УДК 336.71, 336.77

DOI: 10.17323/1813-8691-2025-29-1-160-182

Does Macroprudential Policy Matter to Manage Banking Credit Risk? Evidence from Commercial Banks in Asia-Pacific Region[1]

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The global financial crisis triggered a debate on the pros and cons of using macroprudential policy as a prudential control tool that includes capital reserves or requirements to address systemic risk, financial credit cycles, and macroeconomic stabilization objectives. The macroprudential policy has now been establi-

[1] Thank you to the Faculty of Economics and Business and the Institute for Research and Community Service, University of Jember, who have provided encouragement, facilities, and funding to write this manuscript well.

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The article was received: 26.03.2024/The article is accepted for publication: 06.02.2025.

shed as an area of financial policy to stop excessive risk-taking in the financial sector and reduce its consequences to the real economy in response to the lessons learned from the global financial crisis. Controlling credit risk also requires a government-run fiscal sector, one of which is controlling corruption. Corruption significantly affects credit risk. This study aims to examine the effectiveness of macroprudential policy instruments and the role of institutional instruments in controlling commercial bank credit risk in the Asia Pacific region from 2012 to 2023. This study uses the generalized method of moments (GMM) as an analytical tool. The results show that loan-to-value and corruption significantly affect credit risk in Asia Pacific.

***Key words*:** capital adequacy ratio; capital conservation buffer; corruption; loan to value; credit risk, GMM.

JEL Classification: E51, E61, F55.

For citation: Z. Zainuri, S. Viphindrartin, R.N. Wilantari, A. Roziq. Does Macroprudential Policy Matter to Manage Banking Credit Risk? Evidence from Commercial Banks in Asia-Pacific Region. *HSE Economic Journal.* 2025; 29(1): 160–182.

Introduction

The active use of prudential tools to manage credit allocations and volumes was rendered obsolete in the 1990s as financial liberalization became the prevailing regulatory trend. Then, in 2008, the world financial crisis struck financially developed nations hard, revealing the limitations of the prudential framework that was in place at the time for managing systemic risk. This caused the balance to shift and the active use of prudential tools – known as macroprudential policies in the vernacular – to smooth the credit cycle and prevent significant crises. Examples of these tools include reserve requirements, loan-to-value ratios, taxes on lending, and capital requirements. Macroeconomists were compelled to examine the relationship between financial frictions and economic cycles after the global financial crisis revealed the risky relationships between micro- and macro-stability [Cordella, Pienknagura, 2020]. The most important lessons from this crisis are the necessity of strengthening the macroprudential approach to supervision and regulation, which can recognize vulnerabilities across the system and take appropriate action to ensure financial stability, and the significance of minimizing systemic financial risks.

In order to reduce systemic or system-wide financial risk and, consequently, the likelihood of disruptions in the delivery of essential financial services, which may have detrimental effects on the actual economy, macroprudential policy primarily employs prudential mechanisms. Ebrahimi Kahou and Lehar (2017) state that preserving systemic financial stability and lowering systemic risk are the two primary goals of macroprudential monitoring and regulation. The possibility of a single firm's failure causing the entire financial system to implode is known as systemic risk. According to Calmès and Théoret (2014), it is the outcome of financial institutions' undercapitalization in an increasingly interconnected market. It's critical to comprehend and measure this systemic risk to ensure our financial institutions have enough capital to survive another financial crisis. Time dimension and cross-sectional dimension are the two categories of systemic risks that macroprudential policy addresses, according to Spelta et al. (2018). The financial system's overall risk and how it changes over time are covered under the temporal dimension.

The global financial crisis triggered a debate regarding the pros and cons of using macroprudential policy as a prudential control tool that includes capital reserves or requirements to address systemic risk, financial credit cycles, and macroeconomic stabilization objectives. Nonetheless, macroprudential policies that limit loan-to-value ratios, debt-to-income ratios, credit growth restrictions, balance sheet restrictions, and capital and reserve requirements are of significant concern in reducing systemic risk in financial markets. The macroprudential policy framework has been laid out in the Bank of International Settlements (BIS) since the early 2000s and has been implemented extensively in emerging markets while developed countries have just begun to adopt it [Cerutti, Claessens, Laeven, 2015; Freixas, Laeven, Peydro, 2015; Rojas, Vegh, Vuletin, 2020], but the related models and implementation performance are still ambiguous because the policy has several goals at the beginning of this policy so that the implementation of the policy does not attract much attention in policymaking or academia [Thiemann, Aldegwy, Ibrocevic, 2018]. This ambitious policy program has been reduced to a much more scaled-back incremental approach during implementation. While focusing on increasing the system's resilience, implemented measures largely refrain from intervening in the build-up of financial risks during the upswing of the cycle. Looking at the measures introduced internationally, few, if any, bear a clear anti-cyclical character that could constrain credit in the upswing.

The macroprudential policy focuses on establishing a protective banking framework to create conditions for resilience and financial sector actors while suppressing the procyclical behavior of banks [Benigno, Chen, Otrok, Rebucci, Young, 2013; Buncic, Melecky, 2013; Claessens, Ghosh, Mihet, 2013; Freixas, Perez-Reyna, 2021]. Still, on the other hand, the policy shift towards macroprudential creates a consequence of regulatory change that can also translate into a decrease in credit supply and erosion of economic activity, with unintended consequences such as greater unemployment and decreased investment [Meuleman, Vander, 2020].

Cerutti et al. (2016) have researched using macroprudential policies through 12 macroprudential instruments to control credit growth. It is concluded that the implementation of macroprudential policies in developing countries and developed countries has differences; in developing countries, macroprudential policies related to foreign exchange are used more intensively, while in developed countries, macroprudential policies in the form of borrower-based policies are more widely used. The implementation of borrower-based policies is based on financial openness in developed countries, so fluctuations in credit growth will directly impact pro-perty price growth. The failure of monetary policy to create stability has led to an orientation toward financial stability. The shift towards macroprudential is one of the main consequences of the global financial crisis [Baker, Widmaier, 2015; Galati, Moessner, 2013]. With the policy shift towards macroprudential, central banks worldwide started implementing preventive measures to protect against systemic financial risks and utilizing non-conventional tools to ensure financial stability, where financial stability has become a key economic policy objective within the G-20 to promote international financial stability [Baker, 2013].

The literature study on the relationship between macroprudential policy and credit risk conducted by Behncke (2023) revealed that through macroprudential policy, banks limit lending and ultimately reduce banking risk directly. The spillover effect from other countries suggests that the lending limits should be carefully designed and closely monitored. The provision of capital reserves through capital buffers increases the probability of bank survival during a banking crisis [Berger, Bouwman, 2013]. In addition, the Countercyclical Capital Buffer (CCyB) policy launched can contribute to the banking system's resilience but does not prevent the credit boom

and asset price collapse. According to Altunbas et al. (2018), macroprudential policies significantly affect bank risk evaluated by Z-score, especially for small, heavily funded, and undercapitalized banks. Non-performing loans (NPLs) measure credit risk in other studies [Chaibi, Ftiti, 2015]. Hence, macroprudential policies are created to support traditional macroeconomic instruments and micro-prudential regulation of financial institutions, according to academics and practitioners. By reducing the negative effects of financial volatility and mitigating excessive procrastination, such policies seek to contain (accumulated) risks to systemic stability, reducing the costs to the economy of disrupted financial services that support the operation of financial markets [Gaganis, Lozano-Vivas, Papadimitri, 2019].

Behncke (2023) carried out a research study of the effects of macroprudential measures, such as the loan-to-value (LTV) and countercyclical capital buffer (CCyB) policies, on bank len-ding and credit risk in Switzerland. Although the sectoral CCyB and the LTV ceiling have the same overall goal of protecting the mortgage market from the accumulation of systemic hazards, they do so through different mechanisms. Although it does not explicitly limit any mortgage characteristics, the LTV ceiling, and CCyB are extra capital requirements on all ongoing mortgage loans and aim to target the LTV distribution of new loans. The CCyB requires banks to increase their capital, based on the risk-weighted assets (RWA) associated with residential mortgages.

Wang & Sun (2013) the case of China and conclude that while reserve requirements and housing-related policies can help mitigate procyclicality, They are insufficient to lower systemic risks. This suggests that more carefully targeted policies may be able to contain macro-financial vulnerabilities. The study by Altunbas et al. (2018) assesses the impact of macroprudential tools on bank risk indicators across a broad range of nations. The findings indicate that these tools, particularly those intended to improve banks' resilience, have a noteworthy influence on bank risk. According to other studies that also use bank-level data; applying macroprudential rules may have unintended consequences known as leakage effects [Aiyar, Calomiris, Wieladek, 2014].

Jiménez et al. (2017) investigated the impact of countercyclical provisions on credit growth in Spain and the real effects that followed. They discovered that while these provisions effectively reduced the effects of a credit crunch (because of the accumulation of capital buffers), they were less effective in containing the credit boom that preceded the crisis. Along the same lines, Mustafa and Mirza (2022) find evidence to support the idea that marginal reserve requirements and provisions have increased bank resilience through increases in solvency and liquidity buffers, while Lopez et al. (2018) find that countercyclical provisions in Colombia effectively helped reduce the amplitude of credit cycles. Furthermore, the latter offers proof of how the abovementioned regulations reduced ex-post bank credit risk by utilizing loan-level data.

Zhang and Zoli (2014) analyzed 46 countries, 13 of which were Asian, between 2000 and 2013, concluding that housing-related policies, particularly debt-to-income (DTI) and loan-to-value (LTV) caps, were effective in limiting the growth of credit in Asian countries, while this limiting effect was relatively low for other countries. Kuttner and Shim (2016) concluded that tightening the DTI cap resulted in a 4–7% reduction in housing loans in the subsequent year. Fendoğlu (2017) demonstrated that borrower-based instruments and required reserves are useful in moderating credit cycles.

Studies on Turkey have also revealed the empirical results in the literature on the detrimental and noteworthy effects of macroprudential policy on credit development. According to Kara et al. (2013), the asymmetric interest rate corridor is one macroprudential tool that can be used to manage credit growth by influencing credit spreads. Similarly, Bulut (2015) showed

that the interest rate corridor's uncertainty about the quantity of funds and fund expenses constraining impacted loans. Bumin, Taşkın and Dilvin Taşkın (2015) discovered a statistically significant negative correlation between consumer loans and the macroprudential policies implemented by BRSA. According to Ilhan et al. (2021), consumer loans were restrained by the BRSA's regulations about general requirements and maturity limitations. According to Alper et al. (2018), lending practices impact credit growth due to the reserve requirement policy.

However, further research into macroprudential regulation is needed to fully understand its implementation strategy and effectiveness. The efficiency of macroprudential policy and its underlying components in attaining the ultimate purpose of regulation, which is to improve financial stability by reducing bank systemic risk and procyclicality, has yet to provide consistent outcomes. The implementation and effectiveness of macroprudential policies have previously been studied in several articles [Altunbas et al., 2018; Apergis, 2017; Cerutti et al., 2016; Gaganis et al., 2019].

However, the advantages and disadvantages of macroprudential capital control remain primarily theoretical. Microprudential regulations continue to control commercial banks' capital requirements. While most scholars and regulators now agree that micro-prudential capital regulation alone is insufficient to prevent large-scale bank failures, the effects of preserving this regime in the face of systemic risk have not been well investigated. The majority of research on the effectiveness of microprudential capital regulation, which was conducted before the financial crisis, focuses on individual banks rather than the banking industry as a whole [McKeever, 2023]. By evaluating the risk that each financial institution faces as well as the amount of risk derived from each bank institution's performance outcomes, microprudential policy may be understood. The implementation of supervision or microprudential policies can mitigate the risk of financial instability by impeding the creation of a financial institution risk that may lead to the failure or bankruptcy of other financial enterprises [Fajriani, Sudarmawan, 2022].

This study uses microprudential policy, namely the capital adequacy ratio (CAR). Capital adequacy is defined as having enough capital to absorb losses and successfully avert banking business failures. Implementing regulations to guarantee that these institutions have adequate capital to assure the survival of a secure and efficient financial system that can withstand any predicted challenges ultimately protects banks, their clients, the government, and economy. The purpose of capital adequacy requirements is to safeguard depositors and other creditors from loss in the event of liquidation and to create a buffer against losses not covered by current bank revenues [Okon, 2022]. The quantity of capital that can successfully carry out the primary capital function of preventing bank collapse by absorbing losses was considered appropriate capital from a functional standpoint. The riskier the asset composition, the more capital is needed to maintain a certain degree of soundness and, consequently, the larger the capital adequacy needed to maintain solvency, as capital serves as a buffer against which to charge off losses. The capital adequacy ratio indicates that the bank has risky loans, and the bank should raise capital to keep up with the loans as these risk assets increase [Zulkhibri, 2018].

The Asia Pacific region's economic outlook remains strong, and the region continues to be the most dynamic region in the global economy, accompanied by a range of possible risks such as tightening global financial conditions, a shift towards protectionist policies, and increased geopolitical tensions. Given these uncertainties, macroeconomic policies must be conservative and aimed at building cushions and enhancing resilience. Policymakers also need to continue to push for structural reforms to address medium- and long-term challenges, such as population

aging and declining productivity, and to ensure that Asia can reap the full benefits of increased digitalization in the global economy.

Banking NPLs in the Asia-Pacific Region tend to increase, which is indicated by the increase in NPLs in the region. In 2018, the average NPL increased by 0.30%. Indonesia, Vietnam, and Thailand have the highest NPLs in Asia-Pacific [Dahl et al., 2019]. Unlike in other countries, the banking system in the Asia Pacific Region has been primarily deregulated and privatized by implementing Basel Accord III rules in the form of tightening capital to reduce credit risk [Andrle et al., 2017; Casimano, Hakura, 2011]. Capital cushioning and liquidity buffers significantly contributed to recovering and maintaining banking activities from risks after the financial crisis.

In contrast to previous studies [Bruno, Shim, Shin, 2017; Cantu, Gambarcota, Shim, 2020; Kim, Mehrota, 2019], this paper extends existing research by analyzing the effectiveness of macroprudential policies in controlling commercial banking credit risk in Asia Pacific countries after the 2008 crisis from 2012 to 2023. Other researchers have not used the capital conservation buffer (CCoB) instrument as a critical determinant in influencing bank credit risk. CCoB and the countercyclical capital buffer in Basel Accord III are essential indicators in the regulation of banking capital buffers. In addition, no similar research covers countries in the Asia-Pacific Region, where most previous researchers only conducted research within the scope of a particular country. The benefits gained from a broader research coverage can test whether macroprudential policies projected by CCoB variables can consistently control credit risk in the Asia-Pacific region.

This research also adds an institutional control variable, namely corruption, to credit risk in a country. The influence of corruption on banks' credit risk, particularly in developing nations where banks face significant non-performing loan (NPL) loads and pervasive corruption, it is higher levels of corruption in the targeted nations result in a higher number of bad loans rather than a decrease in loan defaults in the economies with higher lending rates and quicker growth rates. Because of these nations' existing bureaucratic structures, the public sector's hegemonic status, and the lack of transparency, corruption will likely impact the financial sector. Chen, Jeon, Wang, and Wu (2015) looked into how corruption affected banks' propensity for taking risks and discovered a continuous pattern linking higher levels of corruption to higher bank risk-taking. Additionally, this study demonstrated that monetary policy exacerbates the issue of credit risk and that the indirect effects of corruption also affect banks' risk. It also showed how corrupttion impedes economic growth in developing nations by misallocating loanable funds and has a greater effect on banks' propensity for taking risks as corruption worsens.

This study is divided into the following sections. A review of the literature and the formulation of hypotheses are presented in Section 2. The data and the study's empirical approach are described in Section 3. Section 4 summarizes the study's key findings and outcomes. Section 5 gives the study's conclusion.

Literature Review

This paper relates to several sections of the literature. Macroprudential policies emphasize prudential principles to assist central banks in limiting the presence of systemic risks that would weaken the performance of the financial system and impact the economic system in a country [Dumičić, 2017; Lombardi, Siklos, 2016]. Various macroprudential instruments help address procyclicality and daily exposures, and the macroprudential policy is one of the measures established by a central bank that the central bank uses to help banks manage credit risk. Since

the 2000s, macroprudential policies have been implicitly implemented. The purpose of macroprudential policy is to lower expenses arising from interruptions in financial services, including credit, insurance, and other payment services. According to the central bank, controlling systemic risk is the primary goal of macroprudential policy to maintain the financial system's stability as a whole. The Global Financial Crisis (GFC) of 2007–2008 highlighted the need for macroprudential intervention. Systemic risk is dangerous, and the Global Financial Crisis (GFC) of 2007–2008 is a stark reminder of this in a nation's financial system's stability.

Three pillars support the macroprudential policy framework: financial system stability, balanced and high-quality intermediaries, and economic and financial inclusion. Banking, economics, and Sharia finance are the three pillars of economic and financial inclusion. These three dimensions focus on the many tools the central bank uses, which apply to conventional and Sharia banks. The initial pillar centers on promoting equitable and superior intermediation in prospective industries. This pillar contains instruments related to credit, like the capital conservation buffer, which aims to cover losses on risky investments, Loan-to-Value (LTV) for property credit/financing, down payments for motor vehicles, and the Capital Conservation Buffer (CCoB), which is calculated as the weighted average of the buffers in effect in the jurisdictions to which banks have a credit exposure.

The capital conservation buffer, or CCB, ensures that banks accumulate capital reserves outside of stressful periods, which they can use to absorb losses during those times. The requirement is predicated on straightforward capital conservation guidelines meant to prevent minimum capital requirements from being broken. The bank must maintain a minimum Common Equity Tier I (CET1) of 5.5% (8% including CCB) and a minimum Capital to Risk-Weighted Assets Ratio (CRAR) of 9% (11.5% including Capital Conservation Buffer (CCB)). Basel III standards were gradually adopted beginning April 1, 2013. The concept of CCB was first presented in the International Basel III standards. The idea gained prominence after the 2008 financial crisis when big banks saw their capital rapidly depleting due to systemic stress. The Capital Conservation Buffer aims to protect against losses on high-risk investments. The purpose of the countercyclical capital buffer, which must be met, is to shield banks that only deal with the joint sector from potential equity losses. Banks that fail to maintain the countercyclical capital buffer that the capital conservation buffer requirement mandates will be subject to capital payment limits when dividends and share buybacks increase rapidly, thereby depleting the buffer and bonuses.

In addition to the statutory minimum capital requirement of 9%, banks must maintain a capital conservation buffer of 2.5%, made up of Common Equity Tier 1 capital. If the capital level drops below the designated level, banks should not distribute capital – that is, pay dividends or incentives in any manner. But, if losses eat away at their capital conservation buffer, they can still operate normally. As a result, the restrictions only apply to dividend distribution and have nothing to do with how banks operate. Banks should maintain capital buffers above the statutory minimum in good times or outside of stressful periods, which they can use to absorb losses during stressful times. Only in cases of systemic stress on the bank may CCB be withdrawn. Only when the bank has a clear plan to restore capital through internal capital accruals and by lowering the discretionary earnings distribution will drawdowns from the CCB be permitted.

A version of Basel II, known as Basel III, incorporates prudential measures to prevent a banking crisis. Similar to Basel II, Basel III is composed of three main pillars: (1) strengthening banks' capacity to withstand shocks brought on by financial and economic forces, regardless of where they originate; (2) enhancing bank governance and risk management; and (3) boosting

transparency and disclosure of banking data. The first pillar is the capital adequacy ratio, or CAR, which better represents and can foresee the numerous risks banks face. Credit risk, operational risk, market risk, and capital sufficiency can all be undermined by various threats. Risk management must become ingrained in the culture of the banking industry. Two primary elements might impact a bank's capital adequacy ratio (CAR): the quantity of capital it possesses and the quantity of risk-weighted assets (RWA) it owns. This is so because the weighted capital asset ratio (RWA) is the foundation for the capital ratio computation. Maintaining capital adequacy helps keep outside parties satisfied with the company's performance and ability to absorb losses. Anisa and Suryandari (2021) assert that a company's increased CAR level can draw in investors, thus impacting demand and driving up prices, ultimately increasing the company's worth.

Perhaps the most popular metric for evaluating credit risk and financial leverage is the loan-to-value (LTV) ratio, computed as the loan amount as a percentage of the transaction price of the collateralized property. Credit risk rises as the LTV ratio increases since the borrower's newly acquired property is a security for the loan. Practical credit risk assessment and control heavily depend on the LTV ratio to accurately reflect genuine financial leverage because of the narrow margin that separates the transaction price from the total amount of debt. In particular, the premise that the transaction price is an objective indicator of a property's collateral value is necessary for the validity of the LTV ratio as a credit risk indicator.

This study uses several macroprudential policy instruments, including CAR, CCoB, and LTV, adopted from other research [Bruno et al., 2017; Cantu et al., 2020; Wijayanti et al., 2020]. Banks must maintain CAR as the minimum capital requirement to cover possible losses due to banking activities. CCoB serves as a capital cushion for banks by supporting the risk of banking assets. CCoB is an additional layer of capital policy used when losses occur. The level of the CCoB ratio applied is Tier 1-based and is constantly recalculated for each capital distribution calculation. CCoB helps banks continue running their businesses when capital constraints and limitations occur. As a macroprudential policy, LTV controls the growth of property loans and the various risks that may arise.

The existence of credit risk disrupts the smooth operation of banks, especially on the liquidity side, which is the primary source of banking as an intermediary institution for creditors and debtors. NPL can be used to measure credit risk that can affect the country's banking system [Alshebami et al., 2020]. A high NPL value indicates that the bank is in an unhealthy condition. The level of NPLs owned by banks is caused by internal factors, namely the management system, and external factors, namely the decline in economic performance, so customers find it challenging to fulfill their installment obligations. Weak credit procedures, high markup spreads, poor lending principles, and a lack of supervision from policymakers can cause high NPL rates.

Nakatami (2020) investigated the impact of macroprudential policy using the LTV instrument on the banking crisis, especially credit risk, in 2008. The author concluded that macroprudential policy effectively reduced the banking crisis stemming from credit growth and LTV. A significant statistical coefficient value indicates this. However, LTV policy is not effective if the country does not have an inflation target and a capital control framework. Mauleman et al. (2020) analyzed the interaction between macroprudential policy and systemic banking risk and showed that macroprudential policy affects banking systemic risk conditions, especially bank credit and property sales.

Quint and Rabanal (2014) found that implementing macroprudential policies helped banks perform better and reduce losses through countercyclical spread loans. Cantu et al. (2020) analyzed the effectiveness of macroprudential policies in the Asia-Pacific region and found that they

play an active role in dampening credit growth in the household sector. Implementing macroprudential policies in the Asia-Pacific region based on bank size and liquidity conditions can reduce credit growth. Vatansever and Hepsen (2013) examined the determinants of bank NPLs in Turkey. With profit-based banking activities, encouraging the availability of capital to be used for business expansion encourages more unusual cyclical behavior, which allows banking losses to be more significant in periods of economic depreciation. Furthermore, Dadashova et al. (2018) researched the application of CCoB to macroeconomic conditions in the banking sector in Ukraine. They concluded that the policy could increase banking resilience, especially in financial conditions facing global uncertainty.

Hallissey et al. (2014) researched macroprudential instruments and credit risk and found that limiting property lending through loan-to-value (LTV) can reduce the risk of default. Banks will be encouraged to tighten or reduce LTV provisions by considering the risk of loss on default, which will ultimately dampen the mortgage demand cycle and build resilience in the banking sector and households. CCoB affects bank risk-taking in Canada, as Guidara et al. (2013) found still the compatibility of micro and macroprudential «through-the-cycle» approaches to capital adequacy may explain why Canada performed better during the 2008 global financial crisis. LTV can slow down credit growth but cannot improve procyclicality in Indonesia, but CCoB and RR can [Dana, 2018]. However, LTV has a significant and long-lasting impact on household debt and actual house values in Korea [Jung, Kim, Yang, 2017].

Zhang et al. (2018) have conducted research using the assessment results of individual macroprudential tools and group macroprudential tools, namely CCoB, RR, and LTV, to determine whether bank risk-taking behavior will be reduced by strengthening macroprudential supervision. In addition, the reserve requirement has the most enormous impact, followed by LTV and CCoB. Macroprudential policy is usually implemented according to the credit cycle; we specifically consider the credit cycle's function in the transmission mechanism of macroprudential policy [Bruno et al., 2017]. The credit boom increased the benefits of macroprudential policy on bank risk-taking, proving that macroprudential policy was implemented in China at the right time. To support the sustainability of the banking system, the central bank should further enhance the evaluation and supervision of macroprudential measures and implement appropriate mechanisms for different purposes and times, especially during the credit boom period. In addition, this study found that the Chinese commercial banking system is run with modest NPLs, indicating that most Chinese commercial banks have a low-risk appetite.

Our study also alludes to the growing literature on the effectiveness of the capital adequacy ratio as a capital requirement for non-performing loans. The literature shows that microprudential regulation does not significantly affect credit risk using NPL. Mustafa and Mirza (2022) and Barus and Erick (2016) state that CAR does not affect non-performing loans.

H1. The Capital Adequacy Ratio does not affect credit risk.

CCoB serves as a capital buffer for banks in supporting the risk of banking assets, and literature shows that a Capital Conservation Buffer continuously increasing bank capital buffer will not continuously reduce bank risk-taking [Neef et al., 2023].

H2. Capital conservation buffer does not affect credit risk.

Loan-to-value (LTV) is the ratio between the value of loans/financing granted by traditional and Islamic commercial banks and the value of the collateral in the form of property at the time of granting the loan/financing, based on the results of real estate valuation. Bian et al. (2018), Sasikirono et al. (2019), Behncke (2023), and Kim and Oh (2021) concluded that Loan-To-Value (LTV) affects Non-Performing Loans.

H3. Loan-to-value affects credit risk.

The impact of corruption on banks' credit risk, especially in less developed nations where banks are grappling with large non-performing loans (NPLs) and widespread corruption. Corruption has a significant effect on credit risk [Agarwal et al., 2020; Bahoo et al., 2019; Djalilov, Piesse, 2019; Houston, Jiang, Lin, Ma, 2014; Liu, Li, Guo, 2020; Son et al., 2020; Toader et al., 2017; Weill, 2011].

H4. Corruption affects credit risk.

The central bank uses interest rate increases as one tool to manage inflation. Excessive interest rates will limit demand, which will lower inflation. Low interest rates promote inflation and economic expansion. Interest rates have no impact on the likelihood of problematic financing, which suggests that raising interest rates is not the best way to increase lending.

H5. Interest rate does not affect credit risk.

Methodology

Data

This study uses cross-sectional data from 11 central bank countries in the Asia Pacific and nine time-series data from 2015 to 2023. The year selection is adjusted to the availability of macroprudential data at each bank. Meanwhile, the data collected is annual secondary data obtained from World Bank data, financial statements and reports from the Central Bank, and macroprudential regulations.

Variable Measurement

The prudential macroprudential policy stipulates various provisions regarding bank capital and liquidity, which can be used as buffers to absorb losses. This study uses CAR as a microprudential tool indicator to control banking minimum capital requirements. CCoB as macroprudential policy indicators based on the provisions set by the Basel Committee on Banking Supervision, where capital provisions are standardized for banks to determine how much liquid capital to maintain from their assets [Imani, Pracoyo, 2018; Junos et al., 2021]. LTV has been established as a macroprudential policy instrument based on lending. The LTV policy was the regulator's response to the 2008 crisis, caused by the explosion of property prices in America that brought down the entire economy and banking activities. LTV, as a credit policy, is mainly aimed at property loans. Loan to value in each country varies depending on the condition of public interest in property loans [Bian et al., 2018; Morgan et al., 2015; Sasikirono et al., 2019]. This study uses NPL as a measurement indicator or proxy for credit risk based on the risk-based bank rating method, which describes the value of credit failures caused by the inability of debtors to fulfill payment obligations following predetermined conditions. Therefore, a high NPL level indicates a considerable risk value and poor banking conditions [Imani, Pracoyo, 2018]. This study also looks at institutional variables, such as corruption, which is gauged by the Corruption Perception Index (CPI), which shows that the public disapproves of the government's efforts to combat corruption and vice versa. This study also included macroeconomic indicators as the control variable, which is the interest rate. Interest rates on loans to the finance and credit sectors fluctuate in response to the goals and requirements of monetary policy. The risk the relevant bank assumes increases with the loan amount extended. A bank's capacity to insure against the risk

of debtor credit failure can be determined using its non-performing loan (NPL) ratio. The degree of credit risk increases with the NPL level. One barrier to banks extending credit is the amount of non-performing loans (NPLs) [Rahmaningtyas, 2022].

Empirical model

The popularity of the time series model and the development of panel data methods have led to the idea of creating a panel data model by using the dependent variable's lag as a regressor in the regression. By introducing the dependent variable's lag as a regressor into the regression, the results will be biased and inconsistent when calculated using static panel data due to endogeneity issues, either the Random Effect Model (REM) or Fixed Effect Model (FEM) methodology. The Generalized Method of Moments (GMM), often known as the Method of Moments methodology, can be used to tackle this problem.

The System Generalized Method of Moments (SYSGMM) update by Blundell and Bond in 1998 and the First Differences Generalized Method of Moments (FDGMM) by Arellano and Bond are the two estimate techniques that are frequently employed in the GMM method. An effect from the previous year is shown as the explanatory variable in this dynamic panel model. Arellano and Bond developed the FDGMM technique in 1991; this model adds a lag for the dependent variable. When applying this method over a brief or small period of years, consistent estimators will be produced in cases where the number of persons is unlimited. Unlimited number of people during a short or limited period of years. The estimator that is employed may be more biased if there is a connection between the delays or if there are only a few periods. There's a chance the estimator was more biased. One can identify data bias by contrasting the PLS model with the coefficients of the lag variables, models FEM and FDGMM.

This study used the generalized method of moment (GMM) as a data analysis method and the Eview 9 software by Robert Hall. The First Difference Generalized Method of Moment (GMM) is a general technique for estimating parameters in statistical models. GMM is frequently applied to data with little distributional information. A time series that is tagged with forward values by one or more time steps. Using lag 1 in the GMM approach can result in estimators that are consistent. The research model for the influence of macroprudential policy on NPLs can be written as follows:

$$NPL_{i,t} = \beta_1 CAR_{i,t} + \beta_2 LTV_{i,t} + \beta_3 CCoB_{i,t} + \beta_4 Corr + \beta_5 LIR + \varepsilon.$$

NPLs are used as a proxy for measuring credit risk. CAR is used as a microprudential tool. LTV and CCoB are macroprudential policy instruments that maintain banking liquidity conditions and absorb possible risks. This study included the macroeconomic indicator of lending interest rate as the control variable. This study also included institutional variables, namely corruption. GMM is an estimator tool for the dynamic panel research model that includes the condition of the moment, where the moment condition is an expected value of the model parameter. GMM finds the parameters get as close as possible to the weighted sample moment condition [Kim, 2020].

Results and Discussions

Base result

Unit root test for time series data to detect unit root components and random walk trends in time series data. This study uses Levin, Lin, and Chut, and Im, Pesaran, and Shin's W-stat methods to analyze the unit root condition of the data. The stationarity condition of the data is compared with the error degree of 5% (= 0.05).

Suppose the probability value of the variable is above the 5% error degree. Then, the related variable has a unit root, or the data is not stationary. Conversely, if the probability result of the variable is below the 5% error degree, then there is no unit root in the related variable, or the data is stationary. In the first testing stage, all variables are tested at level 1. If one variable is not stationary, the data is tested again in the first or second condition until all variables are stationary. Table 1 describes the unit root test results using Levin, Lin, Chut, Im, Pesaran, and PP Fisher.

Table 1.

Unit root-level test results

Variable	Level		
	Probability Levin, Lin, and Chut	Probability PP-Fisher Chi-Square	Expl
NPL	0.0000	0.0001	Stationary
CAR	0.0002	0.0000	Stationary
CCoB	0.0000	0.0000	Stationary
LTV	0.1269	0.4881	Non-stationary
Corruption	0.0001	0.0168	Stationary
LIR	0.1721	0.1507	Non-stationary

Based on the results of Table 1, the Capital Conservation Buffer (CCoB) and Lending Interest Rate (LIR) were in a non-stationary condition at the level of the research variable. The research was continued by testing the unit root test at different levels. Table 2 describes the unit root test results through the first different levels.

In Table 3, it can be seen that all research variables are stationary with a probability of 0.00. At a significance level of 5%, all variables have passed the unit root problem. The Pedroni test (Pedroni Residual) Cointegration Test is used in this study's panel data cointegration testing, which employs a residual technique. Comparing values is one method of determining whether or not cointegrated data is present in this study. Critical values for the Pedroni test probability are 1%, 5%, and 10%. The data is cointegrated if the Pedroni test probability exceeds the critical threshold. Table 3 describes the cointegration test results.

Table 2.

Unit root 1st different test result

Variable	Level		
	Probability Levin, Lin, and Chut	Probability PP-Fisher Chi-Square	Expl
NPL	0.0000	0.0000	Stationary
CAR	0.0000	0.0000	Stationary
CCoB	0.0000	0.0000	Stationary
LTV	0.0117	0.0307	Stationary
Corruption	0.0000	0.0008	Stationary
LIR	0.0000	0.0000	Stationary

Table 3.

Cointegration test result

Method	Statistics	Probability
Alternative Hypothesis (Ha): Common AR Coefsion (within- dimension)		
Panel PP-Statistic	–12.3382	0.0000
	–3.01908	0.0013
(Ha): Individual AR Coefsion (between dimensions)		
Group PP-Statistic	–7.63521	0.0000

It is known that all indicators of the cointegration evaluation criteria are above the significance level of 5% and 10% based on the table of Pedroni test findings above. This issue demonstrates that the research variables are cointegrated, i.e., there are long-term linkages between the variables that would imply equality and balance. According to research by Saeed Ass Khan and Abbas (2016), data is considered cointegrated when it can be used to conclude. The data is deemed cointegrated if the majority of results (more than 50% of the criteria) from the Pedroni test criteria are significant (less than the critical value). After all the conditions of the research variables were stationary, the generalized method of moment analysis was carried out to see the effect and effectiveness of macroprudential policy in controlling credit risk.

GMM estimator result and discussion

This study used the GMM analysis method to analyze the effect and effectiveness of capital and credit-based prudential policy instruments in controlling the NPL level in the Asia-Pacific Region. Table 4 presents the GMM test results.

Table 4.

GMM test results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NPL(-1)	0.493936	0.06417	7.697298	0.0000
LTV	0.047493	0.025537	1.859741	0.0661*
LIR	0.383542	0.360181	1.06486	0.2897
CAR	1.040706	1.046395	0.994563	0.3225
COC	8.27E-05	3.28E-05	2.523687	0.0133**
CCoB	3.305189	2.382051	1.387539	0.1686

Note: *– significant in 10%; ** – significant in 5%.

LTV is a macroprudential policy launched in response to the 2008 crisis, aiming to control credit, especially property loans. Based on the results of LTV testing, the value of the NPL variable has a positive and significant influence. The increase in LTV will increase the condition of Non-Performing Loans. The borrower's property acquisition acts as collateral for the loan. Thus, as the LTV ratio rises, so does the credit risk. The likelihood of negative equity – when the property's value falls below the amount owed on the mortgage – increases with a greater LTV ratio. Defaults thus become more probable. Corruption has a positive and significant influence on the value of the NPL variable. The increase in corruption will increase the condition of Non-Performing Loans. The impact of corruption on banks' credit risk, especially in less developed nations where banks are grappling with large non-performing loans (NPLs) and widespread corruption throughout society.

The Arellano Bond test (AB test) and the Sargan test are further tests that must be performed to test the model specifications after the generalized technique of the moment test. The Arellano Bond Test, often known as the AB Test, is used to assess the consistency of the estimated findings before employing the Arellano-Bond statistic to test for autocorrelation. This test's AR(2) probability value must be greater than the 5% (0.05) significance level. To find the number of instrument variables that are more than the number of estimated parameters, the Sargan test is used (overidentifying constraints condition). The significance value of 5% (0.05) must be exceeded by the probability value (J-Statistic).

Table 5.

Arellano-Bond test results

Test order	m-Statistic	Rho	SE(rho)	Prob.
AR(1)	–0.88574	–13.9165	15.71182	0.3758
AR(2)	–0.01287	–0.67837	52.70533	0.9897

Based on the results in Table 5 above, the AR(2) probability value is above 5% (0.05) significance, which is 0.9897, indicating that the estimation results are consistent.

Table 6.

Sargan test results

Mean dependent var	0.010137	S.D. dependent var	0.665711
S.E. of regression	0.8135	Sum squared resid	61.54582
J-statistic	4.398645	Instrument rank	11
Prob(J-statistic)	0.493558		

Based on the results in Table 6 above, the probability (J-statistic) value is above 5% (0.05) significance, which is 0.493558, indicating that the instrument is valid.

Discussion

A greater LTV ratio indicates that, in the event of failure, the collateralized property is less likely to sell for enough money at a foreclosure auction to pay off the outstanding loan total, past-due payments, and other foreclosure-related expenses paid by the lender. Loss as a result of default will thus be larger. Real estate is considered more «collateralizable» than most other asset types, and real estate ownership is frequently accompanied by relatively high LTV ratios [Bian et al., 2018; Ranisavljević, Hadžić, 2016].

The application of LTV has a stronger interest in property loans and affects the risk of banking property loans. LTV policies in each country will differ depending on each property's risks. When tightening the LTV, the bank will provide a lower property valuation so that the debtor provides higher installments and down payments on the property to meet the required criteria. Indirectly, this determination will improve credit quality and suppress NPLs [Kinghan et al., 2022; Sasikirono et al., 2019]. For countries with high interest in property loans, tightening loans to value will be effective when balanced with high economic activity to suppress banking NPLs. The results of this study were in line with the credit default theory, which explains that banks need control tools to understand risk and manage risk levels.

The greatest level accessible in the market at the time of origination significantly impacts the evolution of originating LTV. Recent initial LTV levels have decreased considerably, primarily due to a change from values above 90% to those between 80% and 90%. The comparatively higher percentage of first-time purchasers after 2010 may help to explain this since many mortgage holders suffered negative equity after that year, raising the cost of changing homes. Although there is no universal agreement on what defines an LTV that is «too high» at the time of loan origination (in actuality, this will depend on the specific borrower's circumstances) [Hallissey et al., 2014], the tightening of LTV will increase the level of risk faced by banks because property values will decrease. In this condition, the level of banking losses is even more significant, especially in property assets that are the bank's collateral. The results of this study contradicted the research of Yao and Lu (2019), which concluded that there was a negative relationship between LTV and NPL. Table 6 indicates that the magnitude of the previous year's NPL had a positive and significant influence, indicating a lack of proper banking policies or regulations addressing the previous period's NPLs.

Given that corruption contributes to social and economic issues, social scientists have found corruption to be a significant concern. The government enacts regulations to combat cor-

ruption, but creating and enforcing these rules has an accounting cost. Results from such an effort must be positive in the form of socioeconomic progress. Huang (2016) finds that corruption significantly influences Asia-Pacific's economic development. Studies on corruption and economic development have changed over time, with the most recent research focusing on how corruption affects financial development. Economic development is significantly influenced by financial development. Bolarinwa and Soetan (2019) report conflicting results about the effect of corruption on bank profitability in developing nations; however, they affirm that corruption benefits wealthy nations.

Tabish and Jha (2012) examine the connection between fair punishment, standard operating procedures, and corruption-free indicators. The study concludes that corruption decreased as a result of just punishment. One of the important factors contributing to decreased corruption in a community is justice without discretion. Maintaining one's distance from corruption requires adhering to ethical principles. According to Hassan et al. (2021), the public investment sectors of infrastructure and capital-intensive projects are more corrupt than the health and education sectors. Rent-seeking is more prevalent in the defense and infrastructure sectors than in the health and education sectors. To analyze the misallocation of NPL and the connection between these institutions' administrative structures and corruption, it is crucial to examine the organization of financial institutions, particularly the banking industry. After examining the stability of Islamic banks, Bougatef (2015) finds a significant correlation between NPL and corruption. The economy's financial sector ensures that financial resources are allocated effectively within the financial system and that financial institutions meet the needs of both domestic and international investors. The degree of confidence that foreign investors have has disastrous effects, particularly for developing economies where non-performing loans would become a significant source of gambling. The number of non-performing loans can increase or decrease depending on several factors, including information sharing, the bank's ownership structure, corruption, and macroeconomic and bank-specific variables. Among these, corruption is a key element affecting the non-performing loans. Corruption is a significant factor in rising non-performing loans in emerging nations.

Based on this research, it is evident that managing credit risk in a nation involves the banking industry and the collaboration of the government's fiscal sector. The study is significantly impacted by two variables: loan to value and corruption. As a macroprudential policy, loan-to-value is commonly used to evaluate credit risk and financial leverage. It is computed by dividing the loan amount by the collateralized property's transaction price. The borrower's recently purchased home serves as the security for the loan. Thus, as the LTV ratio rises, so does the credit risk. Given the narrow buffer that exists between the transaction price and the total loan amount, the loan-to-value ratio (LTV) is a crucial instrument for appropriately assessing and managing credit risk. The makeup of the administration largely determines the level of bad debts and corruption. Corruption leads to a rise in bank lending, even though potential profits are lower in industrialized and developing nations. Banks operating in severely corrupt situations utilize income-smoothing tactics to control their positive returns. These findings call for more research on the connection between credit risk and insider trading in the banking sector.

Conclusion

Macroprudential policy instruments effectively manage credit risk in banks in the Asia Pacific Region. Based on the study results, it can be concluded that the loan-to-value instruments

positively and significantly impact non-performing loans. Increasing the level of loan-to-value will increase public interest in owning property loans, and it will also simultaneously increase risk. The increase in loan value will reduce property prices and increase demand for property. The uncontrolled growth of property loans will cause the bubble price of houses to explode and increase the risk of default. Corruption instruments positively and significantly impact non-performing loans. Increasing corruption problems in a country will increase credit risk. High levels of corruption will reduce public trust in institutions. On the other hand, the government must also maintain the condition of corruption problems in each country because the existence of corruption will hinder economic growth. For the banking industry, which is based on trust in banking consumers, corruption problems will affect banks' trust levels.

This study recommends a need for proactive prudential policy, considering that currently, almost all countries face the COVID-19 pandemic. This pandemic has reduced banking performance, and the risk factors faced are getting bigger, not only on the credit side but also on banking liquidity conditions. In addition, the use of macroprudential policy can accelerate the transmission process in the monetary sector. Banks, especially the central bank that carries out two policies, namely prudential and monetary, need to align the objectives of the two policies in facing economic uncertainty in the era of the COVID-19 pandemic. An increase in the precautionary principle is also needed to deal with various speculations due to procyclical action.

The implementation of macroprudential policy is not only aimed at absorbing losses experienced by banks but also aimed as a form of banking defense and determining the health condition of banks. Banking performance based on trust needs healthy banking conditions regarding capital, liquidity, operations, and internals. The capital adequacy ratio, as an indicator of banking capital, is intended as a capital reserve to cover and absorb losses. On the other hand, this determination maintains banking liquidity conditions by forcing banks not to use all capital for business expansion. Still, it can also be used to finance sound risk management.

The loan-to-value policy will work based on economic conditions and banking liquidity. In tightening LTV, banks give lower property valuations and apply higher installments. With this policy, the down payment on the property will be higher, and the debtor can only fulfill it. This condition will differ from credit easing, reducing property prices, and attracting public interest in housing credit loans. With the aim of money circulation, it is expected to be stable in its original condition. Stable money circulation conditions in all sectors will be positive and run as expected by regulators. Based on the above explanation, the emergence of macroprudential policy has positively influenced the global banking system. Moreover, it can be seen that macroprudential policy has become very effective in absorbing losses. It is also coupled with other policy alignments to absorb and reduce sources of risk.

This research allows the government, politicians, and bank regulators to use this study to help them create pertinent regulations. Bank regulators should provide an effective system for monitoring loan activity to lower credit risk and boost public confidence in banking. Additionally, the reason for the increase in banking performance can be the stability of the financial banking system. By doing this, prudential policy – particularly Basel III – will be established, enabling banks to sustain liquidity conditions despite fluctuations in the overall economy. Government officials must also confront the corruption problem and create anti-corruption measures to win over investors. Banks will be able to draw in more deposits in this way, which will eventually help the banking sector grow. One policy conclusion of funding risk is that macroprudential policy should be under control, and all financial authorities should work together to enhance their effective lending for client deposits to provide stable conditions.

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Имеет ли макропруденциальная политика значение для управления банковским кредитным риском? Данные коммерческих банков Азиатско-Тихоокеанского региона

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Мировой финансовый кризис вызвал дискуссию о плюсах и минусах использования макропруденциальной политики в качестве инструмента пруденциального контроля, который включает резервы капитала или требования для устранения системного риска, финансовых кредитных циклов и целей макроэкономической стабилизации. Макропруденциальная политика в настоящее время прочно утвердилась в качестве области финансовой политики, призванной остановить принятие чрезмерных рисков в финансовом секторе и уменьшить их последствия для реальной экономики в ответ на уроки, извлеченные из мирового финансового кризиса. Целью исследования является проверка эффективности инструментов макропруденциальной политики в контроле общего банковского кредитного риска в Азиатско-Тихоокеанском регионе в период с 2012 по 2019 год. В качестве инструмента анализа в исследовании использовался обобщенный метод момента (GMM). Анализ показал, что инструменты макропруденциальной политики эффек-

тивно управляют кредитным риском в банках Азиатско-Тихоокеанского региона. По результатам исследования можно сделать вывод, что инструменты «Коэффициент достаточности капитала» и «Ссуда к стоимости» положительно и существенно влияют на необслуживаемые кредиты, как индивидуально, так и в глобальном масштабе.

***Ключевые слова*:** коэффициент достаточности капитала; буфер консервации капитала; стоимость кредита; кредитный риск; GMM.

Подписано в печать 14.03.2025. Формат 70×100 $^{1}/_{16}$.
Печ. л. 11,0. Тираж 150 экз. Заказ №

Отпечатано в ООО «Фотоэксперт»
109316, Москва, Волгоградский проспект, д. 42