Research article

Bank lending behaviour and macroeconomic factors: A study from strategic interaction perspective

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HIGHLIGHTS

• The effects of the interaction of macroeconomic factors (specialized in GDP growth and policy interest rate) with the strategic interaction on bank lending behaviour are examined.
• Banks competing in strategic substitutes will restrict lending activities in periods of economic expansion.
• The impact of monetary policy shocks on bank lending behaviour is less pronounced under a less competitively aggressive environment.

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ABSTRACT

This study investigates the moderating role of strategic interaction on the relationship between bank lending and macroeconomic factors, using panel data on Vietnamese commercial banks over 2008–2018. We find that the effect of macroeconomic and monetary policy shocks on bank lending behaviour is less pronounced when banks engage in a less competitively aggressive environment. The study contributes to the literature of bank lending by incorporating macroeconomic environment and micro (strategic interaction)-level to analyze the lending behaviour of an individual bank. Since the analysis of macroeconomic factors alone is insufficient to explain the aggregate relationships in the model of banking, understanding the nature of strategic interaction is essential to predetermine how bank lending behaviour relates to the transmission mechanism of monetary policy.

1. Introduction

Since the 2008 financial crisis, there has been a renewed interest in studying the role of bank lending in the money creation process. The money creation of the commercial banks is considerably mentioned in the Credit creation theory with various constraints such as regulatory factors, credit demand, the behaviour of non-banks (money holders - household and business), and the need for an individual bank to lend profitably (Bundesbank, 2017). Another strand of literature – the credit channel – argues that bank lending activities are both affected by credit demand (the balance sheet channel) and supply sides (the bank lending channel) (Nguyen et al., 2020). Much of the existing studies have emphasized the impacts of macroeconomic conditions (Jimborean, 2009; Nguyen et al., 2020; Sanfilippo-Azofra et al., 2018), and bank-specific characteristics (Vo et al., 2020; Vo, 2018; Nguyen and Boateng, 2013; Gambacorta and Mistrulli, 2004; Beutler et al., 2020) on bank lending. However, the literature has been scarcely explored how the macroeconomic conditions are interlinked with the microeconomic behaviours (micro-foundations research) to explain bank lending behaviour. The rationale is that the multi-bank system approach revived from Keynesian banking analysis suggests the need to incorporate the macroeconomic framework with micro-foundations in order to explore the aggregate relationships in the model of banking (Dymski, 1988; Dymski et al., 2008). As one of the microeconomic behaviour research themes, strategic interaction plays a key role in determining aggregate market outcomes (bank loans, in the context of this study) (Sutton, 2001). Therefore, it is essential to consider the nature of strategic interaction to explore how changes in macroeconomic factors (specialized in GDP growth and interest rates) affect bank lending. In this research, we use the term “strategic interaction” in the context of bank lending to denote the

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responiveness of the change in a bank’s marginal profits to its own management’s strategic decision in loan expansion, concerning its rivals’ change in balance sheet positions (Sundaram et al., 1996; Dymski et al., 2008; Keynes, 1930). We bifurcate strategic interaction into strategic complements and strategic substitutes based on how aggressively a bank reacts to rivals’ strategic moves (loan volume, in our context) (Bulow et al., 1985). This study attempts to lend a strategic interaction perspective from the lens of the post-Keynesian approach. Specifically, strategic interaction plays a moderating role in bridging between economic growth and bank lending, which is new and our main interest in this paper. Although economic booms may abet some banks to expand their loan strategies, these strategies will differ across banks. Banks with less aggressive strategies tend to conservatively make loans and restrict their lending activities in response to economic upturns compared to those with aggressive strategies. That is, the efficacy of economic booms on bank lending behaviour is weaker when banks compete in a less aggressive environment. Banks who follow conservative strategies will choose a safety target and restrain the lending activities when they judge adopting the same credit expansion strategy could drag them into a battle for loan downgrade during economic booms. In other words, these banks think that they are already competitive and expose risks enough without efforts to make more loans.

In addition, this study also demonstrates the mechanism in which strategic interaction hampers the bank lending channel. This is in line with the arguments that banks with strategic substitutes absorb more reserves from others, and hence, become more liquid and more flexible in response to monetary shocks. This study finds that the impact of economic booms on bank lending behaviour is weaker when banks compete in a less aggressive environment. Moreover, the bank lending channel in Vietnam is evidently less pronounced for banks competing in strategic substitutes. These findings imply that the interaction between macro (structural) environment and micro (behaviour) level adjusts the individual-bank credit expansion. This study thus contributes to the literature on two fronts. First, our study extends the Keynesian theory of multi-bank system and credit creation theory by incorporating the nature of strategic competition into bank lending behaviour. Second, it sheds light on the role of strategic interaction on credit demand channel (or balance sheet channel) and credit supply channel (or bank lending channel). Specifically, the relationship between bank lending and the macroeconomic factors (specialized in GDP growth and policy interest rate) is contained by banks’ strategic competition.

The banking industry of Vietnam provides a fertile laboratory to investigate the moderating role of strategic interaction on the relationship between macroeconomic conditions and banks’ loan expansion. This is because the Vietnamese banking system is characterized by the highly active interbank market (Sarath and Van Pham, 2015), and hence, banks can easily adjust their net interbank lending. In this context, banks easily lend or borrow through the interbank market and feasibly reach two polar approaches to bank lending strategies. Given the highly active interbank market, strategic interaction based on the multi-bank system approach, rather than bank reserves (that easily adjusted through the interbank market), is crucial to shaping banks’ lending behaviours. Over the past decade, Vietnamese banks have been gradually restructured towards liberalization and more competitive following the World Trade Organisation Accession Process in 2007. It is interesting to see how banks countervail to stay competitive in loan-market share when the behaviour of individuals is largely determined by the nature of competition. Figure 1 (A, B) shows the lending and deposit rates over the last ten years in ASEAN. Compared with other countries in ASEAN, such as Thailand and Malaysia with the lending interest rates around 5% and the deposit rates around 1.5%–3%, the interest rates in Vietnam are higher but still at a relatively reasonable level with the macroeconomic conditions. Because Vietnam has lower credit ratings and higher inflation expectations than those countries, the interest rate levels must be correspondently higher to compensate for the risk. In the past ten years, interest rates in Vietnam have been cut many times, while other countries (Thailand and Malaysia, for example) have kept their interest rates stable. Despite not being cut to 0% (like the case of the United States), Vietnam interest rates in recent years are much lower than the average of the prior period (i.e., 2008–2011). In fact, the SBV informed the reduction in interest rates to stimulate economic growth as well as to help commercial banks cut operating costs and risks. As can be seen from Figure 1 (A, B), in comparison with the period of 2008–2011 with the highest lending rate up to 17%, the average lending rate in 2015–2018 is considerably lower and revolves around 7%. It can be inferred that Vietnam has experienced a low interest rate environment, thereby offering a fruitful context to study the monetary policy transmission. Standing accused of one cause of the 2007–2008 financial crisis, the low interest rate environment tends to induce aggressive lending and risk-taking behaviours.

The remainder of this study has the following structure. Section 2 reviews the literature and Section 2.2 develops the hypotheses. Section 4 presents data collection and econometric models. Section 5 discusses the main estimation results and robustness tests. Finally, Section 6 concludes this research.

2. Literature review

2.1. The multi-bank system approach: the post-Keynesian approach

The multi-bank system approach posits that the credit expansion decision of an individual bank does not only depend on its own management decision but also is determined by its competitors’ output (Dymski et al., 2008). Banks decide their strategic moves in credit expansion by responding to rivals’ moves. The multi-bank approach proposed by Wallace and Karmel (1962) underscores a central proposition in Keynesian economics. The Keynesian and post-Keynesian idea about banking is famous for commenting “bankers would rather hang together than hang separately”. In other words, each bank implicitly does so at the same rate or bases its credit-expansion decisions on the average behaviour of other banks, when the whole banking system expands credit (Kregel, 1997). However, Dymski et al. (2008) criticized that Keynesian and post-Keynesian ideas about banking still have some points that need to be considered more carefully in practice. The assumption that banks have little customer information under the Keynesian school is unrealistic. Therefore, a multi-bank system framework of strategic diversity in which each bank decides on how much to loan its borrowers taking into consideration its willingness to take risk is introduced (Dymski et al., 2008). In this approach, it is apparently a bad option to imitate the average lending behaviour of other banks. In line with credit creation theory, banks try to protect themselves against liquidity and credit risk; therefore, they will choose the best strategy “not imitate others/not follow the leader” (Dymski et al., 2008). Dymski et al. (2008) pointed out banks have different strategic behaviour over loan expansion instead of “hanging together”. A bank is categorized into “aggressive

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1 See more: WTO | Accessions: Viet Nam (https://www.wto.org/english/thewto_e/acc_e/a1_vietnam_e.htm)

2 According to Decision 203/QĐ-TTĐT, the SBV’s National Credit Information Centre (CIC) “decided to reduce the prices of its credit information products and services given to credit institutions and foreign banks’ branches in Vietnam by 15 percent”. Read more: “Banks get more support to cut interest rates”, Vietnam News (The National English Language Daily), 04 Oct 2019.

3 According to credit creation theory, one of the key factors binding bank lending behaviour is managing the risks associated with making additional loans (See more: Tobin, J. 1963. Commercial banks as creators of money. Cowles Foundation for Research in Economics, Yale University, Mcleay RADIA, A. & THOMAS, R. 2014. Money creation in the modern economy. Bank of England Quarterly Bulletin in Q1 [Online]. Available: https://ssrn.com/abstract=2416234.)
banks”/“conservative bank” according to the direction of its and the rivals’ strategic moves. Specifically, a bank that sets a credit expansion target by rising its leverage index and simultaneously lowering its liquidity index (willing to expose to more risk) is defined as an aggressive bank (Dal, 2020). Conversely, a bank that sets a liquidity index target by determining an acceptable liquidity-risk level and restricting loan-market activity is a conservative bank. These two types of banks respond differently to economic conditions. Dymski et al. (2008), Loizos (2020) emphasize that banks adjust their strategic behaviour over loan expansion with respect to cyclical upturns and downturns. It can be concluded that the work of Dymski et al. (2008) conceptualizes the idea of strategic interaction among banks in credit expansion. “Aggressive” banks will extend lending, while “conservative” banks will limit lending during an economic expansion. Such opposite moves are referred to as competing in strategic substitutes and corresponding to a negative competitive strategy measure (CSM). However, no study has attempted to empirically analyze the interaction term between macro (structural) environment and micro (behaviour)-level affects individual-bank credit expansion. The goal of this study is therefore to fill this gap in the literature.

2.2. The credit creation theory

According to the credit creation theory, commercial banks are not merely the intermediate institutions buying and selling money (lending against deposits) but also the creators of deposit money (McLeay et al., 2014). This theory states that capital adequacy (theoretically supported by the financial intermediation theory) and reserve requirements (theoretically supported by the fractional reserve theory of banking) are no longer suitable for regulating bank lending behaviour. For example, the case study of Credit Suisse during the crisis 2008 illustrates that banks can individually create their own capital “out of thin air”, thereby rendering nonsense of regulations via capital adequacy (Werner, 2016). Even though commercial banks can create money “out of thin air”, they do not have a “widow’s cruse”. This means that they cannot practically create money without constraints (Tobin, 1969).

Constraints on credit creation include the demand for loans in the real economy, bank regulation (Botos, 2016), the banks’ own desire to make profits (the willingness of the banks) considering the market competition and risks (McLeay et al., 2014), and the interplay between decisions by banks and non-banks (Bundesbank, 2017). The recognition of the veracity of the credit creation theory urges us to pay more attention to the factors related to the willingness of the banks to create credit (constraint arising from the competitive behaviours between banks) which has been unduly neglected by many researchers. This gap can be filled when putting in the scenario of strategic interaction between players/banks in a lending market. That is, the willingness of the banks to create more credit also depends on the nature of rivals’ reactions.

2.3. The bank lending channel

Research on bank lending behaviour mainly focused on the bank lending channel, e.g., Beutler et al. (2020), Sanfilippo-A佐ra et al. (2018), Bernanke (2007) show that the main factor in determining banks’ credit supply is monetary policy. The transmission mechanism of the bank lending channel is as follows: when the expansionary policy stimulates loans, it will increase the access to banks’ loanable funds; conversely, a contractionary monetary policy that involves decreasing in banks’ loan supply hinders borrowers to access banks’ loanable funds (Sanfilippo-A佐ra et al., 2018). There is vast empirical research on the bank lending channel in developed countries (Matousek and Sarantis, 2009; Altunbas et al., 2002; Huang, 2003) and developing countries (Sanfilippo-A佐ra et al., 2018; Yang and Shao, 2016; Khan et al., 2016). With a special focus on developing countries, Sanfilippo-A佐ra et al. (2018) state that the bank lending channel is significant since these countries have higher dependence on bank financing and the bank funding heavily relies on deposits. When policy induces interest rates to rise, bank lending decreases due to a corresponding fall in the bank’s core deposit base (Altunbas et al., 2009b). It is argued that firms hardly diversify their financing sources in countries with low financial development. Therefore, credit demand in developing economies is more influenced by monetary policy shocks than in developed economies (Brissimis and Delis, 2009).

Previous studies using aggregated data have been criticised for suffering from a severe identification problem that fails to disentangle the effects of credit supply from those of credit demand (Kashyap and Stein, 1995). Therefore, following Kashyap and Stein (1995), most studies have employed bank-level data to investigate the effects of monetary policy and bank-specific characteristics on credit supply. For example, using the sample of the Chinese banking system, Nguyen and Boasteng (2013) indicate that large and liquid banks are likely to expand

![Figure 1. (A) Lending and (B) Deposit rates in ASEAN countries (%) - Source: International Monetary Fund Data (IMF Data).](image-url)
their credit supply, while Yang and Shao (2016) find that high liquidity but not size can help banks to buffer their lending against monetary shocks. Despite mixed results for the effect of bank size, it is noteworthy that most empirical studies on the bank lending channel suggest that more liquid banks are more able to insulate their credit supply from monetary policy shocks (Vo and Nguyen, 2014; Altunbas et al., 2009b; Kashyap and Stein, 2000; Matousek and Sarantis, 2009; Sanfilippo-Azofra et al., 2018). The review of the literature on bank lending channel suggests that the documented determinants of bank lending scarcely discuss how the interaction between macro (structural) environment and micro (behaviour) level shifts bank lending behaviours. This is the gap this study would like to fill in.

3. Hypothesis development

The review of the literature on the credit creation, strategic interaction, and the multi-bank system approach suggests the need to incorporate strategic interaction (micro factor) and the macroeconomic factors (specialized in GDP growth and policy interest rate) into a single framework for analysing bank lending behaviour. Ignoring the strategic interaction could lead to incomplete and erroneous conclusions about the credit demand and supply channels since strategic interaction plays a key role in determining market outcomes.

Evidently, economic growth favors credit expansion. GDP growth can be found as an important driver of the demand-effect on bank lending behaviour (Yang and Shao, 2016; Khatat and Shabsigh, 2016). In the period of the economic boom, the increase in credit demand will induce banks to expand correspondingly the supply of loans. Reversely, in the period of the economic depression, lower credit demand and higher possibility of non-performing loans will constrain credit availability (Jimborean, 2009; Vazakidis and Adamopoulos, 2009; Sanfilippo-Azofra et al., 2018; Vo, 2018; Al-Kilani and Kaddumi, 2015; Khan et al., 2016). However, macro-foundational analysis alone is insufficient to explore the aggregate relationships in the model of banking (Dymski, 1988; Dymski et al., 2008). Since analysis of microlevel bank behaviour can delineate “about those units’ reactions to changed circumstances and about the momentum of the system as a whole” (Dymski, 1988), the impact of macroeconomic conditions on bank lending will be alleviated by the nature of strategic interaction. In response to rivals’ credit expansion strategy, some banks would accommodate such aggressive moves in lending by “staying put” and become more conservative. This situation, in microfinance, is referred to accommodating/complaisant competition or strategic substitutes (Sundaram et al., 1996). The motivation behind being conservative reveals how strategic substitutes attenuate the positive impact of economic growth on bank lending. Being conservative helps banks to avoid not only a decline in marginal profits due to the effects of competitive interaction (Bulow et al., 1985; Sundaram et al., 1996) but also greater liquidity and credit risks arising from the multi-bank system approach (Dymski et al., 2008).

Regarding the effects of competitive interaction, in a duopoly, Bulow et al. (1985) demonstrated that the optimal reaction by firm A is to be accommodating (aggressive) when firm B behaves aggressively with strategic substitutes (strategic complements). Following this, banks are not always in the race of credit booms in favor of rapid economic growth, but prudently modify their lending behaviour in accordance with their strategic interaction. If the competition is in strategic complements, banks prefer expanding credit aggressively in response to the high demand for credit associated with a high GDP growth rate. If the competition is in strategic substitutes, banks judge that adopting imitation strategies (i.e., increasing loan volume at the same rate) will reduce their marginal profits, and hence, banks decide to constrain their lending activities. Hence, it is hypothesized that GDP growth has an asymmetric effect on bank lending owing to the nature of competitive interaction.

Regarding the multi-bank system approach, Dymski et al. (2008) introduced a banking system containing two duopolistic banks – an aggressive (bank A) and a conservative (bank B). As the loan volume of bank A grows in response to economic booms, bank B also increases its loans due to the increase in the money multiplier (Dymski et al., 2008). However, the actual bank B’s loans depend on how it reacts to bank A’s credit expansion strategy. Bank B, as assumed to be conservative, accommodates bank A’s strategic moves by restricting lending activity. This reflects bank B’s strategic choice as it picks a safety target and then limits its loan expansion accordingly. It must be recognized that such strategic moves are referred to as competing in strategic substitutes. Therefore, the nature of competition interaction – whether the competition is aggressive or conservative – affects the procyclicality of bank lending. Bearing the effects of competitive interaction and the multi-bank system approach in mind, this research examines whether conservative banks, which prioritize the “safety first” strategy, restrict lending activities even in the period of the economic boom while aggressive ones prioritize their loan expansion.

**Hypothesis 1.** Loan growth has a negative relationship with the interaction of GDP growth and strategic substitutes.

We further argue that if banks have the conservative rhythm of loan expansion, they will gain reserves from aggressive banks (Dymski et al., 2008), and, therefore, might be less financially fragile/more liquid than aggressive banks. Existing literature shows that the impact of monetary policy on bank lending behaviours is weaker for banks with more liquid/higher ratios currency (held as reserves) to assets (Kashyap and Stein, 2000; Peek and Rosengren, 2010; Buch et al., 2019). This argument goes that more liquid banks are better equipped with liquid asset structures and have lower illiquidity risk, so these banks are immune to monetary policy shocks (Acharya and Naqvi, 2012; Janjua et al., 2014; Abuka et al., 2019). Because more reserves injected from aggressive banks indicate that conservative banks are more liquid, it is hypothesized that banks are more flexible in response to monetary policy shocks when competing in strategic substitutes.

**Hypothesis 2.** Loan growth has a positive relationship with the interaction of the policy interest rate change and strategic substitutes.

4 Kashyap and Stein (1995), Vo and Nguyen (2014), Yang and Shao (2016) argue that the effect of bank size on credit supply is negative because bank size represents a poor indicator of informational asymmetries.
aggressive. If CSM < 0, the bank competes in strategic substitutes, indicating that the competition is accommodating. A dummy variable (dcsm) has the value of 1 for banks competing in strategic substitutes, and 0, otherwise.

4.1.2. Bank lending behaviour

Bank lending behaviour is defined as the growth of loans (Caglayan and Xu, 2016; Vo, 2018; Kowalewski, 2019; Borio and Gambacorta, 2017). This study chooses lending growth as a proxy for bank lending behaviour because lending growth not only reflects the financial soundness of commercial banks but also is one of the annual monetary policy objectives of the State bank of Vietnam (SBV) (Vo, 2018). The growth of loans has also been employed by prior studies and received support from the bank lending literature, for example, the studies of Nguyen et al. (2020), Beutler et al. (2020), Vo et al. (2020), Vo (2018), Khan et al. (2016), Sarath and Van Pham (2015), Nguyen and Boateng (2013), Gambacorta and Mistrulli (2004). In this study, the change in the natural logarithm of gross loan (Δlnloan) from bank i in year t relative to year t - 1 is used as a proxy variable for bank lending behaviour. Alternative proxy for bank lending, the year-over-year gross loan (Δloan), is also examined for a robustness check.

4.1.3. Policy interest rates

Because of the coexistence of many interest rates in an economy, it is important to point out which interest rates can fully reflect the monetary policy stance. Some studies maintain to use the benchmark interest rates (referring to discount, refinancing and open-market-operation rates) to index the monetary policy stance (Martin, 2017; Khan et al., 2016; Matemilola et al., 2014; Sanfilippo-Azofra et al., 2018). It is open to doubt in the case of Vietnam. Since the discount and refinancing rates tend to be lower than the market rate (the deposit rate and lending rate), the impact of these rates is still limited in the administrative mechanism (Nguyen and Do, 2017). To overcome this issue, the lending rate and deposit rate are employed. The lending rate and deposit rate are more emphasized to represent the monetary policy rate because they have strong effects on the market rate (Nguyen and Boateng, 2013; He and Wang, 2012). Given this argument, the proxy of the policy interest rate in Vietnam is the change in one year of Lending interest rate (Δl) (Olusanya et al., 2012; Nguyen and Do, 2017; Yang and Shao, 2016; Gunji et al., 2009) and Deposit interest rate (ΔD) (Nguyen and Boateng, 2013). However, we acknowledge that the discount and refinancing rates regardless of their low counterpart figures remain essential in implementing monetary policy in Vietnam since the SBV has still set these rates as monetary policy tools. Therefore, we use them as alternative monetary policy indicators for the robustness tests.

4.1.4. Bank-specific and macroeconomic factors

This research further includes individual bank characteristics since most studies report that bank-specific variables alter the overall bank lending behaviour and capably separate the credit channel from the interest rate channel of monetary policy transmission (Mukhanyi, 2016; Vo, 2018; Sanfilippo-Azofra et al., 2018; Latif et al., 2019; Ebire and Ogunyinka, 2018; Martin, 2017; Khan et al., 2016; Gambacorta and Marques-Ibanez, 2011; Berrospide and Edge, 2010). This research assumes that bank lending behaviour is determined by a set of following bank-specific factors: bank market power (Competition.), deposit growth (ΔDeposit), bank size (size), bank capital strength (Cap.), ex-post accounting measure of credit risk (LLP), and bank efficiency (Efficiency). Bank market power (Competition.) – is defined as the adjusted Lerner index (Lieberson, 2017; Fungacová et al., 2014; Khan et al., 2016; Olivero et al., 2011). It is expected that having less market power hinders the supply of bank loans, since greater competition “reduces the access to alternative sources of funding” (Fungacová et al., 2014; Khan et al., 2016).

Deposit growth (ΔDeposit) – is defined as the percentage change of total Deposits and Short term funding (Sarath and Van Pham, 2015; Latif et al., 2019; Imran and Nishat, 2013). There is no doubt that the banks with a high volume of deposits are more liquid and capable to provide a larger source of bank funding (Latif et al., 2019; Imran and Nishat, 2013; Sarath and Van Pham, 2015). If commercial banks can effectively channel funds from their depositors to their borrowers, banks are well-functioned in their role as intermediate institutions. Deposits are one of the main sources of funds of intermediate institutions (Mishkin and Eakins, 2006); it is, therefore, rational to expect an increase in deposit mobilization will intensify proportionally loan volumes. Bearing this in mind, we expect that higher deposits growth corresponds to more fund resources for banks and higher credit volume.

Bank size (size) – is defined as the natural logarithm of total assets (Vo, 2018; Pruteanu-Podpiera, 2007; Khan et al., 2016; Latif et al., 2019; Rabab’ah, 2015). Because “large banks tend to be more cautious in their lending practice” and “smaller banks tend to make more loans to cover the decrease in bank profitability” in the case of Vietnam (Vo, 2018), this study will take a stance on a negative relationship between bank size and bank lending.

Bank capital strength (Cap.) – is defined as the ratio of total equity to total assets (Khan et al., 2016; Kishan and Opiela, 2006; Fungacová et al., 2014). According to the “credit crunch” literature, bank capitalization is a key factor that may influence bank health and bank’s access to external finance, thereby affecting bank’s ability to fund loans (Kishan and Opiela, 2000). The positive relationship between bank capital and loan growth are well-establish in previous studies (Peek and Rosengren, 1995; Brinkmann and Horvitz, 1995; Berger and Udell, 1994; Hancock and Wilcox, 1998). Recently, the work of Khan et al. (2016) reveals that well-capitalized banks may behave flexibly in loan expansion strategy. Therefore, it is expected that well-capitalized banks tend to grant more loans relative to thinly capitalized ones (Kishan and Opiela, 2006; Fungacová et al., 2014).

Ex-post accounting measure of credit risk (LLP) – is defined as the ratio of loan loss provision to total gross loans (Altunbas et al., 2009a; Bouvatier and Lepetit, 2012). We expect loan loss provision has a negative impact on growth in bank lending. Altunbas et al. (2009a), Bouvatier and Lepetit (2012) find that this impact is more amplified for emerging countries.5 It is argued that income smoothing behaviour, capital management and signalling (Bouvatier and Lepetit, 2012). The higher loan loss provision, which is a signal of higher riskiness, lowers the bank profits and capital, thereby diminishing banks’ incentives to supply lending (Altunbas et al., 2009a).

Bank efficiency (Efficiency.) – is defined as DEA VRS input-oriented (Apergis and Alevizopoulou, 2011). Diallo (2018) asserts bank lending constraints could be considerably eased by a higher level of bank efficiency, supporting the idea that efficient banks are more resilient to economic shocks, thereby upholding their loan supply. Moreover, Shamshur and Weill (2019) argue that bank efficiency lowers the costs of credit and thus foster access to credit. Therefore, it may be inferred that bank efficiency enhances banks’ loan growth.

To distinguish the demand side (balance sheet channel) from the supply side (bank lending channel), this study also aims at investigating the possible impact of the inflation rate besides the GDP growth rate (Yang and Shao, 2016). The inflation rate (INF) is introduced in the estimation model in order to test whether the price instability, in

5 The data set includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Paraguay, Peru, Uruguay, Venezuela, Indonesia, South Korea, Malaysia, Philippines, Taiwan, Thailand.
6 Income smoothing behaviour can be stated that “banks have incentives to smooth earnings over time”. Under this behaviour, “when earnings are expected to be low, LLP are deliberately understated to mitigate adverse effects of other factors on earnings. On the other hand, when earnings are unusually high, banks choose discretionary income-reducing accruals.” Bouvatier, V. & Lepetit, L. 2012. Effects of loan loss provisions on growth in bank lending: some international comparisons. Economie internationale, 91-116.
inflationary environment, negatively influences bank lending. The existing empirical and theoretical studies demonstrate the negative relationship between inflation and loan growth (Pham, 2015; Huybens and Smith, 1998; Boyd et al., 2001; Rousseau and Wachtel, 2002).

### 4.2. Empirical models

The study employs System Generalised Method of Moments Estimator (SGMM) to deal with potential endogeneity caused by the lag of the dependent variable as an explanatory variable. The lagged dependent variable (\(L_{\text{Loan}_{i,t-1}}\)) is introduced to capture the persistence effects of the dependent variable (Sanfilippo-Azofra et al., 2018). It allows controlling for “unobserved characteristics of bank i’s lending in the previous periods that affect loan growth in the current period” (Beutler et al., 2020). Moreover, it is argued that SGMM has a lower bias and higher efficiency than all the other estimators when the sample size is small and with relatively small time periods (Soto, 2009). Eq. (2) describes the general model of SGMM.

\[
Y_{it} = \alpha Y_{it-1} + X_{it} \beta + \mu_i + u_{it} \tag{2}
\]

where: \(|\alpha| < 1\), \(E(\mu_i) = 0\), \(E(u_t) = 0\). \(E(\mu_i u_t) = 0\), for \(i = 1, \ldots, N\) and \(t = 2, \ldots, T\); \(X = (X_1, \ldots, X_j)\) is a column vector of \(j\) regressors; the disturbance term has two orthogonal components: the fixed effects, \(\mu_t\), and the idiosyncratic shocks, \(u_{it}\).

Given the relatively small number of periods, we confidently expect SGMM is the most appropriate estimator for this study to examine the impact of strategic interaction and monetary policy on the credit lending behaviours of Vietnamese banks. SGMM provides an unbiased and consistent estimator which can address the endogeneity caused by the presence of the lagged values of the dependent variable in the set of regressors (Arellano and Bond, 1991). We follow Delis and Kouretas (2011) and suggest that both policy interest rates, country-level variables such as GDP growth and inflation, help support economic growth and control inflation.

The lag selection is conducted by running an OLS regression of the current value of alonloans against lagged values of alonloans. The statistically significant lagged values help identify how many lags should be included in the System GMM model (Li et al., 2021). We assume that all GDP variables (GDP growth rate and Inflation rate) are treated as exogenous since “their changes are unexplained by the model, and banks anticipate the full scale of the macroenvironment” (Le et al., 2022). We follow Delis and Kouretas (2011) and suggest that both policy interest rates and loan growth are endogenous. The following equation is constructed to relate the bank lending behaviour to monetary policy interest rate, country-level variables such as GDP growth and inflation considering the strategic interaction among commercial banks.

\[
\text{Loan}_{i,t} = \beta_1 \text{Loan}_{i,t-1} + \beta_2 \text{GDP}_{i,t} + \beta_3 \Delta \text{INF}_{i,t} + \beta_4 \text{Dcsmt}_{i,t} + \beta_5 \text{INF}_{i,t} + 8\text{Bank}_{i,t-1} + \epsilon_{it} \tag{3}
\]

where: \(\text{Loan}_{i,t}\) is measured by growth in loans of bank \(i\) in year \(t\); \(\Delta \text{INF}_{i,t}\) is the change in the monetary policy interest rate; \(\text{GDP}_{i,t}\) reflects the GDP growth rate; \(\text{INF}_{i,t}\) is the inflation rate in year \(t\); \(\text{Bank}_{i,t-1}\) is a vector of bank characteristics indicators defined in Section 4.1.4; and \(\epsilon_{it}\) is the random error term. \(\text{Dcsmt}_{i,t}\) is defined as in Eq. (4):

\[
\text{Dcsmt}_{i,t} = \begin{cases} 
1 & \text{if bank i competes in strategic substitute, } \text{CSM}_{i,t} < 0 \\
0 & \text{if bank i competes in strategic complement, } \text{CSM}_{i,t} > 0 
\end{cases} \tag{4}
\]

The interaction terms, namely \(\text{GDP}_{i,t} \times \text{Dcsmt}_{i,t}\) and \(\Delta \text{INF}_{i,t} \times \text{Dcsmt}_{i,t}\), are the main variables of interest. Note that this research pays attention to the asymmetric effect of strategic interaction (substitute versus complement strategies) bridging to macroeconomics conditions on loan behaviour. The model specification, therefore, has different slopes (\(\beta_3 \text{GDP}_{i,t} \times \text{Dcsmt}_{i,t}\) and \(\beta_5 \Delta \text{INF}_{i,t} \times \text{Dcsmt}_{i,t}\)) but same intercept (without Dcsmt). This model states that the expected impacts of macroeconomic and monetary policy shocks on bank lending behaviour differ for strategic substitutes and strategic complements but these types of strategic interaction on their own do not increase loan volumes.

### 4.3. Data collection and data description

The bank-level data are collected from annual financial statements of Vietnamese commercial banks for 2008–2018. The study omits 20 out of 46 banks to obtain balanced panel data. Those 20 banks which have stopped publicly reporting financial statements due to banking system restructuring plan (for example, Phuong Nam Bank, Ocean Bank, Trust Bank, etc.) or under the special supervision/investigation of the SBV (for example, DongA Bank, Vietnam Construction Bank, GP Bank, etc.), are excluded from the sample. The final sample consists of 26 commercial banks, with 286 annual observations.

This study considers two measures of policy interest rates from the IMF data, namely, lending rate and deposit rate. From Figure 2, it can be concluded that both deposit and lending rates in Vietnam have gradually declined since 2008, from the highest 13%–15% in 2008 to around 5%–6% in 2018. Due to the shock of the global financial crisis, these two interest rates fluctuated strongly at 5% from 2008 to 2012, but then remained stable and almost no major fluctuations occurred. These two interest rates have gradually decreased to 5%–7% since 2016, reflecting that the monetary policy implemented by the SBV in a cautious easing helps support economic growth and control inflation.

The annual GDP growth rate and inflation rate are collected from World Bank Open Data (Public data). It can be seen from Table 1 that the average GDP growth rate (annual percentage) is 6.1049% with a low standard deviation (0.59), indicating that Vietnam is one of the fastest-growing economies in Southeast Asia. However, high inflation will reduce the success of strong economic growth. Over the sample period, the inflation rate of Vietnam, which varied substantially from 23.116% in 2008 to 0.879% in 2015, has an average of 8.117%. A bright side is that inflation in recent years has been well controlled, capping at a 1-digit level, reflecting that curbing inflation is a special issue that SBV pays special attention to.

As extreme values can distort estimations, we have executed the ‘extremes’ command introduced by Nicholas J. Cox in order to detect outliers. Some variables in form of raw data demonstrate cases with extreme values, such as total assets, and gross loans. Therefore, we adopted a logarithmic scale (transformed scale) to handle outliers. Table 1 details the descriptive definitions, abbreviations, statistics for the variables.

Levin–Lin–Chu and Harris–Tzavalis tests are selected for unit roots. The unit root tests incorporate a time trend and panel-specific means, except for the monetary policy interest rate. Table 2 provides unit root tests for the variables and shows overwhelming evidence against the null hypothesis of a unit root. It is therefore concluded that all variables are stationary.

### 5. Results

#### 5.1. Main estimation results

This section presents the main estimation results of the research question on the interaction effect of strategic interaction and macro environment on bank lending behaviour using the SGMM estimator. This research implements the full specifications with two monetary policy
indicators (lending rate and deposit rate) and a proxy of bank lending behaviour ($\Delta \ln \text{loan}$). It also shows the robustness checks.

Six different specifications are tested, and the results are exhibited in Table 3. In Table 3, models 1 and 2 give the results for the baseline specifications for studying the bank lending behaviour; bank-specific characteristics (i.e., deposit growth, bank size, bank capital strength and loan loss provision) and macroeconomic factors (i.e., policy interest rate, GDP growth rate and inflation rate) are included. Models 3 to 6 are specified to check whether the baseline results are biased by additional determinants. Specifically, Models 3 to 6 focus on two additional factors (efficiency – DEA score and market power – Lerner index), which are hypothesized to have impacts on lending behaviour. The DEA score is added in Models 3 to 4, and the Lerner index is added in Models 5 to 6.

Regarding bank-specific characteristics, a lag of bank size ($\text{sizei}_{i,t-1}$), Deposits and Short-term funding ($\Delta \text{Deposit}_{i,t}$) and past growth of loans ($\Delta \ln \text{loan}_{i,t-1}$) have significant impacts on the current bank lending in all six estimations. Consistent with the expectation that “the larger the more cautious”, the coefficients of bank size are negative. This indicates that small banks are more likely to expand their supply of loans. This finding

![Figure 2. Changes in policy interest rates in Vietnam](source: Author's diagram based on International Monetary Fund, International Financial Statistics, and data files.)

| Variable          | Definition                                                                 | Mean      | Std.Dev | Min     | Max     |
|-------------------|-----------------------------------------------------------------------------|-----------|---------|---------|---------|
| Bank characteristics indicators |                                                                                   |           |         |         |         |
| $\Delta \ln \text{loans}_{i,t}$ | Bank Lending growth rate                                                       | 2.0831    | 2.1626  | -4.0336 | 12.5428 |
| $\Delta \text{Deposits}_{i,t}$ | The percentage change of total Deposits and Short-term funding of bank $i$       | 1.9263    | 2.9861  | -14.5524| 17.3657 |
| $\text{sizei}_{i,t}$ | The natural logarithm of total assets of bank $i$                              | 11.2841   | 1.3247  | 7.9858  | 14.1084 |
| $\text{Dexm}_{i,t}$ | Dummy variable of strategic interaction                                        | 0.4825    | 0.5006  | 0.0000  | 1.0000  |
| $\text{Cap}_{i}$ | The ratio of total equity to total assets of bank $i$                         | 1.0498    | 0.6311  | 0.1400  | 3.4300  |
| $\text{LLP}_{i}$ | The ratio of loan loss provision to total gross loans of bank $i$             | 0.3761    | 1.1383  | -14.011 | 0.7610  |
| $\text{aLerner}_{i}$ | The adjusted Lerner index of bank $i$                                        | 0.3761    | 1.1383  | -14.011 | 0.7610  |
| $\text{Efficiency}_{i}$ | DEA VRS input-oriented of bank $i$                                           | 0.9398    | 0.0512  | 0.7142  | 1.0000  |
| Monetary policy interest rate |                                                                                   |           |         |         |         |
| $\Delta \text{Lending rate}_{i,t}$ | Changes in Lending interest rate                                         | -0.3427   | 3.0756  | -5.7100 | 4.6000  |
| $\Delta \text{Deposit rate}_{i,t}$ | Changes in Deposit interest rate                                          | -0.2354   | 2.9461  | -4.8200 | 5.2370  |
| Macroeconomic factors |                                                                                   |           |         |         |         |
| $\text{GDP}_{t}$ | The GDP growth rate                                                          | 6.1049    | 0.5900  | 5.2470  | 7.0760  |
| $\text{INF}_{t}$ | The inflation rate                                                           | 8.1170    | 6.5568  | 0.8790  | 23.1160 |

| Variable          | Harris-Tzavalis unit-root test | Levin-Lin-Chu unit-root test |
|-------------------|--------------------------------|-----------------------------|
| $\Delta \ln \text{loans}$ | -0.0022***                     | -10.0567***                 |
| $\Delta \text{Deposits}_{i,t}$ | -0.1670***                     | -7.7332***                  |
| $\text{sizei}_{i,t}$ | 0.0427***                      | -17.9259***                 |
| $\text{Cap}_{i}$ | 0.1559***                      | -10.3740***                 |
| $\text{LLP}_{i}$ | 0.3187*                       | -5.6876***                  |
| $\text{aLerner}_{i}$ | -0.3964***                     | -7.0472***                  |
| $\text{Efficiency}_{i}$ | 0.2501***                     | -9.4323***                  |
| $\Delta \text{Lending rate}_{i,t}$ | -0.2888***                    | -6.8677***                  |
| $\Delta \text{Deposit rate}_{i,t}$ | -0.2770***                     | -3.4158***                  |
| $\text{GDP}_{t}$ | 0.1748***                      | -7.6737***                  |
| $\text{INF}_{t}$ | -0.1767***                     | -11.9172***                 |

Note: *** and * denote the rejection of the unit root hypothesis at the 1% and 10% significance levels, respectively.
Table 3. Baseline regression – bank lending behaviour and strategic interaction.

| Dependent variable: the natural logarithm of gross loan (Δln loans) | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|------------------------------------------------------------|--------|--------|--------|--------|--------|--------|
| ΔlΔn loans | 0.471*** | 0.477*** | 0.578*** | 0.520*** | 0.529*** | 0.465*** |
| L(Δn loans) | (0.049) | (0.062) | (0.061) | (0.066) | (0.060) | (0.066) |
| GDP growth (GDPt) | 0.959*** | 0.888*** | 1.708*** | 1.162*** | 1.288*** | 0.829*** |
| L(Δn loans) | (0.110) | (0.122) | (0.205) | (0.172) | (0.173) | (0.157) |
| Δ lending rate | -0.405*** | -0.543*** | -0.483*** | -0.483*** | -0.483*** | -0.483*** |
| L(Δn loans) | (0.046) | (0.059) | (0.059) | (0.059) | (0.059) | (0.059) |
| Δ Deposit rate | -0.422*** | -0.481*** | -0.481*** | -0.481*** | -0.481*** | -0.481*** |
| L(Δn loans) | (0.058) | (0.063) | (0.063) | (0.063) | (0.063) | (0.063) |
| GDPt × Dcsm11 | -0.609*** | -0.688*** | -0.814*** | -0.747*** | -0.704*** | -0.686*** |
| L(Δn loans) | (0.134) | (0.112) | (0.181) | (0.123) | (0.145) | (0.114) |
| Δ(lending rate)1 × Dcsm11 | 0.433*** | 0.560*** | 0.486*** | 0.486*** | 0.486*** | 0.486*** |
| L(Δn loans) | (0.081) | (0.109) | (0.084) | (0.084) | (0.084) | (0.084) |
| Δ(l(deposit rate)1 × Dcsm11) | 0.646*** | 0.694*** | 0.643*** |
| L(Δn loans) | (0.087) | (0.096) | (0.088) |
| Inflation | -0.117*** | -0.200*** | -0.103*** | -0.198*** | -0.109*** | -0.203*** |
| L(capital) | (0.027) | (0.024) | (0.036) | (0.026) | (0.037) | (0.026) |
| L(Loan Loss Provisions) | -0.17 | -0.104 | -0.148 | -0.1 | 0.19 | -0.183 |
| L(capital) | (0.139) | (0.142) | (0.164) | (0.157) | (0.149) | (0.236) |
| Δln deposits | -0.007** | -0.009** | -0.010** | -0.010** | -0.011*** | -0.008* |
| L(Δn loans) | (0.003) | (0.004) | (0.004) | (0.003) | (0.004) | (0.004) |
| L(assets) | -0.414*** | -0.351*** | -0.315*** | -0.305*** | -0.584*** | -0.309*** |
| L(capital) | (0.052) | (0.054) | (0.120) | (0.092) | (0.115) | (0.101) |
| L(credit (efficiency score)) | -7.278*** | -2.841 | | | | |
| L(capital) | (2.394) | (2.021) | | | | |
| L(λA) | 0.337 | -0.132 | | | | |
| L(λA) | (0.579) | (0.297) | | | | |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 260 | 260 | 260 | 260 | 260 | 260 |
| Number of instruments | 25 | 25 | 25 | 25 | 25 | 25 |
| Hansen test of over-identification p-value | 0.149 | 0.180 | 0.133 | 0.149 | 0.137 | 0.138 |
| Arellano-Bond test for AR(1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Arellano-Bond test for AR(2) | 0.148 | 0.265 | 0.214 | 0.305 | 0.181 | 0.267 |

Note: Models 1–6: lending behaviour = Δlnloans; Models 1,3,5: policy interest rate = Lending rate; Models 2,4,6: policy interest rate = Deposit rate. Standard errors in parentheses.

*p < 0.10, **p < 0.05, ***p < 0.01.

is in line with prior studies (Yang and Shao, 2016; Fungáciová et al., 2014; Vo, 2018), which highlight the current issue of a high ratio of NPLs for small banks in Vietnam. An expected positive and significant relationship between deposits and loans is shown in all models, supporting the loanable fund theory regarding the dependence of bank loans on pre-existent savings (Pham, 2015). However, capital strength, loan loss provision, bank efficiency, and market power do not relate to bank lending since the estimated coefficients on Capital, LLP, Efficiency, and aLerner, are statistically insignificant.

Regarding the macroeconomic environments, it is found that the estimated coefficients on the inflation rate are significantly negative, indicating that the extent to which banks reduced their lending is related to the inflation rate. The overall empirical evidence could be considered as a support for the negative effects of inflation on loan markets (Vo, 2018; Pham, 2015). The study implies that the inflationary environment hinders financial development because it restrains borrowers from external financing and induces banks to maintain liquid assets rather than long-run financial projects.

One key contribution of this study is investigating the distributional effects of economic growth on bank lending behaviour under different strategic interaction scenarios, i.e., strategic substitutes versus strategic complements. The coefficients of economic growth (GDP growth, GDPt) are found to be significant in all specifications. This provides evidence for the demand-effect on the bank lending channel and confirms that bank credit is a vital source to finance Vietnamese firms. The significantly negative coefficient of the interaction between strategic substitutes and GDP growth (GDPt × Dcsm11) highlights the different lending behaviours in response to GDP shocks between banks competing in strategic substitutes and strategic complements. This result shows that banks with strategic substitutes tend to conservatively make loans and restrict their lending activities in response to economic upturns compared with those with strategic complements. The result confirms Hypothesis 1, indicating that strategic substitutes hinder the growth of loans during booms.

The coefficients of the policy interest rates (lending rate and deposit rate) are negative as expected, which proves that the bank lending channel exists in Vietnam. This indicates that the Vietnamese authorities succeed in reducing the supply of bank loans when implementing a
tightening monetary policy. More importantly, the interaction between strategic substitutes and policy interest rates (Δit × Dcsmi,t), which captures the effect of banking strategies on the bank lending channel of the monetary policy, is significantly positive across all specifications. This finding confirms Hypothesis 2, which indicates that banks are more resilient in response to monetary policy shocks when competing in strategic substitutes.

Eqs. (5) and (6) represent the marginal effect of GDP and policy interest rates on bank lending, respectively:

\[
\frac{\partial \Delta \text{Inloant}}{\partial \text{GDP}_t} = \beta_3 + \beta_4 \text{Dcsmi}_t = \beta_3 + \beta_5 \\
\frac{\partial \Delta \text{Inloant}}{\partial \Delta \text{i}} = \beta_2 + \beta_4 \text{Dcsmi}_t = \beta_2 + \beta_6
\]

(5)

(6)

where: Dcsmi = 1 for banks competing in substitutes

Focusing on the estimates in the first column in Table 3 (model 1), for example, the marginal effect of GDP growth and policy interest rates on the lending behaviours for banks competing in substitutes (β3 + β5 = 0.959 − 0.609 = 0.350; β2 + β6 = −0.405 + 0.433 = 0.028; respectively) is less pronounced than those competing in complements (β3 = 0.959; β2 = −0.405).

5.2. Robustness tests

This section contains five robustness checks. First, it explores an alternative measure of bank lending behaviour and policy interest rates. Second, it assesses the difference in lending behaviour of state-owned and non-state-owned banks. Finally, it checks whether the crisis period influences the results.

Alternative measure of bank lending behaviour and policy interest rates – The regressions are rerun while bank lending behaviour is measured by the change in the gross loan (YoY) and refinancing and discount rates are proxies for policy interest rates. Refinancing and discount rates are collected from the SBV’s website. The results are reported in Appendix 1 and Appendix 2 are markedly like the main results.

Alternative estimation method – We re-run the main regression model (Eq. (3)) by employing panel regressions with fixed effects. The results in Appendix 3 corroborate those obtained in Table 3 are consistent with our main conclusion that the effect of macroeconomic and monetary policy shocks on bank lending behaviour is less pronounced when banks engage in a less competitively aggressive environment.

Effects of State ownership and Crisis vs. Non-crisis period – Apart from the above bank-specific characteristics, the adverse effect of strategic interaction on the relationship between economic cycle (monetary policy shocks) and bank lending may be different across the state-owned and non-state-owned banks and over crisis periods. This study examines asymmetric lending behaviours in different types of ownership and phases of the economic cycle by using triple-interaction terms (GDPt × Dcsmi × StateDummyt, Δit × Dcsmi × StateDummyt and GDPt × Dcsmi × CRISISit, Δit × Dcsmi × CRISISit). Regression models are as follows.

\[
\text{Loant}_t = \beta_{14} + \beta_{15} \text{Loant}_{-1,t} + \beta_{16} \text{GDP}_t + \beta_{17} \Delta \text{i}_t + \beta_{18} \text{GDP}_t × \text{Dcsmi}_t + \beta_{19} \Delta \text{i}_t × \text{Dcsmi}_t + \beta_{13} \text{INF}_t + \theta \text{Bank}_{-1,t} + \alpha_1 \text{StateDummy}_t + \alpha_2 \text{GDP}_t × \text{Dcsmi}_t × \text{StateDummy}_t + \alpha_3 \Delta \text{i}_t × \text{Dcsmi}_t × \text{StateDummy}_t + \epsilon_t
\]

(7)

\[
\text{Loant}_t = \beta_{14} + \beta_{15} \text{Loant}_{-1,t} + \beta_{16} \text{GDP}_t + \beta_{17} \Delta \text{i}_t + \beta_{18} \text{GDP}_t × \text{Dcsmi}_t + \beta_{19} \Delta \text{i}_t × \text{Dcsmi}_t + \beta_{13} \text{INF}_t + \theta \text{Bank}_{-1,t} + \alpha_1 \text{CRISIS}_t + \alpha_2 \text{GDP}_t × \text{Dcsmi}_t × \text{CRISIS}_t + \epsilon_t
\]

(8)

where: the State-owned dummy (StateDummy) has the value of 1 for state-owned banks and 0 for others. Similarly, the crisis dummy (CRISIS) has the value of 1 for the years 2008–2012 to reflect the global financial crisis and 0 otherwise. As the global financial crisis had a significant effect on bank lending, we control the effect of the financial crisis by constructing a dummy variable that takes a value of 1 for the period of crisis, that is, 2008–2010, and 0 otherwise. This treatment is relevant for the practice in Vietnam, whose the annual growth rate of GDP has been slowing down from 7.1% in 2007 to 5.7% in 2008 then 5.4% in 2009, before recovering to 6.4% in 2010.

As shown in Appendix 4 and Appendix 5, the robustness results are similar to the main estimation results. The coefficients on state-owned, and crisis dummies (α1 in Eqs. (7) and (8)) are statistically significant across all specifications.

Regarding the state-owned effect, the results highlight the difference in lending behaviours between state-owned and private-owned banks. Because of significant differences between state-owned and private banks’ business models, state-owned banks tend to be riskier in terms of having higher lending growth rates (Behr et al., 2013). These results are in line with the soft-budget constraint theory that state-owned banks are expected to reach financial support (bailout) in case of financial distress or economic failure (Jiang, 2008). Another explanation is the “social view”9 in which state-owned banks “might be set up by benevolent social planners to pursue industrial policies directed at remedying market failures” (Fannon et al., 2007).

The insignificant moderator coefficient of ΔGDPt × Dcsmi,t × StateDummy, (the statistically insignificant α1 in Eq. (7)) of state-owned effect cannot be further disentangled. Therefore, it asserts that the economic cycle does not affect the loan supply of banks with different ownership in the presence of strategic substitutes. However, the coefficients (α3 in Eq. (7)) on triple interaction, Δit × Dcsmi,t × StateDummy, are negative and significant in models 25, 29 and 30. Not-so-strong evidence is found for the weakened moderating role of strategic substitutes in the negative impact of policy interest rates on bank lending for state-owned banks. As interest rates rise, lending by banks with state ownership tends to decrease more than lending by other banks, even though state-owned banks follow conservative strategies. This demonstrates that state-owned banks are heavily driven by the lending channel and government support of state-owned institutions seems to fulfill government aims for the economy and rehabilitate the cyclical behaviour of those supported banks.

Regarding the crisis effect, Vietnamese banks tend to increase their lending practice in harsh economic times compared with the post-crisis period. This evidence is unique in the context of Vietnam because prior studies (Kwan, 2010; Ivashina and Scharfstein, 2010; Ibrahim and Rizvi, 2018) imply the negative relationship between bank lending and the crisis period. This shows that unconventional monetary policy instruments (including lending operations,10 asset purchase programs11, low interest rate stance12), which were implicitly

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9 While state-owned banks facilitate the low-profit projects and grant greater loans in order to pursue industrial policies, private-owned banks “cherry-pick” the best loans and grant fewer loans.

10 Banks have expanded the type of assets that the bank accepts as collateral and lending to groups of partners. The goal is to create favorable conditions for customers to access funds.

11 Asset purchase programs (such as government bond market) have been implemented to reduce interest rate hedging and easing market conditions.

12 The policy orientation is aimed at clarifying the SBV’s intention on future policy solutions and making commitments on the implementation of these solutions. At time of economic instability, it is necessary to commit to maintaining interest rates within a certain margin. Overall, the policy orientation has brought relatively high efficiency in reassuring the market and minimizing instability.

13 The reduction of policy interest rates to nearly 0% can boost economic growth, encourage borrowing and spending.
applied by the SBV during the crisis, are effective in boosting the amount of money and stimulating economic growth. This result reflects Vietnamese monetary policy transmission is more enforceable during the crisis, thereby supporting the view of "effective monetary policy during financial crisis" that argues "monetary policy is more potent during financial crises because aggressive monetary policy easing can make adverse feedback loops less likely." (Mishkin, 2009).

More importantly, the coefficients of GDP_t × Dcrm1_t × CRISIS_t, and α_5 are positive and significant in all models. The results show that the moderating role of strategic substitutes in the positive impact of GDP growth on bank lending is weaken during the crisis period. Lastly, the coefficients on triple interaction, DΔin × Dcrm1 × CRISIS_t, are negative and significant in all models. Eq. (9) represents the marginal effect of monetary policy on bank lending in the crisis.

\[ \frac{\partial \ln(loans)}{\partial \Delta i_t} = \beta_3 + \beta_4 D_{crm1} + \alpha_5 D_{crm1} \times CRISIS_t = \beta_3 + \beta_5 + \alpha_3 \]  

(where: CRISIS_t = 1, in the crisis period, Dcrm1 = 1 for banks competing in substitutes).

Focusing on the estimates in the first column in Appendix 5 (model 31), for example, the marginal effect of monetary policy shocks on the growth of loans for banks competing in substitutes during the crisis (\( \beta_3 + \beta_5 + \alpha_3 = -0.151 + 1.586 - 4.827 = -3.392 \)) is more pronounced than during the post-crisis (\( \beta_3 + \beta_5 = -0.151 + 1.586 = 1.435 \)). These findings suggest that policymakers should pay attention to the interaction effect of strategic interaction and the monetary policy interest rates on lending behaviour during the crisis. This demonstrates that even though conservative banks can absorb some reserves from aggressive banks, they are not exceptional enough to be immune to monetary policy shocks during the financial crisis.

6. Conclusion

This study empirically examines the moderating role of strategic interaction on the relationship between bank lending and macroeconomic factors. According to the post-Keynesian banking literature, the relationship between cyclical fluctuations (macro) and banking strategy (micro) in credit expansion has become complexly intertwined. Minsky (1986) argues that cyclical fluctuations are responsive to bank lending behaviour, while Dymski et al. (2008) emphasizes banks adjust their strategic behaviour over loan expansion with respect to cyclical upturns and downturns. Although the moderating role of strategic interaction on the relationship between bank lending and the macroeconomic factors has been built conceptually, no empirical test has been carried out. What this study has put a sharp point on is to identify the influences of strategic interaction on bank lending through both credit demand and credit supply sides. Employing SGMM estimator on the sample of 26 Vietnamese commercial banks from 2008 to 2018, the empirical evidence for the impact of bank size, deposit growth, inflation, GDP growth, efficiency, concentrated market, and bank lending channel on loan growth was found.

The study provides some novel insights into the underlying mechanism that shapes the lending behaviour considering strategic interaction. First, the study finds that the strategic substitutes hinder the growth of loans during economic booms. The empirical results indicate that banks with strategic substitutes tend to conservatively make loans and restrict their lending activities in response to economic upturns compared with those with strategic complements. Second, the banking lending channel in Vietnam is less pronounced when banks compete in strategic substitutes or in a less competitively aggressive environment. It confirms the argument of this study that while experiencing the interest rate shocks, these banks can buffer their lending activities by absorbing reserves from aggressive banks. Results are robust to various tests. A deeper analysis is in line with the soft-budget constraint theory and indicates that state-owned banks tend to be riskier in the manner of having a higher lending growth rate. However, the finding from this study indicates that, regardless of strategic substitutes, state-owned banks are more vulnerable to monetary policy shocks.

These results also provide important policy and research implications. Bank lending behaviour is a topic of great interest not only to policymakers and bank managers but also to economists. For scholars, this study extends the Keynesian theory of multi-bank system and credit creation theory by incorporating the nature of strategic competition into bank lending behaviour. For bank managers, they should pay attention to their strategic choice, especially in pursuit of aggressive competition or strategic complements since their reserves can be drained out by other banks with strategic substitutes. For policymakers, banks with strategic substitutes are evidenced to be less sensitive to monetary policy shocks and this hinders the transmission mechanism of monetary policy. Thus, policymakers should consider whether strategic interactions besides macroeconomic and regulatory factors throw sand into or grease the wheel of bank lending.

While this study successfully deals with the small sample issue by using SGMM,14 there were some limitations. In this study, the sample covers the majority of the Vietnamese commercial banks over 11 years, hence the sample generates sufficient data for econometric analysis and best fits the SGMM estimator. However, it would have been preferable if the sample could capture other banking systems of other emerging countries such as China, India, etc. in order to deliver reliable statistical inferences. Thus, those relying on the findings of this study should bear this in mind.

Declarations

Author contribution statement

Huong Nguyen Quynh Le: Conceived and designed the experiments, Performed the experiments, Analyzed and interpreted the data, Contributed reagents, materials, analysis tools or data, Wrote the paper.

Thai Vu Hong Nguyen: Conceived and designed the experiments, Wrote the paper.

Christophe Schinckus: Conceived and designed the experiments, Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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14 It is evidenced that SGMM is efficient on the panel where the number of periods is small Soto. 2009. System GMM estimation with a small sample. In: Ideas, A. A. (ed.). Barcelona Graduate School of Economics, Arellano, M. & Bond, S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The review of economic studies, 58, 277-297.
## Appendix

### Appendix 1. Alternative measure for bank lending behaviour – YoY gross loan.

| Dependent variable: YoY gross loan (Δ% loans) | model 7 | model 8 | model 9 | model 10 | model 11 | model 12 |
|---------------------------------------------|---------|---------|---------|---------|---------|---------|
| L.gross loans                               | 0.532***| 0.533***| 0.680***| 0.615***| 0.678***| 0.639***|
|                                            | (0.047) | (0.060) | (0.063) | (0.066) | (0.048) | (0.071) |
| GDP growth (GDP_t)                          | 17.534***| 15.618***| 29.762***| 21.577***| 21.577***| 27.844***|
|                                            | (1.637) | (1.587) | (2.521) | (1.994) | (2.949) | (3.330) |
| Δ lending rate                               | -5.911***| -8.374***| -9.801***| -9.801***| -9.801***| -9.801***|
|                                            | (0.701) | (0.856) | (1.065) | (1.065) | (1.065) | (1.065) |
| Δ Deposit rate                               | -6.189***| -7.586***| -9.140***| -9.140***| -9.140***| -9.140***|
|                                            | (0.835) | (0.932) | (1.318) | (1.318) | (1.318) | (1.318) |
| GDP_t; Dcsm_t                               | -9.386***| -8.765***| -11.274***| -11.274***| -11.274***| -11.274***|
|                                            | (1.411) | (1.212) | (2.222) | (1.433) | (2.043) | (1.986) |
| Δ_lending rate; Dcsm_t                       | 6.954***| 8.206***| 7.799***| 7.799***| 7.799***| 7.799***|
|                                            | (0.852) | (1.398) | (1.233) | (1.233) | (1.233) | (1.233) |
| Δ_deposit rate; Dcsm_t                       | 8.830***| 9.565***| 10.124***| 10.124***| 10.124***| 10.124***|
|                                            | (0.991) | (1.191) | (0.952) | (0.952) | (0.952) | (0.952) |
| Inflation                                   | -1.612***| -2.475***| -1.126** | -2.364***| -0.676 | -2.164***|
|                                            | (0.333) | (0.311) | (0.489) | (0.357) | (0.632) | (0.447) |
| Δln deposits                                | -0.224***| -0.232***| -0.276***| -0.264***| -0.285***| -0.284***|
|                                            | (0.045) | (0.051) | (0.060) | (0.057) | (0.043) | (0.046) |
| L.loan assets                               | -8.069***| -6.858***| -5.925***| -5.591***| -17.667***| -13.564***|
|                                            | (0.900) | (0.818) | (2.047) | (1.349) | (2.179) | (2.199) |
| L.capital                                   | -0.167 | 0.088 | 0.962 | 0.695 | -2.184*** | -1.260***|
|                                            | (0.369) | (0.386) | (0.598) | (0.537) | (0.397) | (0.440) |
| L.Loan Loss Provisions                       | 0.304 | 0.564 | 0.264 | 0.476 | 6.462** | 5.472**|
|                                            | (2.277) | (2.118) | (2.005) | (2.091) | (2.722) | (2.507) |
| L.crisin (efficiency score)                  | -130.915***| -66.410** | -6.141***| -66.410** | -66.410** | -66.410**|
|                                            | (33.562) | (24.358) | (33.562) | (24.358) | (33.562) | (24.358) |
| LaLerner (market power)                      | 13.462 | 8.027 | 8.027 | 8.027 | 8.027 | 8.027 |
|                                            | (14.595) | (11.555) | (14.595) | (11.555) | (14.595) | (11.555) |
| Year fixed effects                          | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations                                | 260 | 260 | 260 | 260 | 260 | 260 |
| Number of instruments                        | 25 | 25 | 25 | 25 | 25 | 25 |
| Hansen test of over-identification p-value  | 0.174 | 0.174 | 0.160 | 0.162 | 0.119 | 0.113 |
| Arellano-Bond test for AR(1)                | 0.000 | 0.000 | 0.000 | 0.000 | 0.010 | 0.003 |
| Arellano-Bond test for AR(2)                | 0.473 | 0.640 | 0.545 | 0.713 | 0.435 | 0.714 |

Note: Models 7–12: lending behaviour = Δ% loans; Models 7,9,11: policy interest rate = Lending rate; Models 8,10,12: policy interest rate = Deposit rate. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.

### Appendix 2. Alternative measure for monetary policy rates: Refinancing and Discount rates

| Dependent variable: the natural logarithm of gross loan (Δln loans) | model 13 | model 14 | model 15 | model 16 | model 17 | model 18 |
|------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|
| L.Δln loans                                                      | 0.565*** | 0.383*** | 0.472*** | 0.201*** | 0.581*** | 0.391*** |
|                                                                 | (0.089)  | (0.048)  | (0.072)  | (0.054)  | (0.091)  | (0.050)  |
| GDP growth (GDP_t)                                               | 0.512**  | 0.110    | -0.485   | -1.014***| 0.528**  | 0.064    |
|                                                                 | (0.225)  | (0.151)  | (0.307)  | (0.251)  | (0.235)  | (0.148)  |
| Δ Refinancing rate                                               | -0.185*  | -0.065   | -0.197*  | -0.065   | -0.197*  | -0.065   |
|                                                                 | (0.099)  | (0.098)  | (0.100)  | (0.100)  | (0.100)  | (0.100)  |
| Δ Discount rate                                                  | -0.050   | 0.084    | -0.037   | 0.084    | -0.037   | -0.037   |
|                                                                 | (0.038)  | (0.052)  | (0.037)  | (0.037)  | (0.037)  | (0.037)  |
| GDP_t; Dcsm_t                                                    | 2.195*** | 0.316**  | 2.841*** | 0.240*   | 3.249*** | 0.322*** |
|                                                                 | (0.445)  | (0.120)  | (0.327)  | (0.132)  | (0.455)  | (0.113)  |
| Δ(Δrefinancing rate); Dcsm_t                                     | 2.530*** | 2.256*** | 2.572*** | 2.572*** | 2.572*** | 2.572*** |
|                                                                 | (0.346)  | (0.253)  | (0.354)  | (0.354)  | (0.354)  | (0.354)  |
| Δ(Δdiscount rate); Dcsm_t                                        | 0.416*** | -0.165   | 0.423*** | 0.423*** | 0.423*** | 0.423*** |

(continued on next page)
## Appendix 3. Alternative estimation method: Panel regressions with fixed effects

| Dependent variable: the natural logarithm of gross loan (Δln loans) | model 19 | model 20 | model 21 | model 22 | model 23 | model 24 |
|---|---|---|---|---|---|---|
| L.Δln loans | 0.266*** | 0.241*** | 0.203*** | 0.186*** | 0.250*** | 0.234*** |
| | (0.067) | (0.067) | (0.057) | (0.061) | (0.062) | (0.065) |
| GDP growth (GDPₜ) | 1.189*** | 0.732** | 1.102*** | 0.744** | 1.228*** | 0.874** |
| | (0.351) | (0.351) | (0.351) | (0.342) | (0.346) | (0.340) |
| Δ lending rate | -0.336*** | -0.322*** | -0.324*** | -0.324*** | -0.324*** | -0.324*** |
| | (0.085) | (0.083) | (0.083) | (0.082) | (0.082) | (0.082) |
| Δ Deposit rate | -0.238*** | -0.253*** | -0.253*** | -0.253*** | -0.253*** | -0.253*** |
| | (0.077) | (0.081) | (0.081) | (0.075) | (0.075) | (0.075) |
| GDPₜ × Descm₁₄ | -0.120* | -0.099* | -0.125* | -0.098* | -0.114* | -0.095* |
| | (0.069) | (0.057) | (0.071) | (0.057) | (0.066) | (0.053) |
| Δ(loaning rate)ₜ × Descm₁₄ | 0.116** | 0.115** | 0.097** | 0.097** | 0.097** | 0.097** |
| | (0.046) | (0.046) | (0.045) | (0.045) | (0.045) | (0.045) |
| Δ(deposit rate)ₜ × Descm₁₄ | 0.137*** | 0.132** | 0.113** | 0.113** | 0.113** | 0.113** |
| | (0.047) | (0.049) | (0.049) | (0.049) | (0.049) | (0.049) |
| Inflation | -0.059* | -0.123*** | -0.068** | -0.122*** | -0.072** | -0.128*** |
| | (0.034) | (0.026) | (0.032) | (0.025) | (0.033) | (0.026) |
| Δln deposits | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| | (0.003) | (0.004) | (0.003) | (0.004) | (0.004) | (0.004) |
| L.inassets | -1.371*** | -1.465*** | -1.615*** | -1.717*** | -1.766*** | -1.890*** |
| | (0.400) | (0.429) | (0.214) | (0.241) | (0.263) | (0.289) |
| L.capital | 0.060 | 0.062 | 0.001 | 0.001 | 0.029 | 0.028 |
| | (0.042) | (0.044) | (0.033) | (0.034) | (0.029) | (0.030) |
| L.Loan Loss Provisions | -0.416 | -0.461 | -0.208 | -0.233 | -0.374 | -0.407 |
| | (0.288) | (0.305) | (0.256) | (0.266) | (0.275) | (0.287) |
| L.crsk (efficiency score) | 14.439*** | 15.019*** | 14.439*** | 14.439*** | 14.439*** | 14.439*** |
| | (3.566) | (3.759) | (3.566) | (3.759) | (3.566) | (3.759) |
| LaLerner (market power) | 0.408*** | 0.437*** | 0.408*** | 0.437*** | 0.408*** | 0.437*** |
| | (0.074) | (0.081) | (0.074) | (0.081) | (0.074) | (0.081) |
| Constant | 9.356* | 13.826*** | -0.074 | 3.238 | 13.870*** | 17.941*** |
| | (0.116) | (0.116) | (0.116) | (0.116) | (0.116) | (0.116) |

Note: Models 13–18: lending behaviour = Δ%loans; Models 13, 15, 17: policy interest rate = Refinancing rate; Models 14, 16, 18: policy interest rate = Discount rate. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.
Note: Models 19–24: lending behaviour = Δlnloans; Models 19, 21, 23: policy interest rate = Lending rate; Models 20, 22, 24: policy interest rate = Deposit rate. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.

### Appendix 4. Robustness check for the effect of state-owned ownership

| Dependent variable: the natural logarithm of gross loan (Δln loans) | Model 25 | Model 26 | Model 27 | Model 28 | Model 29 | Model 30 |
|---------------------------------------------------------------|--------|--------|--------|--------|--------|--------|
| L.Δln loans                                                  | 0.434*** | 0.380*** | 0.376** | 0.246* | 0.487*** | 0.422*** |
| (0.110)                                                      | (0.094) | (0.172) | (0.137) | (0.092) | (0.095) |
| GDP growth (GDPₜ)                                            | 1.499*** | 1.457*** | 1.439*** | 0.960** | 1.718*** | 1.611*** |
| (0.277)                                                      | (0.219) | (0.501) | (0.446) | (0.194) | (0.199) |
| Δ lending rate                                               | -0.471*** | -0.384** | -0.483*** |        |        |        |
| (0.112)                                                      | (0.150) | (0.101) |        |        |        |
| Δ Deposit rate                                               | -0.400*** | -0.279** | -0.448*** |        |        |        |
| (0.089)                                                      | (0.117) | (0.097) |        |        |        |
| GDPₜ × Dcsₜ                                                      | -0.279*** | -0.206** | -0.230** | -0.129** | -0.387*** | -0.242** |
| (0.106)                                                      | (0.082) | (0.090) | (0.059) | (0.126) | (0.098) |
| Δ[lending rate] × Dcsₜ                                        | 0.326*** | 0.251** | 0.384*** |        |        |        |
| (0.093)                                                      | (0.092) | (0.100) |        |        |        |
| Δ[deposit rate] × Dcsₜ                                        | 0.347*** | 0.211*** | 0.403*** |        |        |        |
| (0.092)                                                      | (0.059) | (0.107) |        |        |        |
| Inflation                                                     | 0.027 | -0.069** | -0.031 | -0.104** | 0.017 | -0.041 |
| (0.042)                                                      | (0.033) | (0.058) | (0.040) | (0.035) | (0.032) |
| Δln deposits                                                  | -0.012** | -0.010*** | -0.011** | -0.008 | -0.016*** | -0.013*** |
| (0.005)                                                      | (0.003) | (0.006) | (0.005) | (0.003) | (0.003) |
| L.capital                                                     | -0.013 | 0.125 | -0.004 | -0.03 | -0.023 | 0.065 |
| (0.095)                                                      | (0.075) | (0.105) | (0.105) | (0.081) | (0.080) |
| L.Loan Loss Provisions                                       | -0.467 | -0.453 | -0.243 | -0.479 | 0.07 | -0.146 |
| (0.547)                                                      | (0.622) | (0.749) | (0.760) | (0.461) | (0.534) |
| L.inassets                                                    | -0.970*** | -0.964*** | -1.347*** | -1.710*** | -1.117*** | -1.079*** |
| (0.181)                                                      | (0.160) | (0.385) | (0.393) | (0.138) | (0.150) |
| L.cr (efficiency score)                                      | 5.477 | 14.104** |        |        |        |        |
| (7.583)                                                      | (6.207) |        |        |        |        |
| L.Lerner (market power)                                      |        |        |        |        |        |        |
| (0.427)                                                      | (0.481) |        |        |        |        |
| State-owned                                                  | 16.159*** | 16.741* | 17.616* | 21.374* | 16.641** | 18.081** |
| (7.716)                                                      | (8.462) | (10.190) | (10.822) | (6.984) | (7.491) |
| GDPₜ × Dcsₜ × StateDummyₜ                                     | 0.452 | -0.227 | 0.009 | -0.276 | 0.676 | -0.051 |
| (0.627)                                                      | (0.444) | (0.439) | (0.358) | (0.585) | (0.500) |
| Δ[lending rate] × Dcsₜ × StateDummyₜ                         | -0.881* | -0.316 | -1.087** |        |        |        |
| (0.516)                                                      | (0.441) | (0.433) |        |        |        |
| Δ[deposit rate] × Dcsₜ × StateDummyₜ                         | -0.6 |        | 0.116 |        | -0.950* |        |
| (0.497)                                                      | (0.402) | (0.511) |        |        |        |

Note: Models 25–30: lending behaviour = Δlnloans; Models 25, 27, 29: policy interest rate = Lending rate; Models 26, 28, 30: policy interest rate = Deposit rate. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.
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### Appendix 5. Robustness check for the crisis effect

| Dependent variable: the natural logarithm of gross loan (ln loans) | Model 31 | Model 32 | Model 33 | Model 34 | Model 35 | Model 36 |
|---------------------------------------------------------------|----------|----------|----------|----------|----------|----------|
| LΔln loans                                                    | 0.631*** | 0.596*** | 0.530*** | 0.475*** | 0.452*** | 0.512*** |
| GDP growth (GDPt)                                             | 1.265*** | 0.825*** | 0.935     | 0.608     | 1.164*** | 0.723*   |
| Δ lending rate                                                | -0.151   | -0.110   | -0.151    | -0.151    | -0.151   | -0.151   |
| Δ Deposit rate                                                | -0.129   | -0.066   | -0.088    | -0.164    | -0.166   |
| GDPt × Dcsmin                                                | -1.763***| -1.416***| -1.334*** | -1.282*** | -1.380***| -1.420***|
| Δ(ln loans)                                                   | 1.586*** | 0.943*** | 0.978***  | 0.978***  | 0.978***  |
| Δ(ln deposits)                                                | (0.119)  | (0.109)  | (0.119)   | (0.107)   | (0.115)   |
| Lcapital                                                      | 0.027    | 0.068    | 0.015     | 0.022     | 0.023     | 0.079    |
| LLoan Loss Provisions                                         | -0.004   | 0.291    | 0.292     | 0.252     | 0.252     | 0.252    |
| Llnassets                                                     | (0.005)  | (0.007)  | (0.007)   | (0.008)   | (0.008)   | (0.008)  |
| Lcrsin (efficiency score)                                     | 1.580    | 3.351    | (4.671)   | (3.730)   |
| LaLerner (market power)                                       | -0.056   | -0.078   | (0.449)   | (0.330)   |
| CRISIS                                                        | 3.718**  | 3.082*** | 2.667**   | 2.691**   | 2.551***  | 3.197*** |
| GDPt × Dcsmin × CRISIS                                        | 8.268*** | 4.087*** | 7.128**   | 4.503**   | 7.178***  | 4.320*** |
| Δ(ln loans)                                                   | -4.827***| -3.071***| -3.238*** | -3.228*** | -3.228***|
| Δ(ln deposits)                                                | (1.499)  | (1.488)  | (1.087)   | (0.855)   |
| Observation                                                    | 260      | 260      | 260       | 260       | 260       |
| Number of instruments                                         | 25       | 25       | 25        | 25        | 25        |
| Hansen test of over-identification p-value                    | 0.542    | 0.490    | 0.232     | 0.332     | 0.226     | 0.407    |
| Arellano-Bond test for AR(1)                                   | 0.001    | 0.001    | 0.001     | 0.001     | 0.001     | 0.001    |
| Arellano-Bond test for AR(2)                                   | 0.275    | 0.833    | 0.932     | 0.790     | 0.981     | 0.827    |

Note: Models 31–36: lending behaviour = Δlnloans; Models 31, 33, 35: policy interest rate = Lending rate; Models 32, 34, 36: policy interest rate = Deposit rate. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01.
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