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Assessing the Impact of Macroprudential Policies on Housing Credit Dynamics: Evidence from India

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Abstract

This paper evaluates the efficacy of macroprudential (MaP) policy in modulating bank credit to the housing sector and its impact on the asset quality of banks in the Indian context. The empirical analysis suggests that a tightening of MaP policy is effective in controlling bank credit to the housing sector. Tightening policies appear to have a greater impact on credit growth than easing policies. Furthermore, a tighter MaP policy complemented with a tighter monetary policy helps in reducing non-performing assets in the housing sector.

JEL Classification: C23, E58, G21, G28

Keywords*:* Macroprudential policies, housing credit, credit risk

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Introduction

The major objective of macroprudential (MaP) policies is to strengthen the banking and the financial system through pre-emptive regulatory measures (G30, 2009; IMF, 2009; Brunnermeier *et al.,* 2009; and TdLG, 2009). These policies aim at preventing or mitigating the consequences of busts in the credit cycles by utilising the buffers built during booms. Their countercyclical nature assists in dampening credit cycles – these can help to contain excessive credit growth during boom times and support credit growth during downswings in economic activity. Generally, they are intended to complement microprudential regulations as well as conventional macroeconomic management instruments, notably monetary and fiscal policies. According to Adrian and Shin (2010), the increasing interconnectedness of financial institutions and the excessive growth of assets held by them can also cause systemic risks. Therefore, effective MaP policies can contribute to the stability of the financial system.

Since the global financial crisis of 2008, the G20 has supported the use of MaP policies as part of its international regulatory reform agenda. The increasing use of the MaP policies, however, has given rise to a pertinent question about their efficacy. Recent studies on intermediate indicators of systemic risks have provided some evidence about their effectiveness with regard to credit growth and asset prices (Lim *et al.,* 2011; Cerutti *et al.,* 2015; Kuttner and Shim, 2016; Zhang and Zoli, 2014; Akinci and Olmstead-Rumsey, 2018). However, the evidence is still quite scattered for both advanced and emerging economies. Furthermore, a majority of the empirical evidence till now, particularly in the Asia-Pacific region, is from commercial databases or at the systemic level and not at the bank level.

India too has a long history of utilising MaP policies such as Loan-to-Value (LTV) ratios, risk weights, and sector-specific policies. There are studies assessing the efficacy of these policies at the aggregate bank credit (Verma, 2018) and sector-specific levels (Saraf and Chavan, 2023). However, the existing studies have not adequately captured the issue of whether and how far MaP policies have helped in controlling credit risk. In this paper, we evaluate the impact of MaP policies exclusively on the housing sector, which is one of the largest segments of retail credit in India and assess their impact on housing credit growth and non-performing assets (NPA) using bank-level data. Additionally, our paper explores how the stance of monetary policy, the economic cycle, and the financial cycle can affect the impact of MaP. The empirical strategy used in this paper is as proposed by Cantu *et al.* (2019).

The structure of the paper is as follows. Section II provides a review of MaP policies that have been used in the past by different countries and their effectiveness. Section III highlights the MaP policy instruments adopted in India over time. The data and methodologies employed are discussed in Section IV. Section V outlines the results and observations. Finally, we draw conclusions and provide implications for potential policies in Section VI.

II. Review of Macroprudential Policy Measures and Their Impact

A wide variety of MaP tools are included in the MaP policy toolkit. Both advanced economies (AEs) and emerging market economies (EMEs) utilise various mechanisms to mitigate the impact of systemic risk and minimise the negative effects of externalities on the financial sector. While there has been a greater receptivity to MaP policies in AEs, particularly after the global financial crisis (GFC), EMEs have had a longer experience with them given the greater vulnerability of the financial systems in these economies to adverse shocks. Even though a major part of Asia was not directly affected during the GFC, the Asian regulators gave a focused attention to MaP policies, particularly the LTV ratio. Also, the Asian financial crisis of 1997 provided an opportunity to these regulators to experiment with these instruments over a longer period.

The LTV policies have been shown to be effective in some Asian countries. Wong *et al.* (2011) examined the effects of LTV on mortgage delinquency ratios and other measures of market activity, such as housing prices and household debt. Mortgage delinquency ratios were significantly reduced after the introduction of LTVs. An analysis of a panel data set of 13 Asian economies (including India) and 33 other AEs and EMEs by Zhang and Zoli (2014) reveals that MaP tools contributed to reducing the procyclicality of credit in Asia - housing-related tools, including LTV ratios, debt-to-income ratios (DTI), risk weights, and loan loss provisions for mortgage loans, had a significant impact on bank credit, while changes in reserve requirements and capital regulations had a limited impact. The study by Kuttner and Shim (2012), which examined the effectiveness of housing-related MaP policies in 57 AEs and EMEs between 1980 and 2011, found that these measures were successful in restraining the expansion of housing credit and maintaining stability in housing prices. There was a noteworthy correlation between the prudential variables associated with housing sector credit and the LTV ratio. However, no significant correlations were observed between the LTV ratio and the exposure limits imposed on banks in relation to the housing and property sectors.

Claessens *et al.* (2014) utilised bank-level data from 48 AEs and EMEs for the period 2000-2010 and found that MaP instruments were more effective at maintaining

financial intermediation in upswings than during contractions. Similarly, Cerutti *et al.* (2015) examined 119 countries over the period 2000 to 2013, and upheld the efficacy of MaP policies. Tressel and Zhang (2016), focusing on the Euro area, examined the impact of instruments targeting the cost of bank capital on mortgage credit growth. They utilised the Euro-system Bank Lending Survey and found that these instruments had a significant effect in slowing down mortgage credit growth. Additionally, the study highlighted the effectiveness of LTV limits, particularly when monetary policy was eased. In Erdem *et al.* (2017), the data from 30 EMEs, including India, covering the period from 2000 to 2013, was analysed to judge the efficacy of MaP policies in regulating the growth of domestic credit. While underscoring the effectiveness of MaP policies, the study highlighted the challenges of preventing leakages and maintaining the effectiveness of MaP instruments during a global liquidity crisis.

Verma (2018) investigated the efficacy of MaP policy in India by utilising annual data from 1999-00 to 2016-17. Using a panel vector auto-regression (VAR) framework based on bank groups, the study found that a tightening of MaP measures had an adverse effect on credit growth with a one-year lag. The findings were similar for sectors such as housing, commercial real estate and consumer loan portfolios. However, their usefulness in promoting credit growth during periods of economic downturn proved to be limited. Sanjiv *et al.* (2022) investigated the efficacy of MaP policy on bank credit, housing credit, and housing prices in India using a structural vector autoregression (SVAR) on monthly data from 2004-2020. The study demonstrated that MaP policy successfully controlled bank credit, housing credit, and housing price inflation. Moreover, it showed evidence of the asymmetric effect of MaP policy, wherein tightening action had a considerable impact on bank credit and housing prices and easing action largely influenced housing credit. Saraf and Chavan (2023) analysed the efficiency of the MaP policy in managing systemic risk in India using bank-level supervisory data for five major sectors, including the housing sector. They found that the dynamic risk weights and provisioning as tools of MaP were not statistically significant for controlling loan growth in the retail housing sector while the LTV ratios were found to be effective.

Many of these studies have either used aggregated or annual data in their analysis. Aggregation not only leads to a loss of information but also limits inferences about the behaviour of individual financial institutions. Further, distinguishing between long-term and short-term effects of the policies may become difficult with annual data. To address these difficulties, we employ bank-level quarterly data in this paper. Also, the existing studies have not assessed the effect of the MaP policy on credit quality, as has been attempted by us.

III. MaP Regulations in India

India has a strong track record in implementing countercyclical MaP policies, with a sector-specific focus. Key sectors targeted under this approach include capital market exposure, commercial real estate, residential housing, other retail sectors, and non-bank financial companies. An early recourse to the MaP policy was intended to counter the impact of interest rate fluctuations on marked-to-market profits of banks in the early-2000s. During this period, banks' profits were boosted from a fall in interest rates. To safeguard their balance sheets and prepare for the monetary cycle reversal and higher interest rates, the Reserve Bank of India (RBI) directed banks to establish an investment fluctuation reserve (IFR). The IFR required banks to transfer a portion of their investment gains over a five-year period, aiming to reach at least 5 per cent of their investment portfolio.

In 2004, during an expansionary phase of the economy, the MaP measures included pre-emptive countercyclical provisioning and the application of differentiated risk weights for the sectors more sensitive to the economic fluctuations. The goal was to prevent excessive lending and risk-taking during economic booms, which could create vulnerabilities and potentially lead to financial crises. To address inter-connectedness in the financial system, the RBI introduced a framework in 2004 for enhanced monitoring and supervision of large and systemically important financial institutions or groups, commonly known as financial conglomerates. This framework aimed to identify and mitigate risks arising from the interconnections between these institutions, ensuring that their failure did not pose a significant risk to financial stability.

Furthermore, the RBI implemented a capital conservation buffer under the Basel III framework in a phased manner with the last tranche of 0.625 per cent active from October 1, 2021. The framework on Countercyclical Capital Buffer (CCyB) was also put in place by RBI in February 2015 to be activated when the circumstances warranted. The CCyB requires banks to maintain additional capital during periods of excessive credit growth, creating a buffer to absorb potential losses. The RBI introduced additional capital requirements for domestic systemically important banks (D-SIBs). D-SIBs are considered to be of systemic importance due to their size, interconnectedness, complexity, and overall significance. The additional capital requirements for D-SIBs aim to enhance their resilience and reduce the likelihood of their failure and its potential impact on the financial system.

III.1. Housing Credit Measures for Banks

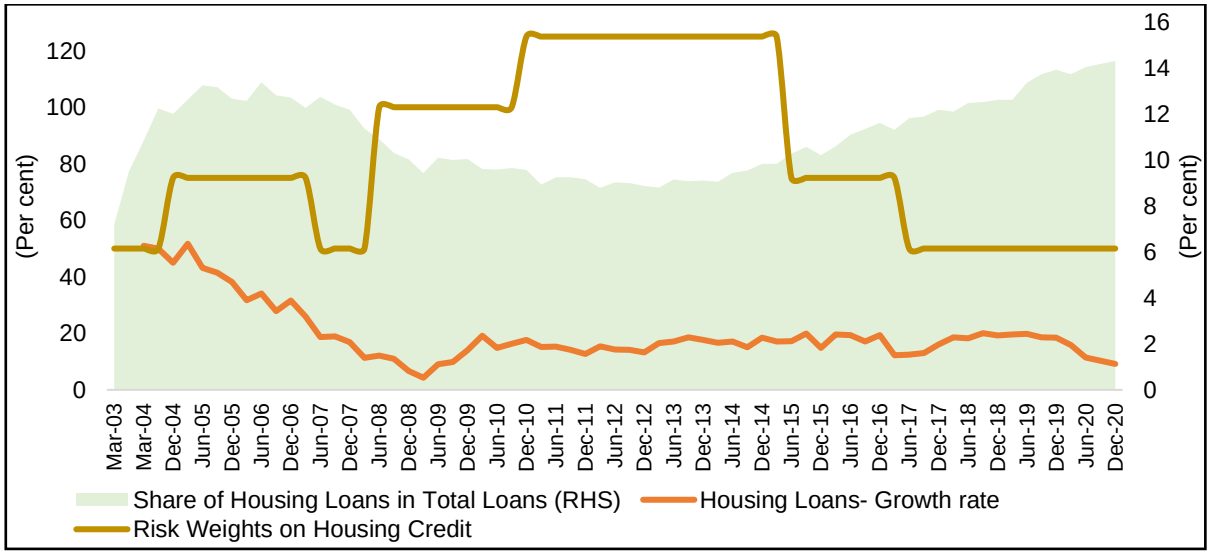
The RBI has deployed a variety of MaP measures for the housing sector, based on the evolving economic and financial cycles, and monetary policy settings. These include LTV ratios according to the size of the loan and category of loan (priority sector

loan or non-priority sector loan), risk weights and standard provisioning. Changes in risk weights affect the capital ratio of the banks, while provisioning affects their profits.

III.2. Time-Varying Risk Weights and Provisioning Norms

India witnessed a disproportionately higher growth in housing credit during the period of high growth and robust capital inflows from 2004 to 2008 (Chart 1). This trend was observed alongside increasing real estate prices. To address the potential risks associated with this credit expansion, the risk weight on retail housing credit was raised from 50 per cent to 75 per cent in December 2004. Furthermore, the RBI made changes to the risk weights on housing credit based on loan size and LTV ratio. The risk weight on smaller-sized housing loans, considered as priority sector loans, was reduced from 75 per cent to 50 per cent while for larger loans and those with an LTV[2] ratio exceeding 75 per cent, the risk weight was increased to 100 per cent.

Chart 1: MaP Instrument - Risk Weights

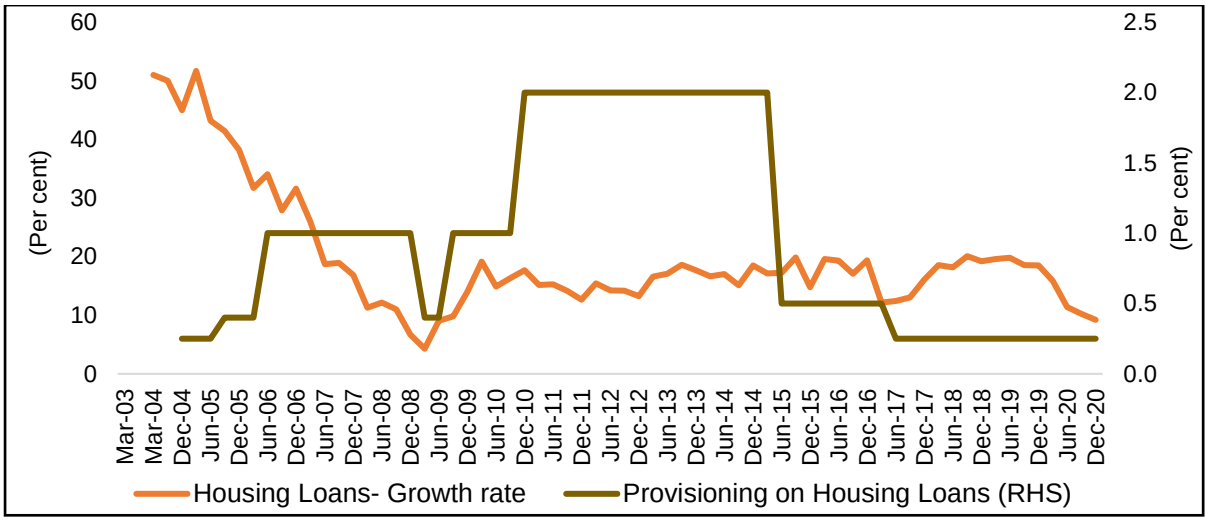


Source: Reserve Bank of India.

In 2010, the RBI increased the standard asset provisioning on outstanding housing credit from 0.40 per cent to 2.00 per cent which was subsequently reduced starting from 2013 onwards (Chart 2). The RBI also implemented changes in LTV policy in November 2015 and October 2016 (Annex: Table A1).

[2] The RBI introduced the LTV cap as a function of loan size for the first time in India on May 14, 2008.

Chart 2: MaP Instrument – Provisioning on Housing Loan



Source: Reserve Bank of India.

In sum, as highlighted by the Financial Sector Assessment Programme (FSAP-2012) of the IMF, India has had a long history of using MaP instruments to counter credit cycles and strengthen the banking system. The LTV policy of RBI has enhanced system resilience (Lu, 2019); this makes the Indian MaP policy relating to the housing sector an important case for study, as attempted in this paper.

IV. Data and the Econometric Model

The paper uses bank-level quarterly data of 51 major banks[3], covering the period from Q1:2002 to Q3:2020. This paper examines the impact of MaP policy on housing credit growth and its NPAs, controlling for individual bank characteristics, such as asset size, liquidity situation, capital ratio, and funding ratio. Furthermore, we consider the impact of these policy actions across the different periods of the business and financial cycles, and the monetary policy cycle. The housing credit growth and NPA ratio are used as response variables. The four bank-specific control variables as described in the cross-country analysis framework of Cantu *et al.* (2019) are used: size (log of total assets), capital ratio (ratio of Tier-1 capital to total assets), funding ratio (deposits share in total liabilities), and liquidity ratio (liquid assets in relation to total assets). These controls are chosen to account for factors at the bank level that can influence strategic lending decisions. The macroeconomic controls are nominal GDP, repo rate, and other relevant variables[4]. To assess the stage of the financial

[3] The dataset utilised is an unbalanced panel encompassing all public sector banks, major private sector banks, and foreign banks operating in India. These banks collectively hold a market share of over 95 per cent in terms of housing credit.

[4] The growth of housing price index (HPI), being an important determinant for housing credit growth, could have been taken into account. However, as the data on HPI are available only from 2010, this variable has not been factored into the model.

cycle, credit-to-GDP gap was used. A full list of variables is provided in Annex Table A2.

We also include dummies which represent the intent of MaP policy changes and the adjustments related to these changes, and baseline capital requirements. First, we examine the overall impact of MaP tools on housing credit growth and bank risk. To do so, we have used a dummy, which takes a value of +1 when the RBI signals a tightening of the policy, *i.e.,* increase in LTV ratio or risk weight or provisioning in the quarter. It takes the value of 0 when there are no such policy adjustments, and -1 when the policy is eased or indicated to ease. As a second step, we introduce two separate dummies, one for tightening policy actions and the other for easing policy actions, to evaluate the differentiated effects of tightening and easing policy actions.

We employ an indicator variable approach because of the difficulty of measuring the intensity of instruments. Furthermore, LTV was fixed according to loan size and amount, thus, constructing a cumulative index is difficult. Consequently, we utilise separate dummies to split MaP policy changes into easing and tightening cases to assess the asymmetric effects of each MaP tool. To address the merger/ consolidation of banks, we adjust our dependent variable after the merger. For other bank controls, no such adjustment was necessary, as no outliers were detected.

The problem of endogeneity is one of the challenges that the literature speaks about when discussing the effects of MaP policy instruments. For the purpose of overcoming endogeneity, the system generalised method of moments (GMM) estimator, pioneered by Arellano and Bond (1991) is preferred due to its superior consistency and efficiency. It incorporates both the level equation and the difference equation, allowing for a more robust estimation of the model. The lag variables (up to lag 4) have been used as instruments.

IV.1. Impact of MaP Policy on Housing Credit Growth

To begin, the panel methodology is used to assess the impact of changes in MaP policy instruments on credit growth. The baseline regression model is defined as follows:

$$\Delta \log Y_{b,t} = \alpha_b + \sum_{j=1}^{k} \Delta \log Y_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \gamma X_{b,(t-j)} + \theta macrovars_{b,t} + \epsilon_{b,t} \quad \text{-----(1)}$$

where, $Y_{b,t}$ is the housing credit outstanding for bank b over quarter t. $\gamma X_{b,t-j}$ are bank-specific characteristics, and $\theta macrovars_{b,t}$ are macroeconomic controls. In our baseline model[5], the main variable of interest is ΔMaP_{t-j}, an indicator dummy, which

[5] ANCOVA models are regression models that incorporate both qualitative and quantitative variables. They offer a means to statistically control the influence of quantitative regressors that encompass both quantitative and qualitative (dummy) variables. These models are extension of ANOVA models which allow a comprehensive analysis of the relationship between variables while accounting for the effects of covariates.

takes value of +1 for tightening MaP policy action in a given quarter and –1 when it is eased and the value of zero when no change happens during that quarter. Four lags of various variables are included to capture the transmission lags and the impact at various horizons.

IV.2. Impact of MaP Policy on Different Types of Banks

According to the literature on the bank lending channel, which discriminates between the supply of loan and the demand for loan movements based on cross-sectional differences between banks, different banks are able to buffer the impact of the policy on their loan portfolios differently. Small banks, which may encounter significant informational friction in financial markets, may have to pay higher interest rates to attract non-secured deposits if rules are tightened. Relatively illiquid banks could also be more affected by a tightening of policy if they face difficulties in reducing their holdings of securities. Thus, we propose the following amendments to our baseline specification:

$$\Delta \log Y_{b,t} = \alpha_b + \sum_{j=1}^{k} \Delta \log Y_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \sum_{j=0}^{k} \delta_j \left(\Delta MaP_{t-j} * X_{b,(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{---------- (2)}$$

The interaction term $\sum_{j=0}^{k} \delta_j \left(\Delta MaP_{t-j} * X_{b,(t-j)}\right)$ has been added to see the differential policy responses according to bank characteristics. The test examines the overall significance of $\sum_{j=0}^{k} \delta_j$. Additionally, we determine the impact of tightening and easing policies separately by differentiating across instruments. For this, we consider two separate dummies: one for tightening and one for easing. Thus, we estimate the following regression:

$$\Delta \log Y_{b,t} = \alpha_b + \sum_{j=1}^{k} \Delta \log Y_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \sum_{j=0}^{k} \delta_j \left(\Delta Dummy\ Ease * X_{b(t-j)}\right) + \sum_{j=0}^{k} \phi_j \left(\Delta Dummy\ Tight * X_{b(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{------(3)}$$

IV.3. Response of MaP Policy over Different Monetary Policy Conditions

The favourable conditions for financing could have a positive impact on the demand for housing credit. Conversely, a more restrictive monetary policy could result in a decline in housing credit growth due to increased costs of funding for banks. In order to examine the effectiveness of MaP policy instruments under different monetary policy settings, the following equation is estimated (Bruno *et al.,* 2017):

$$\Delta \log Y_{b,t} = \alpha_b + \sum_{j=1}^{k} \Delta \log Y_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \sum_{j=0}^{k} \phi_j \Delta Repo_{t-j} + \sum_{j=0}^{k} \sigma_j \left(\Delta MaP_{t-j} * Repo_{b,(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{------(4)}$$

The interaction term $\Delta MaP_{t-j} * Repo_{b,(t-j)}$ is the main coefficient of interest. The test examines the overall significance of $\sum_{j=0}^{k} \sigma_j$.

IV.4. Response of MaP Policy over the Business or Financial Cycle

The paper also examines the differential effects of various phases of the business cycle and the financial cycle on MaP policy. The aim is to investigate as to whether the impact of MaP policy is amplified during periods of high GDP growth or conversely affected during periods of low growth. As a baseline specification for the business cycles, we estimate following equation:

$$\Delta \log Y_{b,t} = \alpha_b + \sum_{j=1}^{k} \Delta \log Y_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \sum_{j=0}^{k} \rho_j \left(\Delta MaP_{t-j} * \Delta \log GDP_{b,(t-j)b,(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{----------(5)}$$

We use credit-to-GDP gap (the difference between the credit-to-GDP ratio and its trend) as a measure of the financial cycle to analyse the effects of policy on the financial cycle. We do this by interacting with the policy dummy and adding the new term $\Delta \log CTG_{b,(t-j)}$, which denotes credit-to-GDP gap.

$$\Delta \log Y_{b,t} = \alpha_b + \sum_{j=1}^{k} \Delta \log Y_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \phi_j \sum_{j=0}^{k} \Delta \log CTG_{b,(t-j)} + \sum_{j=0}^{k} \rho_j \left(\Delta MaP_{t-j} * CTG_{b,(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{---------- (6)}$$

The test examines the overall significance of $\sum_{j=0}^{k} \rho_j$. If coefficients are statistically significant, that means the MaP policies are more successful when the financial cycle is more pronounced.

IV.5. Impact of MaP Policy on Non-Performing Assets

To investigate the impact of MaP policy on banks' NPAs, our baseline specification is as follows:

$$\log NPA_{b,t} = \alpha_b + \sum_{j=1}^{k} \log NPA_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \sum_{j=0}^{k} \sigma_j \left(\Delta MaP_{t-j} * Repo_{b,(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{---------- (7)}$$

Here, the NPA is a ratio of gross non-performing housing credit to total housing credit. Since NPAs persist over time, lagged values of the NPA have been included as an explanatory variable. To determine whether there are any interactions between MaP policy and monetary policy, interaction terms have been included. Asset quality can also be impacted by variations in MaP policy, and therefore, it would be interesting to know the policy impact of easing and tightening instruments individually. To capture the separate effects of each instrument, our specification is as follows:

$$\log NPA_{b,t} = \alpha_b + \sum_{j=1}^{k} \log NPA_{b,(t-j)} + \sum_{j=0}^{k} \beta_j \Delta MaP_{t-j} + \sum_{j=0}^{k} \sigma_j \left(\Delta Dummy\ Ease * Repo_{b,(t-j)}\right) + \sum_{j=0}^{k} \phi_j \left(\Delta Dummy\ tight * Repo_{b,(t-j)}\right) + \gamma X_{b,(t-j)} + \theta \mathit{macrovars}_{b,t} + \epsilon_{b,t} \quad \text{--(8)}$$

In the above equation, we also include the interaction for tightening and easing policy changes.

V. Results and Discussion

The regression estimates for the models are reported in Tables 1-7. The tables are to be read as follows: in our baseline specification (no interaction term), the overall significance of the policy impact has been presented along with controls while the second column (with interaction term) presents the interaction effect. The policy impact is presented with one quarter lag for the short-term policy impact, while the sum of contemporaneous and four lags is presented separately for the overall size of the policy effect.

V.1. Impact of MaP Policy on Housing Credit Growth

The results of our baseline model show that the MaP policy can restrain the housing credit growth on an average, and the effect is statistically significant for two quarters (Table 1). The impact of bank controls interacted with MaP policy variable was not statistically significant except for the liquidity ratio and deposit ratio. The results also indicated that higher capital ratios boost housing credit growth, while the liquid assets ratio[6] had a negative relationship with the housing credit growth.

V.2. Impact of MaP Tightening and Easing Policy on Housing Credit Growth

We employed two dummy variables to assess the impact of tightening and easing policies on housing credit growth independently. The dummy associated with tightening policies is negative and statistically significant for up to two quarters. When bank-specific interaction variables were included, the effect was lower. For easing MaP policy, the coefficient was negative and statistically significant, implying an increase in credit growth. However, tightening had a stronger impact than easing (Table 2).

Table 1: Impact of MaP Policy on Housing Credit Growth

Variables	No interaction term	With interaction terms
D.Log Housing credit (Sum of four Lags)	-0.553**	-0.577***
L1.D.Log Housing credit	-0.245***	-0.223***
L2.D.Log Housing credit	-0.154**	-0.158**
L3.D.Log Housing credit	-0.134**	-0.156**
L4.D.Log Housing credit	-0.019	-0.040
MaP Dummy, -1,0,1 (Sum of contemporaneous and four Lags)	-0.053*	-0.063*
L1.MaP Dummy, -1,0,1	-0.017*	-0.030*
L2.MaP Dummy, -1,0,1	-0.040*	-0.045*
L3.MaP Dummy, -1,0,1	-0.008	-0.078
L4.MaP Dummy, -1,0,1	0.011	-0.029
MaP Dummy x Asset size (Sum of contemporaneous and four Lags)		-0.002
L1.MaP Dummy x Asset size		0.061
L2.MaP Dummy x Asset size		-0.035
L3.MaP Dummy x Asset size		-0.024

[6] Liquid assets include cash fund, due from banks and FIs and SLR approved securities.

L4.MaP Dummy x Asset size		-0.004
MaP Dummy x Capital ratio (Sum of contemporaneous and four Lags)		-0.010
L1.MaP Dummy x Capital ratio		0.050
L2.MaP Dummy x Capital ratio		0.022
L3.MaP Dummy x Capital ratio		-0.031
L4.MaP Dummy x Capital ratio		-0.006
MaP Dummy x Liquidity ratio (Sum of contemporaneous and four Lags)		-0.026*
L1.MaP Dummy x Liquidity ratio		-0.007*
L2.MaP Dummy x Liquidity ratio		-0.001*
L3.MaP Dummy x Liquidity ratio		-0.019
L4.MaP Dummy x Liquidity ratio		0.002
MaP Dummy x Deposit ratio (Sum of contemporaneous and four Lags)		0.260*
L1.MaP Dummy x Deposit ratio		0.011
L2.MaP Dummy x Deposit ratio		0.092*
L3.MaP Dummy x Deposit ratio		0.263
L4.MaP Dummy x Deposit ratio		0.271
Log Asset size (Sum of contemporaneous and four Lags)	0.009**	0.004*
L1.Log Asset size	-0.405	-0.494*
L2.Log Asset size	-0.094	-0.018
L3.Log Asset size	0.084	0.151
L4.Log Asset size	0.188	0.267
Liquidity ratio (Sum of contemporaneous and four Lags)	-0.012*	-0.001*
L1.Liquidity ratio	0.001*	0.013
L2.Liquidity ratio	-0.002	-0.001
L3.Liquidity ratio	-0.001	-0.005
L4.Liquidity ratio	-0.003	-0.005
Capital ratio (Sum of contemporaneous and four Lags)	0.005*	0.004
L1.Capital ratio	0.006	0.010
L2.Capital ratio	0.022*	0.004
L3.Capital ratio	0.011	0.010
L4.Capital ratio	0.002	0.004
Deposit ratio (Sum of contemporaneous and four Lags)	0.260*	0.147**
L1.Deposit ratio	0.245	0.426
L2.Deposit ratio	0.110	0.048*
L3.Deposit ratio	0.011	0.035
L4.Deposit ratio	0.119	0.139
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.021*	-0.031*
L1.D.Repo Rate	-0.017**	-0.004
L2.D.Repo Rate	-0.015	-0.009*
L3.D.Repo Rate	-0.013	-0.007
L4.D.Repo Rate	-0.012	-0.019
D.Log GDP (Sum of contemporaneous and four Lags)	0.764**	0.296**
D.L1.Log GDP	0.072*	0.060*
D.L2.Log GDP	0.263*	0.026
D.L3.Log GDP	0.250	0.218
D.L4.Log GDP	0.212	0.125
D.REER (Sum of contemporaneous and four Lags)	-0.002	-0.004
D.L1.REER	0.002	0.002
D.L2.REER	0.005	0.021
D.L3.REER	-0.003	-0.002
D.L4.REER	-0.023	-0.003
Constant	-0.361*	-0.166
Observations	2,364	2,364
Number of Banks	51	51

Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-3.91 (0.000)	-3.03 (0.002)
Arellano-Bond test for AR(2): Z-stats	-0.92 (0.356)	0.82 (0.414)
Hansen test of overid. restrictions: chi2	9.57 (0.998)	2.22 (0.978)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

Table 2: Impact of MaP Tightening and Easing Policy on Housing Credit Growth

Variables	**No interaction term**	**With interaction terms**
D.Log Housing credit (Sum of four Lags)	-0.553**	-0.581***
L1.D.Log Housing credit	-0.244***	-0.216***
L2.D.Log Housing credit	-0.154**	-0.165**
L3.D.Log Housing credit	-0.135**	-0.159**
L4.D.Log Housing credit	-0.021	-0.041
Dummy ease, -1,0 (Sum of contemporaneous and four Lags)	-0.061	-0.095
L1.Dummy Ease, -1,0	-0.037*	-0.196
L2.Dummy Ease, -1,0	-0.016	0.164
L3.Dummy Ease,-1,0	0.005	0.088
L4.Dummy Ease,-1,0	0.017	-0.130
Dummy Tight, 1,0 (Sum of contemporaneous and four Lags)	-0.076*	-0.062*
L1.Dummy Tight, 1,0	-0.049**	0.125*
L2.Dummy Tight, 1,0	-0.024*	-0.145*
L3.Dummy Tight, 1,0	-0.003	-0.087
L4.Dummy Tight, 1,0	0.009	-0.207
Dummy Ease x Log Asset size (Sum of contemporaneous and four Lags)		-0.264
L1.Dummy Ease x Log Asset size		0.170
L2.Dummy Ease x Log Asset size		-0.219
L3.Dummy Ease x Log Asset size		-0.058
L4.Dummy Ease x Log Asset size		-0.098
Dummy Ease x capital ratio (Sum of contemporaneous and four Lags)		0.044
L1.Dummy Ease x Capital ratio		0.058
L2.Dummy Ease x Capital ratio		-0.033
L3.Dummy Ease x Capital ratio		-0.107
L4.Dummy Ease x Capital ratio		-0.243
Dummy Ease x Liquidity ratio (Sum of contemporaneous and four Lags)		-0.026
L1. Dummy Ease x Liquidity ratio		-0.017
L2. Dummy Ease x Liquidity ratio		-0.013*
L3. Dummy Ease x Liquidity ratio		-0.029
L4. Dummy Ease x Liquidity ratio		0.003
Dummy Ease x Deposit ratio (Sum of contemporaneous and four Lags)		0.250
L1.Dummy Ease x Deposit ratio		0.358
L2.Dummy Ease x Deposit ratio		0.453
L3.Dummy Ease x Deposit ratio		0.381
L4.Dummy Ease x Deposit ratio		0.876
Dummy Tight x Log Asset size (Sum of contemporaneous and four Lags)		-0.023
L1.Dummy Tight x Log Asset size		-0.007
L2.Dummy Tight x Log Asset size		-0.144
L3.Dummy Tight x Log Asset size		0.164

L4.Dummy Tight x Log Asset size		0.068
Dummy Tight x Deposit ratio (Sum of contemporaneous and four Lags)		-0.226*
L1.Dummy Tight x Deposit ratio		0.127
L2.Dummy Tight x Deposit ratio		-0.148
L3.Dummy Tight x Deposit ratio		-0.140
L4.Dummy Tight x Deposit ratio		0.370
Dummy Tight x Capital ratio (Sum of contemporaneous and four Lags)		-0.059
L1.Dummy Tight x Capital ratio		0.022
L2.Dummy Tight x Capital ratio		-0.042
L3.Dummy Tight x Capital ratio		0.087
L4.Dummy Tight x Capital ratio		0.006
Dummy Tight x Liquidity ratio (Sum of contemporaneous and four Lags)		-0.016
L1.Dummy Tight x Liquidity ratio		-0.017
L2.Dummy Tight x Liquidity ratio		-0.065**
L3.Dummy Tight x Liquidity ratio		-0.027
L4.Dummy Tight x Liquidity ratio		0.009*
Log Asset size (Sum of contemporaneous and four Lags)	0.011**	-0.003
L1.Log Asset size	-0.050**	-0.064***
L2.Log Asset size	-0.101	0.150
L3.Log Asset size	0.151	0.090
L4.Log Asset size	0.219	-0.329
Liquidity ratio (Sum of contemporaneous and four Lags)	-0.002	-0.002
L1.Liquidity ratio	0.004	0.003
L2.Liquidity ratio	0.001	-0.003
L3.Liquidity ratio	-0.002	-0.007
L4.Liquidity ratio	0.003	0.006
Capital ratio (Sum of contemporaneous and four Lags)	0.006	0.014
L1.Capital ratio	-0.011	-0.009
L2.Capital ratio	-0.017	0.008
L3.Capital ratio	0.013	0.002
L4.Capital ratio	0.001	-0.004
Deposit ratio (Sum of contemporaneous and four Lags)	0.304*	0.346**
L1.Deposit ratio	-0.729	-0.264
L2.Deposit ratio	-0.505	-0.477
L3.Deposit ratio	0.675	1.060
L4.Deposit ratio	0.360	-0.345
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.028	-0.040
L1.D.Repo Rate	0.011	0.008
L2.D.Repo Rate	-0.019	-0.021
L3.D.Repo Rate	-0.012	-0.006
L4.D.Repo Rate	-0.015	-0.030**
D.Log GDP (Sum of contemporaneous and four Lags)	0.988	0.500
D.L1.Log GDP	0.144	0.038
D.L2.Log GDP	0.286	0.161
D.L3.Log GDP	0.328	0.231
D.L4.Log GDP	0.231	0.240
D.REER (Sum of contemporaneous and four Lags)	0.003	0.015
D.L1.REER	0.003*	0.002
D.L2.REER	-0.002	-0.003
D.L3.REER	0.001	0.004
D.L4.REER	-0.053	-0.081
Constant	-0.127	-0.172
Observations	2,364	2,364
Number of Banks	51	51

Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-3.90 (0.000)	-2.81 (0.005)
Arellano-Bond test for AR(2): Z-stats	-0.89 (0.371)	-0.27 (0.789)
Hansen test of overid. restrictions: chi2	0.15 (0.978)	0.85 (0.988)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

V.3. Response of MaP Policy over Different Monetary Policy Conditions

The repo rate and the growth of housing credit were negatively correlated and statistically significant as shown in Table 3. The coefficient of the interaction term of MaP policy with repo rate was positive and statistically significant, indicating that when both MaP and monetary policies moved in the same direction, they had a stronger impact on housing credit growth.

V.4. Response of MaP policy over Business Cycle and Financial Cycle

The MaP measures were found to be more effective during high growth phase, as indicated by the interaction term (Table 4). The impact of MaP policy on housing credit growth during various phases of the financial cycle did not vary significantly (Table 5).

Table 3: Impact of MaP and Monetary Policy on Housing Credit Growth

Variables	**No interaction term**	**With interaction terms**
D.Log Housing credit (Sum of four Lags)	-0.553**	-0.555**
L1.D.Log Housing credit	-0.245***	-0.242***
L2.D.Log Housing credit	-0.154**	-0.154**
L3.D.Log Housing credit	-0.134**	-0.138**
L4.D.Log Housing credit	-0.019	-0.021
MaP Dummy, -1,0,1 (Sum of contemporaneous and four Lags)	-0.053*	-0.038
L1.MaP Dummy, -1,0,1	-0.017*	0.021
L2.MaP Dummy, -1,0,1	-0.040*	-0.064**
L3.MaP Dummy, -1,0,1	-0.008	-0.017
L4.MaP Dummy, -1,0,1	0.011	0.023
Dummy x Repo (Sum of contemporaneous and four Lags)		0.179*
L1.Map Dummy x Repo		0.272
L2.Map Dummy x Repo		0.178*
L3.Map Dummy x Repo		0.032
L4.Map Dummy x Repo		-0.117
Log Asset size (Sum of contemporaneous and four Lags)	0.009**	0.009*
L1.Log Asset size	-0.405	-0.444**
L2.Log Asset size	-0.094	-0.087
L3.Log Asset size	0.084	0.125
L4.Log Asset size	0.188	-0.224
Liquidity ratio (Sum of contemporaneous and four Lags)	-0.012*	-0.012
L1.Liquidity ratio	0.001*	0.003
L2.Liquidity ratio	-0.002	0.002

L3.Liquidity ratio	-0.001	-0.003
L4.Liquidity ratio	-0.003	0.003
Capital ratio (Sum of contemporaneous and four Lags)	0.005*	0.005
L1.Capital ratio	0.006	-0.013
L2.Capital ratio	0.022*	-0.011
L3.Capital ratio	0.011	0.004
L4.Capital ratio	0.002	0.003
Deposit ratio (Sum of contemporaneous and four Lags)	0.260*	0.238
L1.Deposit ratio	0.245	-0.496
L2.Deposit ratio	0.110	-0.636
L3.Deposit ratio	0.011	0.667
L4.Deposit ratio	0.119	0.282
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.021*	-0.020
L1.D.Repo Rate	-0.017**	0.010
L2.D.Repo Rate	-0.015	-0.015
L3.D.Repo Rate	-0.013	-0.008
L4.D.Repo Rate	-0.012	-0.015*
D.Log GDP (Sum of contemporaneous and four Lags)	0.764**	0.728
D.L1.Log GDP	0.072*	0.123
D.L2.Log GDP	0.263*	0.213
D.L3.Log GDP	0.250	0.254
D.L4.Log GDP	0.212	0.250*
D.REER (Sum of contemporaneous and four Lags)	-0.002	0.003
D.L1.REER	0.002	0.003
D.L2.REER	0.005	0.002
D.L3.REER	-0.003	-0.003
D.L4.REER	-0.023	0.001
Constant	-0.361*	-0.334
Observations	2,364	2,364
Number of Banks	51	51
Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-3.91 (0.000)	-3.89 (0.000)
Arellano-Bond test for AR(2): Z-stats	-0.92 (0.356)	-0.77 (0.439)
Hansen test of overid. restrictions: chi2	9.57 (0.998)	6.71 (0.978)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

Table 4: Impact of MaP Policy on Housing Credit Growth over Business Cycle

Variables	**No interaction term**	**With interaction terms**
D.Log Housing credit (Sum of four Lags)	-0.553**	-0.558**
L1.D.Log Housing credit	-0.245***	-0.158**
L2.D.Log Housing credit	-0.154**	-0.138**
L3.D.Log Housing credit	-0.134**	-0.019
L4.D.Log Housing credit	-0.019	-0.010
MaP Dummy, -1,0,1 (Sum of contemporaneous and four Lags)	-0.053*	-0.127**
L1.MaP Dummy, -1,0,1	-0.017*	0.002
L2.MaP Dummy, -1,0,1	-0.040*	-0.097***
L3.MaP Dummy, -1,0,1	-0.008	-0.038
L4.MaP Dummy, -1,0,1	0.011	0.007
Map Dummy x GDP (Sum of contemporaneous and four Lags)		1.121*

L1.Map Dummy x GDP		-0.237
L2.Map Dummy x GDP		0.625***
L3.Map Dummy x GDP		0.169
L4.Map Dummy x GDP		0.064
Log Asset size (Sum of contemporaneous and four Lags)	0.009**	0.008*
L1.Log Asset size	-0.405	-0.453**
L2.Log Asset size	-0.094	-0.020
L3.Log Asset size	0.084	0.114
L4.Log Asset size	0.188	-0.267
Liquidity ratio (Sum of contemporaneous and four Lags)	-0.012*	0.004
L1.Liquidity ratio	0.001*	0.003
L2.Liquidity ratio	-0.002	0.001
L3.Liquidity ratio	-0.001	-0.003
L4.Liquidity ratio	-0.003	0.004
Capital ratio (Sum of contemporaneous and four Lags)	0.005*	0.004
L1.Capital ratio	0.006	-0.014
L2.Capital ratio	0.022*	-0.005
L3.Capital ratio	0.011	0.005
L4.Capital ratio	0.002	0.012
Deposit ratio (Sum of contemporaneous and four Lags)	0.260*	0.241
L1.Deposit ratio	0.245	-0.553
L2.Deposit ratio	0.110	-0.583
L3.Deposit ratio	0.011	0.665
L4.Deposit ratio	0.119	0.275
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.021*	-0.056*
L1.D.Repo Rate	-0.017**	0.012
L2.D.Repo Rate	-0.015	-0.02
L3.D.Repo Rate	-0.013	-0.01
L4.D.Repo Rate	-0.012	-0.016
D.Log GDP (Sum of contemporaneous and four Lags)	0.764**	1.001
D.L1.Log GDP	0.072*	0.065
D.L2.Log GDP	0.263*	0.358
D.L3.Log GDP	0.250	0.219
D.L4.Log GDP	0.212	0.415***
D.REER (Sum of contemporaneous and four Lags)	-0.002	0.002
D.L1.REER	0.002	0.003
D.L2.REER	0.005	0.003
D.L3.REER	-0.003	-0.004
D.L4.REER	-0.023	0.002
Constant	-0.361*	-0.380*
Observations	2,364	2,364
Number of Banks	51	51
Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-3.91 (0.000)	-3.90 (0.000)
Arellano-Bond test for AR(2): Z-stats	-0.92 (0.356)	-0.48 (0.629)
Hansen test of overid. restrictions: chi2	9.57 (0.998)	3.84 (0.898)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

Table 5: Impact of MaP Policy on Housing Credit Growth over Financial Cycle

Variables	No interaction term	With interaction terms
D.Log Housing credit (Sum of four Lags)	-0.553**	-0.556**
L1.D.Log Housing credit	-0.245***	-0.246***
L2.D.Log Housing credit	-0.156**	-0.157**
L3.D.Log Housing credit	-0.135**	-0.137**
L4.D.Log Housing credit	-0.016	-0.017
MaP Dummy, -1,0,1 (Sum of contemporaneous and four Lags)	-0.053	-0.058
L1.MaP Dummy, -1,0,1	-0.017	-0.024
L2.MaP Dummy, -1,0,1	-0.038*	-0.038
L3.MaP Dummy, -1,0,1	-0.007	-0.006
L4.MaP Dummy, -1,0,1	0.009	0.010
Credit GDP gap (Sum of contemporaneous and four Lags)	-0.010	-0.013
L1.Credit GDP gap	-0.002	-0.002
L2.Credit GDP gap	-0.005	-0.006
L3.Credit GDP gap	-0.003	-0.004
L4.Credit GDP gap	0.001	0.012
Map x Credit GDP gap (Sum of contemporaneous and four Lags)		-0.027
L1.Map Dummy x Credit GDP gap		-0.018
L2.Map Dummy x Credit GDP gap		-0.003
L3.Map Dummy x Credit GDP gap		-0.003
L4.Map Dummy x Credit GDP gap		-0.004
Log Asset size (Sum of contemporaneous and four Lags)	0.009**	0.005
L1.Log Asset size	-0.405	-0.494**
L2.Log Asset size	-0.094	-0.057
L3.Log Asset size	0.084	0.141
L4.Log Asset size	0.188	-0.313
Liquidity ratio (Sum of contemporaneous and four Lags)	-0.012*	0.004
L1.Liquidity ratio	0.001*	0.001
L2.Liquidity ratio	-0.002	-0.001
L3.Liquidity ratio	-0.001	-0.002
L4.Liquidity ratio	-0.003	0.005
Capital ratio (Sum of contemporaneous and four Lags)	0.005*	0.002
L1.Capital ratio	0.006	-0.010
L2.Capital ratio	0.022*	-0.020
L3.Capital ratio	0.011	0.008
L4.Capital ratio	0.002	0.001
Deposit ratio (Sum of contemporaneous and four Lags)	0.260*	0.564
L1.Deposit ratio	0.245	-0.703
L2.Deposit ratio	0.110	-0.590
L3.Deposit ratio	0.011	0.734
L4.Deposit ratio	0.119	0.414
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.021*	-0.025
L1.D.Repo rate	-0.017**	0.011
L2.D.Repo rate	-0.015	-0.016
L3.D.Repo rate	-0.013	-0.015
L4.D.Repo rate	-0.012	-0.011
D.Log GDP (Sum of contemporaneous and four Lags)	0.764**	1.085
L1.D.Log GDP	0.072*	0.158
L2.D.Log GDP	0.263*	0.311
L3.D.Log GDP	0.250	0.396
L4.D.Log GDP	0.212	0.214

D.REER (Sum of contemporaneous and four Lags)	-0.002	0.006
L1.D.REER	0.002	0.002
L2.D.REER	0.005	0.003
L3.D.REER	-0.003	-0.004
L4.D.REER	-0.023	0.012
Constant	-0.361*	-0.245
Observations	2,364	2,364
Number of Banks	51	51
Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-3.91 (0.000)	-4.98 (0.000)
Arellano-Bond test for AR(2): Z-stats	-0.92 (0.356)	-1.02 (0.305)
Hansen test of overid. restrictions: chi2	9.57 (0.978)	10.89 (0.998)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

V.5. Impact of MaP Policy on NPAs

As per our baseline specification, the MaP policy coefficient did not have a statistically significant impact on the NPA ratio in the housing sector. However, when we included the interaction term with the repo rate, the MaP coefficient was positive and statistically significant (Table 6). We did not find any noteworthy influence of the bank-specific characteristics on the NPA ratio.

We also considered two separate dummies for tight and easy MaP policies (Table 7). We observed that a tighter MaP policy decreased the NPA ratio, while an easy policy did not have a significant effect. Since any tightening applies to the entire loan portfolio including new loans, the NPA ratio may reduce because of a rebalancing of the risk weight and provisioning.

Table 6: MaP Policy Impact on NPA Ratio

Variables	**No interaction term**	**With interaction terms**
Log GNPA ratio (Sum of four Lags)	0.909***	0.913***
L1.Log GNPA ratio	0.754***	0.755***
L2.Log GNPA ratio	0.114**	0.113**
L3.Log GNPA ratio	0.040*	0.040*
L4.Log GNPA ratio	0.092	0.091
MaP Dummy, -1,0,1 (Sum of contemporaneous and four Lags)	0.025	-0.027
L1.MaP Dummy	0.025	0.008
L2.MaP Dummy	0.018	0.025
L3.MaP Dummy	-0.006	-0.033
L4.MaP Dummy	-0.004	-0.006
MaP x Repo rate (Sum of contemporaneous and four Lags)		0.394*
L1.MaP Dummy x D.Repo rate		0.125
L2.MaP Dummy x D.Repo rate		0.037
L3.MaP Dummy x D.Repo rate		0.200**
L4.MaP Dummy x D.Repo rate		0.012

Log Asset size (Sum of contemporaneous and four Lags)	-0.016***	-0.016**
L1.Log Asset size	-0.352***	0.375***
L2.Log Asset size	-0.120	-0.134
L3.Log Asset size	0.297	0.293
L4.Log Asset size	-0.342	-0.345
Liquidity ratio (Sum of contemporaneous and four Lags)	0.004**	0.004**
L1.Liquidity ratio	-0.012**	-0.012**
L2.Liquidity ratio	0.012	0.012
L3.Liquidity ratio	-0.023***	-0.021***
L4.Liquidity ratio	0.012**	0.012**
Capital ratio (Sum of contemporaneous and four Lags)	-0.024***	-0.024**
L1.Capital ratio	0.059***	0.058***
L2.Capital ratio	0.038	0.035
L3.Capital ratio	-0.028	-0.024
L4.Capital ratio	-0.011	-0.014
Deposit ratio (Sum of contemporaneous and four Lags)	-0.294	-0.310
L1.Deposit ratio	0.312*	0.387*
L2.Deposit ratio	-0.452	-0.431
L3.Deposit ratio	-0.251	-0.283
L4.Deposit ratio	0.291	0.268
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.043*	-0.042
L1.D.Repo rate	0.005	0.004
L2.D.Repo rate	-0.014	-0.019
L3.D.Repo rate	-0.005	-0.004
L4.D.Repo rate	-0.011	-0.010
D.Log GDP (Sum of contemporaneous and four Lags)	-0.164*	-0.295*
L1.D.Log GDP	0.175	0.227
L2.D.Log GDP	0.226	0.126
L3.D.Log GDP	0.732***	0.837***
L4.D.Log GDP	-0.360*	-0.555**
D.REER (Sum of contemporaneous and four Lags)	-0.001	-0.002
L1.D.REER	-0.003	-0.005
L2.D.REER	-0.002	-0.002
L3.D.REER	0.005*	0.005
L4.D.REER	0.001	0.001
Constant	0.590*	0.612*
Observations	2,364	2,364
Number of Banks	51	51
Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-4.97 (0.000)	-4.98 (0.000)
Arellano-Bond test for AR(2): Z-stats	-0.96 (0.297)	-1.02 (0.305)
Hansen test of overid. restrictions: chi2	21.66 (0.978)	10.89 (0.998)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

Table 7: Impact of MaP Policy Tightening and Easing on NPA Ratio

Variables	No interaction term	With interaction terms
Log GNPA ratio (Sum of four Lags)	0.904***	0.907***
L1.Log GNPA ratio	0.750***	0.752***
L2.Log GNPA ratio	0.117**	0.120**
L3.Log GNPA ratio	0.045*	0.046
L4.Log GNPA ratio	0.089	0.083
Dummy Ease, -1,0 (Sum of contemporaneous and four Lags)	-0.045	-0.080
L1.Dummy Ease, -1,0	0.040	0.035
L2.Dummy Ease, -1,0	0.069	0.027
L3.Dummy Ease,-1,0	-0.021	-0.018
L4.Dummy Ease,-1,0	-0.012	0.029
Dummy Tight, 1,0 (Sum of contemporaneous and four Lags)	-0.067	-0.476**
L1.Dummy Tight, 1,0	0.027	-0.188
L2.Dummy Tight, 1,0	-0.003	-0.632*
L3.Dummy Tight, 1,0	-0.020	-0.438*
L4.Dummy Tight, 1,0	-0.019	-0.082
Dummy Tight x Repo (Sum of contemporaneous and four Lags)		-0.207**
L1.Dummy Tight x D.Repo rate		-0.039
L2.Dummy Tight x D.Repo rate		0.006
L3.Dummy Tight x D.Repo rate		-0.127**
L4.Dummy Tight x D.Repo rate		-0.047*
Dummy Ease x Repo (Sum of contemporaneous and four Lags)		0.079
L1.Dummy Ease x D.Repo rate		-0.011
L2.Dummy Ease x D.Repo rate		0.091**
L3.Dummy Ease x D.Repo rate		0.034
L4.Dummy Ease x D.Repo rate		-0.097***
Log Asset size (Sum of contemporaneous and four Lags)	-0.015**	-0.004**
L1.Log Asset size	0.249	0.316
L2.Log Asset size	-0.642**	-0.677**
L3.Log Asset size	-0.241	0.545
L4.Log Asset size	-0.150	-0.188
Liquidity ratio (Sum of contemporaneous and four Lags)	0.005**	0.005**
L1.Liquidity ratio	-0.013**	0.011**
L2.Liquidity ratio	0.011**	0.006**
L3.Liquidity ratio	-0.022	-0.022
L4.Liquidity ratio	0.008	0.010**
Capital ratio (Sum of contemporaneous and four Lags)	-0.024**	-0.025**
L1.Capital ratio	-0.064	-0.005
L2.Capital ratio	0.027	-0.001
L3.Capital ratio	-0.023	-0.012
L4.Capital ratio	-0.009	0.009
Deposit ratio (Sum of contemporaneous and four Lags)	0.642	-0.728
L1.Deposit ratio	0.473	0.815*
L2.Deposit ratio	0.045	-0.942
L3.Deposit ratio	0.581	0.350
L4.Deposit ratio	0.633	0.504
D.Repo Rate (Sum of contemporaneous and four Lags)	-0.044*	-0.095**
L1.D.Repo rate	0.017	-0.050**
L2.D.Repo rate	-0.012*	-0.019*
L3.D.Repo rate	-0.009	-0.005
L4.D.Repo rate	-0.005	-0.021

D.Log GDP (Sum of contemporaneous and four Lags)	-0.998	-1.549**
L1.D.Log GDP	-0.674*	0.461**
L2.D.Log GDP	0.244	0.341*
L3.D.Log GDP	0.780**	0.917**
L4.D.Log GDP	-0.280	-0.169
D.REER (Sum of contemporaneous and four Lags)	-0.307	-0.056
L1.D.REER	-0.201	-0.352
L2.D.REER	-0.190	-0.747
L3.D.REER	-0.124	-0.094
L4.D.REER	-0.140	-0.052
Constant	-0.092	-0.080
Observations	2,364	2,364
Number of Banks	51	51
Bank Fixed Effect	Yes	Yes
Arellano-Bond test for AR(1): Z-stats	-5.03 (0.000)	-4.98 (0.000)
Arellano-Bond test for AR(2): Z-stats	-0.06 (0.954)	0.36 (0.716)
Hansen test of overid. restrictions: chi2	4.52 (0.978)	10.89 (0.998)

Note: (i) The "D" operator denotes difference while L1, L2, L3, and L4 refer to the first, second, third, and fourth quarterly lags, respectively.
(ii) ***, ** and * indicate statistical significance at 1 per cent, 5 per cent and 10 per cent, respectively.
(iii) Figures in brackets are z-statistics. For Hansen test, figures in brackets are p-values.
Source: Authors' calculations.

VI. Conclusion

This paper evaluated the effectiveness of MaP policy instruments in influencing housing credit growth and credit quality in India using bank-level quarterly data. The empirical analysis indicates that the MaP policies were effective in influencing housing credit growth. Banks' capital adequacy had a positive impact on housing credit growth. MaP policies and monetary policies were more effective when used in tandem. MaP policies were not weakened by business cycle booms. While MaP policy alone did not seem to affect housing sector NPAs, tighter MaP and monetary policies in conjunction could help to reduce the NPA ratio in the housing sector. Stress tests, which are deployed for identifying potential vulnerabilities in the financial system, can guide the calibration of MaP policies within the regulatory toolkit.

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Annex

Table A1: Differentiated Risk Weights, Provisioning and LTV for Housing Loans

Period	**Loan Amount**	**Loan-to-value (LTV) Ratio** (per cent)	**Risk Weight** (per cent)	**Provisioning** (per cent)
May 24, 2002	Irrespective of the amount	-	50	-
Dec 23, 2004	Irrespective of the amount	-	75	-
May 03, 2007	Up to INR 20 lakh	-	50	-
May 14, 2008	Up to INR 30 lakh	LTV Ratio = or < 75	50	-
	Above INR 30 lakh	LTV Ratio = or < 75	75	
	Irrespective of the amount	LTV Ratio > 75	100	
	80 per cent. However, the LTV ratio for housing loans up to INR 20 lakh should not exceed 90 per cent.			
Dec 23, 2010	INR 75 lakh and above	-	125	2
	LTV Ratio, in general, should not exceed		75-125	
	80 per cent. However, the LTV ratio for housing loans up to INR 20 lakh should not exceed 90 per cent.			
June 21, 2013	Up to INR 20 lakh	90	50	0.4
	Above INR 20 lakh and up to INR 75 lakh	80	50	
	Above INR 75 lakh	75	75	
Oct 08, 2015	Up to INR 30 lakh	≤ 80	35	0.4
		> 80 and ≤ 90	50	
	Above INR 30 lakh and up to INR 75 lakh	≤ 75	35	
		> 75 and ≤ 80	50	
	Above INR 75 lakh	≤ 75	75	
June 07, 2017	Up to INR 30 lakh	≤ 80	35	0.25
		> 80 and ≤ 90	50	
	Above INR 30 lakh and up to INR 75 lakh	≤ 80	35	
	Above INR 75 lakh	≤ 75	50	
Oct 16, 2020	Irrespective of the amount	≤ 80	35	0.25
		> 80 and ≤ 90	50	
Feb 18, 2022	Up to INR 30 lakh	≤ 80	35	0.25
		> 80 and ≤ 90	50	
	Above INR 30 lakh and up to INR 75 lakh	≤ 80	35	
	Above INR 75 lakh	≤ 75	50	

Source: Reserve Bank of India.

Table A2: Summary of Variables in Panel Data Set

List of Indicators	Purpose	Transformation
Dependent variables		
Housing credit (outstanding) Credit risk (%)	Covers all housing loans Housing credit risk, calculated as the ratio of non-performing loans to total loans	D Log Log
Independent variables		
Policy variables		
Dummy for MaP policy instruments	1 denotes a tightening policy; −1 an easing; and 0 no change.	MaP Dummy
Dummy for tightening MaP policy instruments	1 denotes a tightening policy; and 0 otherwise.	Dummy tight
Dummy for easing MaP policy instruments	−1 denotes an easing policy; and 0 otherwise.	Dummy ease
Monetary policy condition	Repo rate.	D Repo
Bank characteristics variables		
Total assets	A bank's total assets size	Log
Liquidity ratio (%)	The ratio of liquid assets to total assets.	-
Capital ratio (%)	Ratio of Tier 1 Capital to risk-weighted assets.	-
Deposits to total liabilities ratio (%)	This is a measure of a bank's funding composition, which is the ratio of deposits to total liabilities.	-
Macroeconomic Variables		
GDP(Nominal), seasonally adjusted	Macroeconomic controls for isolating the impact of MaP policy on banks	D Log
Policy rate		D Log
Trade-weighted Real Effective Exchange Rate (REER), seasonally adjusted		D REER
Credit-to-GDP gap		D Log