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MACROPRUDENTIAL POLICIES IN SEACEN ECONOMIES

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Abstract

This study estimates the effect of macroprudential policy changes on bank credit growth. 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 the implementation of macroprudential policies, banks reduce loan growth following an increase in capital requirements. We find that changes in macroprudential policies affect lending with heterogeneous responses for select SEACEN economies.

Key Words: Macroprudential Policies, Loan Supply, Regulation and Supervision

JEL Classification: G10, G20, G21, G23

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Jugnu Ansari

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 favored practical considerations to define financial stability and have suggested the macroprudential approach to ensure financial stability.[1] 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)[2] 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?

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

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

[2] 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 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, this research study is undertaken 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 study provides an integrative view on the concept of macroprudential policies, its implementation and its impact across SEACEN economies. We also survey the related literature and address a few important policy challenges. 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.

The remainder of the paper is organized into 4 sections. Section 2 briefly reviews the related 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 summary descriptives and results from the estimated regression models as well as robustness tests. Finally, Section 4 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 require 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)[3]. 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 spill over 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.

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

[3] 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.

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 1):

(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 1: 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.
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.

Instruments	Conceptual Basis
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

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.

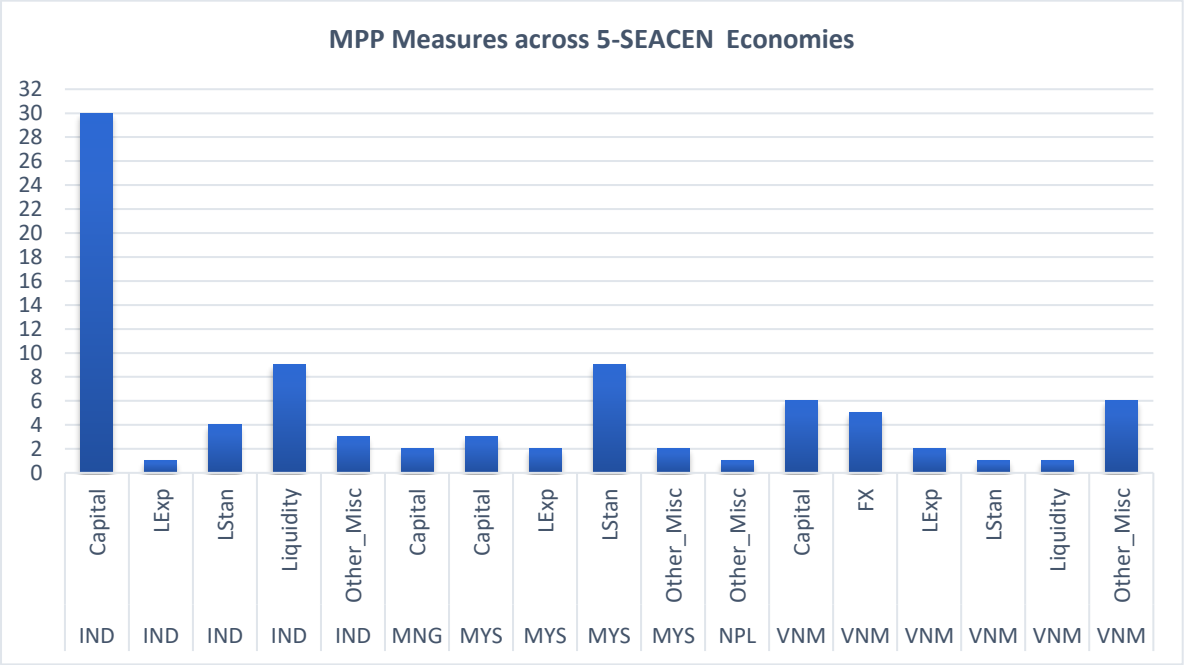
Table 2: Macroprudential Policy Tools Used Across SEACEN Economies

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.

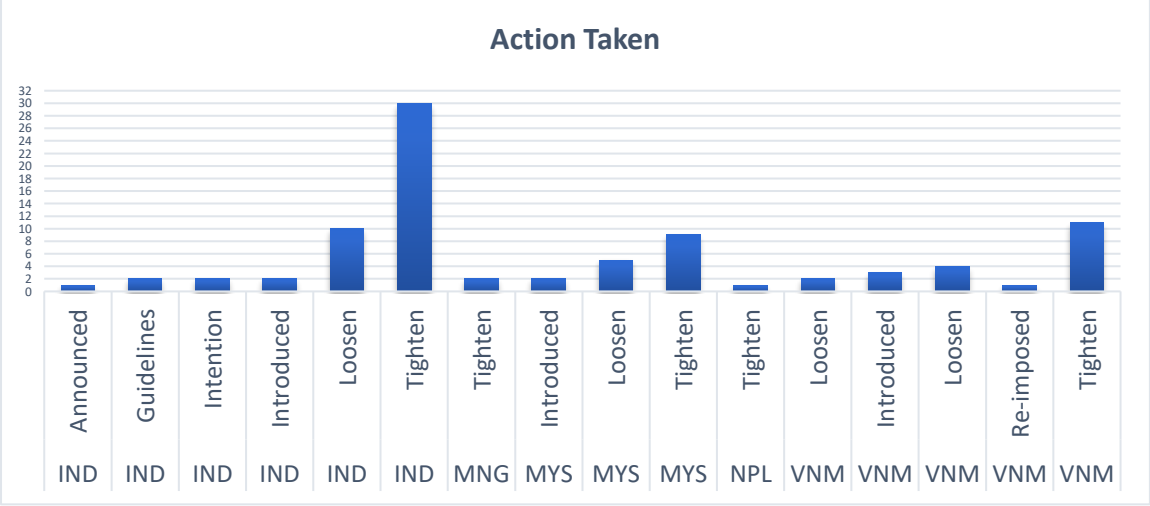
The descriptive analysis of the economy-specific (viz., Malaysia, Mongolia, Nepal and Vietnam) papers show that there has been significant variation in the use of macroprudential instruments in the SEACEN member economies. The use of different macroprudential instruments follows very different trends 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.

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 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 analyze the data on frequency distribution of capital to risk weighted asset ratio (CRAR) and profitability (net profits as percentage of total assets) (Table 3 and Table 4).

An analysis of distribution of CRAR shows that most of the banks had the CRAR of more 10% (Table 3). 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 3: 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 4: 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.

In Malaysia, initial signs of potential risks to financial stability emerged when the Malaysian House Price Index (MHPI) increased substantially since the fourth quarter of 2009 (Figure 3). The annual growth of the index 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 centres such as the Kuala Lumpur, Selangor and Johor (Table 5).

Figure 3: Malaysian House Price Index

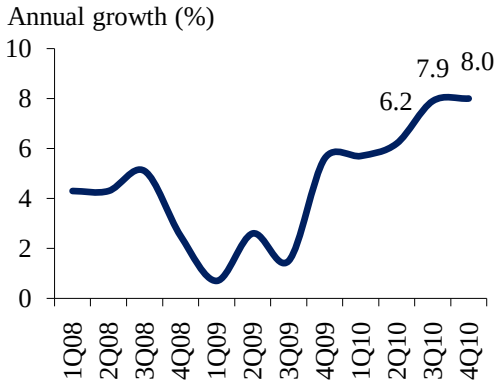


Table 5: MHPI by States

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)[4]

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

[4] The information is collated by Ashraf Rauf, Financial Surveillance Department, Central Bank of Malaysia, as part of the research study.

period of the sold property)[5]. These loans could have a loan-to-value (LTV) ratio of up to 100% and financing tenure of up to 45 years.

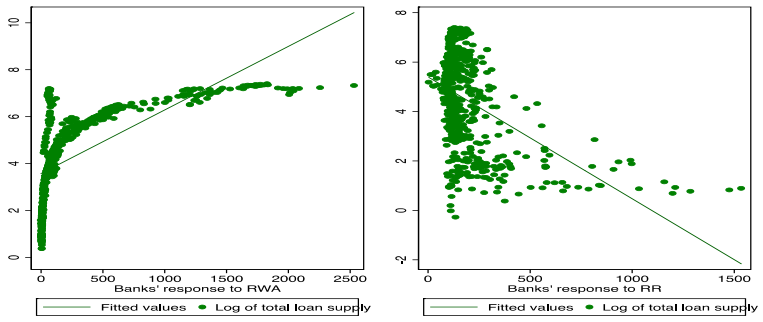
In Mongolia, the correlation matrix of bank's behavioral responses to risk-weighted assets (rwa), dynamic provisioning (prov) and reserve requirement (rr) as macroprudential policy tools, and macroeconomic variables, *viz.*, domestic credit growth, exchange rate depreciation, current account to GDP, capital openness, real GDP growth, and inflation are given below (Table 6).

Table 6: Correlation Matrix

	l_loan_tot	rwa	prov	rr1	l_fxrate_r	ca	open	g_rgdp	inf
l_loan_tot	1.000								
rwa	0.671	1.000							
prov	0.586	0.784	1.000						
rr1	-0.471	-0.192	-0.163	1.000					
l_fxrate_r	-0.196	-0.213	-0.079	-0.057	1.000				
ca	-0.127	-0.140	0.012	-0.026	0.833	1.000			
open	-0.026	-0.022	0.084	-0.000	0.418	0.515	1.000		
g_rgdp	-0.032	-0.044	-0.208	0.043	-0.475	-0.574	-0.397	1.000	
inf	-0.059	-0.087	-0.240	0.036	-0.275	-0.209	-0.251	0.383	1.000

Table 6 presents the correlations between each variable to simply analyze the data prior to any deeper empirical estimation. The correlation matrix shows that the variables of interest, risk-weighted assets and provisioning requirement have strong positive correlation with the log of total loan supply, whereas reserve requirement is negatively correlated with the dependent variables. For the country-level control variables, it is shown that they all negatively correlated with the log of total loan supply.

Figure 4: Banks Response with Respect to RWA and RR[6]



[5] 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.

[6] Prepared and illustrated by Tsenguunjav Byambasuren and Saruul Khasar, Bank of Mongolia.

In addition, the banks' responses to risk-weighted assets requirement and provisioning requirements are highly correlated with each other. The risk-weighted assets of fourteen banks in Mongolia affect their total loan supply positively, while banks' response to reserve requirement leads them to reduce their loan supply (Figure 4).

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:

$$Prob(MPP_{it}) = F\big(\beta_t\, Global_{i,t-1} + \gamma_{it} External_{i,t-1} + \delta_{it} Domestic_{i,t-1}\big) \qquad Equation(1)$$

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 7 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 7: Determinants of Macroprudential Policy Action (Logit Model)

Domestic Variables	Lending Standard	Capital	Large Exposure	Liquidity	Others
Domestic Credit Growth	0.2530 (1.40)***	0.5588 (1.72)***	0.5577 (1.71)***	0.5619 (1.73)***	0.5856 (1.81)***
Domestic GDP Growth	0.7277 (1.28)	1.1190 (3.55)*	1.1126 (3.55)*	1.1155 (3.56)*	1.1226 (3.59)*
Inflation	-0.0200 (-0.03)	-0.5179 (-1.47)	-0.5163 (-1.47)	-0.5129 (-1.46)	-0.5644 (-1.62)***
External Variables					
FX Depreciation	1.3146 (2.13)**	-0.9407 (-2.71)*	-0.8968 (-2.63)*	-0.8999 (-2.64)*	-0.8977 (-2.64)*
Current Account to GDP	1.8315 (2.28)**	-1.4184 (-3.47)*	-1.4079 (-3.46)*	-1.4042 (-3.45)*	-1.4363 (-3.55)*
Capital Account Openness	-.0134 (-1.74)***	-0.0104 (-2.42)*	-0.0104 (-2.42)*	-0.0104 (-2.44)*	-0.0107 (-2.52)*
Intercept	-2.3252 (-2.04)**	-0.9145 (-1.56)	-1.2362 (-2.73)*	-1.2301 (-2.73)*	-1.3647 (-3.16)*
Global Variables					
Global Volatility	-1.0294 (-1.36)	0.5959 (1.53)	0.5815 (1.50)	0.5756 (1.49)	0.5718 (1.49)
Global Growth	0.5231 (1.04)	0.2769 (0.99)	0.2944 (1.06)	0.2938 (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 8: 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[7] and data from participating SEACEN economies.

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

[7] 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.

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 5 depicts the constructed MPP Index.

Figure 5: Macroprudential Policy Index (MPP Index)

When plotting the same MPP index with credit-GDP growth (Figure 6), we find that after tightening of macroprudential, credit boom slowed down significantly.

Figure 6: MPP Index vs Credit-GDP Growth

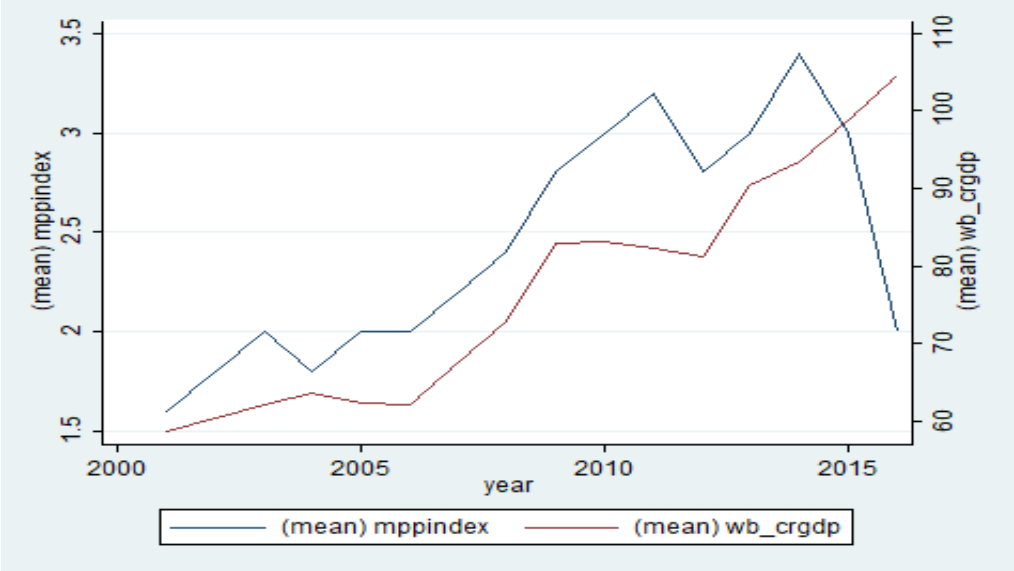


Table 9: Credit-GDP Ratio of the Sample SEACEN Economies

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 9 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 10 and Table 11 depict other risk build-up during the period mentioned therein.

Table 10: 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 11: 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:

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

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

μ_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 β is expected to be negative, the effect of country specific bank credit system depends on the sign of the coefficient δ. 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.

Table 12: Macroprudential Policies and Credit Growth

Variable: Real Credit Growth	(1) OLS	(2) margin	(3) OLS	(4) margin	(5) OLS	(6) 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.

3.3 Reverse Causality and Robustness

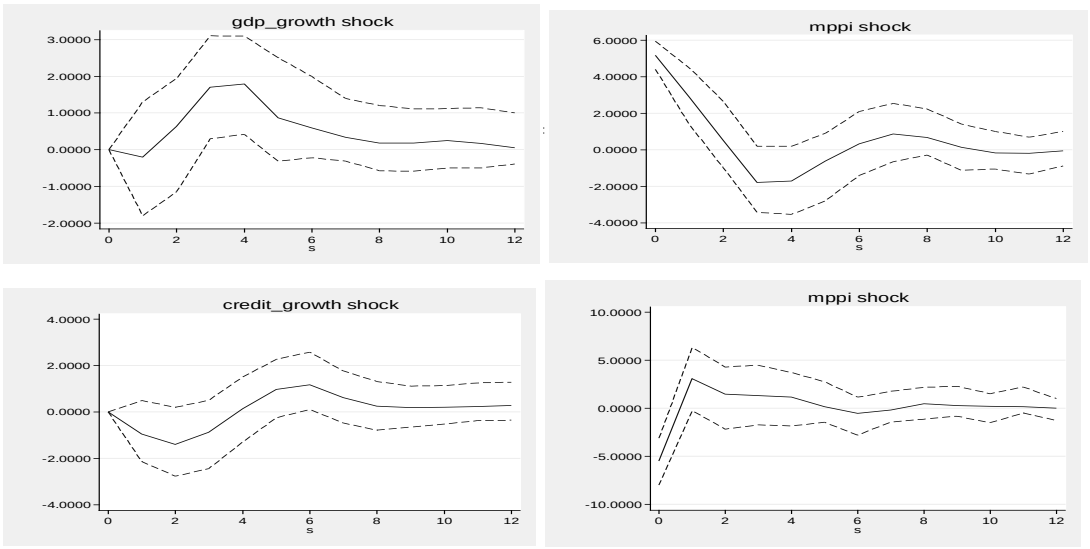
We estimate a panel VAR consisting of lending growth and the change in macroprudential policies to assess whether reverse-causality is likely to be a serious problem. To identify a change in MPP shocks, we assume that the change in MPPI reacts to real lending growth with a lag. This is a realistic assumption, 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:

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

where Z_{it} a vector of macroprudential and credit growth is, $\theta(L)$ is the lag operator and μ_i are the fixed effects. The panel VAR model is estimated using the Bayesian hierarchical approach to avoid dynamic heterogeneity bias. Figure 7 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 7: Impulse Response Function



4. 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.

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 credit growth to a change in capital and provisioning requirement.

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