# MACROPRUDENTIAL POLICIES FOR SMALL OPEN ECONOMIES

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF ECONOMICS

OCTOBER 2022

Approval of the thesis:

**MACROPRUDENTIAL POLICIES FOR SMALL OPEN ECONOMIES**

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## ABSTRACT

MACROPRUDENTIAL POLICIES FOR SMALL OPEN ECONOMIES

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October 2022, 115 pages

Recent global financial crisis has made it crystal clear that solely price stability is not enough for macroeconomic stability. A new consensus underlining financial stability as a prerequisite for macroeconomic stability emerged. However, there is not agreement neither on the exact definition of financial stability nor on the appropriate tools to reach financial stability.

Macroprudential policies are widely employed by policy makers for financial stability purposes following the global crisis, in particular in emerging market economies, despite the scarcity of both theoretical and empirical work on these policies and their efficacy.

We contribute to this field by giving a special emphasis to Turkish experience. We document the macroprudential policies applied in Turkey with their policy intentions. We also develop a theoretical small open economy model to study the impacts of macroprudential policy shocks. Our results show that loosen- ing loan-to-value shocks and capital adequacy shocks trigger credit and deposit growth, output, and inflation. Nevertheless, the responses differ with respect to targeted sectors. Our empirical analysis on Turkish data reveal that change in consumer lending spreads increases whereas inflation and industrial production decline after a reserve requirement hike. Similar to theoretical model results, real credit growth improves following an increase

in the average loan-to-value cap. Industrial production growth and inflation also rise after a loosening loan- to-value shock.

**Keywords**: DSGE, VAR, open economy, macroprudential, financial frictions

# ÖZ

KÜÇÜK AÇIK EKONOMİLER İÇİN MAKRO İHTİYATİ POLİTİKALAR

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Tez Yöneticisi: Doç. Dr. Esma GAYGISIZ

Ekim 2022, 115 sayfa

Son küresel mali kriz, sadece fiyat istikrarını sağlamanın makroekonomik istikrar için yeterli olmadığını çok açık biçimde ortaya koymuştur. Makroekonomik istikrarın ön koşulu olarak finansal istikrarın altını çizen yeni bir konsensüs oluşmuştur. Bununla birlikte, finansal istikrara ulaşma konusunda gerek finansal istikrarın tam tanımı gerekse uygun araçlar üzerinde henüz bir uzlaşı yoktur.

Makro ihtiyati politikalara ve bunların etkinliği üzerine hem teorik hem de ampirik çalışmaların azlığına rağmen, bu politikalar küresel kriz sonrasında, özellikle gelişmekte olan piyasa ekonomilerinde, finansal istikrar amacı için politika yapıcılar tarafından kullanılmıştır.

Bu çalışma ile, Türkiye deneyimini ele alarak bu alandaki çalışmalara katkıda bulunmayı hedefliyoruz. Türkiye'de uygulanan makro ihtiyati politikaları altında yatan amaçlarla birlikte sunuyoruz. Sonrasında, teorik bir açık ekonomi modeli geliştirerek makro ihtiyati politika şoklarının etkilerini inceliyoruz. Sonuçlarımız, gevşetici kredi-değer oranı ve sermaye yeterliliği şoklarının kredi ve mevduat büyümesine yol açtığını, beraberinde üretim ve enflasyonun arttığını gösteriyor. Bununla birlikte, hedeflenen sektörlere göre sonuçlar farklılık arz ediyor. Türkiye verisi ile gerçekleştirdiğimiz ampirik analizimiz, zorunlu karşılıklarda gerçekleşen bir artış sonrasında tüketici kredilerinde oluşan faiz farkının arttığını, enflasyonun ve

sanayi üretimi artışının ise gerilediğini ortaya koyuyor. Teorik model sonuçlarıyla örtüşür biçimde, kredi-değer oranlarında bir gevşeme sonrasında reel kredi büyümesi hızlanırken, sanayi üretimi ve enflasyon da artış gösteriyor.

**Anahtar Kelimeler**: DSGE, VAR, açık ekonomi, makro ihtiyati, finansal friksiyon

*To my mother*

## ACKNOWLEDGMENTS

I would like to express my sincere and deep gratitude to my thesis supervisor Assoc. Prof. Dr. Esma Gaygısız for her guidance, patience and support. It was an honour to be a student of yours Esma Hocam.

I also would like to thank the other members of the thesis committee, Prof. Dr. Elif Akbostancı, Assist. Prof. Dr. Kemal Yıldız, Assist. Prof. Dr. Kağan Parmaksız, and Assist. Prof. Dr. Burak Paç for their insightful and constructive comments.

I would like to thank my previous managers, Rauf Gönenç from OECD and Koray Alper from CBRT, for inspiring me on how to be a good economist.

I thank my dear friends and cousins, Enes Sunel from OECD and Doğan Karaman from CBRT, for their encouragement and support throughout the thesis.

Finally, I want to thank my dear wife and children. They always stood by my side whatever the conditions were. I am indebted to them for understanding me while I was not able to spend time together with them for many evenings.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| BRSA | Banking Regulation and Supervision Agency |
| CBRT | Central Bank of the Republic of Turkey |
| CES | Constant Elasticity of Substitution |
| DSGE | Dynamic Stochastic General Equilibrium |
| DTI | Debt to Income |
| FOC | First Order Condition |
| FX | Foreign Currency |
| GDP | Gross Domestic Product |
| IMF | International Monetary Fund |
| LTV | Loan to Value |
| ROM | Reserve Option Mechanism |
| SME | Small and Medium Sized Enterprise |
| TL | Turkish Lira |
| TURKSTAT | Turkish Statistical Institute |
| VAR | Vector Auto Regression |

# CHAPTER 1

## INTRODUCTION

There was a general consensus among mainstream macroeconomics academics and policy makers on the appropriate policies for macroeconomic and financial stability until the global financial crisis of 2009. On the macroeconomic stability front, price stability was assigned to the monetary policy, and therefore to the central bank. Running a sustainable budget and implementing suitable expansionary or contractionary fiscal policies considering fiscal multipliers were the responsibilities of the governments. On the financial stability front, micro-prudential policies were believed to be enough and regulating financial institutions and markets was assigned to financial authorities. Basel Accord, which defined the capital adequacy for banks, was the main handbook for bank regulators all around the world. The rules in the accord for measuring and managing capital adequacy were designed specific to individual institutions even if they could be consolidated.

Just as the global depression of 1929 demonstrated that longer periods of unemployment were possible and shook the roots of the macroeconomics discipline, the global financial crisis of 2009 clearly showed that ignoring a macro perspective on financial institutions may have detrimental consequences.

The micro-prudential approach pre-crisis focused on containing the risks taken by a single institution and limiting the damage of a failing single institution in case of failure. This approach lacked two main aspects. Firstly, the risks of the financial institutions have an endogenous nature most of the time. As a result, an action can be beneficial for a bank, but if all banks take the same action it can cause unexpected and undesirable outcomes. This was especially evident in the financial crisis. The decrease in house prices in the USA triggered a sell-off of derivative assets dependent on house prices. Although selling such an asset was a logical move for a single bank, as many

banks did the same thing, this caused a collapse in asset prices, hurt the financial system more and fueled another cycle of asset sales which amplified the effects of crisis on asset prices. Similarly, selling a collateral house after an unpaid mortgage credit may be beneficial for a bank but as many banks did the same thing, this created a downward pressure on house prices and the non-performing loan rates of mortgages experienced a hike. Secondly, interconnected structure of the financial institutions necessitates a special consideration. For instance, some financial institutions were too big to fail as the spillovers of their failures could pose an enormous threat to the stability of the financial sector. As a result, their position in the financial markets and connections to the other financial institutions need to be evaluated separately. As always, these drawbacks of the macroeconomic management framework were easily identified by the advantage of the hindsight following the global financial crisis and its devastating effects on the global economy.

On this background, macroprudential policies rose as a promising toolkit for both policy makers and researchers. Macroprudential policies concern the financial system as a whole and try to mitigate evolving "systemic risks", rather than targeting individual institutions. Systemic risks may arise from various channels. One possible source is over sensitivity of banks and other financial institutions to a common risk source. For instance, to some extent there may be some institutions giving a higher weight to their mortgage portfolios. However, if many financial institutions behave this way and the system becomes excessively dependent on housing loans and therefore on housing prices, then even a small change in housing price can create large fluctuations in the system. Another possible source is related to the well-known and documented pro-cyclical nature of the financial system. During boom periods, economic activities gain pace, asset prices rise, risk evaluations get optimistic and support both loan demand and supply, and these all further fuel economic activities. During bust periods, the mechanism works the reverse way. Main result is the amplification of the shocks by the financial system. The aim of the macroprudential policies is containing the systemic risks by supervising the system as a whole and taking counter measures to prevent the formation of these risks, which are easier said than done.

The most important obstacle to implementation of macroprudential policies after the crisis period was the relatively scarce cumulative knowledge on these policies, both in theoretical and empirical terms. Although the economics literature were abundant in terms of models before the crisis, in general financial system and risks solely stemming from financial institutions were generally overlooked in those models. Therefore, the common knowledge on macroprudential policies and their impacts was limited.

Dynamic stochastic general equilibrium (DSGE) models, which were heavily used by academics and central bankers in pre-crisis period to understand the interactions in the economy and to forecast the development of main macroeconomic variables, had many desirable properties such as micro foundations and forward-looking rational agents. In New Keynesian tradition, they also included wage and price stickiness to study the real effects of monetary policy. Nevertheless, they usually did not incorporate a financial system with financial frictions and therefore the feedback mechanisms between financial sector and the macroeconomy were not also studied in detail.

We should here note that there were notable exceptions to this general picture of macroeconomic models. Galati and Moessner (2013) give a brief review of these notable early studies but here we will overview two seminal papers which built a solid base that the many of the following studies built on, namely Bernanke et al. (1999) and Iacoviello (2005).

Bernanke et al. (1999) had a financial accelerator mechanism in modeling approach to financial frictions. In this mechanism, external finance premium de- pends negatively on borrowers' net worth under asymmetric information setting. This implies that if borrowers' net wealth is pro-cyclical, which is a plausible assumption considering the pro-cyclical nature of firm profits and asset prices, then the external finance premium will be counter cyclical. Thus, financial frictions will amplify negative or positive shocks to the economy by effecting borrowing, investment, and consumption.

Iacoviello (2005) modeled financial frictions in form of collateral constraints. Observing that a great portion of borrowing is secured by housing collateral, the borrowings of firms are tied to real estate values. Another important ingredient in the modelling approach of this paper is the borrowings of firms are in nominal terms. In

this framework, these financial frictions accelerate demand shocks but decelerate supply shocks. The transmission mechanism is as following. When a positive demand shock hits, spending and asset prices rise and the borrowing capacity of firms increases. Rising inflation reduces the real value of nominal debt of firms and this improves their net worth. Through these two channels, shock is amplified. On the other hand, in case of an adverse supply shock, rising inflation causes an improvement in borrowers' net worth and the effects of the shock are smoothed.

Gerali et al. (2010) extend Iacoviello (2005) framework to include a stylized modelling of banking. One key ingredient in their modelling approach is the introduction of monopolistic competition at the banking retail level. Banks have market power to some extent in their intermediation activity, and this allows them to adjust rates on loans and deposits in response to shocks or other cyclical conditions in the economy. Together with collateral constraints, this provides a good analytical framework to study the effects of macroprudential policies such as loan-to-value rates. Major drawback of the model is its closed economy structure. Due to this drawback, effects of loan-to-value rates on macroeconomic variables in an open economy setting cannot be studied with this model.

We contribute to the theoretical literature on macroprudential policies by analyzing their effects in an open economy model built on Gerali et al. (2010). Our open economy model differs from other small open economy DSGE studies which are built on Gerali et al. (2010). We follow McCallum and Nelson (2000) which treats imported goods as intermediate goods in the production of final good. They depict that their model specification more realistically reflects correlations between exchange rate and inflation than other conventional standard open economy models. Moreover, as stated in Agenor et al. (2014), this approach is more relevant for many middle-income countries.

Similar to insufficiency of theoretical models, the empirical evidence in favor of macroprudential policies was scarce when the global financial crisis broke out. Nevertheless, this did not prevent policy makers, especially in emerging market economies, applying or rather experimenting with macroprudential policies. Central banks in emerging market economies faced a serious policy dilemma when advanced

economies started to employ quantitative easing policies. This created large capital inflows to emerging markets supporting credit booms and appreciation pressure on local currencies. Conventional monetary policy tool for central banks was short-term interest rate but trying to prevent credit booms by raising interest rates would further accelerate capital inflows and create appreciation pressure on currency. On the other hand, lowering interest rate would further accelerate credit booms. As a result, macroprudential policies emerged as a plausible and alternative response to swings in capital inflows.

As the experiences of macroprudential policy implementations increased, so did the number of empirical studies on the effectiveness of macroprudential policies. In this thesis, we contribute by documenting macroprudential tools employed in Turkey and running a VAR analysis on Turkey to study the effectiveness of LTV rates.

The organization of the dissertation is as following. In the following chapter, we portrait the types of macroprudential policies used in Turkey together with their actual implementations. Later, we present the results of our small open economy DSGE model to contribute to the theoretical discussions on effectiveness of the macroprudential tools. Empirical analysis on Turkey follows. We end with a brief conclusion.

# CHAPTER 2

## MACROPRUDENTIAL POLICIES IN TURKEY

In this chapter, we present a discussion on the macroprudential policies implemented in Turkey for financial stability purposes. We focus on the macroprudential policies implemented after the global financial crisis. We introduce the implemented macroprudential policies according to their types.

The Banking Regulation and Supervision Agency is the authority on regulation of banking. We should also note that various committees such as Systemic Risk Assessment Group, Financial Sector Commission, and Financial Stability Committee are established to maintain consistency and coordination in the policy implementation. In 2016, Financial Stability Committee and Systemic Risk Assessment Group were united as a single secretariat. Financial Stability Committee is the top authority on the coordination of the systemic risk management.

IMF has five broad categories for macroprudential tools, namely: broad-based tools, household sector tools, corporate sector tools, liquidity tools, and structural tools. Broad-based tools have effects on all of the banking system and measures such as countercyclical capital buffers, leverage ratios, and dynamic loan-loss provisioning are under this category. Household sector tools focus on to eliminate excessive risk stemming from household loans and measures such as sectoral capital requirements, loan to value ratios, and debt-service-to-income ratios are under this category. Corporate sector tools focus on the interaction between corporate sector and financial sector. Risk weights, limits on corporate credit growth, limits on loan to value, and debt service coverage ratios are examples of corporate sector macroprudential tools. Liquidity tools try to improve liquidity of the banks and to ensure that they remain well funded during turbulence. Liquidity buffer requirements, stable funding

requirements, liquidity charges on non-core liabilities and reserve-requirements are examples of liquidity tools among others. Lastly, structural tools try to mitigate the risks stemming from interconnected structure of the financial sector. Capital surcharges, sectoral risk weights, and limits on large exposures are examples of structural tools that can be implemented to reduce systemic risk. (IMF, 2014b)

Econometric studies which used long-term data and focused on financial crises established a strong association between financial crises and credit growth (Schularick and Taylor, 2012). In addition to strong link between credit growth and financial crises, credit growth had also been found strongly correlated to current account deficit in Turkey (CBRT Inflation Report, 2011 II). Building on these results, macroprudential policies implemented in Turkey aimed to slow down credit growth and to keep current account balance sustainable after the substantial increase in global liquidity following the expansionary monetary policies of major central banks.

Table 2.1: Categorization of Macroprudential Policies in Turkey

| | |
|---|---|
| **Broad Based Tools** | **Household Sector Tools** |
| Caps on Credit Growth Rate | Loan to Value Requirements |
| Countercyclical Capital Buffers | Debt to Income Requirements |
| Limits on Leverage Ratios | Maturity Restrictions |
| | Minimum Payment Regulations |
| **Corporate Sector Tools** | Differentiated Risk Weights |
| General Provisions | General Provisions |
| **Liquidity Tools** | **Structural Tools** |
| Required Reserves | Systemically Important Bank Buffers |

Main macroprudential policies implemented in Turkey are caps on credit growth rate, required reserves, loan-to-value requirements, debt-to-income requirements, maturity restrictions, counter-cyclical capital buffers, leverage ratios, systemically important bank buffers, differentiated risk weights, general provisions, minimum payment restrictions, and limits on foreign currency denominated loans. We present these policies respectively in the following sections.

## 2.1. Caps on Credit Growth Rate

Caps on credit growth rate are broad-based tools. Citing the literature on the long-run relationship between excessive credit growth and financial crises, CBRT announced a reference loan growth rate of 25% for the first time in year 2011. For 2012, 2013, and 2014 this reference rate was announced as 15%. After 2019, the reference rate was announced as between 10% and 20%. However, this reference rate was not an official target and there were not strict enforcement measures.

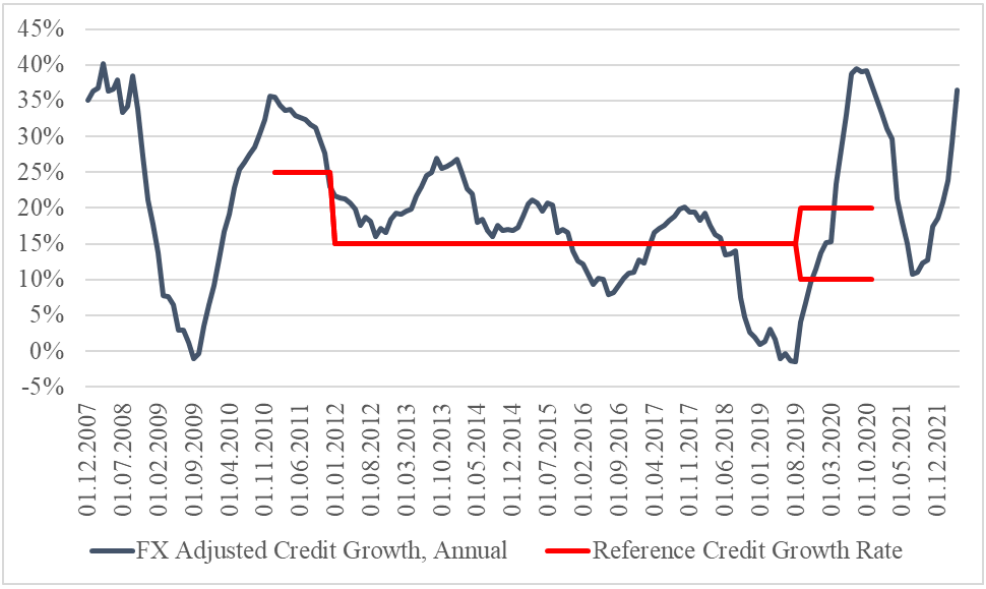


Figure 2.1: Credit Growth Rate and Reference Growth Rate

The main tool to support this reference credit growth was differentiating required reserve ratios and interest paid on reserves according to loan growth rates of banks. The banks satisfying a loan growth in line with reference loan growth rates were

rewarded by lower required reserve ratios and higher interest on reserves after August 2019. In November 2020, CBRT removed the differentiation of required reserve ratios and interest paid on reserves according to loan growth rates of banks.

## 2.2. Required Reserves

Required reserves are liquidity tools under IMF classification. Required reserves can be used as a macroprudential tool to mitigate systemic risks for two reasons. Firstly, required reserves directly affect credit growth. This allows the central banks to smooth credit cycle. Secondly, required reserves build up an important buffer against unwanted liquidity crunches (Lim et al., 2011).

CBRT argued that the macro financial risks occurring as a result of global macroeconomic imbalances after financial crisis necessitated alternative policy tools other than conventional short term interest rate. Limiting short-term capital inflows and slowing down credit growth were two main priorities in this economic environment where FED and ECB applied expansionary monetary policies which fueled capital flows to developing economies. As a response, CBRT applied a wider interest rate corridor to prevent excessive short-term capital inflow and higher required reserves to slow down credit growth after the last quarter of 2010 (Basci and Kara, 2011).

In order to make required reserve tool more effective, remuneration of required reserves was abolished in October 2010. Later, required reserve ratio was in- creased and differentiated across maturities. Until 2010, reserve requirement rate was applied same to all maturities. Moreover, the scope of the liabilities subject to reserve requirement was widened by the time. Beginning in 2019, CBRT started to implement lower required reserves as a reward to the banks satisfying reference credit growth rate as stated in the previous section. The development of weighted average required reserve ratio for TL liabilities is depicted in the following Figure 2.2.

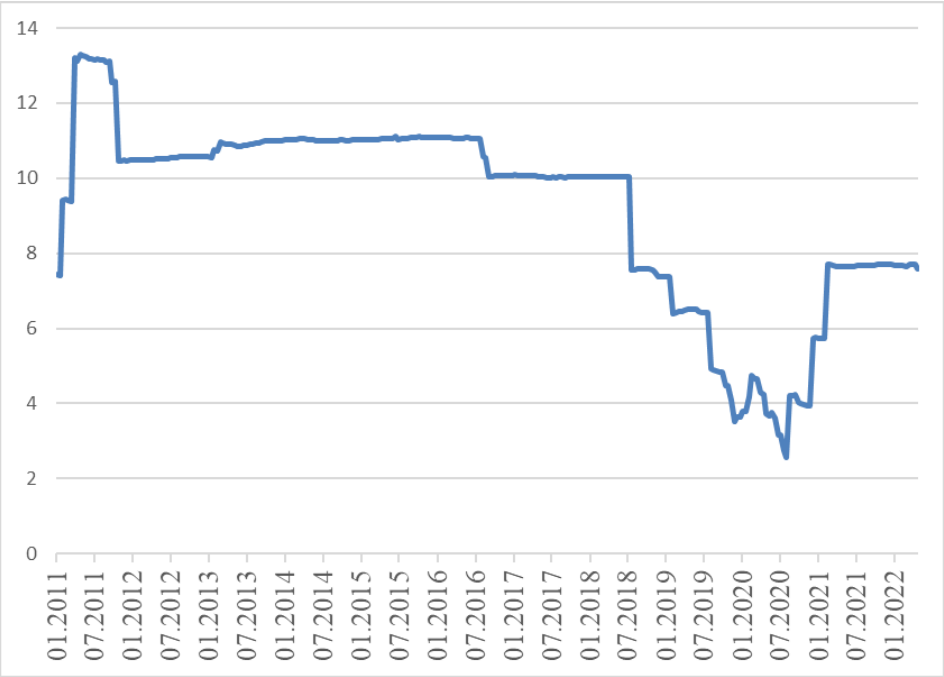


Figure 2.2: Required Reserve Ratio for TL, Weighted Average (%)

### 2.2.1. Reserve Option Mechanism

Besides using required reserves as a macroprudential policy tool to deal with the increase in global liquidity, a novel policy implemented by the CBRT was the reserve option mechanism (ROM). This mechanism allowed banks to hold some of the required reserves in form of foreign currency or gold.

While reserve option ratio determined to what extent this mechanism could be used, reserve option coefficients were applied to determine how much foreign currency or gold should be set instead of TL reserves. As a simple example, assume that reserve option ratio is 90%, reserve option coefficient is 1, 1 USD is exchanged with 2 TL, and required reserves of a bank are 100 TL. In this case, maximum 90 TL of required reserves can be hold as foreign currency or gold since reserve option ratio is 90%. How much to hold is determined by multiplication of this amount of by reserve option coefficient which is in this case 1. Thus, since USD exchange rate is 2, 45 USD can be set instead of 90 TL portion of required reserves (Alper et al., 2012).

Reserve option ratios and reserve option mechanism utilization rates of banks are depicted in the Figure 2.3. CBRT started to decrease FX reserve option ratios by November 2017 as the conditions of global liquidity reversed and depreciation pressures on TL increased. The progressive reduction of FX reserve option ratio continued until October 2021, when the FX reserve option ratio was set as zero. Reserve option rate for standard gold is currently at 10%.

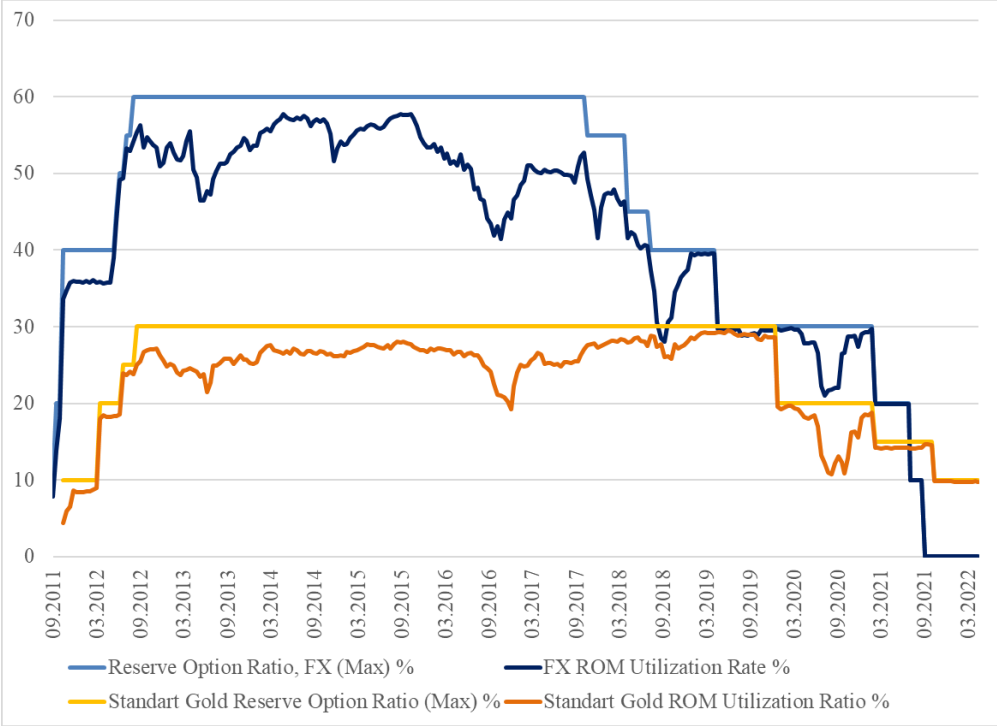


Figure 2.3: Reserve Option Mechanism and Utilization Rates

The main motivation of reserve option mechanism was the rationale that it could serve as an automatic stabilizer. Banks would use reserve option mechanism more in times of high capital inflows due to falling costs of foreign resources. This would suppress the appreciation pressure on TL by getting foreign currency liquidity from the market. Furthermore, credit growth would be more benign (Alper et al., 2012).

## 2.3. Loan-to-Value Requirements

Loan-to-value caps can be used in both household and corporate sector loans. In Turkey, loan-to-value caps are introduced after 2010 following the high growth rates of consumer loans, especially residential mortgages. Thus, they are mainly used as household sector tools.

The loan-to-value caps are determined as 75% for the residential mortgages and 50% for the commercial housing loans starting January 2011. The loan-to-value cap on commercial housing loans was removed in April 2013. The loan-to-value cap on residential mortgages was not removed but the ratio was increased to 80% in September 2016 (CBRT, 2016). After January 2019, loan-to-value caps for residential mortgages were differentiated according to the energy performance of the houses. Cap was increased to 90% for houses which have energy certificate A and to 85% for houses which have energy certificate B. After March 2020, cap was increased to 90% for all houses valued under 500 Thousand TL (Macroprudential Country Report, IMF).

Loan-to-value caps were also used for other consumer loans than housing loans. Caps were introduced for vehicle loans after February 2014 in a two-stage framework. LTV cap was 70% for the vehicles valued less than 50 Thousand TL. For the vehicles valued more than 50 Thousand TL, cap was applied as 70% up to this threshold level and 50% for the amount exceeding this threshold level. This threshold level was increased to 100 Thousand TL in December 2017 and to 120 Thousand TL in January 2019. In July 2021, new thresholds were introduced. Loan-to-value cap for vehicles valued between 300 Thousand TL and 750 Thou- sand TL was reduced to 30%. Similarly, loan-to-value cap for vehicles valued between 750 Thousand TL and 1.5 million TL was reduced to 20%. Loan-to- value cap for vehicles valued more than 1.5 million TL was 0% (Macroprudential Country Report, IMF). In February 2022, the threshold levels for loan-to-value caps of vehicle loans were updated as 400 Thousand TL, 800 Thousand TL, 1.2 Million TL, and 2 Million TL.

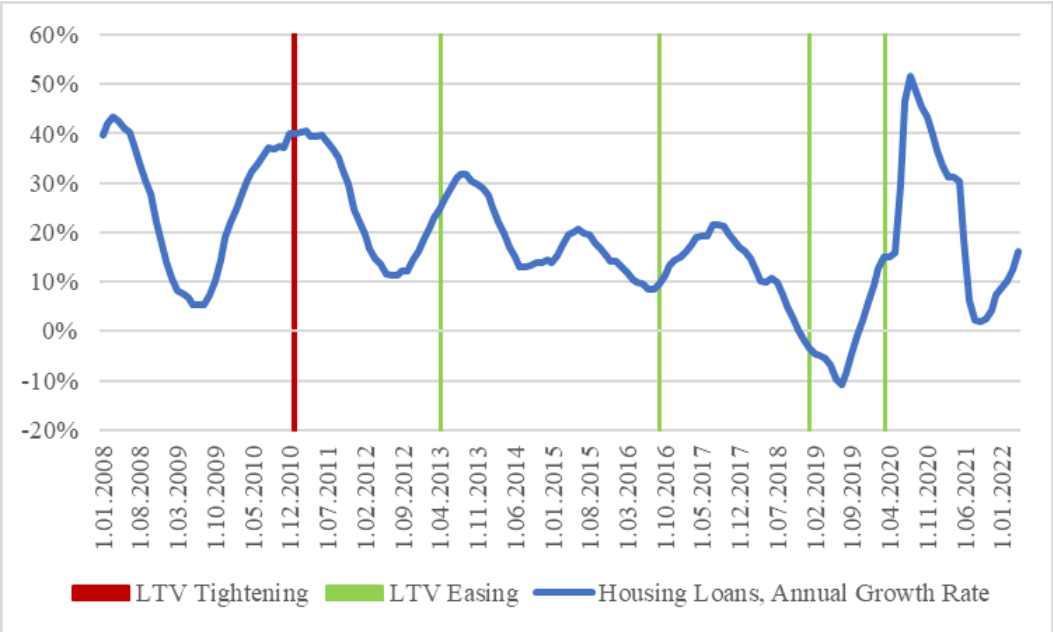


Figure 2.4: Housing Loans, Annual Growth Rate

## 2.4. Debt-to-Income Requirements

Debt-to-Income restrictions are household sector tools and they are mainly implemented for credit card loans in Turkey considering that these loans are unsecured. After October 2013, total credit card loan limit of an individual from all credit card organizations could not exceed twice of average net monthly income for the first year and four times of average net monthly income for the second year (Mahmutoğlu and Ardor, 2019).

Effective September 2020, credit card limits cannot exceed four times of monthly income for existing cards. For new credit cards, limit will not exceed twice of monthly income for the first year and four times of monthly income in the subsequent years. Credit cards secured by cash, cash equivalents and precious metals are exempt from this regulation (Macroprudential Country Report, IMF).

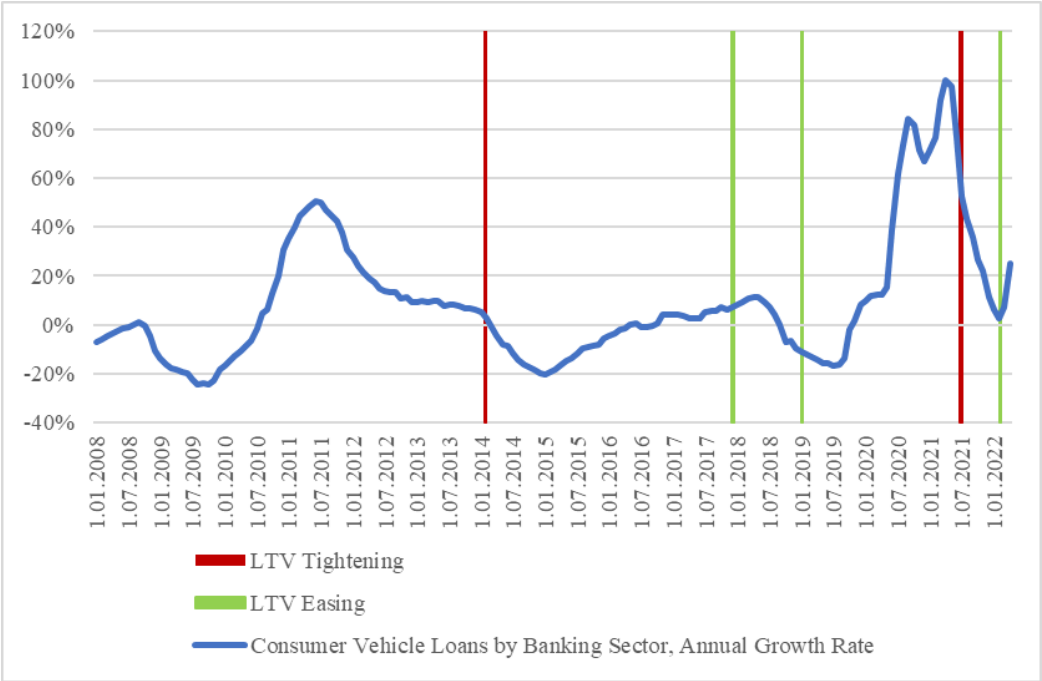


Figure 2.5: Vehicle Loans by Banking, Annual Growth Rate

## 2.5. Maturity Restrictions

As a household sector tool, maturity restrictions were introduced to general purpose consumer loans and vehicle loans in December 2013. The maturity limit of general purpose consumer loans was set as thirty six months and the maturity limit of vehicle loans was set as forty eight months. In September 2016, the maturity limit of general purpose consumer loans was extended to forty eight months (Yilmaz and Ozdemir, 2018). Although it was reduced back to thirty six months in September 2018, the maturity limit for general purpose loans was increased to sixty months in February 2019. The maturity of general purpose consumer loans was reduced back to thirty six months in September 2020 and the maturity of general purpose consumer loans backed by vehicle was reduced from forty eight months to thirty six months in December 2020 (Macroprudential Country Report, IMF). In September 2021, the maturity of general purpose consumer loans over 50 Thousand TL was reduced to twenty four months.

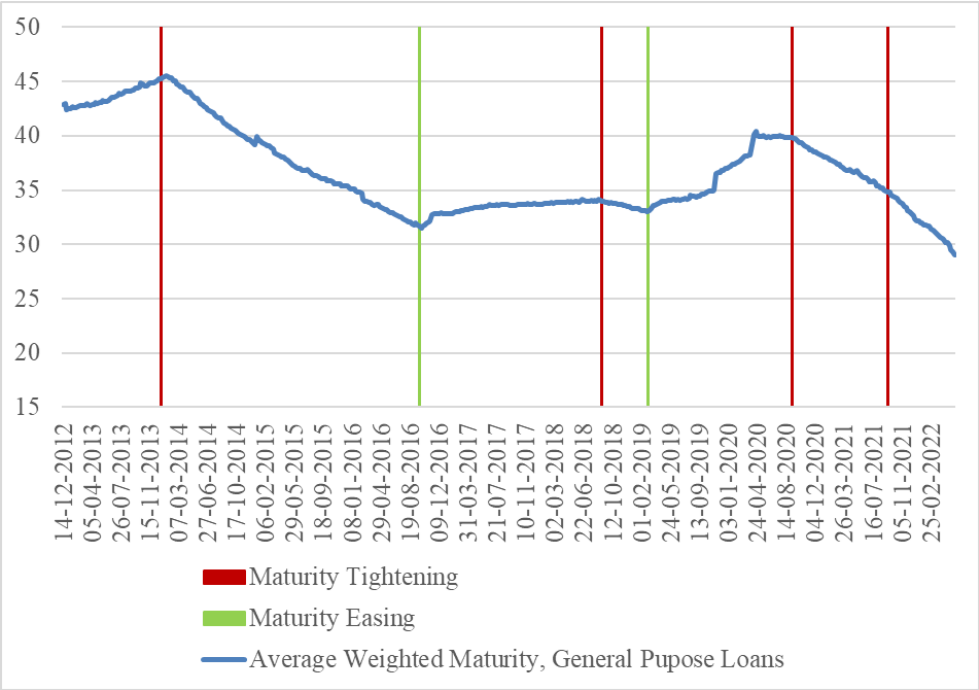


Figure 2.6: Weighted Maturity of General Purpose Loans in Months

Maturity limitations are also applied for credit card debts. As a tightening macroprudential policy, installment period of credit card debt considering sectors is limited by a series of regulations in February 2014, May 2014, October 2014, and August 2018. The installment period of credit card debt is extended by regulations in November 2015, September 2016, and November 2018. In 2020 and 2021, the maturity limits for credit cards were changed for some sectors such as jewelry and consumer electronics (Macroprudential Country Report, IMF).

## 2.6. Counter-cyclical Capital Buffers

Counter-cyclical capital buffers are broad based macroprudential tools. The aim of the counter-cyclical capital buffer is protecting the banking system from excessive credit growth. It complements the capital conservation buffer. In periods without excessive credit growth, the target counter-cyclical capital buffer should be set at zero. On the other hand, in periods of excessive loan growth, an additional capital buffer depending on the excess credit growth can be set (Yayla et al., 2014).

As an adoption of Basel III framework, BRSA adopted counter-cyclical capital requirements and capital conservation buffers. The final regulation was published in November 2013 and became effective in January 2014.

### 2.7. Limits on Leverage Ratios

Limits on leverage ratios are broad based tools affecting all the banking system. Limiting leverage ratios of the banks aims to limit their total risk exposure with respect to their equity. Regulation on leverage ratios was published in November 2013 in accordance with Basel III framework. The leverage ratio is defined as the ratio of Tier-1 capital to total risk exposure. In calculating total risk exposure, off-balance sheet items, derivatives, securities and commodity-backed financial transactions are included besides on-balance sheet items.

The leverage ratios of the banks are calculated monthly. At the end of every quarter, the simple average of leverage ratios should be over the minimum level set by the BRSA. The minimum level for leverage ratio of the banks is set at 3%, which is complaint to Basel III standard.

### 2.8. Systemically Important Bank Buffer Ratios

Systemically important bank buffers are structural tools focusing on risks stemming from big financial institutions. Regulation on systemically important banks was published in February 2016 as an adoption of Basel III framework. The purpose of the regulation is limiting the spillover effects of adverse developments in these big banks on the financial system.

Systemically important banks are categorized under four groups. Additional capital requirements for systemically important banks were set between 1% and 3% depending on the group these banks belong. These additional capital requirements were implemented gradually between 2016 and 2018. The gradual adoption phase was completed in 2019.

## 2.9. Differentiated Risk Weights

Differentiated risk weights are mainly used as household sector tools in Turkey. Banks need to hold enough level of capital with respect to their risk weighted assets. Capital adequacy ratio is calculated by dividing capital to risk weighted assets. Current regulations dictate a minimum level of capital adequacy ratio. Standard capital adequacy ratio of a bank shall not be below 8% according to the latest BRSA regulation.

Increasing risk weight of an asset makes risk weighted assets larger and thus capital adequacy ratio smaller everything else equal. Thus, if the authority wants to limit systemic risk by reducing common exposure to an asset class, increasing specific risk weight may deter banks from that asset class.

In June 2011, risk weights of general purpose consumer loans under two years maturity were increased from 100% to 150%. Risk weights of general purpose consumer loans over two years maturity were increased to 200% (Yayla et al., 2014).

In July 2012, risk weights of credit card loans with a maturity between one and six months, vehicle loans, and general purpose loans were reduced to 75%. This was an easing macroprudential policy (Macroprudential Country Report, IMF).

In October 2013, a tightening macroprudential policy by increasing risk weights to vehicle loans and credit cards was implemented. The risk weight of credit card loans with a maturity between one and six months were increased to 100%. Risk weight of credit card loans with a maturity between six months and one year were increased to 200% and risk weight of credit card loans with longer maturity was increased to 250%. Risk weight of vehicle loans with a maturity between one and two years was increased to 150% and risk weight of vehicle loans with longer maturity was set at 200% (Mahmutoğlu and Ardor, 2019).

To comply with Basel III regulations, BRSA changed the risk weights of consumer loans in March 2016. The risk weight of mortgage loans was reduced to 35% whereas risk weight of all other consumer loans was set at 75% (Macroprudential Country Report, IMF).

## 2.10. Regulations on General Provisions

Provisions are used in banking sector as a compensating precaution against credit losses. Two types of provisions are defined in regulations, namely general and special provisions. Special provisions are applied to credits which have defaulted whereas general provisions are applied to loans before default. Differentiating general provision rates changes the costs of loans to banks and by this way can be used as a macroprudential tool (Yayla et al., 2014). General provision rate adjustments are done for both household sector and corporate sector loans.

Incremental general provision rates for consumer loans are applied by regulations in June 2011, October 2013, and December 2013. In June 2011, general provision rates of consumer loans excluding housing and vehicle loans are increased for the banks having a higher than 20% share of consumer loans in total loans and the banks which have a higher than 8% of non-performing loan rates in consumer loans excluding housing and vehicle loans. General provision rate for these loans is increased to 4% for standard loans and to 8% for closely monitored loans (BRSA, 2012). In October 2013, exclusion of vehicle loans is removed. As a result general provision rates for standard and closely monitored vehicle loans are increased to 4% and 8% respectively for the banks satisfying the conditions stated (BRSA, 2014).

Regulation in October 2013 reduced general provision rates for export loans and SME loans. General provision rate for export loans is reduced to 0% from 1% whereas general provision rate for SME loans is reduced to 0.5% from 1% (BRSA, 2014).

Incremental general provision rates for consumer loans are removed in September 2016. This was an easing macroprudential policy implementation. In December 2016, general provision rates for standard SME loans and syndicated loans for financing of large-scale public procurement loans were reduced to 0%. General provision rates were reduced to 0.5% for standard commercial loans. General provision rates for closely monitored commercial loans, SME loans, and export loans were reduced to half (BRSA, 2017).

## 2.11. Minimum Payments on Credit Cards

Minimum payments on credit cards are household sector tools. Minimum payment rates of credit card debts are increased to ratios between 25% and 40% depending on credit card limits in December 2010 under a progressive transition (BRSA, 2011). This was a tightening macroprudential policy implementation. In another tightening minimum payment regulation in October 2013, minimum payment rates for credit card balances up to 20 Thousand TL were increased. As a result, minimum payment rate for credit cards was set to 30% for credit card balances up to 15 Thousand TL and to 35% for credit card balances between 15 Thousand TL and 20 Thousand TL (CBRT, 2014).

In June 2019, the minimum payment rates for all credit cards irrespective of their limits was set at 30%. As a further easing move, the minimum payment rate for all credit cards was set at 20% in March 2020 (Macroprudential Country Report, IMF). In June 2022, BRSA increased the minimum payment rates to 40% for credit cards with limits over 25 Thousand TL.


Figure 2.7: Individual Credit Cards Balance, Annual Growth Rate

## 2.12. Limiting Foreign Currency Denominated Loans

Residents in Turkey cannot get a foreign currency denominated or indexed loans from domestic banks or abroad. This regulation is brought by an amendment to the Decree No:32 on the protection of the value of the Turkish Lira in 2009. The foreign currency positions of banks are regulated and supervised by the BRSA and this amendment extended foreign currency risk management to households.

# CHAPTER 3

# DSGE MODEL ON MACROPRUDENTIAL POLICIES

## 3.1. Introduction

In this chapter, we analyze the effects of macroprudential policies by building a small open economy model based on Gerali et al. (2010). After we review the literature, we introduce the model and the parametrization. Lastly, we present and discuss impulse responses to macroprudential policy shocks.

## 3.2. Literature Review

Until the collapse of the financial markets in Global Financial Crisis of 2009, the theoretical and empirical work relating the macro economy with financial system was limited as Galati and Moessner (2013) point out. DSGE models pre-crisis suffered three main drawbacks. Firstly, they mostly did not explicitly model financial system and financial frictions within financial system. Secondly, they were not able to model financial booms and busts. Lastly, they abstracted from defaults and loan spreads.

Gerali et al. (2010) is among the influential studies that try to fill the gap in understanding the interactions between financial system and macro economy. Building up on the distinction between different types of households as in Iacoviello (2005), their model introduces a banking sector subject to imperfect competition and financial frictions. They estimate their model for Euro Area and conclude that the shocks in banking sector explains the large part of output fall during 2008. Their model also suggests that the existence of banking sector has different effects depending on the nature of the shock. Banking sector mitigates the effects of demand shocks whereas amplifies the effects of supply shocks. The erosion in bank capital also has adverse effects on lending spreads and investment. However, the model is for a closed

economy and does not consider cases such as abundant global liquidity or excess country risk premium.

Angelini et al (2012) evaluate the effectiveness of macroprudential policies and their interactions with monetary policy in a dynamic general equilibrium framework. The paper assumes that the objective of macroprudential policies is avoiding excessive lending and containing cyclical fluctuations. macroprudential policies considered are countercyclical capital requirements and LTV ratios. The results suggest that in normal times, i.e. when economic fluctuations are driven by supply shocks, countercyclical capital requirements have a limited role on macroeconomic stability whereas macroprudential policies are effective on stabilizing economy when financial shocks are on stage. Moreover, the degree of coordination with monetary policy also plays an enhancing role for decreasing volatility of policy instruments.

Agenor et al. (2014) study the role of macroprudential policies in form of countercyclical capital requirements for an open economy with imperfect capital mobility for cases of sudden floods of foreign private capital. This question was extremely important for emerging market economies in the buildup phase of global financial crisis and after quantitative easing policies of major advanced central banks as a response to the crisis. In their model, capital is imperfectly mobile, a managed float and exchange rate pass through to domestic prices take place, domestic firms borrow from domestic bank and domestic bank borrows from world capital markets. When there is large capital inflow, it generates an economic boom which is magnified by financial accelerator effect through collateral values, banks' balance sheets and loan pricing decisions. Counter-cyclical capital requirements dampen these effects and promote macroeconomic and financial stability.

Ozkan and Unsal (2014) analyze the potential role of macroprudential policies in case of financial shocks. In the model, existence of macroprudential policies create a 'regulation premium' so that financial intermediaries pass the higher costs to the borrowers. As a result, during boom periods it is harder for firms to borrow and restoring financial stability after shock becomes easier. The model assumes the deterioration in the perception of foreign investors on the productivity of entrepreneurs as the negative financial shock. Their open economy model results suggest that there

are no significant welfare gains from monetary policy responses to credit growth in presence of macroprudential policies. Moreover, there are considerable welfare losses when credit growth is responded by monetary policy in case of productivity shock. As a result, the paper suggests a policy mix such that leaning against the wind should be assigned to macro-prudential policy. The distribution of borrowing turns out to be an important factor in evaluating policies. When external borrowing is higher, desirability of macroprudential policies is also higher. For emerging market economies with substantial external borrowing, macroprudential policies can be considered as an important asset in toolkit.

Carrera and Vega (2012) study the effects of reserve requirements as a macro-prudential tool in a DSGE model for Peru where interbank market is explicitly modelled. In the model, an increase in reserve requirements decreases the loanable funds in the interbank market and demand for funds will increase interest rates in the interbank market. The increase in funding cost will be passed to lending and deposit rates and deposits contract. As a result, an increase in reserve requirements rate has qualitatively similar results to policy rate hikes. Output, inflation and asset prices fall in short run.

Quint and Rabanal (2013) study the mix of monetary policy and macroprudential policies for Euro Area where country-specific or sector-specific shocks cannot be addressed through a common monetary policy. Their model includes two countries (core and periphery), two sectors (non-durables and durables, where durables can be thought as housing) and two types of agents (savers and borrowers). The model also incorporates a financial accelerator mechanism. After finding out that extended Taylor rule improves welfare by reacting to credit aggregates, they introduce macroprudential policy into the model. Specifically, macroprudential policy targets credit spreads by effecting the portion of credit in balance sheet. Their results suggest that introduction of macroprudential policy further improves welfare in case of housing demand or risk shocks, however macroprudential policy reduces welfare in existence of technology shocks by amplifying the countercyclical nature of lending spread. Thus, the source of shock carries a huge importance.

Chen and Qolumba (2016) analyze the effects of macroprudential policies and their interaction with monetary policy for Sweden. They build on Gerali et al. (2010), incorporate open economy, and finally calibrate and estimate for Sweden. Their model also includes macroprudential measures such as mortgage risk weights, amortization requirement and tax deduction of mortgage interest payments. They conclude that demand-sided macroprudential tools are more effective than monetary policy in reducing debt-to-income ratio as negative effects on consumption are limited.

In another study built on Gerali et al. (2010), Brzoza-Brzezina and Makarski (2011) use an open economy DSGE model to understand the effects of a credit crunch on a small economy. They estimate the model for Poland and according to their results, financial shocks caused a substantial impact on Polish economy during 2008/2009 financial crisis and lowered GDP around one percent. Their study is not focused on the effects of macroprudential policies, yet their impulse-response analysis also includes the impact of a positive LTV shock to households. The shock increases loans to households and as a result consumption. Increasing consumption results in rising output and inflation and monetary policy reacts with a policy rate hike.

Brzoza-Brzezine et al. (2015) analyze whether the use of macroprudential policies can contribute to the macroeconomic stability of Euro Area by utilizing a two-economy model which has housing frictions as in Iacoviello (2005). For this reason, they build a model where there are two economies and asymmetric shocks to core and periphery economies take place. Their analysis claims that macroprudential policy may partly compensate for the loss of independent monetary policy in the periphery, LTV policy seems more efficient than regulation of capital ratios in terms of lowering the amplitude of output fluctuations in the periphery countries and in order to be effective, these policies must be set individually for each region rather than an area-wide approach. The results indicate that decentralized implementation of LTV policies is desirable.

Vitola and Ajevskis (2011) study the effects of financial shocks and macroprudential policies in an open economy model developed for Latvia. The model incorporates a monopolistically competitive banking sector, yet assumes a fixed exchange rate policy

for the central bank. In this setup, they find out that higher capital requirements lead to higher output, investment and lending but lower deposits and foreign liabilities.

Pagaduan and Majupa (2016) develop an open-economy DSGE model for Philippines. Their model includes both financial accelerator mechanism and collateral constraints. Their analysis yields that tightening LTV requirements sharply contract loans and helps financial stability restore, however with real costs as consumption, investment, and output decline. Thus, coordination with monetary policy is important. Their study also analyzes the responses to a TFP shock. Similar to Özkan and Ünsal (2014) which finds out that implementation of macroprudential policy in a negative TFP shock is welfare decreasing, the impact of a negative shock is magnified under a higher capital requirement policy. Effects of a reserve requirement rate increase are qualitatively similar to a policy rate hike and reserve requirement rate can be used for price stability and financial stability purposes.

Bianchi and Mendoza (2011) study over-borrowing, financial crisis and macro-prudential policy. Their model incorporates business cycles and asset prices with collateral constraints. In their analysis, current borrowing choices affect future prices and wages. Thus internalizing this process, social planner's and private agents' borrowing decisions differ when collateral constraint is not binding. As a result of over-borrowing, adverse effects of a debt-deflation mechanism of a financial crisis are much stronger. This opens a way for policy makers to introduce state-contingent taxes on debts and dividends for decentralizing constraint-efficient allocations, which support macroprudential policies.

Gertler, Kiyotaki, and Prestipino (2020) develop a model to include credit booms and busts. Their model captures two features of financial crises: i) financial crises are associated with rising credit spreads and contracting output and ii) not every credit boom ends up with financial crisis. The non-linear structure of the model makes it necessary to apply numerical methods and their simulations suggest that a macroprudential policy in form of capital requirement limiting leverage could be beneficial.

Yıldırım (2017) employs a DSGE model to understand the dynamics between macroprudential policies and housing market in Turkey. Doğruel and Polat (2015) also

study housing market in Turkey by a DSGE model and conclude that monetary policies and macroprudential policies are not enough to prevent further housing bubbles.

Our model differs from earlier studies having an open economy structure including collateral constraints and banking sector with monopolistic competition. Our modelling approach is more relevant for developing countries as we treat imported goods as intermediate goods in the production of final good. Another distinctive property is that only banks have access to foreign debt and this is rather in contrast with the literature as it assumes foreign borrowing by firms or households (Agenor et al. (2014)).

## 3.3. Model Economy

### 3.3.1. Households and Entrepreneurs

#### 3.3.1.1 Patient Households

The agents maximize expected lifetime utility since there are shocks in the model. The shocks are policy shocks to Taylor rule, loan to value rates, capital adequacy rates and shocks to exogenous processes which are presented in the Appendix[1].

The utility function of patient household depends on consumption (and lagged value of consumption to include habit formation) denoted by $c_t^P$ , housing services denoted by $h_t^P$, and hours worked denoted by $l_t^P$. Both patient and impatient households discount future utility by a discount factor specific to household type. Discount factor should satisfy $0 < \beta_P < 1$ to reflect that current consumption weighs on more than future utility. The patient households have a higher discount factor so that their patience is higher and thus their tendency to save is more than impatient households. The expected lifetime utility of patient households is defined as:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_P^t \left[ \frac{(c_t^P - \eta_c c_{t-1}^P)^{1-a}}{1-a} + \eta_h \ln (h_t^P) - \eta_n \frac{l_t^{P(1+\phi)}}{1+\phi} \right] \tag{3.1}$$

[1] The shocks are normally distributed with mean zero.

Here parameters satisfy[2] $a > 0,\ 0 < \eta_c < 1,\ \eta_h > 0,\ \eta_n > 0,$ and $\phi > 0$. While making her decisions, patient household faces the following budget constraint where $P_t$ is the aggregate price level at time $t$:

$$c_t^P + q_t^h(h_t^P - h_{t-1}^P) + \frac{D_t}{P_t} = w_t^P l_t^P + (1 + R_{t-1}^D)\frac{D_{t-1}}{P_t} + \frac{J_t^P}{P_t} \tag{3.2}$$

In the budget constraint, $(h_t^P - h_{t-1}^P)$ represents the change in accumulated housing, $q_t^h$ denotes the real price of housing and $D_t$ stands for the nominal deposits at time $t$. The patient households earn real wage $w_t^P$ for a unit of labor supply and nominal interest $R_t^D$ on their deposits. They acquire transfers, $J_t^P$ which consist of nominal transfers (profits from firms and banks which they own and net fees from labor union).

The problem of the patient household is to maximize the lifetime utility given in equation 3.1 by choosing $\{c_t^P\}_{t=0}^{\infty}$, $\{h_t^P\}_{t=0}^{\infty}$, $\{l_t^P\}_{t=0}^{\infty}$, and $\{D_t\}_{t=0}^{\infty}$ subject to the budget constraint equation 3.2 for given aggregate prices $\{P_t\}_{t=0}^{\infty}$, real housing prices $\{q_t^h\}_{t=0}^{\infty}$, wages $\{w_t^P\}_{t=0}^{\infty}$, nominal deposit interest rates $\{R_t^D\}_{t=0}^{\infty}$, nominal transfers $\{J_t^P\}_{t=0}^{\infty}$, and initial conditions $h_{-1}^P$, $D_{-1}$, $c_{-1}^P$, and $R_{-1}^D$. Lagrangian functions and corresponding derivations of first order conditions for problems of agents including patient households are presented in Appendix. First order conditions for the maximization problem of the patient household are as following:

$$(c_t^P - \eta_c c_{t-1}^P)^{-a} - \beta_P \eta_c (c_{t+1}^P - \eta_c c_t^P)^{-a} = \lambda_t^P \tag{3.3}$$

$$\lambda_t^P q_t^h = \frac{\eta_h}{h_t^P} + \beta_P \mathbb{E}_t[\lambda_{t+1}^P q_{t+1}^h] \tag{3.4}$$

[2] For a utility function in the form $U(c_t) = \frac{c_t^{1-a}}{1-a}$ , relative risk aversion equals $R_A = -c_t \frac{U''}{U'} = -c_t \frac{-a\, c_t^{-a-1}}{c_t^{-a}} = a$. Thus, $a$ is the parameter for relative risk aversion. Labor supply derived using given utility function satisfies $\lambda_t^P w_t^P = \eta_n l_t^{P\,\phi}$. Frisch elasticity of labor supply is defined as $\frac{d \ln (l_t)}{d \ln (w_t)}$ . Using labor supply condition, Frisch elasticity of labor supply is calculated as $\frac{1}{\phi}$, thus $\phi$ is the inverse of Frisch elasticity of labor supply. As a positive elasticity of labor with respect to wages is expected, we require $\phi > 0$. Habit persistence parameter $\eta_c$ should satisfy $0 < \eta_c < 1$. Since marginal utility of housing is positive and agents get dis-utility form labor, $\eta_h > 0$ and $\eta_n > 0$.

$$\lambda_t^P = \beta_P \mathbb{E}_t \left[ \frac{\lambda_{t+1}^P (1 + R_t^D)}{\pi_{t+1}} \right] \tag{3.5}$$

Here, $\lambda_t^P$ is the marginal utility that the patient household gains when we relax the budget constraint and $\pi_t = \frac{P_t}{P_{t-1}}$ is the gross inflation rate. Equation 3.3 states that the marginal utility of consumption should be equal to shadow price of the budget constraint at the optimum. Equation 3.4 states that in her optimal decisions, patient households shall equate the marginal utility of consumption she can gain by selling her housing stock to marginal utility she gains from housing plus her discounted expected marginal utility of consumption she can gain by selling her house next period. Equation 3.5 determines the first order condition for the deposit demand of patient household. Imposing the following transversality conditions on deposit demand, housing demand, and consumption as boundary conditions together with first order conditions provide solution to the problem of patient household. Since past consumption becomes a state variable by habit formation, we need to impose transversality condition on consumption.

$$\lim_{T \to \infty} \mathbb{E}_0 [\beta_P^T \lambda_T^P d_T] = 0$$

$$\lim_{T \to \infty} \mathbb{E}_0 \left[ \beta_P^T \lambda_T^P q_T^h h_T^P \right] = 0$$

$$\lim_{T \to \infty} \mathbb{E}_0 [\beta_P^T \lambda_T^P c_T^P] = 0$$

### 3.3.1.2 Impatient Households

Similar to patient households, impatient households also maximize expected lifetime utility. However, the discount factor is different. The expected lifetime utility can be expressed as:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_I^t \left[ \frac{(c_t^I - \eta_c c_{t-1}^I)^{1-a}}{1-a} + \eta_h \ln (h_t^I) - \eta_n \frac{l_t^{I\,(1+\phi)}}{1+\phi} \right] \tag{3.6}$$

The parameters satisfy $a > 0$, $0 < \eta_c < 1$, $\eta_h > 0$, $\eta_n > 0$, and $\phi > 0$. The discount factor of impatient hoıseholds satisfy $\beta_I < \beta_P$ so that impatient households turn out to be borrowers. Therefore, the budget constraint for the impatient households includes loans from banks, $B_t^I$ with nominal rates, $R_t^{bH}$. They do not have any transfer payments except net labor union fees, $J_t^I$ and the resulting budget constraint is as following:

$$c_t^I + q_t^h(h_t^I - h_{t-1}^I) + \left(1 + R_{t-1}^{bH}\right)\frac{B_{t-1}^I}{P_t} = w_t^I l_t^I + \frac{B_t^I}{P_t} + \frac{J_t^I}{P_t} \tag{3.7}$$

While borrowing from banks, impatient households face a collateral constraint. Specifically, they can borrow up to a level which is jointly determined by expected value of their housing stock and a regulatory LTV ratio imposed on household loans.

$$\left(1 + R_t^{bH}\right) b_t^I \;\leq\; LTV_t^I \; \mathbb{E}_t[q_{t+1}^h h_t^I \pi_{t+1}] \tag{3.8}$$

Here, LTV ratio for household loans are modelled as AR(1) process and subject to regulatory shocks. This will allow us to study the effects of a change in loan-to-value ratios for households through credit supply.

The problem of the impatient household is to maximize the lifetime utility given in equation 3.6 by choosing $\{c_t^I\}_{t=0}^{\infty}$, $\{h_t^I\}_{t=0}^{\infty}$, $\{l_t^I\}_{t=0}^{\infty}$, and $\{B_t^I\}_{t=0}^{\infty}$ subject to the budget constraint equation 3.7 and to collateral constraint equation 3.8 for given aggregate prices $\{P_t\}_{t=0}^{\infty}$, real housing prices $\{q_t^h\}_{t=0}^{\infty}$, real wages $\{w_t^I\}_{t=0}^{\infty}$, nominal loan interest rates $\{R_t^{bH}\}_{t=0}^{\infty}$, nominal transfers $\{J_t^I\}_{t=0}^{\infty}$, for given policy $\{LTV_t^I\}_{t=0}^{\infty}$, and initial conditions $h_{-1}^I$, $B_{-1}^I$, $c_{-1}^I$, and $R_{-1}^{bH}$. Calling the Lagrange multiplier associated with collateral constraint as $\mu_t^I$ and the Lagrange multiplier associated with budget constraint as $\lambda_t^I$ , first order conditions are presented below[3].

[3] As argued in Iacoviello (2005), the main assumption regarding the discount factors of impatient households and entrepreneurs is that collateral constraints are binding in the steady state and its small enough neighborhood. Otherwise, it is not possible to study the effects of a change in LTV ratios. On the other hand, it is easy to see that as discount factors go to zero, the collateral constraint needs to be binding. For instance, consider the case of $\beta = 0$.

$$(c_t^I - \eta_c c_{t-1}^I)^{-a} - \beta_I \eta_c (c_{t+1}^I - \eta_c c_t^I)^{-a} = \lambda_t^I \tag{3.9}$$

$$\lambda_t^I q_t^h = \frac{\eta_h}{h_t^I} + \beta_I \mathbb{E}_t[\lambda_{t+1}^I q_{t+1}^h] + \mu_t^I \, LTV_t^I \mathbb{E}_t[\pi_{t+1} q_{t+1}^h] \tag{3.10}$$

$$\lambda_t^I = \beta_I \left(1 + R_t^{bH}\right) \mathbb{E}_t \left[\frac{\lambda_{t+1}^I}{\pi_{t+1}}\right] + \mu_t^I \left(1 + R_t^{bH}\right) \tag{3.11}$$

We also assume that transversality conditions for housing demand and consumption in addition to no-Ponzi condition on loan demand hold. These conditions are presented below.

$$\lim_{T \to \infty} \mathbb{E}_0 \left[ \left( \prod_{t=0}^{T} \frac{\pi_{t+1}}{\left(1 + R_t^{bH}\right)} \right) b_{T+1}^I \right] = 0$$

$$\lim_{T \to \infty} \mathbb{E}_0 \left[ \left( \prod_{t=0}^{T} \frac{\pi_{t+1}}{\left(1 + R_t^{bH}\right)} \right) q_{T+1}^h h_{T+1}^I \right] = 0$$

$$\lim_{T \to \infty} \mathbb{E}_0 [\beta_I^T \lambda_T^I c_T^I] = 0$$

### 3.3.1.3 Entrepreneurs

Entrepreneurs operate in a perfectly competitive environment and each entrepreneur has the same following constant returns to scale production technology, which produces a domestic wholesale intermediate good, combining capital and labor inputs:

$$y_t^E = A_t (k_{t-1}^E)^{\alpha} l_t^{1-\alpha} \tag{3.12}$$

Entrepreneurs aggregate the labor supply according to $l_t = (l_t^P)^{\varphi} (l_t^I)^{1-\varphi}$. Their total factor productivity, $A_t$ is subject to productivity shocks as usual. Each entrepreneur tries to maximize the expected lifetime utility given below where $a > 0$ and $0 < \eta_c < 1$.

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_E^t \left[ \frac{(c_t^E - \eta_c c_{t-1}^E)^{1-a}}{1-a} \right] \tag{3.13}$$

Budget constraint for the entrepreneurs can be expressed as:

$$c_t^E + w_t^P l_t^P + w_t^I l_t^I + q_t^k k_t^E + (1 + R_{t-1}^{bE}) \frac{B_{t-1}^E}{P_t} = y_t^E \frac{P_t^w}{P_t} + \frac{B_t^E}{P_t} + q_t^k (1-\delta) k_{t-1}^E \tag{3.14}$$

In the budget constraint, $\delta$ is the rate of depreciation for capital, $P_t^w$ is the price of wholesale intermediate good, $q_t^k$ is the real price of capital in terms of final good, $B_t^E$ is the borrowing from banks with nominal rates $R_t^{bE}$, $w_t^P$ refers to real wage rate of patient households, and $w_t^I$ denotes the real wage rate of impatient households. As in the case of impatient households, entrepreneurs face a collateral constraint while borrowing from the banks. Their lending limit depends on the holdings of physical capital. The collateral constraint is specified as following:

$$\left(1 + R_t^{bE}\right) b_t^E \;\leq\; LTV_t^E \; \mathbb{E}_t [q_{t+1}^k (1-\delta) k_t^E \pi_{t+1}] \tag{3.15}$$

The problem of entrepreneurs is to maximize lifetime utility in equation 3.13 by choosing $\{c_t^E\}_{t=0}^{\infty}$, $\{l_t^I\}_{t=0}^{\infty}$, $\{l_t^P\}_{t=0}^{\infty}$, $\{B_t^E\}_{t=0}^{\infty}$, and $\{k_t^E\}_{t=0}^{\infty}$ subject to the budget constraint equation 3.14 and to collateral constraint equation 3.15 for given aggregate prices $\{P_t\}_{t=0}^{\infty}$, real prices of capital $\{q_t^k\}_{t=0}^{\infty}$, real wages $\{w_t^I\}_{t=0}^{\infty}$, $\{w_t^P\}_{t=0}^{\infty}$, nominal loan interest rates $\{R_t^{bE}\}_{t=0}^{\infty}$, policy $\{LTV_t^E\}_{t=0}^{\infty}$, and initial conditions $k_{-1}^E$, $B_{-1}^E$, $c_{-1}^E$, and $R_{-1}^{bE}$. Calling the Lagrange multiplier associated with collateral constraint as $\mu_t^E$ and the Lagrange multiplier associated with budget constraint as $\lambda_t^E$, first order conditions are presented below.

$$(c_t^E - \eta_c c_{t-1}^E)^{-a} - \beta_E \eta_c (c_{t+1}^E - \eta_c c_t^E)^{-a} = \lambda_t^E \tag{3.16}$$

$$w_t^P = \varphi \, (1-\alpha) \frac{P_t^w}{P_t} \frac{y_t^E}{l_t^P} \tag{3.17}$$

$$w_t^I = (1-\varphi)\,(1-\alpha)\,\frac{P_t^w}{P_t}\frac{y_t^E}{l_t^I} \tag{3.18}$$

$$\lambda_t^E q_t^k = \beta_E \mathbb{E}_t\left[\lambda_{t+1}^E(\alpha\frac{P_{t+1}^w}{P_{t+1}}\frac{y_{t+1}^E}{k_t^E} + q_{t+1}^k(1-\delta))\right] + (1-\delta)\mu_t^E\, LTV_t^E\, \mathbb{E}_t[\pi_{t+1}q_{t+1}^k] \tag{3.19}$$

$$\lambda_t^E = \mu_t^E\left(1+R_t^{bE}\right) + \beta_E\,\mathbb{E}_t\left[\frac{\lambda_{t+1}^E\left(1+R_t^{bE}\right)}{\pi_{t+1}}\right] \tag{3.20}$$

Together with no-Ponzi condition on loan demand and transversality condition on capital stock, these first order conditions are enough to determine optimal path. These conditions are presented below.

$$\lim_{T\to\infty}\mathbb{E}_0\left[\left(\prod_{t=0}^{T}\frac{\pi_{t+1}}{\left(1+R_t^{bE}\right)}\right)b_{T+1}^E\right] = 0$$

$$\lim_{T\to\infty}\mathbb{E}_0\left[\left(\prod_{t=0}^{T}\frac{\pi_{t+1}}{\left(1+R_t^{bE}\right)}\right)q_{T+1}^k k_{T+1}^E\right] = 0$$

### 3.3.1.4 Loan and Deposit Demands

In order to introduce market power of banks, following Gerali et al. (2010), a Dixit-Stiglitz framework for bank products are assumed. Under this framework, the households and entrepreneurs utilize a constant elasticity of substitution[4] basket of differentiated loan and deposit products supplied by different banks. Total loans of impatient household *i*, total loans of entrepreneur *e*, and total deposits of patient household *p* are modelled as:

$$B_t^I(i) = \left(\int_0^1 B_t^I(i,j)^{\frac{\varepsilon^{bH}-1}{\varepsilon^{bH}}}\,dj\right)^{\frac{\varepsilon^{bH}}{\varepsilon^{bH}-1}} \tag{3.21}$$

[4] Since our focus is on policy shocks, we treat elasticities as constant parameters through time.

$$B_t^I(e) = (\int_0^1 B_t^I(e,j)^{\frac{\varepsilon^{bE}-1}{\varepsilon^{bE}}} dj)^{\frac{\varepsilon^{bE}}{\varepsilon^{bE}-1}} \quad (3.22)$$

$$D_t(p) = (\int_0^1 D_t(p,j)^{\frac{\varepsilon^{D}-1}{\varepsilon^{D}}} dj)^{\frac{\varepsilon^{D}}{\varepsilon^{D}-1}} \quad (3.23)$$

As a standard result discussed in detail in Appendix A.1 of Gerali et al. (2010), loan and deposit demands for bank *j* after the optimization of households and entrepreneurs can be expressed as following equations.

$$B_t^I(j) = (\frac{R_t^{bH}(j)}{R_t^{bH}})^{-\varepsilon^{bH}} B_t^I \quad (3.24)$$

$$B_t^I(j) = (\frac{R_t^{bH}(j)}{R_t^{bH}})^{-\varepsilon^{bH}} B_t^I \quad (3.25)$$

$$D_t(j) = (\frac{R_t^{D}(j)}{R_t^{D}})^{-\varepsilon^{D}} D_t \quad (3.26)$$

Elasticity of substitution for deposit demand between any pair of banks can be obtained by:

$$\left( \frac{d \ln [\frac{D_t(j)}{D_t(k)}]}{d \ln [\frac{R_t^D(j)}{R_t^D(k)}]} \right) = -\varepsilon^D \quad (3.27)$$

Similarly, elasticity of substitution for loan demands between banks can be obtained as:

$$\left( \frac{d \ln [\frac{B_t^I(j)}{B_t^I(k)}]}{d \ln [\frac{R_t^{bH}(j)}{R_t^{bH}(k)}]} \right) = -\varepsilon^{bH} \quad (3.28)$$

$$\left( \frac{d \ln [\frac{B_t^E(j)}{B_t^E(k)}]}{d \ln [\frac{R_t^{bE}(j)}{R_t^{bE}(k)}]} \right) = -\varepsilon^{bE} \tag{3.29}$$

### 3.3.2. Labor Unions

To introduce wage stickiness in the model, we follow Gerali et al. (2010) and assume that workers supply differentiated labor which is sold by labor unions to competitive labor packers. Competitive labor packers package them using a CES aggregation and supply homogeneous labor to entrepreneurs. The positive parameter for CES aggregation is $\epsilon_l$ and we refrain from exogenous shocks to this parameter to simplify matters. There are two unions for each labor type, one for patient and one for household patients. Each labor union faces downward sloping demand curve and adjustment costs parameterized with a positive coefficient $\kappa_w$.

We derive labor supply of household types respectively, starting from patient households. Under this setting, each labor union for patient households will maximize the following objective function which is in terms of utils of patient households subject to $l_t^P(m) = \left(\frac{W_t^P(m)}{W_t^P}\right)^{-\epsilon_l} l_t^P$:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_P^t \left[ U_{c_t^P} \left\{ \frac{W_t^P(m)}{P_t} l_t^P(m) - \frac{\kappa_w}{2} \left(\frac{W_t^P(m)}{W_{t-1}^P(m)} - \pi_{ss}\right)^2 \frac{W_t^P}{P_t} \right\} - \eta_n \frac{l_t^P(m)^{(1+\phi)}}{1+\phi} \right] \tag{3.30}$$

Taking derivative of the expected utility function with respect to nominal wage of union type $m$, imposing $U_{c_t^P} = \lambda_t^P$ due to first order condition of patient household and assuming symmetric equilibrium yields the following first order condition:

$$\kappa_w \left(\pi_t^{w^P} - \pi_{ss}\right) \pi_t^{w^P} = \beta_P \mathbb{E}_t \left[ \frac{\lambda_{t+1}^P}{\lambda_t^P} \kappa_w \left(\pi_{t+1}^{w^P} - \pi_{ss}\right) \frac{(\pi_{t+1}^{w^P})^2}{\pi_{t+1}} \right] + (1-\epsilon_l) l_t^P + \frac{\epsilon_l \eta_n l_t^{P(1+\phi)}}{\lambda_t^P w_t^P} \tag{3.31}$$

Applying same steps for impatient households yields:

$$\kappa_w \left(\pi_t^{w^I} - \pi_{ss}\right) \pi_t^{w^I} = \beta_I \mathbb{E}_t \left[ \frac{\lambda_{t+1}^I}{\lambda_t^I} \kappa_w \left(\pi_{t+1}^{w^I} - \pi_{ss}\right) \frac{(\pi_{t+1}^{w^I})^2}{\pi_{t+1}} \right] + (1 - \epsilon_l) l_t^I + \frac{\epsilon_l \eta_n l_t^{I^{(1+\phi)}}}{\lambda_t^I w_t^I} \tag{3.32}$$

### 3.3.3. Firms

There are two production sectors in the economy: capital goods sector and consumption goods sector[5]. Capital good producers, combine investment with non-depreciated capital and produce capital to be sold to entrepreneurs. Domestic retailers buy homogeneous intermediate goods from entrepreneurs and differentiate them by branding whereas importing retailers import intermediate goods from abroad. In this sense, following McCallum-Nelson approach imported goods are not treated as final consumption goods. Final good producers aggregate domestic and imported intermediate goods to produce final good which will be consumed by domestic economy or exported.

#### 3.3.3.1 Capital Goods Producers

Capital good producers operate in a perfectly competitive market and they are owned by entrepreneurs. They are an important part of the model in order to determine the price of physical capital which is necessary to impose collateral constraints. They buy the non-depreciated capital from the last period with a price $P_t^k$ and combine them with new investment in the form of final goods (which have a price $P_t$) to produce the new capital. The price of new capital is also $P_t^k$. One crucial aspect of the capital good production is the quadratic investment adjustment costs:

$$\phi\left(\frac{i_t}{i_{t-1}}\right) = \kappa_i \left(\frac{i_t}{i_{t-1}}\right)^2 \tag{3.33}$$

[5] Housing stock is assumed to be fixed.

Here, $\kappa_i$ is the parameter measuring investment adjustment costs. Thus, recalling that the real price of physical capital $\frac{P_t^k}{P_t}$ is $q_t^k$, the problem of the capital good producers can be formulated as:

$$max \;\; \mathbb{E}_0 \sum_{t=0}^{\infty} \Lambda_{0,t}^{E} \; [q_t^k (k_t - (1-\delta)k_{t-1}) - i_t]$$

$$s.to \;\; (k_t - (1-\delta)k_{t-1}) = \left[1 - \phi\left(\frac{i_t}{i_{t-1}}\right)\right] i_t \qquad (3.34)$$

In this formulation, $\Lambda_{0,t}^{E}$ is the stochastic discount factor for the entrepreneur. Solving for the optimal level of investment yields the following FOC:

$$q_t^k = \left[1 - \phi\left(\frac{i_t}{i_{t-1}}\right) - \phi'\left(\frac{i_t}{i_{t-1}}\right)\frac{i_t}{i_{t-1}}\right]^{-1}\left(1 - \beta_E \mathbb{E}_t\left[\frac{\lambda_{t+1}^E}{\lambda_t^E} q_{t+1}^k \left(\frac{i_{t+1}}{i_t}\right)^2 \phi'\left(\frac{i_{t+1}}{i_t}\right)\right]\right) \qquad (3.35)$$

### 3.3.3.2 Domestic Retailers

Domestic retailers are owned by patient households and they are assumed to operate in a monopolistic competitive environment. They buy the wholesale domestic intermediate good from entrepreneurs at wholesale price $P_t^w$, differentiate them at no cost and sell them to final good producer by imposing a retail price $P_t^D(j)$ for their distinct products. Their prices are sticky and while setting their prices, they are subject to Rotemberg (1982) style quadratic adjustment costs. The real profits of the domestic problem for domestic retailer *j* can be written as:

$$\frac{P_t^D(j) y_t^D(j) - P_t^w y_t^D(j) - \frac{\kappa_p}{2}\left(\frac{P_t^D(j)}{P_{t-1}^D(j)} - 1\right)^2 P_t^D y_t^D}{P_t} \qquad (3.36)$$

Since domestic retailers are owned by patient households, while deciding on their prices, the retailer discounts these real profits with the stochastic discount factor of the patient household. Thus, the problem of the domestic retailer is:

$$max \;\; \mathbb{E}_0 \sum_{t=0}^{\infty} \Lambda_{0,t}^{P} \left[ \frac{P_t^D(j) y_t^D(j) - P_t^w y_t^D(j) - \frac{\kappa_P}{2} \left( \frac{P_t^D(j)}{P_{t-1}^D(j)} - 1 \right)^2 P_t^D y_t^D}{P_t} \right]$$

$$s.to \;\; y_t^D(j) = \left( \frac{P_t^D(j)}{P_t^D} \right)^{-\theta^D} y_t^D \tag{3.37}$$

Solving the problem of the domestic retailer *j* and imposing symmetric equilibrium yield the following adjustment process of nominal price:

$$(1-\theta^D) + \frac{P_t^w}{P_t^D}\theta^D - \kappa_P(\pi_t^D - 1)\pi_t^D + \beta_P \kappa_P \mathbb{E}_t \left[ \frac{\lambda_{t+1}^P}{\lambda_t^P} (\pi_{t+1}^D - 1) \frac{(\pi_{t+1}^D)^2}{\pi_{t+1}} \frac{y_{t+1}^D}{y_t^D} \right] = 0 \tag{3.38}$$

where $\pi_t^D = \frac{P_t^D}{P_{t-1}^D}$ is the gross inflation rate of domestic retailer price. This adjustment process implies that even under flexible prices where $\kappa_P = 0$, the retailer prices will include a markup over wholesale price due to the monopolistic competition.

### 3.3.3.3 Final Good Producers

Final good producers import a continuum of distinct intermediate goods and combine these with domestic intermediate goods in order to produce a domestic final good, which can be exported or sold domestically for consumption and investment. The production technology is CES:

$$y_t = \left[ (\Lambda_D)^{\frac{1}{\eta}} (y_t^D)^{\frac{\eta-1}{\eta}} + (1-\Lambda_D)^{\frac{1}{\eta}} (y_t^F)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}} \tag{3.39}$$

Here $\Lambda_D \epsilon (0,1)$ and $\eta$ is the elasticity of substitution between domestic and intermediate goods. $y_t^D$ and $y_t^F$ are the quantity indices of domestic and imported intermediate goods respectively, which are defined as (for $i = D, F$):

$$y_t^i = \left[\int_0^1 y_t^i(j)^{\frac{\theta^i - 1}{\theta^i}} dj\right]^{\frac{\theta^i}{\theta^i - 1}}$$

The final good producers sell the final good with a perfectly competitive price. The cost minimization problem of the final good producer yields the following demand schedules for intermediate goods (for $i = D, F$):

$$y_t^i(j) = \left(\frac{P_t^i(j)}{P_t^i}\right)^{-\theta^i} y_t^i$$

Where $P_t^i$ (price index for intermediate goods) is defined as (for $i = D, F$):

$$P_t^i = \left[\int_0^1 \left[P_t^i(j)\right]^{1-\theta^i} dj\right]^{\frac{1}{1-\theta^i}}$$

When we aggregate over firms, the allocation of total demand between domestic and imported intermediate goods equals:

$$y_t^D = \Lambda_D \left(\frac{P_t^D}{P_t}\right)^{-\eta} y_t \quad , \quad y_t^F = (1 - \Lambda_D)\left(\frac{P_t^F}{P_t}\right)^{-\eta} y_t \tag{3.40}$$

Here $P_t$ is the final good price, which is given by:

$$P_t = [\Lambda_D (P_t^D)^{1-\eta} + (1 - \Lambda_D)(P_t^F)^{1-\eta}]^{\frac{1}{1-\eta}} \tag{3.41}$$

The price of imported good prices has local currency price stickiness by an imperfect exchange rate pass-through, which is modelled by:

$$P_t^F(j) = (E_t WP_t(j))^{\mu^F} (P_{t-1}^F(j))^{1-\mu^F} \quad (3.42)$$

Here $WP_t$ is the world price in foreign currency and $\mu^F \epsilon (0,1)$ is the speed of the adjustment of local currency prices to their perfect pass through prices. Only when $\mu^F = 1$, then local currency price will perfectly reflect the fluctuations in nominal exchange rate and there will be no price-stickiness.

Finally, we need to specify exports in order to determine the allocation of final domestic good between exports and domestic market. We assume that volume of exports, $y_t^X$ depends positively on the foreign output, $y_t^*$and on the real exchange rate of foreign currency in terms of home final good as following:

$$y_t^X = y_0^X \left(\frac{E_t WP_t}{P_t}\right)^{\Gamma} \frac{y_t^*}{y_{ss}^*} \quad (3.43)$$

Here $\Gamma$ is the price elasticity of outputs and we assume that foreign output follows an autoregressive exogenous process.

### 3.3.4. Banks

Banks are an important part of the model, as they are the only agents operating as financial intermediaries. The banks collect deposits, $D_t$ from patient households while setting reserve requirements at the central bank, $RR_t$. They combine these deposits with their equity, $K_t^b$ and the external borrowings from the world capital markets, $E_t L_t^F$, where $E_t$ is the exchange rate. Total bank lending to the impatient households and entrepreneurs is denoted by $B_t$. Thus, a typical balance sheet of a bank consists of reserve requirements and loans as assets and deposits, foreign borrowings and bank capital as liabilities. In nominal terms:

$$RR_t + B_t = D_t + K_t^b + E_t L_t^F \quad (3.44)$$

Following Gerali et al (2010), we introduce market power of banks for both deposit and loan markets. To better illustrate, each bank can be assumed to have a wholesale branch and two retail branches; one for deposits and one for loans. While wholesale branch operates in a perfectly competitive environment and manages the capital position of the group, the retail banks set the deposit and the loan rates in a monopolistic competition framework, subject to adjustment costs. We extend this approach by introducing foreign borrowing and reserve requirements at the wholesale level.

#### 3.3.4.1 Wholesale Branch

Wholesale branch operates under perfect competition. It collects wholesale deposits, combines with net worth and borrows from the rest of the world on the liabilities side. On assets side, it issues wholesale loans and sets reserve requirements aside at the central bank. It manages the capital position of the bank by considering capital adequacy ratio imposed by the regulator. When capital adequacy ratio moves away from a target level, the bank pays a quadratic cost.

Bank capital is accumulated with retained earnings after the dividends are paid out to patient households:

$$K_t^b = (1 - \delta^b)K_{t-1}^b + \omega^b J_{t-1}^b \tag{3.45}$$

Here, $\delta^b$ stands for the management costs of the bank, $J_t^b$ is the overall nominal profit of the bank coming from wholesale branch and retail branches and $(1 - \omega^b)$ reflects the exogenous fixed dividend policy of the bank. These imply that bank capital is predetermined and not a choice variable for the banks at time *t*. Required reserves held at the central bank are determined by:

$$RR_t = \mu^R D_t \tag{3.46}$$

where $\mu^R$ is the reserve requirement ratio.

While borrowing from world capital markets, the banks face a premium depending on how much they borrow, as in Agenor et al (2014). The cost of foreign borrowing is determined by:

$$(1 + R_t^F) = (1 + R_t^w)(1 + \theta_t^F)\ \mathbb{E}_t\left[\frac{E_{t+1}}{E_t}\right] \tag{3.47}$$

Here $R_t^F$ denotes the cost of foreign borrowing, $R_t^w$ is the risk-free world interest rate and $\theta_t^F$ is the risk premium which is defined as:

$$\theta_t^F = \frac{\theta^0}{2}\left(\frac{E_t L_t^F}{P_t}\right) \tag{3.48}$$

The problem for the wholesale branch is choosing the levels of wholesale deposits, wholesale loans and foreign borrowing in order to maximize the discounted sum of cash flows in real terms, subject to the balance sheet identity. Using balance sheet identity twice at date $t$ and $t+1$, the objective function turns into real period profits:

$$\underset{\{B_t, D_t, L_t^F\}}{max}\left[R_t^b B_t - R_t^d(D_t - RR_t) - R_t^F E_t L_t^F - \frac{\kappa_{Kb}}{2}\left(\frac{K_t^b}{B_t} - v_t^b\right)^2 K_t^b\right] {P_t}^{-1} \tag{3.49}$$

The FOCs give the spread between wholesale deposit and loan rates and link the foreign borrowing level to domestic and external funding conditions as following:

$$R_t^b = R_t^d - \kappa_{Kb}\left(\frac{K_t^b}{B_t} - v_t^b\right)\left(\frac{K_t^b}{B_t}\right)^2 \tag{3.50}$$

$$\frac{E_t L_t^F}{P_t} = \frac{(1 + R_t^d) - (1 + R_t^w)\ \mathbb{E}_t\left[\frac{E_{t+1}}{E_t}\right]}{(1 + R_t^w)\ \theta^0\ \mathbb{E}_t\left[\frac{E_{t+1}}{E_t}\right]} \tag{3.51}$$

Equation 3.50 indicates that, spread between wholesale loan rate and deposit rate depends on two factors, namely regulatory capital adequacy rate and capital position of the banks. Equation 3.51 states that, whenever premium-exclusive cost of borrowing decreases, banks will use foreign borrowing more. Likewise, an increase in

the domestic funding costs will result in more usage of external funding. In order to close the model, we assume that banks have unlimited access to central bank financing at the policy rate, $r_t$. Thus, no-arbitrage implies the following relation between wholesale deposit rate and policy rate:

$$r_t = R_t^d \tag{3.52}$$

### 3.3.4.2 Retail Branches

There are two retail branches, one for lending loans to entrepreneurs and im- patient households and one for taking deposits from patient household. Unlike the wholesale branch, retail branches operate in a monopolistic competitive environment and have market power.

**Lending Branch:** The lending branch of bank $j$ takes wholesale loans $B_t(j)$ from wholesale branch, differentiates them without incurring any costs and resells them to entrepreneurs and impatient households by applying mark-ups. One further assumption is the existence of stickiness in loan rates, simply by imposing adjustment costs on loan rates. Denoting these adjustment cost parameters as $\kappa_{bE}$ and $\kappa_{bH}$, the problem of lending branch can be formulated as following:

$$\max_{\{R_t^{bH}(j),\, R_t^{bE}(j)\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \Lambda_{0,t}^{P} \Bigg[ R_t^{bH}(j)\, B_t^{I}(j) + R_t^{bE}(j)\, B_t^{E}(j) - R_t^{b} B_t(j) - \frac{\kappa_{bH}}{2}\left(\frac{R_t^{bH}(j)}{R_{t-1}^{bH}(j)} - 1\right)^2 R_t^{bH} B_t^{I} - \frac{\kappa_{bE}}{2}\left(\frac{R_t^{bE}(j)}{R_{t-1}^{bE}(j)} - 1\right)^2 R_t^{bE} B_t^{E} \Bigg] {P_t}^{-1} \tag{3.53}$$

subject to loan demands and $B_t(j) = B_t^I(j) + B_t^E(j)$. FOCs, after imposing a symmetric equilibrium yield the following:

$$1-\epsilon_t^{bs}+\epsilon_t^{bs}\frac{R_t^b}{R_t^{bs}}-\kappa_{bs}\left(\frac{R_t^{bs}}{R_{t-1}^{bs}}-1\right)\frac{R_t^{bs}}{R_{t-1}^{bs}} + \beta_P\mathbb{E}_t\left[\frac{\lambda_{t+1}^P}{\lambda_t^P}\kappa_{bs}\left(\frac{R_{t+1}^{bs}}{R_t^{bs}}-1\right)\left(\frac{R_{t+1}^{bs}}{R_t^{bs}}\right)^2\frac{B_{t+1}^s}{B_t^s}\frac{1}{\pi_{t+1}}\right]=0 \qquad (3.54)$$

where $\lambda_t^P$ is the Lagrange multiplier for the budget constraint of the patient household and $s$ is the indexation for loans to households and entrepreneurs.

**Deposit Branch:** The deposit branch of the bank $j$ collects deposits $D_t(j)$ with choosing a deposit rate $R_t^D(j)$. Deposit rates are subject to quadratic adjustment costs parameterized by $\kappa_d$. Later on, these funds are collected at the wholesale unit, which applies deposit rate $R_t^D$ to these deposits. Thus, the problem of the retail branch is:

$$\underset{\{R_t^D(j)\}}{max}\ \mathbb{E}_0\sum_{t=0}^{\infty}\Lambda_{0,t}^P\left[R_t^d\,D_t(j)-R_t^D(j)\,D_t(j)-\frac{\kappa_d}{2}\left(\frac{R_t^D(j)}{R_{t-1}^D(j)}-1\right)^2R_t^D D_t\right]{P_t}^{-1} \qquad (3.55)$$

subject to deposit demand schedule of patient households. After deriving first order conditions and imposing symmetric equilibrium, the optimality condition of deposit rates becomes:

$$-1+\epsilon_t^d-\epsilon_t^d\frac{R_t^d}{R_t^D}-\kappa_d\left(\frac{R_t^D}{R_{t-1}^D}-1\right)\frac{R_t^D}{R_{t-1}^D} + \beta_P\mathbb{E}_t\left[\frac{\lambda_{t+1}^P}{\lambda_t^P}\kappa_d\left(\frac{R_{t+1}^D}{R_t^D}-1\right)\left(\frac{R_{t+1}^D}{R_t^D}\right)^2\frac{D_{t+1}}{D_t}\frac{1}{\pi_{t+1}}\right]=0 \qquad (3.56)$$

Total profits of a bank is the sum of period profits for wholesale branch and retail branches and consists of net interest revenues and adjustment costs. It can be expressed as following (in nominal terms):

$$J_t^b = R_t^{bH} B_t^I + R_t^{bE}\, B_t^E - R_t^D\, D_t + R_t^d\, RR_t - R_t^F\, E_t L_t^F - \frac{\kappa_{Kb}}{2}\left(\frac{K_t^b}{B_t} - v_t^b\right)^2 K_t^b - \frac{\kappa_{bH}}{2}\left(\frac{R_t^{bH}}{R_{t-1}^{bH}} - 1\right)^2 R_t^{bH} B_t^I - \frac{\kappa_{bE}}{2}\left(\frac{R_t^{bE}}{R_{t-1}^{bE}} - 1\right)^2 R_t^{bE} B_t^E - \frac{\kappa_d}{2}\left(\frac{R_t^D}{R_{t-1}^D} - 1\right)^2 R_t^D D_t \quad (3.57)$$

### 3.3.5. Central Bank

Central Bank sets the policy rate according to a standard Taylor rule, which responds to the deviations from inflation and output stability and has a persistence to some extent.

$$(1 + r_t) = (1 + r_{t-1})^{\phi_R}(1 + r)^{1-\phi_R}\left(\left(\frac{\pi_t}{\pi}\right)^{\phi_\pi}\left(\frac{y_t}{y_{t-1}}\right)^{\phi_y}\right)^{1-\phi_R}(1 + \epsilon_t^r) \quad (3.58)$$

Here, $\phi_\pi$ and $\phi_y$ denote the weights of inflation and output, respectively. The persistence in policy rate is denoted with$\phi_R$. Steady state of inflation and policy rates are denoted by $\pi$ and $r$ respectively. Besides setting the policy rate considering inflation and output stability, central bank may also employ macroprudential policies. For this purpose, the macroprudential tools in the model are LTV ratios for household and entrepreneur loans and capital adequacy ratios.

Loan to value rates for entrepreneur and household loans and target capital adequacy ratios are modelled as following equations:

$$LTV_t^I = \rho_I\, LTV_{t-1}^I + (1 - \rho_I)\, LTV^I + \epsilon_t^{LTV^I} \quad (3.59)$$

$$LTV_t^E = \rho_E\, LTV_{t-1}^E + (1 - \rho_E)\, LTV^E + \epsilon_t^{LTV^E} \quad (3.60)$$

$$v_t^b = \rho_v\, v_{t-1}^b + (1 - \rho_v)\, v^b + \epsilon_t^{v^b} \quad (3.61)$$

### 3.3.6. Equilibrium

We consider symmetric equilibrium, where domestic retailers, foreign firms from which final good producer imports intermediate goods, entrepreneurs and banks behave identical compared to other units in their group. The equilibrium condition in the final good market is given by:

$$y_t = c_t^P + c_t^I + c_t^E + q_t^k[k_t - (1-\delta)k_{t-1}] + y_t^X + Adj_t \tag{3.62}$$

Here adjustment costs, $Adj_t$ are real cost of depreciation in bank capital, real adjustment costs of domestic prices, wages, loan rates, and deposit rates.

Equilibrium in labor markets is satisfied by equating labor demand to labor supply for both patient and impatient household labor market. Since housing stock is assumed fixed, equilibrium in the housing market is given by:

$$h = h_t^P + h_t^I \tag{3.63}$$

In our model, net foreign asset position consists of only bank borrowings. Thus,

$$NFA_t + L_t^F = 0 \tag{3.64}$$

Finally, external budget constraint of the economy can be defined as (in foreign currency terms):

$$y_t^X \frac{P_t}{E_t} - y_t^F \frac{P_t^F}{E_t} + R_{t-1}^w NFA_{t-1} - \theta_{t-1}^F L_{t-1}^F = NFA_t - NFA_{t-1} \tag{3.65}$$

### 3.3.7. Parameters

For parameter values, we benefit from the two papers on which the modelling structure is built, namely Gerali (2010) and Agenor et al. (2014). Key parameter values are given in the following Table 3.1.

The discount factor for patient households is 0.9943 and the discount factor for impatient households and entrepreneurs is 0.975. The discount factor of the patient households needs to be set higher to create borrower/saver dichotomy. Weight of housing in the utility is set as 0.2 and weight of labor in utility is set as 1.

Steady state value of loan-to-value requirement is set 0.7 for loans to impatient households and 0.35 for loans to entrepreneurs. Reserve requirement rate is set as 0.09.

The capital share of income is 0.35 as in Agenor et al. (2014) as relatively higher share of capital is seen in emerging economies. The depreciation rate of physical capital is 0.025 which is a common value in the literature. The depreciation rate of bank capital is calibrated as 0.23 to satisfy capital adequacy ratio. Parameter for wage share of patient households is 0.8.

The parameters for elasticities of loan and deposit demands together with all adjustment cost parameters are taken from Gerali (2010). However, we set capital adequacy rate as 0.08 in line with Basel Accord, rather than 0.09 set by that paper.

The parameter for the share of domestic intermediate goods in the final good production function is 0.7 which is plausible for emerging open economies. The elasticity of substitution parameter between domestic and foreign intermediate goods is set 2. The pass-through parameter from world prices to import prices is 0.3 and the price elasticity of exports is 0.6.

Table 3.1: Key Parameters

| Description | Parameter | Value |
|---|---|---|
| *Households and Entrepreneurs* | | |
| Discount factor of patient households | $\beta_P$ | 0.9943 |
| Discount factor of impatient households | $\beta_I$ | 0.975 |
| Discount factor of entrepreneurs | $\beta_E$ | 0.975 |
| Relative risk aversions | $a$ | 2 |
| Habit formation parameter | $\eta_c$ | 0.7 |
| Preference parameter of housing | $\eta_h$ | 0.2 |
| Preference parameter for labor | $\eta_n$ | 1 |
| Inverse Frisch elasticity of labor supply | $\phi$ | 1 |
| Share of capital in intermediate good production | $\alpha$ | 0.35 |
| Wage share of patient households | $\varphi$ | 0.8 |
| *Firms* | | |
| Depreciation rate of physical capital | $\delta$ | 0.025 |
| Elasticity of substitution, intermediate goods | $\theta_D, \theta_F$ | 10 |
| Share of domestic intermediate goods | $\Lambda_D$ | 0.7 |
| Elasticity of substitution parameter | $\eta$ | 2 |
| Exchange rate pass through parameter | $\mu^F$ | 0.3 |
| Price elasticity of exports | $\Gamma$ | 0.6 |
| *Financial Intermediaries* | | |
| Loan-to-value parameter for households | $LTV^I$ | 0.7 |
| Loan-to-value parameter for entrepreneurs | $LTV^E$ | 0.35 |
| Required reserves rate parameter | $\mu^R$ | 0.09 |
| Capital adequacy parameter | $v^b$ | 0.08 |

## 3.4. Impulse Response Functions

We follow DSGE literature by analyzing impulse responses around the steady state. The steady state values are calculated and impulse responses around steady state are obtained using Dynare package 4.4.3 version. Summary of steady-state values are presented in the following Table 3.2.

Table 3.2: Summary Steady State Ratios

| Description | Value |
|---|---|
| Consumption share in final output | 0.5958 |
| Exports share in final output | 0.2569 |
| Investment share in final output | 0.1170 |
| Total loans to final output | 1.6118 |
| Total loans to deposits | 1.0537 |
| Annualized real policy rate (%) | 5.6115 |
| Annualized real loan rate (%) | 9.9250 |
| Real exchange rate | 1.1886 |

We continue with the discussion of impulse responses[6]. The impulse response to a positive technology shock is presented in the Appendix. After a positive technology shock, output increases and inflation falls. Consumption and investment rise. Real wages and real prices of capital increase together with rising marginal productivity levels. These cause an increase in both deposits and entrepreneur loans. Rise in house prices support loans to impatient households. Lending spread falls. Policy rate falls in response to falling inflation. Despite fall in domestic inflation, nominal depreciation dominates and real exchange rate soars as well, which results rising export demand and falling foreign borrowing needs.

The response to a contractionary monetary policy shock (which is presented in the Appendix) resembles a typical small open economy response in New Keynesian DSGE literature. Following an interest rate hike, total loan volume declines. Financial conditions tighten and lending spread increases. Consumption and investment demand fall, which is followed by a decrease in final goods output and inflation. Nominal depreciation rate falls, resulting a decrease in real exchange rate, which causes exports to fall.

[6] The impulse responses presented are log deviations from steady state.

The following Figure 3.1 presents the responses to a loosening shock to loan-to- value rate for loans to households. We immediately notice that loans to households and loans to entrepreneurs respond differently to loosening in loan-to-value rate for households. While loans to households increase, loans to entrepreneurs decline. In other words, increase in LTV rate for households cause household loans to crowd out entrepreneur loans. Nevertheless, the increase in loans to households is much more pronounced and total loan volume increases. Deposits increase in response and lending spreads increase. Consumption soars, inflation rises and investments decrease.

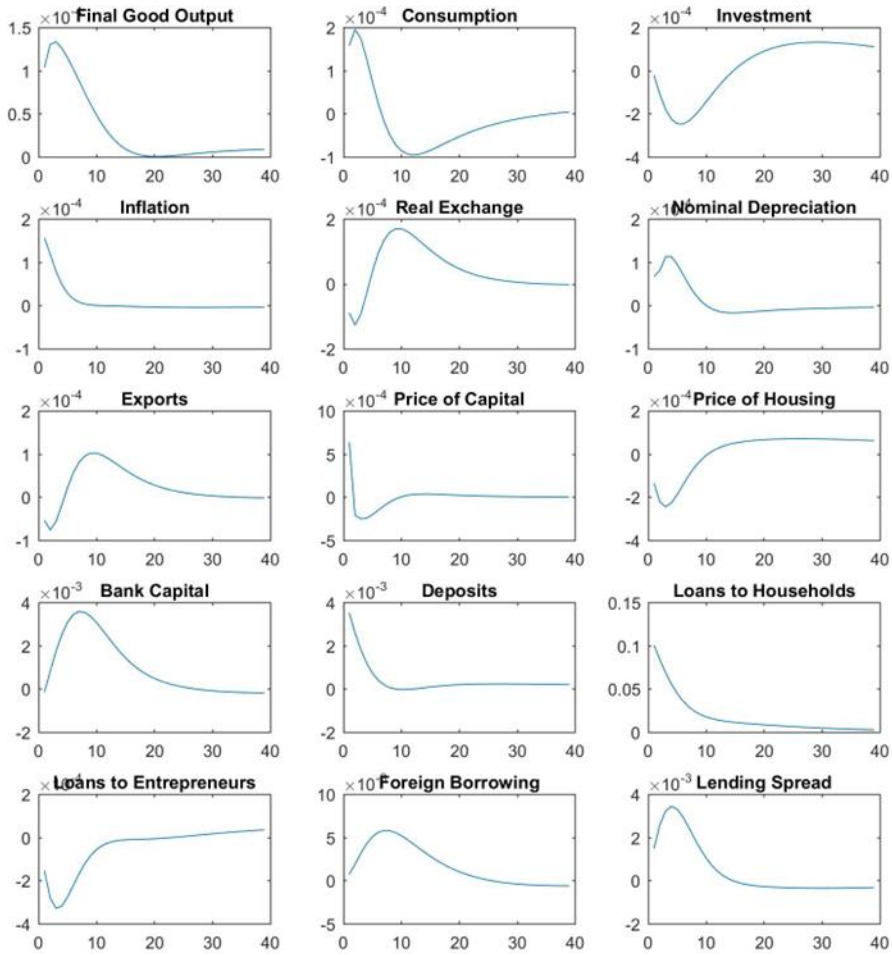


Figure 3.1: Household LTV Shock

Considering open economy aspects, nominal exchange rate depreciation increases but inflation dominates and real exchange rate falls. Exports decrease due to falling real

exchange rate. Responding the increase in final goods output and inflation pressures, monetary policy tightens. Foreign borrowing by banks increases as well reflecting the increase in loans and increase in domestic funding rates.

Responses to loosening of LTV rate of loans to entrepreneurs are presented in the following Figure 3.2.

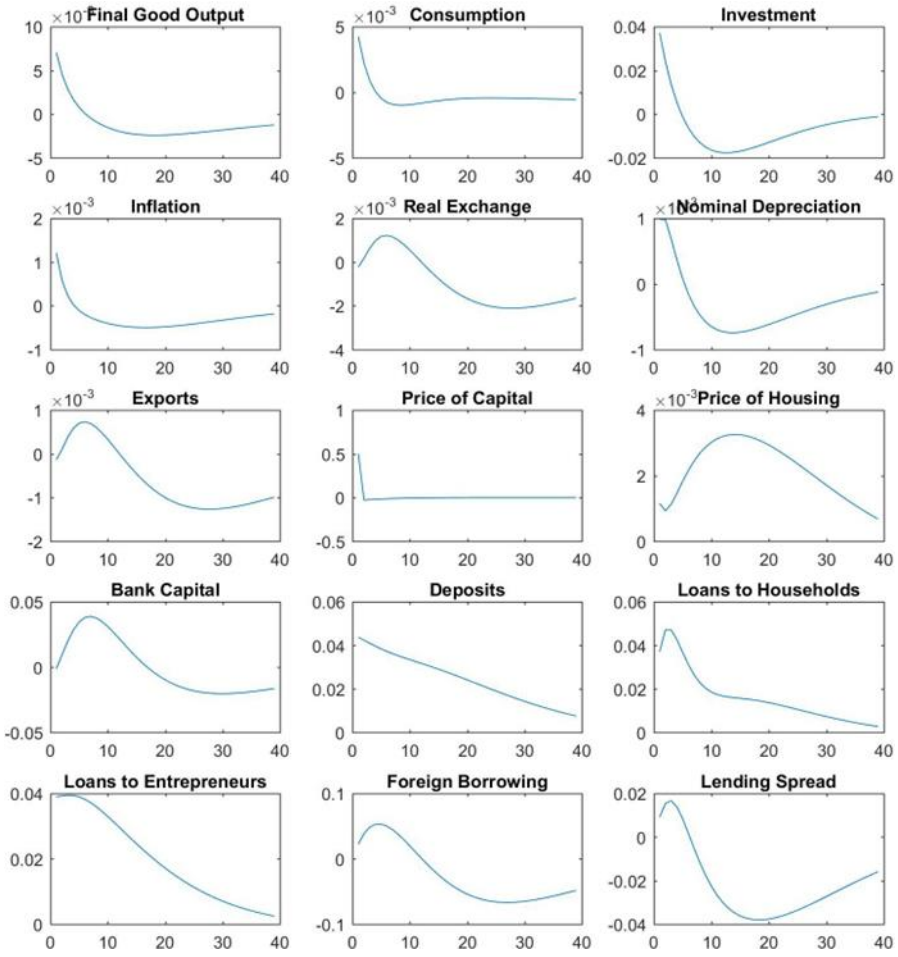


Figure 3.2: Entrepreneurs LTV Shock

In contrast to responses to loosening households LTV rate, both loans to households and loans to entrepreneurs increase following LTV rate hike in entrepreneur loans. Increase in the price of capital further relaxes the collateral constraint and supports the increase in loans to entrepreneurs. Total loan volume increases. Deposits, foreign borrowing and lending spreads rise as well. Increase in total loan volume boosts

consumption and inflation pressures rise. To match up domestic demand and with increased funds to entrepreneurs, investment increases. Policy rate increases in response to rising inflation and output gap. Exports increase as real exchange rate soars. These theoretical responses underline that the macroeconomic and financial results of loosening credit-supply restrictions may depend on the sector targeted.

Responses to a tightening in capital adequacy ratio are presented in the following Figure 3.3.

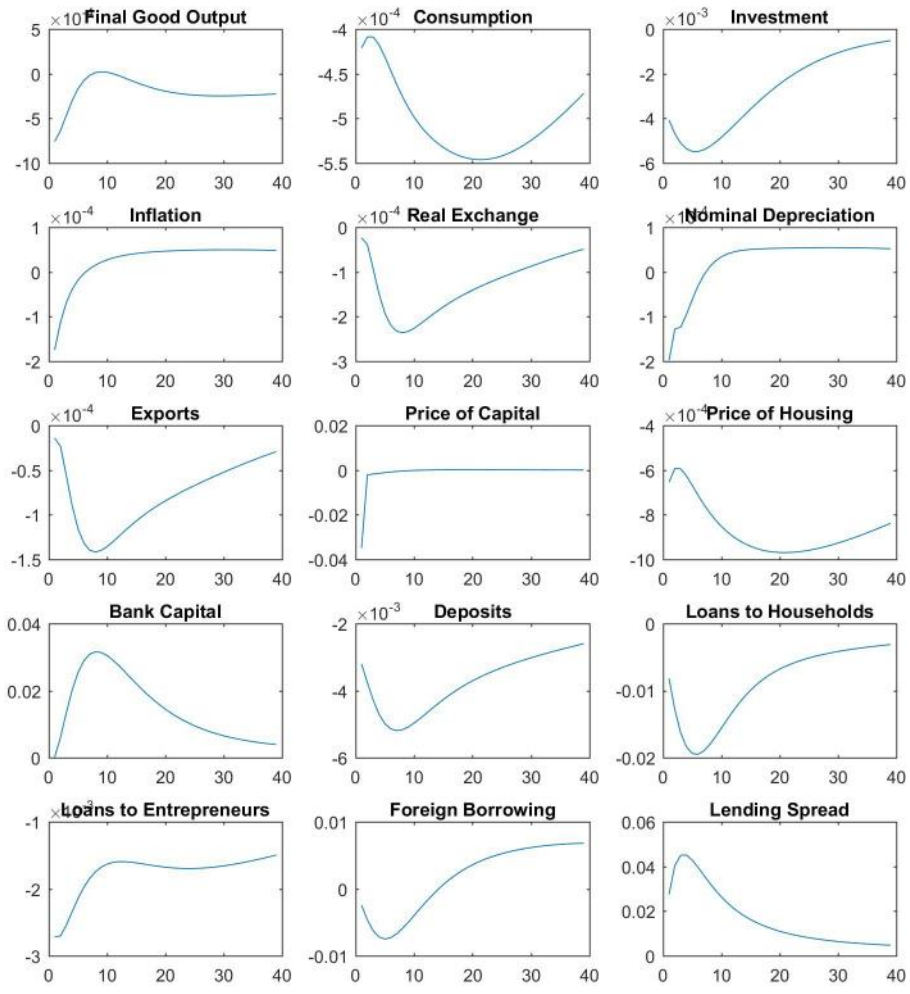


Figure 3.3: Capital Adequacy Rate Shock

Banks respond to this increase in capital adequacy ratio by both improving bank capital and decreasing loan supply. Deposits and foreign borrowing shrink as well. Reduction in loan volume is followed by a dampening aggregate demand as consumption and

investment fall. Fall in real exchange rate and corresponding decrease in exports further pull down final goods output. Monetary policy responds by loosening.

## 3.5. Conclusion

We developed a small open economy model based on Gerali et al. (2010). Our open economy structure is more suitable for developing countries as we treat imported goods as intermediate goods in the process of final good production. The only agents in the model that have access to foreign capital markets is banks and this is another feature of our model that differs from earlier literature. Our model specifically seeks to put forward the implications of macroprudential policy shocks. Thus, we are mainly interested in policy shocks and their transmission.

According to impulse response functions around steady state, after a positive shock to loan-to-value rates, loans and deposits increase. Banks also increase foreign borrowing. These support consumption, investment, and finally final good production. However, there are sectoral differences in our setting. After a positive shock to loan-to-value rate for entrepreneurs, all loan types tend to increase but after a positive shock to loan-to-value rate for households only household loans tend to increase and entrepreneur loans tend to decrease. In other words, there is a crowding out effect on entrepreneur loans. Although aggregate demand increase in both cases, investment only increases when LTV for entrepreneurs is loosened. Following a positive shock to capital-adequacy rate, banks respond by increasing capital and lending spreads. Loans, deposits, and foreign borrowing tend to decline. Consumption, investment, and final good production fall.

# CHAPTER 4

# AN EMPIRICAL ANALYSIS ON MACROPRUDENTIAL POLICIES IN TURKEY

## 4.1. Introduction

In this chapter, we employ VAR methodology to analyze the effects of macro-prudential policies in Turkish economy. We firstly review the literature, then introduce the data and the methodology. After analyzing residual diagnostics, we continue with discussion of the impacts of macroprudential policies in the model. Finally, we provide a brief conclusion.

## 4.2. Literature Review

Borio and Shim (2007) investigate the boundaries of macroprudential policies in terms of supporting monetary policy. They underline that buildup of financial imbalances may occur despite the background of low and stable inflation as a result of financial liberalization, credible anti-inflation regimes and the globalization of the real-side of the economy, thus monetary policy can become more constrained to lean against those imbalances. They conclude that prudential policy has an important role to play and despite increasing awareness, making macroprudential policies operational has been a slow progress. The main obstacles for going forward in the right direction are of an analytical, institutional and political economy nature. Their empirical analysis suggests that macroprudential policies have restraining effect on credit growth and asset prices.

Hanson et al (2011) argue that macroprudential approach to financial regulation shall impose higher capital requirements, in particular higher quality capital requirements. They discuss time-varying capital requirements, higher-quality capital, corrective action targeted at "Dollars of Capital" instead of capital ratios, contingent capital,

regulation of debt maturity and regulating the shadow banking system as useful policies. They state that higher capital requirements may reflect as higher costs of credit but both theoretical and empirical analysis suggests that cost effect is quite small. Their analysis supports the view that banks generally work with higher leverages when they face intense com- petition since cheap financing is the most crucial factor in bank competition. Thus, tougher capital regulation of financial firms has the potential to reduce competition which may create a negative externality and systemic risk.

Lim et al (2011) analyzes the effectiveness of macroprudential measures in reducing systemic risk by using data from 49 countries. They state that countries employ a wide range of macroprudential measures including credit-related, liquidity-related and capital-related measures. Their paper employs three approaches to assess the effectiveness of macroprudential policies, namely case studies, an examination of the performance of the target (risk) variables and lastly panel regression. Their analysis suggests that LTV, DTI, ceilings on credit or credit growth, reserve requirements, countercyclical capital requirements and dynamic provisioning help reduce the correlation between credit and GDP growth. Restrictions regarding net open currency positions, currency mismatches and maturity mismatches may also reduce common exposures. More- over the effectiveness of instruments does not depend on exchange rate regime or size of financial sector, but rather depend on the type of the shocks. Despite these promising results, they underline that there are costs involved in macro-prudential measures and these costs should be appropriately weighed against benefits.

Claessens et al (2013) analyze the effects of macroprudential measures on different aspects of banking system vulnerabilities. Their work focuses on the role of macroprudential measures on individual banks for a large sample of emerging market economies. By employing an IMF survey of country authorities together with an internal IMF survey of country desk economists, their analysis reveals that macroprudential measures aiming the borrowers such as LTV and DTI are quite effective in reducing vulnerabilities. Restrictions on foreign currency lending are also beneficial. They also find out that countercyclical buffers may be useful to mitigate the buildup phase of excess bank leverage and asset growth; however in adverse times few macroprudential policies may help stop declines in these bank variables. Overall

their results suggest that macroprudential policies are much more effective in booms than in busts, thus macroprudential measures are best used as ex-ante tools.

Tovar et al (2012) try to assess empirically the role of macroprudential measures in Latin American countries as Brazil, Colombia and Peru have actively managed reserve requirements. Combining their data with two Latin American countries in which macroprudential measures were not actively used, namely Chile and Mexico, they evaluate the effects of reserve requirements and other macroprudential measures. They employ event analysis and dynamic panel data VAR. Their findings show that reserve requirements and other macroprudential measures cause a moderate and transitory slowdown in the growth of bank credit. Last but not least, they state policy rate hikes and macroprudential policy shocks reinforce each other.

Silva and Harris (2012) assess the experience of Brazil with macroprudential measures. They state that strong capital inflows to Brazil after the global financial crisis could further increase the already strong growth in local credit markets, weaken the transmission mechanism of monetary policy through credit channels and also cause distortions in asset prices. The main macroprudential policy responses were increasing bank reserve requirements, increasing capital requirements in particular for consumer loans, new reserve requirements on banks' short spot FX positions and taxation of specific inflows. These measures were successful in decreasing the loan growth to more sustainable levels, reducing net portfolio inflows and lengthened the tenors of external credit for residents.

Hahm et al (2012) argue that in a lending boom when credit grows rapidly, the pool of deposits may not be sufficient and eventually this will be reflected in composition of bank liabilities. In an open emerging economy, capital inflows and rapid increases in non-core liabilities usually go hand in hand. Thus, growth of non-core liabilities is a promising measure of the state of financial cycle. They show that non-core liabilities are much more procyclical than core liabilities and Korean banks' non-core liabilities are much more sensitive to the US policy rate than to the domestic policy rate.

Bruno and Shin (2014) studies the effectiveness of macroprudential measures for Korea by utilizing a panel study which encompasses 48 economies, including both advanced and emerging ones. Korea has applied a cap on foreign exchange derivatives

contracts and a levy on non-core liabilities as key macroprudential measures. They find that the sensitivity of capital inflows to global liquidity conditions has dropped after the introduction of these macroprudential measures for Korea.

Wong et al (2011) discusses the effectiveness of LTV ratio as a macroprudential measure on housing market of Hong-Kong by employing econometric analyses of panel data from 13 economies. They find out that LTV cap is effective in enhancing the resilience of banking sector as it reduces the sensitivity of mortgage default risk to housing price shocks. On housing market stability, LTV policy has been shown to have a dampening effect on household leverage. Regarding the higher liquidity constraints on homebuyers as a result of LTV measure, the authors propose that mortgage insurance programs may be helpful since empirically mortgage insurance program does not reduce the effectiveness of the LTV policy.

Vandenbussche et al (2012) studies whether macroprudential policy measures had an impact on housing price inflation for Central, Eastern and Southeast- ern European countries, considering the negative consequences of housing price bubbles and the connection of these bubbles with financial instability episodes. Their analysis relies on their construction of quantified strength of macroprudential measures rather than dummy variable approach. They conclude that not all but some measures, namely changes in the minimum capital adequacy ratio, marginal reserve requirements on foreign funding and marginal reserve price requirements linked to loan growth had an impact, in particular in boom periods. On the other hand, they do not find a significant effect of LTV, DTI, increases in reserve requirements or provisioning rules on housing price inflation.

Saurina (2009) discusses dynamic provisioning as a macroprudential policy in Spain. The period considered is from 2000 to 2009 and this period contains both credit extension and contraction sub-periods. Using real data from Spanish deposit institutions; the article shows the build-up of the countercyclical provisions and their use in the downturn. The article also clearly states that loan loss pro- visions are clearly transparent and there is a cap on dynamic provisions in order to prevent over-provisioning in expansion phase, thus it is very difficult for bank management to deceive investors.

Aysan et al (2015) discusses the effectiveness of macroprudential policies applied by CBRT in late 2010, namely asymmetric interest rate corridor and reserve option mechanism. They argue that widening interest corridor should effects on stabilizing supply of foreign funds and reserve option mechanism should decrease the sensitivity of demand for foreign funds to shifts in supply of those funds. They employ a panel data of 46 countries and use external loans of BIS-reporting banks to these countries as a measure of change in gross bank-based capital flows. Their results assert that implementation of these macroprudential measures has decreased the sensitivity of bank-based capital inflows to global factors, in other words capital inflows have been more stabilized. Applying a similar methodology, Fendoğlu et al (2014) finds out that the sensitivity of cross-border portfolio flows to global risk perception has also decreased following CBRT's macroprudential policies.

Alper et al (2012) discusses the Reserve Option Mechanism (ROM), which has been utilized by the CBRT in order to smooth exchange rate and balance sheet effects of capital flow volatility. They state that utilization of ROM depends on the relative cost of FX funding to TL funding and this gives ROM an automatic stabilizer nature. As a result, ROM reduces the need for a wider interest rate corridor in order to deal with exchange rate volatility concerns.

Oduncu et al (2013) discuss the effectiveness of Reserve Option Mechanism (ROM) on the volatility of Turkish Lira. Employing GARCH family of statis- tical techniques and controlling for other factors, they find out that ROM has effectively decreased the volatility of Turkish Lira and served as a useful macroprudential tool against capital flow volatility, in addition to increasing the FX reserves and supporting liquidity management of the banking sector.

Değerli and Fendoğlu (2013) study the effectiveness of Reserve Option Mechanism (ROM) by extracting market expectations for exchange rate from option prices. Their analysis reveals that market expectation for both the volatility and depreciation probability of Turkish Lira significantly decreases during and after the introduction of ROM, relative to other emerging market currencies. Expectations on excessive movements in exchange rate conditional on common external factors significantly

decreases during the ROM era, which supports the automatic stabilizer function of ROM.

Binici et al (2013) discuss that both the width and the asymmetry of interest rate corridor can be used as an active policy in order to response volatile capital flows. Their empirical analysis suggests that after the introduction of this pol- icy, interest rate corridor has been relevant in monetary policy transmission as commercial loan rates became more sensitive to upper bound of the corridor and deposit rates are mainly driven by policy rate. As a result, CBRT can influence loan-deposit spread.

Balcı and İşcan (2016) employ difference in difference approach to analyze the impacts of macroprudential measures on consumer loans. Their analysis reveals that loan to value caps and maturity restrictions on vehicle loans have been effective to slow down vehicle loans. They conclude that macroprudential measures are important tools to slow down loan growth.

Yüceyılmaz et al. (2017) include loan provisions and maturity restrictions as macroprudential tools in their impact study. Their estimations show that in- crease in general loan provision rates and maturity restrictions put a downside pressure on consumer loan growth.

Chadwick (2018) employs a panel VAR to investigate the effects of macroprudential policies on general purpose loans, housing loans, and vehicle loans. The results of the analysis suggest that macroprudential tools are effective in management of credit growth and consumer price inflation. Furthermore, the effects of macroprudential policies are more prominent when employed in coordination with monetary policy.

Mahmutoglu and Ardor (2019) study the effectiveness of macroprudential tools on loan growth, by utilizing a macroprudential tools index. Their analysis reveals that the use of macroprudential tools reduces loan growth, except development and investment banks.

Şahbalı and Kaya (2020) evaluates the effects of macroprudential policies on loan growth of Turkish banking system using VAR analysis. Their study includes interest rate corridor, required reserve ratios for TL and FX liabilities, and weighted average

funding cost as macroprudential tools. The results of the study indicate that average funding rate and required reserve ratios are important to explain credit growth.

İlhan et al. (2021) analyze the effectiveness of macroprudential tools on con- trolling excessive loan growth by building an aggregated macroprudential tools index. They find a limited impact of macroprudential tools on credit growth. Similarly, Eroğlu and Kara (2017) find a limited impact of macroprudential tools on macroeconomic variables in Turkey. According to their estimates, only changes in required reserves have a statistically significant impact on inflation.

Çelik and Oğuş Binatlı (2022) considers mainly the reserve requirement ratio, reserve option mechanism, and interest rate corridor as macroprudential tools in their SVAR study. Their analysis concludes that required reserves are more efficient in reducing current account deficit and stabilising the exchange rate.

As the literature review suggests, the existing literature does not include a VAR analysis on Turkey to study the effectiveness of loan-to-value rate. Required reserves and macroprudential policy index are heavily employed in VAR studies but specific macroprudential tools are missing in VAR analyses. This also points a potential pitfall in existing studies on macroprudential tools. Even though macroprudential tools are found effective by employing macroprudential index, disentangling the effect and determining the specific effect of different macroprudential tools should be done for policy implications. To our best knowledge, this is the first study specifically considering the impacts of loan-to-value rate in a VAR analysis of macroprudential policy tools in Turkey. By this way, we are able to show the effectiveness of loan-to-value rates.

### 4.3. Data

The data used in the empirical analysis covers the period between 2006 and 2017. The data is in monthly frequency. The starting point for the analysis is chosen as 2006 since the CBRT explicitly began to employ inflation targeting framework at this point.

The endogenous variables in the empirical analysis comprise the monthly inflation rate of the consumer price index ($inf_t$), the monthly growth rate of the seasonally and calendar days adjusted industrial production index ($ind_t$), the natural logarithm of the

nominal effective exchange rate of the currency basket consisting of a half USD and a half EURO ($(neer_t)$, the natural logarithm of the real credit volume of the deposit banks ($credit_t$), the lending spread equalling to the difference of interest rates between consumer loans and deposits ($spread_t$), and an indicator of trade balance ($(tb_t)$. All rates and spreads are expressed in percentages.

Trade balance measure is included in the model as the natural logarithm of nominal exports over nominal imports. As Glocker and Towbin (2012) state, the indicator of trade balance can be also thought as a proxy for net capital inflows.

We use weighted reserve requirement rate ($rr_t$) and weighted LTV average ($ltv_t$) for macroprudential policy measures. The data source for weighted reserve requirement rate is the officially announced CBRT data. Differentiated reserve requirement rates for maturities were initiated after January 2011. Therefore, weighted reserve requirement rate was calculated and published by the CBRT. We use the officially announced data for weighted reserve requirement rate.

For weighted LTV average measure, our data source is the integrated Macro-prudential Policy (iMaPP) database of the IMF and CBRT data. Using the loan-to-value rates for housing loans and vehicle loans together with consumer loans data of deposit banks, weighted loan-to-value average for consumer loans is calculated and used in the analysis.

The monthly average of the overnight borrowing rate in the inter-bank market ($mp_t$) is used as an indicator of the monetary policy stance. This is a common practice in the studies analyzing the impact of the monetary policy.

The policy variables are introduced as exogenous variables. These variables are not normally distributed and there are big jumps in their values.

The remaining exogenous variables used in the analysis for controlling external factors are federal funds rate ($fed_t$), oil prices ($oil_t$), seasonal dummies, a dummy variable for the global financial crisis, and a dummy variable for the currency shocks. The dummy variable for the global financial crisis takes the value of 1 from October 2008 to September 2009 and 0 in all other months. The dummy variable for the currency shocks takes the value of 1 only for June 2006 and October 2008.

Table 4.1: Endogenous and Exogenous Variables

| **Endogenous variables** |
|---|
| Monthly CPI inflation ($inf_t$) |
| Monthly industrial production index growth rate ($ind_t$) |
| Natural logarithm of nominal effective exchange rate ($neer_t$) |
| Natural logarithm of real credit volume ($credit_t$) |
| Consumer lending spread ($spread_t$) |
| Natural logarithm of exports over imports ($tb_t$) |
| **Exogenous variables** |
| Lags of weighted reserve requirement rate ($rr_{t-1}, rr_{t-2}, rr_{t-3}$) |
| Lags of weighted LTV average ($ltv_{t-1}, ltv_{t-2}, ltv_{t-3}$) |
| Lags of monetary policy rate ($mp_{t-1}, mp_{t-2}, mp_{t-3}$) |
| Federal funds rate ($fed_t$) |
| Oil prices ($oil_t$) |
| Seasonal dummies |
| Dummy variable for the global financial crisis |
| Dummy variable for the currency shocks |

The endogenous and exogenous variables are presented in Table 4.1. Data sources and other explanatory notes are presented in the following Table 4.2.

Table 4.2: Variables and Data Sources

| Variable Name | Data Source | Notes |
|---|---|---|
| $mp_t$ | CBRT | Policy Rate, EVDS Series Name: TP.PY.P06.ON |
| $rr_t$ | CBRT | Reserve Requirement Rate, CBRT web site |
| $ltv_t$ | IMF, CBRT | Loan to Value rate, iMaPP Database, EVDS |
| $inf_t$ | CBRT | Monthly Inflation, EVDS, Series Name: TP.FG.J0 |
| $ind_t$ | TURKSTAT | Monthly % Change in Industrial Production Index |
| $spread_t$ | CBRT | Consumer Lending Spread, EVDS |
| $neer_t$ | CBRT | Nominal Effective Exchange Rate, (0.5 USD + 0.5 EUR) |
| $credit_t$ | CBRT | Real Credit Volume of Deposit Banks, EVDS |
| $tb_t$ | TURKSTAT | Natural Logarithm of Exports over Imports |
| $fed_t$ | Federal Reserve | Federal Funds Effective Rate |
| $oil_t$ | Federal Reserve | Natural Logarithm of Crude Oil Prices: Brent |

## 4.4. Methodology

### 4.4.1. Unit Root Tests

Before running the VAR model, unit root test on each series in the analysis is performed to ensure that all series in the VAR model are stationary. If series in the VAR analysis are non-stationary and not co-integrated, then the analysis can yield altogether a spurious regression. Therefore, before running the VAR model, Augmented Dickey Fuller test is applied on each series.

The null hypothesis of Augmented Dickey Fuller test is that the series has a unit root. Unit root test results (without trend and drift) on each series are reported in the following Table 4.3. The first difference of any series $z_t$ is denoted by $d(z_t)$ throughout the study.

Following unit root test results, first differences of monetary policy rate, reserve requirement rate, LTV rate, nominal effective exchange rate, real credit volume, lending spread, fed funds rate, and oil are used in the analysis.

Table 4.3: Unit Root Test Results

| **Variable** | **Test Statistic** | **1% cv** | **5% cv** | **10% cv** |
|---|---|---|---|---|
| $mp_t$ | -1.012 | -3.496 | -2.887 | -2.577 |
| $d(mp_t)$ | -6.895*** | -3.496 | -2.887 | -2.577 |
| $rr_t$ | -1.199 | -3.496 | -2.887 | -2.577 |
| $d(rr)_t$ | -9.695*** | -3.496 | -2.887 | -2.577 |
| $ltv_t$ | -1.588 | -3.496 | -2.887 | -2.577 |
| $d(ltv_t)$ | -11.906*** | -3.496 | -2.887 | -2.577 |
| $inf_t$ | -9.985*** | -3.496 | -2.887 | -2.577 |
| $ind_t$ | -14.986*** | -3.496 | -2.887 | -2.577 |
| $spread_t$ | -2.917** | -3.496 | -2.887 | -2.577 |
| $d(spread_t)$ | -10.132*** | -3.496 | -2.887 | -2.577 |
| $neer_t$ | 0.818 | -3.496 | -2.887 | -2.577 |
| $d(neer_t)$ | -9.147*** | -3.496 | -2.887 | -2.577 |
| $credit_t$ | -2.427 | -3.496 | -2.887 | -2.577 |
| $d(credit_t)$ | -9.879*** | -3.496 | -2.887 | -2.577 |
| $tb_t$ | -5.081*** | -3.496 | -2.887 | -2.577 |
| $fed_t$ | -2.036 | -3.496 | -2.887 | -2.577 |
| $d(fed_t)$ | -5.403*** | -3.496 | -2.887 | -2.577 |
| $oil_t$ | -1.532 | -3.496 | -2.887 | -2.577 |
| $d(oil_t)$ | -7.847*** | -3.496 | -2.887 | -2.577 |
| *, **, *** for rejection of unit root at 10%, 5%, and 1% significance respectively | | | | |

### 4.4.2. VAR Model

We specifically estimate the following Vector Auto Regression model:

$$y_t = \sum_{i=1}^{p} A_i \, y_{t-i} + \xi \, x_t + e_t \qquad (4.1)$$

In this formulation, $y_t$ is a vector of endogenous variables, $x_t$ is a vector of exogenous variables, $p$ is lag length, $A_i$ is coefficient matrix for lag $i$, $\xi$ is coefficient matrix for exogenous variables and $e_t$ is error vector. We do not impose any restrictions on coefficients.

To decide the number of lags in the model, lag-order selection criteria are analyzed. The information criteria results are given in the following Table 4.4. The number of lags is chosen as six following AIC and LR.

Table 4.4: Lag Selection Criteria

| **Number of Lags** | **LR** | **FPE** | **AIC** | **HQIC** | **SBIC** |
|---|---|---|---|---|---|
| 0 | | 3.9e-10 | -4.654 | -3.354 | -1.456 |
| 1 | 197.730 | 1.6e-10 | -5.571 | -3.960* | -1.607* |
| 2 | 76.663 | 1.6e-10 | -5.605 | -3.682 | -0.874 |
| 3 | 81.800 | 1.6e-10* | -5.677 | -3.442 | -0.178 |
| 4 | 56.339 | 1.9e-10 | -5.563 | -3.016 | 0.704 |
| 5 | 72.097 | 2.1e-10 | -5.563 | -2.705 | 1.470 |
| 6 | 94.236* | 2.0e-10 | -5.726* | -2.555 | 2.075 |

The results of VAR model are in general studied with impulse response functions as the individual coefficients are difficult to interpret. For exogenous variables, dynamic multipliers are used to evaluate the impacts of changes in exogenous variables on endogenous variables. We present and discuss dynamic multipliers of policy variables after analyzing residual diagnostics.

## 4.5. Residual Diagnostics

When the residual diagnostics are analyzed, LM test for auto-correlation fails to reject the null hypothesis of no auto-correlation at 5 percent significance level. The test statistics and corresponding p values are presented in Table 4.5.

Table 4.5: LM Test Results for Autocorrelation

| **Lag** | **chi-square** | **p value** |
|---|---|---|
| 1 | 23.320 | 0.949 |
| 2 | 32.462 | 0.638 |
| 3 | 28.417 | 0.812 |
| 4 | 31.631 | 0.676 |
| 5 | 37.212 | 0.413 |
| 6 | 42.035 | 0.226 |
| *, **, *** for 10%, 5%, and 1% significance respectively | | |

To test the null hypothesis that the disturbances are normally distributed, Jarque-Bera normality tests are applied. Test results are presented in the Table 4.6. According to Jarque-Bera test results, the null hypothesis of normality cannot be rejected for disturbances of any equation at 5% significance level. Normality of the disturbances for the whole model equations also cannot be rejected at 5% significance level by Jarque-Bera test.

To see whether the VAR model suffers heteroskedasticity problem with changing variance over time, ARCH(1) model is applied to model residuals. According to estimation results, homoskedasticity of disturbances cannot be rejected at 5% significance level.

Table 4.6: Normality Tests

| | **p-values** |
|---|---|
| **Equation** | **Jarque-Bera** |
| $ind_t$ | 0.321 |
| $inf_t$ | 0.948 |
| $tb_t$ | 0.132 |
| $d(neer_t)$ | 0.122 |
| $d(spread_t)$ | 0.532 |
| $d(credit_t)$ | 0.621 |
| $ALL$ | 0.380 |
| *, **, *** for 10%, 5%, and 1% significance respectively | |

Overall these residual diagnostics results suggest that confidence intervals driven in impulse response functions and dynamic multipliers can be relied on.

The stability of the VAR model is checked by eigenvalue stability condition. All the eigenvalues lie inside the unit circle and thus the VAR model in hand satisfies the stability condition. The results of the test are presented in Table 4.7.

## 4.6. Impacts of Policy Variables

We study the dynamic multipliers of policy variables to better understand the dynamics and interaction of these policies with macroeconomic and financial variables.

The ordering of the variables for the estimation should be such that earlier variables have contemporaneous effects on the following variables but following variables effect earlier variables with lag. Following Ozdemir (2015) and Chadwick (2018), we put macroeconomic activity indicators first. State of the economic activity contemporaneously affect remaining variables, but changes in other variables affect

economic activity with lag. Credit indicators follow macroeconomic activity indicators. To sum up, a plausible ordering of endogenous variables in VAR analysis is as following: industrial production, CPI inflation, trade balance, nominal effective exchange rate, consumer lending spread, and real credit. We continue with the discussion of dynamic multipliers of policy variables.

Table 4.7: Stability Test Results

| **Eigen value** | **Modulus** |
|---|---|
| - 0.906 | 0.906 |
| 0.872 + 0.233i | 0.902 |
| 0.872 - 0.233i | 0.902 |
| 0.893 + 0.063i | 0.895 |
| 0.893 - 0.063i | 0.895 |
| - 0.501 + 0.729i | 0.884 |
| - 0.501 - 0.729i | 0.884 |
| 0.440 + 0.754i | 0.873 |
| 0.440 - 0.754i | 0.873 |
| 0.557 + 0.665i | 0.868 |
| 0.557 - 0.665i | 0.868 |
| 0.041 + 0.857i | 0.858 |
| 0.041 - 0.857i | 0.858 |
| - 0.357 + 0.779i | 0.857 |
| - 0.357 - 0.779i | 0.857 |
| - 0.613 + 0.557i | 0.829 |
| - 0.613 - 0.557i | 0.829 |
| - 0.775 + 0.291i | 0.827 |
| - 0.775 - 0.291i | 0.827 |
| - 0.485 + 0.607i | 0.777 |
| - 0.485 - 0.607i | 0.777 |
| 0.210 + 0.744i | 0.773 |
| 0.210 - 0.744i | 0.773 |
| 0.688 + 0.348i | 0.772 |
| 0.688 - 0.348i | 0.772 |
| - 0.042 + 0.744i | 0.745 |
| - 0.042 - 0.744i | 0.745 |
| - 0.744 | 0.744 |
| 0.358 + 0.565i | 0.669 |
| 0.358 - 0.565i | 0.669 |
| - 0.592 + 0.216i | 0.630 |
| - 0.592 - 0.216i | 0.630 |
| 0.577 + 0.044i | 0.578 |
| 0.577 - 0.044i | 0.578 |
| - 0.438 + 0.266i | 0.513 |
| - 0.438 - 0.266i | 0.513 |

### 4.6.1. Reserve Requirement

Figure 4.1 presents the dynamic multipliers which depict the impact of a unit increase in difference of reserve requirement rate on the macroeconomic and financial variables.

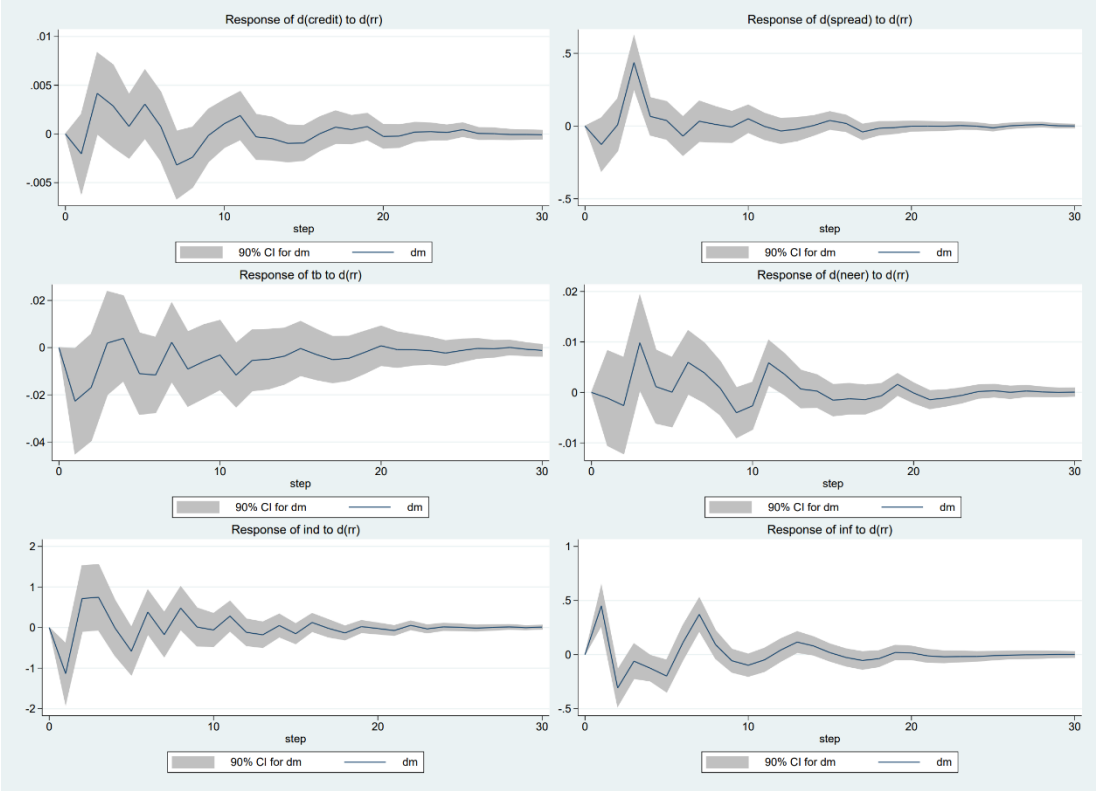


Figure 4.1: Reserve Requirement Shock

In response to a unit increase in the difference of reserve requirement rate, the change in spread between consumer loan rate and deposit rate rises as expected and this impact is statistically significant. Change in consumer lending spread reaches the peak around four months and this change persistently remains over zero for a few months. The difference of the natural logarithm of the real credit volume, which can be interpreted as the approximate percentage growth rate of real credit decreases initially but this response is not statistically significant.

The impacts of a positive shock in reserve requirement on inflation and output are statistically significant. After a unit increase in the difference in reserve requirement rate, monthly growth rate of industrial production decreases but after a short period this effect fades out. Inflation rate also falls down after an initial rise. The impact on inflation continues nearly for a year. Summing up, industrial production growth decreases and inflation decreases following an initial rise after an increase in the difference of reserve requirement rate.

Turning to nominal effective exchange rate and trade balance, the effects are not statistically significant.

### 4.6.2. Loan-to-value Rate

Figure 4.2 presents the dynamic multipliers which show the impacts of a unit increase in the difference of average loan-to-value rate on macroeconomic and financial variables.

The responses of credit markets to increases in loan-to-value cap are statistically significant. Following a unit increase in the difference of loan-to-value cap, the change in spread between consumer loan rates and deposit rates decreases. The growth of the real credit volume growth increases as expected but this effect is marginally statistically significant. Thus, following a unit increase in the difference of loan-to-value rate, change in lending spread declines and real credit volume growth increases which resembles a positive credit supply shock.

Industrial output growth response to a hike in loan-to-value cap is positive and this impact is statistically significant. Similarly, the impact of an increase in LTV rate on monthly CPI inflation rate is positive and statistically significant. Thus, changes in loan to value rate have impacts on macroeconomic variables.

Following a unit increase in difference of loan-to-value rate, log change in nominal effective exchange rate increases which implies depreciation pressure on Turkish Lira. This impact is statistically significant. On the other hand, the response of trade balance

to an increase in loan-to-value rate is not significant, although the sign is negative as expected.

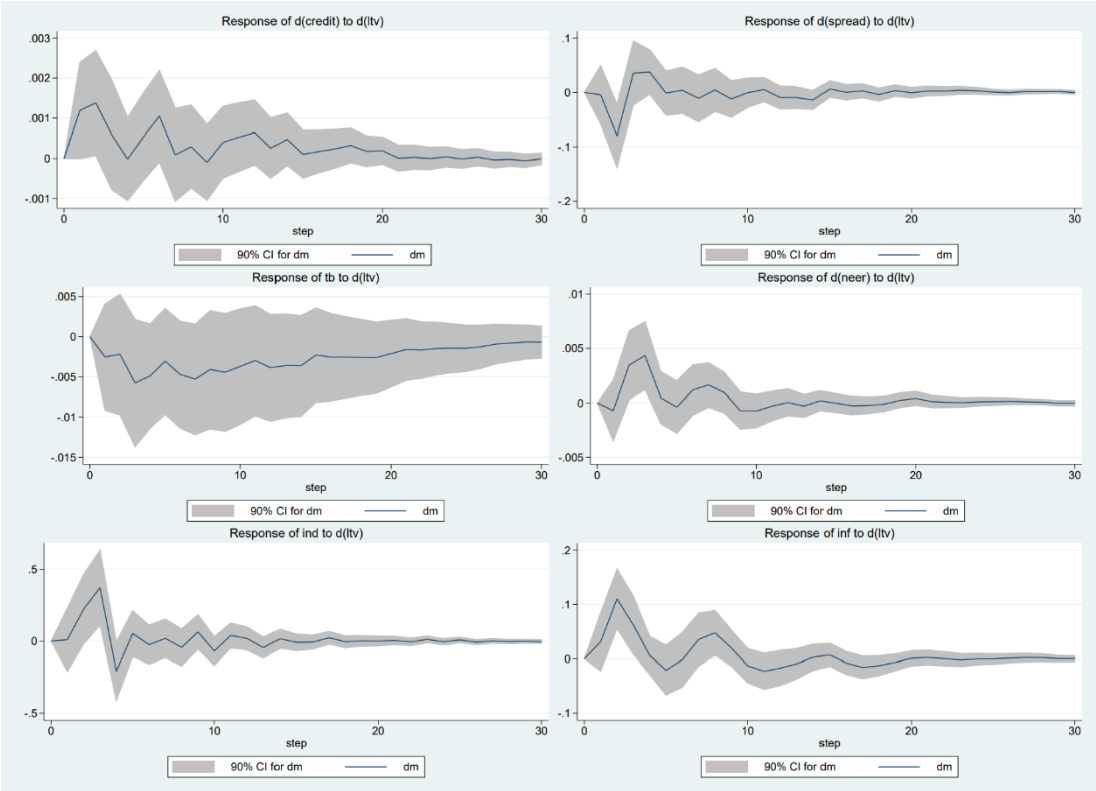


Figure 4.2: Loan-to-value Shock

### 4.6.3. Monetary Policy

Figure 4.3 presents the dynamic multipliers depicting the impacts of a unit increase in the difference of monetary policy rate on macroeconomic and financial variables.

The response of change in consumer lending spread to an increase in monetary policy rate is positive as expected but this effect is not statistically significant. Continuing with credit market volume, the real credit volume growth declines as expected and this effect is statistically significant. Changes in monetary policy rates have statistically significant impact on credit growth.

Industrial output growth responds by initially falling; however this effect is not statistically significant. Overall, the model results cannot confirm a significant impact of monetary policy rate on industrial production. Monthly CPI inflation rate initially increases after a unit increase in difference of monetary policy rate, however this initial increase is not statistically significant. Inflation falls following the initial rise and this fall is statistically significant showing that monetary policy rate hikes cause monthly inflation rates to fall after a few months.

The response of nominal effective exchange rate to monetary policy rate shock is statistically significant. Depreciation of Turkish Lira falls after a unit increase in monetary policy rate. On the other hand, the impact of a unit increase in difference of monetary policy rate on trade balance is statistically insignificant.

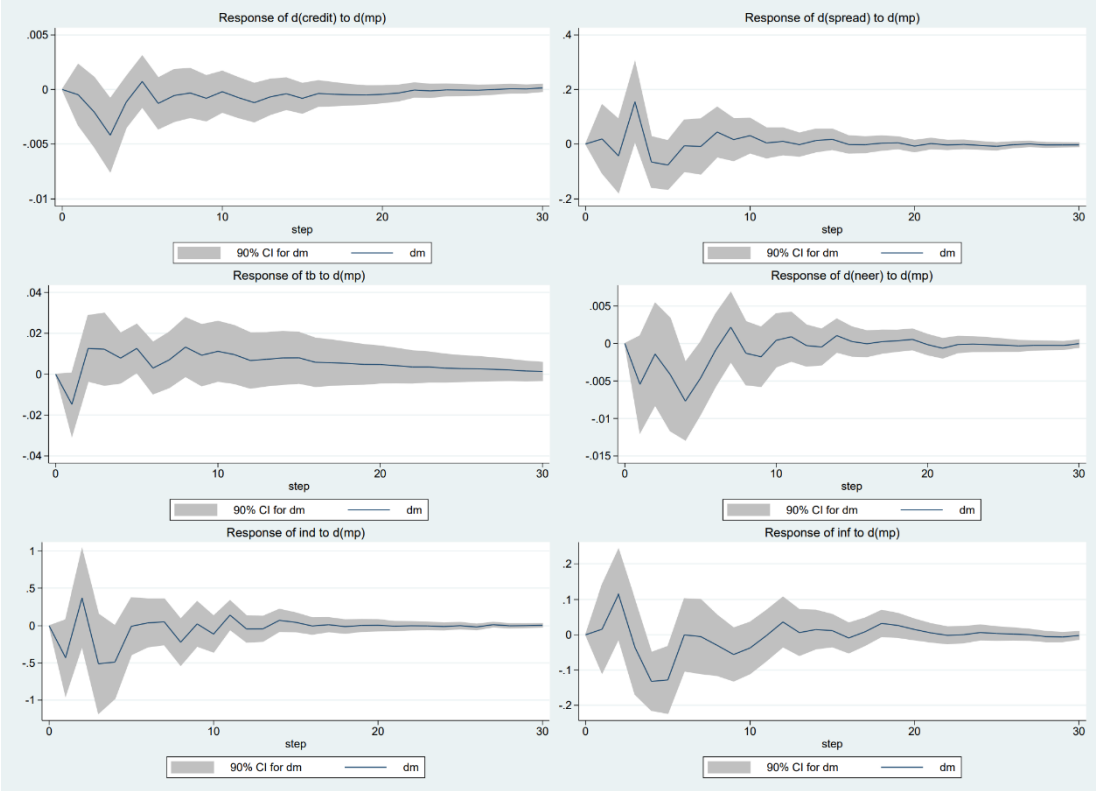


Figure 4.3: Monetary Policy Shock

## 4.7. Conclusion

In our empirical analysis, we employed VAR methodology to analyze the effects of macroprudential policies, namely reserve requirement rate and loan-to-value rate for Turkish economy. The starting point for our analysis is 2006 since the explicit inflation targeting regime started at this date.

In the study, lags of loan-to-value rate and lags of reserve requirement rate are utilized as macroprudential policies in VAR analysis on Turkey. In the existing literature, general approach is including a macroprudential index to study the effects of macroprudential effects but this kind of analysis cannot give a clear picture of feedback mechanisms for different macroprudential tools. This study tries to contribute to the existing empirical literature by presenting responses of macroeconomic variables to shocks in macroprudential tools, specifically reserve requirement rate and loan-to-value rate.

Our results regarding the effects of reserve requirements on macroeconomic variables indicate that after an increase in reserve requirement rate, change in consumer lending spreads increases. Industrial production growth falls. Inflation falls following an initial rise.

Our VAR analysis indicates that after an increase in loan-to-value rate, change in consumer lending spread falls and growth of real credit volume increases. Industrial production growth rises and inflation elevates as expected. Approximate percentage change of nominal effective exchange rate increases implying depreciation pressure of Turkish Lira.

# CHAPTER 5

# CONCLUSION

Micro-prudential policy frameworks were widely implemented for financial stability purposes before the global financial crisis of 2009. However, these frameworks suffered neglecting the endogenous and interconnected structure of financial sector.

Macroprudential policy tools came into scene on this background. Despite the scarce knowledge on these policies, both in theory and practice, policy makers started to use these policies as the economic circumstances dictate. Especially for emerging market economics, usage of these policies was compelling since relying solely on policy interest rate would attract more capital inflow and further accelerate credit growth in these countries.

We contribute to the existing literature by firstly documenting applications of macroprudential policies in Turkey, secondly theoretically analyzing the impacts of macroprudential policy shocks on real and financial variables for a small open economy, and lastly empirically investigating the impacts of macroprudential policy shocks for Turkey.

Policy makers in Turkey implemented various and diverse macroprudential policies to keep loan growth in sustainable levels. These policies included but not limited to caps on credit growth rate, required reserve ratio, loan-to-value and debt-to-income caps, maturity restrictions especially for credit card and general purpose consumer loans, counter-cyclical capital buffers, leverage ratios, systemically important bank buffers, differentiated risk weights, general provisions, minimum payment restrictions, and limits on foreign currency denominated loans.

Caps on credit growth were implemented considering the long-run relationship between excessive credit growth and financial crises. Required reserve ratios were

increased and differentiated to slow down credit growth. Reserve option mechanism was implemented as an automatic stabiliser and allowed banks to hold some of their required reserves as FX or gold. Loan-to-value and debt-to- income caps were applied to contain consumer loan growth. Maturity restrictions were implemented for credit card loans and general purpose consumer loans. Minimum payment restrictions for credit card loans were also utilized. Under Basel III framework, policies such as countercyclical capital buffers, leverage limits, and systemically important bank buffers were set and supervised in line with international practice. Although these various policies were implemented, studies on their impacts were rather limited and authorities generally delivered the development of targeted variables in their communications.

Our theoretical model for studying the impacts of macroprudential shocks is based on Gerali et al. (2010). The model has different types of households to have saver/borrower and banking sector is subject to imperfect competition and financial frictions such as collateral constraints. We extend the model by adding small open economy features. The model we built is different than other open economy models based on Gerali et al. (2010) as it follows McCallum and Nelson (2000) which treats imported goods as intermediate goods in the production of final good.

In our model, both patient and impatient households maximize expected life- time utility, which depend on consumption, housing services, and hours worked with different discount factors. Entrepreneurs produce a domestic wholesale intermediate good by combining capital and labor input in perfect competition. The households and entrepreneurs utilize a constant elasticity of substitution basket of differentiated loan and deposits. Domestic retailers acquire homogeneous intermediate goods from entrepreneurs and differentiate them. Similarly, importing retailers import intermediate goods from abroad. Final good producers aggregate domestic and imported intermediate goods to produce final good. Final good is either consumed by households or exported. Banks are the only financial intermediaries in the model. They collect deposits from patient households and set aside required reserves. They combine deposits with bank capital and external borrowings to supply loans to impatient households and entrepreneurs. Each bank is assumed to have a wholesale branch and two retail branches; one for deposits and one for loans. Wholesale branch operates in

a perfect competition. The retail banks set the deposit and the loan rates in a monopolistic competition framework, subject to adjustment costs.

Impulse responses of loosening loan-to-value shocks for household loans indicate increase in total loan and deposit volume. However, entrepreneur loans decline while household loans increase. Consumption, final good output, and inflation rise. Investments fall reflecting diminishing bank funding to entrepreneurs. Real exchange rate falls and exports follow. Foreign borrowing elevates. Responses to a loosening loan-to-value shock for entrepreneur loans is similar but there are also considerable differences. Both loans to households and loans to entrepreneurs increase after positive LTV rate shock in entrepreneur loans. Thus, responses of macroeconomic and financial variables differ according to sectors targeted. Impulse responses to a tightening capital adequacy rate shock result with an increase in bank capital but loan volumes decline, pulling back aggregate demand and consumption. Real exchange rate falls and exports decline.

In our empirical analysis, we employ VAR methodology on Turkish data. We focus on the impacts of changes in weighted reserve requirement rate and LTV average to understand the implications of macro-prudential policy measures. The endogenous variables in the analysis are inflation, industrial production, nominal effective exchange rate, real credit volume, lending spread, and trade balance indicator. To control for other factors, federal funds rate, oil prices, seasonal dummies, and dummy variables for global financial crisis and currency shocks are utilized.

According to estimation results, change in lending spread increases after a unit increase in difference of reserve requirement rate. Monthly industrial production growth falls. Inflation falls after an initial hike. Following an increase in the difference of average loan-to-value cap, lending spread declines and real credit growth increases. Inflation also rises after positive change in loan-to-value rate. The depreciation of Turkish Lira increases after a unit increase in difference of loan-to-value rate. Considering the monetary policy rate, real credit growth falls following an increase in difference of monetary policy rate. The depreciation of Turkish Lira decreases. Inflation falls after nearly a quarter following a tightening in monetary policy rate.

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# APPENDICES

## A. LAGRANGIAN FUNCTIONS

### Patient Households

$$\mathcal{L}^P = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_P^t \left[ \frac{(c_t^P - \eta_c c_{t-1}^P)^{1-a}}{1-a} + \eta_h \ln(h_t^P) - \eta_n \frac{l_t^{P(1+\phi)}}{1+\phi} \right.$$
$$\left. - \lambda_t^P \left( c_t^P + q_t^h (h_t^P - h_{t-1}^P) + d_t - (w_t^P l_t^P + (1 + R_{t-1}^D) \frac{d_{t-1}}{\pi_t} + j_t^P \quad ) \right) \right]$$

First Order conditions:

$$c_t^P: \quad (c_t^P - \eta_c c_{t-1}^P)^{-a} - \beta_P \eta_c (c_{t+1}^P - \eta_c c_t^P)^{-a} = \lambda_t^P$$

$$h_t^P: \quad \lambda_t^P q_t^h = \frac{\eta_h}{h_t^P} + \beta_P \mathbb{E}_t [\lambda_{t+1}^P q_{t+1}^h]$$

$$d_t: \quad \lambda_t^P = \beta_P \mathbb{E}_t \left[ \frac{\lambda_{t+1}^P (1 + R_t^D)}{\pi_{t+1}} \right]$$

$$\lambda_t^P: \quad c_t^P + q_t^h (h_t^P - h_{t-1}^P) + d_t = w_t^P l_t^P + (1 + R_{t-1}^D) \frac{d_{t-1}}{\pi_t} + j_t^P$$

**Impatient Households**

$$\mathcal{L}^I = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_I^t \left[ \frac{(c_t^I - \eta_c c_{t-1}^I)^{1-a}}{1-a} + \eta_h \ln(h_t^I) - \eta_n \frac{l_t^{I(1+\phi)}}{1+\phi} - \lambda_t^I \left( c_t^I + q_t^h (h_t^I - h_{t-1}^I) + \left(1 + R_{t-1}^{bH}\right) \frac{b_{t-1}^I}{\pi_t} - w_t^I l_t^I - b_t^I - j_t^I \right) - \mu_t^I \left( \left(1 + R_t^{bH}\right) b_t^I - LTV_t^I \, q_{t+1}^h h_t^I \pi_{t+1} \right) \right]$$

First Order conditions:

$$c_t^I: \quad (c_t^I - \eta_c c_{t-1}^I)^{-a} - \beta_I \eta_c (c_{t+1}^I - \eta_c c_t^I)^{-a} = \lambda_t^I$$

$$h_t^I: \quad \lambda_t^I q_t^h = \frac{\eta_h}{h_t^I} + \beta_I \mathbb{E}_t[\lambda_{t+1}^I q_{t+1}^h] + \mu_t^I \, LTV_t^I \, \mathbb{E}_t[\pi_{t+1} q_{t+1}^h]$$

$$b_t^I: \quad \lambda_t^I = \beta_I \left(1 + R_t^{bH}\right) \mathbb{E}_t \left[\frac{\lambda_{t+1}^I}{\pi_{t+1}}\right] + \mu_t^I \left(1 + R_t^{bH}\right)$$

$$\lambda_t^I: \quad c_t^I + q_t^h (h_t^I - h_{t-1}^I) + \left(1 + R_{t-1}^{bH}\right) \frac{b_{t-1}^I}{\pi_t} = w_t^I l_t^I + b_t^I + j_t^I$$

$$\mu_t^I: \quad \left(1 + R_t^{bH}\right) b_t^I = LTV_t^I \, \mathbb{E}_t[q_{t+1}^h h_t^I \pi_{t+1}]$$

**Entrepreneurs**

$$\mathcal{L}^E = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_E^t \left[ \frac{(c_t^E - \eta_c c_{t-1}^E)^{1-a}}{1-a} - \lambda_t^E \left( c_t^E + w_t^P l_t^P + w_t^I l_t^I + q_t^k k_t^E + \left(1 + R_{t-1}^{bE}\right) \frac{b_{t-1}^E}{\pi_t} \right.\right.$$
$$\left. - y_t^E \frac{P_t^w}{P_t} - b_t^E - q_t^k (1-\delta) k_{t-1}^E \right) - \mu_t^E \left( \left(1 + R_t^{bE}\right) b_t^E \right.$$
$$\left.\left. - LTV_t^E \left[ q_{t+1}^k (1-\delta) k_t^E \pi_{t+1} \right] \right) \right]$$

First Order Conditions:

$c_t^E$: $$(c_t^E - \eta_c c_{t-1}^E)^{-a} - \beta_E \eta_c (c_{t+1}^E - \eta_c c_t^E)^{-a} = \lambda_t^E$$

$k_t^E$: $$\lambda_t^E q_t^k = \beta_E \mathbb{E}_t \left[ \lambda_{t+1}^E \left( \alpha \frac{P_{t+1}^w}{P_{t+1}} \frac{y_{t+1}^E}{k_t^E} + q_{t+1}^k (1-\delta) \right) \right] + (1-\delta) \mu_t^E \, LTV_t^E \left[ \pi_{t+1} q_{t+1}^k \right]$$

$b_t^E$: $$\lambda_t^E = \mu_t^E \left(1 + R_t^{bE}\right) + \beta_E \left[ \frac{\lambda_{t+1}^E \left(1 + R_t^{bE}\right)}{\pi_{t+1}} \right]$$

$l_t^P$: $$w_t^P = \varphi \, (1-\alpha) \frac{P_t^w}{P_t} \frac{y_t^E}{l_t^P}$$

$l_t^I$: $$w_t^I = (1-\varphi) \, (1-\alpha) \frac{P_t^w}{P_t} \frac{y_t^E}{l_t^I}$$

$\lambda_t^E$: $$c_t^E + w_t^P l_t^P + w_t^I l_t^I + q_t^k k_t^E + \left(1 + R_{t-1}^{bE}\right) \frac{b_{t-1}^E}{\pi_t} = y_t^E \frac{P_t^w}{P_t} + b_t^E + q_t^k (1-\delta) k_{t-1}^E$$

$\mu_t^E$: $$\left(1 + R_t^{bE}\right) b_t^E = \, LTV_t^E \, \mathbb{E}_t [q_{t+1}^k (1-\delta) k_t^E \pi_{t+1}]$$

## B. FULL MODEL EQUATIONS

### Patient Households

Optimal consumption choice:

$$(c_t^P - \eta_c c_{t-1}^P)^{-a} - \beta_P \eta_c (c_{t+1}^P - \eta_c c_t^P)^{-a} = \lambda_t^P \tag{B.1}$$

Optimal housing demand:

$$\lambda_t^P q_t^h = \frac{\eta_h}{h_t^P} + \beta_P \mathbb{E}_t[\lambda_{t+1}^P q_{t+1}^h] \tag{B.2}$$

Optimal deposit demand:

$$\lambda_t^P = \beta_P \mathbb{E}_t \left[ \frac{\lambda_{t+1}^P (1 + R_t^D)}{\pi_{t+1}} \right] \tag{B.3}$$

Definition of patient household wage inflation:

$$\pi_t^{w^P} = \frac{w_t^P}{w_{t-1}^P} \pi_t \tag{B.4}$$

### Impatient Households

Optimal consumption choice:

$$(c_t^I - \eta_c c_{t-1}^I)^{-a} - \beta_I \eta_c (c_{t+1}^I - \eta_c c_t^I)^{-a} = \lambda_t^I \tag{B.5}$$

Optimal housing demand:

$$\lambda_t^I q_t^h = \frac{\eta_h}{h_t^I} + \beta_I \mathbb{E}_t[\lambda_{t+1}^I q_{t+1}^h] + \mu_t^I \, LTV_t^I \mathbb{E}_t[\pi_{t+1} q_{t+1}^h] \tag{B.6}$$

Optimal loan demand:

$$\lambda_t^I = \beta_I \left(1 + R_t^{bH}\right) \mathbb{E}_t \left[\frac{\lambda_{t+1}^I}{\pi_{t+1}}\right] + \mu_t^I \left(1 + R_t^{bH}\right) \tag{B.7}$$

Collateral constraint:

$$\left(1 + R_t^{bH}\right) b_t^I = \, LTV_t^I \, \mathbb{E}_t[q_{t+1}^h h_t^I \pi_{t+1}] \tag{B.8}$$

Budget constraint:

$$c_t^I + q_t^h (h_t^I - h_{t-1}^I) + \left(1 + R_{t-1}^{bH}\right) \frac{b_{t-1}^I}{\pi_t} = w_t^I l_t^I + b_t^I + j_t^I \tag{B.9}$$

Definition of impatient household wage inflation:

$$\pi_t^{w^I} = \frac{w_t^I}{w_{t-1}^I} \pi_t \tag{B.10}$$

**Entrepreneurs**

Optimal consumption choice:

$$(c_t^E - \eta_c c_{t-1}^E)^{-a} - \beta_E \eta_c (c_{t+1}^E - \eta_c c_t^E)^{-a} = \lambda_t^E \tag{B.11}$$

Optimal labor demand for patient households:

$$w_t^P = \varphi \, (1 - \alpha) \frac{P_t^w}{P_t} \frac{y_t^E}{l_t^P} \tag{B.12}$$

Optimal labor demand for impatient households:

$$w_t^I = (1-\varphi)\,(1-\alpha)\,\frac{P_t^w}{P_t}\frac{y_t^E}{l_t^I} \tag{B.13}$$

Optimal capital choice:

$$\lambda_t^E q_t^k = \beta_E \mathbb{E}_t\left[\lambda_{t+1}^E(\alpha\frac{P_{t+1}^w}{P_{t+1}}\frac{y_{t+1}^E}{k_t^E} + q_{t+1}^k(1-\delta))\right] + (1-\delta)\mu_t^E\, LTV_t^E\, \mathbb{E}_t\left[\pi_{t+1}q_{t+1}^k\right] \tag{B.14}$$

Optimal loan demand of entrepreneurs:

$$\lambda_t^E = \mu_t^E\left(1+R_t^{bE}\right) + \beta_E\,\mathbb{E}_t\left[\frac{\lambda_{t+1}^E\left(1+R_t^{bE}\right)}{\pi_{t+1}}\right] \tag{B.15}$$

Collateral constraint of entrepreneur loans:

$$\left(1+R_t^{bE}\right) b_t^E = \; LTV_t^E\; \mathbb{E}_t[q_{t+1}^k(1-\delta)k_t^E\pi_{t+1}] \tag{B.16}$$

Budget constraint of entrepreneurs:

$$c_t^E + w_t^P l_t^P + w_t^I l_t^I + q_t^k k_t^E + \left(1+R_{t-1}^{bE}\right)\frac{B_{t-1}^E}{P_t} = y_t^E\frac{P_t^w}{P_t} + \frac{B_t^E}{P_t} + q_t^k(1-\delta)k_{t-1}^E \tag{B.17}$$

Production technology:

$$y_t^E = A_t(k_{t-1}^E)^\alpha l_t^{1-\alpha} \tag{B.18}$$

**Labor supply by labor unions**

Patient households:

$$\kappa_w\left(\pi_t^{w^P} - \pi_{ss}\right)\pi_t^{w^P} = \beta_P\mathbb{E}_t\left[\frac{\lambda_{t+1}^P}{\lambda_t^P}\kappa_w\left(\pi_{t+1}^{w^P} - \pi_{ss}\right)\frac{(\pi_{t+1}^{w^P})^2}{\pi_{t+1}}\right] + (1-\epsilon_l)l_t^P + \frac{\epsilon_l\eta_n {l_t^P}^{(1+\phi)}}{\lambda_t^P w_t^P} \tag{B.19}$$

Impatient households:

$$\kappa_w \left(\pi_t^{w^I} - \pi_{ss}\right) \pi_t^{w^I} = \beta_I \mathbb{E}_t \left[\frac{\lambda_{t+1}^I}{\lambda_t^I} \kappa_w \left(\pi_{t+1}^{w^I} - \pi_{ss}\right) \frac{(\pi_{t+1}^{w^I})^2}{\pi_{t+1}}\right] + (1 - \epsilon_l) l_t^I + \frac{\epsilon_l \eta_n l_t^{I^{(1+\phi)}}}{\lambda_t^I w_t^I} \quad \text{(B.20)}$$

**Capital good producers**

Evolution of capital:

$$(k_t - (1-\delta)k_{t-1}) = \left[1 - \phi\left(\frac{i_t}{i_{t-1}}\right)\right] i_t \quad \text{(B.21)}$$

Optimal capital good decision:

$$q_t^k = \left[1 - \phi\left(\frac{i_t}{i_{t-1}}\right) - \phi'\left(\frac{i_t}{i_{t-1}}\right)\frac{i_t}{i_{t-1}}\right]^{-1} \left(1 - \beta_E \mathbb{E}_t \left[\frac{\lambda_{t+1}^E}{\lambda_t^E} q_{t+1}^k \left(\frac{i_{t+1}}{i_t}\right)^2 \phi'\left(\frac{i_{t+1}}{i_t}\right)\right]\right) \quad \text{(B.22)}$$

**Domestic Retailers**

Optimal retail price:

$$(1 - \theta^D) + \frac{P_t^w}{P_t^D}\theta^D - \kappa_P(\pi_t^D - 1)\pi_t^D + \beta_P \kappa_P \mathbb{E}_t \left[\frac{\lambda_{t+1}^P}{\lambda_t^P}(\pi_{t+1}^D - 1)\frac{(\pi_{t+1}^D)^2}{\pi_{t+1}}\frac{y_{t+1}^D}{y_t^D}\right] = 0 \quad \text{(B.23)}$$

Retailer profits:

$$j_t^R = y_t^D \left[\frac{P_t^D}{P_t} - \frac{P_t^w}{P_t} - \frac{\kappa_P}{2}(\pi_t^D - 1)^2 P_t^D\right] \quad \text{(B.24)}$$

**Final Good Producer**

Demand for domestic intermediate good:

$$y_t^D = \Lambda_D \left(\frac{P_t^D}{P_t}\right)^{-\eta} y_t \quad \text{(B.25)}$$

Demand for foreign intermediate good:

$$y_t^F = (1 - \Lambda_D)\left(\frac{P_t^F}{P_t}\right)^{-\eta} y_t \tag{B.26}$$

Competitive markets price relation:

$$P_t = [\Lambda_D (P_t^D)^{1-\eta} + (1 - \Lambda_D)(P_t^F)^{1-\eta}]^{\frac{1}{1-\eta}} \tag{B.27}$$

Price stickiness of imported goods:

$$P_t^F = (E_t WP_t)^{\mu^F} (P_{t-1}^F)^{1-\mu^F} \tag{B.28}$$

Exports of final goods:

$$y_t^X = y_0^X \left(\frac{E_t WP_t}{P_t}\right)^{\Gamma} \frac{y_t^*}{y_{ss}^*} \tag{B.29}$$

Definition of domestic intermediate good inflation:

$$\pi_t^D = \frac{P_t^D / P_t}{P_{t-1}^D / P_{t-1}} \pi_t \tag{B.30}$$

Definition of imported intermediate good inflation:

$$\pi_t^D = \frac{P_t^D / P_t}{P_{t-1}^D / P_{t-1}} \pi_t \tag{B.31}$$

**Banks**

Balance sheet identity:

$$RR_t + B_t = D_t + K_t^b + E_t L_t^F \tag{B.32}$$

Evolution of bank capital:

$$K_t^b = (1 - \delta^b) K_{t-1}^b + \omega^b J_{t-1}^b \tag{B.33}$$

Required reserves constraint on banks:

$$RR_t = \mu^R D_t \tag{B.34}$$

Cost of borrowing with premium:

$$(1 + R_t^F) = (1 + R_t^w)(1 + \theta_t^F)\, \mathbb{E}_t \left[\frac{E_{t+1}}{E_t}\right] \tag{B.35}$$

Risk premium definition:

$$\theta_t^F = \frac{\theta^0}{2} \left(\frac{E_t L_t^F}{P_t}\right) \tag{B.36}$$

Optimal loan supply:

$$R_t^b = R_t^d - \kappa_{Kb} \left(\frac{K_t^b}{B_t} - v_t^b\right) \left(\frac{K_t^b}{B_t}\right)^2 \tag{B.37}$$

Optimal foreign borrowing:

$$\frac{E_t L_t^F}{P_t} = \frac{(1 + R_t^d) - (1 + R_t^w)\, \mathbb{E}_t \left[\frac{E_{t+1}}{E_t}\right]}{(1 + R_t^w)\, \theta^0\, \mathbb{E}_t \left[\frac{E_{t+1}}{E_t}\right]} \tag{B.38}$$

Wholesale deposit rate:

$$r_t = R_t^d \tag{B.39}$$

Retail loan rates for impatient households:

$$1-\epsilon_t^{bH}+\epsilon_t^{bH}\frac{R_t^b}{R_t^{bH}}-\kappa_{bH}\left(\frac{R_t^{bH}}{R_{t-1}^{bH}}-1\right)\frac{R_t^{bH}}{R_{t-1}^{bH}} + \beta_P\mathbb{E}_t\left[\frac{\lambda_{t+1}^P}{\lambda_t^P}\kappa_{bH}\left(\frac{R_{t+1}^{bH}}{R_t^{bH}}-1\right)\left(\frac{R_{t+1}^{bH}}{R_t^{bH}}\right)^2\frac{B_{t+1}^H}{B_t^H}\frac{1}{\pi_{t+1}}\right]=0 \tag{B.40}$$

Retail loan rates for entrepreneurs:

$$1-\epsilon_t^{bE}+\epsilon_t^{bE}\frac{R_t^b}{R_t^{bE}}-\kappa_{bE}\left(\frac{R_t^{bE}}{R_{t-1}^{bE}}-1\right)\frac{R_t^{bE}}{R_{t-1}^{bE}} + \beta_P\mathbb{E}_t\left[\frac{\lambda_{t+1}^P}{\lambda_t^P}\kappa_{bE}\left(\frac{R_{t+1}^{bE}}{R_t^{bE}}-1\right)\left(\frac{R_{t+1}^{bE}}{R_t^{bE}}\right)^2\frac{B_{t+1}^E}{B_t^E}\frac{1}{\pi_{t+1}}\right]=0 \tag{B.41}$$

Retail deposit rates:

$$-1+\epsilon_t^{d}-\epsilon_t^{d}\frac{R_t^d}{R_t^D}-\kappa_d\left(\frac{R_t^D}{R_{t-1}^D}-1\right)\frac{R_t^D}{R_{t-1}^D} + \beta_P\mathbb{E}_t\left[\frac{\lambda_{t+1}^P}{\lambda_t^P}\kappa_d\left(\frac{R_{t+1}^D}{R_t^D}-1\right)\left(\frac{R_{t+1}^D}{R_t^D}\right)^2\frac{D_{t+1}}{D_t}\frac{1}{\pi_{t+1}}\right]=0 \tag{B.42}$$

Total bank profits:

$$\begin{aligned} j_t^b = {} & R_t^{bH}b_t^I+R_t^{bE}\,b_t^E-R_t^D\,d_t+R_t^d\,rr_t-R_t^F\,\frac{E_tL_t^F}{P_t}-\frac{\kappa_{Kb}}{2}\left(\frac{K_t^b}{B_t}-v_t^b\right)^2k_t^b \\ & -\frac{\kappa_{bH}}{2}\left(\frac{R_t^{bH}}{R_{t-1}^{bH}}-1\right)^2R_t^{bH}b_t^I-\frac{\kappa_{bE}}{2}\left(\frac{R_t^{bE}}{R_{t-1}^{bE}}-1\right)^2R_t^{bE}b_t^E \\ & -\frac{\kappa_d}{2}\left(\frac{R_t^D}{R_{t-1}^D}-1\right)^2R_t^Dd_t \end{aligned} \tag{B.43}$$

**Central Bank**

Taylor Rule:

$$(1+r_t) = (1+r_{t-1})^{\phi_R}(1+r)^{1-\phi_R}\left(\left(\frac{\pi_t}{\pi}\right)^{\phi_\pi}\left(\frac{y_t}{y_{t-1}}\right)^{\phi_y}\right)^{1-\phi_R}(1+\epsilon_t^r) \quad \text{(B.44)}$$

Loan to value rate for households:

$$LTV_t^I = \rho_I\, LTV_{t-1}^I + (1-\rho_I)\, LTV^I + \epsilon_t^{LTV^I} \quad \text{(B.45)}$$

Loan to value rate for entrepreneurs:

$$LTV_t^E = \rho_E\, LTV_{t-1}^E + (1-\rho_E)\, LTV^E + \epsilon_t^{LTV^E} \quad \text{(B.46)}$$

Capital adequacy rate:

$$v_t^b = \rho_v\, v_{t-1}^b + (1-\rho_v)\, v^b + \epsilon_t^{v^b} \quad \text{(B.47)}$$

**Exogenous Processes**

Technology:

$$A_t = \rho_A A_{t-1} + (1-\rho_A)\ + \epsilon_t^A \quad \text{(B.48)}$$

**Aggregation and Equilibrium**

Aggregate resource constraint:

$$y_t = c_t^P + c_t^I + c_t^E + q_t^k[k_t - (1-\delta)k_{t-1}] + y_t^X + Adj_t \quad \text{(B.49)}$$

Capital goods equilibrium:

$$k_t = k_t^E \tag{B.50}$$

Domestic intermediate goods equilibrium:

$$y_t^D = y_t^E \tag{B.51}$$

Housing market equilibrium:

$$h = h_t^P + h_t^I \tag{B.52}$$

Net foreign asset definition:

$$NFA_t + L_t^F = 0 \tag{B.53}$$

External budget constraint:

$$y_t^X \frac{P_t}{E_t} - y_t^F \frac{P_t^F}{E_t} + R_{t-1}^w NFA_{t-1} - \theta_{t-1}^F L_{t-1}^F = NFA_t - NFA_{t-1} \tag{B.54}$$

Equilibrium in loan, deposit, and labor markets are ensured above by same variable names.

## C. IMPULSE RESPONSE FUNCTIONS

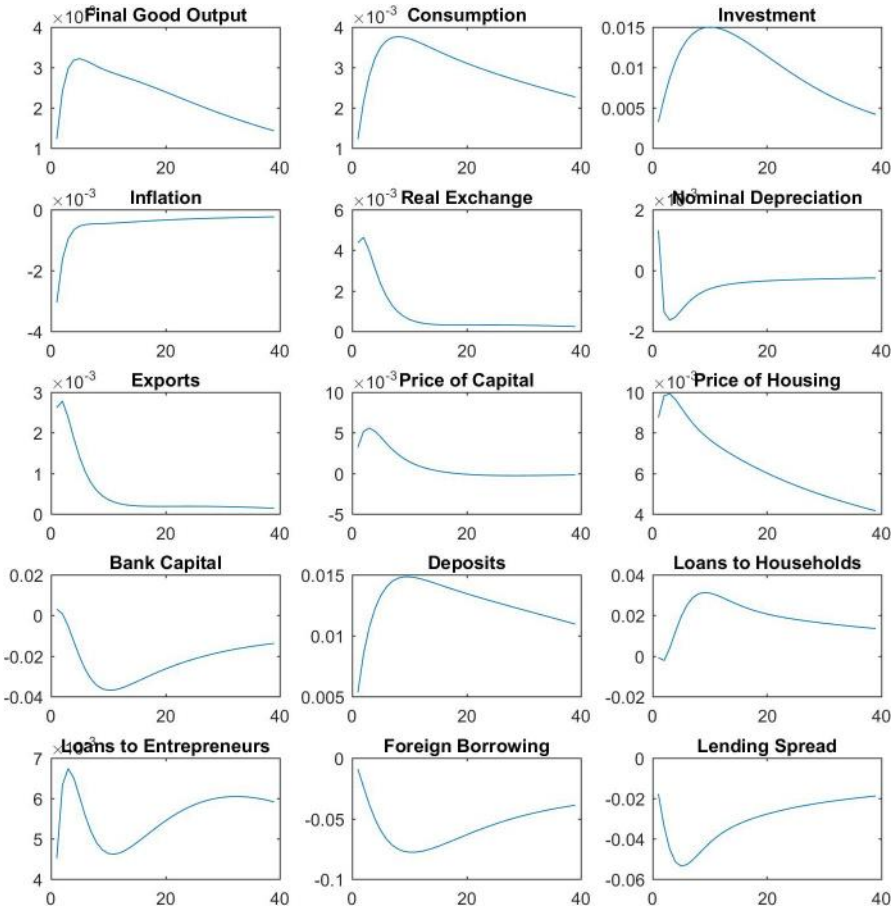


Figure C.1: Positive Technology Shock

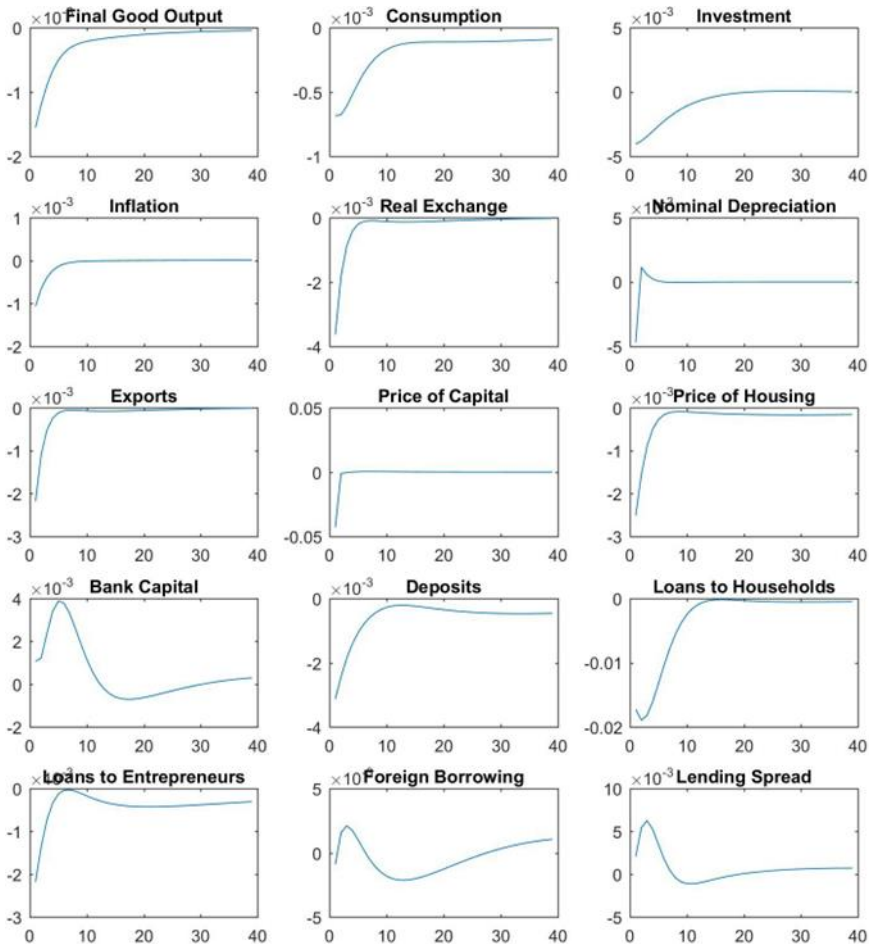


Figure C.2: Contractionary Monetary Shock

## D. VITA

### PERSONAL INFORMATION

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### EXPERIENCE

Assistant Economist | Central Bank of Turkey | 2009-2022

Assistant Specialist | Banking Regulation and Supervision Agency | 2006-2009

### EDUCATION

Master of Arts | Economics | Bilkent University

Bachelor of Science | Industrial Engineering | Bilkent University

### SELECTED PUBLICATIONS

Röhn, O., Gönenç, R., Koen, V., & Karasahin, R. (2012). Tackling Turkey's External and DomesticMacroeconomic Imbalances. OECD Economic Department Working Papers.

Akkoyun, H. Ç., Karasahin, R., & Keles, G. (2013). Systemic Risk Contribution of Individual Banks. Central Bank Review, 13, 5.

Alper, Koray, Kurul D. Mutluer, Karaşahin, Ramazan AND Atasoy, Hakan (2014). "Arzın Merkezine Seyahat:Bankacılarla Yapılan Görüşmelerden Elde Edilen Bilgilerle Türk Bankacılık Sektörünün Davranışı", Tisk Akademi/ II, 130.

Karasahin, R., & Kucuksarac, D. (2016). Revisiting Capital Structure of Non-financial Public Firms in Turkey. Central Bank of Turkey, Working Paper (No. 16/09).

Karasahin, R., & Ozel, O. (2012). Tüketici Kredilerinde Olusan Marjlar ve Kredi Arzı (No. 1210). Research and Monetary Policy Department, Central Bank of the Republic of Turkey, Economy Notes Series

## CAPABILITIES & SCORES

IT & Software:

Stata, Eviews, Matlab, R, and Python

Microsoft Office

Languages:

Turkish, Native

English, TOEFL IBT 107 (March 2015), TOEFL IBT 110 (December 2017)

German, B1 Level

Scores:

GMAT 770 (November 2017)

ALES 97.628 (Quantitative, 2009)

## AWARDS

6th in over 21 age section in Puzzle Competition of Turkey Intelligence Foundation, 2008

Honorable Mention in Bilkent University Industrial Engineering Project Competition, 2003

Gold Medal in National Math Olympiad, held by TUBİTAK (Official Science Foundation of Turkey) among high school students, 1998

Silver Medal in Math Olympiad held by Akdeniz University among high school students, 1998

98th in National University Entrance Examination among over 1,5 million high school graduates attended

# E. TURKISH SUMMARY / TÜRKÇE ÖZET

2009 yılında gerçekleşen küresel finans krizine kadar, ana akım iktisatçılarda ve politika yapıcılarında genel bir uzlaşının olduğu söylenebilir. Makroekonomik istikrar için fiyat istikrarına yönelik bir para politikası oluşturmak merkez bankalarının sorumluluğundayken, sürdürülebilir ve konjonktürün gerektirdiği nitelikte mali politika oluşturmak hükümetlere bırakılmıştı. Finansal istikrara yönelik olarak, mikro ihtiyati politikaların yeterli olduğuna inanılıyordu ve bu politikalar da finansal otoritelere bırakılmıştı. Bankalar için sermaye yeterliliğini düzenleyen Basel Uzlaşısı tüm dünyadaki banka düzenleyicilerinin temel el kitabı niteliğindeydi. Burada yer alan ve sermaye yeterliliğinin ölçülmesi ile yönetilmesine yönelik kurallar ise bireysel finans kurumlarına göre tasarlanmıştı.

1929'da gerçekleşen büyük buhranın uzun süren işsizliğin mümkün olduğunu göstermesiyle birlikte makroekonomi disiplinini temellerinden sarsmasına benzer biçimde, 2009 küresel finans krizi finansal sektöre yönelik olarak makro bir bakış açısının olmamasının hayati sonuçları olabileceğini ortaya koydu.

Krizden önceki mikro ihtiyati yaklaşım, bir finansal kuruluşun aldığı risklere ve bir finansal kuruluşun varlığını sürdürememesi durumunda oluşacak riskleri sınırlamaya odaklanıyordu. Bu yaklaşımın iki sakıncası olduğu söylenebilir. Öncelikle, finansal kuruluşların aldığı riskler çoğunlukla yapısı itibariyle endojendir. Bir banka için yapılması makul bir işlem, bütün bankaların aynı işlemi yapması durumunda beklenmedik ve istenmeyen sonuçlar doğurabilir. Bunu özellikle kriz ortamında gözlemlemek mümkündü. Konut fiyatlarında yaşanan gerileme, ABD'de konut fiyatlarına dayalı türev finansal varlıkların satışını tetik- ledi. Bu varlıkların satılması tek bir banka için sağlıklı olabilirdi ama pek çok banka aynı eyleme başvurunca bu varlıkların fiyatları çöktü, finansal kesimin zararları arttı, bu varlıkların yeniden satışa konulmasına yol açarak krizin etkilerini derinleştiren bir kısır döngü oluştu. Benzer biçimde, ödenmeyen bir konut kredisi sonrası teminat olarak alınan evin satışa konulması bir banka için faydalı olabilir ama pek çok banka aynı şeyi yapınca bu konut

fiyatları üzerinde aşağı yönlü bir baskı oluşturdu ve takibe düşen konut kredilerinin oranını artırdı. İkinci olarak, finansal kuruluşlarının birbirine bağlı yapısı nedeniyle bir kuruluşta ortaya çıkan bir sorun, diğer kuruluşları da etkileme potansiyeline sahipti, özellikle de sorunun ortaya çıktığı finansal kuruluş belirli bir varlık büyüklüğünün üstündeyse. Bu nedenle büyük finansal kuruluşların ve bunların diğer kuruluşlarla ilişkilerinin daha yakından takip edilmesi bir zorunluluk olarak ortaya çıktı. Doğal olarak kriz öncesi makro ekonomi yönetiminin bu defolarını anlamak, kriz sonrasında geriye baktığımızda çok daha kolaydı.

Bu arka planda, makro ihtiyati politikalar umut verici bir araç seti olarak belirdi. Makro ihtiyati politikalar, finansal sektörü bir bütün olarak değerlendiren ve tek tek finansal kuruluşlara yönelik risklerden ziyade sistemik riskleri azaltmaya çalışan politikalardır. Sistemik riskler farklı kanallarla ortaya çıkabilir. Olası bir kanal, bankaların ve diğer finansal kuruluşların ortak bir riske fazla duyarlı hale gelmesidir. Örneğin, bazı finansal kuruluşların portföylerinde konut kredilerine daha fazla ağırlık vermesi beklenir bir durumdur ama pek çok bankanın aynı şeyi yapması durumunda finansal sistem konut kredilerine ve konut fiyatlarına aşırı duyarlı hale gelebilir. Bu durumda konut fiyatlarında gerçekleşen küçük bir değişiklik bile finansal sistemde dalgalanmalara yol açabilir. Başka bir olası sistemik risk kanalı finansal sistemin çok iyi belgelenen ve bilinen döngüsel yapısıdır. Ekonomik aktivitenin canlı olduğu dönemde varlık fiyatları yükselme eğilimi gösterir, risk değerlendirmeleri daha olumlu olur, bu hem kredi arzını hem de talebini destekler ve nihayetinde ekonomik aktivite daha da hızlanarak bu döngü kendini besler. Daralma dönemlerindeyse, mekanizma tersine işler. Bu mekanizmanın doğal sonucu makroekonomiye gelen şokların finansal sistem tarafından daha da büyütülmesidir. Makro ihtiyati politikaların temel amacı, sistemik riskleri bir bütün olarak ele almak ve bu risklerin birikmesini engellemek için gerekli tedbirleri yerine getirmektir.

Kriz sonrası dönemde makro ihtiyati politikaların uygulanmasına yönelik en büyük engel, bu politikalar üzerinde olan bilginin hem teorik hem de pratik düzeyde sınırlı olmasıydı. Kriz öncesi dönemde, makro ekonomi modelleri önemli ölçüde finansal sektörü ve buradan doğacak riskleri üstünkörü ele almaktaydı. Bu nedenle, makro ihtiyati politikalar ve etkileri üzerine olan bilgi birikimi sınırlıydı.

Kriz öncesi dönemde akademisyenler ve merkez bankacılar tarafından ekonominin işleyişini ve temel makro ekonomik değişikliklerin gelişimini anlamak için yoğun olarak kullanılan dinamik stokastik genel denge modelleri, mikro temellere dayanmak ve ileriye bakan rasyonel ekonomik birimlere sahip olmak gibi arzulanan niteliklere sahipti. Yeni Keynesyen geleneğinde, maaş ve fiyat yapışkanlıklarını da içererek para politikasının reel etkilerini çalışmaya da olanak veriyordu. Bununla birlikte, genelde finansal friksiyonlara sahip bir finansal sektör içermezlerdi ve finansal sektörle makroekonominin etkileşimine yönelik detaylı bir analize izin vermezlerdi.

Burada çizdiğimiz genel resmin dışında kalan ve finansal sektörle ekonominin geri kalanı arasındaki ilişkiyi anlamaya yönelik oluşturulmuş önemli çalışmaların olduğunu da belirtmemiz gerekir. Galati ve Moessner (2013) bu çalışmaların genel bir özetini sunmaktadır. Biz burada daha sonra yapılan çalışmalara da kaynak olmuş iki önemli çalışmaya değineceğiz.

Bernanke ve diğerleri (2009) finansal friksiyonların modellenmesine yönelik olarak finansal hızlandırıcı mekanizmasını getirmektedir. Bu mekanizmada, asimetrik enformasyonun olduğu bir düzende dış finansman primi borçlanıcının net değerine bağlıdır. Bu durumda, eğer borçlanıcının net değeri döngüsel ise dış finans priminin karşı döngüsel olması beklenir. Borçlanıcının net değerinin döngüsel olması da makul bir varsayımdır çünkü firma karları ve varlık fiyatları döngüseldir. Bu durumda, finansal friksiyonların borçlanmayı, yatırımları ve tüketimi etkileyerek ekonomiye gelen negatif veya pozitif şokları büyütmesi beklenir.

Iacoviello (2005) finansal friksiyonları teminat kısıtlamaları biçiminde modellemektedir. Borçlanmanın büyük kısmının konut ipoteğiyle gerçekleştiğini gözlemleyerek, firma borçlanmalarını gayrimenkul varlıkları ve fiyatları ile ilişkilendirmektedir. Bu modelin diğer bir yaklaşımı da borçlanmaların nominal olmasıdır. Bu çerçevede finansal friksiyonlar talep şoklarını büyütürken arz şoklarını daha ılımlı hale getirmektedir. Aktarım mekanizması şu şekildedir. Pozitif bir talep şoku geldiğinde, harcamalar ve varlık fiyatları büyürken firmaların borçlanma kapasiteleri artmaktadır. Artan enflasyon da nominal borcun reel büyüklüğünü azaltmakta ve bu da net değerin artmasına yol açmaktadır. Bu nedenlerle pozitif talep şokları daha da büyümektedir. Diğer taraftan, negatif arz şoku geldiğinde yükselen

enflasyon borçlanıcıların net değerini olumlu etkilemekte ve şokun etkilerini yumuşatmaktadır.

Gerali ve diğerleri (2010), Iacoviello (2005) modelini bankacılığı modelleyerek genişletmektedir. Bu çalışmanın önemli bir niteliği, bankacılığı monopolistik rekabetçi olarak modellemesidir. Bankaların finansal aracılık faaliyetlerinde belli düzeyde piyasa gücüne sahip olması kredi ve mevduat faiz oranlarını ayarlamalarına olanak vermektedir. İçerdiği teminat kısıtlamalarıyla birlikte, model kredi-değer oranı gibi makro ihtiyati politikaların çalışılmasına imkan veren bir yapıya sahiptir. Diğer yandan, model kapalı ekonomi modelidir ve makro ekonomik değişkenlerin açık bir ekonomide nasıl gelişeceğini anlamaya olanaklı değildir.

Makro ihtiyati politikalar üzerine olan teorik literatüre Gerali ve diğerleri (2010) modeli üzerine açık bir ekonomi modeli inşa ederek katkıda bulunmayı amaçlıyoruz. Çalışmada ürettiğimiz açık ekonomi modeli, bu model üzerine bina edilmiş diğer açık ekonomi modellerinden ayrışmaktadır. McCallum ve Nelson (2000) modelini takip ederek ithal malları nihai malın üretiminde kullanılan ara mallar olarak modelliyoruz. McCallum ve Nelson (2000) döviz kuru ve enflasyon arasındaki korelasyonu kendi yaklaşımlarının daha gerçekçi yansıttığını belirtmiştir. Ayrıca, Agenor ve diğerlerinin (2014) belirttiği gibi, bu yaklaşım orta gelire sahip pek çok ülke için daha uygundur.

Teorik modellerin nispeten az olmasına benzer biçimde, kriz patlak verdiğinde makro ihtiyati politikalara yönelik ampirik çalışmalar da kısıtlıydı. Ne var ki bu, özellikle gelişmekte olan ülkelerin merkez bankacılarını makro ihtiyati politikaları uygulamaktan veya deneyimlemekten caydırmadı. Gelişmekte olan ülkelerin merkez bankaları, gelişmiş ülkeler krizle mücadele için niceliksel genişleme politikalarını uygulamaya koyunca ciddi bir ikilemle karşı karşıya kaldı. Niceliksel genişleme politikaları gelişmekte olan ülkelere sermaye akışını destekledi ve bu beraberinde kredi genişlemesi ve para biriminde değerlenme riskini beraberinde getirdi. Merkez bankalarının geleneksel para politikası aracı kısa vadeli faizlerdir ama kredi genişlemesine yönelik olarak politika faizini artırmak sermaye akışlarını daha da körükleyebilir ve para birimi üzerindeki değerlenme baskısını artırabilirdi. Diğer taraftan, faiz oranlarını düşürmek kredi genişlemesini daha da büyütebilirdi. Sonuç

olarak, makro ihtiyati politikalar bu ortamda makul ve alternatif bir politika araç seti olarak değerlendirildi.

Makro ihtiyati politika uygulamaları arttıkça, bu politikaların etkinliği üzerine yapılan ampirik çalışmaların niceliği ve niteliği de artış gösterdi. Bu tezde, Türkiye'de uygulanan makro ihtiyati politikaları belgeleyerek ve Türkiye verisi üzerinde bir VAR çalışması gerçekleştirerek bu literatüre katkıda bulunmayı amaçlıyoruz.

Tez üç ana çalışmadan oluşmaktadır. İlk çalışmada, Türkiye'de uygulanan makro ihtiyati politikalar altında yatan amaçlarla ve uygulama sonuçlarıyla beraber sunulmaktadır. İkinci çalışma, tamamıyla teorik bir açık ekonomi modeli çerçevesinde makro ihtiyati politikaların olası etkilerini değerlendirmektedir. Üçüncü çalışma ise, Türkiye verisi üzerinde gerçekleştirdiğimiz ampirik bir çalışmadır ve kredi-değer oranlarının etkilerini VAR modeliyle değerlendirmektedir.

Türkiye'de kriz sonrası dönemde uygulanan makro ihtiyati politikaları planlanan faydalarıyla birlikte sunuyoruz. BDDK, bankacılık düzenlemeleri alanındaki yetkili otoritedir. Diğer yandan, Sistemik Risk Değerlendirme Grubu, Finansal Sektör Komisyonu ve Finansal İstikrar Komitesi politika uygulamalarındaki tutarlılığı ve koordinasyonu yönetmektedir. 2016 yılında Finansal İstikrar Komitesi ve Sistemik Risk Değerlendirme Grubu aynı çatı altında birleştirilmiştir. Sistemik risk yönetiminin koordinasyonunda en üst düzey otorite Finansal İstikrar Komitesidir.

Türkiye'de uygulanan başlıca makro ihtiyati politikalar kredi büyüme oranı, zorunlu karşılıklar, kredi değer oranları, borç gelir oranları, vade kısıtlamaları, karşı döngüsel sermaye tamponları, kaldıraç oranları, sistemik önemli banka tamponları, farklılaştırılmış risk ağırlıkları ve genel karşılıklar, asgari ödeme oranları ve dövizle borçlanmaya yönelik getirilen sınırlamalar olarak sıralanabilir.

Aşırı kredi genişlemeleriyle finansal krizler arasındaki uzun dönemli ilişkiye vurgu yaparak, TCMB ilk defa 2011 yılında %25 olarak belirlediği referans kredi büyüme oranını açıklamıştır. 2012, 2013 ve 2014 yıllarında bu oran %15 olarak duyurulmuştur. 2019 yılından sonra referans kredi büyüme oranı %10 ila %20 aralığı olarak ilan edilmiştir. Referans kredi büyüme oranları açıklansa da, bu oranlara yönelik olarak çok katı zorlamalardan söz etmek mümkün değildir.

Referans kredi büyüme oranını desteklemek için yapılan temel uygulama, bankaların bu büyüme oranlarına ne ölçüde uyduklarıyla belirlenen farklılaştırılmış zorunlu karşılık oranları ve zorunlu karşılıklara ödenen faizler olmuştur. Belirlenen referans büyüme oranlarına riayet eden bankalar, Ağustos 2019'dan sonra daha düşük zorunlu karşılık oranları ve daha yüksek faizlerle ödüllendirilmiştir. Kasım 2020'de zorunlu karşılık oranlarının ve zorunlu karşılıklara uygulanan faizlerin farklılaştırılmasına son verilmiştir.

Zorunlu karşılıklar da TCMB tarafından makro ihtiyati amaçlarla kullanılmıştır. Lim ve diğerlerinin (2011) belirttiği gibi, zorunlu karşılıklar iki temel nedenle makro ihtiyati olarak kullanılabilir. İlk olarak, zorunlu karşılıklar doğrudan kredi büyümesini etkilemektedir. İkinci olarak, istenmeyen likidite sıkışıklarına karşı bir tampon oluşturmaktadır. TCMB, kriz sonrası dönemde dış sermaye akımlarını sınırlamak ve kredi büyümesini yavaşlatmak için zorunlu karşılıkları faiz koridoruyla birlikte kullanmıştır. Kısa dönemli sermaye akımlarını caydırmak için faiz koridorunu genişletirken, kredi büyümesini daha ılımlı hale getirmek için zorunlu karşılıklar kullanılmıştır (Başçı ve Kara, 2011).

Zorunlu karşılıklarda yapılan değişikliklerin etkinliğini artırmak için zorunlu karşılıklara faiz ödenmesine Ekim 2010'da son verilmiştir. Sonrasındaysa, zorunlu karşılık oranları yükseltilmiş ve vadeye göre farklılaştırılmıştır. 2016 yılından itibaren kademeli bir düşüş eğilimine giren zorunlu karşılık oranları, 2019 yılından sonra referans kredi büyüme oranını desteklemek amacıyla kullanılmıştır.

Küresel likiditeki dalgalanmalara yönelik olarak, TCMB zorunlu karşılıkların yanı sıra yeni bir yaklaşım olarak rezerv opsiyon mekanizmasını geliştirmiştir. Bu mekanizma bankaların zorunlu karşılık yükümlülüklerinin belirlenen bir kısmını döviz veya altın cinsinden tutabilmelerine imkan sağlamıştır. Rezerv opsiyon oranı bu mekanizmanın ne ölçüde kullanılabileceğini belirlerken, rezerv opsiyon katsayısı TL zorunlu karşılıkların yerine ne kadar döviz veya altın konulabileceğini belirlemektedir.

Rezerv opsiyon mekanizmasının temel amacı, bu mekanizmanın otomatik istikrar sağlayıcı olarak işlem görmesidir. Bankaların rezerv opsiyon mekanizmasını, sermaye girişlerinin yoğun olduğu ve döviz kaynaklarının maliyetlerinin daha düşük olduğu durumlarda daha ağırlıklı kullanması ve bu yolla piyasadan döviz likiditesinin

çekilmesi yoluyla TL üzerindeki değerlenme baskısının azaltılabileceği düşünülmüştür. Aynı zamanda kredi büyümesinin de daha sınırlı olması beklenmektedir (Alper ve diğerleri, 2012).

TCMB, Kasım 2017'den itibaren küresel likidite koşullarının tersine dönmesi ve TL üzerinde değer kaybetme baskısının hızlanmasıyla birlikte döviz rezerv opsiyon oranlarını düşürmüştür. Zamana yayılan bu düşürme süreci, Ekim 2021'de döviz rezerv opsiyon katsayısının sıfırlanmasıyla son bulmuştur. Standart altın için rezerv opsiyon oranı halen %10 düzeyindedir.

Kredi değer oranları, tüketici kredilerinde ve özellikle konut kredilerinde gerçekleşen hızlı artışı takiben 2010 yılından itibaren uygulamaya konulmuştur. Kredi değer oranları konut amaçlı tüketici kredilerinde %75, ticari konut kredilerinde ise %50 olarak belirlenmiştir. Nisan 2013'te ticari konut kredilerinde kredi değer oranı sınırlaması kaldırılmıştır. Konut amaçlı tüketici kredilerinde kredi değer oranı Eylül 2016'da %80 düzeyine yükseltilmiştir (TCMB, 2016). Ocak 2019'dan sonra, konut amaçlı tüketici kredilerinin kredi değer oranları konutların enerji performansına göre farklılaştırılmıştır. Enerji sertifikası A olan konutlar için kredi değer oranı %90 olurken, enerji sertifikası B olan konutlar için kredi değer oranı %85 olarak uygulanmıştır. Mart 2020'den sonra ise kredi değer oranı 500 bin TL altındaki tüm evler için %90 olarak duyurulmuştur (Makro İhtiyati Ülke Raporu, IMF).

Kredi değer oranı uygulaması taşıt kredilerinde de uygulanmıştır. Şubat 2014'te iki aşamalı olarak taşıt kredilerinde kredi değer oranı belirlenmiştir. 50 bin TL'nin altındaki araçlar için oran %70 olarak tayin edilirken, bu meblağın üstünde kalan tutar için %50 olarak uygulanmıştır. Zaman içerisinde gerek eşik değerler, gerekse kredi değer oranları farklılaştırılmıştır.

Borç gelir oranı kısıtlamaları, teminatsız olmaları da göz önünde bulundurularak özellikle kredi kartı borçlarına yönelik uygulanmıştır. Ekim 2013'te yapılan düzenlemeyle kişilerin sahip oldukları gelir düzeyleriyle ilişkilendirilerek toplam kredi kartı limitleri sınırlandırılmıştır. Eylül 2020'de kredi kartı limitleriyle gelir ilişkilendirilirken, nakit, nakit benzeri veya kıymetli maden teminatlı kredi kartları bu sınırlamadan muaf tutulmuştur.

Vade kısıtlamaları, Aralık 2013'ten itibaren özellikle ihtiyaç kredilerinde ve taşıt kredilerinde uygulanmıştır. İhtiyaç kredileri otuz altı ay vade ile sınırlandırılırken, taşıt kredileri ise kırk sekiz ay vade ile sınırlandırılmıştır. Vade sınırlamaları, politika yapıcılar tarafından zaman içinde güncellemelere tabi tutulmuştur. Başlıca güncellemeler, Eylül 2016, Eylül 2018, Şubat 2019, Eylül 2020, Aralık 2020 ve Eylül 2021 tarihlerinde yapılmıştır. Vade kısıtlamaları, kredi kartları için de uygulanmıştır. Kredi kartlarına uygulanan vade kısıtlamalarında, kuyumculuk ve tüketici elektroniği gibi sektörlere odaklanılarak farklılaştırmalara da gidilmiştir.

Karşı döngüsel sermaye tamponunun amacı bankacılık sistemini aşırı kredi genişlemesine karşı korumaktır. Sermaye koruma tamponunun bütünleyicisi olarak düşünülen bu mekanizmada, aşırı kredi genişlemesinin olmadığı durumlarda karşı döngüsel sermaye tamponu sıfır düzeyinde belirlenirken, aşırı kredi genişlemesi döneminde karşı döngüsel sermaye tamponu ek bir tampon olarak belirlenmektedir (Yayla ve diğerleri, 2014). BDDK, Basel III uyum sürecinde sermaye koruma tamponu ve karşı döngüsel sermaye tamponu düzenlemelerinin nihai hallerini Kasım 2013'te yayınlamış ve bu düzenlemeler Ocak 2014'te hayata geçmiştir.

Kaldıraç oranlarının sınırlandırılması, bankaların özkaynaklarına göre maruz kalacakları risk büyüklüğünü makul bir zeminde tutma amacı gütmektedir. Basel III uyum sürecinde kaldıraç oranına ilişkin düzenlemeler Kasım 2013'te yayınlanmış ve kaldıraç oranı ana sermayenin toplam risk ağırlıklı varlıklara bölünmesiyle çıkan sonuç olarak tanımlanmıştır. Toplam risk ağırlıklı varlıklar hesaplanırken, bilanço kalemlerinin yanında türev varlıklar gibi bilanço dışı kalemler de dikkate alınmaktadır. Kaldıraç oranları, bankalarca aylık olarak hesaplanmaktadır. Her çeyrek sonunda hesaplanan kaldıraç oranlarının basit ortalaması BDDK'nın belirlediği asgari oranın üstünde olmalıdır. BDDK tarafından belirlenen bu oran şu an için %3 düzeyindedir.

Sistemik olarak önemli bankalara yönelik yapılan düzenlemeler de Basel III uyum sürecinin bir parçası olarak Şubat 2016'da yayınlanmıştır. Düzenlemenin amacı, finansal sektörde önemli yer tutan bankalarda yaşanabilecek olumsuz gelişmelerin bulaşıcı etkisini sınırlandırmaktır. Sistemik olarak önemli bankalar dört kategoriye ayrılırken, bu bankalara %1 ila %3 arasında değişen ek sermaye yükümlülüğü zamana yayılacak biçimde getirilmiştir. Adaptasyon süreci 2019'da tamamlanmıştır.

Bankaların risk ağırlıklı varlıklarına kıyasla yeteri büyüklükte sermaye tutmaları yasal bir zorunluluktur. Sermaye yeterliliği rasyosu özkaynakların risk ağırlıklı varlıklara oranı olarak hesaplanmaktadır. BDDK düzenlemelerine göre, bankaların standart sermaye yeterliliği rasyosu yüzde sekizin altında olamaz. Bir aktif kaleminin risk ağırlığının artırılması, diğer her şey sabitken risk ağırlıklı varlıkları büyütür ve sermaye yeterliliğini azaltır. Dolayısıyla, finansal otorite bankaların ortak bir varlık sınıfına yönelik maruziyetini azaltarak sistemik riski sınırlandırmak istediğinde, o varlık sınıfının risk ağırlığını yükselterek bankaları bu varlık sınıfından caydırabilir.

Haziran 2011'de iki yıla kadar vadesi olan ihtiyaç kredilerinin risk ağırlığı yüzde yüzden, yüzde yüz elli seviyesine yükseltilmiştir. İki yıldan daha uzun vadeli ihtiyaç kredilerini risk ağırlığı ise yüzde iki yüze yükseltilmiştir (Yayla ve diğerleri, 2014). Temmuz 2012'de ise bir ay ila altı ay arasında vadeye sahip kredi kartlarının, taşıt kredilerinin ve ihtiyaç kredilerinin risk ağırlığı yüzde yetmiş beşe çekilerek gevşetici yönde bir politika uygulanmıştır (Makro ihtiyati ülke raporu, IMF). Ekim 2013'de ise taşıt ve kredi kartlarına yönelik sıkılaştırıcı bir risk ağırlığı düzenlemesine gidilmiştir (Mahmutoğlu ve Ardor, 2019). Basel III uyum sürecine paralel olarak, BDDK Mart 2016'da tüketici kredilerinin risk ağırlığında yine değişikliğe gitmiştir. Konut kredilerinin risk ağırlığı yüzde otuz beşe düşürülürken, diğer tüketici kredilerinin risk ağırlığı yüzde yetmiş beş olarak belirlenmiştir (Makro ihtiyati ülke raporu, IMF).

Karşılıklar, bankacılık sektörü tarafından olası kredi zararlarına karşı telafi edici bir önlem olarak uygulanmaktadır. Karşılıklar en genel olarak iki türdedir: genel karşılıklar ve özel karşılıklar. Genel karşılıklar krediler takibe düşmeden önce uygulanan karşılıklardır. Özel karşılıklar ise krediler takibe düştükten sonra uygulanan karşılıklardır. Genel karşılık oranlarında yapılan değişiklikler kredi maliyetlerini etkilemektedir ve bu nedenle makro ihtiyati politika aracı olarak kullanılabilir (Yayla ve diğerleri, 2014).

Tüketici kredilerine yönelik genel karşılıklarda Haziran 2011'de, Ekim 2013'te ve Aralık 2013'te kademeli değişikliklere gidilmiştir. Haziran 2011'de, tüketici kredilerinin toplam kredilerdeki payı yüzde yirminin üzerinde olan ve taşıt ile konut kredileri haricindeki tüketici kredilerinde yüzde sekizin üzerinde takibe dönüşüm oranına sahip bankalar için, taşıt ile konut kredileri haricindeki tüketici kredilerinin

genel karşılık oranları artırılmıştır. Bu krediler için standart nitelikteki kredilere yüzde dört, yakın takipteki krediler için yüzde sekiz genel karşılık oranı belirlenmiştir (BDDK, 2012). Ekim 2013'te taşıt kredileri de bu kapsama alınmıştır. Ayrıca, ihracata yönelik kredilerde ve küçük ve orta büyüklükteki işletmelere kullandırılan kredilerde genel karşılık oranları düşürülmüştür. İhracat kredilerinde genel karşılık oranları yüzde birden sıfıra düşürülürken, küçük ve orta büyüklükteki işletmelere kullandırılan kredilerde genel karşılık oranları %0,5'e düşürülmüştür (BDDK, 2014). Eylül 2016'da gevşetici bir uygulamaya gidilerek tüketici kredilerinde kademeli genel karşılık oranı uygulaması sonlandırılmıştır. Aralık 2016'da, standart nitelikteki küçük ve orta büyüklük- teki işletme kredilerinin ve büyük ölçekli kamu alım kredilerinin genel karşılık oranları düşürülmüştür. Standart nitelikli ticari kredilerin ve yakın takipteki ticari kredilerin, küçük ve orta büyüklükteki işletme kredilerinin ve ihracat kredilerinin genel karşılık oranları azaltılmıştır (BDDK, 2017).

Kredi kartlarına yönelik kademeli asgari ödeme oranları Aralık 2010'da uygulamaya konmuştur. Sıkılaştırıcı bir politika olarak, kredi kartlarının asgari ödeme oranları kart limitine bağlı olarak %25 ila %40 arasında oranlara yükseltilmiştir. Ekim 2013'te de yine kredi kartı asgari ödeme oranlarında sıkılaştırıcı bir düzenlemeye gidilmiştir (TCMB, 2014). Haziran 2019'da limitlerinden bağımsız olarak tüm kredi kartlarının asgari ödeme oranı yüzde otuz olarak belirlenmiştir. Mart 2020'de yine gevşetici bir uygulamaya gidilerek tüm kredi kartlarının asgari ödeme oranları yüzde yirmiye düşürülmüştür (Makro ihtiyati ülke raporu, IMF). Haziran 2022'de ise limiti 25 bin TL üzerinde olan kredi kartlarının asgari ödeme oranı yüzde kırka yükseltilmiştir.

Türkiye'de yerleşik hanehalkları döviz cinsinden veya dövize endeksli kredi kullanamamaktadır. Bu düzenleme, Türk lirasının değerini korumayı amaçlayan 32 sayılı karara getirilen bir ekle yapılmıştır. Bankaların döviz pozisyonlarını BDDK düzenlemekte ve yönetmekteyken, bu düzenleme hanehalklarının döviz pozisyonlarının yönetilmesi amacını taşımaktadır.

2009'daki küresel krize kadar ekonominin geri kalanı ile finansal sistem arasındaki etkileşimi etraflıca inceleyen teorik ve ampirik çalışmaların sayısı kısıtlıydı. Kriz öncesindeki DSGE modelleri, üç temel eksiklik nedeniyle bu etkileşimi yeterince irdeleyememiştir. İlk olarak, finansal sistem açıkça modellenmiyordu. İkinci olarak

finansal büyüme ve daralma dönemlerini içermiyorlardı. Son olarak temerrütlere ve faiz farklarına çoğunlukla yer verilmiyordu (Galati ve Moessner, 2013).

Gerali ve diğerleri (2010) bu alandaki önemli çalışmalardan biridir. Iacoviello (2005) çalışmasının izinden giden bu çalışma, teminat kısıtlamalarına ve heterojen hanehalklarına yer vermesinin yanı sıra, bankacılık sistemini eksik rekabetçi bir yapıda ve finansal friksiyonlarla modellemiştir. Euro bölgesi için modeli tahmin etmişler ve 2008'de ekonomik aktivitedeki daralmanın önemli kısmının bankacılık sektörüne gelen şoklarla açıklanabileceğini göstermişlerdir. Model ayrıca, bankacılık sektörünün varlığının, ekonomiye gelen şokun yapısına bağlı olarak farklı etkileri olduğunu ileri sürmektedir. Bankacılık sektörü talep şoklarının etkilerini yumuşatmakta, diğer yandan arz şoklarının etkilerini büyütmektedir. Banka özkaynaklarında meydana gelen erime, borç verme faiz farklarını ve yatırımları olumsuz yönde etkilemektedir. Modelin kapalı ekonomi yapısı, küresel likidite veya ülke risk primi gibi açık ekonomilere yönelik konuların çalışılmasını engellemektedir.

Angelini (2012) çalışması finansal şoklara yönelik olarak karşı döngüsel sermaye yeterliliği ve kredi değer oranı gibi makro ihtiyati politikaların etkili olduğunu ortaya koymaktadır. Bu çalışma para politikası ile makro ihtiyati politikalar arasındaki eşgüdüme de vurgu yapmaktadır. Agenor ve diğerleri (2014) de tam sermaye serbestliğinin olmadığı açık bir ekonomi modelinde, karşı döngüsel sermaye yeterliliği politikasının büyük sermaye akımlarına yönelik olarak uygulanması durumunda, bu akımların yol açacağı finansal hızlandırıcı mekanizmasını sınırlandırarak etkilerini yumuşattığını göstermiştir. Özkan ve Ünsal (2014) çalışması da kredi büyümesine yol açan finansal şoklara karşı makro ihtiyati politikaların kullanıldığı bir politika bileşiminin daha başarılı olduğunu ileri sürmektedir. Bu çalışma ayrıca dış borçlanmanın büyüklüğünün de önemli olduğunu, dış borçlanmanın yüksek olması durumunda makro ihtiyati politikaların kullanılmasının daha gerekli olduğunu savunmaktadır. Quint ve Rabanal (2013) çalışması ise, Euro bölgesine yönelik olarak geliştirdikleri modelle önce kredi büyüklüğüne tepki veren genişletilmiş bir Taylor kuralının refah artırıcı olduğunu gösterdikten sonra, makro ihtiyati politikaların kullanılmasının konut talebi şoklarında daha etkili olduğunu bulgulamışlardır. Bununla birlikte, teknoloji şoklarına karşı makro ihtiyati politikaların kullanılması modelde olumsuz sonuç vermektedir.

Ülke ekonomilerine yönelik yapılan çalışmalara bakıldığında, İsveç ekonomisi üzerine yaptıkları çalışmada, Chen ve Qolumba (2016) borç gelir oranını düşürmek için talep yönlü makro ihtiyati politikaların para politikası yerine kullanılmasını salık vermektedir çünkü bu politikalar para politikasına göre tüketim üzerinde daha sınırlı bir olumsuz etkiye sahiptir. Brzoza-Brzezina ve Makarski (2011) çalışması ise hanehalkı kredilerine yönelik pozitif bir kredi değer şokunun kredileri artırdığını, tüketimi tetiklediğini, bunun neticesinde yükselen üretim ve enflasyona karşılık merkez bankasının politika faizini artırdığını belirtmiştir. Vitola ve Ajevskis (2011) Letonya üzerine geliştirdikleri, sabit kur rejimi altındaki bir açık ekonomi modelinde daha yüksek sermaye gereksiniminin üretimi, yatırımı ve borç vermeyi artırdığını fakat mevduatlarda ve yabancı yükümlülüklerde azalmaya yol açtığını bulmuşlardır. Pagaduan ve Majupa (2016) ise Filipinler üzerine geliştirdikleri bir modelle kredi değer oranlarına gelen sıkılaştırıcı şokların kredilerde keskin bir daralmaya yol açtığını ve finansal istikrarı destekleyici olduğunu, diğer yandan tüketim, yatırım ve üretim açısından reel maliyetlerinin olduğunu belirtmiştir.

Tez için geliştirilen modelde sabırlı hanehalkları, sabırsız hanehalklarına göre daha yüksek bir indirim faktörüne sahiptir. Her iki hanehalkı da, fayda fonksiyonlarını ençoklayacak şekilde tüketim, konut ve işgücü arzı kararlarının yanında mevduat ve kredi kararlarını vermektedir. Daha yüksek indirim faktörüne sahip olmaları nedeniyle, sabırlı hanehalkları borç verici, sabırsız hanehalklarıysa borç alan durumundadır. Sabırsız hanehalkları kredi alırken, sahip oldukları konut miktarının belli bir oranına kadar kredi kullanabilmektedir. Bu da kredi değer oranına gelen şokların çalışılmasına olanak vermektedir. Girişimciler, tam rekabetçi piyasada faaliyet göstermekte ve işgücü ile sermayeyi kullanarak yerel toptan ara malı üretiminde bulunmaktadırlar. Girişimciler de kredi kullanırken, sahip oldukları sermaye mallarının belli bir oranına kadar kredi kullanabilmektedir.

Bankaların piyasa gücüne sahip olmalarını sağlamak amacıyla Dixit-Stigliz yaklaşımı kullanılarak banka ürünleri modellenmiştir. Hanehalklarının ve girişimcilerin, bankalarca sunulan kredi ve mevduat ürünlerine yönelik olarak sabit ikame esnekliğine sahip oldukları varsayılmıştır.

Maaş yapışkanlığını sağlamak amacıyla literatürde yaygın olarak kullanılan iş sendikası yaklaşımı kullanılmıştır.

Modelde iki üretim sektörü bulunmaktadır: sermaye malları üretimi ve tüketim malları üretimi. Konut stoğunun sabit olduğu varsayılmıştır. Sermaye malları üreticileri yatırımlarla yıpranmayan sermaye mallarını birleştirerek, girişimcilere satılacak sermaye malı üretimini gerçekleştirmektedir. Yerel perakendeciler girişimcilerin ürettiği toptan ara malını markalayarak farklılaştırmaktadır. İthalatçı perakendeciler de dışarıdan ara malı ithal etmektedirler. Nihai mal üreticileri, yerel ve ithal ara mallarını kullanarak nihai malı üretmektedir. İthal ara malı fiyatları, yerel para birimi düzeyinde yapışkanlığa sahiptir. İhracat büyüklüğünün de yurt dışı ekonomisinin büyüklüğüne ve nihai malın fiyat rekabetine bağlı olduğu kurgulanmıştır.

Bankalar model açısından önemli bir role sahiptir. Topladıkları mevduattan zorunlu karşılıkları ayırdıktan sonra, özkaynaklar ve dış borçlanmayla birleştirerek hanehalkına ve girişimcilere kredi sağlamaktadır. Her banka tam rekabetçi piyasada faaliyet gösteren toptan şube ve eksik rekabetçi piyasada faaliyet gösteren, biri kredi sağlayan, diğeri mevduat toplayan iki perakende şubeden oluşmaktadır.

Merkez bankasının enflasyona ve çıktı açığına tepki veren bir Taylor kuralıyla faiz oranlarını belirlediği standart yaklaşım kullanılmıştır. Makro ihtiyati politikaların etkilerini çalışmak için, kredi değer oranları ve sermaye yeterliliği oranları birinci dereceden özbağlanımlı olarak modellenmiştir.

Denge koşulları için nihai mal piyasasında, işgücü piyasasında, konut piyasasında, kredi ile mevduat piyasalarında ve dış bütçede denge koşulları tanıtılmıştır.

Parametre değerleri belirlenirken, modelde sıklıkla başvurulan iki modelin parametre değerleri ağırlıklı olarak kullanılmıştır. Kullanılan parametre değerlerine ekte yer verilmiştir.

DSGE literatürünü takip ederek, öncelikle durağan durum değerlerini hesapladıktan sonra durağan durum etrafındaki etki tepki fonksiyonlarını inceliyoruz. Durağan durum değerlerine ait oranlar verilmiştir.

Modelin pozitif teknoloji şokuna ve sıkılaştırıcı para politikasına verdiği tepkiler literatürdeki tepkilere benzerdir. Hanehalkı kredilerine getirilen gevşetici kredi değer oranı şoku sonrasında, toplam kredilerde artış yaşanmakla birlikte, girişimci kredilerinde azalma meydana geliyor. Toplam mevduatlar ve faiz farkları da artış sergiliyor. Tüketimin beraberinde enflasyon yükseliyor. Yatırımlar ise ilk etaptaki kısa artışın ardından düşüşe geçiyor. İhracat, reel döviz kuruyla beraber yükseliyor. Nihai mal üretiminde ve enflasyonda meydana gelen artışa karşılık para politikası faizi artıyor. Dış borçlanma da artış sergiliyor.

Girişimci kredilerine yönelik gevşetici kredi değer oranı şokuna verilen tepkiler benzer olmakla birlikte, hem girişimci hem de hanehalkı kredilerinin artış sergilediği görülmektedir. Toplam mevduatlar, dış borçlanma ve faiz farkları da artış sergiliyor. Yükselen nihai mal üretimi ve enflasyona karşılık merkez bankası politika faizini yükseltiyor. İhracat artış sergiliyor.

Sermaye yeterliliği oranına gelen sıkılaştırıcı şoktan sonra bankalar özkaynaklarını büyüterek ve kredi arzını kısarak tepki veriyor. Mevduatlar ve dış borçlanma da azalıyor. Kredilerin azalması sonrasında toplam talepte, tüketimde ve yatırımlarda azalma meydana geliyor. Reel döviz kurunda ve ihracatta azalma meydana geliyor.

Son çalışmada ise Türkiye verisi üzerine ampirik bir analiz gerçekleştirerek makro ihtiyati politika şoklarının etkilerini çalışıyoruz. Bu çalışmada makro ihtiyati politikalar olarak kredi değer oranını ve zorunlu karşılık oranını ele alıyoruz. Literatürde yer alan çalışmaları inceledikten sonra, veriyi ve metodolojiyi tanıtıyoruz. Farklı şoklara verilen tepki fonksiyonlarını inceledikten sonra, modelin artık terimlerine yönelik testler uyguluyoruz.

Borio ve Shim (2007) düşük ve istikrarlı enflasyon ortamında dahi finansal liberalizasyon, güvenilir enflasyon karşıtı politikalar ve reel üretimin küreselleşmesinin beraberinde finansal dengesizliklerin birikebileceğini ve makro ihtiyati politikaların önemli bir role sahip olduğunu belirtiyor. Hanson ve diğerleri (2011) de makro ihtiyati politika uygulamalarında daha yüksek sermaye yeterliliğinin kullanılması gerektiğini dile getirmektedir.

Lim ve diğerleri (2011) 49 ülke üzerine yaptıkları çalışma sonunda, kredi değer oranı, borç gelir oranı ve kredi büyümesine getirilen sınırlamaların yanında, zorunlu karşılıkların, karşı döngüsel sermaye tamponunun ve dinamik karşılıkların kredi büyümesi ile ekonomik büyüme arasındaki korelasyonu düşürdüğünü bulmuştur. Bu çalışma makro ihtiyati politikaların reel maliyetlerine de dikkat çekmiştir.

Claessens ve diğerleri (2013) makro ihtiyati politikaların etkinliğini gelişmekte olan ülkelerin bankaları üzerinde çalışmıştır. Sonuçlara göre, borçluları hedef alan kredi değer oranı ve borç gelir oranı uygulamaları kırılganlıkları azaltmakta oldukça etkindir. Döviz cinsinden borçlanmaya getirilen sınırlamalar da faydalı bulunmuştur. Bununla birlikte çalışma makro ihtiyati politikaların genişleme dönemlerinde daha iyi çalıştığını vurgulamaktadır.

Tovar ve diğerleri (2012) Latin Amerika ülkelerine yönelik bir panel veri VAR uygulaması gerçekleştirmişlerdir. Çalışma sonuçlarına göre, zorunlu karşılıklar ve diğer makro ihtiyati politikalar, banka kredilerinin büyümesi üzerinde ılımlı ve geçici bir etki yapmaktadır. Latin Amerika üzerine yapılan bir diğer çalışmada, Silva ve Harris (2012) zorunlu karşılıkların yükseltilmesinin, tüketici kredileri için sermaye yeterliliğinin artırılmasının ve bankaların kısa vadeli spot döviz pozisyonlarına yeni rezerv yükümlülüğü getirilmesinin, Brezilya'da kredi büyüme oranlarını daha makul seviyelere çektiğini, net portföy akımlarını azalt- tığını ve dış borç vadesini uzattığını bulgulamıştır.

Bruno ve Shin (2014) Kore'de türev döviz ürünlerine getirilen sınırlamanın ve çekirdek dışı yükümlülüklere getirilen verginin etkilerini ele almaktadır. Çalışma sonuçlarına göre, bu makro ihtiyati politikaların uygulanması, sermaye akımlarının küresel likidite koşullarına duyarlılığını azaltmıştır. Aysan ve diğerleri (2015) de benzer biçimde, makro ihtiyati politikaların bankalarca gerçekleştirilen sermaye akımlarının küresel likidite koşullarına hassasiyetini düşürdüğünü bulgulamıştır.

Wong ve diğerleri (2011) kredi değer oranının Hong-Kong konut piyasası üzerindeki etkilerini incelemektedir. Çalışma, kredi değer oranının hanehalkı kaldıracını azaltarak konut piyasasında istikrara katkı sağladığını göstermiştir. Kredi değer oranı aynı zamanda konut kredisi temerrüt riskinin konut fiyatında meydana gelen şoklara hassasiyetini düşürerek de bankacılık sektörünün dayanıklılığını artırmaktadır.

Vandenbussche ve diğerleri (2012) merkez, doğu ve güneydoğu Avrupa ülkeleri üzerinde gerçekleştirdikleri çalışmada sermaye yeterliliği, dış finansmana yönelik ek zorunlu karşılık ve kredi büyümesiyle ilişkilendirilmiş rezerv uygulamalarının kredi büyümesi üzerinde etkili olduğu sonucuna varmışlardır. Diğer yandan, kredi değer oranlarının, borç gelir oranlarının, zorunlu karşılıkların ve karşılık politikalarının konut fiyat enflasyonu üzerinde etkisini anlamlı bulamamışlardır.

Türkiye üzerine yapılan çalışmalarda makro ihtiyati politikaların etkin olduğuna ve planlanan amaçlara ulaşıldığına dair bulguların ağırlıklı olduğu görülmektedir. Fendoğlu ve diğerleri (2014) sınır ötesi portföy akımlarının küresel koşullara duyarlılığının TCMB'nin makro ihtiyati politikaları sonrası azaldığını bulmuştur. Oduncuoğlu ve diğerleri (2013) rezerv opsiyon mekanizmasının uygulanması neticesinde döviz kurunda görülen oynaklığın azaldığını bulgulamıştır. Değerli ve Fendoğlu (2013) farklı bir yaklaşım uygulayarak, opsiyon fiyatlarından elde ettikleri piyasa beklentilerini analiz etmişlerdir. Sonuçlara göre, rezerv opsiyon mekanizmasının uygulanması ile beraber oynaklık beklentisinin yanında, TL'nin değer kaybetme ihtimalinde de belirgin azalma görülmüştür. Binici ve diğerleri (2013) de faiz koridoru politikası ile birlikte ticari kredi faiz oranlarının koridorun üst bandına daha duyarlı hale gelirken mevduat faizlerinin politika faizine daha hassas olduğunu bulgulamıştır. Bu sonuçlar, faiz koridoru yoluyla TCMB'nin faiz farkını etkileyebileceğini ortaya koymaktadır. Chadwick (2018) çalışması da, makro ihtiyati politikaların kredi büyümesi ve tüketici fiyat enflasyonu üzerinde etkin olduğu sonucuna ulaşmıştır.

Çalışmada kullandığımız veri seti 2006 ile 2017 yılları arasını kapsamaktadır. Açık enflasyon hedeflemesinin başladığı 2006 yılı başlangıç dönemi olarak seçilmiştir. Veri seti aylık frekanstadır. Makro ihtiyati politikalar için ağırlıklandırılmış zorunlu karşılık oranları ve ortalama kredi değer oranı verisi kullanılmıştır. Ağırlıklandırılmış zorunlu karşılık verisinin kaynağı TCMB'dir. Ortalama kredi değer oranı verisi ise IMF'nin iMaPP veri tabanı ve TCMB'nin tüketici kredileri serisi kullanılarak elde edilmiştir. Bankalar arası piyasada gerçekleşen gecelik faiz oranın ortalaması, literatürde yaygın olarak kullanıldığı üzere para politikası duruşu olarak alınmıştır. Çalışmada spesifik olarak kredi değer oranının VAR analizinde kullanılması, daha önceden yapılan çalışmalar- dan farklı bir uygulamadır.

Çalışmada kullanılan içsel değişkenler tüketici fiyat enflasyonu, sanayi üretimi büyümesi, nominal efektif döviz kurunun doğal logaritması, reel kredi büyümesinin doğal logaritması, tüketici kredilerinde oluşan faiz farkı ve dış ticaret dengesi göstergesidir.

Çalışmada politika değişkenleri dışında kontrol amacıyla kullanılan dışsal değişkenler ise ABD politika faizi, petrol fiyatları, mevsimsel kukla değişkenler ile küresel finans krizi ve kur şokları için üretilen kukla değişkenlerdir.

VAR modelinden önce tüm değişkenlere ADF birim kök testi uygulanmıştır. Bu testlerin sonrasında para politikası faizi, zorunlu karşılık oranı, kredi değer oranı, nominal efektif döviz kuru, reel kredi büyümesi, faiz farkı, ABD faiz oranı ve petrol fiyatı için birinci farkların kullanılmasının daha sağlıklı olduğu görülmüştür.

Modelin gecikme sayısını belirlemek amacıyla gecikme sayısını belirleyen kriterler değerlendirilerek AIC ve LR kriterlerince önerilen altı gecikme sayısı uygulanmıştır.

VAR modelince üretilen dinamik çarpan fonksiyonları incelendiğinde, zorunlu karşılıklarda meydana gelen değişimlerin kredi piyasaları üzerindeki etkisi anlamlı bulunmaktadır. Zorunlu karşılıklarda meydana gelen artış sonrasında, tüketici kredilerinde oluşan faiz farkı artmaktadır. Sanayi üretimi büyüme oranı ve enflasyon oranı ise istatiksel olarak anlamlı biçimde gerilemektedir.

Kredi değer oranlarında meydana gelen artışın kredi piyasaları üzerindeki etkisi istatistiksel olarak anlamlıdır. Kredi değer oranlarında meydana gelen artışı takiben reel kredi büyümesi hızlanmakta ve tüketici kredilerinde oluşan faiz farkı gerilemektedir. Bu tepkiler, pozitif bir kredi arzı şokunun tepkileriyle örtüşür biçimdedir. Kredi değer oranlarında meydana gelen artış, ekonomik aktiviteyi ve enflasyonu da artırmaktadır. Kredi değer oranlarında meydana gelen artış, döviz kurunun değerlenmesini artırmakta, diğer bir ifadeyle Türk Lirası'nın değer kaybını hızlandırmaktadır.

Regresyon artık değerlerine yapılan LM testinde, oto korelasyon olmadığına yönelik sıfır hipotezinin altı gecikme sayısına kadar yüzde beş anlamlılık düzeyinde reddedilemediği görülmüştür. Hata terimlerinin normal dağılıma uyup uymadığına yönelik olarak ise, Jarque-Bera testleri uygulanmıştır. Testler genel olarak hata

terimlerinin normalliğini reddetmemektedir. Modelin değişen varyans problemine sahip olup olmadığının belirlenmesi amacıyla ARCH(1,1) modelleri artık terimlere uygulanmıştır. Model sonuçlarına göre, hata terimlerinin eş varyanslılığı yüzde beş anlamlılık düzeyinde reddedilmemektedir. Bu sonuçlar, üretilen etki-tepki ve dinamik çarpan fonksiyonlarının güvenilir olduğunu ortaya koymaktadır.

Teorik modelin öngörüleri ve ampirik analizin sonuçları uyumludur. Kredi değer oranlarında meydana gelen artış, kredi büyümesini ve dolayısıyla ekonomik aktiviteyi desteklemektedir. Diğer yandan enflasyon üzerinde de baskı oluşmaktadır. Bu sonuçlar, makro ihtiyati politikalar uygulanırken, para politikası ile eşgüdümün önemini bir kez daha ortaya koymaktadır.

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