# Macroprudential Policies in SEACEN Economies

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The **SEACEN** Centre

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The **SEACEN** Centre

**The South East Asian Central Banks (SEACEN)**
**Research and Training Centre**

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# FOREWORD

Emerging markets' macroprudential regulatory changes in terms of risk weights, provisioning requirements and loan-to-value ratios (LTVs) occurred with respect to some specific credit sectors, such as housing loans and commercial real estate. The tightening of prudential norms made credit to targeted sectors costlier, thereby moderating the flow of credit to these sectors. There is evidence that moderation in credit flow to these sectors was also in part due to banks becoming cautious in lending to these sectors in response to the signaling effect of the Central Bank's perception of the build-up of sectoral risks.

An integrated overview of the studies undertaken by five SEACEN economies, specifically India, Malaysia, Mongolia, Nepal and Vietnam, is delineated in this report. Nepal contributed to this project but was not able to contribute an in-depth country study due to lack of data. Each study focuses on the effects of macroprudential policies on credit growth in that economy, where the analytical methods were used as per the suitability and availability of data. More specifically, the methods used to derive empirical evidence are panel-VAR models, event analyses and panel regressions with country-specific data availability. The macroprudential policies are captured using relevant control variables.

The project was led by Dr. Jugnu Ansari, Assistant Adviser, Centre for Advanced Financial Research and Learning (CAFRAL), Mumbai, India, and Visiting Research Economist at SEACEN in 2017.The project team consisted of representatives from the Reserve Bank of India, Bank Negara Malaysia, Bank of Mongolia, Nepal Rastra Bank and the State Bank of Vietnam. SEACEN wishes to express its sincere gratitude to the participating central banks for their support.

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**Hans Genberg**
Executive Director
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# EXECUTIVE SUMMARY

After the great financial crisis, financial institutions are being subjected to stronger regulatory frameworks such as macroprudential regulation pertaining to capital adequacy, liquidity and leverage. Macroprudential policy measures fall into the following three broad categories – (i) credit controls, including caps on loan-to-value (LTV) ratio and debt-to-income (DTI) ratio as well as ceilings on credit or credit growth; (ii) liquidity regulations that place limits on net open currency positions or currency mismatches and on maturity mismatches, while establishing reserve requirements; and, (iii) capital requirements, including countercyclical capital requirements, time-varying and dynamic provisioning and restrictions on profit distribution.

The policy responses taken by SEACEN member economies are heterogeneous as these economies follow a wide range of macroprudential and macroeconomic policy frameworks, ranging from inflation targeting to managed exchange rates, different degrees of financial market development, LTVs, capital requirements, provisioning as well as different degrees of macroeconomic resilience.

This paper presents an empirical framework for analysing how effective macroprudential policies control credit growth. The descriptive analysis shows that there has been significant variation in the use of macroprudential instruments in SEACEN member economies. The use of different macroprudential instruments follows very different trends over time. The application of some instruments, such as limits on credit growth, lending standard restrictions, sectoral risk weights or liquidity requirements, seems to have responded to the financial cycle or to financial crisis events. The general pattern of the evidence from SEACEN economies suggests that credit-related macroprudential policies can effectively dampen credit expansion, while liquidity-related macroprudential policy tools moderate leverage growth. In response to implementation of macroprudential policies, banks reduce loan growth following an increase in capital requirements in the targeted sector. This study finds that changes in macroprudential policies affect lending with heterogeneous responses in different sectors, viz., housing and commercial real estate categories for selected economies.

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## Chapter 1

# MACROPRUDENTIAL POLICIES IN SEACEN ECONOMIES: AN INTEGRATIVE REPORT

By

**Jugnu Ansari**[1]

## 1. Introduction and Policy Environment

### 1.1 Introduction

Drawing lessons from the distortions to real sectors across the countries in terms of potential output loss and historic unemployment associated with financial instability during the crisis periods, economists have favoured practical considerations to define financial stability and have suggested the macroprudential approach to ensure financial stability.[2] Accordingly, the financial stability goal is pursued with strong, sound and stable institutions, competitive and effective markets and efficient financial pricing perspectives. After the global crisis, financial institutions are being subjected to stronger regulatory frameworks in line with international standards such as the Basel prudential norms pertaining to capital adequacy, asset quality, management efficiency, earnings and liquidity (CAMEL) indicators. Interestingly, the Basel prudential norms, since their inception in the late 1980s, have witnessed various concerns. Experts in the field led by Borio et al. (2010)[3] have expressed concerns over bank indicators' procyclical nature. Many studies have argued that the regulatory framework that existed prior to the global financial crisis was deficient due to it being largely "microprudential" in nature, aimed at preventing the costly failure of individual financial institutions (Crockett, 2000; Borio, et al., 2001; Borio, 2003; Brunnermeier et al., 2009). In this context, it was suggested that the regulatory framework should focus on 'macroprudential' approach to safeguard the financial system as a whole. Accordingly, the IMF initiated the framework for Financial Soundness Indicators comprising aggregated microprudential indicators, financial market indicators and macroeconomic indicators. In the aftermath of the recent global crisis, the new Basel III framework has embraced macroprudential approach with emphasis on systemic risk and stability. However, the benefits of introducing macroprudential policy tend to be sizeable when financial shocks, which affect the supply of loans, are important drivers of economic dynamics. But can they function smoothly in tandem with monetary policy, and with what effects?

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2. See also Hans Genberg et al. (2015) for a useful conceptual discussion, SEACEN Working Paper 9/2015.

3. Borio et al. (2010) studied the mutually reinforcing feedback mechanism between the financial system and the real economy that can amplify financial and business cycles.

The macroprudential regulatory changes in terms of risk weight, provisioning requirements and Loan-to-Value ratio (LTV) occurred with respect to some specific sectors of the credits class, viz., housing loans, commercial real estate, capital market and other retails in emerging markets. The tightening of prudential norms made the credit to targeted sectors costlier, thereby moderating the flow of credit to these sectors. There is evidence that moderation in credit flow to these sectors was also in part due to banks becoming cautious in lending to these sectors on the signalling effect of the Central Bank's perception of build-up of sectoral risks. Now the question arises as to how to test the impact of macroprudential policies on the loan supply in these specific sectors and to identify whether the changes in the loan is due to the monetary policy shock or macroprudential shock and further, whether it is demand driven or supply driven.

In this milieu, we undertook this research study to assess the effects of changes in macroprudential policies on the supply of loans in sensitive sectors by SEACEN economies. These policy changes occurred over time and by loan category. When modelling the supply of loans, both bank characteristics and locational characteristics have relevance to the identification strategy regarding loan supply and demand in particular. But due to data constraints for most of the participating SEACEN economies, we tried to understand the impact of macroprudential policies on the credit growth in a well-established panel data framework.

This paper forms the introductory chapter of the SEACEN research report on "Macroprudential Policies in SEACEN Economies". The main purpose of this study is to provide an integrative view on the concept of macroprudential policies, its implementation and its impact on SEACEN economies. We also survey the related literature and address a few important policy challenges. The team project papers apply appropriate empirical methodology based on availability of data and experiences of implementing the macroprudential policies in the SEACEN member economies. At the same time, the SEACEN economies offer a wide range of macroprudential policy and macroeconomic policy frameworks ranging from inflation targeting to managed exchange rates, different degrees of financial market development, Loan-to-Value (LTV) ratio, Debt-to-Income (DTI) ratio, capital requirements, provisioning requirements and a large heterogeneity with regard to the degree of macroeconomic resilience. Thus, lessons drawn from these emerging market economies are also important for other regions of the world economy.

This chapter is organized as follows: in Section 2 we survey the literature on macroprudential policies with relation to theory and empirics on financial stability, macroprudential instruments, its implementation and impact on domestic credit. Section 3 presents results from the estimated regression models as well as a battery of robustness tests. Section 4 discusses the use of macroprudential policies and its impact on credit growth in SEACEN economies with a preview on the subsequent chapters contained in this report. Finally, Section 5 concludes with key findings and draws some tentative policy conclusions and its implications.

### 1.2 Policy Environment – Macroprudential Actions

The global financial crisis has forced policy makers to review their policy frameworks, to examine how they could identify time-dimensional and cross-sectional risks in the finance sector, and to deal with those risks. Often procyclical systemic risk rises in tandem with cross-sectional systemic risk. Therefore, policy makers should be fully aware that time-dimensional risk during the peak of a financial cycle can trigger cross-sectional systemic risk that renders banks vulnerable to a common shock. Henceforth, in detecting systemic risks and tackling them, policy makers should avoid any complacency and should build prudent macroprudential policy framework. At the same

time, policy makers should realize that macroprudential policy alone may not be sufficiently effective in achieving financial stability; rather, a judicious mix of both microprudential and macroprudential policy instruments can be more effective than the stand-alone implementation of either.

Before the global financial crisis, financial regulation largely took the form of microprudential policies and centred on monitoring prudential risks to individual institutions. As such, financial regulation failed to consider the build-up of macroeconomic risks and vulnerabilities that could pose systemic risk by destabilizing a number of institutions simultaneously. The global financial crisis underlined an urgent need for financial regulatory authorities to identify and monitor early on, the build-up of macroeconomic risks that could threaten the financial system. Such early detection and prevention requires strong macroprudential policy measures—for example, caps on the loan-to-value (LTV) ratio—designed to mitigate financial stability risks that stem from vulnerabilities building up in the broader financial system (Sinha, 2011)[4]. A macroprudential approach has two dimensions: a time dimension and a cross-sectional dimension (Borio 2010). In the time dimension, the source of system-wide distress can be the procyclicality of the financial system. That is, financial institutions and markets over expose themselves to risks during an upswing in the financial cycle and then become overly risk averse during a downswing leaving the entire financial system and economy vulnerable to booms and busts. On the other hand, the cross-sectional dimension of systemic risk arises from the interconnectedness of financial institutions and markets that can result in joint vulnerabilities and failures of financial institutions, i.e., when the actions and problems of individuals or financial institutions have spillover effects on the overall financial system. Given their interconnectedness, the contemporary market-based finance sector should be thought of not only as the deposit-taking, loan-making activities of commercial banks but also as investment banks, money market funds, insurance firms, and other financial institutions. Seminal work has been done by the IMF based on its global macroprudential instruments (Lim, et al., 2012), which explores the link between macroprudential policy and credit growth, the study finds that several different macroprudential tools reduce the procyclicality of credit by reducing the correlation between credit growth and GDP growth.

### 1.3 SEACEN Economies Context

There is a growing consensus in developing Asia and elsewhere that macroprudential policy measures could be useful for safeguarding financial stability, but their empirical effectiveness has not yet been well-established. We document different types of macroprudential policies which are mostly classified under credit-related, liquidity-related, and capital-related for SEACEN economies in developing Asia that used macroprudential policies.

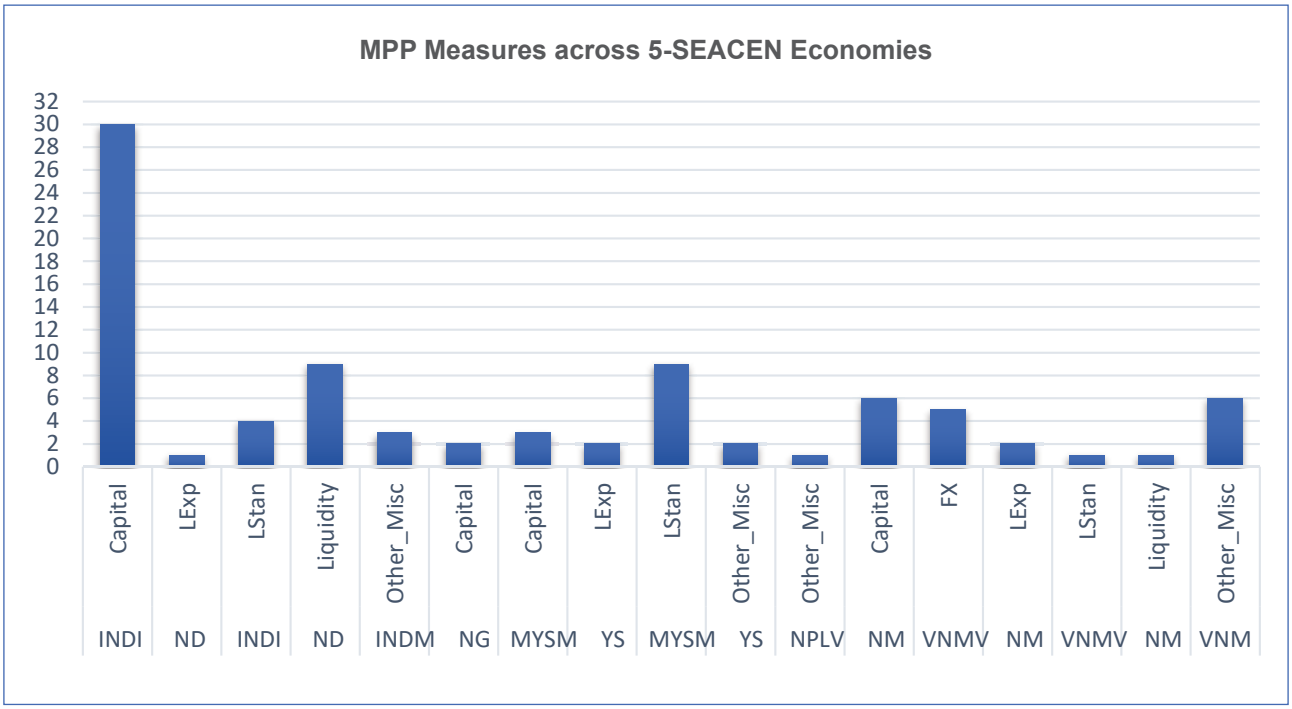
4. Sinha, A., (2011), "Macroprudential Policies: Indian Experience," Address delivered at Eleventh Annual International Seminar on Policy Challenges for the Financial Sector on "Seeing both the Forest and the Trees- Supervising Systemic Risk" co-hosted by The Board of Governors of the Federal Reserve System, International Monetary Fund, and The World Bank at Washington, D.C, June.

**Table1: Macroprudential Policy Tools Used Across SEACEN Economies**

| Macroprudential Tools | Economies | Targeted Sector |
|---|---|---|
| Tightening eligibility requirements, e.g. limits on loan-to-value ratios | China, Hong Kong SAR, Korea, Malaysia, Singapore, India, Philippines, Chinese Taipei, Thailand | Real Estate boom |
| Countercyclical capital buffer | Cambodia, India, Indonesia, Malaysia, Mongolia, Papua New Guinea, Sri Lanka, Chinese Taipei, Vietnam | Leverage growth |
| Exposure/Credit concentration limits | Colombia, Hong Kong SAR, Malaysia, India, Indonesia, Nepal, Papua New Guinea, Philippines, Singapore, Sri Lanka, Chinese Taipei, Vietnam | Sectoral Resilience |
| Provisioning | India, Papua New Guinea, Vietnam | Resilience to cyclical downturn/bust |

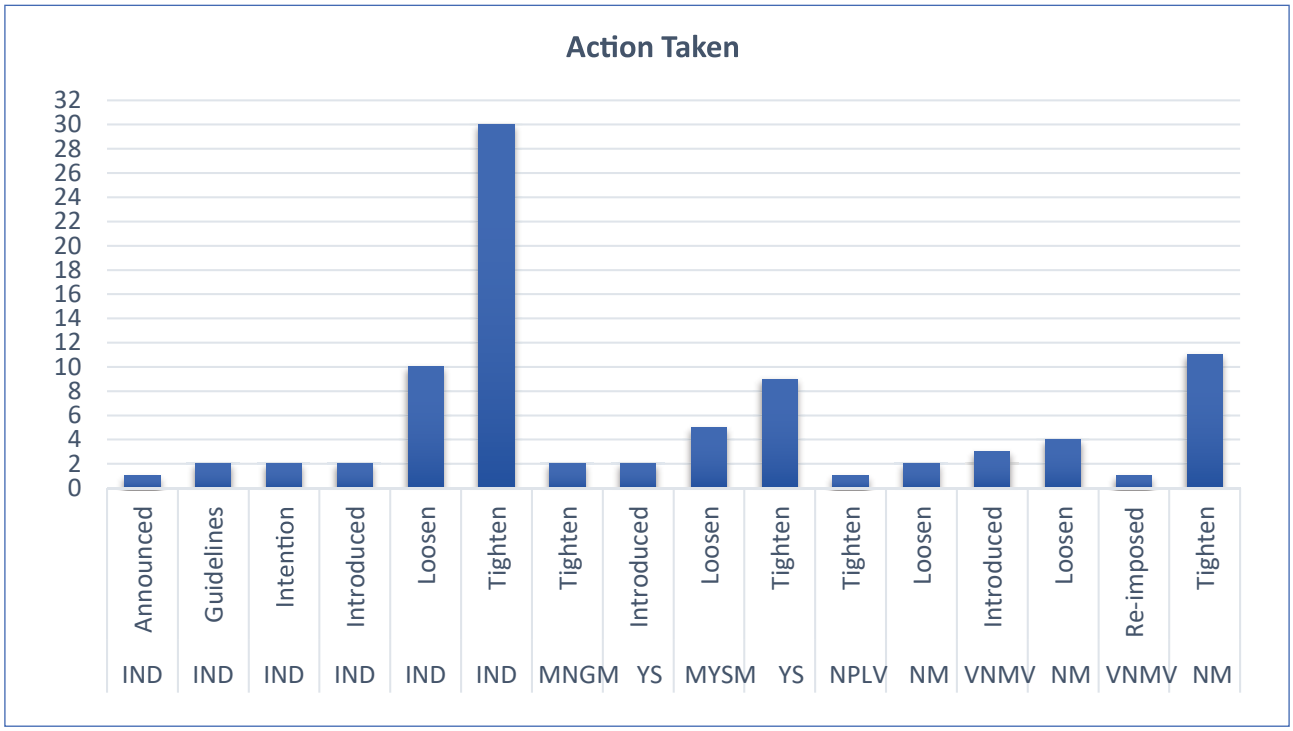
Source: IMF Staff Discussion Note, 2014 and SEACEN Staff Paper, No.79.

**Figure 1: Macroprudential Instruments Used in Sample SEACEN Economies**




IND (India), MNG (Mongolia), MYS (Malaysia), NPL (Nepal) VNM (Vietnam); LStan (Lending Standard), LExp (Loan Exposure), Other_Misc (Others-Miscellaneous).

**Figure 2: Macroprudential Measures Taken by Sample SEACEN Economies**




The descriptive analysis of the country specific (viz., Malaysia, Mongolia, Nepal and Vietnam) chapters show that there has been significant variation in the use of macroprudential instruments in the SEACEN member economies. The use of different macroprudential instruments follows very different trends over time. The application of some instruments, such as limits on credit growth, lending standards restrictions, sectoral risk weights or liquidity requirements, seems to have responded to the financial cycle or to financial crisis events. The general pattern of the evidence from the SEACEN economies suggests that credit-related macroprudential policies can effectively dampen credit expansion while liquidity-related macroprudential policy tools moderate leverage growth.

In the Indian context, two main macroprudential tools are used by the Reserve Bank of India, viz., increased risk weights and provisioning for some sensitive sectors. Now the issue is which of the two tools was more effective? Their relative effectiveness can be assessed by ascertaining as to how binding these norms were on banks. For this, we analyse the data on frequency distribution of capital to risk weighted asset ratio (CRAR) and profitability (net profits as percentage of total assets) (Table 2 and Table 3).

An analysis of distribution of CRAR shows that most of the banks had the CRAR of more 10% (Table 2). It may be noted that it was during 2005-2008 when the macroprudential tools were tightened and relaxed during the latter half of 2008-09 after the global financial crisis hits. The CRAR of the banking sector, on the whole improved in 2009 again, suggesting that increased risk weights improved the resilience of the baking sector.

**Table 2: Distribution of SCBs by CRAR**

| Bank Group | End-March 2005 | | | End-March 2009 | | | End-March 2014 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | <9 | 9-10 | >10 | <9 | 9-10 | >10 | <9 | 9-10 | 10-14 | >14 |
| Public sector Banks | | 2 | 26 | | 1 | 26 | | | 24 | 2 |
| Private Sector Banks | 2 | 5 | 22 | | | 22 | | 1 | 9 | 10 |
| Foreign Banks | | 1 | 30 | | | 30 | | | 1 | 40 |
| Total | 2 | 8 | 78 | | 1 | 78 | | 1 | 34 | 52 |

Source: Statistical Table Related to Banks in India (STRB), RBI.

**Table 3: Distribution of Profitability of Banks**

| Bank Group | 2005 | | | 2009 | | | 2014 | | |
|---|---|---|---|---|---|---|---|---|---|
| | <1 | 1-3 | >3 | <1 | 1-3 | >3 | <1 | 1-3 | >3 |
| Public sector Banks | 16 | 12 | NIL | 15 | 13 | NIL | 18 | 8 | NIL |
| Private Sector Banks | 18 | 10 | NIL | 7 | 15 | NIL | 5 | 15 | NIL |
| Foreign Banks | 17 | 13 | 3 | 7 | 17 | 6 | 13 | 19 | 8 |
| Total | 51 | 35 | 3 | 29 | 45 | 6 | 36 | 42 | 8 |

Source: STRB, RBI.

The Reserve Bank of India tried to assess early signs of credit boom and assets bubbles in terms of broad indicators such as sectoral credit growth and credit-GDP ratio. Overall bank credit and credit to different sector always played an important role in the conduct of macroprudential policies. Macroprudential measures in India were tightened mainly during the expansionary phase. This type of analytical framework in the case of macroprudential policies was introduced only recently in the case of counter-cyclical capital buffers(CCBs) which were based on the credit to GDP gap, analogous to output gap. Under this approach, regulators are allowed to raise CCBs when the credit-to-GDP gap is positive and reduce when it is negative. In this backdrop, the impact of macroprudential tools in India has been assessed from two perspectives, viz., improving the resilience of the banking sector; and preventing the excessive credit build-up.

The macroprudential norms enabled banks to withstand some of the adverse impacts when macroeconomic conditions changed especially when the global financial crisis hit. First, the counter-cyclical prudential requirement relating to investment fluctuations reserve enabled banks to absorb some of the adverse impact when interest rates began moving in the opposite direction in late 2004. When capital charge for market risk was introduced, banks did not face any difficulty in meeting the same.

Second, banks' capital to risk-weighted assets ratio increased every year from 2007 to 2011. The improved capital to risk weighted assets ratio was due to improved profitability as well as also to the decline in the gross non-performing assets ratio. This enabled banks to plough back increased profits. The increase in risk weights for lending to certain sectors and increased provisioning requirements against standard assets also enabled banks to improve their capital adequacy ratio.

Macroprudential policy measures fall into the following three broad categories (Table 4):

(i) Credit controls including caps on ratios of LTV and of debt-to-income (DTI) and on foreign currency lending as well as ceilings on credit or credit growth; (ii) liquidity regulations that place limits on net open currency positions or currency mismatches and on maturity mismatches while establishing reserve requirements; and, (iii) capital requirements including countercyclical capital requirements, time-varying and dynamic provisioning, and restrictions on profit distribution. Macroprudential tools such as minimum capital ratios and LTV ratios have been used for some time. Reserve requirements could provide liquidity cushions while dynamic provisioning could help build capital buffers during upturns.

**Table 4: Conceptual Basis of Macroprudential Policy Instruments**

| Instruments | Conceptual Basis |
|---|---|
| 1) Caps on the loan-to-value ratio (LTV) | The LTV imposes a down payment constraint on household capacity to borrow. In theory, the constraint limits the procyclicality of collateralized lending since housing prices and household capacity to borrow based on the collateralized value of the house interact in a procyclical manner. Set at an appropriate level, the LTV addresses systemic risk whether or not it is frequently adjusted; however, the adjustment of the LTV makes it a more potent countercyclical policy instrument. |
| 2) Caps on the debt-to-income ratio (DTI) | The DTI represents prudential regulation aimed at ensuring banks' asset quality when used alone. When used in conjunction with the LTV, however, the DTI can help further dampen the cyclicality of collateralized lending by adding another constraint on household capacity to borrow. As with the LTV, adjustments in the DTI can be made in a countercyclical manner to address the time dimension of systemic risk. |
| 3) Caps on foreign currency lending | Loans in foreign currency expose the unhedged borrower to foreign exchange risks which, in turn, subject the lender to credit risks. The risks can become systemic if the common exposure is large. Caps (or higher risk weights, deposit requirements, etc.) on foreign currency lending may be used to address this foreign exchange induced systemic risk. |

| Instruments | Conceptual Basis |
|---|---|
| 4) Ceilings on credit/ Credit growth | A ceiling may be imposed on either total bank lending or credit to a specific sector. The ceiling on aggregate credit or credit growth may be used to dampen the credit/asset price cycle—the time dimension of systemic risk. The ceiling on credit to a specific sector, such as real estate, may be used to contain a specific type of asset price inflation or limit common exposure to a specific risk—the cross-sectional dimension of systemic risk. |
| 5) Reserve requirements | This monetary policy tool may be used to address systemic risk in two senses. First, the reserve requirement has a direct impact on credit growth, so it may be used to dampen the credit/asset price cycle—the time dimension of systemic risk. Second, the required reserves provide a liquidity cushion that may be used to alleviate a systemic liquidity crunch when the situation warrants. |
| 6) Countercyclical capital requirements | The requirement can take the form of a ratio or risk weights raised during an upturn as a restraint on credit expansion and reduced during a downturn to provide a cushion so that banks do not reduce assets to meet the capital requirement. A permanent capital buffer, which is built up during an upturn and deleted during a downturn, serves the same purpose. Both can address the cyclicality in risk weights under Basel II based on external ratings that are procyclical. |
| 7) Provisioning | Traditional provisioning is calibrated on historical bank-specific losses, but it can also be used to dampen the cyclicality in the financial system. The provisioning requirement can be raised during an upturn to build a buffer and limit credit expansion and lowered during a downturn to support bank lending. It may be adjusted either according to a fixed formula or at the discretion of the policy maker to affect bank lending behavior in a countercyclical manner. |
| 8) Restrictions on profit distribution | These prudential regulation requirements are intended to ensure the capital adequacy of banks. Since undistributed profits are added to bank capital, the restrictions tend to have a countercyclical effect on bank lending if used in a downturn. The capital conservation buffer of Basel III has a similar role. |
| 9) Limits on net open positions/Currency mismatch | Such prudential regulation tools limit banks' common exposure to foreign currency risks. In addition, the limits may be used to address an externality—sharp exchange rate fluctuations caused by a convergence of purchases/sales of foreign exchange by banks. This externality increases the credit risk of unhedged borrowers with heavy foreign currency debt. |
| 10) Limits on maturity mismatch | These prudential regulation tools may be used to address systemic risk since the choice of asset/liability maturity creates an externality—fire sales of assets. In a crisis, the inability of a financial institution to meet its short-term obligations due to maturity mismatches may force it to liquidate assets thus imposing a fire sale cost on the rest of the financial system. The funding shortages of a few institutions could also result in a systemic liquidity crisis due to the contagion effect. |

Source: Lim et al. 2011.

## 2. Review of Literature

### 2.1 Literature on Empirical Perspective

The procyclicality strand of literature reflects on an amplifying mechanism over time whereas cross-sectional strand of literature focuses on the financial system interconnectedness. Lim et al. (2011), find relatively muted effect of macroprudential policies on aggregate house price and credit growth. However, papers such as Martin and Schechtman (2013) examine the effect of macroprudential policies using micro data on the targeted market find stronger results. Microprudential regulation is necessary but not sufficient to deal with systemic risk, as microprudential regulation tends to view financial institutions in isolation and aims mainly to ensure that each is individually solvent. Yet solvency of individual institutions is not a sufficient condition for the stability of a system as a whole, for two main reasons. First, the focus on individual institutions neglects risks that are of systemic rather than individual nature, such as correlation risk (Acharya, 2009). Second, certain aspects of microprudential regulation, while aimed at protecting individual institutions, may at times destabilize the system as a whole (Hanson et al., 2011). The studies by Aiyar, Calomiris and Wieladek (2014a, 2014b), and Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014), showed that changes in minimum capital requirements had large effects on the supply of credit by UK banks that were subject to UK capital regulation during the sample period of 1998 to 2007. The theory of the bank lending channel of monetary policy (e.g., Bernanke and Gertler 1995) predicts that contemporaneous changes in capital requirements should affect the transmission of monetary policy to loan supply. Additionally, Thakor (1996) argues that the sign of this interaction will depend on the change in the term premium associated with a given change in monetary policy. If the term premium increases (falls), government bonds become a more (less) attractive investment opportunity, given their zero-risk weight relative to lending, leading banks to reallocate their portfolio towards (away) from government securities. A contemporaneous increase in the capital requirement will reinforce (weaken) this effect. These theories may have important implications for the coordination of monetary and macroprudential policy.

The bank capital requirement channel of monetary policy, presented in Van den Heuvel (2002), predicts that bank capital may fall following a monetary policy contraction as a result of unexpected losses due to interest rate risk. In that case, unless dividends are cut, loans will have to shrink to restore the targeted capital buffer. The recent work emphasizes shifts in the risk-taking preferences of banks as a channel through which monetary policy can affect bank lending. Low interest rates can increase banks' net worth (Adrian and Shin 2010), reduce asset volatility and thereby reduce perceptions of risk (Borio and Zhu 2008), and make nominal target returns harder to achieve (Rajan 2005). This may lead to an increase in banks' appetite for risk, and therefore, riskier lending. Empirical evidence for the bank lending, bank capital and risk-taking channel of monetary policy is provided in Kashyap and Stein (1995, 2000), Gambacorta and Mistrulli (2004) and Altunbas, Gambacorta and Marques-Ibanez (2010), respectively. Changes in capital requirements will have an independent impact on bank lending, so long as equity is costly and capital buffers are binding. Both of these conditions have been shown to hold empirically for our UK sample (see Aiyar, Calomiris and Wieladek 2014a, Bridges et al. 2012, Francis and Osborne 2009). Recent literature on financial crises has centered on explaining how leveraging in financial markets causes bubbles and influences economic activity. Measures of economy-wide financial activity such as deviations from the long-run trend of the credit-to-gross domestic product (GDP) ratio are considered to be informative and potential guides for macroprudential policy. There are a number of empirical studies on macroprudential policy, but little empirical evidence exists on its effectiveness, most notably as to which policies work best in

a country-specific context. Quantifying the effectiveness of macroprudential policy is challenging because it involves a multitude of instruments with inconsistent intervals and frequencies targeting different segments of the financial system (Tillmann, 2014) which complicates standard empirical analysis. Some papers have analyzed the effects of macroprudential policy on various measures of financial vulnerability and stability (IMF 2012, 2013a, and 2013b). Lim et al. (2011) reviewed the use of key macroprudential instruments in 46 economies up to 2010 and estimated the effectiveness of tightening individual instruments in reducing the procyclicality of financial risks. They concluded that many of the frequently used macroprudential instruments have been effective in lowering systemic risks.

Another strand of literature exploits information on various policy actions to explain asset price movements and credit growth by conducting event studies or by coding policy episodes with a binary indicator. This strand employs a set of standard macroeconomic control variables to examine the impact of macroprudential policy instruments on housing price escalation and credit growth. Claessens, Gosh, and Mihet (2013) examined the effectiveness of different macroprudential policies aimed at banking system vulnerabilities. Their regression results showed that measures such as caps on DTI and LTV as well as limits on credit growth and foreign currency lending are effective in reducing leverage, asset, and noncore to core liabilities growth during booms. They also suggest that macroprudential policies are much more effective in booms than in busts, implying the presence of asymmetric effects.

## 2.2 Literature on Theoretical Perspectives

In this section, we discuss the theory relevant for our empirical tests. The macroprudential policy objective is to prevent systemic risk from forming and spreading in the financial system and thereby reduce the probability of occurrence of financial crises with large real output losses for the entire economy. By suppressing channels of formation and spread of systemic risk, macroprudential policy should therefore act primarily preventively against signs of financial instability in the future and secondarily at least to mitigate their impacts if prevention fails. The object of macroprudential policy is systemic risk, which has two main dimensions. The time dimension reflects the build-up of systemic risk over time. The source of this dimension is procyclicality in the behavior of financial institutions, contributing to the formation of unbalanced financial trends, which sometimes slip out of the control of institutions themselves or their regulators (see, for example, Brunnermeier et al., 2009 or Borio and Drehmann, 2009a). The time and cross-sectional dimensions, to a large extent, evolve jointly and so cannot be strictly separated. In a growth phase of the financial cycle, rapid credit growth is accompanied by a growing exposure of a large number of banks to the same sectors (usually the property market) and by increasing interconnectedness in meeting the growing need for balance-sheet liquidity. Financial institutions become exposed to the same concentration risk on both the asset and liability side. This makes them vulnerable to the same types of shocks and makes the system as a whole fragile. The time dimension shows up in degree of solvency, while the cross-sectional dimension manifests itself in the quality of financial institutions' balance-sheet liquidity. However, solvency and liquidity are also interconnected, as liquidity problems often transform quite quickly into insolvency.

The standard story about the bank lending channel of monetary policy implies potentially important interactions between monetary policy changes and changes in capital requirements; both policy instruments affect lending through related contingencies involving bank balance sheets.

The bank lending channel of monetary policy relies on the cost to banks of raising debt other than deposits – that is, debts that are not directly affected by reserve requirements – when reserve requirements are binding and banks are constrained in the amount of non-depository debt they can raise (Bernanke and Gertler, 1995). An increase in a binding minimum capital requirement, and the implied limit on leverage, will, therefore, reduce the ability of a bank to access non-depository debt, and thus should strengthen the impact of monetary policy on lending. Alternative mechanisms for an interaction effect can be posited via a "time-varying risk aversion" channel. For example, assume that low policy rates are associated with greater bank willingness to undertake risk, as supported by a substantial body of empirical evidence (Jiminez et al. 2008). In a low interest rate environment, banks become less risk averse, which implies that they may be willing to allow their capital buffers – defined as the proportion of capital relative to risk weighted assets that the bank maintains in excess of its minimum capital ratio requirement – to fall by more in response to an increase in minimum capital requirements. If capital buffers shrink in a low interest rate environment, then a rise in capital requirements will have a smaller effect in shrinking credit supply than it would have during a time of higher interest rates.

Thakor (1996) proposes a formal theory of the interaction between monetary and capital requirements policy, based on banks' portfolio reallocation decisions following a change in either policy instrument. In his model, when capital requirements rise, competition and screening costs prevent banks from passing on the increased cost to borrowers. The relative decline in expected profits from lending relative to holding government securities, which have a risk-weight of zero, leads banks to reallocate their portfolio from the former to the latter. The extent to which a capital requirement change interacts with monetary policy in this framework depends on the coinciding change in the interest rate term premium. If long rates rise (fall) by more than short rates, implying a positive (negative) term premium, government securities will become more (less) profitable. This will magnify (reduce) the effect of the rise in capital requirements. On the contrary, if the capital requirement declines, a positive (negative) term premium will reduce (increase) the effect of the change in the capital requirement on lending. In other words, this theory predicts that changes in capital requirements and monetary policy both affect banks portfolio choice between government securities and loans, but the sign of the interaction term depends on the change in the term spread.

The greater attention to macroprudential policy is evident in both advanced and developing economies. Compared with other regions, developing Asia has a lot of experience in implementing a variety of macroprudential measures consisting of credit-related, liquidity-related, and capital-related policy instruments to prevent or to address asset price bubbles and other threats to financial stability. This experience is derived primarily from dealing with previous threats to financial stability, especially arising from volatile capital flows. Since 2000 and partly in response to the Asian financial crisis of 1997, in order to cope with potentially volatile, large-scale capital inflows, macroprudential measures have been widely used in developing Asia. While advanced economies seldom used macroprudential policies during the 1990s, they implemented many of these tools after the global financial crisis as part of a broader trend toward more stringent financial regulation. Moreover, major advanced economies have recently established regulatory frameworks for macroprudential policy. As the global economy began to recover from the global crisis, many economies in developing Asia have been actively using macroprudential policy to deflate potential bubbles in the property and equity markets. Risks had accumulated during the period of high growth and low inflation, particularly in real estate-related sectors.

## 3. Empirical Methodology and Data

### 3.1 Determinants of Macroprudential Policy Action: Logit Regression

This study has two components. In the first, we look at what determines a country uses which instruments. To this end we estimate the probability of an authority tightening/loosening lending standards, capital requirements, and large exposure or liquidity requirements, (i.e., we will estimate the likelihood of the use of each of these types of macroprudential policies/instruments in each time period using a logit model). The control variables could be indicators of equity market volatility, global growth, domestic credit growth, and change in exchange rate, current account to GDP, capital account openness, domestic GDP growth, inflation, and house price growth. The base case logit model for each of the major types of macroprudential instruments is:

$$Prob(MPP_{it}) = F\left(\beta_t\, Global_{i,t-1} + \gamma_{it} External_{i,t-1} + \delta_{it} Domestic_{i,t-1}\right) \quad \text{(Eq 1)}$$

where $MPP_{it}$ is a dummy variable which takes the value of 1 if that country takes a macroprudential action with respect to lending standards, capital requirements, large exposures, liquidity and others. The variables Global, External and Domestics are vectors of global indicators, external and domestic country indicators respectively.

Table 5 demonstrate the baseline results of the logit model for the full sample. Many of the coefficients are insignificant, in particular in regressions where the dependent variables are not lending standards. This is perhaps not surprising given that in the full sample, many countries were not taking macroprudential actions in this period. Two variables are of note. Domestic credit growth has a positive and significant effect on the probability that a country will tighten lending standards. Capital account openness is also negatively associated with the probability that a country will tighten macroprudential policy. This is consistent with the fact that for many countries, macroprudential policies were taken as part of capital flow management measures. Preliminary analysis suggests that countries have changed lending standard requirements in response to an increase in credit growth, but in general, it provides us with the major determinants which influenced policymakers' decisions to take macroprudential action.

**Table 5: Determinants of Macroprudential Policy Action (Logit Model)**

| Domestic Variables | Lending Standard | Capital | Large Exposure | Liquidity | Others |
|---|---|---|---|---|---|
| Domestic Credit Growth | 0.2530<br>(1.40)*** | 0.5588<br>(1.72)*** | 0.5577<br>(1.71)*** | 0.5619<br>(1.73)*** | 0.5856<br>(1.81)*** |
| Domestic GDP Growth | 0.7277<br>(1.28) | 1.1190<br>(3.55)* | 1.1126<br>(3.55)* | 1.1155<br>(3.56)* | 1.1226<br>(3.59)* |
| Inflation | -0.0200<br>(-0.03) | -0.5179<br>(-1.47) | -0.5163<br>(-1.47) | -0.5129<br>(-1.46) | -0.5644<br>(-1.62)*** |
| External Variables | | | | | |
| FX Depreciation | 1.3146<br>(2.13)** | -0.9407<br>(-2.71)* | -0.8968<br>(-2.63)* | -0.8999<br>(-2.64)* | -0.8977<br>(-2.64)* |
| Current Account to GDP | 1.8315<br>(2.28)** | -1.4184<br>(-3.47)* | -1.4079<br>(-3.46)* | -1.4042<br>(-3.45)* | -1.4363<br>(-3.55)* |
| Capital Account Openness | -.0134<br>(-1.74)*** | -0.0104<br>(-2.42)* | -0.0104<br>(-2.42)* | -0.0104<br>(-2.44)* | -0.0107<br>(-2.52)* |
| Intercept | -2.3252<br>(-2.04)** | -0.9145<br>(-1.56) | -1.2362<br>(-2.73)* | -1.2301<br>(-2.73)* | -1.3647<br>(-3.16)* |
| Global Variables | | | | | |
| Global Volatility | -1.0294<br>(-1.36) | 0.5959<br>(1.53) | 0.5815<br>(1.50) | 0.5756<br>(1.49) | 0.5718<br>(1.49) |
| Global Growth | 0.5231<br>(1.04) | 0.2769<br>(0.99) | 0.2944<br>(1.06) | 0.2938<br>(1.06) | |
| LR $\chi^2(12)$ | 57.52 | 55.80 | 55.07 | 55.03 | 53.91 |
| P Value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| LL | -65.25 | -166.11 | -166.48 | -166.50 | -167.1 |
| Pseudo $R^2$ | 0.16 | 0.14 | 0.15 | 0.17 | 0.14 |

Data Source: CEIC and IMF data.

### 3.2 Panel Regression Results

In the second part, we will use the panel framework to understand the effectiveness of the macroprudential policies with respect to loan growth. We have constructed a macroprudential policy index based on the following parameters.

**Table 6: MPP Index Parameters**

| Instrument/Group | Abbreviation | Definition |
|---|---|---|
| *Instruments (0-1)* | | |
| Loan-to-Value Ratio | LTV | Constrains highly levered mortgage down payments by enforcing or encouraging a limit or by determining regulatory risk weights. |
| Debt-to-Income Ratio | DTI | Constrains household indebtedness by enforcing or encouraging a limit. |
| Time-Varying/Dynamic Loan-Loss Provisioning | DP | Requires banks to hold more loan-loss provisions during upturns. |
| General Countercyclical Capital Buffer/Requirement | CTC | Requires banks to hold more capital during upturns. |
| Leverage Ratio | LEV | Limits banks from exceeding a fixed minimum leverage ratio. |
| Capital Surcharges on SIFIs | SIFI | Requires Systemically Important Financial Institutions to hold a higher capital level than other financial institutions. |
| Limits on Interbank Exposures | INTER | Limits the fraction of liabilities held by the banking sector or by individual banks. |
| Concentration Limits | CONC | Limits the fraction of assets held by a limited number of borrowers. |
| Limits on Foreign Currency Loans | FC | Reduces vulnerability to foreign-currency risks. |
| Reserve Requirement Ratios | RR | Limits credit growth; can also be targeted to limit foreign-currency credit growth. |
| Limits on Domestic Currency Loans | CG | Limits credit growth directly. |
| Levy/Tax on Financial Institutions | TAX | Taxes revenues of financial institutions. |
| *Derived Instruments* | | |
| Loan-to-Value Ratio Caps | LTV_CAP | Restricts to LTV used as a strictly enforced cap on new loans, as opposed to a supervisory guideline or merely a determinant of risk weights. |
| FX and/or Countercyclical Reserve Requirements | RR_REV | Restricts to RR which i) imposes a wedge of on foreign currency deposits or ii) is adjusted countercyclically. |
| *Groups* | | |
| Macroprudential Index (0-12) | MPPI | LTV_CAP + DTI + DP + CTC + LEV + SIFI + INTER + CONC + FC + RR_REV + CG + TAX |

Source: IMF Working Paper, March 2015[5] and data from participating SEACEN economies.

5. Cerutti, Claessens and Laeven (2015) report data for 119 IMF member countries on the use of twelve types of macroprudential policies obtained from a survey of country authorities.

We create an overall macroprudential index (MPI) which is just the simple sum of the scores on all 12 policies parameter. The reason being to construct un-weighted MPI is that available data do not have the intensity of macroprudential measure. Even if these are available for some economies, the level of each instrument change over time and these may not capture the degree to which the instruments are actually binding and is especially hard to measure consistently. Similarly, it is difficult to code the variations in the use of instruments objectively as a tightening or a loosening. We, therefore, construct simple binary measures as to whether or not the instruments were in place. The following Figure 3 depicts the constructed MPP Index.

**Figure 3: Macroprudential Policy Index (MPP Index)**


When plotting the same MPP index with credit-GDP growth (Figure 4), we find that after tightening of macroprudential, credit boom slowed down significantly.

**Figure 4: MPP Index vs Credit-GDP Growth**

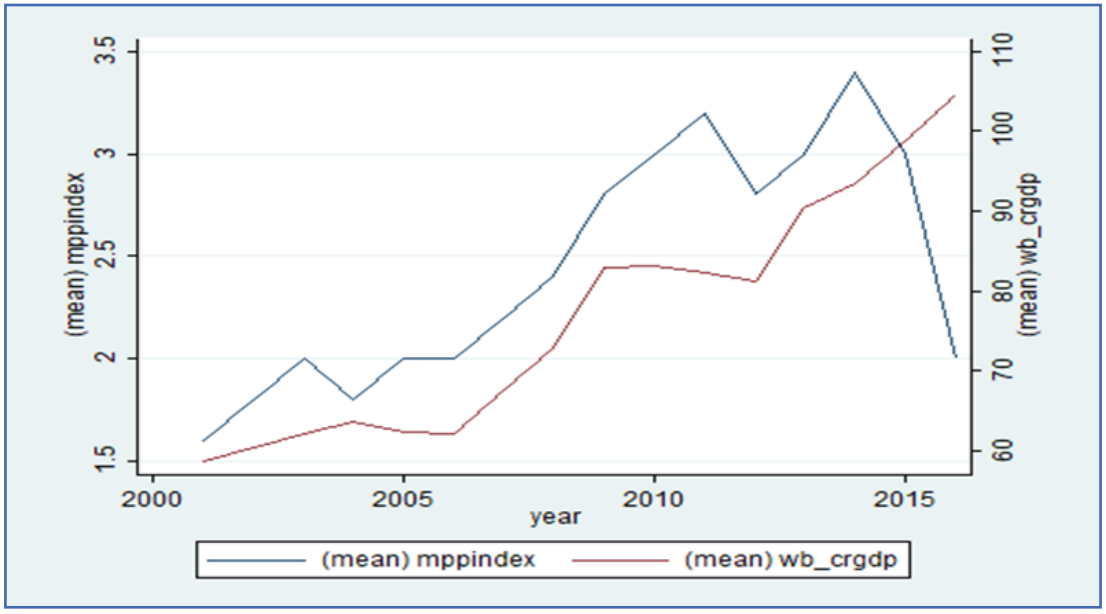


**Table 7: Credit-GDP Ratio of the Sample SEACEN Economies**

| Year | India | Malaysia | Mongolia | Nepal | Vietnam |
|---|---|---|---|---|---|
| 1991-1995 | 24 | 104 | 11 | 16 | 17 |
| 1996-2000 | 25 | 143 | 7 | 27 | 24 |
| 2001-2005 | 34 | 117 | 20 | 26 | 50 |
| 2006-2010 | 48 | 104 | 37 | 47 | 90 |
| 2011-2016 | 52 | 121 | 54 | 64 | 106 |

Table 7 illustrates the credit-GDP ratio of five SEACEN economies. This table provide us an insight about the credit-risk build-up phases across these economies. In a similar line, Table 8 and Table 9 depict other risk build-up during the period mentioned therein.

**Table 8 Bank: Non-performing Loans to Gross Loans (%)**

| Year | India | Mongolia | Malaysia | Nepal | Vietnam |
|---|---|---|---|---|---|
| 2005 | 2.5 | NA | 9.4 | NA | 2.2 |
| 2006 | 2.8 | | 8.5 | | 2.8 |
| 2007 | 3.4 | | 6.5 | | 3.1 |
| 2008 | 2.4 | | 4.8 | | 2.2 |
| 2009 | 2.4 | | 3.6 | | 1.8 |
| 2010 | 2.4 | | 3.4 | | 2.1 |
| 2011 | 2.7 | | 2.7 | | 2.8 |
| 2012 | 3.4 | | 2.0 | | 3.4 |
| 2013 | 4.0 | | 1.8 | | 3.1 |
| 2014 | 4.3 | | 1.6 | | 2.9 |
| 2015 | 5.9 | | 1.6 | | 2.3 |
| 2016 | 6.2 | | 1.6 | | 2.8 |

Source: IMF Global Financial Data.

**Table 9: Interest Rate Spread (Lending Rate minus Deposit Rate, %)**

| Year | India | Malaysia | Mongolia | Nepal | Vietnam |
|---|---|---|---|---|---|
| 2000 | 4.2 | 4.3 | 20.2 | 3.5 | 6.9 |
| 2001 | 3.8 | 3.8 | 23.1 | 2.9 | 4.1 |
| 2002 | 3.1 | 3.3 | 22.3 | 3.1 | 2.6 |
| 2003 | 3.5 | 3.2 | 17.9 | 4.4 | 2.9 |
| 2004 | 3.4 | 3.0 | 17.3 | 5.9 | 3.6 |
| 2005 | 3.2 | 3.0 | 17.6 | 5.9 | 3.9 |
| 2006 | 3.3 | 3.3 | 13.9 | 5.8 | 3.5 |
| 2007 | 3.5 | 3.2 | 8.4 | 5.8 | 3.7 |
| 2008 | 3.5 | 3.0 | 9.2 | 5.6 | 3.1 |
| 2009 | 4.1 | 3.0 | 8.4 | 5.5 | 2.2 |
| 2010 | 3.8 | 2.5 | 8.2 | 4.4 | 1.9 |
| 2011 | 3.9 | 2.0 | 6.1 | 5.3 | 3.0 |
| 2012 | 3.6 | 1.8 | 6.8 | 5.2 | 3.0 |
| 2013 | 3.3 | 1.6 | 6.4 | 5.1 | 3.2 |
| 2014 | 3.2 | 1.5 | 6.7 | 5.0 | 2.9 |
| 2015 | 3.1 | 1.5 | 6.6 | 5.1 | 2.4 |
| 2016 | 3.2 | 1.5 | 6.5 | 5.1 | 1.9 |

Source: IMF Global Financial Data.

In the case of Malaysia, the interest spread declined over the period as with the non-performing loan percentage as well, but this was not true for India and Vietnam. We estimate how the MPPI relate to the growth in the economies' credit using the following base regression model:

$$Y_{i,t} = \mu_i + \beta * MPPI_t + \gamma * X_{i,t} + \delta * MPPI_t * X_{i,t} + \theta * crisis_t + \rho * Policy_{i,t} + \varepsilon_{i,t} \quad \ldots \quad \text{(Eq 2)}$$

where $Y_{i,t}$ = real credit growth in country *i* at time *t*;

$\mu_i$ = country fixed effect to capture any non-time varying country specific conditions, including much of its level of economic and financial development, the relative mix of bank vs. market based financial intermediation, the concentration of its financial system, and various other (institutional) characteristics;

MPPI = Macroprudential Policy Index;

*Crisis* = a dummy variable capturing crisis period as defined by Acharya *et al* (2013);

$Policy_{i,t}$ = a vector with the central bank policy rate;

$X_{i,t}$ = Vector of country control variables viz., GDP growth, Exchange rate; and

$\varepsilon_{i,t}$ = the error term.

Throughout, we report robust standard errors. We include country fixed effect and interactions terms between independent variables and MPPI to analyse the MPP effects. We have not considered how the effects of macroprudential policies vary by the intensity. Using annual data justify the contemporaneous values for the macroprudential policy variables and the fixed effect panel regression techniques, which are a good fit given our small N and small T sample. However, some economies may adopt macroprudential policies precisely at the time when the credit cycle is already peaking and any negative relationship found between the contemporaneous level of the macroprudential policy and credit growth may then reflect reverse causality. Another possibility particularly relevant in recent years is that many countries adopted macroprudential policies in the wake of financial stability concerns and at the same time credit growth slowed as a result of weak demand and supply constraints at banks. Lacking valid instruments for macroprudential policy, we cannot claim to have fully resolved these and other endogeneity issues, due to data constraints. By using GMM regressions, we can mitigate some of them but it needs a large N.

The inclusion of interaction terms between macroprudential policies and country specific characteristics (MPPIt*Xi,t ) is essential for evaluating whether responses to macroprudential shocks differ by country with respect to macroeconomic condition of the countries. This approach builds on the bank lending channel literature. In order to discriminate between loan supply and loan demand movement, most of the literatures have focused on cross-sectional differences. This strategy relies on the hypothesis that certain country-specific characteristics with respect to bank credit (for example, ownership, size, liquidity and capitalization) influence only loan supply movements, while demand for bank loans is independent of these characteristics. In order to address this issue, we should use country-wise bank level data with bank location and time fixed effect panel data analysis.

In particular, we construct a formal test of the impact of macroprudential policy by taking the first derivative of equation (2) with respect to changes in macroprudential policies as follows:

$$\frac{\partial \mathrm{Y}_{i,t}}{\partial \mathrm{MPPIt}} = \beta + \delta * \mathrm{Xit}$$

Since $\beta$ is expected to be negative, the effect of country specific bank credit system depends on the sign of the coefficient $\delta$. Macroprudential tools with a more structural objective which are intended to increase the resilience of the financial sector, are looked at in combination (i.e., capital requirements and provisioning requirements together) because they are positively correlated, and it is possible that taken one at a time, the own responses may be typically negative, but taken together, one may be positive and the other could be highly negative simply because of correlation. By constructing the index, this detailed analysis could not be possible. However, the aggregate results give the dynamics of the macroprudential policy actions and their impact on credit growth. It is likely that the impact could not be very visible due to credit portfolio substitution across different loan products or due to income effect, i.e., targeted market share in select loan categories. Since we have a data constraint of the level of banks' sectoral exposure, we are unable to do this analysis at this moment.

**Table 10: Macroprudential Policies and Credit Growth**

| Variable:<br>Real Credit Growth | (1)<br>OLS | (2)<br>margin | (3)<br>OLS | (4)<br>margin | (5)<br>OLS | (6)<br>margin |
|---|---|---|---|---|---|---|
| MPPI | -0.924*** | -0.273*** | -0.874*** | -0.304*** | -0.771*** | -0.237*** |
| | (0.032) | (0.0030) | (0.032) | (0.0034) | (0.033) | (0.0040) |
| GDP Growth | 0.869*** | 0.278*** | 0.871*** | 0.305*** | 0.271*** | 0.403*** |
| | (0.030) | (0.0031) | (0.030) | (0.0032) | (0.031) | (0.0038) |
| Crisis | -0.064*** | -0.003*** | -0.098*** | -0.005*** | -0.102*** | -0.011*** |
| | (0.009) | (0.0004) | (0.010) | (0.0005) | (0.011) | (0.0006) |
| Policy Rate | -0.049* | -0.011* | -0.087 | -0.7112 | -0.176* | -0.431* |
| | (0.020) | (0.0012) | (0.565) | (0.800) | (0.073) | (0.214) |
| GDP growth*MPPI | | | | | 0.976 | 0.001 |
| | | | | | (1.703) | (0.0004) |
| Country Fixed Effect | Yes | | Yes | | Yes | |
| Controls | Yes | | Yes | | Yes | |
| R-square | 0.669 | | 0.687 | | 0.786 | |
| F-stat P-Value | 0.000 | | 0.000 | | 0.000 | |

Note: Robust standard errors are in brackets. ***, **, and * represents level of significance at 1, 5 and 10 percent, respectively.

The baseline regression results show that the overall index of the usage of macroprudential policies, MPPI, is negatively, and statistically significantly associated with the growth in credit. A one standard deviation change in the MPPI, reduces credit growth margin by 2.3-3.0 percentage points. This suggests that macroprudential policies have significant mitigating effects on credit developments. Economic growth has a positive coefficient, as expected, and a relatively high elasticity. As the coefficient is statistically significant, it indicates that credit may be more crucially related to economic activity for SEACEN economies.

The effect of a country experiencing crisis on credit is negative and amounts to a reduction in credit of some 6-10 percentage points. There are some dampening effects of higher interest rates as the coefficient on the policy rate is negative. In economic terms, however, this effect is relatively small, compared to that of MPPI. It could be analysed in more detail by splitting the monetary tightening and loosening phases. This suggests that macroprudential policies, as implemented on average, have been relatively more powerful compared to monetary policy. However, three important caveats to the interpretation of this result are in order. First, endogeneity concerns may not have been fully addressed. Second, the policy rate can be an imperfect proxy for the monetary policy stance because of annual data. Third, importantly, monetary policy serves other objectives than just managing credit flows (such as exchange rate or inflation stabilization), making monetary policy less relevant by design in this dimension.

In order to test the impact of risk weight and provisioning requirements for sectoral credit growth, particularly housing sector, we have targeted those economies for which having data is available. For the Indian context, the following models were estimated:

$$\Delta\omega_{i,s,t} = \mu_i + T_t + \delta\Delta(MAPP_t * \omega_{i,s,t}) + \beta\Delta X_{it} + \varepsilon_t \quad \text{(Eq 2a)}$$

where $\Delta\omega_{i,d,s,t}$ is bank credit growth of bank 'i' in sector 's' (housing, commercial real estate and other retails) at time t. We include changes in macroprudential policy ($MPP_t$) and its interaction with a vector of bank-specific characteristics ($X_{bt}$) as explanatory variables. We also include a complete set of bank fixed effects ($\alpha_i$) and time fixed effects ($\theta_t$) and bank-specific control variables. Our main coefficients of interests are the vector $\beta$ and $\delta$ that indicate the change of credit induced by the changes in the specific macroprudential tools. We expect the provision requirement could have short-term impact on loan supply. However, capital requirement is more structural in nature, and could take time to propagate their effects and could have long-term effects.

**Table 11: Summary Statistics of Variables**

| *Variables* | *Mean* | *StDev* | *Median* |
|---|---|---|---|
| *House Credit Growth* | *0.330* | *0.554* | *0.168* |
| *CRE Credit Growth* | *0.793* | *1.525* | *0.244* |
| *Others Credit Growth* | *0.298* | *0.361* | *0.196* |
| *Additional Capital required for House Credit* | *0.027* | *0.048* | *0.014* |
| *Additional Provision required for House Credit* | *0.002* | *0.003* | *0.001* |
| *Additional Capital required for CRE Credit* | *0.089* | *0.169* | *0.027* |
| *Additional Provision required for CRE Credit* | *0.007* | *0.017* | *0.001* |
| *Non-performing Assets Ratio* | *0.048* | *0.033* | *0.032* |
| *GDP Growth* | *0.081* | *0.042* | *0.072* |
| *Repo Rate* | *0.071* | *0.012* | *0.075* |
| *Cash Reserve Ratio* | *0.050* | *0.007* | *0.050* |

The estimated results are as follows. The control variables used are bank-specific. These are Non-performing loan (Net NPA ratio), Ownership (Public and Private sector banks), Profitability (Return on assets), Operational efficiency (Non-interest expenditure), Excess capital reserves, and Deposits. The ownership wise average capital requirements are given in the following Table 12.

**Table 12: Ownership Wise Average Required Capital**

| Bank Type | Public Bank | Private Banks |
|---|---|---|
| *Statistics* | Average Required Capital (as % of RWA) | Average Required Capital (as % of RWA) |
| *Mean* | *12.03* | *13.40* |
| *StDev* | *1.23* | *2.48* |
| *p75* | *12.66* | *15.05* |
| *Median* | *12.08* | *12.52* |
| *p25* | *11.22* | *11.78* |
| *Min* | *9.05* | *8.46* |
| *Max* | *20.33* | *29.93* |

Data: STRB, RBI (Author's Calculation).

Table 13 reports the impact of sectoral own regulatory (capital requirements and provisioning) effects on its credit growth with control variables and without cross effects. This specification is estimated in a panel fixed-effect framework, where the bank fixed effect should capture heterogeneity in lending growth arising from relatively long-run, time invariant bank characteristics. An increase in capital requirements and provisioning requirements are associated with a temporary reduction in housing loan growth. Following the regulatory changes in the risk weight of capital requirement, housing loans growth falls sharply with a pick impact of reducing the yearly growth rate by 2.2 percentage point whereas for provisioning requirement, the reduction in loan growth is 1.4 percentage point. We find that lending growth responds negatively to increase in capital risk weights, regardless of the chosen specification. The impact is in similar line for CRE (Commercial Real Estate loans). But it is the reverse in case of other credit. This indicates a portfolio substitution effect of the macroprudential policies.

**Table 13: Regression Estimates**

| | Dependent Variable: *Housing Credit Growth* | Margins at Mean |
|---|---|---|
| Variables | (1) | (2) |
| *Risk Weight * Housing* | *-3.471*** | *-2.221*** |
| | *(0.011)* | *(0.002)* |
| *Risk weight * CRE* | *-1.082*** | *-0.428*** |
| | *(0.026)* | *(0.014)* |
| *Risk weight * Others* | *6.909*** | *1.563*** |
| | *(0.012)* | *(0.015)* |
| *Provisioning * Housing* | *-45.858*** | *-1.412*** |
| | *(0.193)* | *(0.002)* |
| *Provisioning * CRE* | *51.633*** | *-0.259*** |
| | *(0.250)* | *(0.003)* |
| *Provisioning * Others* | *-14.020*** | *0.071*** |
| | *(0.128)* | *(0.001)* |
| *Branch Fixed Effect* | *Yes* | |
| *Year Fixed Effect* | *Yes* | |
| *Controls* | *Yes* | |
| $R^2$ | *0.903* | |
| *F-stat P-Value* | *0.000* | |

### 3.3 Reverse Causality and Robustness

We estimate a panel VAR consisting of lending growth and the change in macroprudential policies to assess whether reverse-causality is likely to be a serious problem. To identify a change in MPP shocks, we assume that the change in MPPI reacts to real lending growth with a lag. This is a realistic assumption, as regulators typically only observe real lending growth with a lag. In addition, the procedures necessary to change an institution's macroprudential action imply that regulators can only react with a delay, even if they are able to observe real lending growth contemporaneously.

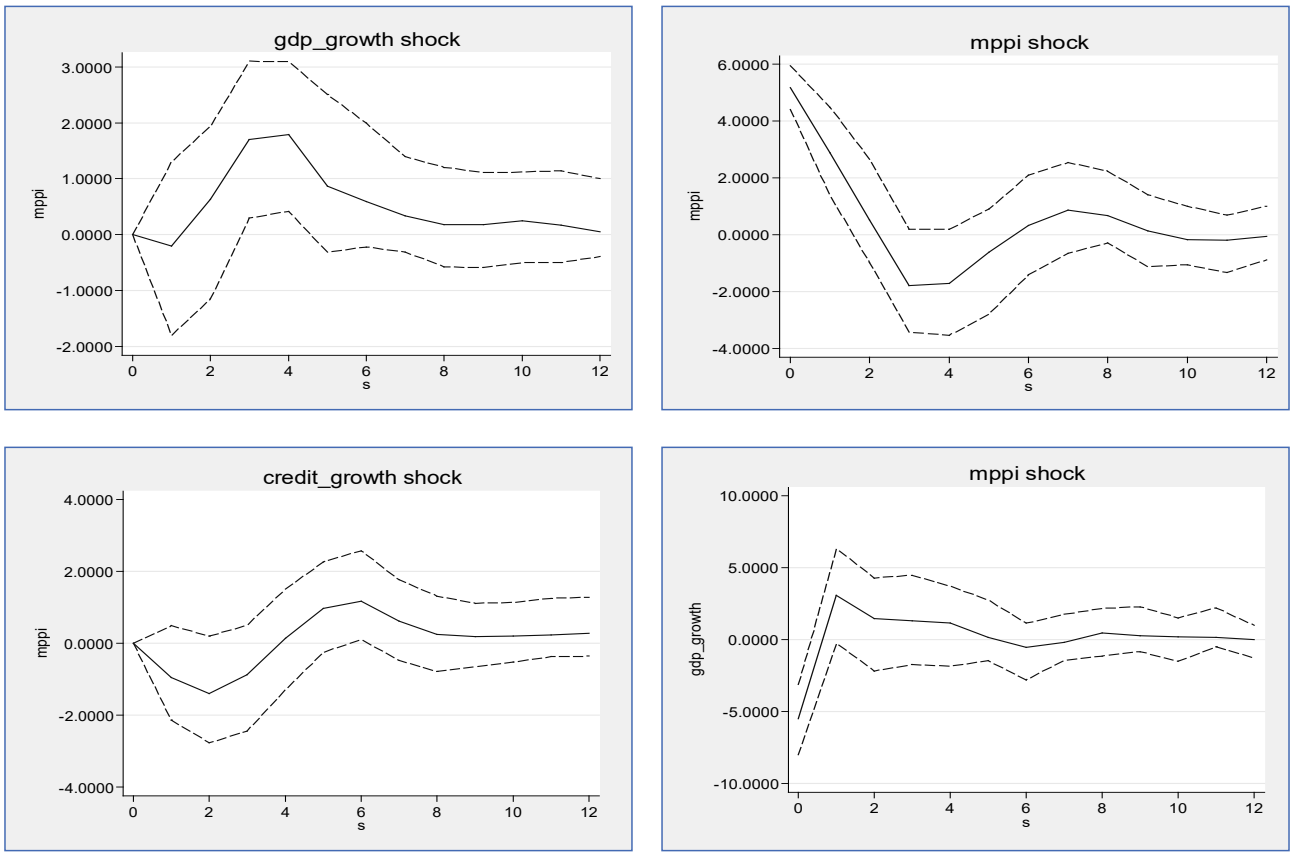
The following panel VAR is used to identify reverse causality and time series behavior of the domestic credit growth against MPPs shocks:

$$Z_{it} = \mu_i + \theta(L) Z_{it} + \varepsilon_t \qquad \text{(Eq 3)}$$

where $Z_{it}$ a vector of macroprudential and sectoral credits is, $\theta(L)$ is the lag operator and $\mu_i$ are the fixed effects. The panel VAR model is estimated using the Bayesian hierarchical approach to avoid dynamic heterogeneity bias. Figure 5 shows the impulse responses to a MPP shock and the associated 5th and 95th posterior coverage bands based on the 1,000 draws from the posterior. The growth rate in real lending of the economy falls by about 2.3% and 3.0%, respectively upon impact and declines

back to zero fairly rapidly. This impact response is almost identical to the estimated impact response in the single equation specification closest to the panel VAR. The similarity of the coefficients allows us to conclude that the joint conditions viz., loan growth and MPP are not autoregressive and there is no reverse causality.

**Figure 5: Impulse Response Function**




## 4. Empirical Evidence from SEACEN Economies: Main Findings

In this section, we cover an integrated overview of the studies undertaken by five SEACEN economies, viz., India, Malaysia, Mongolia, Nepal and Vietnam. Each study focuses on the effects of MPP on credit growth in that economy, although the analysis methods were used as per the suitability and availability of data. The methods used to derive empirical evidence range from panel-VAR-type models to event analysis to panel regressions with country specific bank data and the macroprudential policies with relevant control variables.

### 4.1 Effectiveness of Macroprudential Policies in India

Aggregate bank credit growth has been an important monitor in the conduct of monetary and macroprudential policies. The Reserve Bank of India (RBI) has been using various macroprudential polices, including capital-related policies, since 2004 as a toolkit for ensuring financial stability. While leverage growth and housing price inflation could be marginally affected by implementing credit-related macroprudential measures, credit tends to continue to grow. The impacts of liquidity-related measures appear to be marginally effective in curbing credit growth but significantly effective in impacting housing price escalation. RBI's capital-related macroprudential

policies have focused on banks and applying countercyclical policies to the shadow banking system has been challenging. Time-varying risk weights and provisioning norms on standard assets for certain specific sectors wherein excessive credit growth in conjunction with a sharp rise in asset prices have caused apprehension about a potential build-up of systemic risk and about asset bubbles. Those capital-related policies targeting credit expansion had the desired effect of moderating the credit boom in particular.

*Radheshyam Verma* studies the consequences of MPP experience in India. He finds that macroprudential polices have been effective in the reduction of excessive credit growth. Effectiveness of the macroprudential polices in the Indian financial sector suggests that it can provide an alternative tool other than monetary policy in dampening exuberance in credit cycles. However, usage of the macroprudential polices in various phases of the credit cycle indicates that its impact has been asymmetric. Macroprudential measures have been able to restrain to credit growth in targeted sectors during periods of exuberant growth. However, their ability to uplift credit growth during downturns have been limited.

### 4.2 Measuring the Effectiveness of Macroprudential Policies in Malaysia

In order to mitigate excessive investment and speculative activity in the property market and to contain substantial increases in property prices, in Q4 2010 Bank Negara Malaysia (BNM) introduced a maximum LTV ratio of 70% for loans to purchase third houses. In the following quarter, BNM imposed risk weights from 75% to 100% to strengthen banks' resilience against risky portfolios for loans with an LTV ratio of over 90% that had been approved and disbursed on or after 1 February 2011. The latent propensity to macroprudential tightening illustrates policy makers' strong intention to implement measures during 2010 and 2011. Specifically, in 2004, there were notable shocks to the global economy that contributed to inflationary pressures prompting BNM toward tightening measures. Amidst the Lehman collapse, BNM focused on easing measures in 2008 and early 2009. The divergence in growth performance and consequent differences in policy responses in both the advanced and emerging economies had important implications for global capital flows, asset prices, and exchange rates in 2010, prompting Malaysia to address upward pressure on its exchange rates and asset prices. The unexpected credit-related macroprudential policy tightening had an immediate lessening impact on the housing price boom and a marginally significant effect on credit and leverage growth, and liquidity-related macroprudential instruments had an instant impact on credit growth and a marginally significant effect on dampening leverage and housing price expansion.

*Mohammad Ashraf Mohd Rauf* attempts to answer the question as to whether the macroprudential measures implemented in Malaysia were effective. Using fixed effects estimation, the results of this paper showed that an additional macroprudential measure is associated with a decline in credit growth of three percentage points. Separating the measures based on their transmission mechanisms revealed that measures affecting credit supply and demand are more effective than fiscal measures that affects the cost of homeownership. The estimated effects are more significant for smaller banks, which are argued to experience *excessive* credit growth relative to larger banks. Therefore, the results in this paper suggest that the macroprudential measures implemented in Malaysia has been effective, particularly in curbing *excessive* credit growth. An assumption in this paper is that the effect is homogeneous across house prices and regions. An extension of this paper would be to investigate whether there exists a differential impact across house prices and regions, which may implications on housing affordability.

### 4.3 Effectiveness of selected Macroprudential Tools in Mongolia

Mongolia's economic reforms—such as liberalizing capital flows and foreign trade, among others—opened the door for volatilities and possible contagion. The country faced financial vulnerabilities during the GFC. The increasing procyclicality of systemic risks, rising credit growth, asset price booms and banks' heightened risk appetite all point to the country's growing need to improve its macroprudential policy framework. The current framework involves close coordination between the Bank of Mongolia, Financial Regulatory Commission, and the Ministry of Finance through a Financial Stability Council (FSC). The FSC holds the "duty to agree on macroprudential policy measures critical for sustained long-term economic growth and take coordinated measures." It is specified under the Mongolian Parliament Resolution No. 58, "Approving Monetary Policy Guidelines for 2012" effective 30 November 2011. The FSC was established by a 9 May 2007 joint decree by the Bank of Mongolia, the Ministry of Finance, and the Financial Regulatory Commission, with the primary objective of safeguarding financial stability by determining and managing financial risks. Sukhee and Byambasuren (2016) listed several macroprudential measures introduced to avoid risks that may cause financial instability. Macroprudential policy measures adopted in Mongolia are often aimed at managing volatilities associated with capital flows. These include increase in the liquidity ratio (18% to 25% in 2011), increase in the capital adequacy ratio (12% to 14% for 5 systemic banks), limits on exposure concentration (not to exceed 20% of a bank's capital), limits on net open currency positions (not to exceed 15% of a bank's equity capital), limits on maturity mismatches, setting a reserve requirement on all deposits, and reducing provisioning in times of crisis.

In their report, *Saruul Khasar and Tsenguunjav Byambasuren* examine the effect of set of macroprudential policies including risk-weights, loan-loss provisioning and reserve requirements on bank credit supply in Mongolia using aggregate and individual bank-specific quarterly data for 14 banks in Mongolia over the 2005–2016 period, the effect of macroprudential measures on total credit supply, sectoral lending, as well as some specific type of loans such as foreign currency loans. They find that macroprudential instruments (i.e., risk-weights and reserve requirements) are effective in dampening credit cycles at sufficient level of significance in Mongolia.

### 4.4 The Principal Macroprudential Policies Implemented in Nepal

*Pitambar Bhandari* undertook the study on macroprudential policies implementation in Nepal. The aim was to understand the impact of MPP on Nepal credit growth. As per the presentation made by Mr. Bhandari during the SEACEN workshop, prior to the global financial crisis of 2007-09, Nepal Rastra Bank (NRB) had accorded more focus on microprudential policies. As the financial crisis exposed the gaps in existing supervisory and regulatory framework, regulators worldwide hastened to embrace macroprudential policies due to their significance in overcoming the inherent flaws associated with the traditional microprudential approach. NRB also followed suit and issued a host of macroprudential measures to make BFIs more resilient. The principal macroprudential policies implemented by NRB are related to strengthening the capital of banks and financial institutions, implementing risk-based supervision, making necessary arrangement for system audit, and enhancing corporate governance in BFIs. Likewise, some of the core elements of macroprudential regulation include risk management guidelines to banks, stress testing guidelines, liquidity monitoring, fixation of credit to core capital and deposit (CCD) ratio, loan-to-value ratio, and single borrower limit, among others. NRB has been implementing macroprudential measures together with the monetary policy for facilitating in maintaining financial stability as well as in attaining higher economic growth.

### 4.5 Effectiveness of Macroprudential Policy through Lending Standard Channel: The Case of Vietnam

With Vietnam's growing international presence, increasing interconnectedness within the financial system and between banks and enterprises, improving management of potential systemic risk has gained urgency. Substantial progress has been made to improve the country's macroprudential policy framework. Decree 156/2013/ND-CP, issued during the latter part of 2013, redefined the functions, tasks, powers, and organizational structure of the State Bank of Vietnam (SBV). In February 2014, SBV established a Monetary and Financial Stability Department responsible for analyzing, assessing, and implementing macroprudential policy, and introducing measures to prevent systemic risk in the financial system (Lee et al. 2015).

To contain risks from the sources identified, several macroprudential tools were used. To address currency mismatches, limits or caps on open forex positions, foreign currency loans, and interest rates on foreign currency-denominated deposits were implemented. To mitigate high risk- taking and reduce interest rate volatility, SBV sets caps on interest rates on Vietnamese dong-denominated deposits. Credit growth limits (particularly to pre-identified sectors such as property and stocks) aimed to slow system wide credit growth (Nguyen, 2012). These macroprudential measures, according to Nguyen (2012), were complemented by appropriate monetary, microprudential and structural policies. For example, to curb credit growth, monetary policy on reserve requirements is applied together with selected macroprudential tool.

There is limited empirical evidence of how effective macroprudential measures have been in Vietnam. Nevertheless, Nguyen (2012) noted success in slowing credit expansion (attributed from declining forex loans), decreasing business leverage, deflating asset prices, and waning currency mismatches, among others. Although there has officially been a set of macroprudential policies tools in place, such instruments are also used for monetary policies and banking and financial supervisory. Hence, there is a need for the authorities and related bodies to work closely with a view to measuring and managing systemic risks as well as devising more effective macroprudential policies better suited to addressing systemic risks with relevant tools in the interaction with monetary policies. In addition to known sources of systemic risks, macroprudential authorities must keep an eye on potential sources of risks—such as expected vulnerabilities associated with growing cross-border capital flows across emerging economies and from advanced markets.

The Vietnam project team comprising *Do Thi Bich Hong, Dang The Tung, Pham Thi Hoang Anh, Vu Thi Kim Chi, Tran Thi Xuan Anh, Luong Minh Ha and Tran Nguyen Minh Hai,* undertook the study to understand the impact of MPP on credit growth in Vietnam. The findings were along the similar lines as other participating SEACEN economies.

## 5. Conclusions: Key Findings and Policy Implications

Macroprudential policies implementation in SEACEN economies have shown a dampening effect on excessive credit growth and select sectoral credit growth. The general pattern of the evidence from the five economies suggests that credit-related macroprudential policies can effectively dampen credit expansion while liquidity-related macroprudential policy tools moderate leverage growth. For example, the results suggest that credit-related macroprudential policy dampened credit growth in India, liquidity-related policy slow up leverage growth in Malaysia. The salient implication for Asian financial regulators is that while they explore the use of macroprudential policies, they should assess which specific policies are appropriate for the particular macroprudential risk they face.

Overall, our evidence indicates that macroprudential policies can be a valuable additional tool for financial regulatory authorities. The recent financial crises have shown that microprudential policy based on surveillance of individual financial institutions was not sufficient to safeguard the stability of the financial system. After detecting undue risk accumulation, policy makers should discourage excessive risk taking by providing appropriate incentives to financial market participants. They may also consider implementing macroprudential measures, especially those that have been effective in their own economies. The global financial crisis has forced policy makers to review their policy frameworks, to examine how they could identify time-dimensional and cross-sectional risks in the finance sector, and to deal with those risks. Often procyclical systemic risk rises in tandem with cross-sectional systemic risk. Therefore, policy makers should be fully aware that time-dimensional risk during the peak of a financial cycle can trigger cross-sectional systemic risk that renders banks vulnerable to a common shock.

In response to an increase in capital requirements, banks gradually increase their capital ratios to restore their original buffers held above the regulatory minimum. Banks also reduce loan growth following an increase in capital requirements, banks cut loan growth for housing and substitute to other secured lending. These findings reflect how, on average, individual banks responded in the past to a change in their own confidential and macroprudential capital requirements. And to the extent that there will be similarities in the way in which banks respond to changes in capital requirements across regimes, our results contain some quantitative insights into how changing capital requirements in a macroprudential regime might affect lending. These finding corroborate the findings of Acharya et al. (2016). It is assumed that banks would meet the new heightened capital and provisioning requirements by altering the relative size of their equity-capital to debt funding. However, the substitution of debt with more expensive equity-capital to meet the macroprudential policies may lead to a decrease in the return on equity (ROE) of banks. In order to avoid the decrease in the ROE, it is assumed in this study that banks would increase their lending rates.

Despite the coverage of this study, it is important to acknowledge that the assumptions/approach used in this study has its limitations. First, it ignores the alternatives faced by banks in adjusting their capital structures. Second, the estimates of the approach are not centered on an optimization in a general equilibrium setting. In addition, theory suggests that the cost of debt should reduce as the increase in the equity ratio will reduce the default risk. Nonetheless, the assumptions in this study are conservative, and they provide a starting point for understanding the behavioral response of banks to a change in capital and provisioning requirement.

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## Chapter 2

# EFFECTIVENESS OF MACROPRUDENTIAL POLICIES IN INDIA

By

**Radheshyam Verma**[1]

## 1. Introduction

Macroprudential policies are complementary to microprudential, monetary policy and exchange rate policies in safeguarding financial stability and mitigating systemic risk. They work by limiting the build-up of risk from specific sources of financial imbalances and thus improve the resilience of the financial system. They are also helpful in limiting the consequences of busts, by utilizing the buffers they help to build up during boom times. Thus, they work in a counter-cyclical fashion in helping to dampen the credit-cycles.

Delineating the distinction between macroprudential and microprudential approaches, Borio (2003) asserts that while the objective of the former is to limit the risk of episodes of financial distress with significant losses in terms of the real output for the economy as a whole, the latter approach tries to limit the risk of financial distress at the level of individual institutions. Further, highlighting the significance of macroprudential tools *vis a vis* monetary policy tools in tackling financial stability issues, the International Monetary Fund (IMF) (2013) argues that monetary policy alone cannot achieve financial stability as the causes of financial instability may not always be related to the degree of liquidity in the system which monetary policy can fix. When financial distortions are more acute in some sectors of the economy than in others, as is often the case, monetary policy is a very blunt tool as it will also affect many sectors in an unintended manner. Thus, price and output stability may conflict with financial stability. In such conditions, having additional tools such as macroprudential ones for financial stability goal may be welfare enhancing.

Macroprudential tools have been particularly useful while dealing with excessive credit growth in specific sectors. Shin (2010) argues that the interconnectedness of financial institutions increases with excessive growth in assets held by financial institutions. An effective macroprudential policy may help in addressing it. The experience of the global financial crisis showed that even if the individual financial institutions are in sound and healthy condition, the financial system as a whole may be vulnerable to systemic risk. This underscores the importance of macroprudential supervision of financial institutions.

India is among the fore-runners in the implementation of macroprudential policies. It has been observed that macroprudential tools have been used more often in emerging and developing economies as compared to advanced economies (Orsmond and Price, 2016) (Chart 1).

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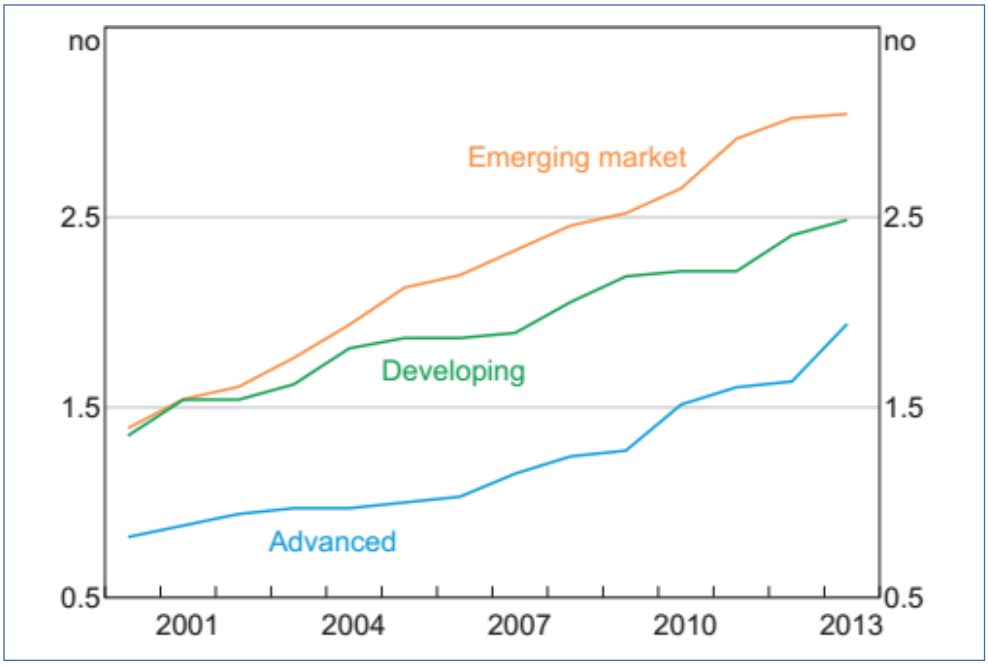
1. The author is Assistant Adviser in the Department of Economic and Policy Research, Reserve Bank of India (RBI). The views expressed in the paper are those of the author and do not necessarily represent the views of the RBI or The SEACEN Centre. The author is thankful to Dr. Jugnu Ansari, Project Team Leader, for constant encouragement, guidance and support. The author also acknowledges Ms. Rekha Misra and Dr. Snehal Herwadkar from RBI for their comments on the earlier draft of the paper.

**Chart 1: Use of Macroprudential Tools* - By Economy Type**




* Use is measured by the average number of tools used per economy type; economy types are defined using the October 2016 IMF *World Economic Outlook* and World Bank publications

Source: Orsmond and Price, 2016.

The rest of the paper proceeds as follows: Section 2 discusses the various literature on effectiveness of macroprudential policies in curbing excessive credit growth and significance of their coordination with monetary policy. In Section 3, various macroprudential tools used in India are discussed. In Section 4, the empirical part related to the effectiveness of macroprudential policies in India is presented. The conclusion is given in the last section.

## 2. Literature Review

There is a rich strand of literature on the effectiveness of macroprudential policies in curbing excessive credit growth in recent years, particularly pertaining to emerging market economies (EMEs). In many works that have cross-country analysis, India has been part of the country data-sets used. However, this author did not find any specific literature on the effectiveness of macroprudential policies on credit growth in India.

Using a panel of 13 Asian economies (including India) and 33 other advanced and emerging economies, Zhang and Zoli (2014) found that macroprudential policy has contributed in reducing credit growth in Asia. However, only housing-related measures such as loan-to- value (LTV) ratios, debt-to-income (DTI) ratios, risk weights and loan loss provisions on mortgage loans were found to have a significant impact. Changes in reserve requirements and capital regulation were not found to have any significant effect on bank credit. Lim et al. (2011), using a panel of 49 countries, also had similar findings. However, they also found reserve requirements and dynamic provisioning to be effective in reducing pro-cyclicality of credit. Further, they also found that the effectiveness of the instruments does not depend on the exchange rate regime and the size of the financial sector.

Using a dataset provided by IMF on macroprudential policies, Arregui et al. (2013) found that LTV limits, reserve requirements and risk weights were effective in reducing credit growth and house price growth. However, tightening in provisioning was not always found to be significant. Similarly, Kuttner and Shim (2012) by using various housing-related macroprudential measures for 57 advanced and emerging market economies for the period 1980–2011, found that these measures are quite effective in dampening growth in housing prices and housing credit. The LTV ratio and exposure limits on banks to the housing/property sector were not found significant. However, jointly the prudential variables related to housing were found to be significant. Further, Dell'Ariccia et al. (2012) found that macroprudential policy can contain credit booms and limit the adverse consequences of busts. However, they argued that it may be difficult to stop a credit boom through macroprudential measures alone in small, financially open economies. Hence, they underlined the importance of coordination with exchange rate and fiscal policies in case of externally funded credit growth.

Claessens et al. (2014) looked at 48 advanced economies and EMEs for 2000–2010 using bank level data and found that measures aimed at borrowers such as caps on DTI and LTV ratios and at financial institutions such as limits on credit growth and foreign currency lending are effective in reducing asset growth. They found that these tools help reduce risks during upswings. In contraction phases, however, these macroprudential tools were less effective in maintaining financial intermediation. Cerutti et al. (2015) covering 119 countries over the period 2000-13 also had a similar finding with regard to the effectiveness of macroprudential policies over the business cycle. Further, they found a statistically significant negative relationship of various macroprudential instruments with credit growth. However, the relationship was strongest for EMEs, and much less so for advanced economies which reflects the high reliance of EMEs on macroprudential policies than of advanced economies. Also, according to them, the more developed financial systems of advanced economies offer various alternative sources of finance and scope for circumvention, possibly making it harder for macroprudential policies to be effective.

Gomez et al. (2017) found that, in case of Colombia which used countercyclical reserve requirement and dynamic provisioning scheme for commercial loans for 2006-09 employing loan-account level data, aggregate macroprudential policy stance worked effectively in stabilizing credit cycles and in reducing bank risk-taking. They also underscored the importance of coordination with monetary policy in moderating the credit growth. Tressel and Zhang (2016) found that in the case of the Euro area using Euro-system Bank Lending Survey, that instruments targeting the cost of bank capital were most effective in slowing down mortgage credit growth, and that the impact was transmitted mainly through price margins, the same banking channel as monetary policy. Limits on loan-to-value ratios were also found to be effective, especially when monetary policy was excessively loose.

Erdem et al. (2017) using data of 30 EMEs (including India) for 2000-13 and applying panel vector auto-regression (VAR) found that macroprudential policies are effective in limiting domestic credit growth especially during the expansion phase of the credit cycle. The number of macroprudential tools also matter to better manage the domestic credit growth, since insufficient number of measures were unable to prevent leakages and reduce the effectiveness of macroprudential policies under a global liquidity shock. Akinci and Olmstead-Rumsey (2017) constructed an index of macroprudential policies in 57 advanced and emerging economies for 2000-13 and found that macroprudential tightening was associated with lower bank credit growth, housing credit growth, and house price appreciation. Further, tools specifically intended to limit house price appreciation were found to be more effective, especially in economies where bank finance was important.

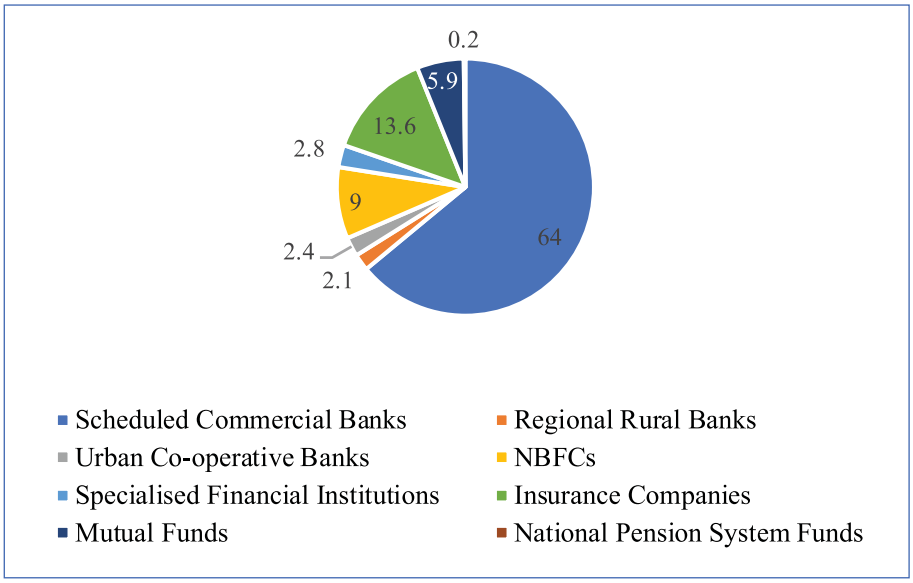
Bruno et al. (2017) analyzing the impact of broadly defined macroprudential and monetary measures (other than policy rate changes) taken in 12 Asia-Pacific economies (including India) over 2004–2013 found that the impact of such measures is ambiguous as they tend to have a positive or insignificant impact on cross-border lending and bank credit which may indicate limitations of macroprudential policy measures. However, using bank-level credit data showed significant effects of domestic macroprudential policies on banks' total asset growth and their leverage. Further, they found high correlations between interest rate policy and banking sector capital flow management policies and domestic macroprudential policies, suggesting macroprudential policies are more successful when they complement monetary policy.

## 3. Macroprudential Regulation in India

Macroprudential regulation has been undertaken to address both dimensions of systemic risk i.e., time dimension and cross-sectional dimension. The time dimension of systemic risk is closely related to pro-cyclicality of credit growth. Financial imbalances build up gradually over time when financial institutions become very aggressive in risk taking so that their leverage, liquidity, and prices of securities and real estate rise sharply in a relatively very short span of time. However, during the down-swing phase, the trend reverses triggering a fall in asset prices, resulting in devastating deleveraging and liquidity squeeze which may result in a financial crisis. The cross-sectional dimension is related to the distribution of systemic risk in the financial system. It is closely related to the concept of inter-connectedness of financial institutions. When an individual financial institution fails, it rapidly contaminates other institutions through various inter-linkages such as counter-party risk, asset fire sales, liquidity crisis, etc. Thus, common exposure to financial market shocks or adverse macroeconomic developments affect a range of financial intermediaries and markets at the same time.

In India, most of the macroprudential measures have been applied primarily on commercial banks (including regional rural banks) as they are central to the Indian financial system, occupying 66.1% of the total assets of the financial system (Chart 2). Non-bank Financial Companies (9%) are also an important component of the financial system. Non-deposit taking systemically important NBFCs which constitute 86% of the total assets of the NBFC sector are closely monitored in view of their systemic importance. However, the paper mainly focuses on macroprudential measures applicable to banks only.

**Chart 2: Share of Different Sectors in Total Assets of Indian Financial System (In %)**

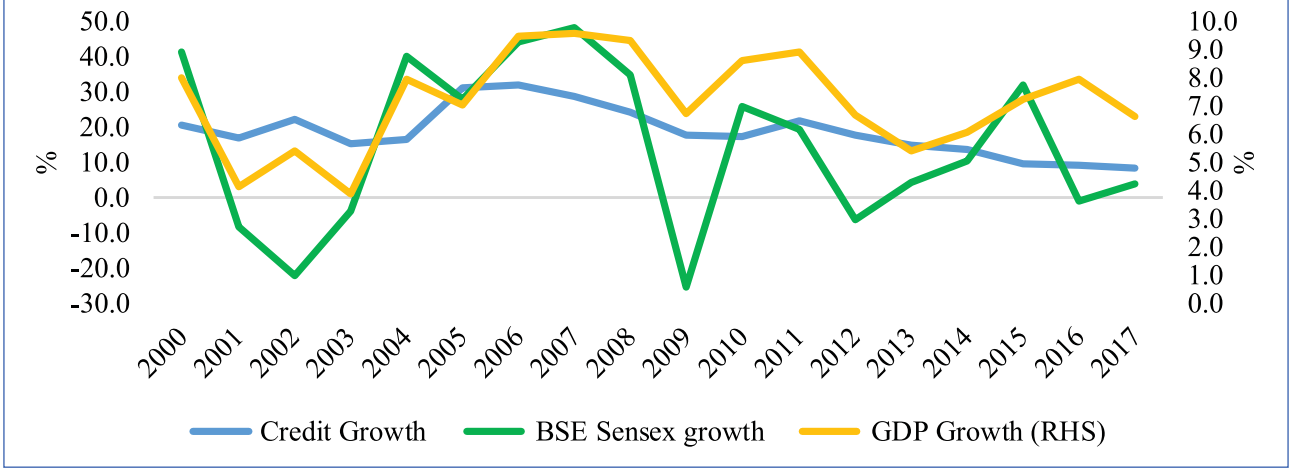



Source: Reserve Bank of India (2014).

## 3.1 Macroprudential Measures Taken in India – Time Dimension of Systemic Risk

**Time-varying Risk Weights and Provisioning Norms:** Counter-cyclical provisioning and differentiated risk weights for certain sensitive sectors were adopted in 2004 to counter pro-cyclical trends (Chakrabarty, 2014). The sectors included residential housing, other retail sector, commercial real estate (CRE), capital market and systemically important non-deposit taking non-bank financial companies (NBFCs). During 2004-08, the Indian economy was going through an expansionary phase with GDP growth of more than 7%. The overall credit also exhibited excessive growth (Chart 3). Advances to sectors such as housing and CRE grew by more than 50% year-on-year. This period was also marked by high capital flows. This exposed the banking sector to various risks associated with costly balance sheet imbalances and asset price booms.

**Chart 3: Growth in GDP, Credit and BSE Sensex**




Source: https://dbie.rbi.org.in.

In order to protect banks' balance sheets against such risks, the Reserve Bank raised risk weights from 50% to 75% in the case of housing loans and from 100% to 125% in the case of consumer credit including personal loans and credit cards with effect from December 2004. Further, risk weights for banks' exposure to CRE were increased from 100% to 125% in July 2005, and further to 150% in May 2006. Later in May 2008, the risk weights on housing loans of up to Rs. 3 million with loan-to-value (LTV) ratio of less than or equal to 75 were reduced to 50% from 75 %, while the risk weights on individual housing loans with LTV ratio higher than 75% were raised to 100%. Simultaneously, as equity prices started rising sharply and there was a boom in consumer credit, risk weights on consumer credit and capital market exposures were increased from 100% to 125% (Table 1, Chart 4).

**Table 1: Countercyclical Prudential Regulation: Variations in Risk Weights and Provisioning Requirements**

%

| Date | Capital Market | | Housing | | Other Retail | | Commercial Real Estate | | Non-Deposit taking Systemically Important NBFCs | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Risk Weight | Provisions | Risk Weight | Provisions | Risk Weight | Provisions | Risk Weight | Provisions | Risk Weight | Provisions |
| Dec-04 | 100 | 0.25 | 75 | 0.25 | 125 | 0.25 | 100 | 0.25 | 100 | 0.25 |
| July-05 | 125 | 0.25 | 75 | 0.25 | 125 | 0.25 | 125 | 0.25 | 100 | 0.25 |
| Nov-05 | 125 | 0.40 | 75 | 0.40 | 125 | 0.40 | 125 | 0.40 | 100 | 0.40 |
| May-06 | 125 | 1.00 | 75 | 1.00 | 125 | 1.00 | 150 | 1.00 | 100 | 0.40 |
| Jan-07 | 125 | 2.00 | 75 | 1.00 | 125 | 2.00 | 150 | 2.00 | 125 | 2.00 |
| May-07 | 125 | 2.00 | 50-75@ | 1.00 | 125 | 2.00 | 150 | 2.00 | 125 | 2.00 |
| May-08 | 125 | 2.00 | 50-100@ | 1.00 | 125 | 2.00 | 150 | 2.00 | 125 | 2.00 |
| Nov-08 | 125 | 0.40 | 50-100@ | 0.40 | 125 | 0.40 | 100 | 0.40 | 100 | 0.40 |
| Nov-09 | 125 | 0.40 | 50-100@ | 0.40 | 125 | 0.40 | 100 | 1.00 | 100 | 0.40 |
| Dec-10 | 125 | 0.40 | 50-125@ | 0.40-2.00# | 125 | 0.40 | 100 | 1.00 | 100 | 0.40 |
| June-13 | 125 | 0.40 | 50-75@ | 0.40-2.00# | 125 | 0.40 | 75* | 0.75* | 100 | 0.40 |
| Oct-15 | 125 | 0.40 | 35-75@ | 0.40-2.00# | 125 | 0.40 | 75* | 0.75* | 100 | 0.40 |
| June-17 | 125 | 0.40 | 35-50@ | 0.25 | 125 | 0.40 | 75* | 0.75* | 100 | 0.40 |

Notes:

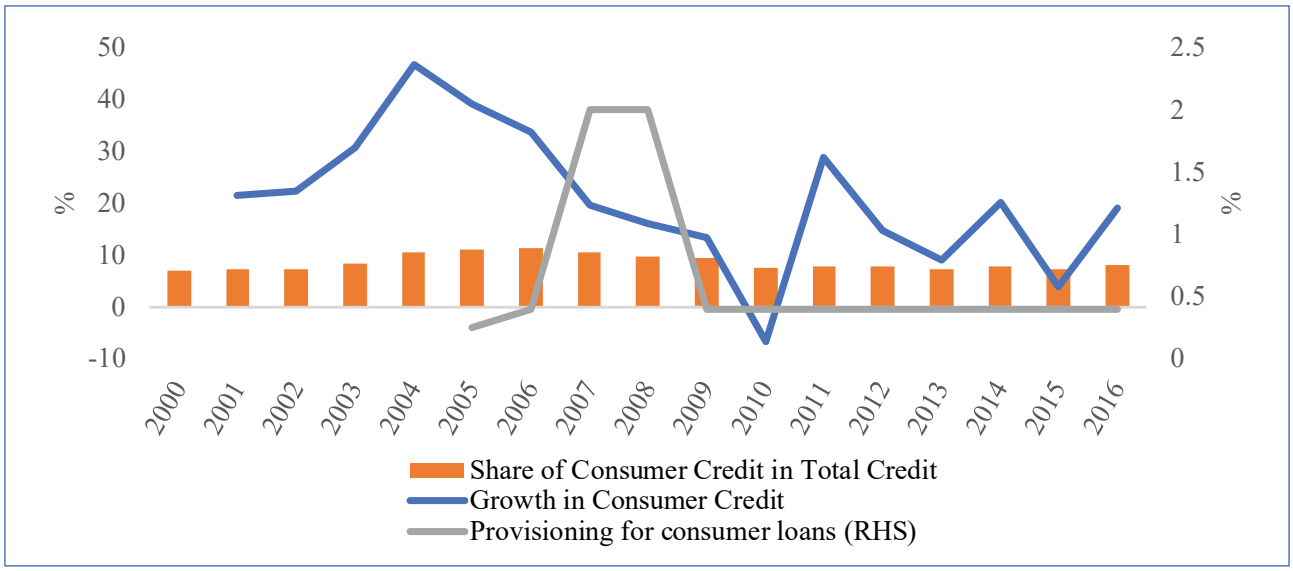
*: Commercial Real Estate- Residential Housing (CRE-RH). For other CRE risk weight and provisioning requirement remained unchanged.

#: Provisioning requirement for housing loans with teaser interest rates was increased to 2.0% in December 2010. In June 2013 and October 2015 review, 2% provisioning requirement on teaser loans remained in force. For other housing loans the provisioning at 0.4%.

@: The risk weights for housing loans vary according to amount of the loan and the loan to value ratio.

Source: Reserve Bank of India and Sinha (2011).

**Chart 4: Effectiveness of Macroprudential Measures- Consumer Loans**



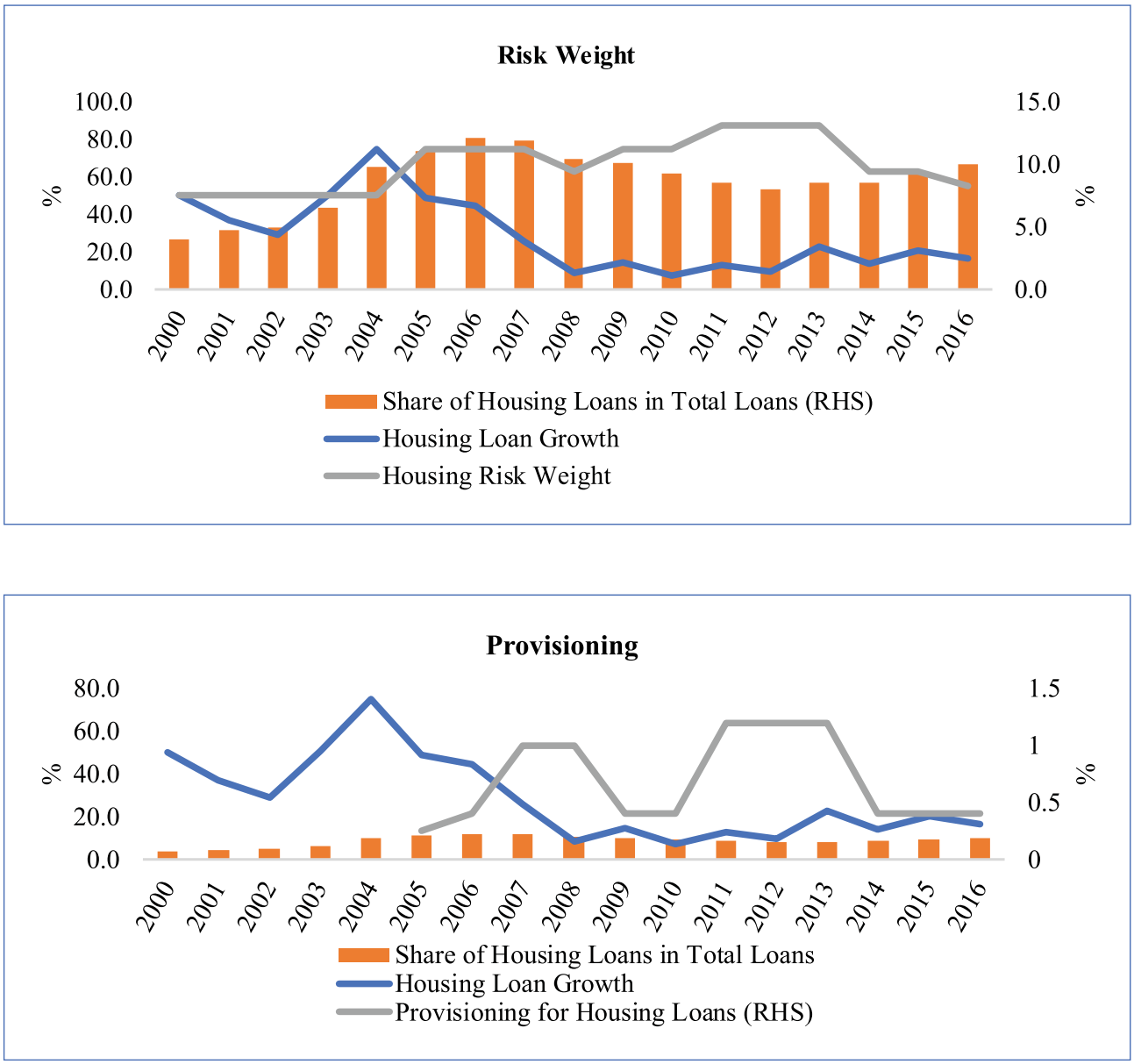

Source: Reserve Bank of India.

Similarly, in view of the excessive growth in credit to non-deposit taking systemically important NBFCs, provisioning on loans to these NBFCs was raised to 0.40% from 0.25% in November 2005 and further to 2% in January 2007 which was later restored to 0.40% in November 2008.

When the global economic crisis started impacting the domestic financial system and other parts of the economy in 2008, some of the pre-crisis tightening measures were relaxed in a counter-cyclical manner, easing both risk weights and provisioning for standard assets. The prudential framework for restructuring of advances was also modified to facilitate viable units facing temporary difficulties to tide over the crisis situation. By late 2009, credit growth began to recover especially in the CRE segment prompting the Reserve Bank to increase the standard asset provisioning requirements for the sector (Chakrabarty, 2014). Further, in December 2010, in order to prevent excessive speculation in the high value housing segment, the risk weights for residential housing loans of Rs.75 lakh and above, irrespective of the LTV ratio, were raised to 125% from 100%. Similarly, in view of the high risk associated with 'teaser loans'[2], the standard asset provisioning on the outstanding amount was increased from 0.40% to 2.00% during the same period. The provisioning on these assets were to revert to 0.40% after 1 year from the date on which the rates are reset at higher rates if the accounts remain 'standard'. Further, with a view to rationalize risk weights on high value individual housing loans, risk weight on loans above Rs.7.5 million was brought down to 75% from 125% in June 2013 (Chart 5).

2. In 2010, some banks were following the practice of sanctioning housing loans at teaser rates i.e., at comparatively lower rates of interest in the first few years, after which rates were reset at higher rates. This practice raised concern that some borrowers may find it difficult to service the loans once the normal interest rate, which was higher than the rate applicable in the initial years, would become effective. It was also observed by the Reserve Bank that many banks at the time of initial loan appraisal did not take into account the repaying capacity of the borrowers at normal lending rates.

**Chart 5: Effectiveness of Macroprudential Measures - Housing Loans**




Source: Reserve Bank of India.

In October 2015, risk weights were further rationalized for housing loans above Rs. 3 million and up to Rs. 7.5 million, reducing to 35% for LTV ratio up to 75%. Further, in June 2017, risk weights and provisioning on standard assets on certain categories of individual housing loans were reduced with a view to providing a boost to the housing segment (Table 2).

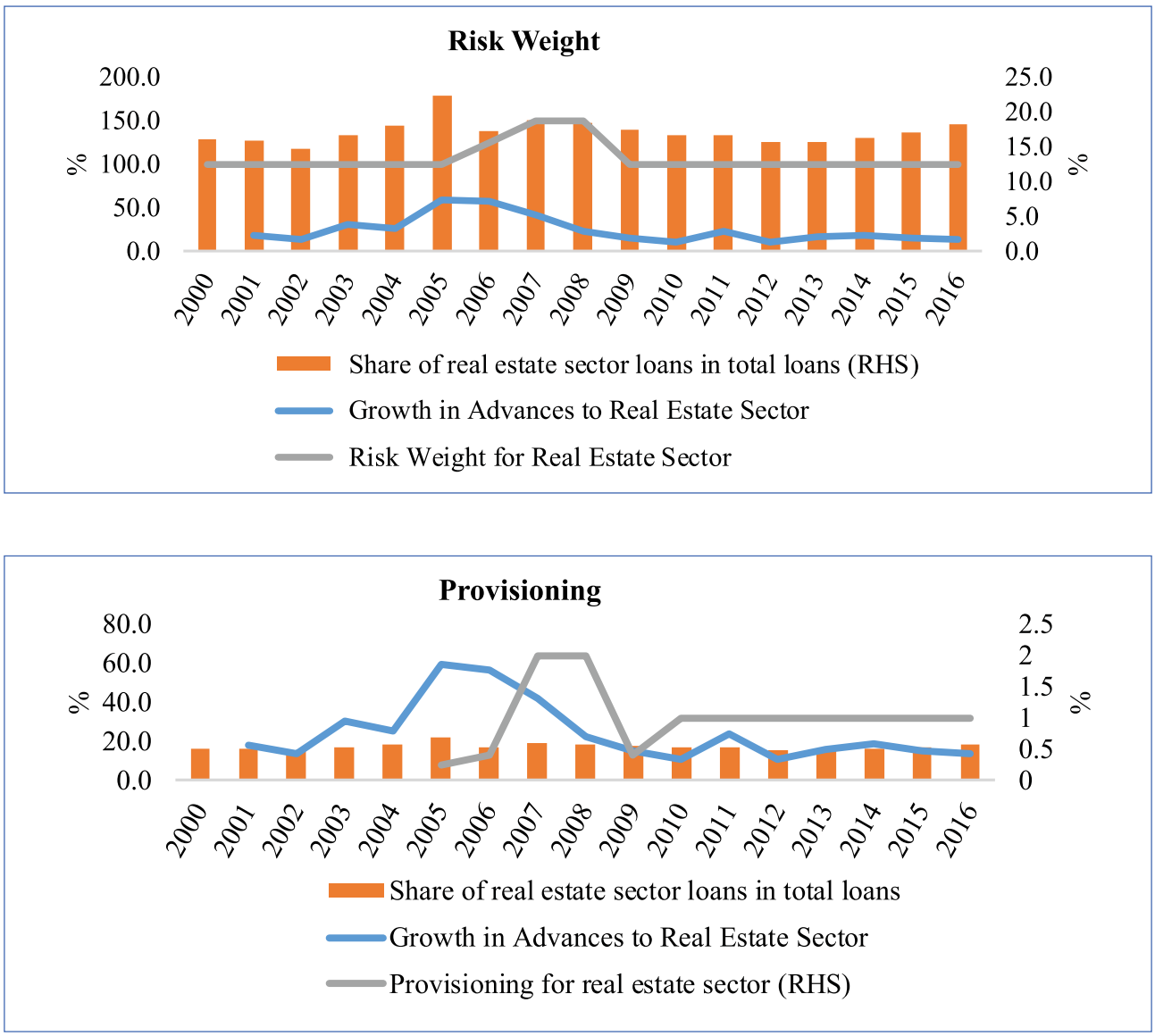
**Table 2: Differentiated Risk Weights for Housing Loans**

| Period | Loan Amount | Loan-to-value (LTV) Ratio (%) | Risk Weight (%) |
|---|---|---|---|
| **May-08** | Up to Rs.3 million | LTV Ratio = or < 75 | 50 |
| | Above Rs.3 million | LTV Ratio = or < 75 | 75 |
| | Irrespective of the amount | LTV Ratio > 75 | 100 |
| **Dec-10** | Rs. 7.5 million and above | - | 125 |
| | LTV Ratio in general should not exceed 80%. However, LTV ratio for housing loans up to Rs. 2 million should not exceed 90 %. | | |
| **Jun-13** | Up to Rs. 2 million | 90 | 50 |
| | Above Rs. 2 million and up to Rs. 7.5 million | 80 | 50 |
| | Above Rs.7.5 million | 75 | 75 |
| **Oct-15** | Up to Rs.3 million | ≤ 80 | 35 |
| | | > 80 and ≤ 90 | 50 |
| | Above Rs. 3 million and up to Rs 7.5 million | ≤ 75 | 35 |
| | | > 75 and ≤ 80 | 50 |
| | Above Rs 7.5 million | ≤ 75 | 75 |
| **Jun-17** | Above Rs. 3 million and up to Rs 7.5 million | ≤ 80 | 35 |
| | | | 35 |
| | Above Rs.75 lakh | ≤ 75 | 50 |

Source: Reserve Bank of India.

In June 2013, a separate sub-sector called Commercial Real Estate – Residential Housing (CRE-RH) was carved out of the CRE Sector as loans to the residential housing projects under the CRE sector exhibited lesser risk and volatility than the CRE sector taken as a whole. CRE-RH consists of loans to builders/developers for residential housing projects (except for captive consumption) under the CRE segment. The CRE-RH segment was put with lower risk weight of 75% and lower standard asset provisioning of 0.75% against 100% and 1.00%, respectively for the CRE segment (Chart 6).

**Chart 6: Effectiveness of Macroprudential Measures - Commercial Real Estate Loans**




Source: Reserve Bank of India.

According to the Reserve Bank guidelines, with effect from October 20, 2016 exposure to housing finance companies (HFCs) has to be risk weighted as per the rating assigned by the rating agencies registered with Securities and Exchange Board of India (SEBI) and accredited by the Reserve Bank of India which is the prevailing practice in lending to corporates.

In India's case, both monetary policy and macroprudential policy complemented each other. During September 2004 - August 2008, monetary policy was in tightening phase to contain the demand pressures. During this period, repo rate was raised by 300 basis points. In this period, provisioning on standard assets on housing loans and commercial real estate were raised by 75 basis points and 175 basis points, respectively. Similarly, risk weights on various segments were raised during this period. During the easing phase of October 2008 - April 2009, both policy rates and risk weights and provisioning norms in various segments were also loosened. Further, in most of the later tightening and loosening phases of monetary policy, it was in sync with macroprudential policy (Table 3).

**Table 3: Coordination between Monetary and Macroprudential Policies**

(Change in basis points)

| | Monetary tightening phase (September 2004 – August 2008) | Monetary easing phase (October 2008 – April 2009) | Monetary tightening phase (October 2009 – October 2011) | Monetary easing phase (January 2012 – May 2013) | Monetary tightening phase July 2013 – January 2014) | Monetary easing phase January 2015 – till date |
|---|---|---|---|---|---|---|
| **Monetary Measures** | | | | | | |
| Repo rate | 300 | -425 | 375 | 125 | 75 | 200 |
| Reserve repo rate | 125 | -275 | 425 | 125 | 75 | 125 |
| Cash reserve ratio | 450 | -400 | 100 | 150 | 0 | 0 |
| **Provisioning Norms** | | | | | | |
| Capital market exposures | 175 | -160 | 0 | - | - | - |
| Housing loans | 75 | -60 | 160* | 160 | 160 | 15-175 reduction |
| Other retail loans | 175 | -160 | 0 | - | - | - |
| Commercial real estate loans | 175 | -160 | 60 | - | - | - |
| Non-deposit taking systemically important non-financial companies | 175 | -160 | 0 | - | - | - |
| **Risk Weights** | | | | | | |
| Capital market exposures | 25 | 0 | 0 | - | - | - |
| Housing loans | -25 to 25@ | 0 | 0-25# | - | 0-50 reduction | 15 |
| Other retail loans | 25 | 0 | 0 | - | - | - |
| Commercial real estate loans | 50 | -50 | 0 | - | - | - |
| Non-deposit taking systemically important non-financial companies | 25 | -25 | 0 | - | - | - |

**Notes:**

*: Provisioning requirement for housing loans with teaser interest rates was increased to 2.0% in Dec 2010.

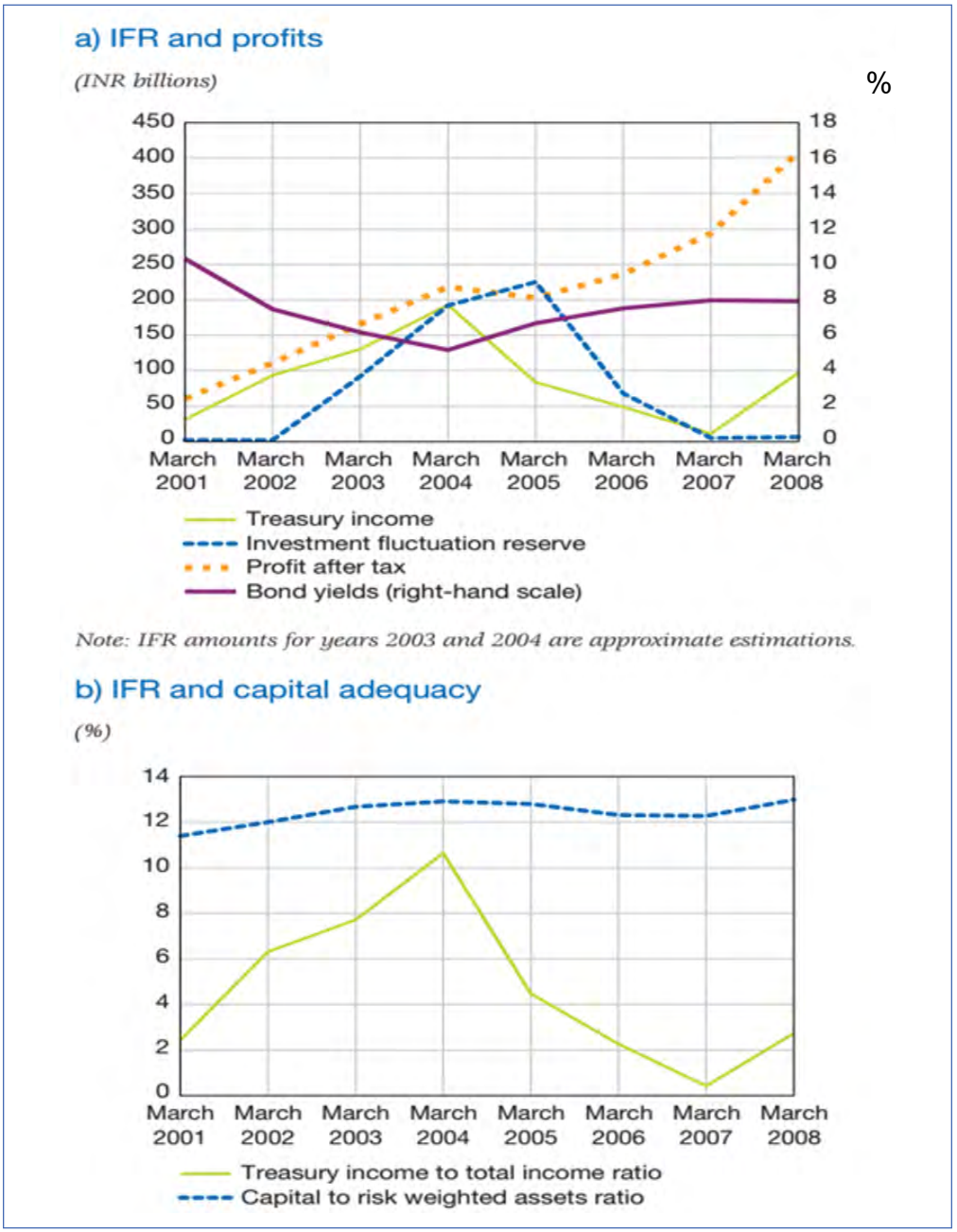
@: Risk weights on housing loans of relatively smaller size classified as priority sector was reduced from 75% to 50% in May 2007, which was not a countercyclical measure but rather an attempt to align the risk weights on secured mortgages with the provisions of Basel II which was to be implemented with effect from March 2008. On the larger loans and those with LTV Ratio exceeding 75% the risk weight was increased from 75% to 100%.

#: The risk weight on loans above Rs. 7.5 million was increased to 125%.

Source**:** Reserve Bank of India and Sinha (2011).

**Investment Fluctuation Reserve:** In the early 2000s, banks were gaining significantly from falling interest rates (Chart 7). With a view to building up adequate reserves to guard against any possible reversal of interest rate loosening cycle in the future, banks were advised to build up the Investment Fluctuation Reserve (IFR) to a minimum of 5% of their total investments by transferring the gains realized on sale of investments within a period of five years. The IFR was allowed to be drawn down when the interest rate cycle turned and treasury incomes started falling. Further, banks were advised in October 2005 that, if they maintained capital of at least 9% of the risk weighted assets for both credit risk and market risks for both Held for Trading (HFT) and Available for Sale (AFS) category as on March 31, 2006, they would be permitted to treat the entire balance in the IFR as Tier I capital. For this purpose, banks could transfer the balance in the IFR 'below the line' in the Profit and Loss Appropriation Account to Statutory Reserve, General Reserve or balance of Profit & Loss Account.

**Chart 7: Investment Fluctuation Reserve**




Source: Chakrabarty (2014).

**Provisioning Coverage Ratio:** The Reserve Bank asked banks to ensure that Provisioning Coverage Ratio (PCR), including floating provisions, is not less than 70% with a view to augmenting provisioning buffer in a counter-cyclical manner when the banks were making good profits, which can be used for absorbing losses during a downturn. Accordingly, banks were advised to achieve this norm not later than end-September 2010. The PCR of 70% may be with reference to the gross non-performing assets (GNPA) position in banks as on September 30, 2010. Excess of provisions for PCR over that required, under prudential norms, would be segregated into a "counter-cyclical provisioning buffer". This buffer is used by banks for making specific provisions for NPAs during periods of system-wide downturn, with the prior approval of the Reserve Bank.

**Cash Reserve Ratio:** Cash reserve ratio (CRR) is the average daily balance that a bank is required to maintain with the Reserve Bank as a share of its net demand and time liabilities (NDTL). Although the CRR has mostly been used as a monetary policy tool, it has macroprudential impacts as well. Reserve requirements serve a counter-cyclical role for managing the credit cycle in a broad context. In the upswing, hikes in reserve requirements may increase lending rates, slowdown credit, and limit excess leverage of borrowers in the economy, thus acting as a speed limit. In the downswing, they can ease liquidity constraints in the financial system, thus operating as a liquidity buffer (Tovar, et al., 2012).

**Statutory Liquidity Ratio:** Statutory liquidity ratio (SLR) is the share of NDTL that a bank is required to maintain in safe and liquid assets, such as unencumbered government securities, cash and gold. They work similarly to reserve requirements as a prudential tool in a counter-cyclical fashion.

**Liquidity Coverage Ratio:** Liquidity coverage ratio (LCR) is intended to promote short-term resilience of banks to potential liquidity disruptions. LCR requires the banks to have adequate high quality liquid assets (HQLAs) to withstand a 30-day liquidity shock. Though both SLR and LCR are microprudential in nature, these liquidity ratios have some macroprudential characteristics as well and hence, are capable of mitigating systemic liquidity risk as they mitigate negative effects from market illiquidity and excessive maturity and liquidity mismatches (ECB, 2012). As part of Basel III implementation, the LCR has been binding on Indian banks since January 1, 2015. The LCR requirement was a minimum of 60% for the calendar year 2015 and to rise by 10 percentage points each year to reach 100% by January 1, 2019. Currently, banks have to comply with both SLR as well as LCR regulations, but SLR requirement is being gradually brought down to facilitate a smooth transition to LCR of 100% by January 1, 2019. Presently, a total carve-out from the SLR is 11% of banks' NDTL that is available for consideration for LCR (RBI, 2017).

**Leverage Ratio:** The leverage ratio is used as a supplement to risk-based capital ratios to constrain the build-up of excessive leverage. It is intended to maintain the resilience of the banking system by limiting a bank's total exposure (both on-balance sheet and off-balance sheet) in relation to its equity. Highlighting the limitations of risk-based capital ratios, IMF (2014) argued that risk-weighted assets can erode in "good times" when measured risks are low. However, they are also subject to "gaming effects" where banks manage risk weights down in order to fatten their capital ratios. Leverage ratios are being monitored in Indian banks with effect from April 1, 2015. In view of testing for a minimum Tier I leverage ratio of 3% by the BCBS till 2017, the Reserve Bank has been monitoring individual banks against an indicative leverage ratio of 4.5%.

**Capital Conservation Buffer:** The primary objective of the capital conservation buffer (CCB) is to use a buffer of capital to achieve the broader macroprudential goal of protecting the banking sector from periods of excessive credit growth that have often been associated with the build-up of system wide risk. As part of Basel III implementation, CCB is being implemented since April 1, 2015, with full implementation (2.5% of risk weighted assets) taking place by March 31, 2019.

**Counter-cyclical Capital Buffer:** Counter-cyclical Capital Buffer (CCyB) can be considered as an extension of the capital conservation buffer. It consists entirely of Common Equity Tier (CET) - 1 capital and, if the minimum buffer requirements are breached, capital distribution constraints are imposed on the bank. Similar to CCB, the primary objective of the CCyB is to use a buffer of capital to achieve the broader macroprudential goal of protecting the banking sector from a build-up of systemic risk. Due to its counter-cyclical nature, the CCyB regime may help to lean against the build-up phase of the credit cycle. During the downturn phase, it may help to reduce the risk that the supply of credit will be constrained by regulatory capital requirements that could undermine the performance of the real economy and result in additional credit losses in the banking system (BIS, 2017). RBI released final guidelines for the CCyB in July 2014. While the framework for the CCyB was adopted, the activation of the CCyB would take place when circumstances warrant. The CCyB will increase gradually from 0 to 2.5% of the risk weighted assets of banks. The credit-to-GDP gap is the main indicator in the CCyB framework. It is being used in conjunction with GNPA growth. Other supplementary indicators being used are the incremental credit-deposit ratio, the industry outlook assessment index and the interest coverage ratio. The CCyB decision would normally be pre-announced with a lead time of four quarters. However, depending on the CCyB indicators, the banks may be advised by the Reserve Bank to build up requisite buffer in a shorter span of time (RBI, 2015).

**Managing Capital Inflows/Outflows:** Capital inflows are determined by a host of factors. Interest rate differentials between domestic and international markets is one of them. In India, debt creating inflows such as external commercial borrowings (ECBs) and non-resident Indian (NRI) deposits unlike equity flows, have been modulated, based on the overall cycle of net capital flows, through the use of both price-based measures (such as linking the interest rate to LIBOR) and administrative measures by stipulating end-use norms for ECB. While during periods of large capital inflows, some outflows relating to residents have been liberalized, during periods of moderate capital inflows, both NRI deposits and ECBs have been made more attractive (Verma and Prakash, 2011).

### 3.2 Macroprudential Measures Taken in India – Cross-section Dimension of Systemic Risk

**Intensive Supervision of Financial Conglomerates**: Since 2004, financial conglomerates have been subject to more intensive supervisory oversight. The supervisory process focuses on management of group-wide risks, intra-group transactions and corporate governance. Furthermore, in December 2010, the Financial Stability and Development Council (FSDC) was set up as an inter-regulatory forum with the Finance Minister as its Chairman. It deals with issues relating to financial stability, financial sector development, inter-regulatory coordination, financial inclusion and macroprudential supervision of the economy including the functioning of large financial conglomerates.

**Identifying and Regulating Domestically Systemically Important Banks**: The Reserve Bank issued the framework for identifying and regulating domestically systemically important banks (D-SIBs) in July 2014. The DSIBs are very significant from the macroprudential perspective as they witnessed amplification in their systemic risk score during the global financial crisis period (Verma, 2017). Depending on their systemic importance scores (based on size, interconnectedness, substitutability and complexity), the Reserve Bank put banks into four different buckets and they are required to have additional CET - 1 capital requirement ranging from 0.20% to 1.00% on full implementation from April 1, 2019, depending upon the bucket they are put into. The higher capital requirements applicable to D-SIBs is implementable from April 1, 2016 in a phased manner. So far three DSIBs-State Bank of India (3rd bucket, additional 0.30% additional CET-1 requirement as per cent of risk weighted assets, in addition to CCB), ICICI Bank (1st bucket, 0.10%), HDFC Bank (D-SIB surcharge applicable from April 1, 2018) have been identified.

**Limits on Inter-bank Liabilities:** Uncontrolled inter-bank liabilities (IBL) may have systemic implications, even if the individual counter-party banks are within the allocated exposure. Further, uncontrolled liability of a large bank may also have a domino effect. In view of this, in March 2017, in order to limit the concentration risk on the liability side of banks, the Reserve Bank put the cap on IBL of a bank at 200% of its net worth as on 31st March of the previous year. However, individual banks with the approval of their Boards of Directors may fix a lower limit for their IBL, keeping in view their business model. However, IBL outside India were excluded.

**Restricted Access to Un-collateralized Funding Market:** In order to ensure that the inter-bank market functions in a non-disruptive manner, access to the un-collateralized funding market is restricted to banks and primary dealers and there are caps on both lending as well as borrowing by these entities (Sinha, 2011).

**Limit on Cross Holding of Capital among Banks/Financial Institutions:** In February 2013, the Reserve Bank put 10% (of the investing bank's capital funds i.e., Tier I plus Tier II) limit on banks' investment in instruments issued by other banks and 5% (of equity capital) limit on acquiring fresh stake in a bank's equity share.

**Banks' Exposure to Mutual Funds:** In July 2011, the Reserve Bank observed that the liquid schemes of mutual funds were relying heavily on institutional investors such as commercial banks whose redemption requirements are likely to be large and simultaneous. Also, they are large lenders in the over-night markets and market repo, where banks were large borrowers. Mutual funds also invested heavily in certificates of deposit (CDs) of banks. Such circular flow of funds between banks and mutual funds could lead to systemic risk in times of stress. Thus, banks could face a large liquidity risk. In view of this, the Reserve Bank put a cap of 10% (of net worth) on banks' investment in liquid/ short-term debt schemes of mutual funds with a maturity of less than one year.

**Single and Group Exposure Limits:** In order to align the exposure norms for Indian banks with the Basel Committee of Banking Supervision (BCBS) standards and to further diversify the banks' lending base, the Reserve Bank issued final guidelines on the large Exposure Framework in December 2016 which will be effective from April 1, 2019 (RBI, 2017). Currently, the exposure limit is 15% (of capital funds of the bank) in case of a single counter-party and 40% of capital funds in the case of a group counter-party. According to the revised Large Exposure Framework, banks' exposure to a single and group counter-party would normally not be more than 20% and 25%, respectively, of its available eligible capital base.

**Banks's Exposure to NBFCs:** According to the Reserve Bank guidelines, the exposure (both lending and investment, including off balance sheet exposures) of a bank to a single NBFC/NBFC-AFC (Asset Financing Companies) should not exceed 10%/15% respectively, of the bank's capital funds. Banks may, however, assume exposures on a single NBFC/NBFC-AFC up to 15%/20% respectively, of their capital funds provided the exposure in excess of 10%/15% respectively, is on account of funds on-lent by the NBFC/NBFC-AFC to the infrastructure sector.

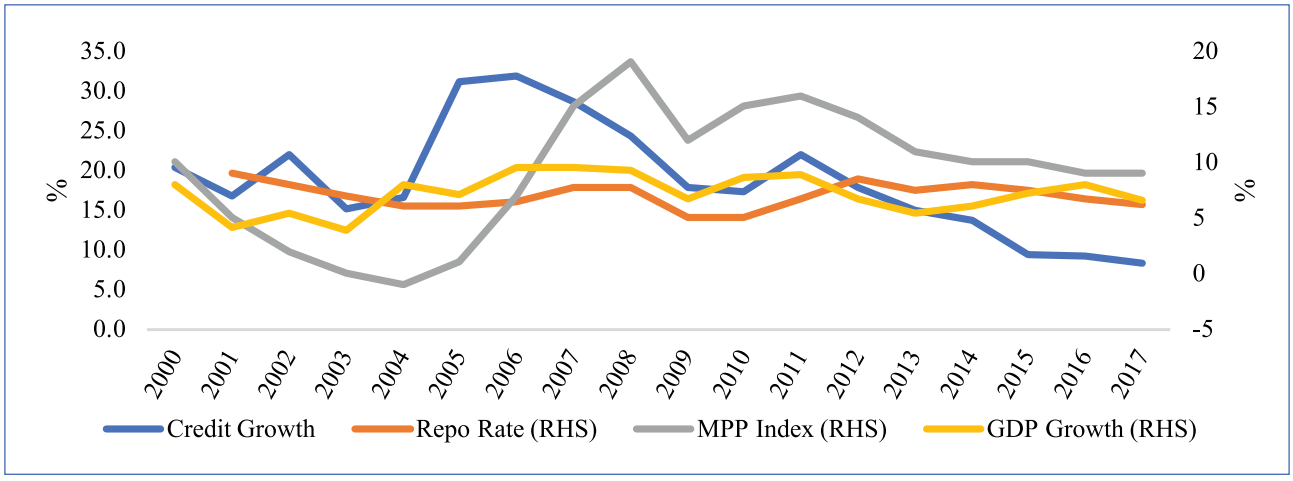
**Limits on Exposure to Sensitive Sectors:** Banks' exposures to the capital market (both fund based and non-fund based) are subject to a limit of 40% of their net worth. Further, their exposures to sensitive sectors such as the real estate, systemically important NBFCs and the commodity sector are closely monitored. Banks are also encouraged to place internal sectoral limits so as to ensure that their aggregate exposures are well dispersed (Sinha, 2011).

## 4. Effectiveness of Macroprudential Policies

### 4.1 Construction of Macroprudential Index

An aggregate macroprudential policy (MPP) index was constructed using risk weights and provisioning for standard assets for housing, CRE, consumer loans, capital market and CRR. The methodology for construction of MPP index is based on Akinci and Olmstead-Rumsey (2017). To derive the aggregate MPP index, firstly, individual indices for each of these macroprudential measures were constructed. Starting with zero (it can be any value) in the base year (here financial year 1999-2000 designated as 2000 in the Chart), a value of one was added if any macroprudential measure was introduced or tightened to contain credit or asset price growth. Similarly, a value of one was subtracted if the macroprudential measures were loosened. If the macroprudential measure was tightened or relaxed multiple times during the year, one was added or subtracted as many times. If no action was taken in a year, there was no change in the value of the index. Then, these individual indices were aggregated horizontally to construct the MPP index. Later, the aggregate MPP index was scaled up by 10, to remove negative values. The impact of macroprudential policies as indicated by the MPP index is visible on credit growth with a lag (Chart 8).

**Chart 8: Macroprudential Policy and Credit Growth**




Source: Reserve Bank of India except MPP index which has been calculated.

### 4.2 Panel-VAR

A panel vector auto-regression (VAR) model was constructed using credit growth, GDP growth and the MPP index following Love and Zicchino (2006) and Abrigo and Love (2016). It combines the traditional VAR technique, which treats all the variables in the model as endogenous, with the panel-data approach, which allows for unobserved individual heterogeneity. The first order VAR is given below:

$$zit = \Gamma 0 + \Gamma 1 zit\text{-}1 + fi + dc,t + et$$

where, $z_t$ is a three-variable vector {totalcredit_g, GDP_growth, MPPindex}. totalcredit_g is growth in total credit. In the regression, bank-groups were used as panels. To apply the VAR procedure in the panel data setting, one needs to impose the restriction that the underlying structure is the same for each cross-sectional unit. In order to overcome the restriction on parameters "individual heterogeneity" was brought in the model by introducing fixed effects, denoted by *fi*. Since the fixed effects are correlated with the explanatory variables due to lags of the dependent variables, in place of mean-differencing procedure, forward mean-differencing was used to eliminate fixed effects. Given that it preserves the orthogonality between transformed variables and lagged explanatory variables, the latter can be used as instruments and the coefficients estimated by the generalized method of moments (GMM) (Love and Zicchino, 2006).

### 4.3 Database

The period for the study is 1999-00 to 2016-17 using annual data.[3] Bank groups were used as panels in the regression. There are four bank groups, namely, State Bank of India and associates, nationalized banks, private sector banks and foreign banks. Data pertaining to total credit was taken from the Basic Statistical Returns of Scheduled Commercial Banks in India published by the Reserve Bank of India. Data on GDP was taken from Reserve Bank of India's Data Warehouse at https://dbie.rbi.org.in. The MPP index was prepared based on information on risk weights and provisioning on standard assets in various sectors and CRR as released by the Reserve Bank of India from time to time.

### 4.4 Results

On the basis of model selection criteria *ala* Andrews and Lu (2001), the first-order panel VAR was found to be the preferred model as this had the smallest MBIC, MAIC and MQIC. However, the coefficient of determination was found to be higher at higher lags. Based on the selection criteria, the first-order panel VAR model was selected using GMM estimation (Annex Table 1). Forecast-error variance decompositions which indicates the relative cumulative contribution of each of the variables to the overall behavior of the model suggested that the MPP index explains 3.1% of the variations in credit growth two periods ahead. It increases to 11.2% if the forecast horizon is 4 periods ahead (Annex Table 2). Furthermore, all the eigenvalues were found to lie inside the unit circle which confirms that the panel VAR estimates are stable (Annex Table 3).

The panel VAR results suggests that, on average, tightening of macroprudential measures as reflected in an increase in the MPP index affects credit growth negatively with a one-year lag. The result is significant at 1% level of significance. The result is in line with empirical literature. Although

3. Financial year is from 1st April to 31st March.

this result is for total credit, similar results were found for various sectors such as housing, CRE and consumer loans as the desired aim of the macroprudential policies is to contain overheating or sluggishness in the specific sectors. However, one unintended consequence of tightening of macroprudential policies is the decline in real GDP growth due to the decline in aggregate demand as evidenced from the results (Table 4). As macroprudential policies affect the availability and cost of credit by reallocation of spending over time by the agents, this in turn affects the aggregate demand (Shin, 2015). Kim and Mehrotra (2016) also found significant negative effect on real GDP from tighter macroprudential policies in case of four inflation targeting economies in the Asia-Pacific region. However, Boar et al. (2017) using a panel of 64 advanced and emerging market economies, found that the more active a country is in the use of macroprudential measures, the higher and less volatile is its per capita GDP growth. Thus, the effect of macroprudential policies on economic growth is influenced by economy's openness and financial development.

**Table 4: Impact of Macroprudential Policy (Three Variable Panel VAR)**

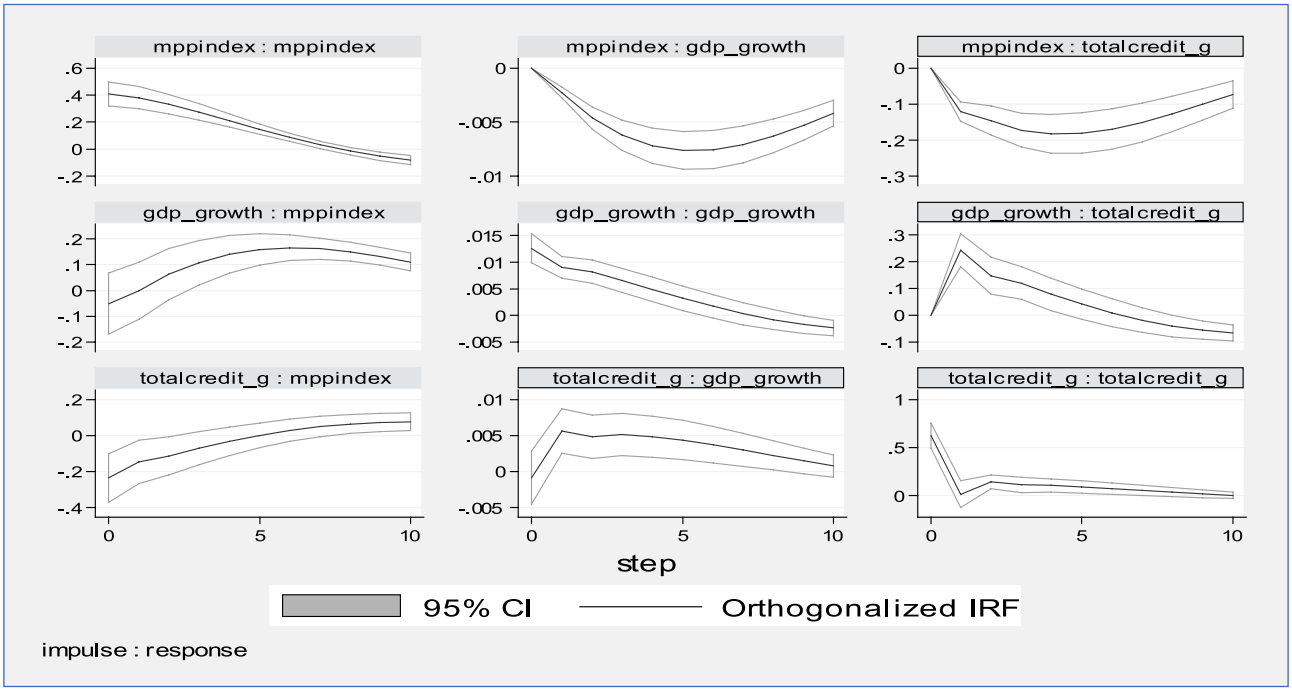
| Response of | Response to | | |
|---|---|---|---|
| | Total credit growth (t-1) | GDP growth(t-1) | Ln (MPP Index(t-1)) |
| Total credit growth(t) | -.06315<br>(.096) | 17.9757***<br>(.514) | -.2951***<br>(.009) |
| GDP growth(t) | .0078***<br>(.001) | .6952***<br>(.005) | -.0055***<br>(.001) |
| Ln(MPP Index(t)) | .1235***<br>(.022) | 3.7632***<br>(.109) | .9337***<br>(.004) |
| No. of obs.- 48 | | | |

Notes: (1) Figures in parentheses are standard errors.

(2) ***p<0.01; **p<0.05; *p<0.10.

The orthogonalized impulse-response function with the 5% error bands were generated by Monte Carlo simulation with 200 reps. The impulse response of growth in total credit to one standard deviation shock in the MPP index is negative for up to four periods. Similarly, the impulse response of GDP growth to one standard deviation shock in the MPP index was found to be negative for up to five periods (Chart 9).

**Chart 9: Impulse Response of Credit Growth to Macroprudential Shocks**




Note: Errors are 5% each side generated by Monte-Carlo simulation with 200 reps.

## 5. Findings and Conclusion

Emerging market economies including India have been very proactive in taking various macroprudential measures to restrain incipient systemic risk. Given that the Indian financial system is dominated by the banking sector, most of the macroprudential measures have been channelled through the banking sector. Among various macroprudential measures, risk weights and provisioning on standard assets in lending to sectors such as housing and CRE sector have been effective in restraining credit growth. At the aggregate level, macroprudential polices have also been effective in reducing excessive credit growth. One important feature of the macroprudential policies in India is that, for most of the time, it has been in sync with monetary policy as the implementing authority of both is the Reserve Bank of India. The effectiveness of macroprudential polices in the Indian financial sector suggests that they can provide an alternative tool other than monetary policy in dampening exuberance in credit cycles. However, the usage of macroprudential polices in various phases of the credit cycle indicates that their impact has been asymmetric. Macroprudential measures have been able to restrain credit growth in targeted sectors during periods of exuberant growth. However, their ability to uplift credit growth during downturns have been limited. Therefore, the limitations of macroprudential policies have to be kept in mind.

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**Annex Tables**

**Annex Table 1: Criteria for Lag Order Selection**

| Lag order criteria | Lag | | |
|---|---|---|---|
| | 1 | 2 | 2 |
| CD | 0.7506 | 0.9565 | 0.9615 |
| J | 46.5041 | 30.3495 | 23.1016 |
| J (p value) | 0.0112 | 0.0342 | 0.0060 |
| MBIC | -58.0183 | -39.3321 | -11.7392 |
| MAIC | -7.4959 | -5.6505 | 5.1016 |
| MQIC | -26.5884 | -18.3789 | -1.2626 |

**Annex Table 2: Credit Growth, GDP Growth and Macroprudential Policy Index: Variance Decomposition**

| Forecast Horizon | Impulse Variable | | |
|---|---|---|---|
| | Total credit growth | GDP growth | Ln (MPP Index) |
| Panel A: Response on Total credit growth | | | |
| 2 | 0.84178 | 0.1268623 | 0.0313577 |
| 4 | 0.725107 | 0.1628106 | 0.1120824 |
| 6 | 0.6541469 | 0.1519534 | 0.1938997 |
| 8 | 0.6119484 | 0.1401395 | 0.2479122 |
| 10 | 0.5880006 | 0.1405099 | 0.2714895 |
| Panel B: Response on GDP growth | | | |
| 2 | 0.1163167 | 0.8654021 | 0.0182812 |
| 4 | 0.164893 | 0.7047409 | 0.1303661 |
| 6 | 0.1821221 | 0.5629759 | 0.2549019 |
| 8 | 0.1808865 | 0.4752417 | 0.3438718 |
| 10 | 0.1732479 | 0.4378148 | 0.3889372 |
| Panel B: Response on Ln (MPP Index) | | | |
| 2 | 0.197087 | 0.0067928 | 0.7961202 |
| 4 | 0.1554819 | 0.0301667 | 0.8143514 |
| 6 | 0.1326426 | 0.0877225 | 0.779635 |
| 8 | 0.1257253 | 0.1485774 | 0.7256972 |
| 10 | 0.1291469 | 0.1868909 | 0.6839622 |

**Annex Table 3: Eigenvalue Stability Condition**

| Eigenvalue | | |
|---|---|---|
| Real | Imaginary | Modulus |
| 0.8859355 | 0.2050323 | 0.9093514 |
| 0.8859355 | -0.2050323 | 0.9093514 |
| -0.2061114 | 0 | 0.2061114 |

Note: All the eigenvalues lie inside the unit circle.

## Chapter 3

# MEASURING THE EFFECTIVENESS OF MACROPRUDENTIAL POLICIES – THE MALAYSIAN EXPERIENCE

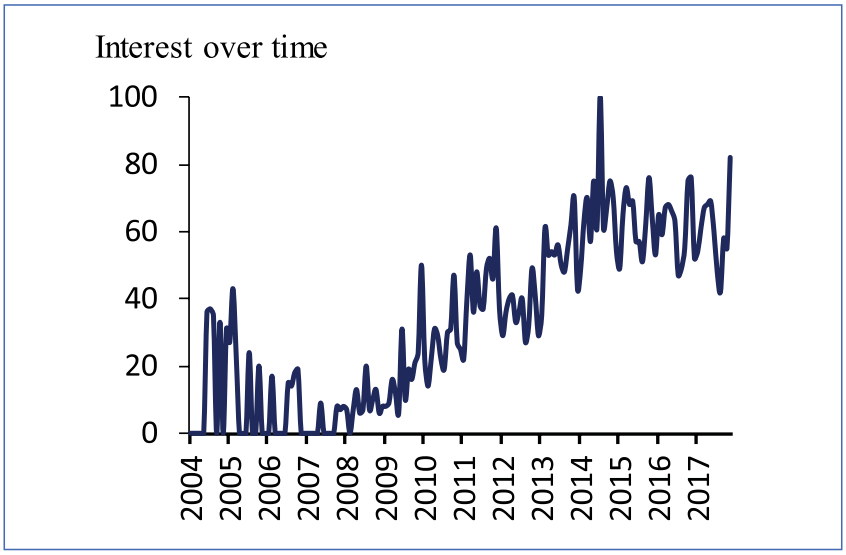
By

**Ashraf Rauf**[1]

## 1. Introduction

The term macroprudential became increasingly common in the aftermath of the 2008 financial crisis (Chart 1), as it became clear that traditional monetary policy was insufficient to maintain financial stability. However, research related to macroprudential policy, although on an increasing trend, has remained relatively small (Galatti and Moessner, 2011).

**Chart 1:**
**Popularity of 'Macroprudential' Term on Google Search**




Source: Google Trends.

Despite the lack of clear evidence of the effectiveness of macroprudential policies, the use of macroprudential polices by central banks around the world has generally increased (Cerutti et al., 2017). In particular, housing-related macroprudential policies have been used more extensively in Asia (Zhang and Zoli, 2016). Similarly, in Malaysia, various macroprudential policies have been implemented since 2009, after the objective of safeguarding financial stability was legislated in the Central Bank of Malaysia Act 2009.

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Disclaimer: This paper represents the views of the author and may not necessarily be those of Bank Negara Malaysia (BNM). The views expressed herein should therefore be attributed to the author and not to BNM.

The contribution of this paper would be to examine the effectiveness of the measures that were implemented. Specifically, this paper aims to answer the question: what is the effect of the housing-related macroprudential policies on the growth of housing loans? The rest of the paper is structured as follows. Section 2 will give a brief overview of the literature on effectiveness of macroprudential policies. Section 3 will outline the Malaysian context which led to the implementation of the policies. Section 4 will describe the empirical model and the data used. Section 5 discusses the results. Section 6 concludes.

## 2. Literature Review

There is an increasing strand of literature regarding the effectiveness of macroprudential measures in the housing market. This partly reflects the fact that the housing market was a key source of vulnerability during the recent financial crisis. It also reflects an environment of rising house prices and increasing housing loan growth that is faced by many countries.

The general aim of macroprudential policies in the housing market would be to reduce *excessive* household leverage and dampen house price cycles (Eerola, 2017). Kuttner and Shim (2016) classified the tools available for housing-related macroprudential measures based on their transmission mechanisms. Firstly, policies that operate by limiting banks' supply of credit. Policies in this category include credit growth restrictions, limits on the exposure to the sector and risk weights applicable on housing loans. Secondly, policies that are targeted at lowering the demand for housing credit. The two main policies in this category would be the loan-to-value (LTV) ratio and the debt-service-to-income (DSTI) ratio. Thirdly, policies that affect the cost of homeownership, which includes housing-related tax policies.

Using a fixed-effects panel regression, Kuttner and Shim (2016) found that reducing the maximum DSTI ratio and increasing housing-related taxes have a significant dampening effect on housing credit growth of about 4-6 percentage points and 3-4 percentage points respectively. Schularick and Shim (2016) applied local projection methods and similarly found that macroprudential policies appear to cause a moderation in credit growth, although the magnitude is smaller. Cerutti et al. (2017) constructed an aggregate macroprudential index and found some evidence of a negative relationship between the macroprudential index and credit growth.

This paper contributes to the literature by highlighting the Malaysian experience in macroprudential policy and examining its effectiveness in reducing credit growth.

## 3. Malaysian Experience

### 3.1 Setting the Stage

Initial signs of potential risks to financial stability emerged when the Malaysian House Price Index (MHPI) increased substantially since the fourth quarter of 2009 (Chart 2). The annual growth of the MHPI accelerated to 6.2% in the second quarter of 2010, from an average of 3.4% for the period of 2000-2009. However, the higher growth rates were observed mainly in the key employment centers such as the Kuala Lumpur, Selangor and Johor (Table 1).

**Chart 2: Malaysian House Price Index (MHPI)**

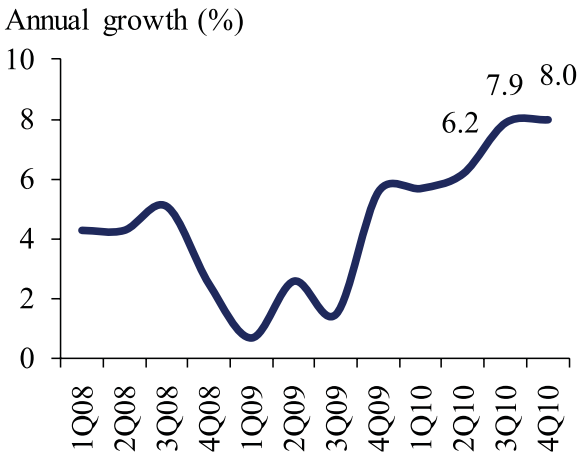


**Table 1: MHPI by States**

| Annual growth (%) | Overall | KL | Selangor | Johor |
|---|---|---|---|---|
| 1995-96 average | 15.7 | 20.6 | 11.5 | 11.1 |
| 2000-09 average | 3.4 | 4.7 | 2.8 | 0.8 |
| 2009 | 1.5 | -2.5 | -0.9 | 5.5 |
| 2010 | 6.7 | 12.2 | 9.0 | 2.7 |
| 4Q 2010 | 8.0 | 7.1 | 13.0 | 4.4 |

Source: National Property Information Centre (NAPIC).

At the same time, household debt also grew at an accelerated pace to 12.1% year-on-year as at end-June 2010, relative to the lower compounded annual growth rate (CAGR) of 9% between January 2009 and December 2009. The increase in household debt was mainly driven by increase in borrowings for the purchase of residential properties (i.e., housing loans), which accounts for 35% of total household debt. This is mainly due to the ease in obtaining house financing, as financial institutions were offering housing loans at highly competitive financing rates and low initial investment costs. (e.g., zero repayment during the construction period of the sold property).[2] These loans could also have a loan-to-value (LTV) ratio of up to 100% and financing tenure of up to 45 years.

Notwithstanding the increase in household debt, the overall debt repayment capacity of households was still sustained, given the decline in household impaired and delinquent loans. Households also still maintained strong financial asset buffers at the aggregate level, which stood at more than twice the level of household debt.

A closer look at the housing loans revealed that the increase in borrowings were mainly driven by households with multiple outstanding housing loans. This suggested that the increase in housing loans as well as house prices were driven by speculative behavior of residential property investors.[3] These borrowers also exhibited lower debt repayment capacity, as evidenced by the higher number of delinquent loans. Apart from that, housing loans with an LTV ratio of 90% and above also exhibited higher number of delinquent loans.

2. Malaysian residential developers mostly practice the "sell-then-build" approach, where the buyer typically receives the completed house a few years after purchase. It is common for the buyer to obtain a housing loan which only requires interest payments during the construction period, with the repayment of the principle happening after the completion of the house.

3. Property ownership or investment is usually viewed as an important financial goal for Malaysians, as properties act as a form of financial security for retirement, preparation for marriage, or investment to finance higher education. However, Bank Negara Malaysia opines that multiple housing loans per borrower may reflect speculative behavior.

### 3.2 Policy Implementation

Bank Negara Malaysia's policy formulation process took into account five key considerations: i) curtailing credit-fueled speculative investments in residential property; ii) preventing *excessive* increase in house prices that is not supported by fundamentals; iii) nudging banks to practice responsible financing and marketing; iv) allowing continued access to financing for first-time house buyers; and, v) minimizing any over-correction in the property market (A. Rani and Lau, forthcoming).

Based on the surveillance indicators, supervisory assessments, and the above considerations, Bank Negara Malaysia (BNM) decided to impose a 70% limit on the LTV ratio for the third and above outstanding housing loans per individual. The policy was arrived at after considering the possible unintended consequences of alternative measures (A. Rani and Lau, forthcoming):

- A broad-based LTV ratio limit was not introduced in order to avoid affecting first-time house buyers and non-speculators. The measure was deliberately targeted to borrowers with three or more outstanding housing loans due to the relatively higher delinquencies.
- No geographical or price-based were applied despite that higher growth being concentrated in key employment areas. This is because of the anticipated challenges in implementation and enforcement due to potential circumvention.
- The limit was applicable to institutions under the regulatory purview of the BNM. These include banks, development financial institutions (DFIs) and insurance companies, accounting for more than 90% of total outstanding housing loans. The possibility of a shift in source of financing to non-bank financial institutions was assessed to be limited as these institutions prefer to focus on other segments of household financing.

Due to the targeted nature of macroprudential policies and the potential distributional impact on the economy, BNM has put in place a robust institutional and accountable governance framework to effectively carry out its financial stability functions (see Appendix A for details).

## 4. Empirical Approach and Data

This paper employs a fixed effects panel regression model, which is widely used based on literature. This model allows the elimination of all unobserved, time-constant factors that may affect the dependent variable, which causes the coefficients estimated to be biased (Wooldridge, 2012). In the context of this paper, using a fixed effects model eliminates any unobserved bank heterogeneity that may affect housing loan growth. A concern from the use of this model is the bias that might arise with the inclusion of a lagged dependent variable. However, given the relatively long time series of the data used in this paper, the size of any resultant bias will be small (Kuttner and Shim, 2016).

### 4.1 Methodology

$$\Delta y_{i,t} = \alpha + \beta \cdot \Delta y_{i,t-1} + \mu \cdot mpru_{t-1} + \gamma \cdot X_{t-1} + \delta \cdot Z_{i,t-1} + \varepsilon_{t-1} \quad (1)$$

Equation 1 shows the base regression model, estimated using fixed-effects estimation. The dependent variable is the annual growth of housing loans for bank $i$ in month $t$. $X_{t-1}$ is a vector of macroeconomic controls. This includes the inflation rate; the overnight policy rate as a proxy for the monetary policy stance; the coincident index to capture the current state of the economy; and the

housing loans-to-GDP gap as a proxy for the state of the housing cycle and the degree of systemic risk associated with it (Kuttner and Shim, 2016). $Z_{i,t-1}$ is a vector of bank-specific characteristics, consisting of banks' capital ratio, liquidity ratio and funding structure. All controls are lagged one period to avoid potential endogeneity issues.

The main independent variable of interest is $mpru_{t-1}$, which is the overall macroprudential policy index. Following Cerutti et al. (2017), the index is constructed such that it increases by 1 if a housing-related measure is taken in the particular month. In theory, the index will also decline by 1 if a housing-related measure is loosened in the particular month. However, the Malaysian authorities did not loosen any measure during the period of estimation, hence the index is an increasing function. The coefficient $\mu$ can be interpreted as the percentage point change in the growth of housing loans due to an additional housing-related measure being implemented.

The paper also attempts to measure the effectiveness of the measures based on their transmission mechanisms. Kuttner and Shim (2016) identified three main classifications based on their transmission mechanisms: i) policies that limit banks' supply of credit; ii) policies aimed at demand for housing credit; and iii) policies that affect the cost of homeownership. This gives the following equation:

$$\Delta y_{i,t} = \alpha + \beta \cdot \Delta y_{i,t-1} + \sum_{k=1}^{3} \mu_k \cdot mpru_k + \gamma \cdot X_{t-1} + \delta \cdot Z_{i,t-1} + \varepsilon_{t-1} \quad (2)$$

Aiyar et al. (2016) found that the response of loan supply towards policies may vary depending on the size of the bank. Hence, this paper also investigates whether there are any differences in the effectiveness of measures based on the size of banks. This is done by running the regressions of equations 1 and 2 separately for large banks and small banks.

### 4.2 Data and Descriptive Statistics

The monthly data for housing loans is from the Malaysian central bank's internal database and is defined as loans taken for the purpose of purchasing residential properties. The median annual growth for housing loans over the period of interest is 6.0%, but the mean annual growth is 28.3%. This suggests that there are certain periods that housing loan growth may have been *excessive*. By winsorizing the data at 5%, the overall median and average annual growth of housing loans are 4.9% and 5.2%, respectively.

The size of a bank is measured by a dummy variable that takes the value of 1 (i.e., a large bank) if the bank's time-average of total assets is in the top 15%. This is because a model that involves the bank size variable entering linearly may not capture behavioral differences very well (Aiyar et al., 2016). By differentiating large and small banks, data shows that the *excessive* loan growth are associated with smaller banks.

The data for inflation rate and coincident index are obtained from the Department of Statistics Malaysia (DOSM). The overnight policy rate is obtained from the Central Bank of Malaysia's website. The housing loans-to-GDP gap is estimated using a one-sided HP filter. Bank-specific characteristics are obtained from the central bank's internal database. The overall panel dataset consists of 60 banks for the period 2006-2017[4]. Table 2 shows the detailed summary statistics of all the variables used.

4. Number of banks may vary due to bank mergers, ceased operations or new operations.

The measures that were included in the macroprudential index were based on the database compiled by Shim et al. (2014) and updated to the latest position. Table 3 shows the list of housing-related measures that were considered in the construction of the index.

**Table 2: Summary Statistics**

| Variables | Observations | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| **Housing Loans Growth** | 5,793 | 28.33 | 361.32 | -100 | 2,5088.05 |
| **Inflation Rate** | 8,400 | 2.60 | 1.68 | -2.44 | 8.51 |
| **Overnight Policy Rate** | 8,400 | 3.03 | 0.42 | 2 | 3.5 |
| **Housing Loans to GDP Gap** | 8,400 | 0.47 | 0.85 | -1.47 | 3.15 |
| **Δ Coincident Index** | 8,400 | 2.27 | 3.67 | -12.7 | 9.3 |
| **Banks' Capital Ratio** | 7,512 | 13.84 | 12.23 | -0.29 | 100 |
| **Banks' Liquidity Ratio** | 6,939 | 4.88 | 7.51 | -0.07 | 97.93 |
| **Banks' Funding Structure** | 6,931 | 71.83 | 24.12 | 0 | 99.70 |

**Table 3: List of Macroprudential Measures**

| Limit Banks' Supply of Credit | Limit Housing Credit Demand | Affects Cost of Homeownership |
|---|---|---|
| ***February 2011***<br>Increase risk weights for housing loans with LTV ratio > 90% | ***November 2010***<br>Maximum 70% LTV ratio limit on third and above outstanding housing loans for individuals | ***January 2010***<br>Real Property Gains Tax (RPGT) is reintroduced |
| ***July 2013***<br>Limits maximum tenure of housing loans to 35 years | ***December 2011***<br>Maximum 60% LTV ratio limit on all outstanding housing loans for non-individuals | ***January 2012***<br>Increase in RPGT |
| ***November 2013***<br>Prohibit financial institutions from financing new development projects and end-purchases of properties with elements of interest capitalisation schemes | | ***January 2013***<br>Increase in RPGT |
| **December 2015**<br>Banks are required to hold minimum collective impairment provisions and regulatory reserves of 1.2% of total outstanding loans, net of individual impairment provisions | | ***November 2013***<br>Developers are prohibited from implementing projects that have Developer Interest Bearing Scheme features |
| | | ***January 2014***<br>Increase in RPGT |

## 5. Empirical Results

### 5.1 Main Regression Results

The results of the various specifications of the model that were estimated is shown in Table 4. The raw regression of the overall macroprudential index on the growth of housing loans is shown in column (1), indicating a negative relationship between the overall macroprudential index and housing loan growth. Adding more controls decreases the magnitude of the coefficient by around two percentage points, demonstrating that some of the decline in housing loan growth is attributable to other factors. However, the coefficient on the overall macroprudential index remains negative and statistically significant across all specifications, providing some evidence that the macroprudential measures were effective in slowing down housing loan growth. Based on the full set of regressors, an additional macroprudential measure is associated with a decline of housing loan growth of three percentage points

**Table 4: Main Results Using Overall Macroprudential Index**

| **Dependent Variable: Housing Loan Growth** | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Macropru Index $_{t-1}$ | -4.9259*** (1.2215) | -2.6722*** (0.4425) | -2.9579*** (0.5165) | -3.0000*** (0.5275) |
| Housing Loan Growth $_{t-1}$ | – | 0.1288*** (0.0047) | 0.1275*** (0.0047) | 0.1273*** (0.0047) |
| Inflation Rate $_{t-1}$ | – | – | -0.5817 (1.3428) | -0.6184 (1.3438) |
| Overnight Policy Rate $_{t-1}$ | – | – | 27.2998*** (6.1358) | 27.5012*** (6.1752) |
| Housing Loans to GDP Gap $_{t-1}$ | – | – | 5.7872* (3.4547) | 5.6177 (3.4621) |
| Coincident Index $_{t-1}$ | – | – | -0.1989 (0.5172) | -0.1845 (0.5174) |
| Bank Capital Ratio $_{t-1}$ | – | – | – | -0.1657 (0.3910) |
| Bank Liquidity Ratio $_{t-1}$ | – | – | – | -0.6378* (0.3744) |
| Bank Funding Structure $_{t-1}$ | – | – | – | -0.0743 (0.1476) |
| $R^2$ | 0.0015 | 0.1375 | 0.1391 | 0.1408 |
| No. of Observations | 5,793 | 5,730 | 5,730 | 5,728 |

*Standard errors are in parentheses. *** Significant at 1% ** Significant at 5% * Significant at 10%*

Nevertheless, the effectiveness of macroprudential policies may differ based on the transmission mechanisms that they are presumed to operate. Table 5 shows the results of the different specifications of the model estimated, with the three macroprudential indices differing in terms of their transmission channel. Measures that are aimed at the demand and supply of housing credit have negative coefficients in all regressions, although the coefficients become statistically significant only after the inclusion of additional controls. It is notable that the coefficient on measures that increases the cost of homeownership is statistically insignificant, and in fact positive throughout, contrary to the findings of Kuttner and Shim (2016). This suggests that housing credit-related measures are more effective in slowing down loan growth than fiscal measures. A possible explanation could be given that fiscal-related measures are announced a few months earlier before the implementation, the decline in loan growth would be apparent in the immediate month after the announcement was made.

**Table 5: Main Results by Type of Macroprudential Measure**

| **Dependent Variable: Housing Loan Growth** | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Macropru Index_1 $_{t-1}$ | -8.9351<br>(11.2903) | -10.3681**<br>(4.0575) | -10.2346**<br>(4.6984) | -10.1513**<br>(4.7156) |
| Macropru Index_2 $_{t-1}$ | -13.6846<br>(12.1526) | -6.6030<br>(4.3662) | -9.4429**<br>(4.5570) | -9.1385**<br>(4.5773) |
| Macropru Index_3 $_{t-1}$ | 0.86636<br>(9.2526) | 3.6444<br>(3.3235) | 3.8206<br>(3.6530) | 3.5293<br>(3.6592) |
| Housing Loan Growth $_{t-1}$ | – | Yes | Yes | Yes |
| Macroeconomic Controls | – | – | Yes | Yes |
| Banks' Characteristic Controls | – | – | – | Yes |
| $R^2$ | 0.0016 | 0.1383 | 0.1396 | 0.1411 |
| No. of Observations | 5,793 | 5,730 | 5,730 | 5,728 |

*Standard errors are in parentheses. *** Significant at 1% ** Significant at 5% * Significant at 10%*
*'Yes' indicates inclusion of the respective controls in the regressions.*

## 5.2 Differentiating by Bank Size

By estimating the regression separately for large and small banks, the results show that the coefficient on the overall macroprudential index remains negative for all specifications (Table 6). Interestingly, the size of the coefficients is larger in magnitude and statistically significant for the smaller banks. Based on the full set of regressors, an additional macroprudential measure is associated with a decline in housing loan growth of 3.9 percentage points. As noted earlier, *excessive* loan growth[5] is associated with smaller banks. Therefore, this provides evidence that to the extent that one of the objectives of macroprudential policies is to curb *excessive* housing loan growth, the measures implemented have been effective.

**Table 6: Results Differentiated by Bank Size, Using Overall Macroprudential Index**

| **Small Banks** | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Macropru Index $_{t-1}$ | -6.2372***<br>(1.5407) | -3.3791***<br>(0.5586) | -3.8009***<br>(0.6531) | -3.9044***<br>(0.6687) |
| Housing Loan Growth $_{t-1}$ | – | Yes | Yes | Yes |
| Macroeconomic Controls | – | – | Yes | Yes |
| Banks' Characteristic Controls | – | – | – | Yes |
| $R^2$ | 0.019 | 0.1369 | 0.1390 | 0.1399 |
| No. of Observations | 4,641 | 4,587 | 4,587 | 4,585 |

| **Large Banks** | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Macropru Index $_{t-1}$ | -0.1617**<br>(0.0698) | -0.0125<br>(0.0220) | -0.0022<br>(0.0256) | -0.0494<br>(0.0336) |
| Housing Loan Growth $_{t-1}$ | – | Yes | Yes | Yes |
| Macroeconomic Controls | – | – | Yes | Yes |
| Banks' Characteristic Controls | – | – | – | Yes |
| $R^2$ | 0.0037 | 0.9222 | 0.9226 | 0.9195 |
| No. of Observations | 1,152 | 1,143 | 1,143 | 1,143 |

*Standard errors are in parentheses. *** Significant at 1% ** Significant at 5% * Significant at 10%*

*'Yes' indicates inclusion of the respective controls in the regression.*

5. Defined as the top 5% of loan growth values in the data.

Using the indexes differentiated based on the policies' transmission mechanism further supports the analysis above. The coefficients on housing-credit related measures remain negative throughout for small banks and are statistically significant after the inclusion of controls (Table 7). The results provide further evidence of the effectives of macroprudential policies in curbing *excessive* growth of housing loans.

**Table 7: Results Differentiated by Bank Size, Using Macroprudential Index by Type**

| **Small Banks** | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Macropru Index_1 $_{t-1}$ | -10.6213<br>(14.0447) | -12.5569**<br>(5.0466) | -12.4596**<br>(5.8422) | -12.3871**<br>(5.8629) |
| Macropru Index_2 $_{t-1}$ | -18.6624<br>(15.1880) | -9.4875*<br>(5.4551) | -13.5139**<br>(5.6991) | -13.1080**<br>(5.7398) |
| Macropru Index_3 $_{t-1}$ | 1.3238<br>(11.5190) | 4.8419<br>(4.1364) | 5.1488<br>(4.5447) | 4.6718<br>(4.5569) |
| Housing Loan Growth $_{t-1}$ | – | Yes | Yes | Yes |
| Macroeconomic Controls | – | – | Yes | Yes |
| Banks' Characteristic Controls | – | – | – | Yes |
| $R^2$ | 0.0021 | 0.1379 | 0.1396 | 0.1402 |
| No. of Observations | 4,641 | 4,587 | 4,587 | 4,585 |

| **Large Banks** | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Macropru Index_1 $_{t-1}$ | -0.6792<br>(0.6672) | 0.0026<br>(0.2133) | 0.1000<br>(0.2467) | -0.0453<br>(0.2530) |
| Macropru Index_2 $_{t-1}$ | 4.9295***<br>(0.7048) | 0.0021<br>(0.2308) | 0.1568<br>(0.2395) | 0.3025<br>(0.2471) |
| Macropru Index_3 $_{t-1}$ | -2.5225***<br>(0.5451) | -0.0411<br>(0.1760) | -0.1420<br>(0.1934) | -0.2521<br>(0.1982) |
| Housing Loan Growth $_{t-1}$ | – | Yes | Yes | Yes |
| Macroeconomic Controls | – | – | Yes | Yes |
| Banks' Characteristic Controls | – | – | – | Yes |
| $R^2$ | 0.0373 | 0.9221 | 0.9226 | 0.9186 |
| No. of Observations | 1,152 | 1,143 | 1,143 | 1,143 |

*Standard errors are in parentheses. *** Significant at 1% ** Significant at 5% * Significant at 10%*
*'Yes' indicates inclusion of the respective controls in the regressions.*

### 5.3 Extensions and Robustness

As a supplementary analysis, all of the regressions above were repeated using housing loan growth data winsorized at the upper 5% level. The intuition behind this analysis was that to the extent the measures implemented were to curb *excessive* housing credit growth, the results would indicate that the measures would not have any significant impact. Table 8 shows the values of the coefficient of interest for each of the model, with the full set of regressors.

**Table 8: Results Using Upper 5% Winsorized Data**

| | All Banks | By Bank Size | |
|---|---|---|---|
| | | Small | Large |
| Overall Macropru Index $_{t-1}$ | -0.0171<br>(0.0221) | -0.0264<br>(0.0276) | -0.0494<br>(0.0336) |
| *By transmission mechanism:* | | | |
| Macropru Index_1 $_{t-1}$ | -0.0781<br>(0.1978) | -0.1231<br>(0.2412) | -0.0453<br>(0.2530) |
| Macropru Index_2 $_{t-1}$ | 0.3331*<br>(0.1937) | 0.3986*<br>(0.2384) | 0.3025<br>(0.2471) |
| Macropru Index_3 $_{t-1}$ | -0.1535<br>(0.1538) | -0.1775<br>(0.1880) | -0.2521<br>(0.1982) |

*Standard errors are in parentheses. *** Significant at 1% ** Significant at 5% * Significant at 10%*

As expected, the coefficients are considerably smaller and mostly statistically insignificant, providing further support that the measures implemented were targeted and effective in curbing *excessive* credit growth.

## 6. Conclusion

This paper attempts to answer the question of whether the macroprudential measures implemented in Malaysia were effective. Using fixed effects estimation, the results of this paper showed that an additional macroprudential measure is associated with a decline in credit growth of three percentage points. Separating the measures based on their transmission mechanisms revealed that measures affecting credit supply and demand are more effective than fiscal measures that affects the cost of homeownership. The estimated effects are more significant for smaller banks, which are argued to experience *excessive* credit growth relative to larger banks.

Therefore, the results in this paper suggest that the macroprudential measures implemented in Malaysia has been effective, particularly in curbing *excessive* credit growth. An assumption in this paper is that the effect is homogeneous across house prices and regions. An extension of this paper would be to investigate whether there exists a differential impact across house prices and regions, which may implications on housing affordability.

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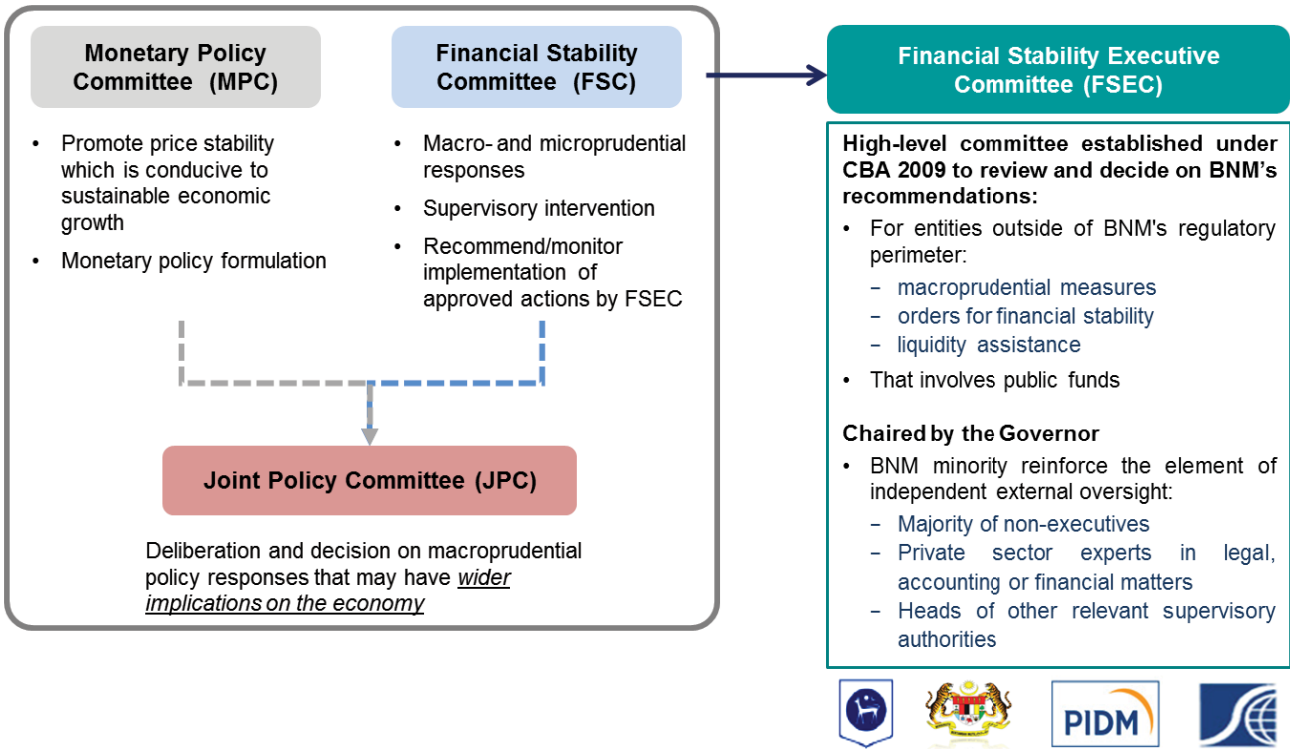
**Appendix**

## A. Central Bank of Malaysia's Financial Stability Governance Framework

The Central Bank of Malaysia (Bank Negara Malaysia) discharges its financial stability mandate mainly through two internal committees: i) the Financial Stability Committee; and ii) the Joint Policy Committee (Diagram 1). The Bank also chairs an inter-agency forum called the Financial Stability Executive Committee.

**Diagram 1: BNM's Financial Stability Governance Framework**




### *Financial Stability Committee (FSC)*

The FSC is chaired by the Governor and includes all Deputy Governors and specific Assistant Governors in charge of financial regulations, supervision, development and markets. Serving as a high-level forum within the Bank, the FSC is responsible for discussing risks to financial stability and deliberate on potential policy measures to mitigate vulnerabilities.

### *Joint Policy Committee (JPC)*

Given the interdependence between monetary and financial stability, the JPC was established to deliberate and decide on macroprudential policies that have broader implications on the economy, and to facilitate effective coordination between monetary policies and macroprudential policies. Members of the JPC includes members in both the FSC and Monetary Policy Committee (MPC), which allows for robust discussions on policy trade-offs and the interactions between the policies.

***Financial Stability Executive Committee (FSEC)***

In instances where the Bank intends to issue measures on entities that are not regulated by the Bank, or involve public funds, the Central Bank of Malaysia's Act 2009 provides that such decisions are taken by the FSEC. The committee comprises of only two representatives from the Bank: the Governor and a Deputy Governor. Other members of the committee include the Secretary General to the Treasury, the Chief Executive Officer of the Malaysia Deposit Insurance Corporation, Chairman of the Securities Commission Malaysia, and selected independent technical experts. The minority of BNM representation is deliberate to reinforce the element of oversight.

## Chapter 4

# EFFECTIVENESS OF SELECTED MACROPRUDENTIAL TOOLS IN MONGOLIA

By

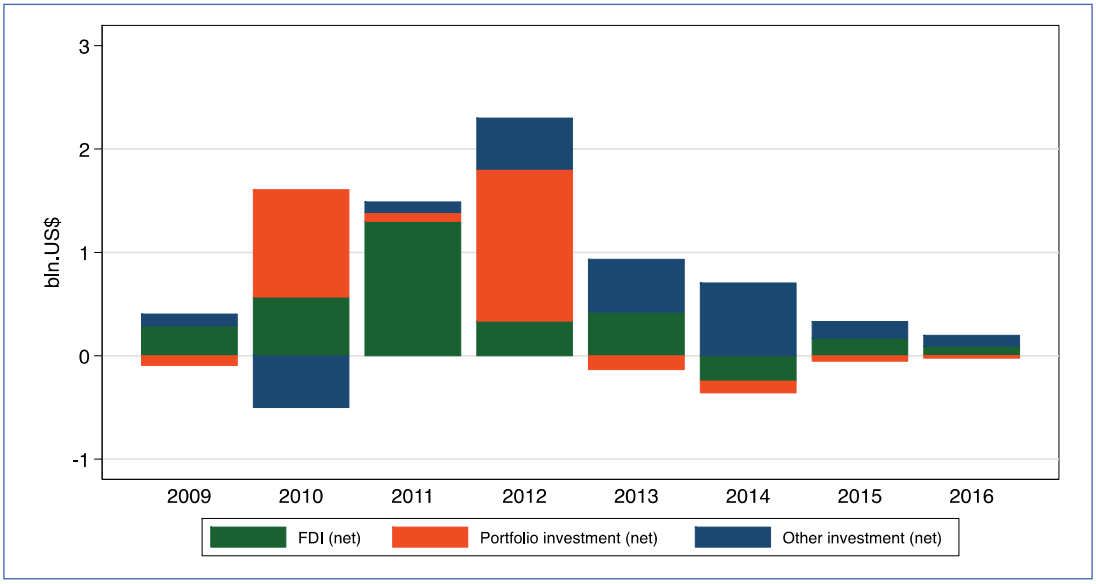
**Tsenguunjav Byambasuren**[1†]

**Saruul Khasar**

## 1. Introduction

Mongolia, a country known for its abundance of mineral resources, has a little experience with utilizing macroprudential policies to mitigate systemic financial risk. The Bank of Mongolia, the central bank of the country, tends to mainly respond to financial instability and vulnerabilities in domestic financial system through its active monetary policy instruments including policy rates. However, long-term prospects of Mongolia and its sensitivity to commodity prices raise a validity to manage systemic risks in the financial sector using an alternative policy tools such as macroprudential measures. Following the global financial crisis (GFC) of 2008/09, Mongolia faced overheating pressures from surges in capital inflows (Figure 1) and procyclical macroeconomic policy, e.g., loose fiscal policy (Figure 2).

**Figure 1: Net Capital Flows**




Source: Bank of Mongolia.

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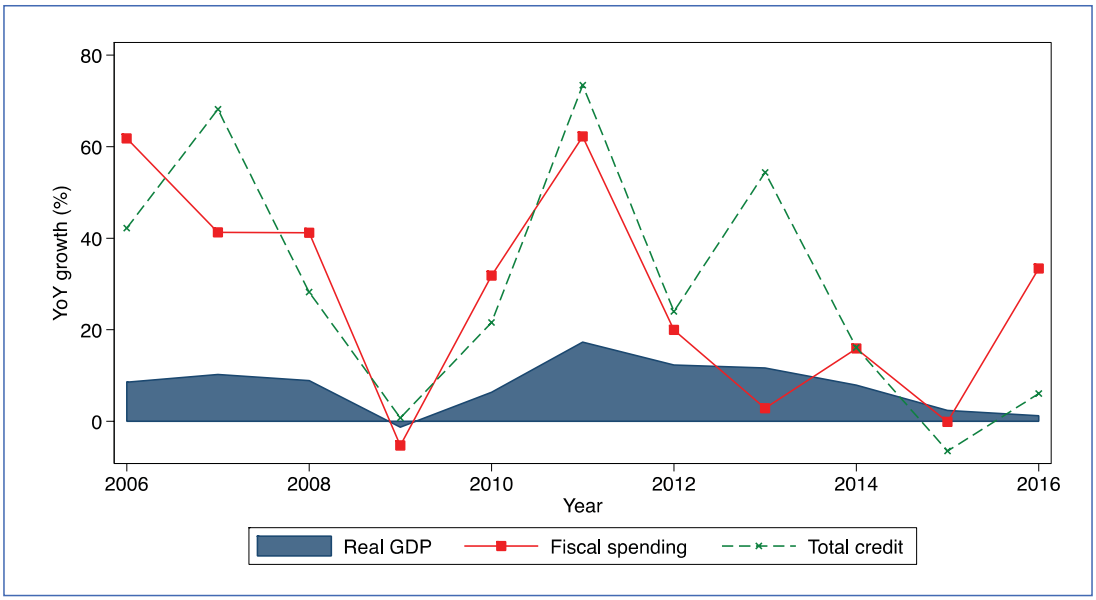
However, the economic situation worsened and growth contracted in the aftermath of China's slow-down and the sharp drop in commodity prices in the global market. The commodity price decline mainly caused a sudden stop of capital flows into Mongolia (Sukhee and Byambasuren, 2016). It has been also challenging to reverse the expansionary macroeconomic policies implemented during the good years, which have caused public debt to accumulate and international reserves to decline, which consequently led the authorities to approach the International Monetary Fund (IMF) for an economic and financial assistance program, the so called Extended Fund Facility (EFF). The IMF approved a three-year EFF arrangement on May 2017 to support the country's economic recovery.

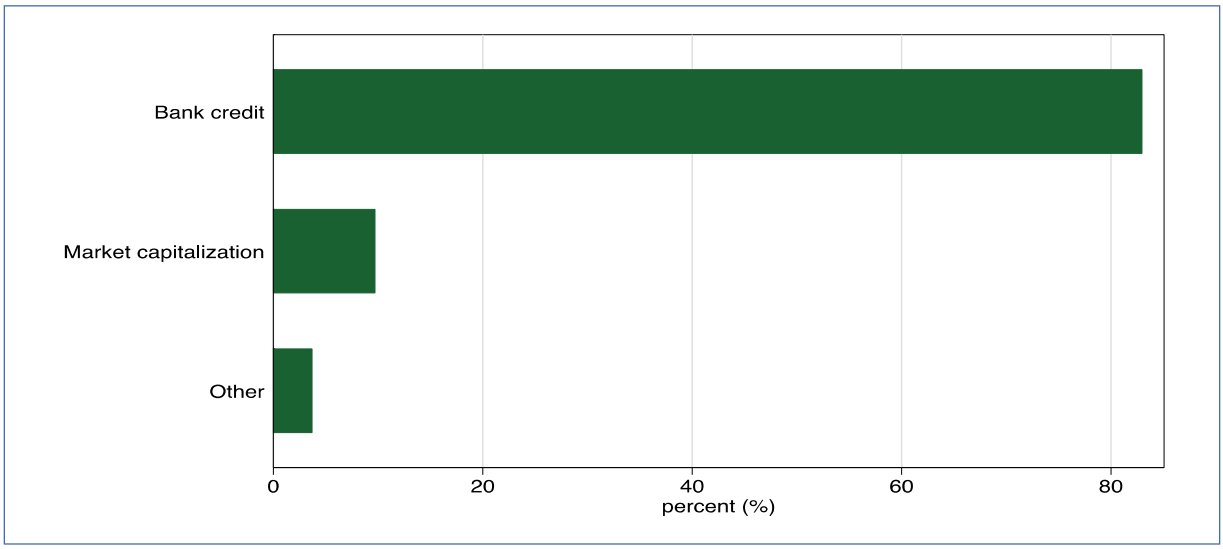
**Figure 2: Procyclical Fiscal Policy**




Source: Bank of Mongolia, Ministry of Finance.

Given the country's large mineral resources, the economy is significantly susceptible to external shocks (e.g., volatile capital flows and terms of trade shocks). Policymakers recognized the risks accompanied by surge in capital inflows and began taking certain actions to implement prudential policies. However, it is questionable whether those prudential measures are effective and if so, it is also uncertain as to what extent they affect bank lending to sensitive sectors and demand for commercial loans. To answer these questions, we analyze the effectiveness of macroprudential policies in dampening credit cycles in Mongolia by assessing policy actions implemented by the Bank of Mongolia using a panel data regression and an event study, which are widely used methods in policy analysis.

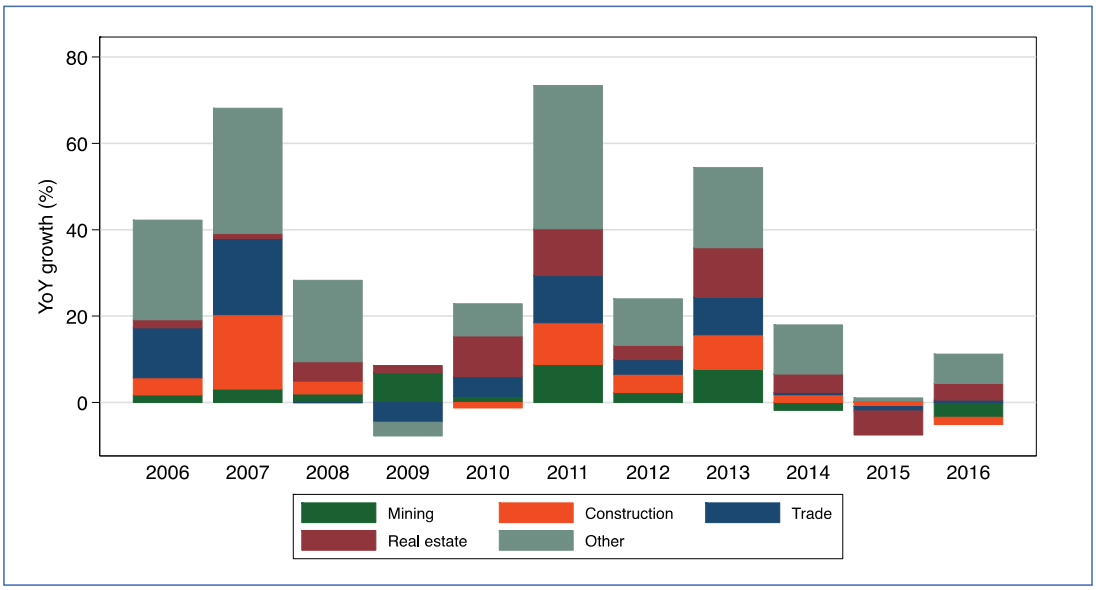
**Figure 3: Credits to the Private Sector by Source of Funding**




Source: Bank of Mongolia.

Since the establishment of a two-tiered banking system in 1991, the Mongolian financial system has been dominated by the banking sector accounting for 95% of total assets in the financial system. In terms of credits to the private sector, 83% of total credit supply to private sector has been provided by the banking sector (Figure 3). The banking sector is also very concentrated with five large banks holding 87% of total banking credits and 91% of total bank deposits. Additionally, construction, real estate (i.e., mortgage), and wholesale and retail loans are the major sources of credit growth in Mongolia (Figure 4).

**Figure 4: Credit Growth by Sectoral Contribution**




Source: Bank of Mongolia.

The rest of the paper is organized as follows. Section 2 presents a brief background and recent developments of macroprudential policies in Mongolia, reviews the related literature, and desbribes the data. Section 3 lays out the empirical strategy and Section 4 presents model estimation results. Section 5 concludes.

## 2. Background and Data

In this section, we first review macroprudential policies implemented to address systemic risk in Mongolia's financial system and provide a very brief review of existing related literature. We then present our data.

### 2.1 Macroprudential Policies in Mongolia

Mongolian regulators are in the early stages of providing a legal framework and introducing a set of macroprudential instruments to mitigate systemic risks. In particular, limitations are evident in the availability of instruments for the time-dimensional systemic risks. Table 1 reports common macroprudential instruments in Mongolia, specifically, instruments that are currently available under Mongolian jurisdiction. Although some positive changes have been made in the institutional framework for macroprudential policies, there are still huge gaps to be filled to strengthen the policy toolkits that are helpful for reducing systemic financial risks.

**Table 1: Common Macroprudential Instruments**

| | Time dimension | Cross-sectional dimension |
|---|---|---|
| Capital | • Counter-cyclical capital buffers<br>• Dynamic risk weights<br>• *Dynamic provisioning*<br>• Limits to profits distribution | • *SIFI capital surcharges*<br>• SIFI liquidity surcharges<br>• Levy on non-core liabilities<br>• *Sectoral risk weights* |
| Credit | • Limits to credit growth<br>• Time varying caps on LTV or DTI<br>• Dynamic leverage ratio | • *Limits on concentration of counter-party risk*<br>• Limits to foreign currency lending |
| Liquidity | • *Reserve requirement*<br>• *Liquidity ratio* | • Caps on FX lending<br>• *Limits on net open FX mismatches*<br>• Limits on maturity mismatches |

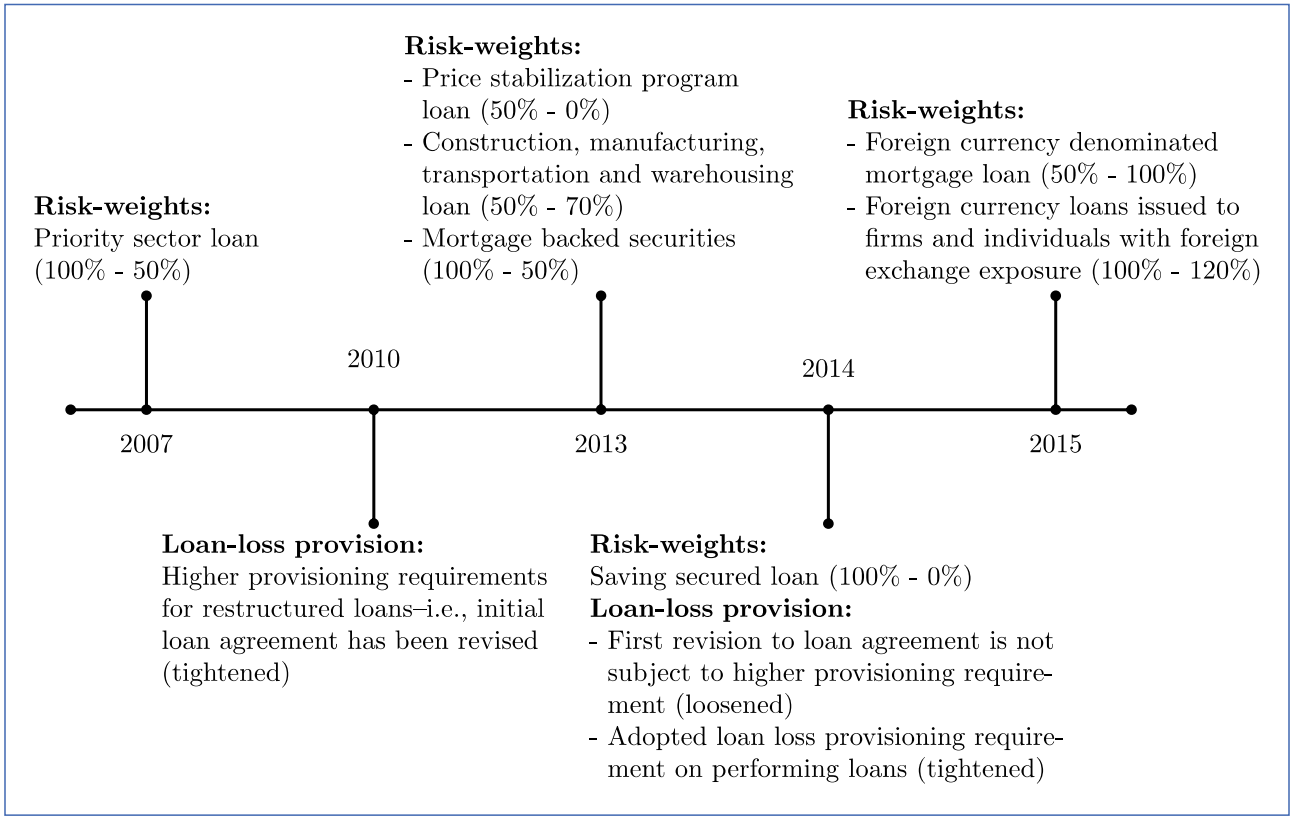
*Notes*: Currently available instruments are expressed in *italics*. SIFI = systemically important financial institution, LTV = Loan-to-Value, DTI = debt service-to-income, FX = foreign currency.

A dynamic provisioning was recently adopted in the revised regulation on asset classification and provisioning and its disbursements.[2] Moreover, reserve requirement is one of the main monetary policy instruments the Bank of Mongolia uses for monetary policy implementation. In general, reserve requirement is considered as a monetary policy toolkit, but it is also classified as one of the commonly used macroprudential policy instruments (Board, 2011). However, it has been hardly used for macroprudential purposes in Mongolia, while proposed changes to regulation on reserve requirement includes stipulating the right to use the instrument for macroprudential purposes.

2. "The regulation on asset classification and provisioning and its disbursements," June 2017.

Risk-weights and dynamic provisioning requirements have been occasionally changed in Mongolia. Aside from systemic risk concerns, most of the changes were made for different reasons. For example, the Bank of Mongolia decreased the risk-weights on priority sector loans to support those sectors in 2007. The Bank of Mongolia introduced the so-called "Price Stabilization Program", a quasi-fiscal stimulus program intended to moderate the prices of consumer goods and services in 2013. The risk weights on loans issued as part of this program were reduced, following a decline in the risk weights on mortgage backed securities aimed at promoting the secondary mortgage market.

**Figure 5: Measures on Risk Weights and Provisioning Requirements**




In the last decade, three changes in risk-weights and dynamic provisioning requirements have had some macroprudential implications. The Bank of Mongolia increased provisioning requirements on restructured loans in 2010. According to this measure, if the initial loan agreement has been revised, the loan classification is required to be downgraded, and this is translated into higher loan-loss provisioning. This measure was slightly relaxed in 2014 and the first revision to the loan agreement is not currently subject to higher provisioning. However, the second revision requires the bank to downgrade the loan classification twice. Moreover, the Bank of Mongolia recently adopted a new tightening measure of 1% provisioning on performing loans. In terms of risk weights, some measures on foreign currency lending was tightened in 2015. Figure 5 summarizes the actions taken for risk weights and provisioning requirements.

**Table 2: Measures on Foreign Currency Loan**

| Policy action | Implementation date |
|---|---|
| The authorities increased the risk weights on foreign currency denominated mortgage loans from 50 to 100 percent in July 2014. Along with this measure they also increased the risk weights from 100 to 120 percent on foreign currency loans issued to firms and individuals with foreign exchange exposure. | Effective since January 1, 2015 |

The Bank of Mongolia changed risk-weight on foreign currency loans in July 2014. Table 2 summarizes the event and its implementation period.

## 2.2 Related Literature

The large banking sector generates credit risk in the Mongolian financial system and strong banking interconnectedness fuels the build-up of cross-sectional systemic risks (Maino, Imam and Ojima, 2013; Bukh-Ochir, 2014).

In recent years, Mongolia has also been experiencing a large volatility in credit growth due to the commodity price boom-bust cycles. Sukhee and Byambasuren (2016) provides some background on macroprudential policies implemented in Mongolia to mitigate financial instability induced from capital flow volatility and interprets their effectiveness in the short-term. Estimating a vector error correction model (VECM) based on quarterly data of Mongolia for the period 2006–2012, Maino, Imam and Ojima (2013) suggest that dynamic loan loss provisioning contributes to mitigating procyclicality in real credit growth. They also find that bank credit growth in Mongolia is unaffected by changes in the monetary policy rate by using the recursive vector autoregressive (VAR) analysis and simple regressions. Except for these few studies, macroprudential policies in Mongolia tend to be highly neglected while the Bank of Mongolia has been emphasizing its importance for financial and economic stability.

The use of macroprudential policies to mitigate systemic financial risks have spread in emerging market economies (EMEs). However, their effectiveness is not very clear. There are few studies that assess the effect of macroprudential policy tools on some financial measures such as asset prices, leverages, risk premia, or credit growth. For example, Claessens, Ghosh, and Mihet (2013) analyzes the response of balance sheets of 2,800 banks in 48 countries over 2000–2010 to specific macroprudential regulations – such as caps on loan-to-value and debt-to-income ratios, limits on credit growth and foreign currency lending, reserve requirements, limits on profit distribution, and dynamic provisioning. They show that these borrower-targeted measures and countercyclical buffers are effective in mitigating banking systems vulnerabilities. Covering more instruments, countries, and time-periods, Cerutti, Claessens, and Laeven (2017) suggests that the effectiveness of macroprudential policies are weaker in financially developed and open economies than less developed EMEs.

### 2.3 Data

The data set (nearly 450 observations) covers the bank-specific variables for all 14 banks that are currently operating in Mongolia and country-level macroeconomic and policy indicators over the period from the beginning of 2005 to the mid- 2017 in a quarterly frequency.

We are examining the effect of macroprudential policies measures including risk-weights, dynamic provisioning and reserve requirement, while macroeconomic variables included in our model comprise real exchange rate depreciation, current account to GDP, capital openness, real GDP growth, inflation, and interest rate differential. Table 3 reports the description of the data.

**Table 3: Data Description**

| Variables | Definition | Source |
|---|---|---|
| A. Dependent variables: | | |
| *Total loan supply* | Log of total loan supply by a particular bank $i$ | BoM |
| *Sectoral loan supply* | Log of loan supply by a particular bank $i$ to a particular sector $s$ | BoM |
| B. Independent variables (macroprudential measures & bank's performance/response to policy changes): | | |
| *Risk-weights* | Dummy variable that represents two events of increasing risk-weights on foreign currency denominated mortgage loans and foreign currency loans issued to firms and individuals with foreign exchange exposure; takes value of 1 since the beginning of 2015 | BoM |
| *Reserve requirement* | Bank's performance to reserve requirements (RR) on domestic and foreign currency liabilities, which indicates how banks react to policy changes; takes value greater than 1 when bank over satisfy the requirement, otherwise takes value less than or equal to 1 | BoM |
| *Provisioning* | Total amount of provisions calculated by the bank's exposure in each risk category multiplied by the respective provisioning coefficient | BoM |
| C. Independent variables (country-level macroeconomic indicators): | | |
| *Real FX rate* | Log of real MNT/US$ rates | BoM |
| *Current account* | Current account balance (% of GDP) | BoM, NSO |
| *Capital openness* | Index of openness to capital flows* | authors' calc. |
| *Real GDP growth* | Growth (YoY) of cumulative real GDP | NSO |
| *CPI inflation* | Growth (YoY) of consumer price index | BoM |
| *Interest rate differential* | Weighted average of domestic currency lending rates minus weighted average of domestic currency deposit rates | BoM |

*Notes*: BoM = Bank of Mongolia, NSO = National Statistics Office, MNT = Mongolian Tugrik, YoY = Year-on-Year, GDP = Gross Domestic Product

* See Becker and Noone (2009) for a definition/formula of calculating an index of openness to capital flows as a proxy for capital openness; refer to Sukhee and Byambasuren (2016) for previously calculated index of capital openness in Mongolia.

Table 4 presents the correlations between the candidate variables to investigate the data prior to any further empirical estimation that we will analyze in the following section. This helps us to correctly define the specification of our model.

**Table 4: Correlation Matrix**

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) Log of total loan supply | 1.00 | | | | | | | | | |
| (2) Risk-weights dummy | 0.15 | 1.00 | | | | | | | | |
| (3) Res. requirement | −0.51 | −0.15 | 1.00 | | | | | | | |
| (4) Provisioning | 0.57 | 0.40 | −0.19 | 1.00 | | | | | | |
| (5) Log of real FX rate | −0.01 | 0.41 | 0.05 | 0.17 | 1.00 | | | | | |
| (6) Current account | 0.03 | 0.52 | 0.05 | 0.22 | 0.76 | 1.00 | | | | |
| (7) Capital openness | 0.03 | 0.40 | 0.02 | 0.15 | 0.46 | 0.65 | 1.00 | | | |
| (8) Real GDP growth | −0.05 | −0.53 | 0.02 | −0.22 | −0.71 | −0.75 | −0.49 | 1.00 | | |
| (9) CPI inflation | −0.06 | −0.57 | 0.03 | −0.28 | −0.48 | −0.41 | −0.18 | 0.45 | 1.00 | |
| (10) Int.rate differential | −0.11 | −0.19 | 0.14 | −0.09 | 0.43 | 0.35 | 0.38 | −0.42 | −0.05 | 1.00 |

The correlation matrix shows that risk-weights dummy and provisioning requirement are positively correlated with log of total loan supply, while reserve requirement is negatively correlated with the dependent variable. Moreover, the country-level control variables are negatively correlated with the log of total loan supply except for current account balance and capital openness. We also observe that the risk-weights dummy and provisioning requirements are moderately correlated with each other. We thus exclude the provisioning variable from our regression to overcome the endogeniety issue.

## 3. Empirical Strategy

In this section, we first describe the empirical specification for the relationship between the set of macroprudential policies and the total and sectoral credit supply. We then discuss the method used for estimating the effect of risk-weights on foreign currency loans.

### 3.1 Credit Supply-Macroprudential Policy Relationship

To understand the effectiveness of macroprudential policies in Mongolia, we estimate the panel regression model using both bank-specific balance sheet data and country-level macroeconomic variables. Since the effect of macroprudential measures on an individual bank and its response to a change in macroprudential policies might be different from one another, it is preferable to use the panel framework to examine the effectiveness of macroprudential instruments. In addition to this benefit of controlling for individual heterogeneity, panel data models are favorable in numerous ways, which can be found in Baltagi (2013), Hsiao (2003) and Klevmarken (1989).

In particular, the fixed effect model is estimated because banks tend to be relatively different from each other such as in terms of their ownership, location, bank size, loan size and business strategy. The time-invariant fixed effect model is described in the following general form:

$$Y_{i,t} = \alpha + \lambda * MaPP_{i,t-j} + \beta^{jump} * \mathbf{1}(t > t^*) + \varphi * X_t + \varepsilon_{i,t} \quad (1a)$$

$$Y_{i,s,t} = \alpha + \lambda * MaPP_{i,t-j} + \beta^{jump} * \mathbf{1}(t > t^*) + \varphi * X_t + \varepsilon_{i,s,t} \quad (1b)$$

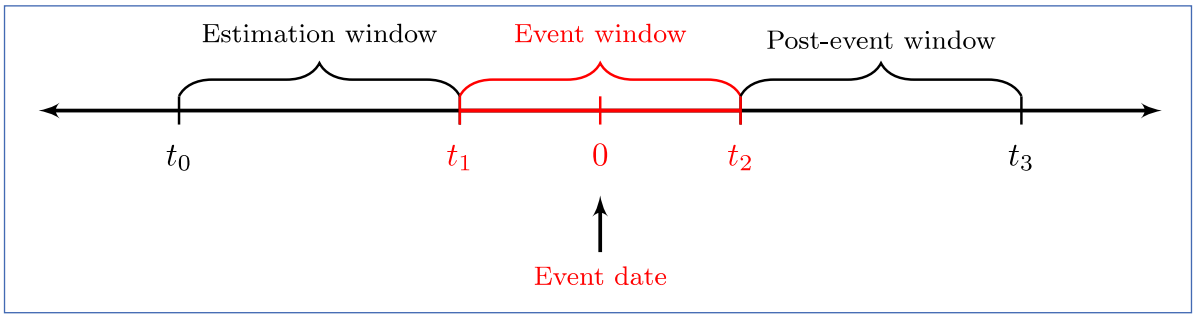
where $Y_{i,t}$ and $Y_{i,s,t}$ represent the total and sectoral credit supply by a particular bank $i$ at time $t$, respectively, $\alpha$ denotes the fixed effects that capture the heterogeneity across banks (i.e., company cultures or business practices), a vector of lagged variables $MaPP_{i.t-j}$ consists of a set of macroprudential policies (dynamic provisioning and reserve requirement), $t^*$ is the date on which risk-weights of some distinctive loans increased (Table 2), a vector $X_t$ includes the country-level aggregate macroeconomic indicators, and $\varepsilon_{i,t}$ and $\varepsilon_{i,s,t}$ are the error-terms. The coefficient estimate $\beta^{jump}$ represents the change in the outcome following the event, an increase of risk-weights on foreign currency denominated mortgage loans and foreign currency loans issued to firms and individuals with foreign exchange exposure (Table 2).

Using this model specification, we evaluate the impact of a changes in macroprudential policies on total loan supply of banking system and sectoral lending by individual banks using pooled OLS regression and the panel fixed effect methodology for comparison.

### 3.2 Foreign Currency Loans-Risk Weights Relationship

The event study is one of the most frequently used analytic tools in financial research and has many applications. In this section, we provide some interpretation of this simple method that we use to examine whether changes in risk-weights on foreign currency loans are associated with changes in growth of foreign currency loans. The main reason why we use this approach is that there is hardly a dynamic change in macroprudential policies (i.e., risk-weights, loan-loss provision, and reserve requirement) in Mongolia while individual banks tend to actively respond to policy changes and economic swings.

**Figure 6: Typical Timeline of an Event Study**




The purpose of our event study is to find the abnormal growth attributable to the event by removing the systemic part of the movement in the credit growth. The event study starts with the definition of an event, and then proceeds by the specification of an event window and estimation window. The timeline of an event study consists of two periods. An estimation window is a period over which parameters are estimated, while an event window is a period over which the estimated parameters are used to estimate abnormal growth.

In general, we follow the market model, one of the several statistical approaches proposed by MacKinlay (1997) to analyze an event study. Abnormal growth is the event-specific non-systematic growth component of the credit growth which is simply calculated by the following equation:

$$AG_{it} = G_{it} - E(G_{it}|X_t) \tag{2}$$

where $G_{it}$ is the actual growth, $E(G_{it}|X_t)$ represents the normal growth in the absence of an event, and $X_t$ captures the variable used to extract systemic growth component. It is possible to use a number of models to calculate the normal growth and this paper uses the market model, a commonly used model for estimating the normal growth:

$$G_{it} = \alpha_i + \beta_i G_{st} + \epsilon_i$$
$$E[\epsilon_{it}] = 0 E[\epsilon_{it}] = 0 \qquad var[\epsilon_{it}] = \sigma^2_{\epsilon_i} var[\epsilon_{it}] = \sigma^2_{\epsilon_i} \tag{3}$$

where $G_{it}$ and $G_{st}$ represents a growth associated with the credit and the system, respectively, $\epsilon_{it}$ is the error term with zero-mean and $\sigma^2_{\epsilon_i}$ variance, and $\alpha_i$ and $\beta_i$ are the parameters of the market model.

In this analysis, we try to eliminate the systemic part of the foreign currency credit growth through two groups of variables. A group of variables on external factors of credit growth which include real GDP growth and foreign currency non-performing loan growth. Another group of variables on domestic factors of credit growth which include foreign direct investment and portfolio and other investments. The composition of capital flows is particularly important because the portfolio and other flows have relatively short maturities. Thus, credit booms which ended in credit busts were characterized by having large portfolio and other flows (Elekdag and Wu, 2013).

## 4. Estimation Results

We first present the OLS and fixed effect model estimation results for Equations (1a) and (1b), and then present the estimates of the market model described in Equations (2) and (3).

### 4.1 The Effects of Risk-Weights and Reserve Requirements

Table 5 presents the empirical results from the estimation of pooled OLS regression and the fixed effect model. The first column of Table 5 reports results from a specification including only the event dummy that indicates both policy changes of increasing risk-weights on foreign currency denominated mortgage loans and foreign currency loans issued to foreign exchange exposed firms. The second adds the performance of banks on reserve requirement as a policy variable, the third includes the country-level macroeconomic determinants of bank credit supply, the fourth adds bank-specific fixed effects as a control, and the fifth specifies the event dummy to take a value of 1 since the policies have become effective (July 2014). Meanwhile, the first column specifies the event dummy which takes a value of 1 for the policy announcement date (January 2015). Specifying an event dummy for the two-different time frames (announcement versus effective dates) enables us to distinguish the effects of expected and real policy shocks, while including bank-specific fixed effects allows unobserved heterogenetiy across banks to be identified. The last column of Table 5 sets the policy variables with four lags (four quarter lags).

We find that macroprudential policy instruments we are investigating in this paper affect the total loan supply at a sufficient level of significance. The effects of risk-weights and reserve requirement are consistent with the theoretical hypothesis, e.g., when the monetary authority or central bank increases the risk-weights and reserve requirement, banks reduce their loan supply because their available sources of lending will be decreased in response to these policy changes. Note also that the coefficients of policy variables are persistent when changing the model specification. Thus, we consider our estimates to be robust (Table 5).

We use the exact same specification of the event dummy variable for policy impact analysis put forth by Lafortune et al. (2016).[3]

**Table 5: Effect of Macroprudential Policies on Total Loan Supply**

| | (1) OLS | (2) OLS | (3) OLS | (4) FE | (5) FE | (6) FE |
|---|---|---|---|---|---|---|
| Risk-weight events dummy (announced) | −0.29 | −0.59** | −0.64*** | −0.12 | | |
| | (0.22) | (0.25) | (0.18) | (0.07) | | |
| Bank's performance to RR | | −0.00*** | −0.01*** | −0.00 | −0.00 | |
| | | (0.00) | (0.00) | (0.00) | (0.00) | |
| Log of real FX rate (MNT/US$) | | | −1.90 | −0.97** | −0.82* | −0.44 |
| | | | (1.52) | (0.41) | (0.39) | (0.32) |
| Current account (% of GDP) | | | 0.02*** | 0.00 | 0.00 | 0.00 |
| | | | (0.01) | (0.00) | (0.00) | (0.00) |
| Capital openness | | | −0.00* | −0.00 | 0.00 | −0.00 |
| | | | (0.00) | (0.00) | (0.00) | (0.00) |
| Real GDP growth (YoY %) | | | 0.01 | −0.01** | −0.02*** | −0.01 |
| | | | (0.01) | (0.01) | (0.01) | (0.01) |
| CPI inflation | | | 0.01 | 0.01*** | 0.01** | 0.01** |
| | | | (0.01) | (0.00) | (0.00) | (0.00) |
| Interest rate differential (MNT, WA) | | | −0.01 | −0.04*** | −0.06*** | −0.03** |
| | | | (0.05) | (0.01) | (0.01) | (0.01) |
| Risk-weight events dummy (effective) | | | | | −0.29*** | |
| | | | | | (0.09) | |
| Risk-weights events dummy (effective, lagged) | | | | | | −0.34*** |
| | | | | | | (0.06) |
| Bank's performance to RR (lagged) | | | | | | −0.00* |
| | | | | | | (0.00) |
| Number of observations | 613 | 601 | 438 | 438 | 438 | 438 |
| Adjusted $R^2$ | 0.06 | 0.29 | 0.25 | 0.96 | 0.96 | 0.97 |

*Notes*: Robust standard errors in parentheses.
OLS = Ordinary Least Squares, FE = Fixed effect, RR = reserve requirement, MNT = Mongolian tugrik, GDP = Gross Domestic Products, YoY = year-on-year, Interest rate differential = Lending rate − Deposit rate, WA = weighted average
*, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

Note that the two events (increases in risk-weights on foreign currency denominated mortgage loans and loans issued to foreign currency exposed firms and individuals) are represented by a single dummy variable. We estimated the regression by including separate two dummy variables for each of

3. See also Jacobson, LaLonde and Sullivan (1993) for classical event study.

the individual policy changes at the same time. However, one of the dummy variables was automatically omitted due to perfect collinearity. Therefore, we combine these two macroprudential policy actions and treat them as one event, implying that the coefficient estimate expresses the combined effects. To look at the individual effect, we also estimate the regression including the individual event dummy variables one at a time. By comparing the estimate of the combined event dummy in columns (4) and (5), we can observe that banks respond to real policy shock much stronger than the expected shock because the statistical significance and value of the coefficient on risk-weight events dummy are improved when we set the dummy following the effective date.

Moreover, we find quite significant negative impact of the exchange rate on banks' loan supply before we specify our policy variables with lags, suggesting that the banks generally tend to reduce their loans due to real depreciation of the domestic currency against the US dollar. However, we lost the effect of exchange rates on banking credit supply when we include the lagged policy variables. This is inconsistent with the fact that banks reduce their foreign currency loans to avoid the exchange rate risk on their loan portfolio. The banks are also likely to consider an inflation and interest rate spread as their economic fundamentals for decisions on lending. However, we could not find any evidence for any statistically significant effect of the foreign trade condition (proxied by current account balance), capital openness and economic growth on loan supply. It should be noted that the statistical significance of country-level variables is not so important and we should only focus on the macroprudential policy variables of our interest, risk-weights dummy and performance of banks on reserve requirement.

**Table 6: Effect of Macroprudential Policies on Individual Sector Loan Supply**

| | (1) Agr. | (2) Mining | (3) Man. | (4) Const. | (5) Trade | (6) Food |
|---|---|---|---|---|---|---|
| Risk-weights dummy (effective, lagged) | −0.304* | −0.030 | −0.257** | −0.515*** | −0.216* | −0.568*** |
| | (0.142) | (0.532) | (0.095) | (0.121) | (0.117) | (0.141) |
| Bank's performance to RR (lagged) | −0.000 | 0.000 | −0.000 | −0.001 | −0.001** | 0.000 |
| | (0.001) | (0.000) | (0.000) | (0.001) | (0.000) | (0.001) |
| Log of real FX rate (MNT/US$) | −0.851 | −0.243 | −0.441 | 0.663 | −0.484 | −0.537 |
| | (0.710) | (0.737) | (0.541) | (0.798) | (0.426) | (0.995) |
| Current account (% of GDP) | −0.005 | −0.004 | −0.003 | −0.012 | −0.002 | −0.002 |
| | (0.003) | (0.008) | (0.004) | (0.007) | (0.003) | (0.005) |
| Capital openness | 0.002 | −0.002 | 0.002 | 0.001 | 0.000 | 0.000 |
| | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) |
| Real GDP growth (YoY %) | −0.009 | −0.007 | −0.020* | −0.021 | −0.017* | 0.014 |
| | (0.010) | (0.015) | (0.010) | (0.019) | (0.009) | (0.017) |
| CPI inflation | 0.004 | 0.003 | −0.001 | 0.016 | 0.024*** | 0.009** |
| | (0.008) | (0.007) | (0.011) | (0.009) | (0.008) | (0.004) |
| Interest rate differential (MNT, WA) | 0.012 | 0.010 | −0.057 | −0.123** | 0.004 | 0.041 |
| | (0.029) | (0.025) | (0.042) | (0.046) | (0.039) | (0.026) |
| Number of observations | 403 | 407 | 415 | 433 | 434 | 420 |
| Adjusted $R^2$ | 0.87 | 0.85 | 0.93 | 0.88 | 0.93 | 0.81 |

*Notes*: Robust standard errors in parentheses.
Agr. = Agriculture, Man. = Manufacturing, Const. = Construction, RR = reserve requirement, MNT = Mongolian tugrik, GDP = Gross Domestic Products, YoY = year-on-year, WA = weighted average, Interest rate differential = Lending rate − Deposit rate
*, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

We then evaluate the effect of macroprudential policies on sectoral lending by an individual bank using the fixed effect model. We use our last model specification with fixed effects presented in column (6) of Table 5, but we change the dependent variable of total loan supply to loan supply to a particular economic sector. We then estimate these panel regressions separately, with all other explanatory variables remaining the same. Nine main economic sectors and loans issued to each of these sectors are considered. However, we find that the risk-weights and reserve requirements are effective only for six sectors including agriculture, mining, manufacturing, construction, trade, and accomodations and food services. Table 6 presents the combined results from the individual sector estimations.

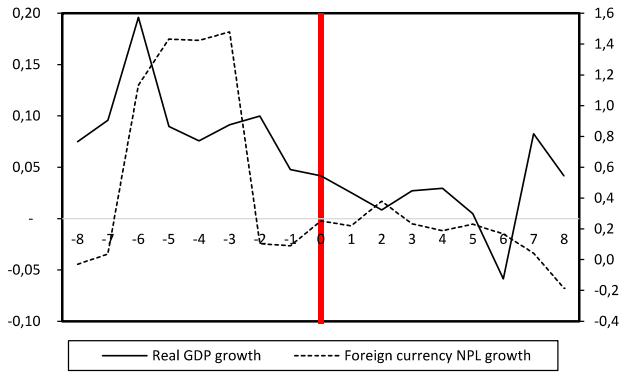
We observe that events of increasing risk-weights successfully reduce the credit supply to the individual sectors except mining. This result illustrates the decisions for banks' portfolio allocation. In other words, commercial banks do not reduce credits to the mining sector even when the risk-weights tightened. With an increase in risk-weights, we find that the banks prefer maintaining mining loans while reducing loans to other sectors more. On the other side, we find from the effect of reserve requirement on performance of banks is that only trade credits are affected. This result is actually expected since the effect of reserve requirement on total loan supply is almost negligible.

Similar to the estimation of total credit supply, we could not find any causality of exchange rates on sectoral lending. This could be explained by the fact that we expressed the exchange rate in real terms. In other words, if we use the nominal exchange rate instead of real exchange rate, we may find some effect of exchange rates on bank credits to these sectors. The estimation results also suggest that interest rate spread or the difference between lending rates and deposit rates only affects the loans to the construction sector, while the inflation rate is effective for increasing loan supply to trade and food industries. Other country-level macroeconomic indicators hardly affect the sectoral loan supply. In general, we can observe that, across all other sectors, trade credits closely reflect the changes in macroprudential policies and macroeconomic condition.

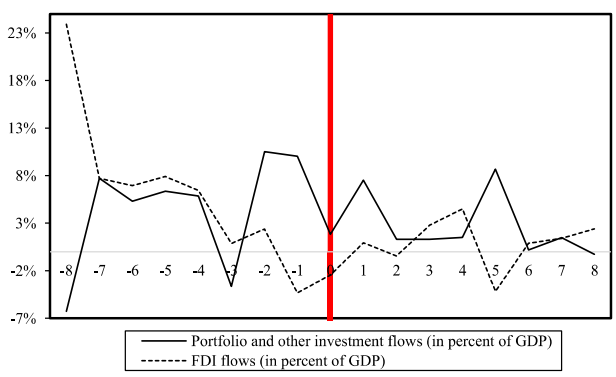
## 4.2 The Effects of Changing Banks' Risk-Weights

The estimation window covers 28 quarters over the 2006–2012 period, whereas the event window covers eight quarters prior and after the policy announcement; time 0 is the event period, i.e., period when policy is implemented.

**Figure 7: Driving Factors of Foreign Currency Credit Growth**



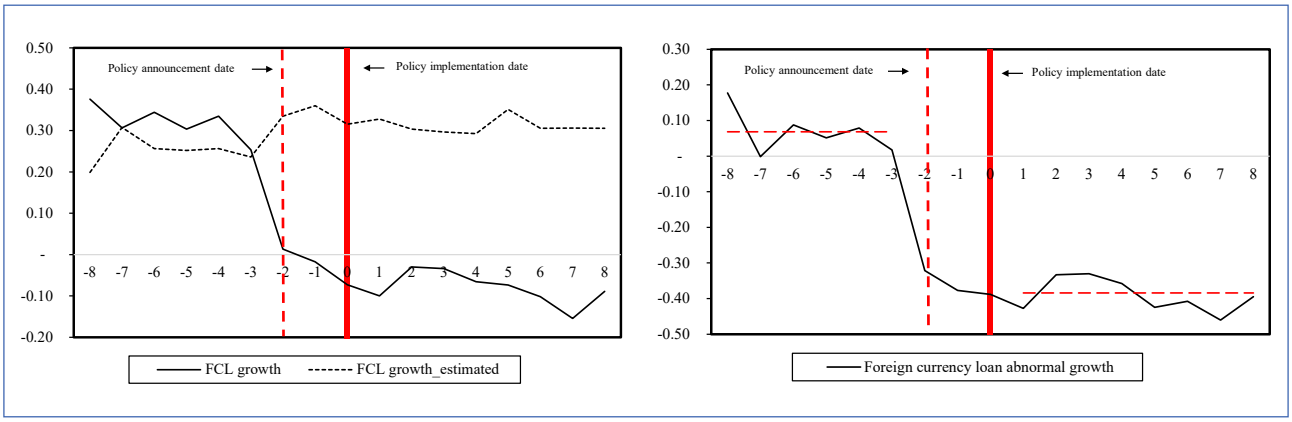

(a) Domestic factors




(b) External factors

Figure 7 shows the pattern of domestic and external factors that affect the foreign currency credit growth. The real GDP growth and growth of foreign currency non-performing loans (NPL) tend to decline throughout the event window, while the real GDP growth is positive for most of the period. The inflows of foreign direct investment (FDI) into Mongolia was at an all-time high point at the beginning of the event window.

**Figure 8: Growth of Foreign Currency Loans**




(a) Normal growth (b) Abnormal growth

On the other hand, Figure 8 shows the normal and abnormal growth of foreign currency loans. Foreign currency loans started to decline two quarters prior to the event, which is consistent with the announcement date of policy changes. There is a persistent decline in foreign currency loans for two quarters prior to the event date until the end of an event window. Foreign currency loans showed an average annual decline of 8% in the post-event window.

## 5. Conclusion

This paper examines the effect of a set of macroprudential policies including risk-weights, loan-loss provisioning and reserve requirements on bank credit supply in Mongolia, a country with a little experience for implementing macroprudential policies. Using aggregate and individual bank-specific quarterly data for 14 banks in Mongolia over the 2005–2016 period, the effect of macroprudential measures on total credit supply, sectoral lending, as well as some specific type of loans such as foreign currency loans, is analyzed.

To better understand the effectiveness of macroprudential policies, we estimate the effect of risk-weights and reserve requirements on total and sectoral lending, using an event study research design in the spirit of Lafortune et al. (2016) and the panel framework. Controlling for endogeneity, we find that macroprudential instruments (i.e., risk-weights and reserve requirements) are effective in dampening credit cycles at sufficient levels of significance in Mongolia. The event study specification models the events of increasing risk-weights on foreign currency denominated mortgage loans and loans issued to foreign exchange exposed firms as permanent and immediate (jump) shifts. The coefficient estimate of the risk-weights dummy was statistically significant and robust. Thus, we argue that these foreign exchange related macroprudential policies help to reduce foreign currency lending, indicating the ex-ante nature of macroprudential measures. In addition, we find that the real (effective date) policy shock of increasing risk-weights on foreign currency denominated mortgage loans and loans issued to foreign currency exposed firms is much stronger than the expected (announced date) policy shock. We also postulate that reserve

requirement measures on the performance of banks is generally effective for reducing total banking credit supply based on its statistical significance. Therefore, we argue that risk-weights and reserve requirement act as countercyclical buffers to mitigating increases in bank leverage in Mongolia. For sectoral lending, bank credit supply to wholesale and retail trade closely reflects the changes in macroprudential instruments across other main economic sectors.

The effect of increasing risk-weights is confirmed by estimating the market model proposed by MacKinlay (1997). After removing the systemic part of the movement in foreign currency credit growth, we find that an increase in risk-weights on foreign currency mortgage loans and loans issued to borrowers with foreign exchange exposure was effective in reducing foreign currency credit growth. It is shown that the growth of foreign currency loans consistently declines by about 8% following the build-up of risk-weights on foreign currency loans.

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## Chapter 5

# EFFECTIVENESS OF MACROPRUDENTIAL POLICY THROUGH LENDING STANDARD CHANNEL: THE CASE OF VIETNAM

By

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## 1. Introduction

Since the global financial crisis of 2008, the design of a macroeconomic policy framework that closely interacts with monetary policy has become a top policy concern of nations and international financial institutions. Accordingly, there is growing evidence of the effectiveness for the use of macroprudential policy tools in minimizing systemic risks in economies through transmission channels as well as how these instruments interact with monetary policy (IMF, 2011; Bruno and Hyun, 2013). Many countries also publish bank lending surveys that provide very useful information on how banks modify the prices and non-prices terms of loans to private sector, and on the drivers of these lending conditions. Some of the terms of loans (such as actual Loan-to-Value ratios (LTVs)) or some of the drivers of lending standards (such as the cost of bank capital or the liquidity position of a bank) are directly related to macroprudential instruments implemented in many jurisdictions (BCBS, 2011; ESRB, 2013; Ono, Uchida, Udell and Uesugi, 2014; Tressel and Zhang, 2016; Lee, Gaspar and Villaruel, 2017).

Prolonged periods of substantial capital inflows, booming real estate markets, and rapid credit growth have raised financial stability challenges across many parts of Asia since the mid-2000s. In some cases, macroeconomic policies alone have struggled to address these risks to financial stability. Vietnam might be among the countries which first introduced macroprudential policy in the early 2000s, in the aftermath of damages from the 1997 Asian financial crisis. Nevertheless, the term of macroprudential policy approach has just been used widely over the last few years. This circumstance seems reasonable when the Vietnamese stock market is still in its infancy (established in 2000), the incomplete development and low-level of financial system inclusion as well as a lack of transparency in developing countries (where the decentralization is still in progress). Since the global financial crisis of 2008, the identification of systemic risk and the strengthening of the macroprudential policy has been paid great attention by the Vietnam government as a key element of national financial stability. Vietnam is pursuing a multi-pronged monetary policy and is aiming to maintain a balance between growth and stability in recent years. Accordingly, the macroprudential policy is expected to be appropriately designed under specific circumstances in order to detect, prevent, estimate and minimize losses when systematic risk occurs by combining comprehensive risk control tools. This is because a single tool is not enough to address the various risk sources. In

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addition, macroeconomic institutions should also be able to flexibly use macroprudential tools to deal with specific risks identified by appropriate analytical methods. In the period before the global financial crisis of 2007 - 2008, Vietnam's financial system has developed rapidly, contributing effectively to economic growth. However, there are a multitude of potential risks when the macroeconomic instability takes place, whether in the form of increased deteriorating asset quality, non-performing loans and bad assets, the bad reputation among financial institutions and businesses and the liquidity stresses of financial institutions. All these can lead to systemic instability and negative impacts on the economy. Thus, a proper assessment of the systemic risk that exists in Vietnam's financial markets is crucial for developing an effective monitoring policy that will contribute to a stable, healthy and sustainable financial market as well as economic development (NFSC, 2014).

The paper focuses on the macroprudential policy instruments which are related to the lending standard channel imposed by the State Bank of Vietnam (SBV) and to assess the effectiveness of macroprudential policies in Viet Nam's banking system for the period of 2000 - 2016. Firstly, we examine the elements determining which macroprudential policy instruments a country will use. Then, we estimate the probability of the imposed tightening/loosening lending standards. The control variables in the suggested quantitative model for time series data are CPI, domestic GDP growth, and interest rate.

The outline of paper is as follows. We begin by describing the literature review on the choice of instruments to measure the effectiveness of macroprudential policy, then focusing on Loan- to-Value (LTV) and Debt to Income (DTI) ratios. We also further explain how Vietnam has implemented macroprudential policies up to now. The core empirical analysis of the paper follows in Section 4 with model specifications and empirical results on the effectiveness of macroprudential policy instruments related to lending activities imposed by SBV. Finally, we conclude by drawing several implications for the relationship between the implementation of macroprudential policy through the lending standards channel and financial stability.

## 2. Literature Review

Macroprudential policy has been highlighted in the need to move beyond a purely micro-based approach to financial regulation and supervision, but rather to an overarching framework to cope with global build-up of financial imbalances as a result of the financial crisis of 2007, which resulted in recessions affecting a number of countries and many banks needing to be shored up. In particular, there has been a failure to appreciate how aggressive risk-taking by various types of financial institutions has supported a massive growth in balance sheets in the financial system. Overreliance on the self-adjusting ability of the financial system and insufficient recognition of the role of financial deregulation in magnifying the unwinding of financial imbalance have been attributed to the underestimation of the consequence of accumulating stocks of debt and leverage, which arose from booming credit and asset prices – most specifically in the housing sector.

In light of this, the policy debate is accentuating the usage, implementation and effectiveness of macroprudential tools, as well as their impact on macroeconomic outcomes and monetary policy. The term was first introduced in 1970s which generally indicated a systemic orientation of administration towards the macroeconomy (G. Galati. and R. Moessner, 2013). In other words, such policies can be put into place to limit risks and vulnerabilities from building up further and spreading across the financial system. Although there has not been a universal definition of this term, researchers mostly associate macroprudential polices with maintaining financial stability. In the wake of the

financial crisis, the notion of macroprudential policy has called for attention from both academia and practitioners. However, limited research has been conducted to inform decisions on a macroprudential policy framework.

Macroprudential policy focuses on the stability of the financial system as a whole, with a view to limiting macroeconomic costs from financial distress. Therefore, it emphasizes the procyclical behavior of the financial system and the interconnectedness of individual financial institutions and markets, as well as their common exposure to economic risk factors (Crockett, 2000). An effective macroprudential policy framework ensures the use of appropriate macroprudential policy instruments (MPIs) or tools. The choice of measures mainly depends on the risks identified and its consequences, notwithstanding other factors, including macroeconomic policies already in place (Lee, et al, 2017).

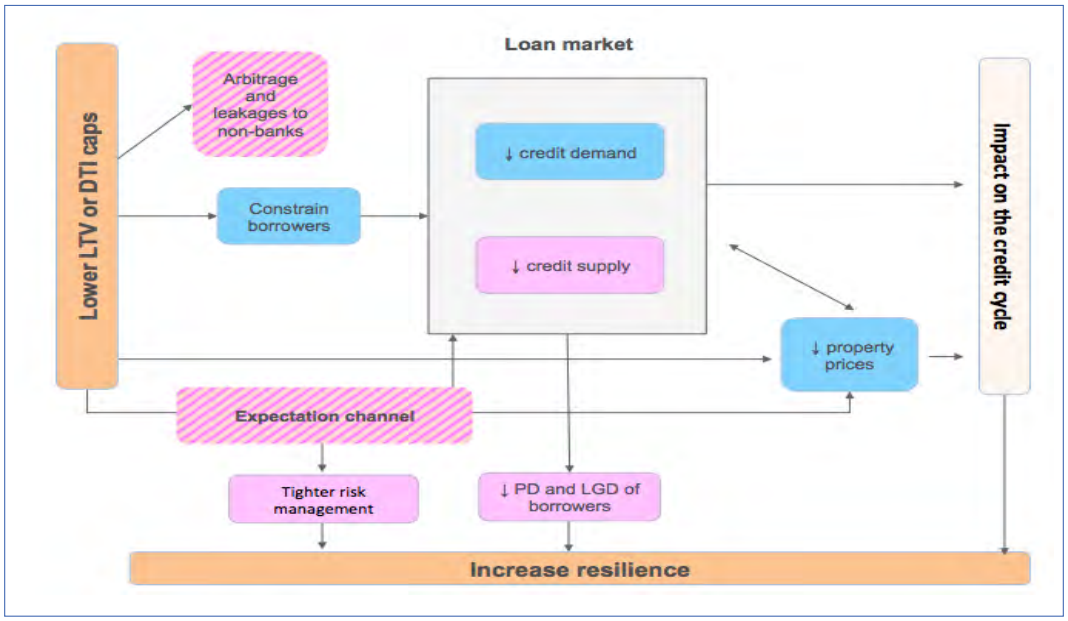
Blaise and Kaushik (2016) looked at three types of instruments as indicated in the macroprudential toolbox depending on macroprudential objectives (Table 1). In order to reduce risks from excessive credit or credit growth, authorities can apply credit controls such as caps on the Loan-to-Value (LTV) ratio, caps on the Debt-to-Income (DTI) ratio, caps on foreign currency lending, and ceilings on credit or credit growth. The second remedy - liquidity-related instruments - includes limits on net open currency positions or currency mismatches, limits on maturity mismatches, and reserve requirement. The last is building sufficient buffers to withstand the cycle, while capital-related tools can include countercyclical capital requirements, time-varying/dynamic positioning, and restrictions on profit distribution. These instruments are intended to address threats to financial stability arising from excessive credit expansion and asset price booms, and limit amplification mechanisms of risks through leverage and also help mitigate vulnerabilities arising from the influence of global factors on the domestic economy. IMF (2011a) argues that for these to be effective macroprudential tools, two conditions need to hold. First, they should target explicitly and specifically systemic risks. Second, the selected institutional framework is underpinned by the necessary governance arrangements to ensure there is no slippage in their use.

**Table 1: Policy Instruments and Potential Indicators**

| Policy instrument | Potential indicators |
|---|---|
| **Capital-based instruments** | |
| Countercyclical capital buffers[1] | Measures of the aggregate credit cycle |
| Dynamic provisions[1] | Bank-specific credit growth and specific provisions (current and historical average) |
| Sectoral capital requirements | Measures of the price and quantity of different credit aggregates (stock and new loans) on a sectoral basis: interbank credit, OFIs, non-financial corporate sector and households<br>Measures of sectoral concentrations<br>Distribution of borrowing within and across sectors<br>Real estate prices (commercial and residential, old and newly developed properties)<br>Price-to-rent ratios |
| **Liquidity-based instruments** | |
| Countercyclical liquidity requirements | LCR and NSFR<br>Liquid assets to total assets or short-term liabilities<br>Loans and other long-term assets to long-term funding<br>Loan-to-deposit ratios<br>Libor-OIS spreads<br>Lending spreads |
| Margins and haircuts in markets | Margins and haircuts<br>Bid-ask spreads<br>Liquidity premia<br>Shadow banking leverage and valuation<br>Market depth measures |
| **Asset-side instruments** | |
| LTVs and DTIs | Real estate prices (commercial and residential, old and newly developed properties)<br>Price-to-rent ratios<br>Mortgage credit growth<br>Underwriting standards<br>Indicators related to household vulnerabilities<br>Indicators of cash-out refinancing |

Source: CGFS Paper, No 48 (2012).

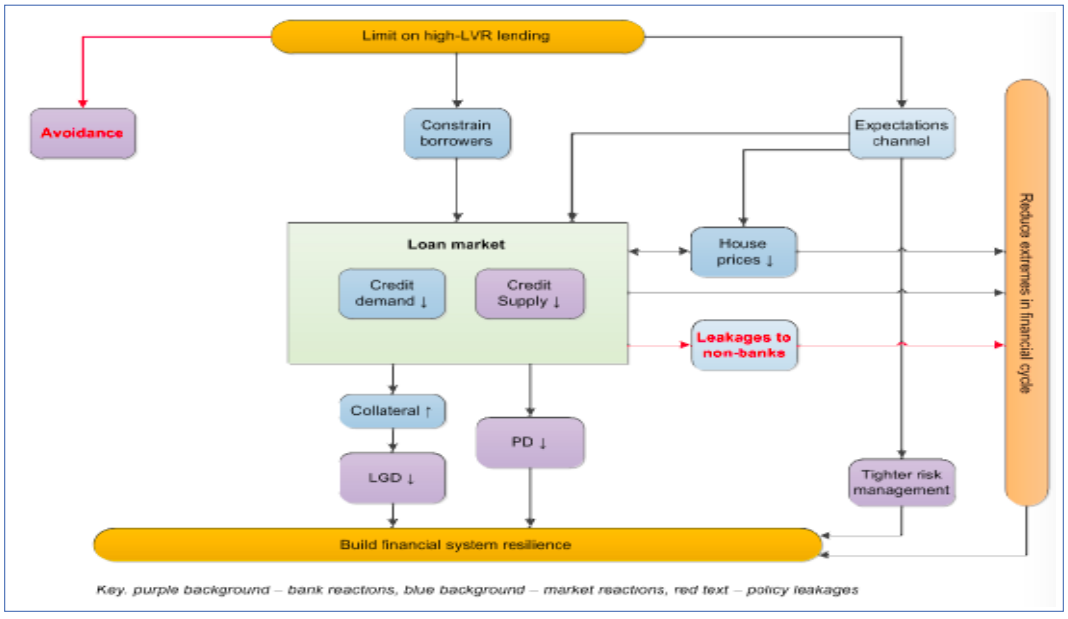
**Figure 1: Transmission Mapfor Tighter Asset-side Tools**




Source: Reserve Bank of New Zealand (2013).

In terms of asset-side instruments, the LTV and DTI are currently widely used to curb financing/ loan growth as well as non-performing loans, therefore impacting resilience and the credit cycle. However, the literature concerning the transmission mechanism of LTV and DTI policy is scanty. Recent theoretical works by the Committee on the Global Financial System (CGFS, 2012) have shed light on this issue by sketching a transmission map of a LTV policy, which suggests that a LTV cap tightening could strengthen the resilience of banks through its dampening effect on the leverage of borrowers and credit growth. Ascarya, Rahmawati and Karim (2016) showed that tighter LTV caps reduce the sensitivity of households to income and property price shocks. Additionally, LTV and DTI caps during booms slow down real credit growth and house price appreciation (Crowe et al., 2011).

**Figure 2: Transmission Map of Housing LTV Limits**

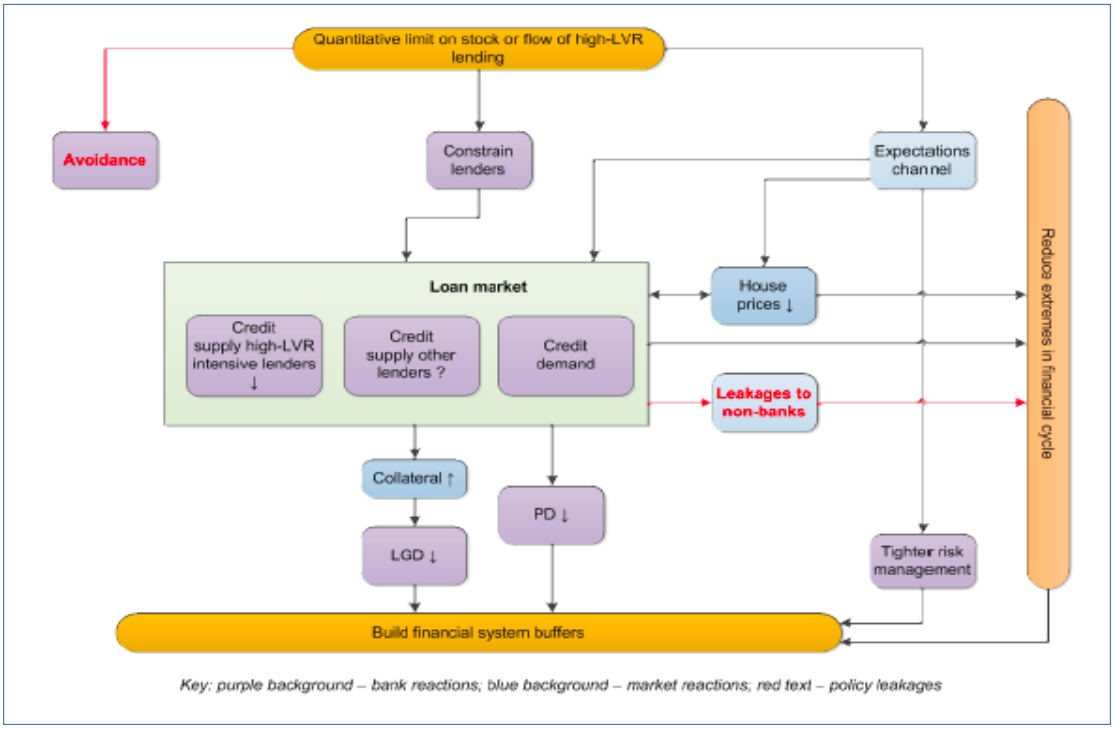



Source: Reserve Bank of New Zealand (2013).

Roger (2013) detailed the impact of LTV on resilience, credit cycle and expectations-based effects as in the following. Restrictions on high LTV housing lending provide a supplementary tool for addressing the financial stability risks that could emerge from imbalances in the housing sector. They would typically be applied when growth in high-LTV housing lending and house prices is judged to be excessive, with the objective of dampening the housing cycle and strengthening the resilience of banks and households. Figure 2 maps the impact of outright LTV limits, which directly constrain borrowers' lending capacity by blocking all access to high-LTV lending. Figure 3 maps the effect of quantitative restrictions; the impact will vary by bank, according to whether the restriction proves binding given their existing share/flow of high-LTV lending.

**Impact on Resilience:** At its most basic, LTV limits can increase the resilience of the banking system directly through decreasing both the probability of default (PD) and loss-given-default (LGD) of loans. Firstly, LTV limits reduce PDs since a greater proportion of new borrowers would have higher equity buffers to withstand negative shocks, such as rising interest rate. Secondly, by restricting the amount that can be borrowed against the given value of a property, limits on LTV ratios restrict leverage and, in doing so, decrease LGD.

**Figure 3: Transmission Map of Quantitative Restrictions on High-LTV Lending**




Source: Reserve Bank of New Zealand (2013).

Resilience is also indirectly leveraged via the impact on the credit cycle or expectations, which in turn, may lead to a tightening of banks' risk management standards. Hence, LTV restrictions would limit the risks to which banks are exposed. Where quantitative limits are applied, the impact on individual banks' resilience will be reliant on whether the limit is binding. If the overall share of high-LTV lending falls, this will increase the resilience at a system level also. A system-wide fall in the share of high-LTV lending will depend on whether other banks step in to take up the high-LTV lending vacated by the former group.

However, it should be emphasized that LTV restrictions are likely to be imposed at times when risks associated with such lending appear excessive (and hence potentially not adequately reflected in microprudential settings). These effects will need to be balanced against the fact that the banking system will be holding less capital, as there will be less high-LTV lending. Where microprudential capital requirements are appropriately calibrated for the extra risk in the high-LTV lending book, the increase in resilience due to LTV restrictions would be cancelled out by the decrease in capital.

**Impact on the Credit Cycle and House Price:** LTV restrictions would likely be more effective than the other instruments at reducing house price growth, because LTV restrictions would directly affect the supply of housing credit**.** Also, tighter LTV caps restrict the quantity of credit by limiting the funding available for marginal borrowers, reducing effective housing demand and increasing savings. In principle, house prices will tend to ease, reducing households' ability to obtain credit and withdraw equity more generally. These combined effects on the supply of and demand for housing credit would dampen credit growth. This would help to reduce households' ability to borrow against existing equity of their houses (i.e., refinancing or equity withdrawal), and ease house price inflation. Further, such restrictions could be expected to help curb expectations and speculative incentives.

The strength of these transmission channels may be moderated by the fact that LTV limits do not directly affect the cost of borrowing – they simply restrict the ability of a specific group to borrow. While this may constrain some households, it is also possible that the demand from others with sufficient wealth might continue to drive house price growth.

The ultimate impact (including second-round effects) of any change in LTV caps may be quite sensitive to its initial impact on house prices, in particular when house price growth is disconnected from fundamentals. If LTV tightening is followed by an initial house price decline, LTVs of existing borrowers will increase, reducing the scope for equity withdrawals and GDP growth, which may trigger further declines in house prices. If, by contrast, house prices continue to rise after the LTV cap is tightened, aggregate demand may continue to be supported by equity withdrawals as LTV ratios fall. Both amplification channels might be stronger when house price changes are due to speculative demand.

The effect of imposing a quantitative restriction rather than outright limit will depend on whether banks that are not bound by the restriction increase their share of high-LTV lending. If these lenders soak up the marginal borrowers, the restrictions may be less effective in containing aggregate housing lending.

**Expectations-based Effects:** LTV limits provide a highly visible signal of the central bank's discomfort with developments in the housing market, which is likely to increase its impact on expectations. However, there is a risk of expectations playing a destabilizing role under some circumstances. If caps are expected to be tightened, households might respond by bringing forward borrowing. House price growth might then accelerate, at least temporarily. These effects may be avoided by implementing limits over relatively short periods of time. Accordingly, the notice period could be as short as two weeks for LTV restrictions.

Empirically, the effectiveness of asset-side instrument is mixed, not conclusive and country specific, so there is insufficient guidance on the optimal target of this macroprudential tool from the literature.

Empirical results from developed countries are broadly in line with our expectation. The Financial Services Authority (2009) demonstrates that in the United Kingdom (UK), there is evidence of a relationship between LTVs and defaults. In particular, this study finds that default rates for ten of the largest UK mortgage lenders are generally higher at higher LTVs during 2008.

Demyanyk and Hemert (2009) used a loan-level database containing information on about half of all subprime mortgages in the U.S. that originated in the period 2001-2007. They stated that high-LTV debtors become increasingly risky compared to their counterparts with low-LTV. Securitizers seem to have been aware of this particular pattern in the relative riskiness of debtors. In addition, mortgage rates become more sensitive over time to the LTV ratio of debtors. For instance, in 2001 a debtor with a one-standard-deviation above-average LTV ratio pays a 10-basis point premium compared to her/his counterpart with average-LTV. By contrast, in the year 2006, the premium paid by the high-LTV debtors is roughly 30 basis points.

Crowe et al. (2011) in their study of "How to Deal with Real Estate Booms: Lessons from Country Experiences" used data of 50 U.S. States between 1978 and 2008 and showed the effect of LTV on origination of loan - approximately 5% increase in house price for a 10% point rise in LTV.

Another study for the U.S. case by Duca et al. (2011), built a series for LTV faced by first-time home buyers and estimated a cointegration model of house price-to-rent ratios at the national level from 1979 to 2007. The finding of the study is that, assuming rents remain constant, a 10 percentage point decline in LTV ratio of mortgage loans for first-time buyers leads to a 10 percentage point decrease in the house price appreciation rate.

Igan and Kang (2011) assessed the effects of LTV and DTI limits on regional housing and mortgage market activity, and household choices in Korea. They pointed out that there has been a significant decrease in transaction activity in the three-month period after the tightening of LTV or DTI regulations. House price inflation also dropped but in the six-month period. Futhermore, LTV tightening is more effective than DTI tightening in terms of reining in price dynamics. Additionally, this study analyzed survey data by using a matching estimator framework and showed that in the future, growth of expected house price becomes lower after the implementation of caps on LTV and DTI, suggesting that adoptions of loan eligibility criteria curb expectations and speculations in Korea.

Westin et al. (2011) conducted a regression from a data set of 19 countries belonging to the Organization for Economic Development and Cooperation (OECD) from 1980 to 2010 and stated that the LTV ratio plays a role in increasing house price dynamics. A high LTV ratio reinforces the impact of real GPD growth on house price development, and this correlation is considerably significant and economically relevant. The study's result is in line with the existence of an accelerator mechanism: a high cap on LTV amplifies the influence of income shock on house prices.

Using sample data of 49 countries during the period 2000-2010 and GMM (Generalized Method of Moments), Lim et al. (2011) analyzed the connection between macroprudential policies and credit, and leverage growth rate. The study indicates that the presence of macroprudential policies such as caps on LTV and DTI, limits on credit growth and dynamic provisioning have a relationship with the decline in the pro-cyclicality of credit and leverage. In particular, credit development falls after the introduction of caps on LTV and DTI ratios, with the LTV measure reducing the pro-cyclicality of credit development by 80%. The authors suggest that the effectiveness of macroprudential policies is sensitive to the type of shock facing the financial sector.

Claessens et al. (2013) employed GMM panel regressions to investigate how changes in the balance sheets of 2,800 banks in 48 countries from 2000 to 2010 respond to specific macroprudential policies. They pointed out that DTI and LTV ratios and limits on foreign currency loans and ceiling credit growth decelerate the increase in asset and bank leverage, and growth in noncore to core liabilities. While countercyclical buffers are effective in alleviating rises in bank leverage and assets, some measures help to stop drops in adverse times.

Price (2014) showed that in New Zealand, without a cap on LTV, house price appreciation could have been 3.3 percentage points higher and household credit development could have been 0.9 percentage points higher. The result of this study supports evidence found in another study for New Zealand carried out by Bloor and McDonald (2013). In particular, over the first year, house price appreciation seemed to decrease by 1-4 percentage points, and credit development likely dropped by 1-3 percentage points.

Hallissey et al. (2014) used loan-level data in Ireland to investigate the correlation between mortgage defaults and originating levels of LTV and DTI ratios. These authors point out that there has a positive correlation between these ratios and subsequent defaults, with the strength of the correlation dependent upon the point of the property cycle at which a loan is originated. Default rates on loans issued near the peak of the cycle to first-time buyers are particularly sensitive to LTV at origination while those issued to non-first-time buyers are sensitive to both LTV and LTI at origination. Moreover, there is a dramatic growth in the losses on defaulted loans for loans issued above 85% LTV. Although lending at higher LTI ratios dropped noticeably, the year 2003 saw 50% of new lending to owner occupiers at LTV levels above 80%.

Neagu et al. (2015) used a GMM model to test how introduced or changed LTV and/or DTI may affect the loan growth in Romania. The study demonstrates that LTV and DTI limits have relative effectiveness in curbing high lending activity and in making sure that borrowers as well as lenders can deal with adverse shocks in real estate prices, depreciation of currency and sudden increase in interest rate. Furthermore, the study also estimates another panel data regression using GMM to investigate the influence of DTI and LTV caps on lending volumes and NPL ratio movements. The findings are that there exists a significant negative relationship between the loan amount and the repayment ability of debtors. In addition, borrowers having lower income and high DTI are associated with higher NPL ratio, regardless of the lending purpose. The correlation between the LTV level and borrower's repayment capacity is also found - the higher the LTV, the higher the nonperforming loan ratio. These results support the argument for applying DTI and LTV caps to promote repayment capacity of borrowers.

A study conducted by Afanasieff et al. (2015) showed that the Central bank of Brazil enhanced the standards of origination of auto loans by doubling the risk weight factors for loans with certain characteristics. The measure was implemented for new auto loans by combining high LTV with long maturities. The macroprudential policy applied for origination of auto loans was found to be effective. The characteristics of newly originated auto loans such as LTV and maturity enhanced the application of the measure. Furthermore, the measure successfully signaled to banks the need to maintain sound origination standards as these did not worsen after the measure was withdrawn in 2011.

The evidence for the impact of LTV and DITs on developing countries' financial system resilience, credit growth and house price is mixed. The 2008-09 financial crisis might be considered as a milestone for emerging of literature on MaPP, especially in developing financial markets. Many of the papers on this area focused on simulating the influence of MaPP regulations on the capital

market and housing price growth, considering that these indices are important (and quantifiable) criteria to estimate the effectiveness of MaPP on economic stability. Although the analysis concludes that there is a limited consensus on the effectiveness of implementing MaPP instruments for countries, the outcome is nonetheless still promising.

In examining the effect of MaPP tools on credit growth, the studies of Zhang and Zoli (2016) and Bruno, Shim and Shin (2015) are often cited as significant empirical literature. Using an event study, Zhang and Zoli (2016) showed that LTV and DTI tightening mitigated credit growth in Asia but the effect was not very large. In particular, credit growth had declined in one quarter and was 2 percentage points below its peak after six quarters. Rising LTV and DTI ratios was also followed by a softening of property markets in Asian economies. However, the results by OLS estimation suggest that LTV and DTI tightening do not have significant dampening impact on credit in Asia economies. Meanwhile, housing related policies (including LTV and DTI) when tightened in emerging Asia countries, have strong effects on house price escalation, curbing its growth by nearly 2% in a one-quarter horizon. In contrast, Bruno et al. (2015) discussed the consequences of implementing five types of macroprudential regulations on cross-border financial indices. Taking 12 Asia-Pacific economies during the 2004-2013 period, the authors found ambiguous results on how LTV, DTI and other MaPP tools affect cross border total credit and bank credit.

Before Bruno et al. (2015), Wong, Fong, Li and Choi (2011) also examined effects of LTV, highlighting the case of Hongkong in the 1991-2010 period. The authors pointed out that LTV as a tool of MaPP can reduce systemic risk arising from housing escalation, with a minor trade-off of imposing higher liquidity constraints on homebuyers. In particular, when the LTV ceiling were loosened from 70% to 90% before 1997, the bad debt rate after the 1997-98 crisis would have been 1.7%, 0.86 percentage point higher than the actual ratio in December 1998. Moreover, the mortgage insurance programs (MPIs) that protect lenders from credit losses on the portion of loans over maximum LTV can enhance the MaPP tool by diminishing this limitation without undermining the effectiveness of the instrument. However, the effectiveness of LTV ratios on dampening household leverage appear more apparent than that for property market movements. This insight suggests that the effect on household sector leverage might be considered as a major channel through which LTV policy stabilizes the financial market.

In line with Wong et al. (2011), Se (2013) reviewed experiences of some Asian countries as well as other developed economies that successfully implemented the LTV cap to curb house price growth in the aftermath of the 1997-1998 crisis. Notwithstanding the country specifics, the statistics indicated that the results of executing LTV and DTI are extremely promising.

Morgan, Regis and Salike (2015) conducted a unique research which estimated directly the effects of the LTV – the macroprudential policy tool widely used to mitigate mortgage loan growth – on the development of the housing market. The sample of the study covered 10 Asian economies for which the authors constructed robust-to-outlier estimations. The results show strong evidence to support the conclusion that LTV-ratios-related polices help moderate mortgage loans.

Lee, Asuncion and Kim, (2016) also found that many countries in emerging Asia employed mostly LTV and DTI. These included the Republic of Korea, Singapore and Thailand. Their finding is similar to what Zhang and Zoli (2016) unveiled in their analysis for 13 Asian economies and 33 economies in other regions. The table below shows more details.

**Table 2: Specific Use of Macroprudential Policy Tools by Economy, 2000-2013**

| MPP type | Economy | | | | | | | | | | Total | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SIN | HKG | INO | MAL | KOR | IND | TAP | THA | PHI | PRC | | |
| *Credit-related*[a] | 13 | 5 | 11 | 6 | 23 | 6 | 3 | 15 | 1 | 9 | 92 | 49.2 |
| *Liquidity-related*[b] | 0 | 0 | 7 | 3 | 3 | 18 | 6 | 1 | 10 | 31 | 79 | 42.2 |
| *Capital-related*[c] | 1 | 1 | 1 | 0 | 2 | 4 | 0 | 0 | 6 | 1 | 16 | 8.6 |
| Total | 14 | 6 | 19 | 9 | 28 | 28 | 9 | 16 | 17 | 41 | 187 | 100.0 |

PRC = People's Republic of China; HKG = Hong Kong, China; IND = India; INO = Indonesia; KOR = Republic of Korea; MAL = Malaysia; MPP = macroprudential policy; PHI = Philippines; SIN = Singapore; TAP = Taipei,China; THA = Thailand.
Notes:
[a] Caps on loan-to-value ratio, caps on debt-to-income ratio, caps on foreign currency lending, and ceiling on credit/credit growth
[b] Limits on net open currency positions/currency mismatch (NOP), limits on maturity mismatch, and reserve requirements
[c] Countercyclical/time-varying capital requirements, time-varying/dynamic provisioning, and restrictions on profit distribution

Source: Lee, M.; R. Asuncion and J. Kim (2016).

It is interesting to note that Lee et al. (2016) used MaPP variables as continuous variables rather than as binary variables and they used the multivariate dynamic probit model instead of probit regression like previous researches. This innovative technique has contributed to data analysis methodology. The data was gathered from 10 Asia developing economies including China, Hongkong SAR, Indonesia, India, South Korea, Malaysia, Singapore, Thailand, Chinese Taipei and Philippines. From their analysis, Lee et al. (2016) concluded that LTV and DTI can effectively diminish credit escalation and housing price growth. In Korea, the credit-related instruments showed a lagged decrease for housing price growth until the second period and an immediate decline in leverage expansion. The leverage expansion in Thailand was impacted immediately with the implementation of credit-based tools, while its housing price inflation was also slightly affected.

Kim and Mehrotra (2016) estimated the effects of macro-instruments (monetary and prudential policy) in Australia, Indonesia, Korea and Thailand, for which MaPP instruments including LTV, DTI and other tools were taken into account. The paper revealed that LTV and DTI indeed have an impact on credit growth, with the tightening of MaPP supporting the process of disinflation in these countries.

One of the more recent papers is by Fendoğlu (2017) that showed that economies, including emerging East Asia, implemented borrower-based MaPP tools (containing LTV and DTI) more frequently than the others. On the credit cycle side, he emphasized the effects of borrower-based instruments on credit cycles. The estimation showed that borrower-based MaPP is likely to be more effective in curbing credit cycles in emerging Asian countries (Thailand, Korea, Indonesia, Malaysia and Philippines) during the 2003-2012 period. Meanwhile, such evidence appeared less clear for Latin America or emerging European economies. In addition, Erdem, Özen and Unalmis (2017) conducted another study which provides more details on the changes of MaPP tools by the phase of credit cycles. Using a dataset of 30 countries, Erdem et al. (2017) argued that LTV and DTI appeared more effective in the expansion period of credit cycles. This conclusion is noteworthy given that global liquidity shocks cause significant increase in domestic credit growth in emerging and developing countries, as is evidenced in this paper.

## 3. An Overview of Financial System in Vietnam

### 3.1 The Structure of the Financial System

Up to 1988, the financial system in Vietnam only comprised of the State Bank of Vietnam (SBV), and several affiliates aimed at distributing credit to State-Owned-Enterprises (SOEs) and other entities under directives of the central plan and handling deposits of these SOEs and entities (O'Connor, 2000). During 1988-1989, the government implemented a banking reform in an effort to transform the mono-bank system into a two-tier banking system, which means that the SBV would restrict itself to acting as the central bank while its commercial banking activities would be taken over by four sector-specialized state-owned commercial banks.

During the 1990s, the government facilitated the entrance of new players into the financial sector. This policy resulted in the mushrooming of a number of representative offices and branches of foreign banks and the so-called joint-stock commercial banks. Joint ventures between foreign banks and state-owned commercial banks were also established, but the services they offered were strictly circumscribed. In the meantime, non-bank financial institutions, such as finance and insurance companies, have come into existence, but have shown little importance in terms of financing firms. The components of the financial system in Vietnam are presented in Table 3.

Table 3 shows that Vietnam has a number of commercial banks, few non-bank financial institutions, and a newly-established stock market. This table, together with the fact that banks account for 85-90% of financial intermediation (O'Connor, 2000), suggest that Vietnam has a bank-based financial system. As shown in Table 3, the Vietnamese financial system is large for a low middle-income country, with assets of 200% of GDP in 2011. The banking sector dominates the financial system, with its assets amounting to about 183% of GDP (including the two policy banks) and 92% of financial institutions' assets. The banking sector is large by international comparison, whether measured by deposits or credits. However, while the banking sector is large, but non-banking financial institutions and securities markets remain small. Non-banking financial institutions (including cooperatives) account for only 17% of GDP and 8% of financial institution assets. Finance companies provide project and consumer finance and represent the largest class of non-banking financial institutions, accounting for 6% of GDP and 3% of financial institution assets. Insurance companies account for 4% of GDP, while mutual funds account for less than one percent of GDP and private pension funds remain negligible. The Social Security Fund (SSF) is the only institutional investor of significant size, managing pension reserves amounting to 6.5% of GDP. Equity markets have grown rapidly but are still at an early stage of development. While the number of companies listed in the two exchanges has increased dramatically, primarily due to the "equalizations" of SOEs, total equity market capitalization is relatively small at 20% of GDP in 2011, reflecting the fact that listed firms in Vietnam are generally small. The fixed income market is of a moderate size and is dominated by government bonds.

**Table 3: Structure of the Vietnamese Financial System**

| | Dec-07 | | | | Dec-11 | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of institutions | Total Assets [VND tln.] | Share of Total Assets % | Share of GDP % | Number of institutions | Total Assets [VND tln.] | Share of Total Assets % | Share of GDP % |
| **Universal and Commercial Banks** | 78 | 1,733.3 | 80.5 | 151.5 | 97 | 4,750.5 | 85.9 | 170.9 |
| Private | 73 | 801.8 | 37.3 | 70.1 | 92 | 2,838.2 | 51.3 | 102.1 |
| *Domestic* | *35* | *597.7* | *27.8* | *52.3* | *38* | *2,285.8* | *41.3* | *82.2* |
| *Foreign* | *38* | *204.0* | *9.5* | *17.8* | *54* | *552.4* | *10.0* | *19.9* |
| State-owned | 5 | 931.5 | 43.3 | 81.4 | 5 | 1,912.3 | 34.6 | 68.8 |
| **Development Banks** | 2 | 189.7 | 8.8 | 16.6 | 2 | 346.4 | 6.3 | 12.5 |
| **Other depository institutions** | | | | | | | | |
| Cooperative banks | 2 | 19.1 | 0.9 | 1.7 | 2 | 46.4 | 0.8 | 1.7 |
| **Other credit institutions** | | | | | | | | |
| Finance companies | 8 | 69.0 | 3.2 | 6.0 | 18 | 159.5 | 2.9 | 5.7 |
| Leasing companies | 12 | 14.1 | 0.7 | 1.2 | 12 | 24.0 | 0.4 | 0.9 |
| **Investment banks and financial auxiliaries** | | | | | | | | |
| Securities brokers/dealers | 62 | 54.9 | 2.6 | 4.8 | 102 | 81.0 | 1.5 | 2.9 |
| Asset management companies | n.a. | | | | n.a. | | | |
| Foreign exchange houses | n.a. | | | | 270 | | | |
| **Insurance** | | | | | | | | |
| Insurance companies | 31 | 56.3 | 2.6 | 4.9 | 43 | 107.0 | 1.9 | 3.8 |
| *Life* | *9* | *39.7* | *1.8* | *3.5* | *14* | *71.5* | *1.3* | *2.6* |
| *Nonlife* | *22* | *16.7* | *0.8* | *1.5* | *29* | *35.5* | *0.6* | *1.3* |
| Reinsurance companies | 1 | 0.6 | 0.0 | 0.1 | 2 | 4.4 | 0.1 | 0.2 |
| **Pension funds 1/** | n.a. | | | | n.a. | | | |
| **Collective investment schemes 1/** | | | | | | | | |
| Money market funds | | | | | | | | |
| Investment Funds (closed) | 17 | 15.4 | 0.7 | 1.3 | 23 | 10.3 | 0.2 | 0.4 |
| **Total financial system** | | **2,152.3** | **100.0** | **188.2** | | **5,529.4** | **100.0** | **198.9** |

***Memorandum items:***

| | Total Value [VND TRlln.] | Share of GDP % | Total Value [VND TRlln.] | Share of GDP % |
|---|---|---|---|---|
| **Capital Markets** | | | | |
| Outstanding Government bonds | | | 353.6 | 12.7 |
| Outstanding Bills | 3.4 | 0.3 | 2.1 | 0.1 |
| Outstanding Corporate bonds | | | 35.5 | 1.3 |
| *Issued by Financial Firms (e.g. banks)* | | | *21.6* | *0.8* |
| *Issued by Non-Financial Firms* | | | *10.8* | *0.4* |
| Equity Market Capitalisation | 498.5 | 43.6 | 533.7 | 19.2 |
| *o/w financial sector* | n.a. | | n.a. | |
| Social Security Fund | 68.7 | 6.0 | 181.0 | 6.5 |
| GDP | 1,143.7 | 100.0 | 2,779.9 | 100.0 |
| Exchange Rate | 16,017 | | 21,034 | |

Sources: National authorities, IMF, ADB, Bloomberg.

So far, credit institutions and banks play a pivotal role in the financial institution system. In terms of asset size, at the end of 2015, the total assets of credit institutions accounted for about 184% of GDP, more than 12 times the total assets of non-CI financial institutions. Many commercial banks are operating in all three financial market sectors through the establishment of affiliated units or participating in capital contribution and share purchase in enterprises operating in securities, securities insurance. In contrast, some insurers have also been active in banking and securities business.

### 3.2 Financial Supervision in Vietnam

Vietnam is currently using an institutional surveillance model, whereby each regulatory authority oversees a separate sector. Banking operations are subject to direct supervision by the Banking Supervision Department, and are subject to supervision by the Deposit Insurance of Vietnam (although the supervision of the DIV is still not sufficiently strong). Simultaneously, insurance activities are subject to direct supervision by the Insurance Administration and Supervision Department while the State Securities Commission is responsible for direct supervision of the securities market.

In addition, the National Financial Supervisory Commission (NFSC) was established in 2008, to undertake the responsibility of the overall supervision of the financial system. The Committee is the advisory body of the Prime Minister and serves the following functions: "Advising the Prime Minister on the analysis, assessment and forecasting of impacts of financial markets on macroeconomics. the impact of macroeconomic policy on the financial market, the coordination of supervision of the national financial market (banking, securities, insurance), assist the Prime Minister in overseeing the overall financial market." The NFSC has a direct relationship with the Ministry of Finance and the State Bank of Vietnam (SBV) in order to capture the developments in the banking, insurance and securities sectors, as well as financial institutions under the management of the SBV and the Ministry of Finance, to provide information for monitoring; make recommendations on the handling of violations amongst organizations and individuals involved in these three areas.

SBV and the Ministry of Finance have a cross coordinated relationship in managing and supervising state-owned commercial banks under the management of the Ministry of Finance. These two organizations have a strong relationship in terms of the issuance of treasury bonds, as well as the implementation of public financial policies and monetary policy related to the use of bonds.

The activities of the supervisory authorities are based on specialized laws, including the Law on the State Bank, the Law on Credit Institutions, the Law on Securities and the Law on Insurance. There are no separate regulations for the financial supervision of the NFSC.

## 4. The Implementation of Macroprudential Policy in Vietnam

Vietnam has achieved remarkable progress since the start of its transition from a centrally planned economy in the mid-1980s. Nonetheless, the Vietnamese economy is showing signs of financial and enterprise distress, and weaker growth. The weak performance of the financial sector is due to a complex array of institutional and regulatory factors and, more recently, heightened macroeconomic volatility. Erratic macroeconomic policies also contributed to volatility of economic activity over the last five years. Three main episodes of the "stop-and-go" policies are closely associated with the observed real and financial cycles. The first of these episodes was when stimulus policies were implemented in 2009 in response to the global crisis. This included the relaxation of fiscal and monetary policies, which were followed by an acceleration of credit growth and a surge in inflation. Nearly half of international reserves were lost in that year. This prompted a round of policy tightening in early 2011 under "Resolution 11". Monetary policy was tightened through a cumulative increase of 500 basis points in the refinance and discount rates, which saw the reduction in the fiscal deficit. Credit growth slowed to less than 10%, the lowest rate in a decade. Fears that the tightening may have been overdone amidst a weakening global environment prompted another aggressive loosening of policies. Monetary policy measures in

2012 included cuts in policy rates and a range of administrative measures. This time, however, credit growth remained slow despite the policy easing, partly on account of a rapid deterioration in banks' balance sheets and the associated need for deleveraging. A relatively weak liquidity management framework prevented monetary policy from having a more predictable impact on aggregate demand.

Therefore, there is a need of a unified organization to be in charge of measuring and managing systemic risks as well as generating a framework of macroprudential policies with relevant tools. According to the Financial Sector Assessment Program, the IMF (2014) has classified macroprudential tools into five categories, including: (i) Broad-based tools (CCyB, LTV, DPR,…); (ii) Household sector tools ; (iii) Corporate sector tools (DSTI,…); (iv) Liquidity tools ( LCR, LTD,…); and, (v) Structural tools (sectorial capital requirements,…). In Vietnam, although there is yet to be an official set of macroprudential policies tools, a number of similar tools are available that are being used for monetary policies and banking supervisory as follows.

### 4.1 Ceiling on Credit Growth

The ceiling on credit growth was first applied in 2011, after an extended period of high credit growth which had negative impacts on the liquidity of credit institutions, resulting in high inflation. In view of this, SBV took the decision to manage credit growth - the target for the annual credit growth is to be based on the government's decision while the SBV is in charge of visualizing a mutual target as well as calculating the target for individual credit institutions based on their performance. The ceiling on credit growth helps control the flow of capital from credit institutions into the economy, and will enable the credit institutions to control risks from adverse effects of macroeconomic management of inflation.

This tool has shown to be effective as it allows effective credit institutions to provide more loans while constraining ineffective ones so that they can deal with existing issues relating to non-performing loans.

### 4.2 Limits on High Risk Sectors' Credit Growth

Controlling cash flow into high risk areas helps to stabilize the system of credit institutions and control the bad debt ratio. SBV has controlled the proportion of loans to the property and equity related areas, starting from 2011 - 2012, especially paying attention to high risk areas as directed by the government, in order to support the transmission of credit into the production sectors. The proportion of the non-production sector decreased from 22% (on June 2011) to 16% (on December 2011). Subsequently, SBV has maintained an annual assessment on the loan performance of high risk areas in order to formulate prompt solutions, if necessary.

### 4.3 Reserve Requirements

SBV has issued a number of legal documents relating to reserve requirements, among which are Decision No.2951/QĐ-NHNN dated 3 December 2008 on the adjustment of required reserve ratio for Vietnamese dong deposit of credit institutions, followed by Circular No. 23/2015/TT-NHNN dated 4 December 2015 on amendments to the regulation on reserve requirement for credit institutions issued together with Decision No.581/2003/QD-NHNN dated 9 June 2003 of the SBV Governor.

The required reserve ratios applicable to credit institutions are as follows:

**Table 4: Required Reserve Ratios Applicable to Credit Institutions (Decision No.581/2003/QD-NHNN)**

| | Demand VND deposit and VND deposit with the term of less than 12 months | VND deposit with the term of 12 months and more | Demand foreign currency deposit and foreign currency deposit with the term of less than 12 months | Foreign currency deposit with the term of 12 months |
|---|---|---|---|---|
| For State owned commercial banks (excluding Bank for agriculture and rural development) | 6% | 2% | 7% | 3% |
| Bank for agriculture and rural development | 3% | 1% | 6% | 2% |
| Rural commercial joint stock banks, Central Peoples Credit Fund, cooperative banks | 1% | 1% | 6% | 2% |

From 2009, the required reserve ratios applicable to credit institutions were adjusted by the Decree No.379/QD-NHNN (24/2/2009) as follows:

**Table 5: Required Reserve Ratios Applicable to Credit Institutions (Decree No.379/QD-NHNN (24/2/2009))**

| | Demand VND deposit and VND deposit with the term of less than 12 months | VND deposit with the term of 12 months and more | Demand foreign currency deposit and foreign currency deposit with the term of less than 12 months | Foreign currency deposit with the term of 12 months |
|---|---|---|---|---|
| For State owned commercial banks (excluding Bank for agriculture and rural development) | 3% | 1% | 8% | 6% |
| Bank for agriculture and rural development | 1% | 1% | 7% | 5% |
| Rural commercial joint stock banks, Central Peoples Credit Fund, cooperative banks | 1% | 1% | 7% | 5% |

### 4.4 Prudential Ratios

SBV has issued Circular No.36/2014/TT-NHNN dated on 20 November 2014, stipulating the minimum safety limits and ratios for transactions performed by credit institutions and branches of foreign banks and Circular No. 06/2016/TT-NHNN (27/5/2016) which adjusted the Circular No.36/2014/TT-NHNN. According to this latter Circular, safety limits and ratios are defined as:

a) CAR (%) = $\frac{Owner's\ equity}{Risk\ weighted\ assets}$ $\frac{Owner's\ equity}{Risk\ weighted\ assets}$ x 100%; minimum total CAR is set to 8%

b) ST deposits financing MLT loans = $\frac{MLT\ loans - MLT deposits}{ST\ deposits}$ $\frac{MLT\ loans - MLT deposits}{ST\ deposits}$ x 100%

| Credit institutions | Limits |
|---|---|
| Commercial banks | 60% |
| Branches of foreign banks | 60% |
| Non-bank credit institutions | 200% |
| Co-operative Bank of Viet Nam | 60% |

c) LTD = $\frac{Total\ loans}{total\ deposits}$ $\frac{Total\ loans}{total\ deposits}$ x 100%

| Credit institutions | Limits |
|---|---|
| State-owned commercial banks | 90% |
| Branches of foreign banks | 90% |
| Joint stock commercial banks, Joint venture banks, 100% foreign-owned banks | 80% |
| Co-operative Bank of Viet Nam | 80% |

According to Circular No. 41/2016/TT-NHNN (30/12/2016) which will be valid from 2020, the new CAR will be defined as:

$$CAR = \frac{C}{RWA + 12{,}5(K_{OR} + K_{MR})} \times 100\%$$

C: Owner's equity
RWA: Credit risk weighted assets
$K_{OR}$: Require capital for operation risk
$K_{MR}$: Require capital for market risk
Minimum total CAR remains the same (8%).

The prudential ratios help credit institutions to operate safely and effectively, avoiding bankruptcy and adversely affecting depositors' confidence and the macro economy.

### 4.5 Limits on Open FX Positions

The limits on open FX position was first applied in 2002 by the Decree No.1081/2002/QĐ-NHNN (07/10/2002) and the Decree No.1168/2003/QĐ-NHNN (2/10/2003). From 2012, SBV officially tightened the FX positions of commercial banks by issuing the Circular No.07/2012/TT-NHNN dated 20 March 2012. Thus, the previous foreign currency position which was +/- 30% of equity was narrowed to +/- 20%. Previously, in early 2011, the foreign exchange market experienced volatile fluctuations in the USD/VND exchange rate. There are views that SBV should narrow the foreign currency position of credit institutions, even down to +/- 5% to limit speculative activities.

### 4.6 Limits on Credit in Foreign Currency

SBV has issued a number of legal documents relating to the foreign currency credit limit, mainly on who could borrow foreign currency, such as: Decree No.418/2000/QĐ-NHNN7 (21/9/2000); Decree No.343/2003/QĐ-NHNN (10/4/2003); Decree No.966/2003/QĐ-NHNN; Decree No.09/2008/QĐ-NHNN (10/4/2008); Circular No.25/2009/TT-NHNN (15/12/2009); Circular No.07/2011/TT-NHNN (09/5/2011); Circular No.03/2012/TT-NHNN (08/3/2012); Circular 37/2012/TT-NHNN (28/12/2012); Circular No.29/2013/TT-NHNN (06/12/2013); Circular No.24/2015/TT-NHNN (08/12/2015) and Circular No.07/2016/TT-NHNN (27/5/2016). According to the Circular No.24/2015/TT-NHNN (the updated one) and two adjustments Circular (31/2016/TT-NHNN dated 15 December 2016 and 07/2016/TT-NHNN dated 27 May 2016), the credit institutions are allowed access to foreign currency credit in 3 cases: (i) foreign import payment; (ii) gas import enterprises; and (iii) important foreign projects investment.

### 4.7 Foreign Exchange Reserve Requirements

Reserve requirements differ by maturity of deposit, currency, and type of institution. With the exception of foreign exchange deposits, it is generally preferable to have a single reserve requirement to avoid distorting market signals and for administrative simplicity. Having differentiated RRs can also complicate liquidity management as it can involve banks assuming maturity and interest rate structures that are sub-optimal. It can also increase the cost of mobilizing particular deposit maturities. Related to the foreign exchange reserve requirements, SBV released the Decree No.581/2003/QĐ-NHNN (9/6/2003) and the Decree No.1925QD-NHNN (26/8/2011). According to these, the minimum reserve requirements ratio for USD deposit is 5% and the maximum 8%.

### 4.8 Tentative Tools

SBV has not yet applied tentative tools because they are deemed to be complicated for Vietnam's inadequate commercial bank database. Recently, the authority released Circular No.41/2016/TT-NHNN (30/12/2016) which included several capital prudential ratios for financial institutions. According to this, SBV has yet to impose caps on LTV and banks are to make their own decisions on this.

## 5. Model Specifications and Results

### 5.1 Model Specifications

The paper applied a simple OLS model of Cerutti et al. (2015) for evaluating the effectiveness of the transmission mechanism of macroprudential policy through the lending standard channel. The evaluation framework is set as follows:

(i) Through intermediate objectives: Lending standards ↑ (Tighten lending standard) → credit supply↓→ mortgage loans ↓ → domestic credit growth ↓

(ii) Through ultimate objectives: Lending standards ↑ (Tighten lending standard) → credit supply↓→ mortgage loans ↓ → housing price↓ → risk of housing bubble ↓→risks and instability of financial system ↓.

However, due to unavailability of historical housing prices, the paper will only focus on the first stage of the evaluation framework. In other words, it will assess impacts of activation of lending related to MaPP instruments on credit growth. Therefore, model is set as follows:

$$DC\_G = \propto + \beta_1 DC\_G_{t-1} + \beta_2 CPI_t + \beta_3 GDP_t + \beta_4 IR_t + \beta_5 MAPP1_t + \beta_6 MAPP2_t + \beta_7 MAPP3_t + \beta_8 MAPP4_t + u_t$$

where DC_G : Domestic credit growth (in percent).
IR : Lending interest rate (in percent)
CPI : Inflation rate (in percent)
GDP : GDP growth rate (in percent)

The first two variables are collated from the International Financial Statistics (IMF) and calculated based on q-o-q basis. The last two are derived from the General Statistics Office of Vietnam. All variables are on quarterly basis for period Q1/2000-Q4/2016, giving a total of 84 observations.

MaPP: Vector of macroprudential policy instruments related to lending activities imposed by the State Bank of Viet Nam, including:

+ *MAPP1* (Ceiling credit growth rate for each or group of commercial banks):
The State Bank of Vietnam classifies commercial banks into four groups (from 1 to 4) based on their performance and soundness. The monetary authority assigns different ceiling credit growth rates for the different groups in the sense that the better the bank performance is, the higher the credit growth rate assigned. This MaPP instrument was applied for the year of 2012 and 2013. Therefore, MaPP1 will be 1 for these years; others will be zero (0).

+ *MaPP2*:
Restrictions on institutional entities that could borrow foreign currency (FC) denominated loans from banks (Circular 07, dated 24 March 2011- effective from 9 May 2011):

(i) Q1/2000 - Q1/2011: MaPP2 = 0

(ii) Q2/2011 – Q 4/2016: MaPP2= 1

+ *MaPP3*:
Limits on loans per total deposit ratio (LDR) (Circular 36, dated 20 November 2014 – effective from 1 February, 2015)

(i) Q1/2000 – Q1/2015: MaPP3=0

(ii) Q2/2015 – Q 4/2016: MaPP3=1

+ *MaPP4*:
Applying higher risk weights on loans to securities and housing sectors (Decision 03/2007). This variable could be coded in two ways:

(i) Option 1: Q1/2000 – Q4/2006: MaPP4=0
Q1/2007 – Q 4/2016: MaPP4=1

(ii) Option 2: Q1/2000 – Q4/2006: MaPP4a=1
Q1/2007 – Q2/2010: MaPP4a=1.5
Q3/2010 – Q4/2014: MaPP4a=2.5
Q1/2015 – Q4/2016 MaPP4a=1.5

**Table 6: Effectiveness of MaPP Instruments Related to Lending Standards on Credit Growth in Vietnam**

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| **Variables** | **Coefficients** | **P-value** | **Coefficients** | **P-value** |
| C | 42.833*** | 0.0001 | 39.816*** | 0.0001 |
| DC_G(-1) | 0.7050*** | 0.0000 | 0.773498*** | 0.0000 |
| D(GDP_G) | 0.644080 | 0.2612 | 0.106645 | 0.8587 |
| CPI2 | -0.3253*** | 0.0062 | -0.3487*** | 0.0031 |
| D(IR) | 0.348676 | 0.3824 | 0.199226 | 0.6358 |
| MaPP1 | 0.413525 | 0.7905 | -1.207343 | 0.5031 |
| MaPP2 | -9.3951*** | 0.0000 | -8.2816*** | 0.0032 |
| MaPP3 | 1.110918 | 0.7166 | 5.419671 | 0.1765 |
| MaPP4 | 4.5065*** | 0.0020 | | |
| MaPP4a | | | 3.797803** | 0.0313 |

Note: ***, **, * indicates coefficient is significant at the 1%, 5%, 10% level, respectively.

## 5.2 Results and Comments

With regard to the first variable CPI, there is a negative association between inflation and lending by the financial sector to the private sector. In conventional theory, inflation is a key determinant in commercial bank lending volumes. It may affect the trends in lending volumes positively or negatively. Huybens et al. (1998, 1999) and Boyd et al. (2000) assert that inflation has an adverse impact on long-term lending and the movements of open market interest rates are fully and quickly transmitted in commercial loans to customers, suggesting that the amount of bank lending declines

with inflation. However, the positive correlation between inflation and credit growth (or lending volumes) in Vietnam can be accounted for by the fact that a rise in the inflation rate will result in higher demand for nominal credit. The result can also be explained on the rationale that while Vietnam's recent economic performance has rightly drawn much praise, there are increasing signs that the economy is overheating, and prices in large cities are also rising sharply. While exports continued to grow strongly, intense demand pressures have fueled rapid import growth, resulting in a rise in credit growth. On top of real economic growth, the strong expansion in money supply caused by loose monetary policy and excessive credit growth (which has been above 20% in the past few years in Vietnam) have also led to higher inflation. This is yet another indication that the inflation we are seeing in Vietnam is not simply imported inflation, but rather a demand-driven phenomenon that needs to be tackled by monetary policy.

A positive but insignificant relationship is found between GDP growth and credit growth. As a result of the established link between credit booms and financial crisis, excessive credit growth is now generally considered a reliable 'early warning indicator'. The issue in calibrating an early warning indicator is identifying credit growth that is justifiably based on economic fundamentals. The extensive growth in domestic enterprises' credit demand can be explained by production and trading activities that have gradually picked up pace and the strong recovery in the real estate and stock markets. In a developing economy like Vietnam, higher investment usually translates into higher growth – into 'hot' sectors like real estate and stocks. Rapid expansion in private sector credit goes hand in hand with surges in both house prices and activity levels. Besides, it seems true that credit growth should be roughly in the same proportion as GDP growth, in the sense that rising GDP should imply rising credit growth. In a developing country like Vietnam, it is also reasonable to say that credit growth should actually be a rising proportion of GDP, as the population gain increasing access to the banking system. The Vietnamese financial system should be characterized as a bank-based, as opposed to market-based financial system, suggesting that large volumes of trading activities would be settled through banks, ultimately leading to a high credit growth.

The beta coefficient of credit interest rate is positive, showing a positive relationship between credit interest rates and credit growth. The positive sign of the beta coefficient shows that an increase in credit interest rates determines the rise in credit growth. This result, however, is not in line with other studies in this field, which show that lower interest rates should promote credit in the private sector, implying a negative sign for this variable. The opposite finding in Vietnam can be accounted for by several reasons. From the perspective of banks, it can be seen that banks have two key sources of revenue: interest income and non-interest income. Interest income from lending is mainly the core revenue for many banks in Vietnam and it currently represents 70 to 80% of net income for the 7 largest listed banks in the country.

Since the country's accession to WTO in 2007, there has been a rise in investment activities in the country which led to strong credit growth averaging 33% from 2004 to 2011. However, credit growth started to decline from a peak of 124.7% in 2011 to 108.2% in 2013, despite an average deposit growth of 29% in 2012 to 2013. This decline in credit growth since 2011 has led to a negative impact on the banks' performance compared to their regional peers since 2010. The slow credit growth is due to the banks' reluctance to lend as a result of high NPLs from growing loans for non-core activities of SOEs in real estate, hospitality business and land acquisitions. In February 2014, Moody's estimated that NPLs in the country's banking system totaled at least 15% of its total assets, more than three times the central bank's official ratio of 4.7%. Despite the slow credit growth which hampered bank earnings, decelerating loans might allow them to deal with liquidity and asset quality problems. From the perspective of enterprises, since it joined the WTO in 2007, Vietnam

has received large FDI inflows, attracted by its comparative advantages such as a skilled workforce for labor-intensive industrial activity, increasing openness to foreign capital, various deals signed with trade partners, and a geographical location that favors regional supply chain integration. Strong foreign investment has led Vietnam's export industry to increase its production capacity rapidly, to move up the value chain, integrate regional supply chains and gain global market shares. In light of this, although the interest rate is high, credit growth has experienced an exponential rise due to the lucrative opportunities for investors.

In the second part, we used a panel framework to analyze the effectiveness of the macroprudential policies with respect to loan supply behavior of banks. Before running the regressions, we created basic graphs and tables plotting the sectorial lending patterns and relating them to policy changes over time. We then evaluate the impact of changes in macroprudential policies on credit supply using a panel methodology. The results are as follows.

The beta coefficient of credit growth ceiling (MAPP1) is positive but statistically insignificant, showing the ineffectiveness of macroprudential policies implemented. The explanation lies in a policy issued in 2012 by the State Bank of Vietnam – Bank's Internal Credit Growth Rating. Commercial banks are categorized into four groups based on performance reviews and credit growth: Groups 1, 2, 3, 4 are entitled to a maximum credit growth of 17%, 15%, 8% and no growth rate, respectively. However, a main disadvantage of the credit rating system is the non-disclosure of significant information. Information such as credit ratings is confidentially delivered to each bank, which means that banks have no knowledge of the category other banks are grouped under. Under such circumstances, this might lead to a situation where banks resort to their own negotiation techniques to increase their credit growth limit. Commercial banks which have almost reached the lending growth cap can request the SBV to set a higher credit growth limit to ensure more room for lending. As a consequence, such a distortion has led to the ineffectiveness of macroprudential policies. After two years, this tool is no longer used due to its deficiencies in both the analytical framework and the policymaker's capacity to mitigate emerging system-wide vulnerabilities.

The beta coefficient of limit on FCD (MAPP2) is negative and statistically significant, showing the effectiveness of macroprudential policies undertaken. During the implementation, Circular No. 07/2011 / TT-NHNN dated 24 March 2011, showed the effectiveness of the restriction on lending in foreign currency by credit institutions to resident borrowers. In fact, this Circular was promulgated to implement Resolution No. 11 / NQ-CP dated 24/2/2011 by the government on major measures to control inflation, stabilize the macro-economy and ensure social security. Accordingly, in order to pay loans, customers borrowing capital in foreign currency to pay for the import of goods and services, must have sufficient sources of foreign currency counterparty. This Circular also stipulates that credit institutions authorized to conduct foreign exchange transactions shall consider and decide to provide loans to foreigners in foreign currency for the following capital requirements: (i) firstly, short-term, medium and long-term loans and long-term offshore payments of goods or services for which borrowers need foreign currency to repay debts from production business and purchase sources of credit institutions or groups and other credit institutions are committed in written documents; (ii) secondly, short-term loans for the implementation of plans for production and trading of export goods through border gates and cross-borders of Vietnam, where borrowers have enough foreign currency to repay debts from export revenues; in case where a borrower borrows in foreign currency for this capital requirement for domestic use, the borrower shall have to sell such foreign currency amounts to the lending credit institution in the form of spot trading; and, (iii) thirdly, lending to other capital needs in foreign currency must be approved in written form by the Governor of the State Bank of Vietnam (SBV).

One year later, SBV issued Circular No. 03/2012 / TT-NHNN dated 8 March 2012 stipulating lending in foreign currencies by credit institutions and foreign bank branches. This replaces the Circular No. 07/2011/TT-NHNN dated 24 March 2011, issued on the auspices of the Governor of the SBV, regulating the lending of foreign currency loans to the resident borrowers to ensure that foreign currency credit growth is in line with the mobilization of capacity and the policy of limiting dollarization in the economy as directed by the government in Resolution No. 01/NQ-CP dated 3 January 2012. Accordingly, credit institutions and foreign bank branches authorized to conduct foreign exchange transactions should consider and decide to provide short-term, medium-term and long-term loans to resident customers in foreign currencies in order for them to pay for the import of goods and services when the borrowers have sufficient foreign currency from production and business taxes. In addition, credit institutions should consider the decision to provide loans to residents in the following cases: (i) short-term loans for off-shore payment of petrol and oil imports when allowed by the SBV in written documents; (ii) borrowing capital requirements approved by the SBV for each specific case at the request of a credit institution or branch of a foreign bank, on the basis of the borrower's demand for foreign currency loans to carry out projects and projects on production and trading of goods in the priority domains according to the undertakings of the government or credit institutions which have been appraised and ensured that the projects and production and business plans of customers are feasible and able to meet the loan conditions in accordance with the provisions of the law on lending activities and have the ability to recover debts on time (principal and interest). As a result, when the State Bank of Vietnam imposed a restriction on FCD, the lending channel was eroded and the central bank's ability to act as a lender of last resort in the case of a run on deposits could be somewhat limited, thereby inhibiting credit growth. This is a sensible approach as such a measure would prevent an adverse impact in confidence in the banking system and re-intermediation, and foster closer prudential supervision of foreign currency loan operations.

The beta coefficient of limits on loans per total deposit ratio (LDR) (MAPP3) is positive and statistically insignificant, showing the ineffectiveness of macroprudential policies undertaken. As a result of these limits, commercial banks had to stop lending in foreign currencies and switch to pure dollar trading except for some specific groups. As explained by the SBV, foreign currency borrowers need to boost their export promotion and trading plans to meet their domestic capital needs and not only borrow foreign currency in order to sell them for VND to gain profits. This measure is applied in an attempt to to reduce dollarization in the national economy. The limit on LDR is intended to maintain a prudential ratio for banks, ensure bank liquidity, and balance the mobilization of funds with the use of mobilized capital, rather than to control credit growth. On the other hand, the reality is that, during the application of this tool, banking and financial markets were more volatile. Other investment channels, such as securities and real estate, were risky, and people tended to deposit money into the banking system which was much safer. As a result, the growth rate of mobilized capital throughout the banking system increased over the years, leading to an increase in lending, ensuring a balance between mobilizing capital and use of capital.

The beta coefficient of the Loan-to-Deposit Ratio (MAPP4) in both models is positively and statistically significant, showing the ineffectiveness of macroprudential policies implemented. In 2014, the SBV issued Circular 36/2014/TT-NHNN ("Circular 36") regulating prudential ratios for the operations of credit institutions and foreign bank branches. Accordingly, the determination of the LDR applicable for each type of commercial bank, aimed to strengthen the quality of banking operations, as well as for monitoring the credit scope of each commercial bank more effectively. For instance, the LDR applicable for joint stock banks, joint venture banks, and 100% foreign banks was 80%. For these credit institutions and foreign bank branches established within the first three years, the Governor of the SBV determines the specific level for each type of credit institutions and foreign bank branches.

However, the relationship between the LDR and credit growth is positive, provisionally failing to prove its effectiveness as a macroprudential policy. This can be accounted for by the fact that before the issuance of the Circular, credit growth in Vietnam remained relatively low and the economy was quite sluggish for the medium-term. Since 2008, as in many countries in the world, Vietnam has been affected by the global financial crisis and the public debt crisis in Europe which started in 2010. Furthermore, the domestic economy was undergoing a turbulent period with increased trade deficit, budget deficit, rising public debt, high inflation and slow economic growth. This has partly caused the banking system of Vietnam to face many uncertainties, including liquidity problems and non-performing loans (KPMG, 2013). There is widespread agreement that the excessive credit expansion in the period 2007-2010 along with the expansion in terms of the number and size of the banking system was considered to be the underlying cause for the deterioration in the soundness of Vietnam's banking system at a later stage. The credit boom has had, on the whole, diminishing marginal benefits for the Vietnamese economy. However, in the wake of the introduction of the Circular, the economy during the period 2015-2016, has shown some sign of recovery, signaling for a rise in credit growth in Vietnam. Moreover, SBV has gradually cut or scrapped the ceiling rates on dollar deposits to combat dollar hoarding and even abolished some dollar lending. However, it recently resumed short-term loans in foreign currencies to support economic growth, thus leading to an increase in credit growth.

## 6. Concluding Remarks

The results show that except for the credit ceiling for each group based on their performance and soundness, the effectiveness of macroprudential policy in Vietnam is statistically significant at the 1% level through (i) the restrictions on institutional entities which could borrow foreign currency denominated loans from banks; and, (ii) applying higher risk to loans to housing and securities. Such findings confirm that lending standards are directly and integrally related to macroprudential instruments.

In the context of Vietnam, a macroprudential policy framework must be formulated to respond appropriately to the latest economic developments and changing financial environment. For the identification and control of systematic risks and effective macro surveillance; transparency, focus and unrestricted access to information are prerequisites. The financial monitoring system should be strengthened in terms of professionalism and independence, moving from compliance monitoring to effective risk monitoring. Along with this, it is imperative that the safety of the current Vietnam financial system be recognized and guaranteed. Although there is officially a set of macroprudential policies tools in place, such instruments are also used for monetary policies and banking and financial supervisory. Hence, there is a need for the authorities and related bodies to work closely together to measure and manage systemic risks as well as devise more effective macroprudential policies and relevant tools which are better suited to address systemic risks in interaction with monetary policies. In addition to known sources of systemic risks, macroprudential authorities must keep an eye on potential sources of risks—such as expected vulnerabilities associated with growing cross-border capital flows among emerging economies and from advanced markets. A more integrated world and growing Asian regionalism also demand more regional and international cooperation in the discipline of macroprudential policy experience.

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