

Personal Research Statement ^{*}

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I am a macroeconomist with empirical and theoretical policy-oriented research interests in monetary economics, macroeconomics of capital market imperfections, banking, macroprudential policies and open economy macroeconomics. My research so far has mainly concentrated on three broad categories. The first category focuses on the macroeconomic effects of conventional and unconventional monetary policies in both advanced and emerging market economies (EMEs) as well as the normative implications of these policies using quantitative medium-scale DSGE models. Section I discusses my work in this category. The second category includes projects that investigate the role of financial intermediaries in business cycle fluctuations and that study how macroprudential policies might mitigate the adverse macro-financial feedback loops. Section II is devoted to this line of my research in more detail. The third category concentrates on cross-sectional facts on bank balance sheets over the business cycle, the role of bank heterogeneity in the determination of credit growth dynamics, and the effects of monetary and macroprudential policies on individual bank behavior and the macroeconomy in heterogeneous agent models of banking sector. Section III briefly describes my papers in this category. Finally, the last category includes my papers that does not directly fit into these three main categories. I then conclude with my future research agenda.

1 Monetary Economics

The 2007-09 Global Financial Crisis has significantly altered our understanding of the role of financial sector in the macroeconomy, presented huge challenges for conventional monetary policy making and pointed out the need for new policy instruments. In advanced economies, as the policy rates had been reduced at an unprecedented pace and eventually hit the effective zero lower bound (ZLB), central banks deployed a diverse set of unconventional policy measures, mostly in the form of quantitative easing policies. These policies have particularly been regarded as helpful to mitigate the financial market disruptions by reducing the rise in risk premia and help attenuate the spillovers

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from the financial sector to the real economy. Despite some empirical evidence on the effectiveness of quantitative easing as a crisis management tool, the precise transmission of such policies and the real economic consequences in their absence are yet to be understood. Moreover, in EMEs, the crisis generated an adverse feedback loop of capital outflows, depreciating exchange rates, deteriorating balance sheets, rising credit spreads and falling real economic activity. In addition to this adverse feedback cycle, the unconventional policy response of advanced economies to the crisis caused EMEs to sail in uncharted waters from a monetary policymaking perspective. The fact that banks are still the main source of credit extension, their reliance on non-core debt is sizable and exchange rate developments significantly affect both inflation and balance sheet dynamics also complicates price and financial stability tasks of EME central banks. Taken all together, these adverse developments (i) make academics and policymakers continuously assess the performances of unconventional policy measures mostly implemented in advanced economies, and (ii) revitalized the previous debate among academics and policymakers about whether central banks should take into account financial and external variables over and above their effects on inflation and real economic activity, mostly in EMEs. Below I describe my completed work in this area in more detail.

1.1 Completed Projects

1.1.1 External Shocks, Banks and Optimal Monetary Policy: A Recipe for Emerging Market Central Banks (with Enes Sunel, Revise and Resubmit at the *International Journal of Central Banking*)

We start this project with the question of whether external and/or financial factors should explicitly play a role in monetary policymaking, or in short-term policy rate determination in EMEs. Using a canonical New-Keynesian DSGE model of a small open economy augmented by a banking sector that has access to both domestic and foreign funds and in which uncovered interest parity does not hold due to asymmetric financial frictions, we investigate the quantitative performances of optimal, simple and implementable interest rate rules, that also respond to external and/or financial factors, relative to a Ramsey-optimal monetary policy rule. We consider a small number of targets among a wide range of variables that are arguably important for policymaking. In particular, we look at bank credit, asset prices, credit spreads, the U.S. policy rate and the real exchange rate as additional inputs to policy. We then compare these optimal augmented Taylor rules with standard optimized Taylor rules under five different types of domestic and external shocks such as TFP, government spending, country risk premium,, the U.S. policy rate and export demand. We also analyze optimal policy in an economy driven jointly by all of these shocks given that it might be difficult for the policymaker to perfectly disentangle the different sources of business cycle fluctuations when designing a policy.

The main results suggest that a Ramsey-optimal policy reduces inefficient fluctuations in intratemporal and intertemporal wedges driven by movements in the consumer price index (CPI) inflation, the aggregate markup and the real exchange rate, together with those of loan-domestic deposits and loan-foreign deposits spreads compared with a decentralized economy, which entails a standard Taylor rule. Furthermore, optimized augmented interest rate rules feature direct and non-negligible responses to lending spreads, the real exchange rate and the U.S. policy rate, together with a mild-inflationary policy stance.

1.1.2 When markets sneeze, the Fed gets bold: The Collateral Framework as an Unconventional Policy Tool (with Osman Furkan Abbasoğlu, Salih Fendoğlu and Birol Kanik, under review at the *Journal of Money, Credit and Banking*)

In this project, we study the macroeconomic effects of easing collateral standards on financial intermediaries in open market operations (OMOs), a widely-used unconventional policy in the aftermath of the 2007-09 crisis, and assess its effectiveness in terms of attenuating the adverse impact of credit market disruptions on the real economy. Using a New-Keynesian DSGE model with an explicit banking sector and central bank collateralized lending, we investigate how an easing the collateral policy affects bank balance sheets, their lending behavior, credit and bond spreads, and eventually macro aggregates such as investment and output, including the case of zero lower bound (ZLB) of interest rates. What would be the real economic outcome in the absence of such policies? In particular, we analyze two types of collateral policies: (i) increasing the fraction of safe assets such as Treasury securities and government bonds, which we call as safe asset collateral policy and (ii) widening the eligible pool of assets via including risky securities such as commercial loans and corporate securities, which we call as risky asset collateral policy.

A model suitable to address these questions requires three departures from a standard New Keynesian model. First, the existence of collateralized lending market between the central bank and commercial banks, by definition, requires a model with an explicit banking sector (which optimally chooses how much to demand monetary injection from the central bank in addition to loan supply and deposit demand decisions) and explicit role for the central bank (e.g. central bank setting the collateral standards as a policy tool). Second, in equilibrium, for different assets to effectively serve as collateral, asset portfolio of commercial banks should be determinate and endogenous. Moreover, for active collateral policy and hence changes in the composition of central bank's balance sheet to matter for the real economy, different assets should have different returns, leading to multiple interest rates and liquidity premia. Third, commercial bank's problem of choosing the demand for injection should be non-trivial: banks would otherwise demand an indefinitely high level of injection at a given policy rate to expand their balance sheets and earn unbounded profits. Therefore, a proper approach should incorporate an endogenous limit to central bank liquidity injection due to

potentially risky banking activity.

The main findings reveal that both types of collateral policies attenuate the effects of financial shocks on the real economy. In particular, by reducing either bond or credit spreads, safe and risky asset collateral policies help banks receive a higher funding base and provide credit to non-financial sector at more favorable terms. This mitigates the fall in credit, investment and output, and raises inflation. We also show that this policy is more effective if accompanied with a looser conventional policy response. This also implies that hitting the ZLB and thus being unable to reduce the policy rate further limits the effectiveness of active collateral policies. Therefore, under unfavorable financial conditions, central banks do not need to wait until their policy rates hit the ZLB in order to implement active collateral policies. Taking the analysis to the Fed's recent experience, when the policy rate endogenously hits the ZLB due to sudden rise in funding stress, active use of collateral policies helps mitigate the sharp drop in asset prices, credit, investment and output.

2 Financial Intermediaries and Macroprudential Policy

The 2007-09 global financial crisis underlined the importance of the role of financial intermediaries and financial shocks in driving business cycle fluctuations. Before the crisis, most of the prominent DSGE models used in the literature and at the central banks for policymaking process treats financial sector as a veil and does not model it explicitly due to famous Modigliani-Miller theorem. However, the crisis pointed out the significant contribution of financial market imperfections and balance sheet fluctuations to the dynamics of macroeconomic aggregates. Therefore, documenting the standard business cycle statistics of aggregate balance sheet variables and reconciling them with the quantitative predictions of widely-used DSGE models proved to be crucial in understanding the dynamics of real variables and it requires an explicit modelling of financial sector. Moreover, policymakers in both advanced and emerging economies have been exercising a variety of measures to mitigate the transmission of financial disruptions to the real economy and implement macroprudential policies to stabilize financial cycles, and hence to achieve macroeconomic stabilization. To that end, frictions in the financial sector and macroprudential policy instruments have been the focal point of the recent literature on macroeconomic dynamics and policy.

2.1 Completed Projects

2.1.1 Financial Intermediaries, Credit Shocks and Business Cycles, (*Oxford Bulletin of Economics and Statistics*, 2016)

Based on the aforementioned observations in the aftermath of the 2007-09 crisis, I started this project with two questions in mind. First, what are the cyclical properties of aggregate balance

sheet variables of the U.S. banking sector? Second, how important are financial shocks relative to standard productivity shocks in driving real and financial business cycles in the U.S.? To address these questions, this paper proposes an equilibrium real business cycle model with a financial sector, that is capable of matching the fluctuations in both standard macroeconomic aggregates and balance sheet variables of the banking sector observed in the U.S data. Although a growing body of literature studies the relevance of financial shocks together with an explicit modelling of frictions in financial sector, the behavior of aggregate financial variables and how they interact with real variables over the business cycle have not been fully explored in the literature. Most previous studies have not tried to match fluctuations in both standard macro aggregates and balance sheet variables of the U.S. banking sector simultaneously. This paper aims to fill this gap in the literature.

I first systematically document the business cycle properties of aggregate financial variables, using the data on the U.S. commercial banks from the Federal Reserve Board. I then assess the quantitative performance of a theoretical model by its ability to match these empirical facts. The model features two main departures from an otherwise standard real business cycle model: (i) an active banking sector with financial frictions and (ii) empirically-disciplined shocks to bank net worth in addition to conventional demand and supply-side shocks in the literature. Both calibrated and estimated-extended versions of the model show that shocks to bank net worth are important not only for explaining the dynamics of financial flows but also for the dynamics of macroeconomic variables. The results also suggest that the recent deterioration in aggregate net worth of the U.S. banking sector contribute significantly to the 2007-09 recession. Finally, the tightness of bank capital constraint in the model given by its Lagrange multiplier (which determines the banks' ability to extend credit to non-financial firms) tracks the index of tightening credit standards (which shows the adverse changes in banks' lending conditions) constructed by the Fed Board quite well. This result may also imply that the Lagrange multipliers attached to the financial constraints in DSGE models with credit frictions might contain valuable real-time information about the financial conditions of an economy.

2.1.2 Required Reserves as a Credit Policy Tool (with Enes Sunel and Temel Taşkın, *The B.E. Journal of Macroeconomics*, 2013)

The 2007-09 global financial crisis led many EMEs to implement a variety of macroprudential policies to counteract the immediate economic downturn brought by the crisis and the consequent boom fuelled by strong capital inflows due to unconventional monetary policies of advanced economies. Among many policy tools, reserve requirements have been used extensively as a macroprudential policy tool in several countries such as China, Brazil, Malaysia, Peru, Colombia and Turkey. They mainly used this policy tool to curb excessive credit growth in upturns and to ease financial constraints in downturns, hence to maintain financial stability. Therefore, reserve requirements can

be used as a countercyclical policy instrument to mitigate the excessive fluctuations in credit in the financial sector and hence to stabilize the real economy.

Taking the stock of these observations, the goal of this paper is to investigate the effectiveness of reserve requirements that countercyclically respond to expected credit growth in moderating the real and financial cycles of an economy. We do so in a model in which real and financial fluctuations are amplified by a financial accelerator mechanism. In particular, using a monetary DSGE model augmented by a banking sector, we explore the stabilizing role of reserve requirements as a credit policy tool in the transmission of productivity and financial shocks. Our quantitative exercise involves comparing a fixed reserve requirement ratio (RRR) economy in which the RRR is calibrated to its long-run value preceding the interventions of the central bank and the time-varying RRR economy in which the RRR is countercyclical with respect to expected credit growth. We also simulate the model under moderate and aggressive RRR policies in order to understand the strength of this tool. We then compute optimal credit policy intensity by using an exogenous loss function, which includes the variabilities of credit, output and the RRR as its arguments.

The main results suggest that a countercyclical required reserves policy mitigates the negative effects of the financial accelerator mechanism triggered by adverse TFP and bank capital shocks on key macroeconomic and financial aggregates in comparison with a fixed reserves policy. The policy works through reducing the rise in loan-deposit spreads, boosting asset prices and bank net worth. As a result, we conclude that RRRs might be used as a credit policy tool in an economy that exhibits financial frictions. Second, a time-varying RRR policy is always welfare superior to a fixed RRR policy under both shocks. Finally, the effectiveness of the policy increases as financial frictions become more severe. Thus, the mitigating effect of a time-varying RRR policy is bigger in a high-risk economy with a less efficient financial system where loan-deposit spreads are higher and the leverage of the banking sector is lower.

2.2 Ongoing Projects

2.2.1 Optimal Bailouts of Financial Sector

During the 2007-09 financial crisis, the U.S. government initiated Troubled Asset Relief Program (TARP) and Capital Purchase Program (CPP) to assist many financial institutions in order to (i) to raise the franchise value of financial institutions (to bolster their capital position), (ii) to avoid a complete disruption of the credit intermediation, and (iii) hence to support real economic activity. The recent literature studying the policy tool to correct credit market dysfunctions generally assumes that government interventions are financed via lump-sum taxes, which in most cases trivially achieves first-best allocations. Based on this, this paper investigates the optimal bailout policy to mitigate the adverse effects of financial shocks and credit frictions in banking sector in the presence of distortionary taxation. Specifically, I answer the following questions:

(i) What should be the optimal interest rate subsidies to banks given that they are financed via distortionary labor taxation, (ii) What are the role of frictions in banking sector in designing the optimal policy, and (iii) what are its welfare implications? To this end, I build a quantitative equilibrium business cycle model with a financial sector capable of replicating real and financial fluctuations observed in the U.S. data. I then solve Ramsey planners problem subject to same type of frictions in the laissez-faire economy and to same type of shocks of same magnitude.

I show that these credit frictions lead to an inefficiently low volume of financial intermediation and an inefficiently high level of credit spreads in the laissez-faire economy. In the absence of exogenous government spending, optimal policy features a state-contingent tax on labor of 11% and a state contingent interest rate subsidy to banks of 1.35%, on average. Ramsey planner faces a trade-off between relaxing balance sheet constraints of banks and costs associated with distortionary labor taxation. Hence, it reduces the fluctuations in the intertemporal wedge via subsidies at the expense of creating static distortions due to labor taxation. Although workers may seem to earn lower wages due to labor tax, higher investment by non-financial firms leads to higher wages, which is enough to compensate the cost of financing the bailout, leading to a higher welfare, which is estimated to be 3.75% in consumption equivalent terms.

3 Banking

Fluctuations in the asset and liability sides of balance sheets of banks within different size classes play an important role in driving the dynamics of macroeconomic aggregates in both advanced and emerging economies over the business cycle. Banks with different sizes might experience different intensity of frictions in obtaining external or internal finance during recessions and based on the composition of the asset side of their balance sheets, they might be forced to reduce their lending to non-financial sector, leading to a decline in firm investment and thus aggravating the recession. For instance, on the asset side, bigger banks with more liquid balance sheets can easily protect their loan portfolios in response to a contractionary monetary policy shock which causes their deposits to decrease, simply by drawing down on its large buffer stock of securities. On the liability side, smaller banks facing relatively more severe capital market imperfections cannot frictionlessly switch to other non-deposit financing sources in response to shocks to their deposit base, and therefore are forced to reduce their lending to non-financial firms.

The 2007-09 global financial crisis has also reaffirmed that understanding the cross-sectional cyclical behavior of different items at the asset and liability sides of bank balance sheets is crucial in explaining business cycles and has significant policy implications in both advanced and emerging economies. Although a vast body of literature studies the cyclical changes in firm financing at both aggregate and cross-sectional levels, little work is done in investigating cross-sectional business cycle properties of bank balance sheets, and in both empirically and theoretically quantifying the cross-

sectional differences in how bank balance sheets react to monetary and macroprudential policies.

3.1 Completed Projects

3.1.1 Cross-sectional Facts on Bank Balance Sheets over the Business Cycle (with Osman Furkan Abbasoğlu and Şerife Genç, *Central Bank Review*, 2015)

Fluctuations in banks' financing sources play an important role in driving business cycles in economies with bank-based financial systems since banks are the main economic agents for efficiently transferring funds from savers (mainly households) to borrowers (mainly firms) which undertake investment activities. Moreover, it is important to study the cyclical properties of fluctuations in banks' financing sources from a cross-sectional perspective since relying solely on aggregate data might lead to an ambiguous picture of individual bank behavior over the business cycle as aggregate data is mainly driven by the behavior of a few number of very large banks. Based on these observations, in this project, we investigate the cyclical behavior of commercial banks balance sheet variables for different size groups using individual bank-level data. We first rank banks based on the size of their assets, and then systematically document business cycle facts of various balance sheet items and profitability measures of different bank groups, using Turkish data.

We find that the cyclical behavior of these variables is quite heterogeneous at the cross-sectional level: (i) Bottom 25 percent banks finance 30 percent of their assets with equity while for larger banks this ratio is around 12 percent, implying that debt financing is more prevalent for larger banks, (ii) bank assets and credits are highly procyclical and the level of procyclicality is lower for larger banks, (iii) security holdings of small banks are countercyclical whereas those of large banks are procyclical, (iv) total deposits are procyclical except for top 25 percent and equity issuance is acyclical to countercyclical at best, (v) loan spread is strongly countercyclical except for small banks while return on assets and equity are acyclical, and (vi) switching between debt and equity financing is more pronounced for the top 25 percent banks. The rich set of cross-sectional empirical facts about the cyclicity of bank balance sheets presented in this paper should be helpful for researchers to build and evaluate theoretical heterogeneous models about financing sources of banks.

3.2 Ongoing Projects

3.2.1 Determinants of Credit Growth: Does Bank Size Matter? (with Osman Furkan Abbasoğlu and Şerife Genç)

Credit growth has been an important indicator of financial stability for emerging economies in recent years. With the onset of 2007-09 financial crisis, the global economy has been shaped by

the quantitative easing policies of advanced economies. This long-lasting period of easy monetary policy environment resulted in a flow of funds from advanced economies to EMEs. The surge in capital inflows to EMEs lead to excessive credit growth in these countries. Facing the overheating of economy activity and concerns regarding financial stability EME policymakers put some monetary and macroprudential policies in action to curb credit growth in the banking sector. As one might correctly predict, the effects of these policies on banks' financing behavior is not uniform since banks with different sizes have different asset and liability compositions. Hence investigating the impact of these policies on the aggregate banking sector may conceal possible differences in policy reactions of different-sized banks. Based on these conjectures, in this paper, we use Turkish bank level data to examine the effects of monetary and macroprudential policies on credit growth. We conduct our analysis separately for big and small banks based on the size of their assets.

3.2.2 Monetary and Macroprudential Policies in a Heterogeneous Agent Model of Banks (with Osman Furkan Abbasoğlu, Pablo D'Erasmus and Şerife Genç)

Based on the significant observed heterogeneity in banks' behavior and their potential implications for both the macroeconomy and policymaking processes, this project aims to construct a quantitative macroeconomic model with heterogeneous banks to analyze the implications of monetary and macroprudential policies on banks' lending behavior, their debt vs. equity financing decisions, their default decisions as well as on the real economy.

4 Miscellaneous

4.1 Completed Projects

4.1.1 On International Consumption Risk Sharing, Financial Integration and Financial Development (*Emerging Markets Finance and Trade*, 2016)

International macroeconomic theory suggests that a higher financial integration leads to a higher consumption risk sharing among regions and countries, and developed financial markets facilitate this process. One of the widely known benefits of financial integration is that it creates more opportunities for risk sharing and intertemporal consumption smoothing in response to country-specific income shocks via the cross-ownership of both productive and financial assets in capital and credit markets. Together with the rise in the set of different financial instruments thanks to the financial development, countries are able to diversify their portfolios and share idiosyncratic risk among them. On the contract to this widely believed notion, some recent literature suggest that the median of the volatility of total consumption to that of income has increased from the 1980s to the 1990s in more financially integrated economies, risk sharing is lower for newly liberalizing

emerging economies and the fact that the interaction of financial integration with domestic financial development fosters risk sharing is not present for developing and emerging economies.

Although a vast body of empirical literature studies international consumption risk sharing, the benefits of financial integration and development, to the best of our knowledge, little research is done on the apparent relationship among them. In this regard, we address the following questions in this paper: (i) do more financially integrated regions or economic blocks engage in a greater degree of consumption risk sharing?, (ii) do regions or economic blocks with more developed financial markets achieve higher consumption risk sharing?, and (iii) how do the contributions of financial integration and financial development to consumption risk sharing differ across regions? In order to address these questions, we first compute the degree of consumption risk sharing of the countries in the Euro area, the G-7, and the OECD using a risk sharing measure developed by Crucini (1999). Computing a consumption risk sharing measure is important because it enables us to quantify how much the countries can smooth consumption intertemporally. It then allows us to ask the question of by how much the degrees of financial integration and financial development translate into the ability of consumption smoothing. We choose those particular economic regions since they constitute a significant part of the world GDP and they differ in terms of heterogeneity of countries which are in different stages of their financial integration and financial development processes. We then relate the risk sharing measure of these countries with their levels of financial integration and financial development. We find that (i) the international consumption risk sharing in the Euro area is higher than those in the G-7 and the OECD, and (ii) a higher degree of international risk sharing is associated with a greater degree of financial integration and a lower level of financial development. According to these results, we claim that more financially integrated countries might be better able to insure themselves against idiosyncratic income shocks and countries with more developed financial markets might tend to engage in less consumption risk sharing with other countries thanks to their own sophisticated financial markets. When per capita income and measures of output risk and trade openness are included as additional explanatory variables, they reduce the effects of financial integration and financial development on consumption risk sharing. Holding the levels of their financial integration and financial development constant, countries in the Euro area engage in significantly more consumption risk sharing than the ones in the G-7 and the OECD.

4.2 Ongoing Projects

4.2.1 A Macroeconomic Model of Fiscal Multipliers in Small Open Economies (with Enes Sunel)

Recent literature on fiscal multipliers documented that fiscal multipliers are larger in economies that are industrialized, closed, less indebted and that possess less flexible exchange rate regimes.

In this project, we aim to assess these empirical observations using a medium-scale New-Keynesian DSGE model of a small open economy and would like to explore the size and effectiveness of fiscal multipliers conditional on these broad aspects of countries. We are especially interested in the ineffectiveness of fiscal multipliers under a sovereign debt overhang. The Ricardian explanation to small multipliers under too much debt is that private sector saves out the fiscal stimulus reflecting the expectation that future taxes will have to increase to ensure debt sustainability in the long-term. In this project, we are curious of an alternative explanation: financial crowding out. Specifically, we would like to first empirically investigate whether commercial banks hold proportionally more government debt on their balance sheet compared to private sector credit when sovereign indebtedness increases. This might depend on adverse financial spillovers from sovereigns to the private sector.

5 Future Research Agenda

The 2007-09 global financial crisis created a sharp and persistent increase in unemployment rate and its recovery is quite slow despite the unconventional policy measures implemented by the major central banks around the world. The crisis also caused a strong deterioration in bank lending conditions and a sharp increase in lending spreads in most advanced economies. Taking the stock of these observations, I would like to explore the empirical and theoretical link between financial market imperfections and labor market frictions. In particular, using a New Keynesian DSGE model with a banking sector and search and matching frictions in the labor market, I aim to quantitatively investigate the role of financial frictions in the banking sector in the sharp and persistent increase in unemployment and its slow recovery aftermath.

The global financial crisis also led the major central banks to reduce their policy rates at an unprecedented pace and eventually to hit the effective zero lower bound (ZLB). At the same time, the crisis significantly tightened financial conditions of firms and banks and led their credit constraints to be binding. Therefore, we have observed that both the ZLB constraint and the credit constraint become binding simultaneously in major advanced economies. Thus, in order to advise monetary policy formulation and to answer interesting research questions, one need to have quantitative macro models that can accommodate two occasionally-binding constraints, which might bind at the same time or at different times. This will bring large nonlinearities that are mostly missing from our current macro models and the interaction of these two constraints with each other has a lot of potential to bring additional insights into monetary policymaking. My aim is to integrate these occasionally-binding constraints into state-of-the-art medium scale DSGE models.

I am also interested in the redistributive features of monetary and macroprudential policies as these policies have not only significant but also different implications for each segment of the

society. Using medium-scale New Keynesian DSGE models with heterogeneous households, I would like to quantitatively investigate distributional and welfare consequences of these policies. It might also help monetary policymakers when they are formulating monetary policy decisions.