market.

2.1.6 Dynamic Loan-Loss Provisioning

Dynamic Loan Loss Provisioning (DLLP) defines holding reserves as collateral which are saved during the expansionary and positive financial shock times with a precautionary motives to be used in contractionary and credit crunch terms. This is an automatic stabilization mechanism in itself. Likewise in the case of Loan to Value Ratio, it can be worked as countercyclical. The most prominent country applying this macroprudential tool is Spain. After joining the EURO region, decrease in interest rates as a result of common monetary policy was raised up the credit growth rates especially in the real estate sector. When the defaults and non-performing loans coincided with adaptation process to EU, the supervisory authority regulates primarily the home and then commercial, vehicle and corporate credits by implementing the loan-loss provisioning. Provisioning is a macroprudential tool that is generally applied with 1 time lag operator. Bad loans are determined at first, and a provision is allocated for that in the second term. Nevertheless, this is applied in Spain in a different way. By putting floor to the provisions rather than ratio in the expansionary periods, the Spanish authorities tried to increase the efficiency of the

macroprudential policy in this way. Besides its pros, the dynamic loan-loss provisioning system are not generally implemented by authorities since it can open the door to tax evasion, showing profits less than it is and manipulation in other accounting standards.

2.1.7 Debt to Income Ratio

Debt to Income Ratio (DTR) can be defined as the correct choose of borrowers on credit lending and to be used more credits to who has higher ability to pay. This concept is fundamentally relevant with notion of asymmetric information, moral hazard and risk in banking literature. As it is mentioned before, one of the basic triggering point of the crises in U.S is letting households with low ability to pay use of higher mortgage credits by relaxing the prior condition on lending.

Within this framework which is better understood after the crises, databases and risk pools are structured to perform more efficiently in order to prevent from asymmetric information or other market failures. More credits have been used for whom have higher ability to pay, whereas limits for each category (low-mid-high income) are applied with respect to their earnings. Likewise other policy tools, DTR also works as an automatic stabilizer for economy. In case of increase in the credit growth rates, lending and credit ratios can be put in a reasonable path by lessening the limits that how much household can borrow in terms of their income.

2.1.8 Countercyclical Capital Buffers

Countercyclical Capital Buffers (CCB) is countercyclical policy tools which are implemented to prevent credit growths from creating a systemic risk by restricting the cyclicality in economies. Also mentioned in Basel III, this tool is designed either to decrease the over tendency of banks in credit lending or to make provisioning for such banks whose capital structure are suitable to do so. The basic method in this policy tool is decreasing the demand of credits by increasing their costs. The way for increasing the cost of credit is either rising up

the funding costs (credits given to the banks) or decreasing the quantity of funds that can be used as credit.

The regulatory and supervisory authorities in the country request from banks or other financial institutions to evaluate and publish their capital buffers at the same date with their calculation of minimum capital adequacy requirements. This ratio is equal to 0-0,25% of total risk weighted assets. But each country can determine its own values by providing that to be in this interval. Changing and applying the upper and lower limit bounds have been realized with a 12 months lag.

This policy implementation, like in the Dynamic Loan Loss Provisioning, is targeting to restrict the cyclical movements with an automatic stabilizer mechanism. The ratio, which defines what percent of risk weighted assets will be equal to allocated buffer, can be used as a macroprudential tool. An increase in this ratio will decrease the credit growth and heating up in economies by either increasing the cost of credit or decreasing the amount to be given as credit or vice versa.

2.1.9 Levy on Non-Core Liabilities

Levy on Non-Core Liabilities means restricting non-deposit liabilities, the traditional way of banks to find funds, by taxing them in case of this amounts exceeding the determined threshold points.

In the expansionary periods of the economies, demands for credits are increased from both households and business sector. However deposits, the conventional method of financial institution to find funds, are in a structure that increase in income of the households results in an increase in savings and then that households may put some portion of saving as a deposit or not. Banking sector usually finds non-deposit liabilities to meet the increasing need of credits. In this cycles, deposits called as core liabilities and non-deposits liabilities which are also generally in FX or from abroad are called as non-core liabilities.

Non-core liabilities are in a negative structure for general economic outlook since it increases current account deficits, depreciation in exchange rates and accelerate the credit growth rates. Including FX, interest rate and maturity mismatch risk in itself, this borrowing tool is also one of the fundamental reasons of twin crises which can be known as both bank and exchange rate crises.

After the crises and expansionary period, banks liabilities are consisting of mostly from non-core borrowings due to cheaper funds and easing policies, and hence this will force countries to take measures on this issue. In US, the non-core liabilities of financial institutions were subjected to a 0,15 % tax in 2010 whose assets are more than 50$ billion, known as Obama Tax. Revenues from this tax also have a valuable contribution on government budget. Levy or tax on non-core liabilities is a macroprudential policy tool. It can be restricted the fragility of financial institutions by increasing this ratio and hence the cost of non-core liabilities.

2.1.10 Margin and Haircut Adjustments on Repo

Margin and Haircut adjustments are leveling the collaterals used in repo transitions according to their market price changes and work as a countercyclical mechanism. Margin is a ratio of collateral market price minus bought value to its market price. The initial margin is equal to 1/ (1–margin). For this reason, ceteris paribus, an increase in the market price of collateral increases both initial margin and haircut. And this triggers the usage of collaterals in new borrowings since its increase in market value and hence an increase in credits and funding amounts.

A decrease in initial margin or haircuts brings an increase in the value of bought asset and in leverages as well. Margin and haircut adjustments are used as macroprudential policy tools since they result in a decrease or increase in the amount of value to be given as credits.

2.1.11 Credit Valuation Adjustments for OTC Derivatives (CVA)

CVA defines the difference between the assumption of counterparty risk is zero and counterparty has a risk. As the default risk increases, the commission fee or cut increases as well.

After the global financial crises, it was realized that how much the counterparty risk can cause a financial turmoil and it was started a regulation by Basel Committee for this area. In this context, a new sanction was introduced on Credit Value Adjustments to increase banks' resilience. The main purpose of this implementation is either the hindrance or making transparent the counterparty risk by subjecting it to some sanctions which is created by untruthful and nontransparent derivative operations and can have the probability of spread from market to market.

2.1.12 Liquidity Risk Charges

The Liquidity Risk Charges is a macroprudential policy tool that is designed to discourage the liquidity risks created by banks or other financial institutions.

The Liquidity coverage ratio within the context of Basel III made it mandatory to put liquid assets that can cover 30 days of net cash outflows of the banks. It is applied sanctions in such ratio for those who couldn't achieve this target. Sanctions are in a pattern which is decreasing with the maturity of mistrustful short term liabilities. The main target here is putting this liquidity risk into the cost function of relevant institution by hindering the systemic risks that brings cost to whole system. And the ultimate goal is preventing the financial system and institutions from taking risk with high costs and creating credit growth with short term money buy/sell. While reaching this target, it is paid attention on not to change the costs for the whole system. Like the indigenization of the risk premium into the individual cost function, the liquidity risk is considered as a different variable.

2.2 MACROPRUDENTIAL POLICY IMPLEMENTATIONS FROM THE SELECTED COUNTRIES

When the applied policies during the crises are analyzed, it has been observed that countries have been taken measures proportional to their macro outlook and financial relations with advanced economies. If it is taken into consideration that capital flows increased the fragility and countries are in the different stage of business cycles, this situation is fitting with the expectation. In the following sentences, it will be mentioned implementation of macroprudential policies from the selected countries. Among those, most of them are the emerging market economies. They are chosen since the capitals were flown to these countries during the crises.

2.2.1 China

The most crowded, highest imported and exported country of the world, China, became the world biggest economic power by surpassing the US according to IMF data in GDP based on Purchasing Power Parity. With awesome growth rates even in the period of global countries dealing with crises, China now became the sources of global apprehension with its decreased growing rates in last years.

The housing sector, which can be assumed as the motor of the China, gave positive contribution to growth during global excess liquidity and low rates. Nevertheless, the excess borrowing of local governments and US rate hikes decreased the growth rates and creates a stock in housing industry. Moreover, the decrease in the prices of commodities and negative developments in the biggest trade partner Japan forced Chinese authorities to take additional measures on economy.

The initial ones are those started in 2010. In order to both restrict the price increase in housing sector and adjust the credit growth in accordance with

economy dynamics, the reserve requirement ratio is risen up gradually. Beside these, it was introduced rate differentiation for the first and second home buyers along with legal responsibilities. Furthermore, Loan to Value Ratios are lessened from 80% to 70% for first home buyers, to 50% for the second home buyers and prohibited for the third home buyers. Tax on mortgage loans was hiked by 10% and for owners it was forbidden to sell assets within 5 years after bought[33].

During this period, capital adequacy ratio was risen up from 8% to 11,5%, provisions from 100% to 150% for normal and 2,5% for non-performing loans. In the same period, policy rate and reserve requirement rates were increased by 125 and 450 basis points, respectively (Lim et al, 2011).

The primary objectives of those whole measures are maintaining the financial stability by preventing an asset bubbles led by housing sector. In addition, it was also tried to restrict the alleviation of price stability by a bubble in financial system.

2.2.2 Colombia

Colombia is one of the Latin American (LATAM) countries that experienced capital inflow during the crises. Especially to prevent from bubbles in mortgage sector, the LTV ratios were dropped to 70%. Together with it, DTIs were restricted not to rise above the 30% of disposable income (Lim et al, 2011). The main purposes of these measures were to make credit growth rates compatible with the income levels.

Besides these measures, Central Bank of Colombia put a restriction on private banks' FX positions. Global open FX position and spot open FX position were limited with 30% and 50% of capital, respectively (Lim et al, 2011). To prevent from the fragile adverse effects of the access to global liquidity on domestic economy, the Colombian authorities also tried to avoid from liquidity crises in the case of sudden stop or capital outflow.

[33] C. Lim, F. Columba, A. Costa, P. Kongsamut, A. Otani, M. Saiyid, T. Wezel, and X. Wu (2011); Macroprudential Policy: What Instruments and How to Use Them? Lessons from Country Experiences

2.2.3 South Korea

Implemented macroprudential policies in South Korea have been more inclusive compared to its peers. As having a deep and developed financial markets, measures are proportional to market depth in Korea. As a first, for foreign investors who wanted to benefit from interest rate differentials during the crises, it was tried to restrict capital inflows by putting an additional tax on their purchase of Korean government bonds.

Indeed the main area of the implemented macroprudential policies in Korea was the banking sector. It was made mandatory for banks to put at least 20% of foreign assets as liquid and raised up long term foreign credits from 80% to 90% (Lim et al, 2011). FX forward operations were limited as of 125% of export revenues. Moreover, for all FX derivative operations, it was given a limit 50% of capital for local banks and 250% of capital for foreign banks (Lim et al, 2011). In this way, it was targeted to reduce fragility created by banking systems who increased the external borrowing by hedging themselves and making forward contracts.

2.2.4 Brazil

Brazil is one of the fragile five countries together with Turkey, South Africa, India and Indonesia. The fragile five was composed by choosing five most fragile among those who have highest current account deficit and need external financing as well as experienced huge capital inflows during the financial crises.

The Brazilian Real was one of the most appreciated currencies against USD during the crises. To reduce the pressure on local currency, Brazilian Central Bank put an additional 2% tax on capital inflow as portfolio investment. In order to prevent the unhealthy prices equilibrium in stock and real estate market, it was brought a maturity limit on mortgage and vehicle credits in 2010. For whom to

demand additional maturity exception, it was put additional capital adequacy requirements.

The measures on banking sector were similar those applied in emerging market economies. It was limited to banks FX short position as well as FX reserve requirements were increased up to 20% . On January 2011, it was made mandatory 60% reserve requirement on short FX position to restrict short term capital mobility[34].

2.2.5 Indonesia

Indonesia is also one of the fragile five mentioned above. In order to sterilize the capital inflow, Central Bank started to sell its own bills in 2009-2010. The main purpose of this policy was to sterilize some part of intervention to the market.

After a short term in measures, when most of the Central Bank bills were bought by foreign investors and capital inflows rose above the threshold points, authorities started to take additional actions. Policy makers prohibited to change hand or sold the bills which taken within a one month. In this context, although the amount of bills hold by foreigners increased, the share of it in total liquidity decreased gradually. Furthermore, the banks were limited on short term external borrowings with their capitals' 30% (Pradhan et al, 2011).

In addition to those countries mentioned above, in Poland, LTV ratios were dropped in 2010 and especially mortgage credits in FX currencies were limited. Bulgaria started to new risk weighting measures based on credit ceiling and LTV to limit credit growth. In Spain, after the decreasing interest and home sales rise above threshold points, it was started to dynamic loan loss provisions.

[34] Pradhan et al, Policy Responses to Capital Flows in Emerging Markets, IMF Staff Discussion Note 2011

CHAPTER 3

3. FINANCIAL STABILITY AND MACROPRUDENTIAL POLICIES IMPLEMENTATIONS IN TURKEY

As we mentioned earlier, financial stability has gained a critical importance after the global financial crises. Since the global market and economies connected to each other with mutual transactions, every change in financial market is creating a domino effect on rest of the world. In order to regulate the financial markets, global authorities and decision makers took measues and start some new implementation to maintain financial stability. Central Bank of Turkey also closely followed the new rules and changes in global market during the quantitative easing period. It has changed its target basket for inflationf and added financial stability as a complementary objective to price stability. In this section, I will try to explain financial stability in a deeper sense and focus on its relation with macroprudential policies.

3.1 Definition of Financial Stability

Financial stability is a multidimensional phenomenon that does not have a full and unequivocal definition which gained importance after the global crisis. Although the definition varies according to the priorities of the financial authorities in the countries, there are points on which consensus has been reached. The most fundamental and broad-based of these definition about financial stability, which describes financial markets as being "protected against systemic risks, reaching financial depth at a sufficient level and having a robust economic outlook against external and internal shocks". According to another definition, financial stability represents a financial environment in which people do not have a sudden collapse

expectation about near future and don't have institutions that may probably collapse[35]. Financial stability has been closely monitored throughout the global crisis as the most fundamental indicator of fragility and capital movements. In an economy that has access to financial stability; the following basic features must be provided[36]:

a) No shocks that may affect the decisions of decision-makers operating in financial markets

b) Financial activities in the markets are foreseeable and resistant to shocks

c) Financial markets have developed and deepened enough to not allow volatility and manipulation

The Bank of England (BoE) has listed the characteristics that should be included in the definition or description of financial stability. Financial stability refers to "the effectiveness of a financial system that affects prosperity is observable and can be controlled by the public authority and does not take into account small shocks". In an economy with financial stability, the economic effects of small or big shocks experienced can be corrected in the market balance of the system. The reason is that the system as a whole is both shock resistant and far from harmful effects that would reveal shocks.

According to another definition, Frederic S. Miskhin (1991) described financial stability as "the environment in which savings can be effectively transformed into investments"[37]. But the point to note here is whether the resulting inefficiency has cost or not. For example, in an open economy, it is not possible to talk about market efficiency here, if the savings are not being converted into investments effectively, or if resources are left idle and inefficient, such as keeping them under pillows. In such a case, the cost for economy is too high; such as current account deficit, high exchange rate, high interest, or they may all be at the same time. Possible result that they will cause will be financial instability. But if an economy cannot carry out its operations under an effective market hypothesis, the fact that the

[35] William A. Allen and Geoffrey Wood (2005); Defining and Achieving Financial Stability, LSE Financial Markets Group Special Paper Series
[36] William A. Allen and Geoffrey Wood (2005); Defining and Achieving Financial Stability, LSE Financial Markets Group Special Paper Series
[37] An Anatomy of Financial Crises, NBER Working Paper, No: 3934, 1991

instabilities that will arise from saving-investment gap will not be a cost, hence will not lead to financial instability in this economy.

One of the most important features of an economy with financial stability is that it has a shock-reducing structure. Since the economies are not confronted with a magnitude of shock to break down stability of the market, at first glance, they may look have a financial stability. The prominence here is the relative size of the shocks and volume of the economy together with the depth of the financial system. A shock to the American or European economy that can be absorbed into the system, can result in a crisis for a relatively small world economy. For this reason, in order for financial stability to be mentioned, the relevant economies need to have sufficient financial depth. Otherwise, it is almost impossible to predict whether the instability is due to the lack of deepness in financial markets or the system is vulnerable to shocks.

For this reason, it is difficult to foresee the extent to which an economy reaches financial stability, without experiencing the generally accepted economic instability or a global shock. While we do not have a general benchmark, the resistance of the economies against global monetary and fiscal policies can be used as an indicator. It is possible to say that among the developing country economies, in the period when the end of the monetary expansion and the application of the contractionary monetary policy are popular, the ones who are positively differentiated from the others are at or near to financial stability.

While the dispute on the definition of financial stability and its meaning are on the way, it is stated in the literature that if financial instability is understood, financial stability can be conceptually shaped. In this context, Anna Schwartz (2009) defines financial instability as: "payment instruments or assets are inaccessible at any price level"[38]. Here, it is underlined the trouble in the market and the situation that can be more called "panic sale". While establishing the link between the real and financial economies within the country, the financial system has also obliged all world economies to be interdependent or at least connected. For this reason, it is almost impossible to prevent from a contagion risk, taking place in the real or financial economy. The sudden contraction or wave of sales in any sector or country can cause financial crises by creating panic sales and by leaping to other countries or

[38] Real and Pseudo Financial Crises, F.H. Capie and G.E. Wood, London, 1986

sectors. In such a case, the commodity or value to be sold may sometimes not be available at any price level. This means that financial stability has been lost.

The perception that financial stability or instability is a cluster of problems arising from the financial system is not fully realistic. A situation that is independent of the financial system, such as the reduction of water resources, and which is a purely natural phenomenon, can also indirectly reveal financial instability. The decline in water resources can create instability by first affecting the production and the real sector, then the payment performance and the financial sector. In this case, when providing financial stability or talking about stability, the point that needs to be emphasized is not the way it emerges but the factors it will affect.

When financial stability is achieved, regulatory and supervisory authorities may sometimes have to decide on the change in loss - gain. Almost every product or entity in the economy has an opportunity cost. That is, while passing from benefit or endowment to another endowment, we always have a sacrifice ratio to obtain additional unit of one good or benefit. This rule remains valid at the point of ensuring and maintaining financial stability.

By ensuring financial stability, the institutions in charge can impose some costs on the economy by introducing restrictions on the tendency to lend on the market. At the forefront of these is the macro view of the industry (sales, profit, growth, etc.) that is regulated. A number of measures put in front of the credit growth rate will lead to a decline in the banking sector and hence the growth of output. Despite such a high cost, the main reason for the implementation of these and similar measures is the statement given to us by the global crises. As already mentioned, the "unhealthy" and "lack of economic fundamentals" economic growths created by aggressive credit expansion are creating balloon effects. These bubbles cause unhealthy price formation, especially by raising asset prices. The overall outcome of these is the possibility of balloon explosion and instability with the accumulation of risks and increasing uncertainty. For all these reasons, the main objective in the measures taken is to achieve a healthy and stable economic outlook. Although it brings some costs, it is aimed to avoid future risks and more damages.

3.2 Leading Indicators and Financial Stability in Turkey

Following the global crisis, unconventional monetary policy implementations initiated by developed countries to prevent recession in the markets and in the real economy have made new policy implementations mandatory in developing country economies. Mainly the Fed, the ECB and the BoJ, have lowered the interest rates to historically low levels, resulted in transmitting the capital to emerging market economies to that expect the higher return. The CBRT, taking some measures in order to limit the negative effects of capital movements on price and financial stability, has set itself as the interim target closely followed by the leading indicators for financial stability. The main objective was to maintain price stability and financial stability was added to the final objectives, taking into account price stability. The two leading indicators closely monitored by the CBRT in order to ensure financial stability are the exchange rate volatility and the credit growth rates. In addition, the recently designed Financial Stress Index is a change that is followed by an early warning system and followed as a leading indicator in parallel to the stress tests created by the regulatory authorities of developed countries.

3.2.1 Credit Growth and Exchange Rate Volatility

Loan growth and exchange rate volatility are closely monitored variables by regulatory and supervisory authorities due to their sensitivity to business cycles. Global capital brought risks to developing country economies, where asset prices were relatively cheap and have high returns in the period of monetary expansion. Capital inflows in this period provided both local currency appreciation and facilitated access to cheap credit. Since the valuation of local currency makes imports cheaper, it increased more the chronic problem of developing and fragile economies - the current account deficit- . On the other hand, as loan growth also supports economic growth, the growth rate must be consistent with the basic variables of the

economy. The higher real growth rate of credit growth will both triggers in increase consumption demand (inflation) as well as import demand (current account deficit).

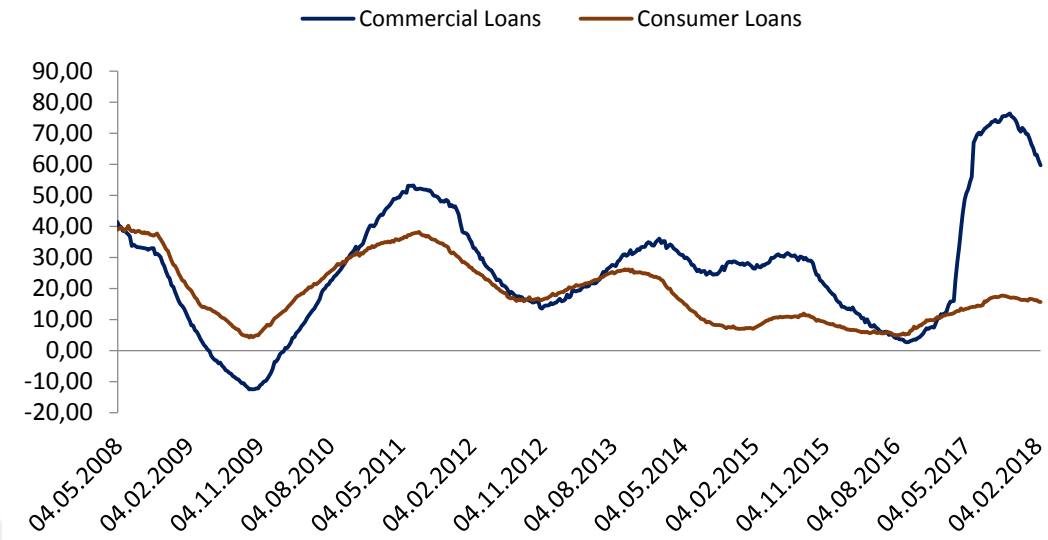
i. Credit Growth

The pace and magnitude of credit growth is closely monitored by the CBRT as one of the two main indicators of financial stability. Studies in the literature have shown that credit growth rate, which is incompatible with economic bases, is at the top of the most important triggers of financial crises (Schulorik and Taylor, 2012 - Mendoza and Terrones, 2008). Loan growth, which grew cyclically during periods of economic growth, has been the most important factor that has triggered the crisis in recession periods.

For these reasons, the CBRT is monitoring the credit growth rate as a leading indicator of financial stability as a supervisory institution. For this purpose, the ratio of the credit growth to the output was chosen as a leading indicator. The reason for this choice is to distinguish between static and dynamic variables and to obtain a dynamic indicator. Since households' income is varying and dynamic, it is thought that following the ratio of change in debt to income change will be beneficial in obtaining more healthy results. The reference level follows a 10% nominal growth rate, which is 15% of the loan growth rate (7% for real growth and 18% for nominal growth, with a reasonable growth rate of 22% in 2017)[39]. In the case of loan growth rates above 15%, the CBRT will introduce macro-prudential policies implemented during the global crisis period, reducing the need for direct instruments such as foreign exchange intervention. The macroeconomic instruments introduced into the commission regarding the composition of the credits and the growth rate will be explained in more detail later.

[39] A.Hakan Kara, Hande Küçük, S.Tolga Tiryaki, Canan Yüksel (2013); Türkiye için Makul Kredi Büyüme Oranı Ne Olmalı? CBRT Research Notes, www.tcmb.gov.tr

Graph 2: Credit Growth Rate, year-on year % change



Source: CBRT

At Graph 2, consumer and commercial loans are shown as percent annual growth rate in Turkey. In parallel with the global recession that began immediately after the global financial crisis (end of 2008), the growth rate of both consumer loans and commercial lending declined to near zero levels. With the measures taken to mitigate the devastation of the crisis, the credit growth rate recovered and reached record levels in the monetary expansion period (2009-2013). After the CBRT has implemented macroprudential measures to reduce consumer loans and increase commercial lending in the credit growth pace, the growth rate of commercial lending has begun to diverge positively, as seen in the graph. The factor that started in commercial lending in the last period and has a growth effect of 80% level is the incentives within the scope of the Credit Guarantee Fund which will be mentioned in more detail in the future.

The composition of the credits is closely followed by the CBRT as well as the growth rate of the credits. Closely related with economic growth, the credits which were generally segregated as consumer and commercial loans were previously mentioned. The CBRT has introduced macro-prudential policies to ensure that credits that contribute to growth are placed on a healthier path without inflationary or fragility effects. In this context, consumer credits were tried to be limited due to the inflationary effects and the negative contribution they made to the current account

deficit. Measures such as difficulty of installment shopping facilities, cash only for some products are included in this scope. On the other hand, commercial loans were encouraged. The reason for this is that the commercial loans are usually turned into investment, by correcting current account balance which is a reflection of the savings-investment deficit, and hence the growth to be accelerated with an investment dynamics, rather than consumption-based. Transformation and incentive mechanisms in commercial lending and the effects of restrictions on consumer loans will be examined in more detail in the future

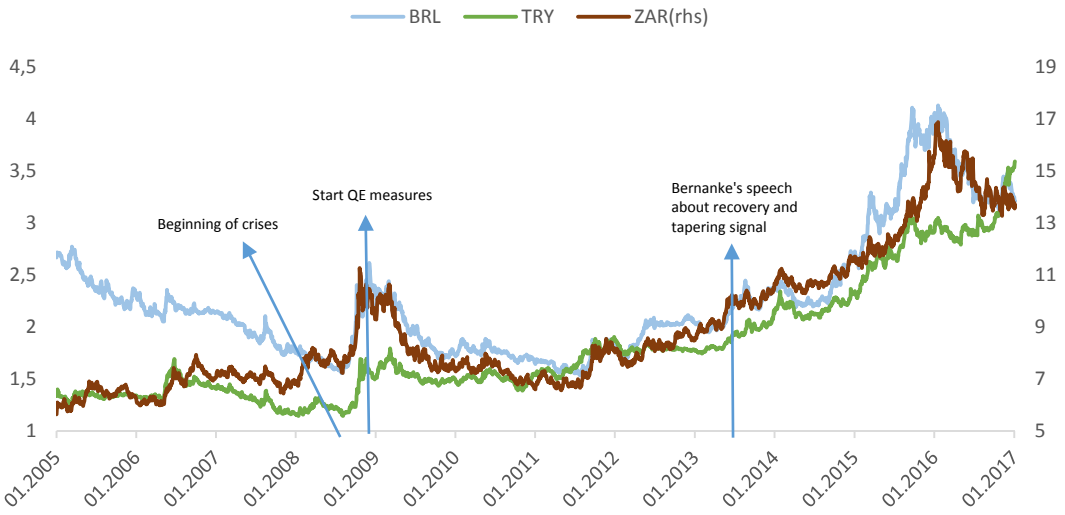
Rapid and continuous movements or volatility in asset prices are also considered to be one of the leading indicators of financial stability. For this reason, in the literature, price movements are one of the issues that are emphasized on whether or not they are "healthy". Because every up or down and unstable price movements in the market is not a balloon or stagnation signal. In order to be able to talk about the balloon effect in the financial markets, it is necessary to create price movements that are separated from the economic bases. For example, the disconnection between the real and financial economies today may be a sign of near-term financial crises if measures are not taken. Because positions in stocks or derivative instruments indicate the possibility of a balloon, although the desired or potential levels at the price and growth level in the real economy have not yet been reached. Economies have grown at an average of 1 - 3%, while the increase in asset prices has exceeded 50% annually. For this reason, when an “unhealthy” word is selected, a set of price movements separated from economic bases is implied. On the other hand, movements in the price of an asset or instrument that differs positively from the general trend of the economy or of the industry are not balloon-shaped if supported by its economic and financial structure. A new invention, discovery, software or value-added product of a firm or a price increase or a steady and positive trend in the value of an asset will be a reflection of the positive expectations about that product, so it is compatible with economic basis and dynamics.

ii. FX Volatility

Since the CBRT has passed into free exchange rate regime, it did not set any foreign exchange target until the time of global financial crisis. Foreign exchange prices were determined according to the supply and demand conditions in free market. Since there was no exchange rate target, the exchange rate policy can often be summarized as exchange rate intervention or buy / sell auctions. In the new period, it was introduced an exchange rate policy, which is rule based and also monitoring financial stability. Unhealthy price movements in the market have been closely monitored and volatility elimination structures have been designed without direct intervention.

Exchange rate fluctuation has negative effect on the basic macro variables such as current account deficit, risk premium, price stability. The impact on the current account deficit is essentially the result of maturity and exchange rate mismatches on the balance sheet. In an environment where local currency is depreciating, imports are becoming more expensive and the current account balance has a positive impact, or vice versa. The impact on the risk premium is that the level of exchange rate and volatility is a fragility indicator. Severe depreciation in the currencies has a negative effect on the risk premium, accompanied by the sudden stop effect. The effect on price stability is mainly due to the influence of the exchange rate pass through effect. The prices of imported goods are reflected in the price of domestic products due to the depreciation of the exchange rate, which causes inflation.

Graph 3: Selected Currencies Performance Against USD

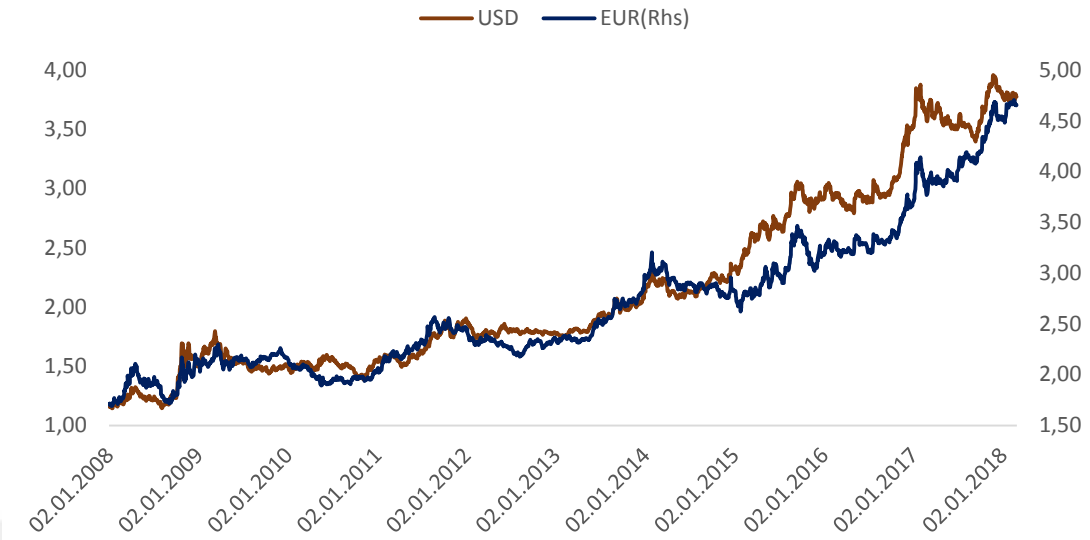


Source: CBRT

Graph 3 shows 3 selected fragile countries FX performance against USD during crises, QE and tapering period. Till 2008, stable appreciation in these currencies suddenly turn into a sharp depreciation in 2009. Then with QE policies, massive amount of USD in the markets make these fragile currencies more expensive. However after tapering period, all these emerging market currencies has depreciated against USD till today. Especially TRY, negatively differentiated from the EM currencies during 2013-2016. Furthermore, socio-political developments (like coup attempt in 2016) added more pressures on the depreciation of TRY. On these days (in the first half of 2018), it is the most fragile currency in the world after Argentinien Peso.

In this environment, while the CBRT is making inflation forecasts, it has accepted that a real exchange rate appreciation or loss of 1-2% is reasonable (Balassa-Samuelson effect). The exchange rate movements that cause any price fluctuations outside this appreciation or depreciation have been tried to be stabilized by rule-based methods. In this period, the need for direct foreign exchange intervention has decreased and two mechanisms, which can operate in the form of automatic stabilizers, have been introduced. These are the Interest Rate Corridor application and Reserve Option Mechanism (ROM), which will be explained in more detail later.

Graph 4: USD/TRY and EUR/TRY



Source: CBRT

Graph 4 shows the performance of the Turkish Lira against the USD and EUR since the global crisis. The USDTRY and EURTRY currencies were in the 1.15 and 1.70 levels respectively in the initial period of the crisis. In about 10 years since the crisis, USDTRY has risen to 4.05 and EURTRY to 5.05. Basket rate (0,5USD + 0,5EUR) is 1.40 at the beginning of the crisis, but it has exceeded 4.50 levels today. This means that the Turkish Lira depreciated more than 200% on average against USD and EUR. As can be seen in the graph, the general trend in exchange rate has been upward in the last ten years, and in some periods volatility in exchange rate has increased. The measures taken to reduce and drive these volatility will be examined in more detail in the future.

After the crisis, analyzes of warming and cooling in economics revealed that the crisis have some leading indicators. Studies conducted for this purpose are generally called stress tests and the system itself is defined as an early warning system. Early warning systems, which are a reflection of the answers to the question of why the global crisis is unpredictable, are generally trying to explain the past crisis or macroeconomic dilemmas. Stress testing is one of the most known and most frequently used applications of early warning systems. The general functioning of the system is designed as follows: an index created by weighting the basic indicators of the economy's overall appearance caused by the past period of crise in the financial

system, and thresholds defined for normal / stable times (such as a 12 month moving average). If the index value aggressively exceeds or falls below this threshold, the alarming system predicts a potential crisis in the future.

In this context, the following variables and related markets are used for Financial Stress Index for Turkey.[40]

Graph 5: Financial Stres Index for Turkey: Variables and Markets

Money Market	3M TRLIBOR Volatility TED Spread
Bond Market	Bill Volatility EMBI + Turkey Index
FX Market	FX Volatility FX CMAX Conversion
Stock Exchange Market	BIST 100 Volatility BIST 100 CMAX Conversion BIST 100 and Bill correlation
Banking Sector	Banking Sector Stock Exchange Volatility Banking Sector Stock CMAX Conversion Banking Sector BETA

Source: CBRT

At Graph 5, financial stress index and explanatory variables created for Turkey are shown. Accordingly, it has been chosen as the explanatory variable for the leading indicators of the money, bonds, foreign exchange and stock markets and the banking sector, which are thought to have the greatest impact on the behavior of financial markets and decision-makers.

Financial Stress Index that specially created for Turkey, tested the relationship with the overall economic cycle and has shown successful results. Along with producing successful results, there are some missing aspects of the index. At the beginning of the important points here are thresholds to be defined for stable periods.

[40] Financial Stability Report, November 2017, www.tcmb.gov.tr.

While financial stress index created for Turkey doesn't give this threshold value, the rise in the index values indicate the unstable period. In this sense, it can be assumed that the index value, which started to move upwards from the general trend, is a warning system for the risks or fragilities that accumulate in the financial system. In the light of the above variables, the upward movement of the macro indicators at a significantly higher rate than the mean value indicates that risk premium and financial stability may deteriorate in the near future.

3.3 Macro-prudential Instruments and Applications

Until the global financial crisis of 2008, open inflation targeting, which started in 2006, has been successfully implemented. In this period, the inflation expectations were kept under control by using short term interest rates. At that time, there is no obstacle in practice or in the global context to keep the main objective as price stability or inflation under control. Central Bank of the Republic of Turkey (CBRT), had not set up monitoring systems or any measures related to the financial markets.

In this period, the most fundamental problem in front of the CBRT is that the tool basket is insufficient in terms of global financial conditions. Achieving more than one goal with a single instrument is almost impossible in a market that has not reached the financial depth adequately. For example, interest rates, which have been harshly reduced by adhering to global economic developments, have relatively compensated for the recession in the economy with the impact of the recovery in domestic demand. However, capital inflows and relatively low interest rates from global markets have facilitated access to credit and have resulted in the artificial growth of asset prices in both real and financial economies. Price increases or declines that are incompatible with economic bases of asset prices include danger signals for financial stability.

The single objective and instrument policy (price stability - short term interest rates) applied by CBRT until global financial crises has lost its appeal with the crisis, and policymakers have decided to create a new set of tools appropriate to cyclicality.

The rapid change in the global financial outlook, the increase and volatility in risk appetite has made the emerging countries more attractive for capital owners and at the same time the macro financial risks have increased in importance. Some non-traditional monetary policy tools have been designed to mitigate the risk appetite experienced during this period and the negative effects of volatility in capital flows on developing country economies. These instruments have been effectively implemented throughout the crisis in both developed and developing country economies and are generally referred to as "macroprudential" policies. Because interfering to exchange rate or capital movements with existing instruments has become both inefficient and more costly. In this context, the CBRT, which is the sole authority to conduct the monetary policy, designed a monetary policy aim and a basket of tools that are both considering financial risks and ensuring price stability, but also takes into account developments in global financial markets. Because at the beginning of the lessons learned from the crisis, financial stability is a prerequisite for price stability; it is almost impossible to maintain price stability without financial stability in the global crisis environment.

Another aim of the new policy mix is the exchange rate volatility, which is incompatible with market dynamics. Key economic indicators and the exchange rate gain or loss experienced in parallel with the developments experienced in foreign markets constitute a problem for economic activities. However, in the foreign exchange market, volatile and unhealthy price structures independent of the economic bases disturb the distribution of resources and threaten price stability by the influence of the exchange rate to the domestic prices.

Due to the reasons mentioned above, the design and implementation of a new mechanism that takes financial stability into consideration without harming price stability has become inevitable. Because the interest rates lowered in order to remove the negative effects of capital inflows are causing price stability as a result of an increase in domestic demand. The ultimate solution of this situation is to introduce more than one vehicle at the same time and implement a policy mix.

This policy mix consists of the change in the purpose and tool basket mentioned earlier. In this context, interest rate corridor, reserve requirements, Reserve Option Mechanism and liquidity management were the most widely used macro-prudential instruments. The main purpose of these instruments is to ensure

price stability by taking financial stability into account as well. In order to take reserve requirements as a policy instrument, the interest payment applied to reserve requirements was abolished first. However, the CBRT was the one that started to cut interest rate in the highest rate within a year to start from 2008 and implemented it as soon as possible. Together with the 1025 bps discount, efforts were made to prevent the short-term capital inflows and the volatility of the economy with unhealthy price developments. But low interest rates have made lending more attractive, as it reduces the cost of loans. Rapid credit growth is one of the two key financial stability indicators closely monitored by the CBRT, with its volatility. For this reason, the CBRT tried to avoid credit growth by increasing the required reserve ratios while at the same time deterring short-term capital inflows through interest rate cuts. Together with this, the application of the "maturity based reserve requirements ", which will be discussed in more detail later, has been put into practice. With the measures taken in this context, it is aimed that credit growth will sit on an overlapping path on economic grounds.

The previous and the following set of objectives and tools for the newly designed monetary policy are presented in Graph 4. Accordingly, price stability has been removed from being the sole purpose, and financial stability has been added to the purpose basket. However, a structured and circular basket of vehicles was created to achieve this goal. How these tools can be used to reach the ultimate goals will be examined in detail in the future.

Graph 6: Design of Monetary Policy

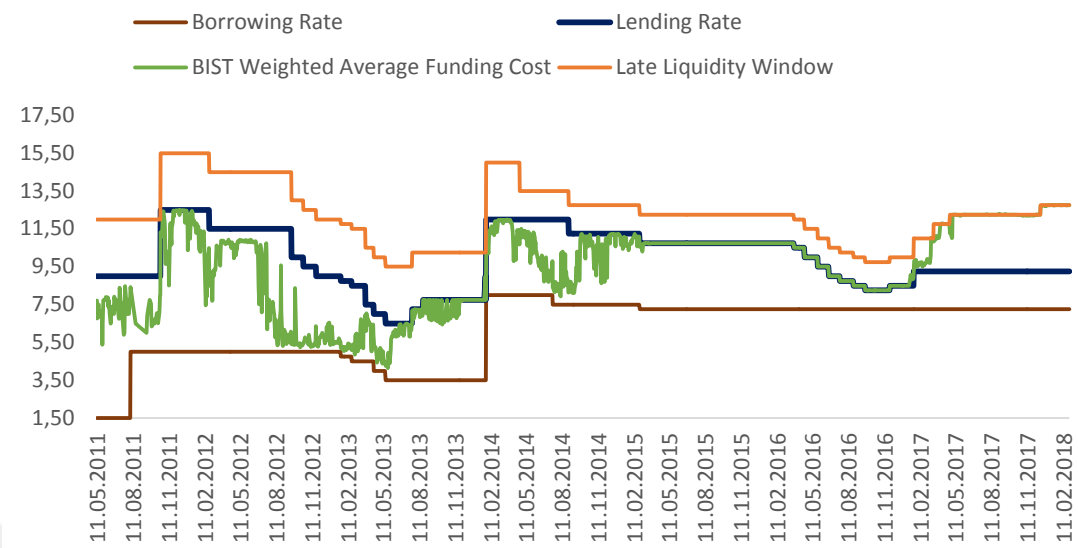
	FORMER	CURRENT
TARGET	Price Stability	Price +Financial Stability
TOOL	Short Term Interest Rate	Structural Tools (ROM, MBRR) Cyclical Tools (Interest Rate Corridor, Liquidity Management)

3.4 Macroprudential Instruments Implemented in Turkey

3.4.1 Asymmetric Interest Corridor

In the practice of traditional monetary policy there are various interest rates used by central banks like repo rate, borrowing / lending rate, marginal funding rate and liquidity window. The CBRT uses the repo rate (1 week) as the policy interest rate from these rates. The borrowing and lending rate are the active instruments used in case of liquidity surplus or deficit in the market. The band between the overnight borrowing and lending rates applied to the deposits that banks can hold in their CBRT accounts is called the interest rate corridor. The policy rate represents the pre-determined weekly repo rate that occurs between this band. Almost all of the central banks in the world have a similar corridor structure. But what makes it special application in Turkey, lies in its ability to be used as a monetary policy tool, the width of this corridor. Because the corridor in other country implementations has a structure that generally looks symmetrical around the policy rate. However, the CBRT has started to use this corridor asymmetrically after 2010. Thus, without changing the policy rate, it is aimed to quickly control the unhealthy and volatile price movements in the market and to prevent manipulative capital movements.

Graph 7: Implementation of Interest Rate Corridor



Source: CBRT

In Graph 7, the interest rate corridor application obtained from the data of the Central Bank is shown. Starting in 2011, the data show the late liquidity window and the weighted average funding cost, along with borrowing and lending interest rates. The interest corridor application has been abandoned since the end of 2016. It is also possible to see this in the graphic. While the weighted average funding cost is in the region between the borrowing and lending interest in the period in which the interest corridor was applied, the funding cost has risen above the lending rate after abandonment.

The biggest advantage of the asymmetric interest rate corridor here is to give flexibility to the application of monetary policy. Because the policy rate is determined by the monetary policy committee, which is collected once a month at that time, and is kept constant until the next meeting. In the new practice, interbank market interest rates between the borrowing and lending rates can be adjusted on a daily basis by repo auctions.

The interest corridor policy has been used as an active macro-prudential tool since the end of 2010. After the second quantitative easing (Q2) initiated by the FED, the corridor lower limit was strongly reduced. This is because it has deterred capital inflows that started to move towards developing countries' economies from near zero interest rates in developed countries and lowered interest rates in other countries. Thus, interest rate volatility and uncertainty have been increased and short-term

capital inflows have been tried to be avoided. Following the emergence of the debt crisis in the EURO region, no action was taken for a while, and the corridor upper band was raised to prevent sudden stalling and capital outflows of the crisis in other countries.

In an effort to limit the volatility of capital movements on the exchange rate, the width of the interest rate corridor was actively used to prevent direct foreign exchange interventions. Although direct foreign exchange interventions seem to be a more effective tool, they are less preferred by the CBRT. Because of the free market conditions, there is a negative signal both to the market makers and to the CBRT reserves. For this reason, the interest corridor has been used as an effective tool to limit the adverse effects of short - term inflows and outflows especially of capital flows. In the period when the capital inflow is strong, the lower limit of the corridor (the borrowing interest rate) has been reduced in order to avoid the strong appreciation of the local currency. The underlying effect of the downward borrowing rate is two-fold. First of all, low interest rates will hinder excess liquidity in the market by preventing new capital inflows. In this way, both overvaluation in the exchange rate will be prevented and the short-term capital entering the country will be prevented from turning into credit. The second effect is that as the corridor lower band is pulled down and as a result corridor widened, the uncertainty of the expected return of the portfolio will increase and cause a decrease in risk appetite. In either case, new capital inflows will be reduced and unhealthy price movements in the currency and on the loans will be avoided.

3.4.2 Reserve Option Mechanism

The Reserve Option Mechanism (ROM) is a macroprudential tool designed by the CBRT after the global crisis and aiming to reduce exchange rate volatility. The main objective is to optimize the foreign exchange liquidity on the market and to act as an automatic stabilizer, taking into account the cost structure of the banks, instead of direct intervention in the market.

In the reserve option mechanism, the system basically operates as follows. The provisional reserves (required reserves) that the banks have to keep in the accounts of the CBRT could only be established in Turkish Lira (TL) until 2010. Since 2010, the CBRT has allowed the banks to hold their required reserves in the form of foreign currency or gold. The main purpose here is to make the exchange gains or losses in the capital inflows and outflows more stable. Depending on the relative price of the currency or TL, the banks may choose the option that best suits them. An optimization mechanism is also designed for this. What is important in this mechanism is how much gold or foreign currency can be allocated per TL. The coefficient indicating this is called Reserve Option Coefficient (ROC). That is, when ROC 1, one unit of foreign currency or gold can be kept for 1 TL, while for ROC 2, 2 units of foreign exchange or gold should be allocated for 1 TL. The general optimization formula for ROC is as follows:

$$\mathbf{ROC^{TL}} = \frac{\mathbf{r_t^{TL}}}{\mathbf{r_t^{FX}} * \mathbf{E}\,(e_{t+1})/e_t}$$

ROC^{TR}: threshold ROC

r_t^{TL}: TL interest rate

r_t^{FX}: FX interest rate

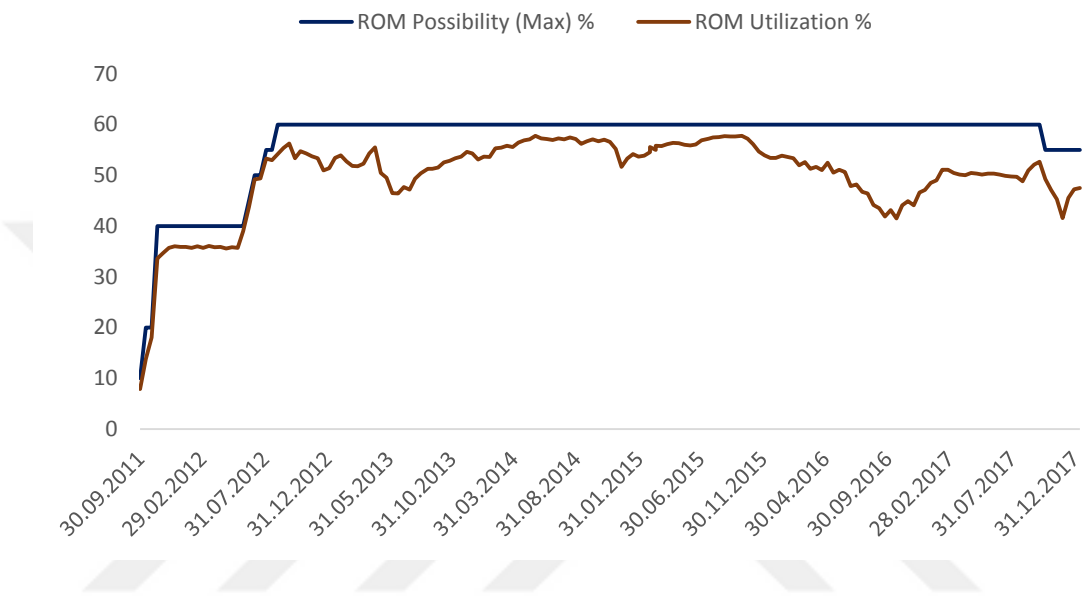
$E(e_{t+1})$: FX rate expectation for the next period

$E(e_t)$: current FX rate

As stated in the above form, ROM is an optimization problem for each bank. There is a threshold ROC value for each bank that calculates the future exchange rate expectation that the domestic TL and FX rate is the data. As each institution has varying borrowing costs from domestic and international markets in the market for debt instruments, each bank has an optimal ROC threshold value for itself. The threshold here is the value that leaves the bank indifferent to using or not using this opportunity. If the ROC coefficient determined by the CBRT is higher than the

threshold ROC of the bank, the bank will not use this opportunity, but will benefit from the possibility of equal opportunity unless it is equal. ROM mechanism has been designed in an increasing proportion of the amount of foreign currency that can be held in the CBRT, and the system operates in such a way as not to make the method of using the whole facility attractive to any institution.

Graph 8: ROM Limits and Utilization



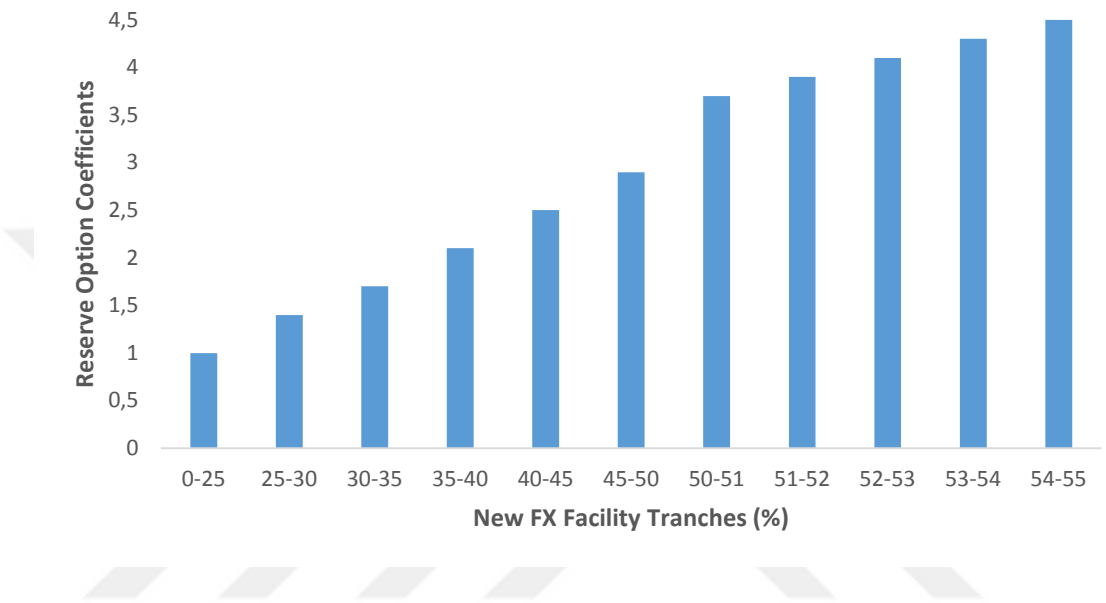
Source: CBRT

As can be seen in Graph 8, the most important factors affecting ROM usage are the relative costs of foreign currency and local currency. It is the period when the price movements in foreign currencies are unstable and the expectations are deteriorated in the middle of 2013 and the year 2016 is markedly decreased. The main reason for this, in May 2013 speech that he would end the monetary expansion that former Fed Chairman Bernanke are doing, and political developments in Turkey in 2016. In both periods, local currency depreciated rapidly and foreign currency costs increased.

The CBRT can adjust the foreign exchange liquidity in the market without having to intervene directly. In this context, the changes made in the ROC automatically inject foreign currency liquidity into the market or allow foreign currency to be withdrawn from the market. So the ROC is implemented as a means of monetary policy. In a period when capital inflows to the market are experiencing

and foreign exchange liquidity is rising, the CBRT is lowering the ROC values to reduce the pressure on local currency appreciation. Thus, the amount of foreign currency to be allocated per TL is decreasing, which makes it more attractive for the banks to set their required reserves in foreign currencies. As a result, foreign exchange liquidity can be withdrawn or injected without market intervention.

Graph 9: Reserve Option Mechanism, Utilization Rate and Coefficients



Source: CBRT

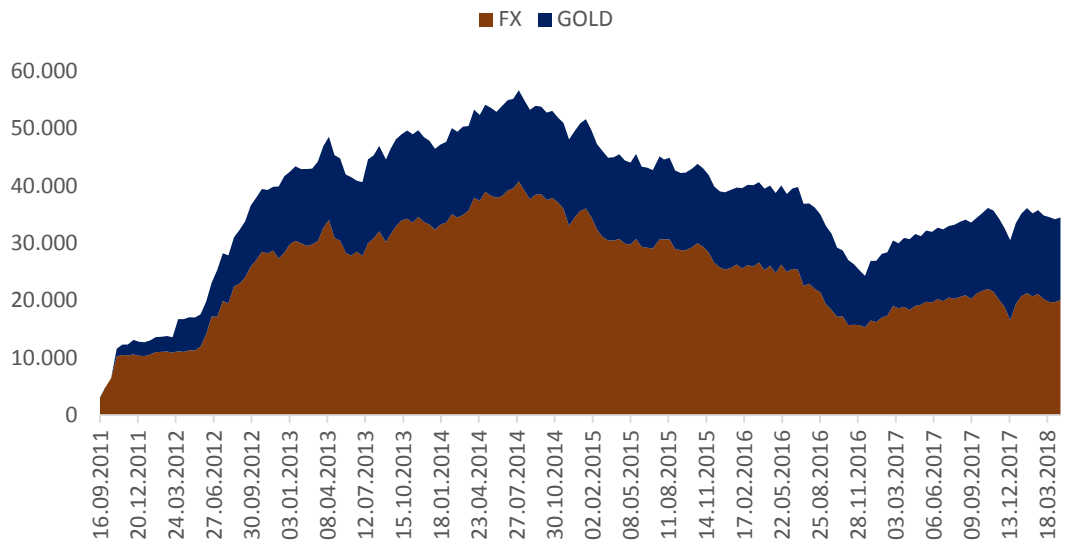
Graph 9 shows the last ROM opportunity and ROC levels implemented by the CBRT. The rates, which have been changed since the first application, are now adjusted according to global and local economic developments and the aim is to reduce exchange rate volatility. Setting a different ratio for each usage level ensures that ROM is implemented as an automatic stabilizer.

As an example, the upper limit of the ROM that banks can use with the last regulation is 55%. Assuming that a bank has to keep a TL denomination of TL 100, assuming that it wants to use 25% of this opportunity, it has to keep the 25 TL equivalent in the CBRT accounts. If USD/TL rate in current period is considered to be 3.8, 25 / 3.8 = 6.58 USD should be kept in CBRT accounts. If the use of the same bank increases to 30%, the calculation is as follows. If ROC is 1 for the first 25% of the ROM and 1.4 for the next 5%, then 100 TL * (0,25 * 1 + 0,05 * 1,4) = 32 TL.

When conversion is made over the current exchange rate, 32 / 3.8 = 8.42 USD must be kept in the accounts of the CBRT.

ROM is more efficient than other monetary policy tools, since it is not a mandatory application but is designed in a structure entirely left to the preference of the banks. The operation of an automatic stabilizer prevents both negative signals that can be given to the market and gives flexibility to additional measures to regulatory and supervisory agencies. If we assume an environment where the local currency is overvalued at a time when the capital inflow is high, the CBRT may restrict the pressure on the TL to two levels. The first is the foreign exchange intervention against TL and the second is the changes to be made in the foreign exchange required reserve ratios. If the first option is preferred, there is a risk that an intervention in the exchange rate will be confused with an intervention in the exchange rate level. At the same time, it will cause the Central Bank to increase foreign exchange reserves, increase TL liquidity in the market and decrease interest rates. In the second option, the required rate of foreign exchange reserves can be increased and the pressure on the appreciation of TL can be reduced in a certain way. However, this change will cover all banks and financial institutions, and will leave the institutions suffering foreclosure access at that time difficult.

Graph 10: Reserves hold by banks via ROM facility, Billion USD



Source: CBRT

Graph 10 represents the FX and Gold reserves hold by banks via ROM utilization. During the capital inflow period between 2011 and 2014, the cost of FX relative to TRY was lower and hence banks preferred to hold more FX as a reserve requirement. After the cost of FX started to rise, holding foreign currencies on Central Bank accounts became more expensive. Thus, banks started to hold higher TRY and lower FX as required reserves.

Despite these possibilities, the reason for preferring ROM is that it provides the opportunity to make its own decision for every financial institution without intervention in the market and without any compulsory application. While an implementation such as required reserve ratios is a structure where all banks are binding and sanctioned, but ROM is a matter of preference. In other words, every bank that makes optimization calculations has the right to use it, or not to use it. The most important point that should be emphasized here is that the ROM is not designed to lift direct foreign exchange interventions. ROM is designed to be compatible and complementary to other monetary policy instruments. The main aim is to make it easier for the market to find a balance in entering a circuit that has a stabilizing structure before possible unavoidable interventions. The aim of ROM is to mitigate the negative signal that foreign exchange interventions will give to the market and to stabilize the market without intervention.

3.4.3 Implementation of Required Reserves

The reserve requirement (foreclosure reserves) is generally defined as legally keeps a certain percentage of deposits held by the banks in the accounts of the Central Bank as determined by the CBRT. Especially at the beginning of the courses taken during the banking crisis, banks are prevented from creating unlimited loans. By changing the required reserve ratios, which are at the top of the factors affecting the money multiplier, the amount of money to be created by the banking system can be adjusted. In addition, the reserve requirements kept in CBRT accounts affect both lending facilities and the rights of depositors. In an environment where the allowance

rates are raised, the credit facilities of the banks are limited in order to allocate a higher rate for each unit deposit. However, it acts as a natural insurance to the depositors to pay some of their deposits in the event of a default or bankruptcy.

As a result, despite an ineffective tool until financial crises, reserve requirements became an effective monetary policy instrument after the global financial crisis. In the period of policy mix, the necessity of putting more than one tool at the same time increases the reason for the application of the reserve requirement, complementary to each other with the application of the interest rate corridor.

To give an example, when there is an increase in global capital inflows, the negative effect of extreme value gains on the currencies is observed on the macro variables. At the beginning of these, overvalued local currency makes imports cheaper and puts a negative contribution to the current account deficit. In addition, since capital inflow facilitates credit access, the growth rate of lending is increasing and leads to unhealthy price developments in real / financial assets. Interest rate lowered to eliminate all these effects and deter capital inflows increase the demand for TL-denominated loans and cause credit growth. In this environment, the CBRT cut interest rates to limit capital inflows on current account balances and exchange rates, while at the same time increasing the required reserve ratios to avoid credit growth. This practice, called the policy mix, alleviated maneuver constraints in the single tool era and put together effective and supportive policy instruments.

The effect of reserve requirements on credit growth has an impact over two channels. These are interest and liquidity channels. A bank that tries to close the liquidity gap created by an increase in the required reserve ratio through the CBRT's funding will have to reduce the amount of credit it uses in the future. The Bank will face maturity mismatch if it tries to close the funds it uses with repo contracts with deposits. Because the repo maturity is 1 week while the average maturity of deposits is 50 days. In this case, the maturity mismatch will either go to borrowing from the outside the CBRT to solve the problem, or it will reduce the amount of loan it uses. In both cases, the final outcome will be the reduction in loan growth of the increase in required reserves.

The CBRT adopted the new medium-term macroprudential tool, called the "required reserve based on the maturity," as a major change in the application of the reserve requirement. The method of calculating the required reserves was in the form of keeping the liquidity in the CBRT declared by the CBRT before the start of the new application. With the amendment, long-term borrowing and lending structure was encouraged by changing the rates to be applied to reserve requirements in the current application according to maturity structures. In an application designed to have a higher required reserve ratio for short-term deposits, attempts have been made to extend the maturity structure of the banking system and to prevent the conversion of short-term deposits into credits. Because the lending of the credits is 1 year and over, the deposits are between 1-3 months on average. The fragility created by this maturity mismatch, which banks and financing companies face, is one of the issues that financial stability may be deteriorated. Along with the new application, both the banking and finance companies tried to prevent short-term loan usage and a mechanism was introduced to encourage long-term borrowing structure.

In addition to this practice, developments in the global economy and changes in the scope of Basel III are closely monitored. Some changes have been made in the calculation of the "minimum capital adequacy ratio" applied to increase the resilience of banks to systemic risks. The leverage structure of banks and financing companies is being closely monitored in order to prevent new crises with the influence of lessons learned from the global crisis.

For this purpose, the capital adequacy ratio has been provided with an additional reserve requirement for financial institutions that are below the minimum ratio (8%) determined by the committee. The aim here is to introduce a mandatory provision that takes account of the indebtedness of banks and financing companies operating with high leverage. This practice has been called the "reserve requirement based on withdrawal". While the leverage ratios allow institutions with a specified or higher level of credit to be extended, an additional reserve requirement is provided at an additional 1-2 percentage points in the leverage ratio of 3-3.5%. Thus, both the asset quality and the fragile financial institutions are borrowed to prevent systemic risk.

Graph 11: Macroprudential Regulations on Retail and Corporate Loans

Macroprudential Tools	Regulation	Macroprudential Measures (Tightening)	Enforcement Date	Macroprudential Measures (Easing)	Enforcement Date
Credit restrictions	Regulation on Bank Cards and Credit Cards	Increasing minimum payment rates of credit cards	17.12.2010 01.01.2014 (kademeli geçiş)[1]		
		Loan/Income ratio restriction for credit card limits	08.10.2013		
		Closing credit cards in certain cases	17.06.2011 08.10.2013		
		Limiting the installment period of credit card debt	01.02.2014 13.05.2014 22.10.2014	Extending the installment period of credit card debt	25.11.2015 27.09.2016
	Regulation on Credit Operations of Banks Regulation on Principles for Establishment and Operations of Financial Leasing, Factoring and Financing Companies	Restricting maturity of vehicle loans to 48 months and consumer loans except housing and vehicle loans to 36 months	31.12.2013	Extending maturity restriction for consumer loans except housing and vehicle loans to 48 months	27.09.2016
		Loan/Value ratio restriction (75%) for housing loans extended to consumers	01.01.2011	Increasing the Loan/Value ratio restriction to 80% for housing loans extended to consumers	27.09.2016
		Loan/Value ratio restriction (50%) for housing loans extended for commercial purposes	01.01.2011	Abolition of Loan/Value ratio restriction for housing loans extended for commercial purposes	04.04.2013
		Loan/Value ratio restriction for vehicle loans (70% up to 50,000 TL of the billing value, 50% for the rest)	01.02.2014		
Capital adequacy	Regulation on Measurement and Assessment of Capital Adequacy of Banks	Increasing risk weights applied to consumer loans and credit cards	22.03.2008 18.06.2011 08.10.2013	Decreasing risk weights applied to consumer loans and credit cards (To comply with Basel regulations)	01.07.2012 31.03.2016
General provisions	Regulation on Procedures and Principles for Determination of Qualifications of Loans and Other Receivables by Banks and Provisions to Be Set Aside Regulation on Accounting Applications and Financial Tables of Financial Leasing, Factoring and Financing Companies	Incremental general provision rates for consumer loans except housing loans[2]	18.06.2011 08.10.2013 24.12.2013[3]	Abolition of incremental general provision rates for consumer loans except housing loans	27.09.2016
				Reducing general provision rates • to 0% for export loans[4], • by half for SME loans, which are categorized in the first group	08.10.2013
				Reducing general provision rates • to 0% for SME loans and syndicated loans for large-scale public procurements, • by half for commercial loans, which are categorized in the first group	14.12.2016
				Reducing general provision rates by half for commercial loans, SME loans and export loans, which are categorized in the second group	14.12.2016
Reserve requirements	Communiqué on Reserve Requirements	Inclusion of financing companies in the reserve requirement system	06.12.2013		

Source: CBRT

As seen in the graph 11, there are multiple measures taken by Central Bank and Banking Regulation Authority to restrict credit growth rate in Turkey. Since the policy mix approach has been applied, measures have 4 dimension[41]. Credit, capital, provision and reserve requirements are the sub categories of the measures. To restrict credit growth rates, firstly payment via installments have been abolished or lessened on some specific transaction. Additionally, to converge the rates for Basel III, capital adequacy and its quality have been regulated. Some provisions are reserved for specific balance sheet channel. Required reserve ratios have also been increased as a counter-cyclical tool after the interest rates are dropped.

[41] Financial Stability Report, May 2017, Central Bank of Turkey, www.tcmb.gov.tr

CHAPTER 4

4. FX VOLATILITY AND MACROPRUDENTIAL POLICIES

In the process that began after the 2008 global crisis, the capital flows that started towards the developing countries from the developed countries had basically two effects on the macroeconomic indicators of the developing countries. These are the overvaluation pressures in the currencies of the countries concerned and credit expansions is the second. Since the Central Bank includes the financial stability in the target basket as well as the price stability, the risks that these variables indirectly create for price stability are closely monitored. In this context, the CBRT considered these variables as an intermediate variable as two basic indicators of financial stability.

While the Central Bank is making inflation forecasts, it makes year-end inflation forecasts based on the exchange rates. The Central Bank does not have a currency target, nor does it interfere with the usual flow of foreign currency transactions in the free market. But the main problem is that the aggressive movements in foreign exchange rates are damaging to price stability. This situation, which is referred to as the FX pass-through to domestic prices from the exchange rate, refers to the situation where the price of imported goods is reflected in the resulting domestic prices after the fluctuations in the exchange rates and creates price distorting power. In such a case, the Central Bank intervenes in its volatility, not its level and tries to meet year-end inflation forecasts and inflation targets. For this reason, the volatility levels in exchange rates have a damaging and fragile effect on macroeconomic price stability, while at the micro scale, the outlook of firms is deteriorating via balance sheet channel.

In this part of the study, the impact of global capital entering Turkey ob exchange rate volatility will be investigated by empirical indicators. The impact on credit expansion was excluded from this section. The effects of the variables (interest corridor, ROM, liquidity management etc.) contributing to lowering the volatility of the exchange rate will be discussed in general and it will be examined whether the

Reserve Option Mechanism is an effective tool to decrease the exchange rate volatility.

4.1 The Effects of Asymmetric Interest Rate Corridor and Liquidity Management on FX Volatility

In order to limit the adverse effects of capital movements on the macroeconomic risk indicators, which began immediately after the global crisis, , the Central Bank put a series of measures into practice. Interest rate corridor and liquidity management are also two of the most complementary of these applications. Until May 2010, the CBRT started liquidity funding with an overnight interest rate. The one-week repo interest rate is set as the policy interest rate, and the corridor between the borrowing and lending rate is designed as a policy tool. In traditional monetary policy applications, the interest rate or policy rate in the interbank money market is symmetrical. In the new practice, the width of the corridor served as a policy tool. Instead of a symmetrical and narrow band, a relatively broad and asymmetric interest corridor structure was applied. The most important contribution of this application to the implementation of the Monetary Policy is flexibility. Flexibility is low because the interest determined by the decision of the Monetary Policy Committee, which was convened every four weeks (now every six weeks), can not be changed until the next board meeting. In the current situation, the Central Bank can change the weight of the funding and change the overnight interest on the market even on a daily basis.

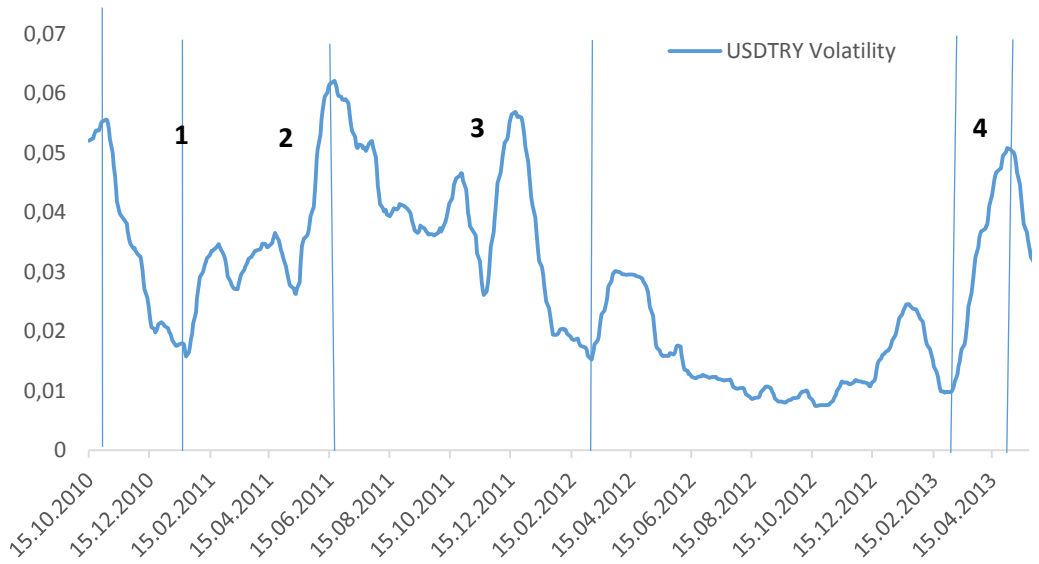
With the width of interest corridor, the liquidity management policy has been adopted as a complementary policy to increase the efficiency of the corridor application. Changes in additional monetary tightening and reserve requirement management have reinforced the effectiveness of discounts or increases in interest rate corridors. The effective use of the policy mix, especially during periods of external shocks (such as quantitative easing or the EUR crisis), eased the pressure on macro financial risks

The borrowing interest rate, which is the corridor lower band, was lowered due to the overvaluation pressure on the local currency and the negative

contributions to the current account, due to the increase in global risk appetite. Thus, it has been tried to prevent hot money inflows which can be regarded as short-term and portfolio investments. Downward expansion of the corridor will have a deterrent effect on portfolio investments as it will increase the expected volatility of short-term interest rates. At the same time, the over-valuation pressure on local currency will be eased by this method.

On the other hand, declining interest rates also reduce borrowing costs and create an effect of reducing saving / stimulating consumption. The decline in interest rates increases the use of credit and encourages investments. The pace of growth that is devoid of the economic bases of credit expansion is deteriorating both the current account balance and the inflationary effect. To counteract this negative effect, the Central Bank implemented the policy mix. On the one hand, interest rates have been reduced, short-term capital inflows (and exchange rate volatility) have been tried to be discouraged. Reserve requirements have been increased from the other side, bringing the credit growth rate to reasonable levels. The chart below shows the exchange rate fluctuation between 2010-2013. This trend has been divided into four distinct cycles, and the policies applied in this period are classified as follows.

Graph 12: USDTRY volatility and implementation of interest tools



Source: CBRT

Graph 12 is the moving average of the 50-day standard deviation of the USDTRY exchange rate and represents the exchange rate volatility. The data set starts from late 2010 when the interest payment is terminated in order to increase the effectiveness of the reserve requirement application, and ends in the middle of 2013, when the global liquidity tightening signal is voiced.

Region 1 represents the decline in the volatility of the currency after the Central Bank reduced its borrowing interest rate gradually from 5.75% to 1.5%. After the global financial crisis accelerated, the Central Bank radically lowered borrowing rates by 1025 basis points until 2010. The ongoing upward movement in risk appetite has put pressure on lowering borrowing interest rates and the level has been reduced to 1.5%. As a result, capital flows in the form of short-term and portfolio investments were prevented, and the valuation pressure on the exchange rate was lightened.

Region 2 represents the volatility increase on the USDTRY following the deterioration in the outlook of peripheral countries, particularly Greece, following the intensification of the debt crisis in the EUR region. Capital outflow from developing countries accelerated and risk appetite declined. In this period, the Central Bank expanded the lending rate, which is the corridor upper band, in order to limit the capital outflow. At the same time, market funding is weighted not only by policy interest rates but by higher lending rates. Thus, the market has been signaled that it will be able to raise interest rates further. Thus, the depreciation of the exchange rate has been limited and has started to decline since 2012.

Region 3 shows the effect on the volatility of the Additional Monetary Tightening, which was not previously disclosed. Due to the fact that the Central Bank is the sole authority to control the liquidity in the market, it went on to apply the Additional Monetary Tightening measures during the periods when there was an excess depreciation or appreciation of the exchange rate. In summary, during periods when upward movement in the currency was accelerating, market funding was reduced and interest rates on the interbank market increased. Increasing the interest rate on the market without changing the policy rate has increased the Turkish lira costs and reduced liquidity. In this context, the banks that need liquidity have been meeting the Turkish Lira liquidity requirement by selling foreign exchange assets in

order to close the gap. Thus, the rate of change in the exchange rate has been eased without changing the policy rate.

Region 4, on the other hand, is influenced by the statements made by the FED in May 2013 that the quantitative easing policies will be terminated soon. The FED, which provides economic recovery by providing a total of three quantitative expansions to the market with a monthly liquidity of USD 85 billion, said that targeted unemployment levels for the US economy were captured. It is stated that starting with 2014, the amount of low cost USD given to the market will be gradually decreased and then the balance sheet reduction efforts will begin. This decision has created a large amount of capital outflow from Turkey and other emerging economies and resulted in the loss of value in exchange.

In a nutshell, the Central Bank has used the interest rate corridor as an active policy instrument to reduce exchange rate volatility. The design of the interest corridor in the asymmetric structure has increased the efficiency and application flexibility. In addition, liquidity management has been implemented as a complementary mechanism in order to enhance the effectiveness of the corridor on monetary policy. Additional policy instruments have also been actively used in the event that the interest rate corridor is insufficient to control multiple targets in practice. In order to mitigate the effects of global shocks, a front-loaded monetary policy has been applied. Traditional instruments (policy interest) as well as non-traditional instruments of monetary policy (macro-prudential) have been put in place and the vulnerabilities of external shocks to the local economy have been mitigated.

In this period, besides the Central Bank, other regulatory and supervisory institutions such as the BRSA and CMB have also taken necessary measures. In particular, the BRSA has taken some measures for manipulative capital movements (previously mentioned) for credit growth and composition. However, these measures have been left out of the scope of this chapter since they are largely related to the growth and composition of lenders and capital.

4.2 An Empirical Study on Reserve Option Mechanism (ROM) and Exchange Rate Volatility

Reserve Option Mechanism is a macroprudential policy tool designed by the Central Bank and implemented after the global crisis. Until the end of 2011, the banks were only able to establish the required reserves that they were obliged to hold in the Central Bank in terms of Turkish Lira. ROM is an application that allows banks to hold required reserves in foreign currency or gold. As mentioned before, ROM is not an obligation but an optional application. By comparing the Turkish Lira and foreign exchange costs to banks and financial institutions, it provides the opportunity to establish required reserves in the appropriate structure.

ROM differs from other macroeconomic tools in that the most basic feature is a matter of choice. The change in required reserve ratios obliges all financial institutions to comply with this regulation, but there is no such requirement in ROM. Each institution may choose ROM as a result of cost optimization or vice versa. In this context, ROM is designed as an automatic stabilizing mechanism, which removes the need for foreign exchange intervention.

The basic variable that increases the effectiveness of ROM is the Reserve Option Coefficient (ROC). ROC is the currency of the unit Turkish Lira showing how much exchange or gold can be established. The calculation method of this ratio has been stated before. The point to be emphasized here is the threshold ROC values that leave the banks indifferent at the point of using or not using the ROM mechanism. As the cost of foreign borrowing for each bank will be different, the threshold ROC value also differs. For this reason, each financial institution will benefit from the ROM mechanism up to the threshold ROC value.

The central bank's strength is the ability to use ROM rates and ROC coefficients as a means of monetary policy. For example, ROC coefficients have been raised (lowered) when exchange rates have been observed to be upwards (downwards) volatile. Thus, the cost of holding foreign currency required reserves is raised and Turkish currency is withdrawn from the market and foreign exchange is injected. This adjustment made without any intervention is due to the design of the ROM as an automatic stabilizer.

Data and Methodology

The impact of macroprudential policies on volatility will be examined in this part of the study. Only the effect of the reserve option mechanism will be empirically examined from non-traditional monetary policy instruments such as interest rate corridor, reserve option mechanism, maturity and leveraged based on reserve requirement.

The value of the US Dollar (USD) against the Turkish Lira was chosen as the exchange rate. Since the currencies are generally non-stationary, they are first converted into stationary series and then mean regression result is obtained. While solving the stationarity problem, the variance must be constant in order to obtain effective estimators in ordinary ordinary least squares method. However, when the structure of exchange rate variance is examined, it has been determined that it exhibits a changing variance (heteroscedasticity) that is not constant but varying. For this reason, estimates to be made by ordinary least squares method lose efficiency while they are unbiased and linear. The autoregressive conditional heteroscedasticity (ARCH) and the generalized autoregressive conditional heteroscedasticity (GARCH) model are used to remove this problem from the middle.

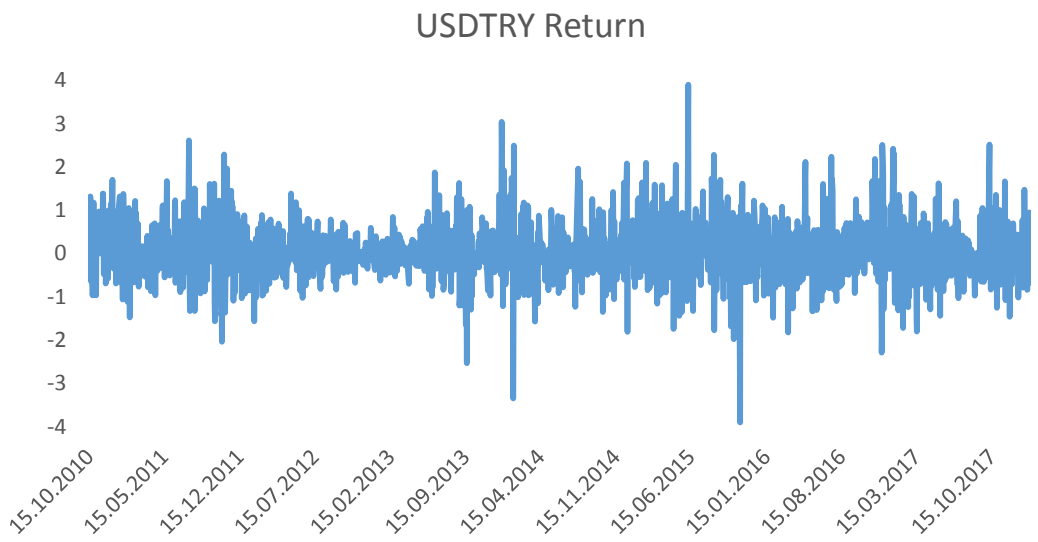
The ARCH and GARCH models are mechanisms that incorporate delayed values of error term and residuals into the model, taking into account that the variance is changing. It can be considered that the variance of the error term exhibits a learning and correction mechanism. The ARCH model creates a constraint by limiting the number of delays to be accounted for. The advantage of the GARCH model over the ARCH is that the number of delays is made up to the time of the effective estimator generation (in theory up to infinity). The GARCH model is an ARMA structure according to the ARCH model.

For modeling the exchange rate, the data are obtained from the Central Bank Electronic Data Distribution System. Daily exchange buying rate for USDTRY was selected and converted. The start date of the grant was selected in October 2010. This is the reason why the application of the interest payment to the required reserves has

been terminated at this time. This has increased the effectiveness of the ROM and removed the interest rate effect on volatility of exchange rate. The last observation for the data was in May 2018.

Two different periods were used to test whether ROM was effective or not. The first is the period in which the global capital flows between 10/2010 and 05/2013 continue and the other is the period in which the global liquidity and risk appetite declines between 2013-2018. A dummy variable for ROM has been created to test this situation. Since the ROM mechanism was not active until the end of September 2011, the dummy variable received a value of zero (0) during the period from 10/2010 to 10/2011, after which it received a value of one (1).

Graph 13: USDTRY volatility



Source: CBRT

As can be seen in Graph 13, even if the change in the currency is stationary, the changing variance feature multiplies. It is evident here that lower volatility, called volatility clustering, follows lower volatility and higher volatility follow higher volatility. For this reason, the model is formed as follows.

$$R_t = Ln\left(\frac{P_t}{P_{t-1}}\right) * 100 \qquad \textbf{(1.a)}$$

From the variables in Equation 1.a, R_t represents USDTRY returns. P_t represents the USDTRY value of the corresponding day, and P_{t-1} is the exchange rate of the previous day. Since the USDTRY series is not stationary, the natural logarithm is subtracted and converted to percent and make series stationary. Extended Dicky-Fuller (Augmented Dicky-Fuller) test was applied to test for stationaries. The test result is as follows.

Table 1: Stationary test and results

		t-Statistic	Prob*
Augmented Dickey-Fuller test statistic		-41,85641	0.0000
Test critical values:	1%	-3,433563	
	5%	-2,862846	
	10%	-2,567512	

*McKinnon (1996) one-sided p-values.

Table 1 shows the stationarity test results after the logarithmic difference of the USDTRY data is taken. The null hypothesis suggests that residuals have unit roots (non-stationary). Even at the 1% level of significance, the Dicky-Fuller value, which is significantly higher than the t-statistic threshold value, indicates that the null hypothesis can be rejected, that is, there is no unit root problem and series are stationary. Furthermore, I made a cross-check for unit root problems with PP and KPSS. Both gave the same result like Dicky Fuller, hence we solved the stationarity problem.

Then, the average equation obtained from this series was obtained and the variance and autocorrelation structure of residuals from the mean data were tested. The model result for the average data is as follows.

Table 2: USDTRY mean equation

Variable	Coefficient	Std. Error	t-Statistic	Prob*
C	0,063701	0,015488	4,11279	0.0000
R-squared	0,00000	Akaike info criterion	2,06159	
Adjusted R-squared	0,00000	Schwarz criterion	2,06449	
Log likelihood	-1975,04100	Hannan Quin. Criter.	2,06566	
Durbin-Watson stat.	1,91119			

The variables in Table 2 are only USDTRY data and the mean equation obtained with the fixed term. When the variance structure of the mean estimates was examined, the following findings were obtained.

Table 3: USDTRY mean residuals heteroscedasticity test results

Heteroskedasticity Test: ARCH				
F-statistic	74,58849	Prob. F(1,1914)		0,00000
Observ.*R-squared	71,86583	Prob.Chi-Square(1)		0,00000
Variable	Coefficient	Std. Error	t-Statistic	Prob*
C	0,37072	0,028824	12,86188	0,0000
Residual^2 (-1)	0,19367	0,022425	8,636463	0,0000
R-squared	0,0375	Akaike info criterion		3,166851
Log likelihood	-3031,844	Schwarz criterion		3,172653
Durbin-Watson	2,02876	Hannan-Quinn crit.		3,168986

Table 3 shows the results of the ARCH test, which is used to estimate the variance of residuals with a one-time delayed data. This change away from the normal distribution converges to the Chi-Square distribution and uses Chi-Square distribution threshold values for the test statistics. The null hypothesis suggests that there is no ARCH effect (changing variance structure) in the residuals. Looking at the p-value of the Chi-Square distribution, it appears to be at a level less than 1%. For this reason the null hypothesis can be rejected. In summary, there is an altered variance and ARCH image in the remains. For this reason, instead of Ordinary Least Squares method, it will be estimated with ARCH and GARCH method.

The results of ARCH, GARCH, EGARCH and TGARCH models are presented in detail (See Appendix). Which one of these is preferred is determined according to the Akaike and Schwarz criteria. The main constraint in the literature is that the lowest Akaike and Schwarz values produce the most efficient predictors. While the most effective method for the turnover (2010-2013) in which the volatility of the exchange rate can be controlled by macroprudential policies is TGARCH, the most effective estimation for the period 2010-2018 was obtained by the EGARCH method. At the same time, the variance and autocorrelation problem of error terms obtained from the GARCH result is also tested. Estimation results are as follows:

Table 4: h_t ARCH test results (heteroscedasticity)

Heteroskedasticity Test: ARCH				
F-statistic	0,537858	Prob. F(1,1914)		0,4634
Observ.*R-squared	0,538269	Prob.Chi-Square(1)		0,4632
Variable	Coefficient	Std. Error	t-Statistic	Prob*
C	0,98360	0,051581	19,0688	0,0000
Weig.Res.^{2} (-1)	0,01676	0,022855	8,63646	0,0000
R-squared	0,00028	Akaike info criterion		4,248898
Log likelihood	-4068,444	Schwarz criterion		4,254699
Durbin-Watson	1,99908	Hannan-Quinn crit.		4,251033

Table 4 shows whether the changing variance problem, h_t error, when predicted by the GARCH structure, is still present. As can be seen in the table, the level of significance was not reached enough to reject the null hypothesis of no ARCH effect. The p-value is at a very low level, such as 54%, and therefore the null hypothesis can not be rejected. In other words, there is no ARCH effect and the problem of changing variance in the new model has ceased to exist.

Table 5: h_t serial correlation (aotucorrelation) test results

Included observations: 1917

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.026	0.026	1.2588	0.262
		2	-0.001	-0.002	1.2605	0.532
		3	0.016	0.016	1.7491	0.626
		4	-0.001	-0.002	1.7503	0.782
		5	0.036	0.037	4.2979	0.507
		6	0.005	0.003	4.3459	0.630
		7	-0.026	-0.026	5.6476	0.581
		8	-0.005	-0.005	5.6923	0.682
		9	-0.038	-0.038	8.5351	0.481
		10	-0.019	-0.018	9.2381	0.510
		11	-0.010	-0.009	9.4305	0.582
		12	-0.042	-0.039	12.840	0.381
		13	0.005	0.008	12.890	0.456
		14	0.018	0.020	13.489	0.488
		15	0.026	0.028	14.810	0.465
		16	-0.010	-0.012	14.987	0.526
		17	-0.000	0.001	14.988	0.596
		18	-0.025	-0.028	16.164	0.581
		19	-0.005	-0.009	16.221	0.643
		20	-0.015	-0.018	16.670	0.674
		21	0.002	0.002	16.679	0.730
		22	0.018	0.019	17.341	0.744
		23	-0.002	0.000	17.349	0.792
		24	-0.007	-0.005	17.453	0.829
		25	-0.029	-0.029	19.097	0.792
		26	0.003	0.005	19.112	0.832
		27	0.006	0.004	19.187	0.863
		28	-0.006	-0.009	19.257	0.890
		29	0.008	0.007	19.393	0.911
		30	-0.030	-0.031	21.116	0.884
		31	-0.018	-0.016	21.779	0.890
		32	-0.022	-0.024	22.758	0.886
		33	-0.032	-0.028	24.706	0.850
		34	-0.001	-0.000	24.708	0.878
		35	0.002	0.004	24.717	0.902
		36	-0.001	-0.001	24.720	0.922

Table 5 tests whether there is serially related or autocorrelation between the error terms estimated by GARCH (1,1). The p-values for all delay levels in the serially correlated link up to the delayed value of 36 are quite high than the 5% level. For this reason, the null hypothesis of no serial correlation can not be rejected. In other words, there is no autocorrelation problem in the new model.

The following model is estimated in order to test whether the volatility of the exchange rate can be reduced by ROM application in the direction of the results obtained from this data.

$$\boldsymbol{R_t = \beta_0 + \sum_{i=1}^{6} \beta_i R_{t-i} + \varepsilon_t} \quad \textbf{(1.b)}$$

$$\boldsymbol{\varepsilon_t \sim N(0, h_t)} \quad \textbf{(1.c)}$$

$$\boldsymbol{h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 DROM} \quad \textbf{(1.d)}$$

The variables in equation 1.b are the return values in USDTRY mentioned earlier. These values were estimated with six delayed periods and the residuals ($\boldsymbol{\varepsilon_t}$) were obtained. Equation 1.c shows the distribution of these residuals. The error term $\boldsymbol{\varepsilon_t}$ follows normal distribution with zero mean and h_t variance. The point to be emphasized here is that the variance of the error term is not constant but changed depending on the variable h_t.

Equation 1.d shows the structure of h_t variance. This structure is GARCH (1,1) model. Unlike ARCH, the error variance of the first equation is also added to the model. In Equation 1.d, a DROM dummy variable is added differently from GARCH (1,1). As mentioned before, this variable is a dummy that takes a zero value before 29.09.2011 and is evaluated as one for later periods. The aim here is to test whether there is a decline in volatility in the period following the implementation of

the ROM mechanism. If the coefficient of the DROM variable is statistically significant and negative (positive), it can be said that the ROM mechanism reduces (increases) the FX volatility. Equation 1.d, model result of h_t variance is as follows.

Table 6: h_t GARCH (1,1) model results and ROM effects for 2010 – 2013

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 DROM$$

GARCH (1,1)

Variable	Coefficient	Std. Error	t-Statistic	Prob*
C	0,006392	0,002427	2,633793	0,0084
ε_{t-1}^2(Res.^{2} (-1))	0,029150	0,010332	2,821319	0,0048
h_{t-1}(GARCH(-1))	0,959555	0,010979	87,39583	0,0000
DROM	-0,005465	0,002084	-2,621795	0,0087

R-squared	0,00161	Akaike info criterion	1,475856
Log likelihood	-475,3912	Schwarz criterion	1,510253
Durbin-Watson	1,91204	Hannan-Quinn crit.	1,489197

Table 6 shows that even at 1% level of significance, all coefficients in the model are significant. The GARCH and ARCH effects were evident in the model. The most important point is that between 2010 and 2013, when the dataset is selected, the ROM mechanism shows whether it reduces the volatility of the exchange rate. The coefficient of ROM dummy variable is negative and statistically significant as expected. For this reason, it can be said that the ROM mechanism has contributed to lowering exchange rate volatility as a means of active monetary policy after implementation.

The same result can not be said for the range covered by the data set for the 2010-2018 period. In this period, although ARCH and GARCH effects continue, it seems that ROM application is insufficient to decrease the fluctuation in FX. In Table 7, the coefficient of the ROM dummy variable is not sigificant and can be assumed to be zero. One of the main reasons for this is that the risk appetite declining in the global markets and the effect of the rapid capital outflow from developing countries on the exchange rate are limited by the restriction of ROM implementation.

Table 7: h_t GARCH (1,1) model results and ROM effects for 2010 – 2018

$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 DROM$, estimation for 2010-2018

GARCH (1,1)

Variable	Coefficient	Std. Error	z-Statistic	Prob*
C	0,006380	0,003543	1,800902	0,0084
ε_{t-1}^2(Res.^{2} (-1))	0,087098	0,007873	11,06231	0,0048
h_{t-1}(GARCH(-1))	0,911158	0,008022	113,5775	0,0000
DROM	-0,002347	0,003210	-0,731089	0,4647

R-squared	0,001880	Akaike info criterion	1,922621
Log likelihood	-1837,832	Schwarz criterion	1,937119
Durbin-Watson	1,90761	Hannan-Quinn crit.	1,927955

CONCLUSION

The 2008 global financial crisis is the greatest one on the global scale since the great depression of 1929 in terms of the loss of confidence and the damage it has created. It first started in the sub-prime housing market, then spreaded to the entire financial system. Along with the real economy bounce from the financial system, a recession and a boost have been observed in almost all economies.

The rise in macro financial risks and the decline in risk appetite combined with the reduction in aggregate demand have united and raised global concerns. For this reason, efforts to combat the crisis, which were initiated by the central banks of the developed countries, especially the FED, led to the implementation of new monetary and fiscal policies. These practices, generally referred to as macro-prudential policies, were then put into practice by almost all monetary authorities.

The quantitative easing policies initiated by the FED have triggered a period of low interest and abundant liquidity in global markets and triggered capital flows towards developing countries. Long-term refinancing (LTRO) and targeted long-term refinancing (TLTRO) applications, which started with the EUR debt crisis later, also led to a second period of liquidity expansion.

The cheap and abundant liquidity entering developing countries has caused volatility on the macro indicators of the countries concerned. Especially in the countries that are giving current account deficit and needing external financing, there is an incongruity between the economic pressure and the pressure of overvaluation in the currencies and the credit growth rates. To limit the adverse impact of capital inflows on macroeconomic indicators, developing countries central banks put a series of tactics into practice. Turkey is also in the same basket with those countries called fragile five, thus parallel implementation of the monetary policy in these countries have been applied in Turkey as well.

The Central Bank abandoned the practice of the single target - the single instrument policy (price stability - short term interest rates), after the global crisis. Financial stability has also been added to the target basket, under the condition that it

is not contradict with price stability. To achieve these goals, the tool basket to be applied is diversified, cyclical and structural tools are being implemented.

The policies applied in this period are generally called non-conventional or macro-prudential policies. The fundamental macroprudential policies implemented by the Central Bank are the asymmetric interest rate corridor, the required reserve based on maturity and leverage, the liquidity management and the reserve option mechanism. Although some of these practices have lost their effect, others are still being used as an effective tool by the Central Bank.

Exchange rate volatility and credit growth rate have been examined in detail from pioneering indicators for financial stability. The main aim of the study is; the question is whether the applied macroprudential policies are an effective tool in reducing the rate of exchange rate volatility. Empirical studies on volatility models (ARCH - GARCH) show that macroprudential policies (studied in ROM in this study) are particularly effective in reducing FX volatility, especially in the quantitative easing period (2009 - 2013). Former studies on this area also indicated the same result. However, with this study, the same data set shows that macroprudential policies have not had any effect on reducing exchange rate volatility when viewed for the period 2010-2018. The main contribution of the thesis to literature is that “ there is a break point fort the efficiency of macroprudential policies during 2010-2018 and for FX volatility, most effective method is EGARCH model.”

APPENDIX

Table 8: h_t ARCH forecasts with 5 lag operators

$h_t = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \alpha_2\varepsilon_{t-2}^2 + \alpha_3\varepsilon_{t-3}^2 + \alpha_4\varepsilon_{t-4}^2 + \alpha_5\varepsilon_{t-5}^2$

ARCH with 5 lags

Variable	Coefficient	Std. Error	z-Statistic	Prob*
C	0,192014	0,013361	14,37105	0,0000
ε_{t-1}^2	0,141278	0,020048	7,046807	0,0000
ε_{t-2}^2	0,136837	0,019103	7,163280	0,0000
ε_{t-3}^2	0,092009	0,020379	4,514907	0,0000
ε_{t-4}^2	0,094653	0,022308	4,242955	0,0000
ε_{t-5}^2	0,180719	0,026098	6,924551	0,0000

R-squared	-0,001570	Akaike info criterion	1,956663
Log likelihood	-1868,461	Schwarz criterion	1,976960
Durbin-Watson	1,908203	Hannan-Quinn crit.	1,964131

Table 9: h_t EGARCH results

$\ln(h_t) = \alpha_t + \sum \beta_k g(z_{t-k}) + \alpha_{t-1} \ln(h_{t-1})$, $\varepsilon_t = z_t h_t^{1/2}$

EGARCH

Variable	Coefficient	Std. Error	z-Statistic	Prob*
C	-0,038221	0,006634	-5,761777	0,0000
z_t	0,040184	0,008513	4,720163	0,0000
z_{t-1}	0,070325	0,004828	14,56557	0,0000
h_{t-1}	0,991197	0,001451	683,2249	0,0000

R-squared	-0,000069	Akaike info criterion	1,902731
Log likelihood	-1818,768	Schwarz criterion	1,917229
Durbin-Watson	1,911067	Hannan-Quinn crit.	1,908066

Table 10: h_t TGARCH results

$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 D * \varepsilon_{t-1}^2$, D=1 if $\varepsilon_{t-1} < 0$ and D=0 if $\varepsilon_{t-1} \geq 0$

TGARCH

Variable	Coefficient	Std. Error	t-Statistic	Prob*
C	0,003104	0,001294	3,047784	0,0000
ε_{t-1}^2(Res.^{2} (-1))	0,084740	0,007904	11,03443	0,0000
$D < 0 * \varepsilon_{t-1}$	-0,063221	0,007838	-8,066306	0,0000
h_{t-1}(GARCH(-1))	0,941385	0,006723	140,0251	0,0000

R-squared	-0,000527	Akaike info criterion	1,910639
Log likelihood	-1826,347	Schwarz criterion	1,925136
Durbin-Watson	1,910193	Hannan-Quinn crit.	1,915973

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WORK EXPERIENCE

Risk Underwriter and Economic Research, EULER HERMES, 2017 - …

- Euler Hermes, a company of Allianz, operating in insurance sector for trade receivables. Portfolio management and underwriting the limits for trade receivables. Risk management and sectoral analysis in micro/macro dimension. Preparation of country risk reports and macro outlook. Econometric forecast and early warning system design of underwriting stance.

Market Analyst and Research, CENTRAL BANK OF REPUBLIC OF TURKEY, 2012- 2016

- FX Market Division – Reserve Management Division: Monitored daily FX market changes and developments in Turkey and abroad. Reported weekly FX market and macroeconomics changes, forecast and expectation to the head of Department. Other responsibilities in the division included controlling FX liquidity in the market and injecting/drawing FX through FX buying/selling auction or intervention, implementation of macro prudential tools in FX market together with monetary policy tools (policy mix). Policy recommendation, forecast and presentation for the Monetary Policy Committee to inform about global changes and conjecture for rate decisions.
- Comprehensive economic Research on China and RMB

Specialist, EASTERN BLACK SEA DEVELOPMENT AGENCY, 2011 - 2012

- Eastern Black Sea Development Agency: Investigated the Black Sea region and finding suitable development projects for the appropriate sectors.
- Guided local and international investors and assisted them how to make investment decisions.
- Monitoring and evaluation of ongoing projects.
- Prepared feasibility analysis for the projects and forecasting cost-benefit flowing.
- Channeled funds to EU and other parts of the world to the Turkish development areas

EDUCATION

Galatasaray University, Istanbul, Turkey Master of Arts**,** Economics,
Bogazici University, Istanbul, Turkey, Bachelor of Arts in Economics, 2006 – 2011

TECHNICAL SKILLS

- Proficient in Microsoft Office applications
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- Reuters and Data Stream
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LANGUAGES

- English (advanced)
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