# How effective are macroprudential policies in Asia-Pacific? Evidence from a meta-analysis

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## Abstract

This paper evaluates the effectiveness of macroprudential policies in five Asia-Pacific countries (Australia, Indonesia, New Zealand, the Philippines and Thailand). We use supervisory bank-level data and apply a common empirical strategy. We find that macroprudential policies are effective in reducing excessive household credit growth. Additionally, a tightening in macroprudential policy has a stronger effect than an easing. We also find that banks' size and liquidity influence the effect of macroprudential policy on credit growth. Finally, macroprudential policy is effective in reducing bank risk as measured by the non-performing loan ratio.

Keywords: macroprudential policy, household credit, bank-level data, meta-analysis

JEL classifications: E51, E58 G18, G28

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# 1. Introduction

The Great Financial Crisis made clear that financial stability has a macroprudential or systemic dimension that cannot be ignored. Treating the financial system as merely the sum of its parts leads one to overlook the system's historical tendency to swing from a boom to a bust. Interestingly, it was in more advanced economies (AEs) that the macroprudential dimension had received less attention in the run-up to the crisis. Graph 1 shows that the use of macroprudential tools in AEs was quite limited before 2007 and increased only following the crisis. By contrast, emerging market economies (EMEs) have historically been more active in the use of macroprudential measures, and more willing to intervene in response to evidence of a build-up of imbalances and risks.

The implementation of a new macroprudential framework for financial stability raises a number of challenges for both AEs and EMEs. One is how to evaluate the effectiveness of macroprudential policies, especially when more than one tool is activated. Moreover, effectiveness should be analysed with respect to the specific goal macroprudential policies are designed to achieve; that is, to increase the resilience of the financial system or, more ambitiously, to tame financial booms and busts. At the moment, the evidence is mixed and more work is needed.

In Asia and the Pacific, central banks and regulatory authorities have implemented several asset side instruments to shield the economy against the risks of volatile credit cycles and tame the business cycle (Graph 2). Most of the evidence produced so far on the effectiveness of these policies in the Asia-Pacific region has been obtained using aggregate data or commercial databases such as BankScope. Limited use has been made of high-quality bank-level supervisory data, while evidence using credit registry data is even more scarce.

The objective of this paper is to study the effectiveness of macroprudential policies in the Asia-Pacific region, using supervisory bank-level data for the household sector.[2] Supervisory data are highly confidential. This means that it is not possible to merge the data into a single data set. The only possibility is to coordinate a common exercise and summarise the different results. To this end, the BIS coordinated the implementation of a common research protocol that established the modelling strategy and data definition (as far as data sources allow in terms of coverage, collection methods and definitions). In this way, it was possible to define a policy experiment by using the same baseline specifications and running similar tests.

The main focus of the research protocol was to establish the effects of macroprudential tools on household lending and on bank risk, the latter measured by the share of non-performing loans (NPLs) in total loans. In a second step, we evaluated whether the responses to a macroprudential shock differed for banks with different characteristics. Finally, we compiled and summarised the results by conducting a meta-analysis.

Our main results are the following. First, we find that macroprudential policies are effective in reducing excessive household credit growth. Second, bank characteristics are relevant when considering the strength of the transmission of macroprudential policies to credit. Third, there are asymmetric effects in the

[2] Countries that participated in the protocol exercise are Australia, Indonesia, New Zealand, the Philippines and Thailand.

implementation of macroprudential policy when we separate tightening from easing episodes. Finally, macroprudential policies are effective in reducing the build-up of bank risk, as measured by the NPL ratio.

The structure of the paper is as follows. In Section 2, we present a short literature review. Section 3 describes the empirical strategy implemented by each country team. Section 4 summarises the results obtained from the individual country teams by applying meta-analysis techniques. The last section concludes.

## 2. Literature review

Our paper contributes to the literature on the effects of macroprudential policies on credit. For instance, recent evidence suggests that debt service-to-income ratio rules and, to a lesser extent, loan-to-value ratio rules are more effective than capital requirements as tools for containing credit growth (Claessens et al (2013)). Indeed, the recent activation of the Basel III countercyclical capital buffer in Switzerland seems to have had little impact on pricing and credit extension (Basten and Koch (2015)). As clarified by the Basel III framework, the main objective of this buffer is to increase the resilience of the banking system. Restraining booms is perhaps no more than a welcome, possible side benefit (Drehmann and Gambacorta (2012)). Some instruments may work better in achieving the narrow aim of increasing financial system resilience rather than the broader aim of constraining the financial cycle.

An important feature of this paper is the use of supervisory data at the quarterly frequency. Gambacorta (2005) compares the results on the effectiveness of the bank lending channel in Italy using supervisory quarterly data with those using annual data obtained from BankScope, a publicly available data set. In particular, his analysis suggests that differences in the results are mainly due to a different quality of the data and to some extent to the annual frequency of the BankScope data. By using supervisory data in our paper, we aim to contribute to a better evaluation of the effectiveness of macroprudential measures.

Finally, our work is related to other research that conducts economic meta-analysis by pooling results from different countries. Regarding our first research question on the effectiveness of macroprudential policies, Gambacorta and Murcia (2019) present a meta-analysis based on credit registry data for five Latin American countries. Related to our second research question, Cantú et al (2019) study the role of bank characteristics on the transmission of shocks to credit supply in Latin America.

## 3. Empirical strategy

The first step is to evaluate the impact of a change in macroprudential tools on credit availability using a panel methodology. In particular, we estimate the impact on bank loans at the bank level using the following dynamic panel specification:

$$\Delta log\ Loans_{b,t} = \alpha_b + \sum_{j=1}^{k} \gamma_j\, \Delta log\ Loans_{b,t-j} + \sum_{j=0}^{k} \beta_j\, \Delta \mathrm{MaP}_{t-j} + \vartheta X_{b,t-1} + \theta macrovars_{b,t} + \varepsilon_{b,t} \quad (1)$$

where $\Delta log\ Loans_{b,t}$ is the change in the logarithm of credit by bank *b* to households over quarter *t*, $\alpha_b$ are bank fixed effects, $X_{b,t-1}$ are bank-specific characteristics, and $macrovars_{b,t}$ are macroeconomic variables. The impact of a change in the macroprudential tool on credit supply is evaluated by means of $\sum_{j=0}^{k} \beta_j$, the main coefficients of interest. Residuals are clustered at the bank level. All variables are considered in real terms to eliminate inflationary effects in nominal variables.

The analysis focuses on $\Delta MaP_t$, a dummy that takes the value of +1 if a macroprudential tool is tightened in a given quarter and −1 if it is eased. It takes the value of zero if no change occurs during that quarter.

We make two distinctions in the macroprudential policy variable. First, we differentiate between macroprudential measures depending on whether they are implemented to respond to cyclical conditions or to enhance resilience. We also consider two separate dummies: one for tightening actions and the other for easing actions. We can then verify asymmetric effects for each type of tool.[3]

Controls consist of macroeconomic variables and bank-specific characteristics. In particular, macroeconomic variables include changes in real GDP, changes in the monetary policy rate and the effective exchange rate. Bank-specific characteristics *X* includes four standard indicators: (i) size (log of total assets); (ii) liquidity ratio (cash and securities over total assets); (iii) capital ratio (Tier 1 capital to total assets); and (iv) funding composition (deposits over total liabilities).

## 3.1 Do responses to macroprudential shocks differ by type of bank?

The second step of the analysis evaluates the role of bank-specific characteristics in the transmission of macroprudential policy using the following equation:

$$\Delta log\ Loans_{b,t} = \alpha_b + \sum_{j=1}^{k} \gamma_j\, \Delta log\ Loans_{b,t-j} + \sum_{j=0}^{k} \beta_j\, \Delta \mathrm{MaP}_{t-j} + \vartheta X_{b,t-1} + \sum_{j=0}^{k} \delta_j\, \Delta \mathrm{MaP}_{t-j} * X_{bt-1} + \theta macrovars_{b,t} + \varepsilon_{b,t} \quad (2)$$

The test is on the overall significance of $\sum_{j=0}^{k} \delta_j$. This approach builds on the bank lending channel literature. In order to discriminate between loan supply and loan demand movements, the literature has focused on cross-sectional differences between banks.[4] This strategy relies on the hypothesis that certain bank-specific characteristics influence only loan supply movements, while banks' loan demand is independent of these characteristics. Broadly speaking, this approach assumes that after a monetary tightening (macroprudential tightening in our case), the ability to buffer the policy's impact on loan portfolios is different for different banks. For example, small banks, which suffer a high degree of informational friction in financial markets, face a higher cost in raising non-secured deposits, and reduce their lending by more after a tightening in policy. Similarly, illiquid banks have less room to buffer the effect of a monetary tightening on lending simply by drawing down cash and securities.

[3] See, for example, Kuttner and Shim (2012).

[4] For a review of the literature on the distributional effects of the bank lending channel, see, amongst others, Gambacorta (2005).

## 3.2 Do responses to macroprudential policy vary over different monetary policy conditions?

We test this hypothesis by introducing additional interaction terms, which combine macroprudential dummies and monetary policy conditions *r* (ie real interest rate or monetary policy stance measured by the gap between the actual policy rate and the policy rate calculated from a version of the Taylor rule). In particular, we estimate the following equation:

$$\Delta log\ Loans_{b,t} = \alpha_b + \sum_{j=1}^{k} \gamma_j\, \Delta log\ Loans_{b,t-j} + \sum_{j=0}^{k} \beta_j\, \Delta \mathrm{MaP}_{t-j} + \sum_{j=0}^{k} \varphi_j r_{t-j} + \sum_{j=0}^{k} \rho_j\, \Delta \mathrm{MaP}_{t-j} * r_{t-j} + \vartheta X_{b,t-1} + \theta macrovars_{b,t} + \varepsilon_{b,t} \quad (3)$$

The goal of this test is to verify the effectiveness of macroprudential tools when monetary policy pushes in the same or opposite direction (see Bruno et al (2017) for details). The test is on the overall significance of $\sum_{j=0}^{k} \rho_j$.

## 3.3 Do responses to macroprudential policy vary over the business or financial cycle?

We carry out an additional test by introducing interaction terms that combine macroprudential dummies and real GDP growth (or the credit-to-GDP gap):

$$\Delta log\ Loans_{b,t} = \alpha_b + \sum_{j=1}^{k} \gamma_j\, \Delta log\ Loans_{b,t-j} + \sum_{j=0}^{k} \beta_j\, \Delta MaP_{t-j} + \sum_{j=0}^{k} \varphi_j \Delta logGDP_{t-j} + \sum_{j=0}^{k} \rho_j\, \Delta MaP_{t-j} * \Delta logGDP_{t-j} + \vartheta X_{b,t-1} + \theta macrovars_{b,t} + \varepsilon_{b,t} \quad (4)$$

The goal of this test is to verify the possible presence of contemporaneous effects between real GDP/the credit-to-GDP gap and macroprudential tools: their impact may be stronger when real GDP growth is high or vice versa. The test is on the overall significance of $\sum_{j=0}^{k} \rho_j$.

## 3.4 Effects on bank risk (non-performing loans)

In general, the goal of macroprudential policies is to contain systemic risk that is by nature endogenous. By using macroprudential tools, policymakers aim to reduce banks' risk-taking and the probability of the occurrence of a financial crisis. We evaluate how macroprudential tools affect bank risk by estimating their effect on the ratio of banks' non-performing loans over total assets (NPL ratio).[5] To do so, we

[5] Measurement of systemic risk is, however, still rudimentary. While some concepts have been developed, it is difficult to compute such measures (for example, CoVaR, stress testing, and Shapley value measures).

consider the NPL ratio as the dependent variable in equations (1)–(4). For example, equation (1) becomes:[6]

$$\mathrm{NPL}_{b,t} = \alpha_b + \sum_{j=1}^{k} \gamma_j \,\mathrm{NPL}_{b,t-j} + \sum_{j=0}^{k} \beta_j \,\Delta\mathrm{MaP}_{t-j} + \vartheta X_{b,t-1} + \theta macro_{b,t} + \varepsilon_{b,t} \qquad (5)$$

where $NPL_{b,t}$ is a logit function of the ratio of gross NPLs to total loans. In particular, the logit function is given by $NPL_{b,t} = ln[\mathrm{NPL\ ratio}/(1 - \mathrm{NPL\ ratio})]$. Given the persistence of NPLs, we use a dynamic specification that includes a lagged value of the NPL as an explanatory variable. We use data on gross NPLs (including provisions) as the dependent variable, since this definition captures the overall quality of the loan portfolio (net NPLs reflect the realisation of loan defaults).

## 3.5 Endogeneity issues

One possible limitation of the empirical strategy is that, in principle, the situation of the banking sector (lending supply or bank risk) could also have an impact on macroprudential policy decisions. In order to mitigate such endogeneity problems, we use a dynamic generalised method of moments (GMM) panel methodology to obtain consistent estimates of the relationship between macroprudential policy and the dependent variables.[7] The use of this methodology is essential because in the presence of a lagged dependent variable with fixed effect, the ordinary least squares (OLS) method would produce inconsistent estimates. Thus, GMM reduces any endogeneity bias that may affect the estimation of other regression parameters. It also takes into account the heterogeneity of the data caused by unobservable factors affecting individual banks.

We use the instruments as defined by Blundell and Bond (1998). In particular, the exogenous variables, transformed in first differences, are instrumented by themselves, while the endogenous regressors (also transformed in first differences) are instrumented by their lags in levels.[8] As a final precaution, we consider all bank-specific characteristics lagged at $t$-1.

## 3.6 Meta-analysis techniques

We estimate the mean effect of macroprudential policy on household lending in the Asia-Pacific region by applying meta-analysis techniques. A meta-analysis is suitable for our study since the low number of observations (country studies) prevents us from applying minimum square techniques. We exploit the fact that by construction, all

[6] See Jiménez and Saurina (2006) and Chavan and Gambacorta (2019).

[7] This methodology was first described by Holtz-Eakin et al (1988) and Arellano and Bond (1991), and further developed by Blundell and Bond (1998).

[8] This approach has been applied to other areas of research in which the model was affected by possible endogeneity biases. For instance, Blundell and Bond (1998) use it to estimate a labour demand model, while Beck et al (2000) apply it to investigate the relation between financial development and economic growth.

studies have the same design and the coefficients are comparable between them. We can then compute a weighted average across the studies' individual estimates.[9]

The weights of the coefficients in the estimated mean effect are proportional to the two sources of variance in the studies. The first is the within-study sampling error and the second the between-study variance (that is, the level of variability of the estimated coefficients among the studies).

We present the results in two forms. First, for the effects of macroprudential policies on household lending and bank risk, we show the results by means of forest plots. In these graphs, the rows show the coefficients reported by each country (red dots) and their confidence interval (black line). The last row shows the estimated mean effect (blue dashed line) and its confidence interval (blue diamond). Second, for the rest of the exercises, we present tables showing the estimated mean effect and the estimated level of heterogeneity ($I^2$ statistics). This statistic is the percentage of the residual variation that is attributable to between-study heterogeneity.[10]

## 4. Results

Our main result is that macroprudential policies are effective in reducing growth in household credit (Graph 3). The estimated mean coefficient implies that, on average, an increase in the macroprudential index (ie a macroprudential tightening) reduces growth in real household credit by 4 percentage points in the subsequent quarters. The weights of each coefficient in the mean estimate are evenly distributed, which implies that there is no dominant study driving the results.

Next, we turn to the results on the role of bank characteristics in the transmission of macroprudential policies (Table 1). First, we find that, on average, large banks and banks with high liquidity are less sensitive to a macroprudential policy change.[11] As explained before, these banks are better able to raise additional funds when faced with a macroprudential shock. Second, banks with high capital are slightly more sensitive to changes in macroprudential policy. The result is only marginally significant. One explanation may be that, during the analysed period, bank capital levels were adjusted to adhere to Basel III capital requirements in conjunction with other tools. As banks shifted their capital composition, they tended to reduce their credit provision. Finally, the estimated level of heterogeneity ($I^2$ statistic) is higher than 85% for all the estimates in this block. This implies that there are important sources of heterogeneity between countries.

Our third set of results differentiates the effects of macroprudential policy depending on their objective (cyclical vs resilience) and the direction of change (tightening vs easing). First, as shown in Graph 2, most of the macroprudential policies implemented in Asia in 2017 responded to cyclical conditions. For our study, there

[9] See Gambacorta and Murcia (2019) and Cantú et al (2019) for a formal explanation on meta-analysis applied to economics.

[10] Although there can be no absolute rule for when heterogeneity becomes important, Harbord and Higgins (2008) tentatively suggest adjectives of low for $I^2$ values between 25 and 50%, moderate for 50–75% and high for values greater than 75%.

[11] The coefficient on the interaction term of macroprudential policy and deposits is positive but not significant.

are not enough observations to conduct a proper meta-analysis on the effect of macroprudential policies aimed at increasing banks' resilience. For the same reason, the results on the effects of the cyclical macroprudential policies were almost the same as the results using the aggregate index (Table 2). Second, we find that there are asymmetric effects in the implementation of macroprudential policies. In particular, a tightening in macroprudential policy has a stronger effect on credit growth than an easing; a tightening reduces growth in household credit on average by around 9 percentage points, whereas an easing increases it by around 7 percentage points (Table 1). It is important to consider this asymmetric effect when winding down macroprudential policies in the event of a credit crunch. In addition, we find no significant effect in the coefficients on the interaction term of bank characteristics and the two macroprudential indexes for tightening actions and easing actions, respectively. Finally, the coefficients on the interaction term of macroprudential policy and monetary policy, business cycle or credit cycle were also not significant (Table 4).

Finally, we show the results on the effect of macroprudential policies on bank risk, proxied by banks' share of NPLs in total loans (Table 3). First, we find that macroprudential policies are effective in reducing bank risk. In contrast to our previous results, we do not find a prominent role for bank-specific characteristics in the effect of macroprudential tools on bank risk. Second, as with our previous results, there are not enough observations to differentiate macroprudential policies aimed at building resilience from those that respond to cyclical conditions. Third, we find asymmetric effects of macroprudential policies on bank risk. In particular, a tightening in macroprudential policy has a stronger effect on bank risk than an easing. Finally, in Table 4 we find no significant effect of the interaction of macroprudential policy and economic conditions (monetary policy, business cycle or credit cycle).

## 5. Conclusions

Researchers have endeavoured to reach a consensus on the effect of macroprudential policies on credit growth. This paper presents the results of a joint project by five central banks in the Asia-Pacific region that evaluates the effectiveness of macroprudential policies with regard to household credit and bank risk. Each country team used confidential supervisory bank-level data and followed a common empirical specification. We then estimated the mean effects by applying meta-analysis techniques.

The results from the meta-analysis are intuitive and economically and statistically significant. First, we find that macroprudential policies are effective in reducing excessive growth of household credit. Second, large banks and banks with high liquidity ratios are less affected by macroprudential shocks. Third, there are asymmetric effects in the implementation of macroprudential policy; in particular, a tightening has a stronger effect than an easing. Finally, macroprudential policies are effective in reducing the build-up of risk as measured by banks' NPL ratios.

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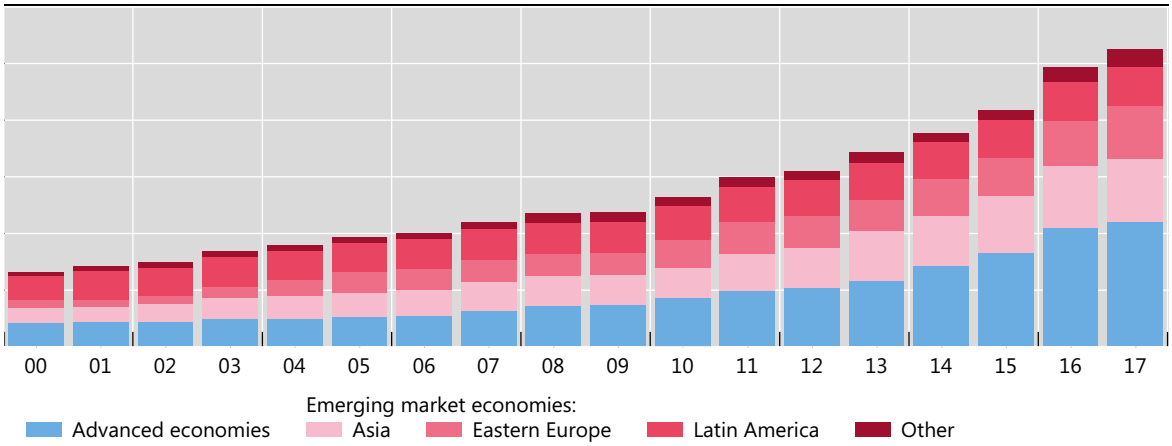
# Graphs and tables

## The use of macroprudential instruments increased after the Great Financial Crisis

Number of policy actions — Graph 1

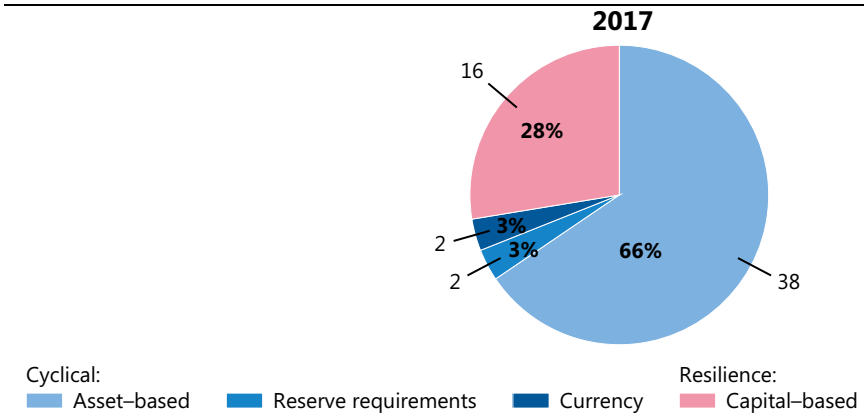



The sample covers macroprudential instruments adopted in 59 economies (27 advanced and 32 emerging market economies).

Source: Cerutti et al (2017).

## In Asia-Pacific, most macroprudential tools available are asset-based instruments

Type of instrument — Graph 2

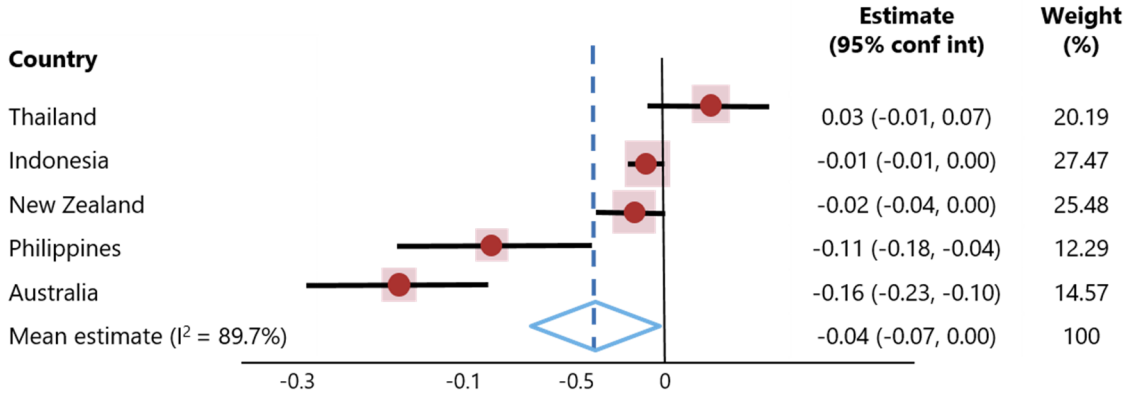



The sample covers macroprudential tools in place during 2017 for the following 14 Asia-Pacific economies: Australia, China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippine, Saudi Arabia, Singapore, Thailand and the United Arab Emirates. Macroprudential tools for resilience include (a) capital-based instruments (countercyclical capital requirements, leverage restrictions, general or dynamic provisioning). Cyclical macroprudential tools include: (b) asset-based instruments (credit growth limits, maximum debt-service-to-income ratio, limits on banks' exposures to the housing sector as a maximum loan-to-value ratio); (c) changes in reserve requirements; and (d) currency instruments (variations in limits on foreign currency mismatches and on net open positions).

Source: Cerutti et al (2017).

## Macroprudential policies are effective in reducing household credit growth

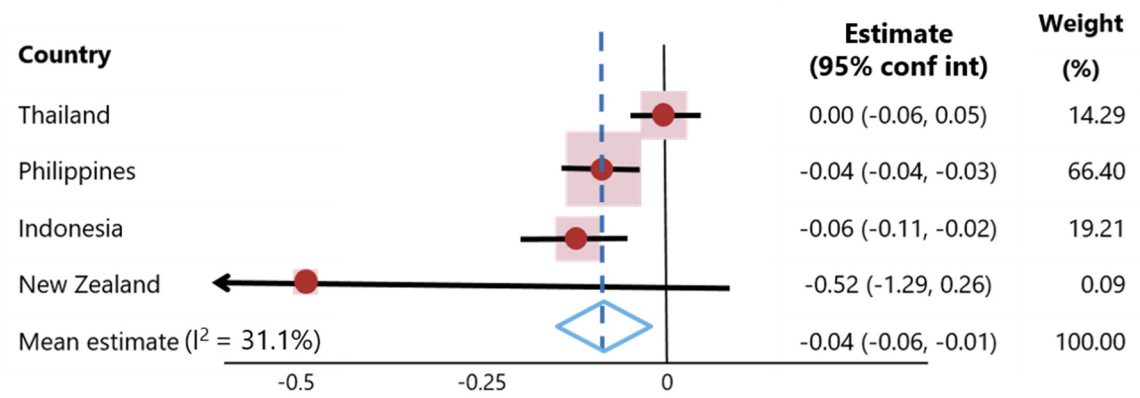
Graph 3




Results from a random-effects meta-analysis. The rows correspond to the coefficient obtained by each country (red dots). The size of the squares represents their weights in the estimated mean effect. The weight is calculated as the inverse of the estimate's standard error, as reported in the underlying study, plus the estimated between-study variance. The blue diamond represents the estimated 95% confidence interval of the estimated mean effect (dashed blue line).

## Macroprudential policies are effective in reducing bank risk

Graph 4




Results from a random-effects meta-analysis. The rows correspond to the coefficient obtained by each country (red dots). The size of the squares represents their weights in the estimated mean effect. The weight is calculated as the inverse of the estimate's standard error, as reported in the underlying study, plus the estimated between-study variance. The blue diamond represents the estimated 95% confidence interval of the estimated mean effect (dashed blue line).

## Effect of macroprudential policy on household credit and asymmetric effects

Table 1

| | Mean effect | Percentage of heterogeneity ($I^2$) (0–100) | Observations |
|---|---|---|---|
| Macroprudential index | **–0.04**** | 89.74 | 5 |
| Interaction with: | | | |
| Size | **0.11**** | 97.14 | 5 |
| Capital | **–0.30*** | 87.14 | 5 |
| Liquidity | **0.26***** | 98.46 | 5 |
| Deposits | 0.15 | 95.06 | 5 |
| Easing index | **0.07**** | 97.42 | 4 |
| Interaction with: | | | |
| Size | 0.00 | 0.00 | 4 |
| Capital | –0.49 | 88.09 | 4 |
| Liquidity | 0.52 | 80.19 | 4 |
| Deposits | –0.09 | 75.64 | 4 |
| Tightening index | **–0.09**** | 98.53 | 5 |
| Interaction with: | | | |
| Size | 0.00 | 73.35 | 5 |
| Capital | 0.10 | 98.01 | 5 |
| Liquidity | 0.07 | 97.13 | 5 |
| Deposits | 0.10 | 90.86 | 5 |

## Effect of macroprudential policy by objective

Table 2

| | Mean effect index | Interaction with: | | | | Observations |
|---|---|---|---|---|---|---|
| | | Size | Capital | Liquidity | Deposits | |
| Household credit | | | | | | |
| Cyclical | **–0.03**** | **0.13**** | **–0.29**** | **0.39***** | **0.45***** | 5 |
| Resilience | –0.19 | –0.01 | 0.59 | 0.33 | –0.16 | 2 |
| Non-performing loans: | | | | | | |
| Cyclical | **–0.03***** | **0.14*** | 0.86 | 0.21 | –0.15 | 4 |
| Resilience | –0.01 | 0.07 | 0.00 | 0.01 | –0.33 | 2 |

Results from a random-effects meta-analysis. The mean effect corresponds to the weighted average of coefficients reported in different estimations. The weights are calculated considering the sampling fluctuation of each effect size (standard error per reported coefficient) and estimated between-study variance. The $I^2$ statistic is the magnitude of the level of heterogeneity in effect sizes and is defined as the percentage of the residual variation attributable to between-study heterogeneity. Although there can be no absolute rule for when heterogeneity becomes important, Harbord and Higgins (2008) tentatively suggest adjectives of low for $I^2$ values between 25 and 50%, moderate for 50-75% and high for values greater than 75%. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

## Effect of macroprudential policy on bank risk and asymmetric effects

Table 3

| | Mean effect | Percentage of heterogeneity ($I^2$) (0–100) | Observations |
|---|---|---|---|
| Macroprudential index | **–0.04*** ** | 31.1 | 4 |
| Interaction with: | | | |
| Size | 0.02 | 82.39 | 4 |
| Capital | 0.17 | 85.37 | 4 |
| Liquidity | 0.02 | 51.8 | 4 |
| Deposits | –0.42 | 97.51 | 4 |
| Easing index | **0.002** ** | 40.05 | 3 |
| Interaction with: | | | |
| Size | 0.0328 | 51.54 | 3 |
| Capital | 1.274 | 83.07 | 3 |
| Liquidity | –1.7858 | 71.96 | 3 |
| Deposits | 0.3519 | 93.33 | 3 |
| Tightening index | **–0.04*** | 65.93 | 4 |
| Interaction with: | | | |
| Size | 0.0464 | 97.92 | 4 |
| Capital | 0.4538 | 92.97 | 4 |
| Liquidity | **0.80** ** | 96.35 | 4 |
| Deposits | **0.28*** | 94.84 | 4 |

## Interaction of macroprudential policy with other economic variables

Table 4

| | Interaction with: | | | Observations |
|---|---|---|---|---|
| | Monetary policy | GDP | Credit | |
| Household credit growth | 0.02 | 0.34 | 0.00 | 5 |
| Non-performing loan ratio | –0.02 | 0.49 | 0.01 | 4 |

Results from a random-effects meta-analysis. The mean effect corresponds to the weighted average of coefficients reported in different estimations. The weights are calculated considering the sampling fluctuation of each effect size (standard error per reported coefficient) and estimated between-study variance. The $I^2$ statistic is the magnitude of the level of heterogeneity in effect sizes and is defined as the percentage of the residual variation attributable to between-study heterogeneity. Although there can be no absolute rule for when heterogeneity becomes important, Harbord and Higgins (2008) tentatively suggest adjectives of low for $I^2$ values between 25 and 50%, moderate for 50-75% and high for values greater than 75%. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.