

MACROPRUDENTIAL POLICY: IMPLEMENTATION, EFFECTS, AND LESSONS*

NITZAN TZUR-ILAN^{**}

Abstract

In this paper, I review the development of macroprudential policy (MPP) and, in particular, its regulatory structure, its influence on the financial system, and its costs and benefits. I find that the effectiveness of MPP depends on the institutional setup in which it is implemented: often, MPP is under the responsibility of the central bank, due to its independence, expertise and incentives to take action. However, this setup may generate conflicts between MPP and traditional monetary policy. I also discuss another issue undermining the effectiveness of MPP, namely, “leakages,” i.e., migrations of financial activity to institutions beyond the scope of application and enforcement of the MPP tool. Based on the Israeli experience of implementing MPP, I argue that coordination between the regulatory authorities supervising different sectors of the financial system is crucial for the successful implementation of MPP.

Keywords: Macroprudential policy, financial regulation, monetary policy, central banks, housing market, LTV

JEL Classification: E52, E58, E61, E65, G21, G28

1. INTRODUCTION

Macroprudential policy (MPP) is a relatively new approach to financial regulation that was developed mainly in the aftermath of the global financial crisis (GFC), and countries around the world, advanced and emerging economies alike, are trying to assess its effects and establish a regulatory framework for its implementation. The popularity of MPP comes from the important lesson learned from the GFC, that the microprudential approach of regulating the risk taken by individual financial institutions ignores the systemic risk faced by the financial

* I thank Yishay Yafeh, Efraim Benmelech, Nathan Sussman, David Genesove, Michel Strawczynski, Michael Kahn, Yoav Friedmann, Yoav Soffer, two anonymous referees, and seminar participants at the Bank of Israel Research Department, for their helpful comments and insightful discussions. The views expressed herein are those of the author and do not necessarily reflect the views of the Bank of Israel.

^{**} Bank of Israel and the Hebrew University Email: nitzan.tzur@boi.org.il

system as a whole. Systemic risk is a complex phenomenon and our understanding of it is still limited. The work of [Allen and Carletti \(2013\)](#) suggests that there are at least four types of systemic risk: banking panics, asset price falls, contagion in the banking system, and foreign exchange mismatches in the banking system.

The primary aim of MPP is to reduce systemic risk, especially the frequency and depth of financial crises.¹ In practice, many countries translated the MPP objectives to focus on dampening house price-credit cycle, e.g., limiting credit growth and the rate of house price appreciation.² One possible reason for that is the extensive evidence that the most important cause of financial crises is real estate booms and busts.^{3,4} The first question in this regard is why focus on real estate and not on other financial assets (e.g., stocks)? Unlike stock prices, where returns follow random walks, returns on housing are positively serially correlated ([Case and Shiller, 1990](#)), which means that once a bubble starts, speculation becomes more attractive, which in turn makes the bubble longer-lived. Also, the real estate market is not efficient and reacts slowly to macroeconomic shocks and price discovery is slow (due to infrequent trading and low transparency in prices). Additionally, house purchases and construction projects are often credit-financed and the credit is often provided by leveraged lenders. As a consequence, a material downturn in real estate prices can cause borrowers to default and the cumulative effect of these defaults is exacerbated by a deleveraging process of the lenders that incur losses from such defaults. The second question in this regard is why not focus directly and primarily on increasing the resilience of financial institutions? One possible reason is that MPP is a relatively new field of banking regulation and after the GFC many countries experienced a housing boom; thus, their first act was to stabilize the housing market. It is possible that in the next few years we will see more countries using MPP tools to stabilize the financial system.⁵

In this study I analyze the MPP toolkit. The MPP toolkit can be divided into two sets of tools:

1. Financial institution-based tools: The objective of these tools is to increase the resilience of the financial system, thereby helping to maintain the supply of credit in adverse conditions. They include the countercyclical capital buffer (CCyB), which protects the financial system and the liquidity coverage ratio, which reduces the buildup of liquidity and foreign-exchange risks associated with lending booms.

¹ See IMF (2013).

² See Akinci and Olmstead-Rumsey (2018).

³ Reinhart and Rogoff (2009) and Crowe, et al. (2013) provide evidence that the most important source of systemic risk is the collapse of real estate prices. In addition, recessions associated with housing busts are two to three times more severe than other recessions (Cerutti, et al. 2015).

⁴ The GFC was not exceptional in this regard. For a broad discussion of the role of housing markets in the 2007-2009 financial crisis, see Duca et al. (2011).

⁵ For example, by using the countercyclical capital buffer more frequently.

2. Borrower/housing-based tools: These tools have been found to have a relatively strong impact on the volume of credit, thereby helping to moderate procyclical feedback between housing prices and credit. The most common such tool is the LTV limit. As mentioned, most MPP tools used throughout the world are from this category.

The body of empirical evidence on the effectiveness of MPP tools, while still small, is growing fast. The most recent studies use bank-level or credit registry data in an attempt to overcome the identification problem that plagues this literature, namely, the endogeneity between MPP tools and real and financial developments. They show that MPP tools are quite effective in stabilizing financial institutions, especially banks. The studies also find that MPP tools manage to curb leverage and housing prices. Overall, the literature finds that MPP tools manage to lower the probability of booms and busts in the real estate and credit markets and thus increase the resilience of the financial system.

Many models of institutional design are used to implement MPP tools. One common model suggests having the central bank conduct MPP (in addition to its traditional role of conducting monetary policy) since it has the capacity to analyze systemic risk and is often relatively independent and autonomous. How do these two policies, monetary and macroprudential, interact? To answer this, consider that a low interest rate can create incentives for banks to seek more risks in order to achieve higher returns, to expand their balance sheets and reduce efforts in screening borrowers.⁶ A low interest rate can also raise asset prices, which can trigger further increases in leverage and lead to asset price booms.⁷ However, a well-designed MPP has the potential to contain these effects. For example, a DTI limit can soften the impact of a tightening of monetary policy on defaults and an LTV limit can tame house price boom-busts (Igan and Kang, 2011).

Having the central bank implement MPP also creates frictions with what used to be its main role of implementing monetary policy. While the regulator of monetary policy has few main tools and a clear and measurable objective (low and stable inflation), the regulator of MPP has an entire toolkit at his disposal and the much more complicated objective of financial stability. Indeed, the regulator of MPP can break down the objective of financial stability into many objectives that are difficult to measure, and it is not clear when the regulator should act. For example, how much should the regulator of MPP allow credit and housing prices to increase before it acts? And can a banking system be "too stable"? Such questions underline the fact that unlike in monetary policy (MOP), in MPP there is not an easily measurable target. I expect that over time central banks will learn how to combine MOP and MPP, and we will see more finance experts on the boards of central banks, using tools other than just interest rate policy to stabilize the financial system.

A main issue that financial regulators are just now coming to terms with is the unintended side effects of MPP. One such side effect is that when policies clamp down on banking

⁶ See Rajan (2006) and Borio and Zhu (2012).

⁷ See Crowe, et al. (2013).

activities, other, unregulated institutions, e.g., shadow banking, pick up the slack. Another side effect of MPP is that in limiting credit in the domestic financial system, the central bank might cause borrowers to transfer their business from domestically regulated institutions to foreign banks whose activities are regulated from abroad. Another side effect is that implementing LTV and DTI limits causes borrowers to find ways to circumvent these restrictions (for example, by taking unsecured loans, which are not regulated). The problem with such leakages is that they cause the MPP tools to be less effective. If, for example, an LTV limit causes borrowers to take consumer loans from unregulated entities, it is not necessarily decreasing risk in the financial system. The probability of such borrowers defaulting increases due to higher leverage and higher interest rate payments. In the case of a downturn in the business cycle, if these borrowers cannot repay their loans, the banks will need to sell their secured homes. If this is the case in a number of large financial institutions, it may cause an even bigger decline in housing prices than the projection of each individual bank, which can cause distress in the financial system. Therefore, addressing regulatory arbitrage and cross-border leakages is important for the effectiveness of the MPP. The solution to all these unintended side effects of MPP is to extend the scope of MPP beyond banking to any type of financial intermediation and to any source of credit. However, it may well be that the costs involved in doing so will far outweigh the benefits. For instance, how involved should the regulator be in controlling the allocation of unsecured credit? Perhaps such regulation should instead be considered a constraint that needs to be taken into account in designing an optimal macroprudential policy.

As part of the literature on the international experience of implementing MPP, this paper presents a detailed picture of the Israeli experience in implementing MPP. Israel is a unique case of an advanced economy that has used a variety of MPP tools and has a long history of doing so relative to other OECD countries. In addition, Israel has detailed micro-level data on its housing and credit markets that can help to assess the effect of MPP implementation in Israel. In addition, this paper investigates the financial regulatory framework and the interaction between macroprudential policy and monetary policy in Israel. Finally, it discusses the challenges of implementing MPP.

The main contributions of this paper are as follows. First, I provide a detailed and up-to-date review of the implementation of MPP using data from a large sample of advanced countries, including the different interpretations of the term “MPP,” the different MPP tools implemented and their effect on the economy in those countries, the different regulatory structures of MPP, and the interactions of MPP with monetary policy. Second, this paper is one of a few to explore the costs and unintended consequences of MPP, as experienced in different countries. The objective here is to demonstrate a need to rethink how to implement MPP and, in particular, how to avoid regulatory arbitrage. Third, I produce some evidence on the unique experience of implementing MPP in Israel, including an assessment of the impact, costs and benefits, regulatory framework, and challenges Israel is facing in implementing such a policy.

The rest of the paper is organized as follows. Section 2 reviews the development and objectives of MPP. Section 3 presents the MPP toolkit. Section 4 reviews the literature on the effectiveness of MPP in the credit and housing markets and other financial institutions. Section 5 presents some dilemmas posed by the institutional design of MPP. Section 6 reviews the unintended consequences of MPP and Section 7 describes the Israeli experience of implementing MPP. Section 8 points out some remaining issues that have to be addressed in future research.

2. THE DEVELOPMENT AND OBJECTIVES OF MACROPRUDENTIAL POLICY

As documented by [Clement \(2010\)](#), the origin of the term “macroprudential” can be traced back to the late 1970s in the context of work on international bank lending carried out by the Bank for International Settlements. During this period, the term generally denoted a systemic orientation of regulation and supervision linked to the macroeconomic sphere.⁸ However, use of the term “macroprudential” became much more widespread in the wake of the GFC. In the nine years that have elapsed since the GFC, there has been a dramatic increase in the number of speeches and studies dedicated to MPP, its use, and its effectiveness ([Galati and Moessner, 2013](#)).

While advanced market economies have come to implement MPP as a result of the recent financial crisis, emerging market economies have traditionally had a much greater engagement with MPP, in part because they have been subject to more frequent business and financial cycles since the emerging markets crises of the 1990s (Chile implemented MPP as early as 1982, following the massive banking crisis there). Emerging market economies are more prone to cyclicity due in part to their greater exposure to international capital flow volatility, commodity price shocks, and external and internal transmission channels that operate more adversely ([Claessens et al., 2013](#)).

For advanced market economies, one of the main lessons of the GFC has been that solving the moral hazard problem for each individual institution (via microprudential regulation) is not a sufficient condition to ensure the stability of the financial system as a whole. It is necessary, therefore, that MPP contribute to the maintenance of the stability of the financial system as a whole by reducing systemic risk. Systemic risk, which is the risk of widespread disruption to the provision of financial services that is caused by an impairment of all or some parts of the financial system, can have serious negative consequences for the real economy. Systemic risk is correlated with the notion of negative externalities arising from a failure in a financial institution or from overleveraged borrowers. In mitigating systemic risk, MPP aims to reduce the frequency and severity of financial crises in the following ways ([IMF-FSB-BIS, 2016](#)):

1. "Increasing the resilience of the financial system to aggregate shocks, by building

⁸ See [Borio \(2011\)](#).

buffers that help to maintain the ability of the financial system to function effectively, even under adverse conditions;

2. Containing the build-up of systemic vulnerabilities over time (boom and bust cycles), by reducing procyclical feedback between asset prices and credit and by containing unsustainable increases in leverage, debt stocks, and volatile funding; and
3. Controlling structural vulnerabilities within the financial system that arise from interlinkages, common exposures, and individual institutions too big to fail."

In principle, macroprudential policies should be motivated by externalities and market failures arising from various financial frictions and market imperfections that exist even when microprudential supervision and monetary policy are conducted effectively. [De Nicoló et al. \(2012\)](#) identify the following externalities that can give rise to procyclicality and systemic risk: 1. Externalities related to strategic complementarities, which arise from the strategic interactions between banks and other financial institutions and agents, cause the buildup of vulnerabilities mainly in the boom period. 2. Externalities related to fire sales and credit crunches, which arise from a generalized sell-off of assets, cause a decline in asset prices, a deterioration of balance sheets of intermediaries and investors, and a drying up of financing, especially during the contractionary phase of a financial (and business) cycle. 3. Externalities related to interconnectedness, which arise from the propagation of shocks from systemic institutions or through financial markets or networks ("contagion").

MPP can pursue a narrow objective of building resilience in the financial system in a dynamic way, so that the system is better able to absorb large adverse shocks, or it can pursue the broader and bolder objective of smoothing the swings in debt and asset prices associated with the financial cycle. In practice, most countries use MPP tools for the second objective. The reason for this is the extensive evidence⁹ that the most important source of systemic risk that can lead to a banking crisis is real estate booms and busts. For example, boom and bust episodes preceded more than two-thirds of the 46 systemic banking crises for which house-price data are available ([Crowe et al., 2013](#)). [Hartmann \(2015\)](#) gives several reasons why real estate bubbles can lead to systemic risk. First, many firms and households own real estate and, moreover, construction is an important sector of the real economy. Thus, when there is a sharp downturn in real estate prices, the effects can be felt systemwide and have major implications for the real economy and social welfare. Second, construction projects and house purchases are often credit-financed and the credit is often provided by leveraged lenders. As a consequence, a sharp downturn in real estate prices can cause these borrowers to default and the cumulative effect of these defaults is exacerbated by a deleveraging process of the lenders that incur losses from the defaults. Third, real estate supply tends to adjust sluggishly and price discovery is slow (due to infrequent trading and low transparency in prices). For the above-mentioned reasons, the real estate market is in practice an area of primary application of MPP in most advanced countries.

⁹ See [Herring and Wachter \(1999\)](#) and [Reinhart and Rogoff \(2009\)](#).

An important issue is the difference between macroprudential policy and macroprudential perspective. The latter is a broader term as it includes all types of policies (monetary, fiscal, microprudential, and structural) that interact with macroprudential policy to facilitate financial sector stability. Section 5.1 discusses the coordination between monetary policy and macroprudential policy. Regarding fiscal policy, taxes can contribute to systemic risk when they encourage leveraging (e.g., when interest payments are tax deductible). Moreover, real estate taxes can affect housing prices, making tax policies relevant to financial stability. Therefore, coordination between fiscal policy and macroprudential policy may be needed. Regarding microprudential policy, it may seek to retain or tighten regulatory requirements in bad times in order to protect the interest of depositors of individual banks or investors, whereas macroprudential policy may suggest relaxing such requirements. Therefore, coordination between microprudential policy and macroprudential policy may be needed. Regarding structural policy, a very high loan-to-value ratio is likely to increase the incidence of real estate booms. Even when set optimally from a microprudential perspective, capital requirements can increase overall procyclicality (Repullo and Suarez, 2012).

3. THE MACROPRUDENTIAL TOOLKIT

MPP has become increasingly popular since the GFC, but putting policy into practice has largely been a learning-by-doing process, given the lack of quantitative models that provide market-failure arguments to justify policy intervention and that facilitate the design and development of MPP tools.¹⁰ Experience suggests that a broad range of tools to address potential vulnerabilities of the financial system to systemic risk may be needed to attain MPP objectives (IMF (2013), IMF (2014)). The MPP toolkit available in principle is quite large, in part because it includes existing microprudential tools as well as new ones. It consists of two sets of tools (Claessens et al. (2013), De Nicoló et al. (2012)).^{11,12}

1. Financial institution-based tools: These include: (1) liquidity-related tools that aim primarily at addressing the buildup of liquidity and foreign- exchange risks associated with lending booms, such as reserve requirements and the Basel III liquidity coverage ratio (LCR); (2) capital tools, such as dynamic provisioning requirements,

¹⁰ See Mendoza (2016).

¹¹ As noted, many of the measures are tools traditionally used for microprudential objectives. However, by making them vary by time, institution, or global situation, they can be adapted to achieve MPP objectives.

¹² Some papers categorize macroprudential tools differently. For example, Lim et al. (2011) divide them into credit-related tools (e.g., caps on LTV ratios, DTI ratios, credit growth), liquidity-related tools (e.g., limits on reserve requirements, maturity mismatches), and capital-related tools (countercyclical/time-varying capital requirements, time-varying/dynamic provisioning). Other papers, such as Cerutti et al. (2015), consider tax policy as part of the MPP toolkit, but that topic is beyond the scope of this paper.

countercyclical capital buffers, and time-varying leverage ratio caps; and (3) repeated macro-supervisory stress tests that evaluate resilience to prospective vulnerability scenarios and recommend restrictions on institutions. These tools aim primarily at increasing resilience in order to help to maintain the supply of credit in adverse conditions; however, some of these tools can also have a moderating effect on credit in buoyant times (see Objectives 1 and 3 in Section 2).

2. Borrower/asset-based tools: Due to the systemic importance of the real estate sector, MPP offers many tools targeted specifically at addressing risks of booms and busts in the real estate sector, such as time-varying caps/limits/rules on the loan-to-value (LTV) ratio, the debt-to-income (DTI) ratio, and the loan-to-income (LTI) ratio. These tools can be expected to be more effective in fighting house price inflation and credit growth, while exercising only an indirect effect on the resilience of financial intermediaries. Such tools increase the resilience of both borrowers and lenders to asset price shocks, and decrease loan demand and hence credit growth and households' expectation of increased home prices. In particular, LTI and DTI increase borrowers' resilience to interest-rate and income shocks and, therefore, indirectly increase the resilience of lenders. Borrower/asset-based tools are often targeted at mortgages, but can also be applied to other segments, including credit cards, commercial property, and leveraged loans to the corporate sector. These tools have been found to have a relatively strong impact on the volume of credit, thereby helping to moderate procyclical feedback between asset prices and credit (see Objective 2 in Section 2).

The choice of a specific macroprudential policy, including its extensive margin (whether to use a specific tool) and its intensive margin (how much to use the tool), varies with the degree of amplification in the financial and real sector cycles, exposure to systemic risks, and the effectiveness of the policy. Thus, many dimensions come into play in adopting a policy, including an economy's structural, institutional, and financial-market characteristics (Claessens, 2015).

The GFC prompted an increasing number of countries to implement macroprudential policies, and with greater frequency. Information on the actual use of macroprudential policies is limited, partly because their use is not always clearly identified. Cerutti et al. (2015) find that of the 189 countries that are IMF members, a majority of 119 of them use MPP tools. According to MPP regulators, MPP tools are less blunt than monetary tools, and more flexible than most fiscal tools. In order to limit the cost of policy intervention, many MPP tools (e.g., caps on: LTV, DTI, foreign-currency lending, and capital-risk weights) can be tailored to the risks faced by specific sectors or loan portfolios without reducing economic activity. LTV ratios are the most widely used MPP tool, followed by DTI and leverage ratios for banks. In advanced countries, LTV and DTI ratios are the most often used MPP tools¹³ (perhaps out of

¹³ At the other end of the spectrum is the countercyclical capital buffer, which has been used by only 6 countries to date. This is surprising given that it is the only tool that has a well-defined

concern for excessive leverage and due to their developed financial systems, which offer various alternative sources of finance). Emerging market economies use more MPP tools and for longer periods of time than advanced economies do, and tend to favor foreign-exchange and liquidity-related tools, perhaps due to their concern over large and volatile capital flows and related systemic risks. Also, emerging markets have higher exposure to external shocks, including from volatile capital flows, and they have more imperfect financial systems with more “market failures.” Table 1 shows the results of the survey of the 119 IMF member countries that use MPP tools, as reported in Cerutti et al. (2015).

According to survey data, MPP regulators indicate that they choose instruments that are easy to implement, effective, and result in minimal market distortions. They consider it necessary that the choice of macroprudential instruments be consistent with other public policy objectives, be they fiscal, monetary, or prudential. The regulators also believe it is important to choose macroprudential instruments that minimize regulatory arbitrage. This latter criterion is especially relevant in advanced economies with large non-bank financial sectors and complex and highly interconnected financial systems.

Table 1
Overall Use of Macroprudential Instruments

Type of Instrument	Total Countries	Advanced	Emerging Markets	Developing	Open	Closed
Loan-to-Value Ratio	21%	40%	20%	6%	29%	14%
Debt-to-Income Ratio	15%	13%	21%	0%	19%	12%
Dynamic Loan- Loss Provisioning	9%	5%	6%	19%	5%	11%
Countercyclical Capital Buffer	2%	1%	3%	1%	0%	3%
Leverage Ratio for Banks	15%	13%	17%	12%	28%	8%
Foreign Currency Loans	14%	9%	16%	13%	10%	16%
Reserve Requirement Ratios	1%	0%	24%	33%	4%	32%

Notes: Countries are classified into advanced versus emerging countries (source: IMF World Economic Outlook, April 2014). The frequency of use is the ratio of country-year pairs using a particular instrument to the total number of country- year pairs using a macroprudential instrument in the sample period 2000–2013.

The LTV ratio is defined as the subset of LTV measures used as a strict cap on new loans, as opposed to LTV-based risk weights that is classified as reserve requirement ratios. Financial openness is calculated using the updated version of the dataset constructed by Lane and Milesi-Ferretti (2007). A country is categorized as financially open if its median openness score over 2000-2011 is greater than the median of the median score for all countries in the sample, otherwise it is categorized as financially closed.

Source: IMF Survey as reported in Cerutti et al. (2015).

operating framework internationally and that includes jurisdictional reciprocity. A potential explanation is that the Basel guidelines suggest that the buffer should be activated when excess credit growth threatens an increase in system-wide risk, while the majority of advanced economies have not come close to experiencing aggregate credit booms in the post-crisis period.

a. The LTV Limit as an MPP Tool

The LTV (loan-to-value) ratio is defined as the ratio of the loan amount to the value of the collateral dwelling. Limiting LTV ratios can help to reduce financial accelerator mechanisms that otherwise lead to positive two-way feedback between credit and housing prices.¹⁴ IMF (2011a) shows that limiting LTV ratios in a boom can restrict the amount of credit extended to a borrower (and expand it in a downturn), thereby tempering procyclical feedback between credit and housing prices.¹⁵ LTV limits thus guarantee that borrowers have “skin in the game” when taking out a mortgage loan, and prevent buyers without savings from borrowing for a housing purchase. In the interest of financial stability, LTV limits attempt to reduce default rates and dampen bank leverage without affecting other sectors of the economy. For these reasons, LTV limits are by far the most commonly used MPP tool.¹⁶

LTV limits are also popular because they can be targeted at specific groups. For example, Lim et al. (2011) show that some countries implement LTV limits based on whether or not a property is located in a real-estate investment zone. Others differentiate LTV limits according to the currency in which the loan is denominated. Crowe et al. (2013) argue that the narrower focus of LTV limits reduces their overall costs. However, the narrow-target nature of LTV ratios may also increase political-economy obstacles, particularly since the groups influenced by LTV limits tend to be those that are in greater need of credit, i.e., low-income and younger borrowers. Further, some politicians are keen to make home ownership easier for the public, who are also voters. For these reasons, MPP tools to restrict housing credit may be more difficult to implement from a political-economy standpoint (See Section 7.4).

4. THE EFFECTIVENESS OF MPP TOOLS

Theoretical work on MPP has burgeoned in recent years. Two approaches can be broadly identified in the literature. One highlights that individual price-taking agents tend to “over-borrow” without internalizing the full general-equilibrium impact of their decisions, and shows how MPP can induce agents to internalize such a negative externality.¹⁷ The second approach focuses on the role of MPP in dampening procyclicality caused by financial

¹⁴ Theoretical research argues that endogenous developments in financial markets can greatly amplify the effects of small income shocks throughout the economy (e.g., Bernanke et al., 1996, 1999). This amplification mechanism is often referred to as the “financial accelerator”. The key idea behind the financial accelerator is that shocks to the net worth of households have a procyclical effect on households’ borrowing capacity. Almeida et al. (2006) find evidence that LTV limits have an effect on the financial accelerator mechanism and that housing prices are more sensitive to aggregate income shocks in countries with higher maximum LTV ratios.

¹⁵ These mechanics are at work in many theoretical models; see, e.g., Allen and Carletti (2013).

¹⁶ See Cerutti et al. (2015), Darbar and Wu (2015) and Section 4b of the present paper.

¹⁷ For some examples, see Jeanne et al. (2014).

frictions and in mitigating the cyclical effect of macroeconomic shocks.¹⁸ While in the theoretical literature it is assumed that MPP tools meet their objectives effectively, in practice this is still an unsettled issue.

Empirical evidence on the effectiveness of MPP tools is still inconclusive. More work is needed in order to identify which tools are the most suitable for mitigating financial-system vulnerabilities. The empirical literature on MPP can be divided into macro- and micro-econometric studies. The first group includes cross-country studies using macroeconomic data to analyze the link between MPP, credit growth, and other financial indicators.¹⁹ The second group of studies – nascent but growing in number – is largely characterized by the use of micro-level evidence such as bank-level and credit registry data.

This section is divided into two subsections. The first focuses on the effect of MPP on lenders (mostly banks) in the financial sector and the second focuses on the effect of MPP on the credit and housing markets.

a. MPP and the Financial Sector: Existing Studies

Banking crises often occur after periods of strong bank credit growth. Due to their negative real-economy effects, they have generated broad agreement among academics and policy makers that financial policy has to acquire a macroprudential dimension. This was certainly the case after the GFC, when almost one-third of the world's advanced countries experienced credit booms (Dell'Ariccia et al. 2012). During this period, policy makers in most of those countries were in broad agreement that financial policy had to acquire a macroprudential dimension and accordingly employed MPP to contain credit expansion and financial sector risks. Their main target was to increase the resilience of the financial system to aggregate shocks by building buffers, while reducing common exposures across financial institutions.

Despite the popularity of MPP, it remains an open question whether MPP is effective in lowering the risk faced by the financial system, mainly because of measuring issues, data availability, and historical experience. As mentioned, most of the MPP literature consists of cross-country studies, where identification is difficult to achieve.²⁰ For example, Tovar Mora et al. (2012) focus on six Latin American countries and show that MPP in general and reserve requirements in particular had a moderate but transitory impact on private bank credit growth. Akinci and Olmstead-Rumsey (2018) and Dell'Ariccia et al. (2012) obtain similar results.

¹⁸ For some examples, see Angeloni and Faia (2013).

¹⁹ An important part of this work is based on the dataset presented by Lim et al. (2011). More recent papers have updated the existing databases or have created new ones in order to test the robustness of previous results, e.g., Kuttner and Shim (2016).

²⁰ The main empirical issue is endogeneity due to the fact that those MPP tools are implemented in response to a sharp increase in credit growth, and almost all of them face challenges in controlling for country characteristics.

To the best of my knowledge, only a handful of papers examine the effect of MPP on the financial system using micro-level data. Claessens et al. (2013) use micro-level data from 2,800 banks in 48 advanced and emerging economies for the period from 2000 to 2010. They find that caps on financial institutions' asset and liability-based measures were effective in reducing growth in assets. They also find that MPP tools aimed at borrowers (LTV and DTI ratios) were effective in reducing growth in bank leverage and in asset and non-core-to-core liabilities growth during booms, and that a few MPP tools helped to stop declines in bank leverage and assets during downturns. Acharya et al. (2017) use loan- and security-level data and find that, in response to macroprudential policy, banks increased their risk-taking in both corporate credit and holdings of securities and reduced the rate charged to high-income households that leveraged up by buying expensive properties. The advantage of using micro-level data is not only that it is possible to control for more characteristics driving balance sheet behavior, but also that there is less cause for concern about endogeneity since MPP tools are adopted in response to aggregate bank behavior more than in response to individual bank behavior.

Among the more recent studies using credit registry data, Epure et al. (2018) analyze the effects of MPP on local bank credit growth in Romania. They find that tighter MPP conditions were associated with a stronger decline in the volume of household credit for (riskier) foreign versus local currency loans. In addition, the mitigating effects of MPP on FX credit growth were more effective for ex-ante riskier borrowers. Using credit registry data to examine similar questions, Aguirre and Repetto (2017) assess the impact of two types of MPP tools on credit growth: one that was based on capital buffers and one that limited the global foreign currency position of financial institutions in Argentina. They find that both MPP tools had a significant effect on credit growth at the firm-bank level, but that there were differences between their short- and long-term effects. While both types of MPP tools were associated with lower credit growth, both initially and in the long term, the currency-based measures appear to have had a quantitatively more significant effect than the capital-based ones.

The main conclusion of this review of the literature on the effect of MPP on the financial sector is that MPP is quite effective in stabilizing financial institutions (in particular, banks) and that it helps to curb declines in bank assets and leverage during downturns and thus contributes to the stability of the financial system.

b. The Effect of MPP on the Housing and Credit Markets

Real estate is an important depository of wealth in an economy.^{21,22} The real estate asset class is different from other asset classes: the vast majority of home purchases and commercial real estate transactions in advanced economies involve borrowing. Moreover, home buyers are

²¹ See Crowe et al. (2013) and Guiso et al. (2003).

²² In Israel, for example, real estate constitutes roughly one-half of the total assets held by households (Bank of Israel Annual Report, 2016).

allowed leverage ratios that are orders of magnitude higher than those of other investment activities. A typical mortgage loan, averaged across a global sample of countries (Crowe et al., 2013), carries an LTV ratio of 71 percent. By contrast, stock market participation by individuals is hardly ever reliant on borrowed funds. In addition, the supply-side effects associated with house-price dynamics can be substantial. The construction sector takes property prices as a signal and adjusts production accordingly. Housing prices therefore have an impact on residential investment, consumption, and credit. As a consequence, boom-bust cycles are an intrinsic feature of real estate markets (Igan and Loungani, 2012).

Real estate booms and busts can have serious consequences for financial stability. Real estate booms are generally accompanied by fast credit growth and sharp increases in leverage, and when the bust comes, debt overhang and deleveraging spirals can threaten financial and macroeconomic stability. In advanced economies, recessions that coincide with a house-price bust tend to be deeper and last longer than those that do not.²³

Many countries woke up to these facts after the GFC and started to apply MPP tools to the housing market in order to lower the systemic risks arising from the high demand for housing and credit in the boom. The literature was soon to follow; the first papers to be published on the effectiveness of MPP were cross-sectional studies that used mainly aggregate data and focused on procyclicality. Among the first of these papers is Lim et al. (2011), which uses data from a survey of 49 countries conducted by the IMF in 2010. Using a panel regression analysis, the authors find that a variety of MPP tools, including reserve requirements, dynamic provisioning,²⁴ maximum LTV ratios, and maximum DTI ratios, had measurable effects on the growth rate and cyclicity of private sector credit and leverage. Crowe et al. (2013), using a cross-sectional sample of 21 (mostly) developed countries between 2000 and 2007, find that a 10 percent lowering of the LTV limit led to a decline of between 8 and 13 percentage points in the rate of house-price appreciation. The authors conclude that the LTV limit has the highest probability of curbing a real estate boom.²⁵ Duca et al. (2011) obtain similar results for first-time home buyers (the marginal group most likely to be affected by down-payment constraints) in the US between 1979 and 2007. Kuttner and Shim (2016) use data from 60 countries over a period dating back to 1980 and find that housing credit growth was significantly affected by changes in the maximum DTI and LTV ratios, with a typical policy tightening slowing housing credit growth by roughly 4 to 7 percentage points over the following four quarters. McDonald (2018) finds that the lowering of LTV and DTI limits was more effective when credit was expanding quickly or when housing prices were high relative to income.

²³ See Crowe et al. (2013).

²⁴ Dynamic provisions – called “dynamic” as they vary over the cycle – are forward-looking: Before any credit loss is recognized on an individual loan, a buffer is built up from retained profits in good times to cover the realized losses in bad times.

²⁵ Kelly et al. (2018) obtain similar results.

Turning to Asia, Wong et al. (2011) show that LTV policy was effective in reducing systemic risk in Hong Kong in terms of procyclicality of credit, and argue that losses in the financial sector in the wake of the Asian crisis were limited in Hong Kong because of low LTVs. Zhang and Zoli (2016) review the use of key MPP tools in 13 Asian economies and 33 other economies since 2000 and find that measures helped to curb house-price growth, credit growth, and bank leverage. Ahuja and Nabar (2011) use data on 49 emerging and advanced economies and find that LTV limits slowed house-price growth. In their case study of Hong Kong SAR in the same paper, they find that lowering LTV limits reduced both transaction volumes and house-price growth, albeit with a lag. However, there are major drawbacks to these cross-country studies.

The main empirical drawback of cross-country studies is endogeneity due to the feedback loop between mortgage credit availability and house-price movements. Another drawback is the difficulty of controlling for country characteristics, including the quality of MPP supervision. As a consequence, few cross-country studies consider both the use and the intensity of a policy (i.e., the presence of LTV and its level, whether set high or low) or differentiate between the phases of the financial cycle. Moreover, in many countries there is no data available for multiple points in time.

Due to the econometric challenges faced by cross-country studies, more recent studies are using micro-level data (mainly single-country case studies) to measure the impact of specific MPP tools. These studies use information at the household level or at the loan level to exploit variation across borrowers (or lenders) and thus go beyond the correlation between MPP tools and credit and housing market developments in order to assess the causal impact of these tools.

The first paper from this set of studies is that of Igan and Kang (2011). Using data on housing tenure and mortgage decisions in South Korea from 2001 to 2009, they examine the impact of LTV and DTI limits on house-price dynamics, residential real estate market activity, and household leverage. They find that transaction activity dropped significantly by 16 percent for LTV limits and 21 percent for DTI limits in the three-month period following the tightening of LTV/DTI regulations. House-price appreciation slowed down a bit later, in a six-month period rather than a three-month period, but more so after LTV tightening than after DTI tightening. They find a stronger effect among older households and investors (contrary to the criticism that MPP may crowd out the lower-income population from the credit market). Their findings suggest that tighter limits on loan eligibility criteria, especially on the LTV ratio, helped to curb expectations and real-estate investors' incentives. Similar results are obtained by Krznar and Morsink (2014), who show that a one percentage point reduction in the maximum LTV ratio lowered annual mortgage credit growth by about one-quarter to one-half of a percentage point. They also find LTV ratios, DTI ratios, and risk weights to have been effective in containing house-price growth.

Micro-level data are traditionally obtained only from regulated financial entities that are under the supervision of the financial authorities. Although micro-level data usually cover a

significant share of the entire financial system,²⁶ they do not include data from unregulated financial entities or commercial companies. To fill this gap, the regulatory perimeter for information gathering has been significantly expanded over time. Particular attention has been devoted to exploiting data from credit bureaus, which comprise information on the behavior of individual debtors of regulated as well as unregulated lenders.²⁷

Among this recent set of papers using credit registry data is Jiménez et al. (2017), which examines the impact of a countercyclical MPP (i.e., dynamic provisioning) on credit supply during a business cycle in Spain. The authors find that dynamic provisioning was useful in taming credit-supply cycles, even though it did not suffice to stop the boom. More importantly, they find that during recessions, dynamic provisioning helped to smooth the downturn by upholding firm credit availability and performance. Another study that uses credit registry data is Gambacorta and Murcia (2017), which examines the MPP experience of several Latin American countries (Brazil, Colombia, Mexico and Peru). The authors find that MPP tools were quite effective in stabilizing credit cycles, and that they had a greater effect on credit growth when monetary policy was pushing in the same direction. De Araujo et al. (2016) use credit registry data to examine the effect of (strict) LTV limits in Brazil. They find evidence suggesting that borrowers who were constrained by the LTV limit purchased more affordable homes, defaulted less, and settled on housing loan contracts with less favorable terms, that is, higher interest rates and lower maturity. A possible explanation of these results is that the macroprudential supervisor signaled excessive risks and a buildup of systemic vulnerability in the specific segment of the population targeted by the regulation.

Overall, MPP tools appear to achieve the objective of curbing real estate prices,²⁸ and leverage, and, to a more conclusive degree, credit growth. MPP tools attack the problem at its source, adapt to different circumstances in different locations at different times, and increase the resilience of borrowers and lenders (Crowe et al., 2013). In summary, MPP tools lower the probability of booms and busts in the housing and credit markets, and thus increase financial and macroeconomic stability.

5. DILEMMAS OF INSTITUTIONAL DESIGN: WHICH REGULATORY ENTITY SHOULD CONTROL AND OPERATE MPP?

MPP needs a strong institutional framework in order to work effectively. Institutional arrangements need to suit country-specific circumstances and institutional backgrounds. Considerable differences across countries suggest that there is no “one-size-fits-all” approach. The framework needs to enable regulators to act in the face of evolving systemic

²⁶ In Israel, for example, the Bank of Israel data on credit to households is only 93% complete.

²⁷ See “Central Bank Statistics: Moving beyond the Aggregates,” Eighth European Central Bank Conference, July 2016.

²⁸ However, there are studies that do not find empirical support for the effect of MPP on housing prices; see, e.g., Vandenbussche et al. (2015).

threats, facilitate access to information, and offer an appropriate range and reach of MPP tools (Jácome et al., 2011). In practice, there is an increasing prevalence of models that assign the main MPP mandate to a well-identified authority, committee, or interagency body. The three most common models for implementing MPP are the following (De Nicoló et al. (2012); IMF-FSB-BIS (2016); see also Table 2 of the present paper):

- Model 1: The MPP mandate is assigned to the central bank, with MPP decisions ultimately being made by its governor.²⁹ This model, in which the relevant regulatory and supervisory powers are already concentrated in the central bank, is the prevalent choice.
- Model 2: The MPP mandate is assigned to a dedicated committee within the central bank structure. For example, the Bank of England set up a Financial Stability Committee, separate from the Monetary Policy Committee within the central bank structure. This setup creates distinct sets of objectives and decision-making structures for monetary and macroprudential policies, while having both policy committees under one roof of the central bank can help to mitigate the potential risks of dual mandates (De Nicoló et al., 2012).
- Model 3: The MPP mandate is assigned to a committee outside the central bank, with the participation of the central bank. In Chile, for example, the monetary and financial authorities are separate entities, and in France the governor of the central bank chairs the body that coordinates between the bank and its external committees. This model allows for a stronger role of the finance ministry in MPP decisions, and can thus be useful in creating political legitimacy and enabling MPP decision makers to consider policy choices in other fields (for example, those of the fiscal authority).

There is no single answer to which model is the most effective one. In many countries, the central bank plays an important role, on account of its expertise, incentives to take action, and independence (Jácome et al. (2011), IMF (2012), IMF (2013)).

Regardless of the model used to implement MPP, the institutional framework should be strong enough to counter political pressure and opposition from the financial sector and to establish the legitimacy and accountability of MPP. It has been found that a strong institutional framework ensures that policy makers can obtain information from other authorities, influences the activation and calibration of regulatory constraints, contributes to the designation of individual institutions as systemically important, and initiates changes in the regulatory perimeter to capture financial institutions whose activities may give rise to financial stability risks (IMF, 2011b). Finally, in order to successfully carry out macroprudential policy, the institutional framework should be one in which the MPP authority is sufficiently empowered to identify risks to financial stability, to act on these risks, to interact productively with the microprudential and monetary policy authorities, and to duly weigh the costs and benefits of proposed actions (Kohn, 2014).

²⁹ The adoption of this model in Israel is discussed in Section 7.2.

Table 2
Macroprudential Policy Institutional Framework Models¹

	Central Bank Model		External Committee Model
	Model 1 (Board or Governor) ²	Model 2 (Internal Committee)	Model 3 (External Committee) ³
Countries	Argentina, Belgium, Brazil*, Cyprus, Czech Republic, Estonia*, Hong Kong SAR*, Hungary, Indonesia, Ireland, Israel, Italy*, Lebanon, Lithuania, Netherlands*, New Zealand, Norway, Portugal*, Russia, Singapore, Slovakia, and Switzerland.	Argentina, Belgium, Brazil*, Cyprus, Czech Republic, Estonia*, Hong Kong SAR*, Hungary, Indonesia, Ireland, Israel, Italy*, Lebanon, Lithuania, Netherlands*, New Zealand, Norway, Portugal*, Russia, Singapore, Slovakia, and Switzerland.	Austria (M), Chile (M), Denmark (C), France (M), Germany (M), Iceland (M), India (M), Korea (M), Malta (C), Mexico (M), Poland (C), Romania (C), Turkey (M), and the US (M).

¹ Source: IMF-FRB-BIS(2016).

² Jurisdictions with an "*" have an additional council, including insurance supervisory authorities and financial market authorities, that plays a coordinating role.

³ "(C)" or "(M)" indicates whether the council is chaired by the central bank or by a government minister (usually the minister of finance), respectively.

a. The Interaction with Monetary Policy

In the decades prior to the GFC, the macroeconomic regulatory authority assigned a strong role to monetary policy, with a primary focus on price stability. To this end, it set an inflation target and used a short-term interest rate as a tool. Prudential policies were focused narrowly on the soundness of individual financial institutions. This paradigm was successful in achieving price stability and moderation in business cycles.

Following the GFC, many countries realized that price stability did not ensure full macroeconomic stability. Credit and asset prices rapidly increased, leading to excessive real estate investment and consumption and exacerbating macroeconomic volatility. The lesson learned was that additional tools would be helpful in complementing monetary policy in countercyclical management. The use of financial regulations focused on macrofinancial risks; thus, macroprudential tools were chosen (BIS, 2018).

Monetary policy aims primarily at price stability, while macroprudential policy aims primarily at financial stability. To enhance their coordination, the central bank can take a leading role in determining macroprudential policy. In particular, it can ensure that macroprudential policy draws on the central bank's expertise in financial and macroeconomic analyses, make available data and analyses prepared by each policy field to other policy fields, and facilitate analyses of the side effects of each policy. Furthermore, by virtue of its generally

greater degree of independence, the central bank can better shield macroprudential policy from political influence compared to a separate regulatory body. On the other hand, when the central bank regulates macroprudential policy, it needs to counter the risks that monetary policy and macroprudential policy have dual objectives. Regardless of whether these two policy functions are assigned to one or two agencies, this consideration works towards setting these functions under different regulatory frameworks, with separate decision-making, accountability, and communication structures (Claessens and Kose (2018); Claessens (2013)).

Recent advances in analytical modeling offer a simple conceptual framework for policy interactions between MOP and MPP. Cecchetti and Kohler (2012) examine this interaction in general equilibrium models³⁰ with borrower collateral constraints and a banking sector and find that it is optimal for MOP to stay focused on price stability, as is commonly found to be the case in traditional models without the MPP component. In practice, MPP may not be fully effective in containing systemic risk, whether because of political considerations that may limit the use of unpopular MPP tools, the uncertainty faced by the policymaker, the economic costs of using macroprudential policy, etc. As a result, MOP may still need to respond to financial conditions.

However, MOP is not optimally suited to maintaining financial stability, and price and output stability should thus remain its primary objective. MOP alone cannot achieve financial stability because the causes of financial instability are not always related to the degree of liquidity in the system (Claessens, 2014). Therefore, when MOP is kept focused on its primary objectives, the central bank is more likely to reach those objectives and at the same time dispel public fears that MOP will be co-opted for other objectives.

In practice, MPP tools are more targeted at specific financial sector distortions and MOP tools are too blunt to be used alone against a financial shock. MOP affects the entire economy and is likely to incur substantial costs if the boom is limited to the housing market. Moreover, well-targeted MPP tools have the potential to contain the undesirable effects of MOP (IMF, 2012). Appropriate MPP tools can attenuate these side effects, thereby reducing policy dilemmas arising from implementing MOP. For example, when MOP drives up asset prices, MPP tools, such as caps on LTV ratios, can tame house-price boom-busts and this is the relevant and desirable interaction that most countries target to.

³⁰ The dominant approach to designing MOP in many central banks is to use quantitative neo-Keynesian dynamic stochastic general equilibrium (DSGE) models, typically to conduct inflation targeting with a Taylor rule for a short-term nominal interest rate (the “policy rate”). For more details, see Mendoza (2016).

6. THE UNINTENDED CONSEQUENCES OF MPP

In addition to its intended costs and benefits, MPP can have unintended side effects in the form of leakage. The term “leakage” refers to the migration of financial activity outside the scope of application and enforcement of the MPP tool, potentially undermining its effectiveness. Wherever incentives for risk-taking exist, market players not subject to MPP constraints will strive to exploit them.

To the best of my knowledge, there are three main kinds of leakage. The first is leakage from the (regulated) banking sector to the (less regulated) non-banking sector. When policies clamp down on banking activities, other institutions pick up the slack. China, for example, is now struggling with a large amount of debt in its shadow financial sector, which is unregulated and makes up close to one-third of all financing in the Chinese economy, raising significant concerns about financial stability (Braggion et al., 2017). Kim et al. (2018) find that MPP triggered a migration of leveraged lending to non-banks; thus, although MPP was effective in reducing banks’ leveraged lending activity; it is less clear whether it accomplished its broader goal of reducing the risk to the financial system. Another example can be found in Cizel et al. (2016), who use micro-level data (a BIS database) from 40 economies to show that while bank credit growth fell on average by 7.7 percentage points after the implementation of MPP, total credit growth fell on average by 4.9 percentage points. The reason was the increase in non-bank credit growth. This is called the “substitution effect”: credit provision shifts from banks to non-banks following the adoption of MPP. This effect is much stronger in advanced economies, which is in line with expectations given their more developed financial systems in which market-based finance plays a large role. Overall, the findings underline the need for such a broad approach to monitoring and addressing systemic risks, especially in advanced economies.

From a microprudential perspective, the above-mentioned leakage may be seen as acceptable as it moves risk off the balance sheets of banks that are formally insured and thereby reduces the official contingent liabilities of the lender of last resort for banks. However, from a macroprudential perspective, such leakage implies that lending activities in unregulated segments of the financial market impose enormous negative externalities on the rest of the economy: when a credit bubble shifts from banks to financial markets, and households or corporates continue to accumulate debt, macroeconomic vulnerabilities continue to rise and may result in a crisis, even if the debt is owed to investment funds or to capital markets. Similarly, when investment funds purchase illiquid debt securities while promising liquidity to end investors, debt markets become vulnerable to refinancing risks and sudden price shocks. Moreover, when the non-banking financial sector is interconnected with the formal banking sector (e.g., through credit lines), shocks in the former reverberate in the latter. As a result, our economies continue to be vulnerable to excessive booms and busts and the associated large externalities.

The second channel of leakage has to do with the limitations of the international reach of domestic macroprudential regulation. In an internationally integrated banking system, the borrowers of a given country can borrow from foreign banks, either directly or through their domestic branches. But the branches of foreign banks (unlike their domestic counterparts) are subject to domestic regulation only to a very limited extent. As a result, the borrowers of a given country can respond to a restriction in domestic MPP by transferring their business from domestically regulated institutions to foreign banks whose activity is regulated from abroad. Therefore, the policies applied by a given country to address its systemic risk can have unintended consequences in the form of risk-shifting to other countries. For example, [Aiyar et al. \(2014\)](#) show that in the United Kingdom, foreign bank branches increased their lending in the UK in response to tighter measures applied to local banks, a sign of cross-border competition and regulatory arbitrage. [Cerutti et al. \(2015\)](#) document that an increase of one standard deviation in an index of MPPs increased the ratio between cross-border and local lending by 3 percentage points, or about one-sixth of its standard deviation. This evidence of greater cross-border borrowing arising from the implementation of MPP is largely taken from advanced economies, and suggests that borrowers find it preferable to tap international alternatives than to be subject to domestic MPP. [Frost et al. \(2016\)](#) show that Dutch banks increased their local and cross-border lending in countries with tight prudential policies, and decreased such lending after the loosening of those policies. These results can be interpreted in terms of regulatory arbitrage or country risk signaling. [Avdjiev et al. \(2016\)](#) find that the tightening of MPP via loan-to-value limits and local-currency reserve requirements can lead to significant international spillovers.

The third channel of leakage has to do with implementing LTV and DTI limits when borrowers and lenders are generally quick to find ways to circumvent the restrictions. For example, [Crowe et al. \(2013\)](#) show that during the housing boom in the U.S., the practice of combining two or more loans to avoid mortgage insurance (which kicked in when the LTV limit exceeded 80 percent) became widespread. Similarly, an obvious way to get around a DTI limit would be to extend sequential loans and report the ratios separately. [Crowe et al. \(2013\)](#) find that in Hong Kong SAR, where regulators imposed maximum limits on DTI,³¹ supervisors often encountered cases where borrowers chose not to report all outstanding debt obligations, and that in South Korea, lower LTV limits for loans with a maturity of less than three years spurred a boom in loans with a maturity of three years and one day.

LTV and DTI limits aim to limit households' ability to borrow, which reduces household leverage and slows house-price appreciation, which in turn stabilizes the financial system. However, if borrowers find ways to bypass those limits, they put themselves at risk and increase the probability of default and debt resolution during busts. According to this view, collateralized borrowing leads to externalities because individual borrowers do not internalize that increasing leverage during good times will force them into greater

³¹ This took into account the payments the borrower had to make on non-mortgage loans as well.

deleveraging during bad times when they fire-sell assets, thereby exacerbating downturns (Aiyar et al., 2014). From a macroprudential perspective, if all banks need to sell at the same time part of their secured assets, it might cause an even greater decrease in house prices, which will put them in higher risk than the risk in their own individual balance sheets (microprudential perspective).³²

A related, but distinct, mechanism through which financial frictions can affect the wider economy is through aggregate demand externalities. In Korinek and Simsek (2016), credit-constrained households de-lever sharply when an adverse shock hits. If the shock is large enough, the resulting fall in aggregate demand can push the economy into a liquidity trap with interest rates constrained at the effective lower bound. In this environment, MPP that slows the build-up of household leverage ex-ante can be welfare-improving in avoiding this outcome.³³

There are some lessons to be drawn from the evidence presented here on the unintended consequences of MPP. First, while MPP mitigates banking sector risks, there is a need to extend its scope beyond banking to any type of financial intermediation. Second, MPP tools similar to those applied to domestic banks should be applied to foreign banks with domestic branches. In the UK, for example, where there is evidence of leakage of capital requirements, LTV and DTI limits could be applied even to foreign banks with domestic branches (BOE Financial Stability Report, 2011). Finally, to counter consumer credit leakage (due to an LTV limit), the macroprudential supervisor could coordinate with the consumer protection agency to receive information on the total loan amount of the borrower (Claessens, 2015).

7. THE IMPLEMENTATION OF MPP: ISRAEL AS A CASE STUDY

Israel's case study in implementing MPP is interesting for four main reasons: first, Israel has quite a lot of experience in MPP, relative to other advanced economies, with a diversified set of MPP tools and long history of using them. Second, the Bank of Israel has detailed loan-level data on the housing and credit markets, which helps to examine more accurately the effect of the MPP tools implemented here. Third, in Israel MPP are coordinated by the central

³² In the GFC, highly-levered banks were forced to sell illiquid assets at highly discounted prices. This, in turn, lowered valuations further and tightened constraints for other banks. This contributed to the depth and duration of the economic downturn (Brunnermeier, 2009). While this fire-sale mechanism applies most directly to financial intermediaries, a similar dynamic can operate if there are forced sales by owners of real estate who are credit-constrained borrowers. This, too, can drive prices lower in a feedback loop.

³³ The case for MPP interventions to address build-ups in leverage is documented in Mian and Sufi (2010), who argue that the persistence of the decline in US GDP after the crisis was caused by excessive household leverage. Jordà et al. (2013) report that credit booms not only increase the likelihood and severity of financial crises, but also make normal recessions more painful. Bunn and Rostom (2015) find that more highly indebted groups of households made larger cuts in spending following the financial crisis.

bank (see Model 1 in Section 5) and coordination between MOP and MPP requires some caution and poses a significant challenge, as it may highlight weaknesses in the monetary transmission mechanism. Other countries have been dealing with similar issues regarding implementation of MPP and interact with MOP and can learn from the Israeli experience. Fourth, the implementation of MPP in Israel generated a public controversy over some of the policies implemented. In the rest of this section I will describe how Israel chose to deal with those issues.

a. The Credit and Housing Markets in Israel

Following are a few facts about the Israeli housing and credit markets:

1. Israeli households are not highly leveraged. The ratio of total household debt to gross domestic product in Israel is 42 percent, which is low compared to other developed economies (92 percent in the UK and 89 percent in the US on average between 2006 and 2013). The Israeli household debt-to-income ratio is lower than that of Germany, which is the lowest among the major economies, and far below that of the United States. Further, LTV ratios on mortgages in Israel are low³⁴ compared to other developed economies, averaging about 53 percent, following recent changes in regulations, and no one can obtain a mortgage with an LTV ratio of more than 75 percent. Most mortgages have an LTV ratio of 60 percent or less.
2. Mortgages in Israel are recourse loans; therefore, in the event of nonpayment, the lender can seek to attach other assets of the borrower in addition to the dwelling itself.
3. The government's role in housing finance is more limited than in most other countries and it provides almost no upfront subsidies to first-time or other buyers.³⁵ On the tax side, the interest rate paid on mortgages is not tax deductible in Israel.³⁶
4. Over 93 percent of all mortgage loans in Israel are made by banks. The rest are insignificant and come mostly from insurance companies. The mortgage industry is highly concentrated, with the four largest banks controlling over 85 percent of the mortgage market. However, compared to other segments of the banking sector, it is considered highly competitive.
5. Default rates have historically been, and continue to be, extremely low.³⁷
6. The home ownership ratio in Israel is close to 70 percent, and is higher than the average home ownership rate in OECD countries (63 percent).

³⁴ For further discussion, see Cerutti et al. (2015).

³⁵ The government's share of the mortgage market in Israel is less than 2 percent.

³⁶ According to Cukierman (1975), until the end of the sixties, a homeowner who lived in his own home had to impute to his income for tax purposes the value of the services he got from the dwelling. Against this income, he was allowed to charge interest and indexation expenses from any mortgage used to finance the house. In practice, most such homeowners did not impute the value of the housing services and did not claim the interest expenses.

³⁷ Between 1 and 2 percent on average in the last 10 years. Source: Bank of Israel.

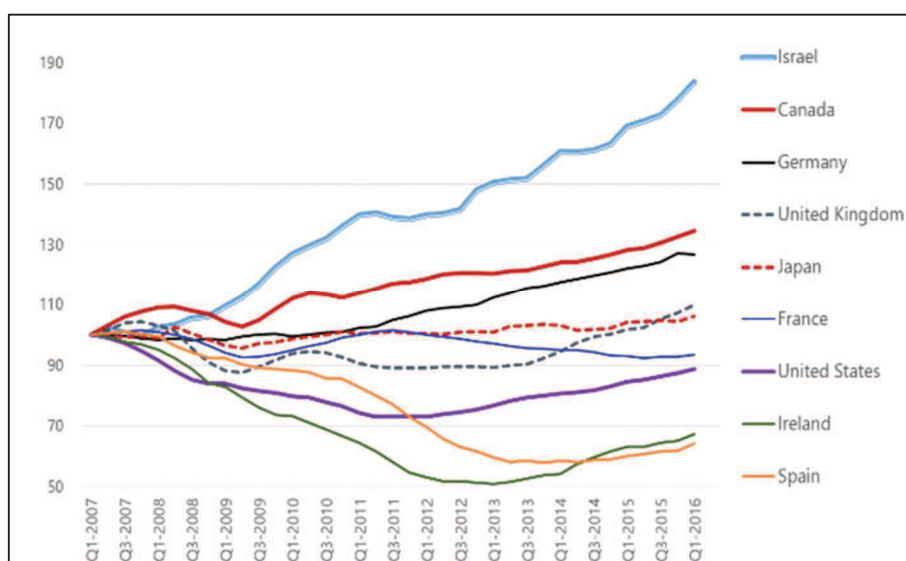
7. Housing supply in Israel is particularly slow in reacting to changes as a result of government ownership and control of most of the land, a centralized planning process, and an extensive bureaucracy at all stages of construction.³⁸ The time that elapses between the moment when the Israel Land Authority (ILA) decides to zone land for development and the moment when the building permit is granted is estimated at 11 years (Bank of Israel Annual Report for 2014). As a result, positive demand shocks tend to have large price effects.

The Israeli financial system weathered the GFC relatively well and came out unscathed. Several factors helped to mitigate the effect of the GFC, including the timing of the crisis, which followed five years of rapid growth, and certain features of the economy and the financial system, such as a conservative banking system that is subject to tight regulation, a conservative mortgage market, and the virtual absence of complex structural assets. Another contributory factor was the conservative conduct of households that maintained a high rate of savings. These factors also helped to prevent the development of overleveraging and a real estate bubble in Israel during the years prior to the crisis. Israel's financial institutions, including the banks, showed resilience relative to the intensity of the crisis, and they remained stable with none collapsing (Bank of Israel Annual Report, 2011).

Notwithstanding its favorable state of readiness for the GFC, Israel is a small open economy, which means that its domestic financial conditions cannot be disconnected from the consequences of low global interest rates. As domestic interest rates declined along with global rates, housing prices in Israel began to increase. Rising housing prices, in turn, encouraged an increase in the rate of residential construction. In Israel, the increase in the rate of residential construction was not sufficient to meet the demand for housing, and prices continued to rise. To date, nominal housing prices have risen by 128 percent since 2007, and real housing prices have risen by 95 percent (see Figure 1 for an international comparison³⁹). Rents have gone up 52 percent in nominal terms and 34 percent in real terms. At the same time, the volume of mortgages has increased by 95 percent, raising concerns among policy makers.

³⁸ See Bank of Israel Annual Report for 2012 and Gruber (2014).

³⁹ Between 2000-2007, there was a decline in house prices in Israel and an increase in house prices in most of the countries shown in Figure 1.

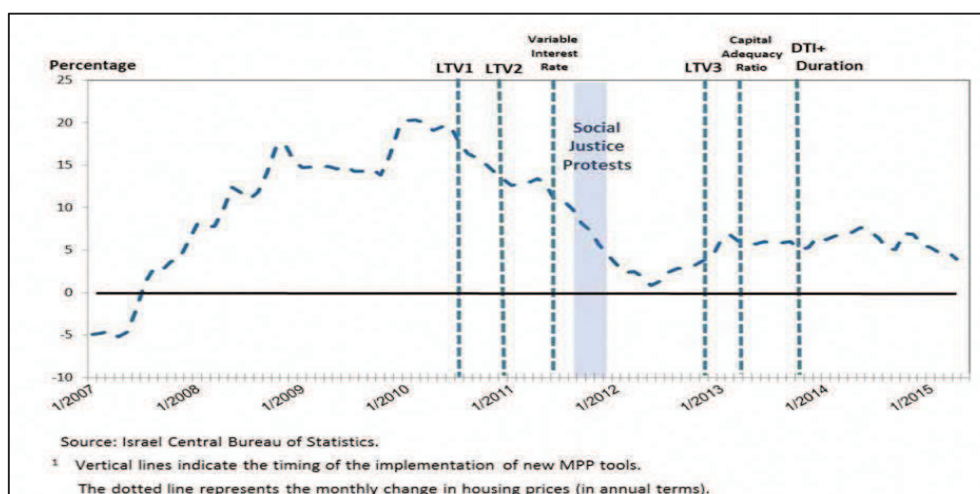
Figure 1**Housing prices: Various countries, Index of real housing prices: 2007–16**

Housing prices rose particularly fast between 2009 and 2010, at 18.6% annually. Therefore, in the middle of 2010, the Israeli Supervisor of Banks announced the first of a series of MPP tools designed to reduce the exposure of banks to highly leveraged borrowers and to limit the housing credit cycle (see Table 3). At the same time, the Bank of Israel began to tighten MOP by successively raising the interest rate to ensure that inflation remained within its target as the economy rebounded from the trough of 2009. Thus, both MPP and MOP actions moved in a common restrictive direction. In May 2011, the Bank of Israel limited the portion of a mortgage that could be financed through a variable interest rate component to one-third of the financing of any loan. It is possible that this last MPP tool was intended to accompany the direction change in the policy rate, showing the interaction between MOP and MPP (Baudot-Trajtenberg et al., 2017). The change of direction came in June 2011, when the Bank of Israel started to gradually lower interest rates from 3.25% to 0.1% in early 2015. This level has been maintained until the end of 2018. In order to break the transmission mechanism between MOP and the housing market, additional MPP tools were implemented (see Table 3, MPP4-MPP7). As Table 3 shows, Israel has quite a lot of experience in MPP. It has a diversified set of tools and uses combinations of tools simultaneously. These tools can target specific groups (such as real-estate investors). They were intended, among other things, to increase the public's awareness of the risks inherent in the various mortgage options and they were gradually intensified.

Figure 2 shows the rate of change in housing prices in Israel and, in vertical lines, the timing of the implementation of various MPP. The lessons being learned from the crisis both in Israel and worldwide are still ongoing, though some conclusions have already been drawn and are reflected in recent legislation, regulation, and the conduct of MPP authorities.

Table 3
List of MPP Tools Implemented in Israel

	Date	Type of MPP	Intended impact on supply and demand for housing credit	Monetary policy decision (announced on same day as MPP decision)
MPP 1	May 2010	Banks required to make additional provisions (0.75%) for housing loans with a high LTV ratio (LTV>60%)	Raises cost of lending for higher LTV mortgages	Policy rate raised
MPP 2	Oct. 2010	Higher capital provision (100% of RWA instead of 35% – 75%) for floating rate loans granted with a high LTV ratio (LTV>60% AND % of variable rate loans>25), for housing loans above 800,000 NIS	Raises cost of lending for higher LTV mortgage and variable rate loans	Policy rate raised
MPP 3	May 2011	Limit on the variable-rate portion of a loan for which the rate could change within less than five years to 33.33% of the total loan	Raises cost of borrowing since variable rate<fixed rate	Policy rate peaks in June 2011
MPP 4	Nov. 2012	Limit on the LTV to 75% for first-time buyers, 50% for investors and, 70% for upgrading homes	Reduces the demand for mortgages	Policy rate reduced
MPP 5	Feb. 2013	Risk weights for capital adequacy requirements raised: those with 45%<LTV<60% rised to 50%; and 60%<LTV<75% are weighted at 75%.	Raises the cost of lending for all loans where LTV>45%	Policy rate reduced
MPP 6	Aug. 2013	PTI limited to 50% of HH net income, risk weights for capital adequacy requirements on PTI>40% raised to 100%, share of variable-rate loans limited to two-thirds for all loan periods, loan period limited to 30 years	Reduces demand for mortgages and raises cost of lending and borrowing	Policy rate reduced
MPP 7	Sep. 2014	Additional Tier 1 capital requirement equal to 1% of total outstanding housing credit portfolio. Gradual implementation with final target to be reached by 1 January 2017	Raises cost of lending	Policy rate reduced

Figure 2**Rate of Change in Housing Prices in Israel following Implementation of MPP Tools****b. The Bank of Israel's Rule for Setting Both MPP and MOP**

In Israel, MOP and MPP are coordinated by the central bank (see Model 1 in Section 5). In the Israeli institutional setup, banking supervision is carried out under the auspices of the central bank. The Supervisor's primary responsibility is to maintain the stability of the banking system, but one difficulty in this regard is that the Bank of Israel law⁴⁰ does not relate to MPP, which nowadays is the main policy tool being used with the purpose of maintaining stability. Therefore, the regulatory power of the central bank to conduct MPP is limited. While the classic role of the Bank of Israel in setting the interest rate independently of political control remains essential, this is not the case for MPP, which is subject to political pressure regarding the power that the central bank has, mainly in affecting housing and credit prices (Fischer, 2014).

Given the Bank of Israel's institutional setup, coordination between MOP and MPP requires some caution. MOP decisions are made by the Monetary Committee (MC) and MPP decisions are proposed by the banking supervision and approved by the Governor. Twice a year there is a special meeting of the MC devoted to financial stability, and MPP tools are recommended for the stability issues discussed in those meetings. However, the channel of coordination between the MC and the Supervisor of Banks goes through the Governor, who is both the chairman of the MC and the person to whom the Supervisor of Banks reports (Fischer et al., 2014). The fact that all MPP decisions are announced to the public within few days as

⁴⁰ The original Bank of Israel law was established in 1954. In 2010, a new Bank of Israel Law was passed, and since then the Bank has operated under the new law, which emphasizes the independence of the Bank and redefines its goals, the tools available to it, and how its decisions are made, also regarding financial stability issues.

MOP decisions (Table 3) underlines the issue of coordination between MOP and MPP. More specifically, does the central bank need MPP to support its monetary policy? In theory, the need for MPP tools during times of monetary expansion poses a significant challenge as it may highlight weaknesses in the monetary transmission mechanism. Indeed, if large liquidity injections are mostly channeled into sectors that, instead of expanding output, fuel asset price inflation and then lead to the imposition of MPP tools, the effectiveness of MOP may have to be reconsidered. Even in a country that has not undergone a major financial crisis, such as Israel, the monetary transmission mechanism may weaken both in terms of its ability to channel investment to productive uses and in terms of the time lag needed for the policy to take effect. The latter case is certainly true for the Israeli housing market, where the supply response is particularly slow owing to the many bureaucratic hurdles that need to be overcome. Still, there is a need to develop a better understanding of what the optimal interaction between MOP and MPP is, and what the limitations of MPP tools are.⁴¹

c. The Effect of MPP on the Credit and Housing Markets in Israel

The Bank of Israel has accumulated a wealth of experience in recent years with MPP tools; however, the effectiveness of the MPP tools is difficult to assess, particularly given that the business cycle has not gone into a downturn since implementation: unemployment continues to fall, wages are increasing, inflation is low, the interest rate remains at an all-time low, and housing prices continue to increase. One of the main questions regarding the effect of MPP tools is the counterfactual: what would have happened in the absence of these tools? There is no sure answer to that question, but Israel, like other countries, has tried to examine the effect of MPP tools on some macroeconomic variables.

Using aggregate (macro-level) data, the IMF (2014) explored the effect of MPP tools on the credit and housing markets in Israel. According to the report, MPP tools appear to have had an effect only in the six-month period following their implementation. Within this time horizon, direct measures (such as LTV and PTI restrictions) were more effective than indirect ones (caps on growth rate, capital buffers, etc.). That is, restrictions on the size and risk of mortgages were more successful than measures aimed at weakening banks' incentives to lend. In the housing market, MPP tools somewhat reduced the level of transactions, but there is no evidence that they contributed to curbing house-price inflation.

Using loan-level data, I wrote two studies on the effects of an MPP tool (the LTV limit) on the credit and housing markets. This loan-level data set enabled me to examine the effect of MPP on different segments of the population more accurately. In Tzur-Ilan (2017), I find that the LTV limit had an effect on mortgage contract terms but did not lead to credit rationing (no segment of the population has been excluded from the market). The LTV limit induced borrowers to buy cheaper and lower-quality assets and to move farther from high demand

⁴¹ See Ben-Bassat (2007), Committee on Capital Markets Regulation (2009), and Israel Securities Authority (2015).

areas to lower-quality neighborhoods. In line with Igan and Kang (2011), the study finds that older households and investors (individuals who own more than one residential property) were more affected by this LTV limit. Tzur-Ilan (2018) explores the effects of an LTV limit implemented in Israel in 2012, where the LTV limit had three different cutoffs according to the borrower's type: first-time home buyers, upgraders (individuals who must sell their first home within 18 months), or investors (individuals who own more than one residential property). This study obtains even stronger results than Tzur-Ilan (2017):⁴² investors were found to be the borrower type most affected by the LTV limit, even when controlling for their different cutoff. According to these findings, and contrary to the criticism that MPP excludes from the credit market those most in need of credit, the LTV limit was not found to discriminate against weaker segments of the population.

d. The Political and Social Challenges of MPP in Israel

A major issue, and one that is closely related to institutional design, is how MPP tools will play out in the political economy. Most governments consider housing a basic human need and politically important and therefore strive to make it widely available. As a result, governments generally support homebuilding and encourage homeownership. However, since MPP tools can cause households to delay housing purchases, the narrow-target nature of MPP tools may raise political-economy obstacles, particularly since the groups that are more affected by the MPP tools tend to be those that are in greater need of credit, i.e., low-income and younger borrowers (Claessens, 2015). In addition, unlike with MOP, the consequences of these tools are immediate and transparent. To tear down the political-economy obstacles, countries have adopted more targeted approaches in an attempt to protect more vulnerable groups and take aim at those they consider to be market-destabilizing investors.

For these reasons, in October 2010 the Bank of Israel limited the LTV ratio to 60 percent, but exempted those taking out mortgage loans below NIS 800,000. Furthermore, the LTV limit does not apply to housing loans received by those entitled to housing benefits in accordance with the criteria set by the Ministry of Housing and Construction. In a related move, in October 2012 the Bank of Israel limited the LTV ratio to 50 percent for investors and 75 percent for first-time home buyers (MPP4 in Table 3). Many other countries also let political considerations influence their choice of MPP tools. South Korea sets different LTV limits for different regions based on the extent of house-price appreciation. China and Singapore impose lower limits on second mortgages in an effort to avoid hurting first-time home buyers.

⁴² The two papers examine different LTV limits. The first examines a "soft" LTV limit (i.e., an increase in the capital requirement for loans with LTV ratios above 60 percent), and the second examines a "hard" LTV limit (i.e., the borrower is not allowed to borrow above the limit specified for each borrower type.)

8. BROADER LESSONS AND OUTSTANDING ISSUES

The literature on MPP has been growing rapidly. The literature that examines the effect of MPP on the stability of the banking system finds that MPP measures are effective in reducing growth in bank leverage, assets, and non-core-to-core liabilities growth during booms. It has also been found that MPP can reduce the growth rate of housing prices and credit, making countries less vulnerable to financial crises. However, those MPP measures come with some costs in the form of unexpected leakages and spillovers. Leakages are migrations of lending or credit activity to other institutions in the same country, while spillovers are migrations to other countries. The evidence suggests that leakages and spillovers are frequent and can be significant, but also tend to be meaningfully smaller than the direct effects of the MPP measures (Forbes, 2019). However, it is important to put the effects of leakages and spillovers in context, because they can still be meaningful when assessed relative to the size of the sector in which the risks are shifted.⁴³ Therefore, when implementing MPP measures, the MPP regulator must make sure that they do not divert risks to other, perhaps less visible, areas of the financial system. In order for the regulator to be able to do so, a coordination mechanism needs to be set up between financial regulatory authorities.

As use of these MPP tools becomes more widespread, a number of research papers have begun to analyze what works and what does not.⁴⁴ However, the MPP literature is far from being as solid as the monetary policy literature. The MPP literature, including the most recent papers, comes with many economic and econometric caveats, making it difficult to determine which policy tools to use and when to tighten or loosen them. More work is also needed in order to analyze the trade-off between social policies aimed at home ownership and the high economic costs of a housing-related financial crisis.

A remaining issue of current interest is the design of mechanisms for relaxing MPP tools already in place. Effective formulation of MPP involves an *ex ante* consideration of the conditions under which MPP tools should be relaxed (IMF, 2014). Even though some tools can be designed to allow for automatic relaxation (e.g., dynamic provisions), MPP regulators typically need to base a decision on the appropriateness, timing, and speed of any relaxation on the particular circumstances (IMF-FSB-BIS, 2016). Decisions to relax macroprudential constraints are complicated because of the need to ensure an appropriate degree of resilience against future shocks. Moreover, the experience in relaxing MPP tools is still limited and uncertainty remains over how effective this relaxation would be in times of stress. As mentioned in Section 2, much can be learned from Asian countries such as Hong Kong SAR and South Korea, which have longer histories of implementing, tightening, and relaxing MPP according to the phases of the financial cycle.

⁴³ For example, Ahnert et al. (2018).

⁴⁴ For example, Cerutti et al. (2015) and IMF-FSB-BIS (2016).

REFERENCES

- Acharya, V. V., Bergant, K., Crosignani, M., Eisert, T., and McCann, F. (2017). The anatomy of the transmission of macroprudential policies: Evidence from Ireland. In *16th International Conference on Credit Risk Evaluation, Interest Rates, Growth, and Regulation, September*, pages 28–29.
- Aguirre, H. and Repetto, G. L. (2017). Capital and currency-based macroprudential policies: an evaluation using credit registry data.
- Ahnert, T., Forbes, K., Friedrich, C., and Reinhardt, D. (2018). Macroprudential fx regulations: shifting the snowbanks of fx vulnerability? Technical report, National Bureau of Economic Research.
- Ahuja, A. and Nabar, M. (2011). Safeguarding banks and containing property booms: Cross-country evidence on macroprudential policies and lessons from Hong Kong Sar. *IMF Working Papers*, pages 1–26.
- Aiyar, S., Calomiris, C. W., and Wieladek, T. (2014). Does macro-prudential regulation leak? Evidence from a UK policy experiment. *Journal of Money, Credit and Banking*, 46(s1):181–214.
- Akinci, O. and Olmstead-Rumsey, J. (2018). How effective are macroprudential policies? An empirical investigation. *Journal of Financial Intermediation*, 33:33–57.
- Allen, F. and Carletti, E. (2013). Systemic risk from real estate and macro-prudential regulation. *International Journal of Banking, Accounting and Finance*, 5(1-2):28–48.
- Almeida, H., Campello, M., and Liu, C. (2006). The financial accelerator: Evidence from international housing markets. *Review of Finance*, 10(3):321–352.
- Angeloni, I. and Faia, E. (2013). Capital regulation and monetary policy with fragile banks. *Journal of Monetary Economics*, 60(3):311–324.
- Avdjiev, S., Koch, C., McGuire, P., and von Peter, G. (2016). International prudential policy spillovers: A global perspective.
- Baudot-Trajtenberg, N., Frayberg, R., and Tzur-Ilan, N. (2017). Assessing the impact of macroprudential tools: the case of Israel. *BIS Paper*, (94o).
- BIS (2018). Moving forward with macroprudential frameworks.
- Borio, C. (2011). Implementing the macroprudential approach to financial regulation and supervision. *The Financial Crisis and the Regulation of Finance*, pages 101–117.
- Borio, C. and Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism? *Journal of Financial stability*, 8(4):236–251.
- Braggion, F., Manconi, A., and Zhu, H. (2017). Is fintech a threat to financial stability? Evidence from peer-to-peer lending in China. *SSRN*: [https://ssrn.com/abstract, 2957411](https://ssrn.com/abstract,2957411).
- Brunnermeier, M. K. (2009). Deciphering the liquidity and credit crunch 2007–2008. *Journal of Economic Perspectives*, 23(1):77–100.
- Case, K. E. and Shiller, R. J. (1990). Forecasting prices and excess returns in the housing market. *Real Estate Economics*, 18(3):253–273.

- Cecchetti, S. G. and Kohler, M. (2012). When capital adequacy and interest rate policy are substitutes (and when they are not).
- Cerutti, E., Claessens, S., and Laeven, M. L. (2015). *The use and effectiveness of macroprudential policies: New evidence*. Number 15-61. International Monetary Fund.
- Cizel, J., Frost, J., Houben, A., and Wierst, P. (2016). *Effective macroprudential policy: Cross-sector substitution from price and quantity measures*. International Monetary Fund.
- Claessens, S. (2013). Interactions between monetary and macroprudential policies in an interconnected world. In *Bank of Thailand-IMF conference on Monetary Policy in an Interconnected World, Bangkok*, volume 31.
- Claessens, S. (2014). *An overview of macroprudential policy tools*. Number 14-214. International Monetary Fund.
- Claessens, S. (2015). Important questions for housing markets and housing policy. *Journal of Money, Credit and Banking*, 47(S1):419–421.
- Claessens, S., Ghosh, S. R., and Mihet, R. (2013). Macro-prudential policies to mitigate financial system vulnerabilities. *Journal of International Money and Finance*, 39: 153–185.
- Claessens, S. and Kose, M. A. (2018). Frontiers of macrofinancial linkages. *BIS Paper*, (95).
- Clement, P. (2010). The term 'macroprudential': origins and evolution.
- Crowe, C., Dell'Ariccia, G., Igan, D., and Rabanal, P. (2013). How to deal with real estate booms: Lessons from country experiences. *Journal of Financial Stability*, 9(3):300–319.
- Cukierman, A. (1975). Price-level-adjusted mortgages in Israel. In *New Mortgage Designs for an Inflationary Environment*. Eds. Franco Modigliani and Donald R. Lessard, *Conference Series*, number 14. Citeseer.
- Darbar, M. S. M. and Wu, M. X. (2015). *Experiences with macroprudential policy—Five case studies*. Number 15-123. International Monetary Fund.
- De Araujo, D. K. G., Barroso, J. B., Gonzalez, R. B. (2016). Loan-to-value policy and housing loans: Effects on constrained borrowers. Technical report.
- De Nicoló, M. G., Favara, G., and Ratnovski, L. (2012). *Externalities and macroprudential policy*. International Monetary Fund.
- Dell'Ariccia, G., Igan, D., and Laeven, L. U. (2012). Credit booms and lending standards: Evidence from the subprime mortgage market. *Journal of Money, Credit and Banking*, 44(2-3):367–384.
- Duca, J. V., Muellbauer, J., and Murphy, A. (2011). House prices and credit constraints: Making sense of the us experience. *The Economic Journal*, 121(552):533– 551.
- Epure, M., Mihai, I., Minoiu, C., and Peydró, J.-L. (2018). Household credit, global financial cycle, and macroprudential policies: credit register evidence from an emerging country.
- Fischer, S. (2014). Financial sector reform: How far are we. *NBER Reporter*, (3):1–8.
- Fischer, S. et al. (2014). Macroprudential policy in action: Israel. *What have we learned*, pages 87–98.

- Forbes, K. J. (2019). Macroprudential policy: What we've learned, don't know and need to do.
- Frost, J., de Haan, J., and Van Horen, N. (2016). International banking and cross-border effects of regulation: Lessons from the Netherlands.
- Galati, G. and Moessner, R. (2013). Macroprudential policy—a literature review. *Journal of Economic Surveys*, 27(5):846–878.
- Gambacorta, L. and Murcia, A. (2017). The impact of macroprudential policies and their interaction with monetary policy: an empirical analysis using credit registry data.
- Gruber, N. (2014). The Israeli housing market. *State of the Nation Report: Society, Economy and Policy*, pages 91–168.
- Guiso, L., Haliassos, M., and Jappelli, T. (2003). Household stockholding in Europe: where do we stand and where do we go? *Economic Policy*, 18(36):123–170.
- Hartmann, P. (2015). Real estate markets and macroprudential policy in Europe. *Journal of Money, Credit and Banking*, 47(S1):69–80.
- Herring, R. J. and Wachter, S. M. (1999). Real estate booms and banking busts: An international perspective. *The Wharton School Research Paper*, (99-27).
- Igan, D. and Kang, H. (2011). Do loan-to-value and debt-to-income limits work? Evidence from Korea. *IMF Working Papers*, pages 1–34.
- Igan, D. and Loungani, P. (2012). Global housing cycles.
- IMF (2011a). Macroprudential policy: An organizing framework. *Prepared by the Monetary and Capital Markets Department*.
- IMF (2011b). Macroprudential policy: An organizing framework.
- IMF (2012). The interaction of monetary and macroprudential policies. IMF (2013). Key aspects of macroprudential policy—background paper. IMF (2014). Selected issues paper on Israel. *IMF Country Report 14/48*.
- IMF-FSB-BIS (2016). Elements of effective macroprudential policies: Lessons from international experience.
- Jácome, L. I., Nier, E. W., Osinski, J., and Madrid, P. (2011). Towards effective macroprudential policy frameworks: An assessment of stylized institutional models. *IMF Working Papers*, pages 1–51.
- Jeanne, O., Korinek, A., et al. (2014). Macroprudential policy beyond banking regulation. *Financial Stability Review*, (18):163–172.
- Jiménez, G., Ongena, S., Peydró, J.-L., and Saurina, J. (2017). Macroprudential policy, countercyclical bank capital buffers, and supply: evidence from the Spanish dynamic provisioning experiments. *Journal of Political Economy*, 125(6):2126–2177.
- Kelly, R., McCann, F., and O'Toole, C. (2018). Credit conditions, macroprudential policy and house prices. *Journal of Housing Economics*, 41:153–167.

- Kim, S., Plosser, M. C., and Santos, J. A. (2018). Macroprudential policy and the revolving door of risk: Lessons from leveraged lending guidance. *Journal of Financial Intermediation*, 34:17–31.
- Kohn, D. (2014). Institutions for macroprudential regulation: The UK and the US. *On the Record*.
- Korinek, A. and Simsek, A. (2016). Liquidity trap and excessive leverage. *American Economic Review*, 106(3):699–738.
- Krznar, M. I. and Morsink, J. (2014). *With Great Power Comes Great Responsibility: Macroprudential Tools at Work in Canada*. Number 14-83. International Monetary Fund.
- Kuttner, K. N. and Shim, I. (2016). Can non-interest rate policies stabilize housing markets? evidence from a panel of 57 economies. *Journal of Financial Stability*, 26:31–44.
- Lim, C. H., Costa, A., Columba, F., Kongsamut, P., Otani, A., Saiyid, M., Wezel, T., and Wu, X. (2011). Macroprudential policy: what instruments and how to use them? lessons from country experiences. *IMF working papers*, pages 1–85.
- McDonald, C. (2018). 11 when is macroprudential policy effective? *Macroprudential Policy and Practice*, page 248.
- Mendoza, E. G. (2016). Macroprudential policy: Promise and challenges. Technical report, National Bureau of Economic Research.
- Mian, A. and Sufi, A. (2010). Household leverage and the recession of 2007–09. *IMF Economic Review*, 58(1): 74–117.
- Rajan, R. G. (2006). Has finance made the world riskier? *European Financial Management*, 12(4):499–533.
- Reinhart, C. M. and Rogoff, K. S. (2009). *This time is different: Eight centuries of financial folly*. princeton university press.
- Repullo, R. and Suarez, J. (2012). The procyclical effects of bank capital regulation. *The Review of financial studies*, 26(2):452–490.
- Tovar Mora, C. E., Garcia-Escribano, M., and Vera Martin, M. (2012). Credit growth and the effectiveness of reserve requirements and other macroprudential instruments in Latin America.
- Tzur-Ilan, N. (2017). Unintended consequences of credit constraints on housing: The case of LTV limits.
- Tzur-Ilan, N. (2018). LTV limit and borrower risk.
- Vandenbussche, J., Vogel, U., and Detragiache, E. (2015). Macroprudential policies and housing prices: a new database and empirical evidence for Central, Eastern, and Southeastern Europe. *Journal of Money, Credit and Banking*, 47(S1):343–377.
- Wong, T., Fong, T., Li, K.-f., and Choi, H. (2011). Loan-to-value ratio as a macroprudential tool- Hong Kong's experience and cross-country evidence.
- Zhang, L. and Zoli, E. (2016). Leaning against the wind: Macroprudential policy in Asia. *Journal of Asian Economics*, 42:33–52.