

Nguyen, Thanh Phuc; Dinh, Thi Thu Hong; Tran, Ngoc Tho

## Article

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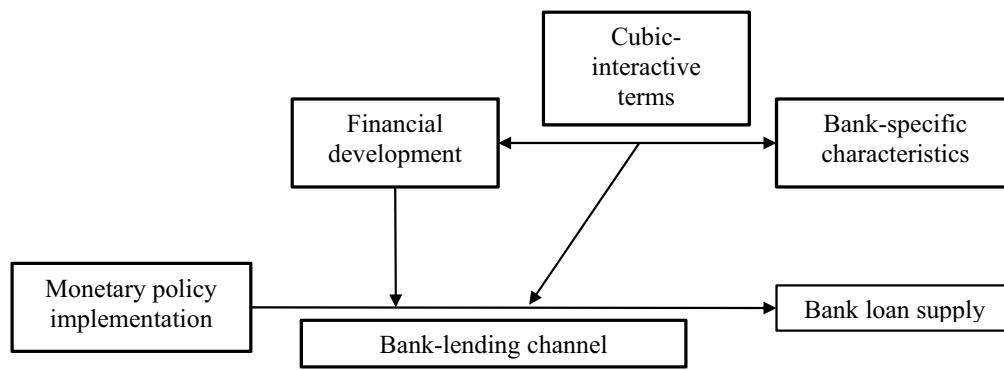
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\*Corresponding author: Thanh Phuc Nguyen, School of Finance, University of Economics Ho Chi Minh City, 59C Nguyen Dinh Chieu str., Vo Thi Sau Ward, District 3, Ho Chi Minh City, Vietnam  
E-mail: [phucnguyen.ncs2019033@st.ueh.edu.vn](mailto:phucnguyen.ncs2019033@st.ueh.edu.vn)

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Stirling United Kingdom

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## BANKING & FINANCE | RESEARCH ARTICLE

# Financial development and monetary policy transmission in a multiple-tool regime: The case of Vietnamese commercial banks

Thanh Phuc Nguyen<sup>1\*</sup>, Thi Thu Hong Dinh<sup>1</sup> and Ngoc Tho Tran<sup>1</sup>

**Abstract:** The research aims to test the impact of financial development on the bank lending channel of monetary policy transmission for the case study of an emerging market characterized by a multiple-tool regime, which has been ignored in previous studies. Given the two-step system generalized moments of method (GMM) estimation for a comprehensive sample of commercial banks covering the period of 2007–2020, findings show that the financial development weakens the bank lending channel of monetary policy transmission, indicating the accessibility of banks to financial instruments and financing sources insulating these banks from the monetary policy shocks. Furthermore, the influence of the financial market on the response of the bank loan supply to monetary policy shocks is heterogeneous for each case of bank individual characteristics. These results are consistent across the GMM options for cross-section fixed effects, a set of monetary policy instruments, an alternative proxy for the financial development and the time event such as the Vietnamese financial banking system. The study sheds light on several policy recommendations for policy-makers to navigate the bank loan supply of monetary policy pass-through considering the critical role of financial development.

**Subjects:** Economics; Monetary Economics; Banking

**Keywords:** Financial development; Bank lending mechanism; Monetary policy transmission; Vietnamese commercial banks

**Jel codes:** E42; E52; O16

## 1. Introduction

Among the numerous determinants of bank loan supply, many studies have emphasized that monetary policy is regarded as a major component affecting the credit supply of banks (Disyatat, 2011; Kashyap & Stein, 1995). Especially, in order to stabilize the price level and to promote economic growth properly, monetary policy is appropriately applied in which central banks may achieve diverse transmission objectives through the banking sector using many monetary

## PUBLIC INTEREST STATEMENT

Much needed attention has been paid to the role of financial development because of its relevance to the pursuit of economic agendas. Over the years, numerous studies devoted to financial development have recognized its crucial influence in the attainment of economic objectives, including monetary policy effectiveness. Our research reveals that financial development could hamper the bank lending channel of monetary policy transmission, suggesting that banks' access to financial instruments and funding sources may insulate them from monetary policy shocks. In addition, the effect of the financial market on the sensitivity of the bank loan supply to monetary policy shocks varies according to the bank-specific balance sheet items.

instruments (Dang & Nguyen, 2020). In this vein, a monetary policy contraction could limit the banks' access to creditable funds, resulting in the decrease in credit supplies of banks (Bernanke & Blinder, 1988). Conversely, loosening monetary policy could encourage banks' lending activities, which stimulates loanable funds for banks. Therefore, this bank lending is a pivotal channel through which monetary policy is workable and thereby impacts the economic activities (Abdul Karim et al., 2011).

The impacts of monetary policy on bank loan supply could depend on different factors. Prior studies, mostly focusing on bank-specific characteristics, indicate that banks with weak balance sheets are unable to isolate lending activities from monetary policy shocks (Altunbas et al., 2010; Kashyap & Stein, 1995; Kishan & Opiela, 2006). Some other studies have discussed the sensitivity of banks' loan supply to monetary policy shocks with other factors pertaining to internal factors of banks or the macro-economy, such as ownership structure (Allen et al., 2017), foreign banks (Jeon & Wu, 2014), bank risk taking (Altunbas et al., 2010), stock market response (Scharler, 2008), financial crisis (Brei & Schclarek, 2015), and financial integration (Atta-Mensah & Dib, 2008). However, the level of financial development, possibly playing an important explanation of the variations in bank lending behaviors of monetary policy pass-through, is under-explored.

The degree of financial development might have an impact on the monetary policy transmitted through the bank lending mechanism. Under the developed financial systems, monetary policy shocks might less influence banks' lending activities, because these banks have more chances to gain the available financial instruments and a larger choice of funding sources. This leads to less response of bank loan supply to the monetary policy stance (Sanfilippo-Azofra et al., 2018). For more details, the failure of banks for their ability to access the external financing market could be eliminated under the development of financial markets. This is because the financial instruments and external capital driven by the financial development could increase the banks' financial flexibility, and hence shield these banks from shocks of monetary policy (Sanfilippo-Azofra et al., 2018). In addition, the rich instruments in financial markets could provide a new way for households to invest, thus leading to a decrease in the loanable funds of banks in the form of households' deposits. Given the less dependence of households' investment on banks' credit, the bank loan supply is strongly restricted under monetary tightening. Moreover, small- and medium-sized enterprises (SMEs) could obtain alternative financing funds due to the diverse instruments driven by the development of the financial market, hence reducing their financing reliance on banks' credit (Zhan et al., 2021). This could lead to the ineffectiveness of monetary policy transmission through the bank lending channel. On the contrary, poorly developed financial markets could induce banks to reduce the lending amount due to banks' dependence on conventional financing sources (e.g., deposits from customers), which are severely affected by the implementation of monetary restrictions.

The added value of this study could stem from several key points as follows. First, there is rather much research on bank lending channel of monetary policy transmission conditional on bank's balance sheets and other factors relating to banking system (Akinci et al., 2013; Altunbas et al., 2010; Bashir et al., 2020; Dang & Dang, 2021a; Heryán & Tzeremes, 2017; Hou & Wang, 2013; Leroy, 2014); however, only a few research highlight the driving role that financial development could play in shaping the monetary policy pass-through via bank lending channel (Sanfilippo-Azofra et al., 2018; Zhan et al., 2021). Moreover, this research has been conducted in developed and developing countries rather than emerging and frontier ones.

Second, as aforementioned, research on monetary policy transmission via bank lending channel in emerging countries are inconclusive (Amidu & Wolfe, 2013; Archer, 2006; Olivero et al., 2011), partly because the presence of bank lending channel of monetary policy pass-through could depend on the country sample and estimation periods (Rashid et al., 2020). The study aims at confirming the existence of bank lending channel transmitted by monetary policy using the bank-level data instead of time-series data, which is widely used in previous research (Anwar & Nguyen,

2018; Hoshi et al., 2007; Ippolito et al., 2018; Mahathanaseth & Tauer, 2019; Neuenkirch, 2013). Specifically, there are two shortcomings of time series analysis such as the identification issue between supply side and demand side and the failure of testing the heterogeneity of bank-specific characteristics.

Third, theoretical perspectives on the influence of financial development on the bank lending channel of monetary policy pass-through are inconclusive into negative or positive relationships, giving a rise to explore this relationship by more empirical research in order to provide some ideas to the effective conduct of monetary policy when considering the development of the financial market. We also contribute to the limited literature on the joint effect of bank-specific characteristics and financial development in the response of bank loan supply to monetary policy. This linkage could be captured by the approach of cubic-interactive terms among monetary policy tools, financial development, and bank's balance sheet items, which remain scarce in recent empirical studies.

It is appealing to investigate this topic in an emerging country like Vietnam due to some unique nature as follows. First, due to the pivotal role of the banking system in which economic agents are highly dependent upon bank loan supply, it could be seen that transmission of monetary policy via bank lending conduit is more pronounced (Vo & Nguyen, 2014). Second, following the objectives of financial market development, the banking reforms in particular have caused some significant changes in scale, banking structure, risk, and performance of commercial banks (Dang & Nguyen, 2020). Third, a series of monetary policy tools such as refinance rate, rediscount rate, and inter-bank interest rate are simultaneously adopted by the State Bank of Vietnam (SBV). This multiple tool regime could make SBV more flexible in achieving different macroeconomic targets (Dang, 2020). The research of Sanfilippo-Azofra et al. (2018) for 31 low- and middle-income countries is relatively similar to this study, but they do not include Vietnam in their studied sample. Therefore, Vietnam provides a favorable scenario to shed a further light on the understanding of financial development and bank lending mechanism of monetary policy, from a typical regime with multiple monetary instruments.

For the case study of a comprehensive bank-level data of commercial banks over the period of 2007–2020, we highlights the presence of the bank supply channel through which the monetary policy could transmit in the emerging market. Furthermore, the bank lending mechanism of monetary policy is attenuated when considering the influence of financial development, which implies the ineffectiveness of monetary policy caused by the enhanced process of financial markets. Moreover, the impact of financial development could work through the response of the bank lending channel of monetary policy pass-through to bank-specific characteristics. In this vein, the financial development also weakens the influence of the credit risk and bank capital on the bank lending channel of monetary policy while it has a weak effect on the responses of the bank lending mechanism of monetary policy to the liquidity and scale of banks.

Following this introduction, the rest of the study is organized as follows. Section 2 summaries the related literature, while Section 3 outlines the methodology and measures of variables. The results are discussed in Section 4, and the further investigation is also reported. Finally, Section 5 concludes this paper, followed by several policy implications.

## 2. Literature review

Monetary policy could impact the aggregate economy and price levels via several mechanisms (Mishkin, 1995), including interest rates mechanism, assets' price mechanism, exchange rate mechanism, risk-taking mechanism, bank loan mechanism, and liquidity creation mechanism. This paper places an emphasis on the amount of bank loan provided through which the monetary policy could operate (Bernanke & Blinder, 1988; Bernanke & Gertler, 1995). Given this conduit, the tight monetary policy could lead to lower loans from banks because of a decrease in bank's ability to approaching loanable funds (such as bank deposits) and an increase in the cost of market

financing for banks. More recently, using a sample of 80 Sub-Saharan African banks covering a period of 2010–2019 and the dynamic system-generalized method of moments, Modugu and Dempere (2022) show that loosening (tightening) monetary policy causes an increase (a decrease) in the total volume of loans granted. The justification for the negative impact of monetary policy on bank loan supply is that a monetary expansion (restrictions) could stimulate (hamper) greater bank deposits and hence an increase in capacity for granted bank loans and the rejection of bank loan applications, respectively.

There is a vast empirical research on the bank lending channel of monetary policy transmission depending on the heterogeneities in bank characteristics (Altunbaş et al., 2002; Juurikkala et al., 2011), structure of banking system (Hou & Wang, 2013), and macro-economy-related factors (Auer et al., 2019). To be specific, under the tightening monetary policy, banks with small-sized, less liquid, under-capitalized features could encounter a decrease in bank loan supply to a greater extent than peers with large-sized, well liquid, and highly capitalized features. In addition to banks' balance sheets, other studies investigate the role of banking market power (Khan et al., 2016). Accordingly, banks operating in more concentrated markets could be less affected by monetary policy shocks. According to Gambacorta and Marques-Ibanez (2011), financial advancement and significant changes in the model structure of banks' operating could drive the bank lending channel of monetary shocks. Furthermore, Cantero-Saiz et al. (2014) indicate that banks in the countries with high degree of sovereign risk could be more susceptible to monetary policy tightening.

The pass-through of monetary policy through the bank loan supply is a well-established topic in literature in the field of banking and economics. However, studies examining the role of financial development in monetary policy transmission via the bank lending channel are rather limited in breadth and context. For example, Krause and Rioja (2006) discover that financial growth enhances monetary policy efficiency using a sample of 37 industrialized and developing economies. Covering the sample of developed and Asian economies, Sukudhew Singh et al. (2008) argue that the interest rate transmission from the policy interest rates to retail bank deposit rates is higher than that to lending rates, which implies the weakening effect of monetary policy on bank loan supply. Carranza et al. (2010) observed that under a financially less-developed system, monetary policy does matter; however, it takes more time to influence these countries. However, these results do not investigate the change in bank lending behaviors of monetary policy attributed to the level of financial development. Sanfilippo-Azofra et al. (2018) employing 31 developing countries directly highlights the weakening role of the bank lending channel of monetary policy pass-through under-developed financial systems. However, this research ignores Vietnam's context and covers the different periods of 2000–2012.

More recently, using 37 African economies covering the period of 1990–2017, Fiador et al. (2022) reveal the inconclusive impact of financial development components (i.e., the financial institutional development index and equity market development) on the lending rate. The financial institutional development index, which measures depth, accessibility, and efficiency, had a statistically significant negative influence on lending rates, but financial market indices had no effect. This suggests that the growth of financial institutions in Africa is more closely tied to interest rates than to the development of the equity market, which is expected based on the fact that financial intermediaries in the majority of African economies are banks. Overall, financial development can facilitate the transmission of monetary policy through the lending rate. However, our research differs from the use of a single country, such as Vietnam, with a multiple-tool regime and bank-level accounting data. This can be a justification for the impact of financial development on reducing the potency of monetary policy transmission. This weakening effect is also consistent across different measures of financial development, such as the growth of the stock market and the amount of domestic credit given to the private sector.

Using disaggregated bank-level data for Saudi Arabia covering 2008Q1 to 2020Q4, as well as econometric estimations such as the panel VAR approach and the Impulse Response Functions, Boukhatem



and Djelassi (2022) show that a positive shock in the monetary policy (represented by money reserves) can lead to a statistically significant positive reaction in both Islamic financing and traditional credit. This research confirms the existence of the bank lending channel; however, it differs from the econometric treatment and model's bank-level accounting variables when compared to our study.

Given these under-researched points, it should be taken into account the role of financial development on the bank loan supply of monetary policy pass-through. Furthermore, apart from the approach of interaction terms widely used in the prior research, this paper includes the cubic-interactive terms among monetary policy, the level of financial development, and banks' characteristics to assess how the financial development affect the response of the bank lending channel of monetary policy transmission to bank idiosyncratic features.

There is rather consensus related to explanations for the significant impact of financial development on bank lending of monetary policy transmission. For the case of EU banks, Ferreira (2010) finds that the development of bank's size as well as the financial instruments of bond and money markets could weaken the pass-through of monetary policy via the bank lending. This is because the financial innovation and external financing chances could prevent these banks from curtailing the bank loan supply. Altunbas et al. (2009) show that the dampening of the bank loan supply channel could stem from the increase in bank's liquidity and trading securities and the development of financial tools could enhance the diversification risk of banks. This insulates the impact of monetary policy on bank loan supply. In addition, Perera et al. (2014) highlight the role of financial development with respect to funding structures on the bank lending mechanism for the case of South Asian economies. The weakening impact of monetary policy transmission could be evidenced for the country with a more developed banking sector. This is because banks could obtain alternative financing sources to overcome the negative effect of monetary policy on bank loan supply. Zhan et al. (2021) suggest that the importance and significance of the bank lending channel is primarily dependent on the failure of banks' accessibility to the external financing market, which allows banks to avoid the reduction of loan supply caused by monetary policy tightening. It is worth mentioning that the financing opportunities from the external market could be shaped by the financial development (Lerskullawat, 2017). Therefore, in addition to the well-established literature on the determinants of bank lending mechanism, there is a need for more research on how the financial development could shape the response of the bank lending channel to the monetary policy. Taken together, financial development could bring more opportunities for banks to get access to external financial funds, thereby dampening the influence of monetary policy on the bank lending.

The potency of monetary policy transmission could rely on the different degree of financial development. For the under-developed financial systems with insufficient external capital and the primary financial assets captured by households under the form of banks' deposit, monetary policy restrictions would result in a decrease in bank reserves, and hence bank loan supply. This means the effectiveness of monetary policy through its strong impact on bank lending activities (Sanfilippo-Azofra et al., 2018). In addition, the bank lending channel is more pronounced in countries depending mainly on banking financing than those with the financial systems following the market orientation (Brissimis & Delis, 2009; Brissimis & Magginas, 2005). However, in case of high financial development, financial markets hold a critical position in facilitating the external financing sources as well as financial instruments, which induce households, SMEs, or even banks to become reliant on these financial innovations (Rybczynski, 1997) rather than banks' deposits. In this vein, the weakening effect of financial development on the bank lending channel of monetary policy transmission could be confirmed. Motivated by these contradictory explanations, we conduct this research to examine the role of financial development in the response of bank loan supply to monetary policy transmission.

In the context of Vietnam, monetary policy has an impact on real output through several mechanisms such as interest rate, exchange rate, and foreign shocks (Anwar & Nguyen, 2018;



Hung & Pfau, 2009). In this line, Vo and Nguyen (2017) show the existence of the cost channel and the absence of exchange rate channel and asset price channel. For the approach of disaggregate data for commercial banks in Vietnam, Vo and Nguyen (2014) confirm the presence of the bank lending channel in Vietnam for the period of 2003–2012 and the dependence of this channel on bank-specific characteristics. More recently, Dang and Dang (2021b) provide evidence on the weakening effect of bank diversification on the bank lending mechanism of monetary policy transmission. To the best of our understanding, there is no empirical research on the influence of financial development on the bank lending channel through which monetary policy could work in Vietnam. Therefore, this study fills the void to provide the evidence of financial development in relation to the bank lending channel for the case study of an emerging market such as Vietnam.

To sum up, the bank lending channel of monetary policy pass-through depending on the heterogeneities of bank-specific characteristics and other determinants relating to internal banking system and macro economy is more pronounced in previous studies. However, the empirical evidence on the impact of financial development on this channel still remains scarce and the explanation for the role of financial development on the bank lending channel is inconclusive. Therefore, the next section of empirical analysis is designed to address these voids.

### 3. Data and methodology

#### 3.1. Selection of the studies sample

The study's sample consists of 30 commercial joint stock banks in Vietnam, covering the period of 2007–2020, which captures the considerable variations in operating activities of the banking system and the adaptive implementation of SBV's monetary policy. Based on the bank information published by SBV for the end of 2020, there are 31 commercial joint-stock banks operating in Vietnam. Because of special controls in 2015, Dong A Commercial Joint-Stock Bank (DAB) was removed from the studied sample to remain consistent in normal operation among these banks. All studied banks are reported in the Appendix A. One should note that the standardized pattern of financial reports from Vietnamese commercial banks has been implemented since 2007. Furthermore, prior to 2007, the published and audited financial reports mainly belonged to a few large banks. The rationale of including only the commercial banks in the research sample is to reduce the potential heterogeneity in goals and operations from the different types of banks (Wu et al., 2020).

Annual bank-level data of the balance sheets and income statements are collected from the Bankscope database in comparison with the audited financial reports to ensure the data accuracy. Several studies also employed the dataset on the annual basis (Altunbas et al., 2010; Gambacorta, 2005; Lerskullawat, 2017; Wu et al., 2020), suggesting that using the annual observations are enough to address the heterogeneity in the adjustment of bank lending supply to monetary policy. There are no banks without the five consecutive years of financial reports, which helps to test the null hypothesis of second-order serial correlations to make estimates carried out by system-GMM estimation more robust (Arellano & Bond, 1991). Moreover, banks involving mergers or acquisitions (M&A) in the studied period are excluded. For example, Hanoi Building Commercial Joint Stock Bank (HBB), Housing Bank of Mekong Delta (MHB), and Southern Bank (PNB) were removed due to being under M&A in August 2012, May 2015, and October 2015, respectively.

For data of macroeconomic variables, the growth of gross domestic product information is sourced from World Development Indicators (WDI). The final sample includes 409 observations, accounting for approximately 90% of the Vietnamese banking sector's total assets (Dang & Dang, 2021a). Before making regression treatment, the winsorizing process, followed by the work of Dang (2020), is adopted for the micro-level variables at 2.5% and 97.5% of the interval levels to insulate potentially negative consequences of the extreme values.

### 3.2. Econometric model

In order to test the impact of financial development on the bank lending channel of monetary policy transmission, according to Kashyap and Stein (1995) and Sanfilippo-Azofra et al. (2018), the econometric model is adopted as follows:

$$\Delta \ln(\text{loans})_{i,t} = \beta_0 + \beta_1 \Delta \ln(\text{loans})_{i,t-1} + \beta_2 \Delta i_t + \beta_3 FD_t + \beta_4 (\Delta i_t * FD_t) + \beta_5 CAP_{i,t-1} + \beta_6 SIZE_{i,t-1} + \beta_7 LIQ_{i,t-1} + \beta_8 LLP_{i,t-1} + \beta_9 GDPG_t + \varepsilon_{i,t} \quad (1)$$

where  $i$  and  $t$  denote the bank  $i$  and corresponding year  $t$ , respectively;  $\Delta \ln(\text{loans})_{i,t}$  is the growth rate of bank loan supply;  $\Delta i_t$  is the changes in the interest rate-related tools of monetary policy such as rediscount rates ( $\Delta REDIS_t$ ), refinance rate ( $\Delta REFI_t$ ), interbank interest rate ( $\Delta VNIBOR_t$ ) and ( $\Delta LEND_t$ );  $FD_t$  is the financial development measured by two proxies such as  $CMD_t$  (the stock market capitalization over GDP ratio) and  $CPS_t$  (the domestic credit to private sector divided by GDP); The set of bank individual variables consists of  $SIZE$  (the natural logarithm of total assets),  $LIQ$  (the ratio of liquid assets to total assets),  $CAP$  (the equity divided by total assets), and  $LLP$  (the loan loss provision over gross loan ratio).  $GDPG$  is the growth rate of gross domestic product. The definition of all variables are reported in Table 1.

For more details,  $\Delta \ln(\text{loans})_{i,t}$  refers to the percentage change in bank loan supply, which is largely employed in the literature on the bank lending mechanism (Gambacorta & Marques-Ibanez, 2011; Jimborean, 2009; Olivero et al., 2011). The lagged form of bank loan supply is included to reflect the bank loan persistence (Altunbas et al., 2010; Bashir et al., 2020; Dang & Dang, 2021a; Khan et al., 2016; Matousek & Sarantis, 2009; Vo & Nguyen, 2014).

There are no widely consistent indicators in the literature to measure the monetary policy stance. For the monetary policy implementation by the SBV, a series of interest rates are employed simultaneously ( $\Delta REDIS_t$ ,  $\Delta REFI_t$ ,  $\Delta VNIBOR_t$ ). These proxies take the first-difference form, meaning that the positive (negative) values indicate a tightening (loosening) monetary policy (Borio & Gambacorta, 2017; Dang & Dang, 2021b; Khan et al., 2016; Lerskullawat, 2017; Sanfilippo-Azofra et al., 2018). The refinance rate and rediscount rate aim to charge for short-term loan supply and

**Table 1. Summary of the studied variables**

Variable	Description	Source
LG	The lagged one-year of bank loan supply	Bank's audited financial reports and author's calculation
$\Delta REFI$	Refinance rate	State of Bank Vietnam
$\Delta REDI$	Rediscount rate	State of Bank Vietnam
$\Delta VNIBOR$	Vietnam interbank interest rate	State of Bank Vietnam
$\Delta LEND$	Lending rate	International Financial statistics of International Monetary Fund
CAP	The proportion of bank capital over total assets	Bank's audited financial reports and author's calculation
SIZE	The natural logarithm of total assets	Bank's audited financial reports and author's calculation
LIQ	The ratio of cash and deposits to total assets	Bank's audited financial reports and author's calculation
LLP	The loan loss provision divided by gross loan	Bank's audited financial reports and author's calculation
CMD	The ratio of stock market capitalization to GDP	World Development Indicators (WDI)
CPS	Domestic credit to private sector divided by GDP	World Development Indicators (WDI)
GDPG	The growth rate of gross domestic product	World Development Indicators (WDI)

discounted valuable documents, respectively. Interbank interest rate is applied to capture the short-term liquidity demands of banks with insufficient capital. The alternative proxy for  $\Delta i_t$  such as short-term lending interest rate ( $\Delta LEND_t$ ) could be used as the robustness test (Chen et al., 2017; Yang & Shao, 2016).

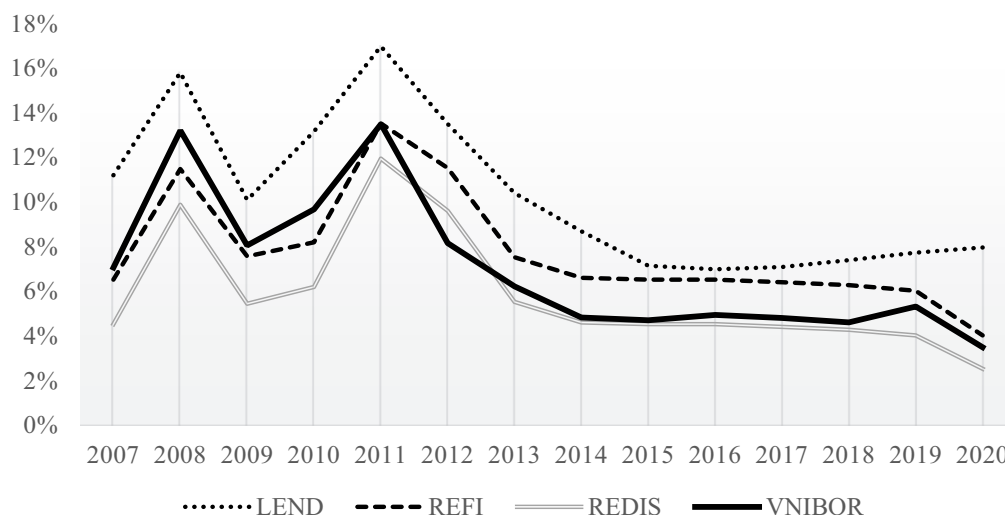
If the coefficients on the monetary policy instruments—bank loan supply nexus are statistically negative, the bank lending channel of monetary policy transmission exists. It is expected that the coefficients  $\beta_2$  have negative signs. Figure Figure 1 shows the evolution of monetary policy instruments from 2007 to 2020. Although there have been different fluctuations across the studied period 2007–2020, all indicators for monetary policy have the same pattern to prove the simultaneously adaptive implementation of monetary policy instruments initiated by the SBV. The high interest rates in 2008 and 2011 were implemented in order to deal with the consequences of the global financial crisis and the high inflation, respectively.

Likewise, there is no consensus among researchers on the most suitable measures of financial development (Levine, 2002; Sanfilippo-Azofra et al., 2018). A more profound financial sector captures its better potential to facilitate vital capital to the economy. In developed countries, the bank system and the stock market are considered as two critical sectors to compose the financial market, while for the developing and emerging countries, the banking system plays a primary proxy for the financial market, where stock markets are relatively nascent. With respect to the measures of financial development, private sector domestic credit and stock market capitalization are two indices often widely employed as financial depth proxies (Choi & Park, 2018; Fisman & Love, 2003; Shen, 2013). In this research, following Sanfilippo-Azofra et al. (2018) and Zhan et al. (2021), the capital market development  $CMD_t$  (measured by the stock market capitalization over GDP ratio) and  $CPS_t$  (measured by the domestic credit to private sector divided by GDP) are employed to gauge  $FD_t$ . Figure Figure 2 illustrates the evolution of financial development in Vietnam over the period 2007–2020. As a whole, the stock market development and the domestic credit development progressed in the same direction. Based on this upward trend, it is clearly implied that the financial market in Vietnam has witnessed a continuous development in the period of 2007–2020. This is in line with the fact that the stock market and banking system in Vietnam are the critical channels to facilitate the capital for the private demands in particular and the entire economy in general.

The financial market characterized by a variety of financial instruments allows commercial banks to benefit from more non-conditional income, thus inducing banks to become less reliant on bank loan supply as the main channel to create interest-based income. Therefore, the sign of

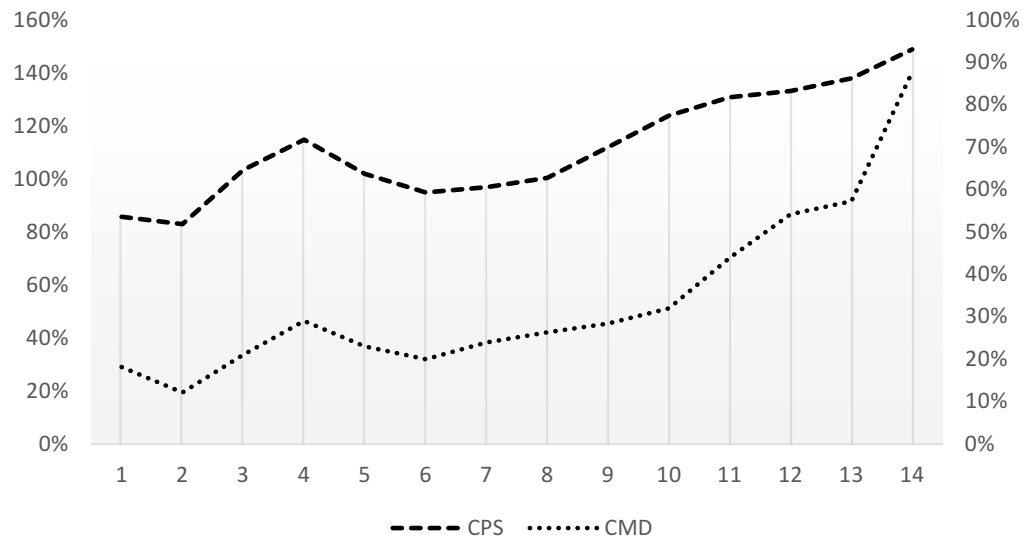
**Figure 1. The interest rate for the monetary policy implementation in Vietnam for the 2007–2020 period.**

Sources: Author's elaboration



**Figure 2. The evolution of financial development in Vietnam from 2007 to 2020.**

Sources: Author's elaboration



coefficients  $\beta_3$  for the impact of financial development on the bank lending channel is expectedly negative.

To control for the impact of financial development on the potency of monetary policy via bank loan supply, the interaction term between financial development and monetary policy instruments such as  $\Delta i_t * FD_t$  is inserted into model (1). On the one hand, when the economic agents (e.g., households and SMEs) are exposed to diverse financial instruments innovated by the higher level of financial development, the financing demands become less dependent on the credit channel of banks. Therefore, banks that could not exploit the deposits from the public to provide loans, leading to the decrease due to the monetary policy restrictions. In this case, monetary policy would be efficient. On the other hand, the exposure of banks to financial innovations no longer makes these banks reliant on the bank loan supply. This implies that the potency of monetary policy is weakened. Based on these arguments, one expects the positive sign of  $\beta_4$ .

### 3.3. Control variables

Current research employs numerous key bank-specific characteristics. All these bank-specific variables are lagged one-period to eliminate the potential endogeneity problem (Dang, 2020). According to prior research (Altunbas et al., 2010; Gambacorta & Marques-Ibanez, 2011; Jimborean, 2009; Kashyap & Stein, 1995; Kishan & Opiela, 2006; Lerskullawat, 2017), large-sized, more liquid, well-capitalized, and lower credit risk banks could stimulate the bank loan supply. Therefore, the coefficients of  $\beta_5$ ,  $\beta_6$ , and  $\beta_7$  on  $SIZE_{i,t-1}$ ,  $LIQ_{i,t-1}$ , and  $CAP_{i,t-1}$ , respectively, have positive signs; meanwhile the negative sign of coefficient  $\beta_8$  is expected for  $LLP_{i,t-1}$ .

Following several previous studies (Ehrmann et al., 2003; Gambacorta, 2005; Jimborean, 2009), all bank-specific variables are normalized in terms of their mean across all banks in the studied sample.

$$SIZE_{i,t} = \log A_{i,t} - \frac{\sum_{i=1}^N \log A_{i,t}}{N_t} \quad (2)$$

$$LIQ_{i,t} = \frac{L_{i,t}}{A_{i,t}} - \frac{\sum_{t=1}^T \left( \sum_{i=1}^N \left( \frac{L_{i,t}}{A_{i,t}} \right) / N_t \right)}{T} \quad (3)$$

$$CAP_{i,t} = \frac{E_{i,t}}{A_{i,t}} - \frac{\sum_{t=1}^T \left( \sum_{i=1}^N \left( \frac{E_{i,t}}{A_{i,t}} \right) / N_t \right)}{T} \quad (4)$$

$$LLP_{i,t} = \frac{P_{i,t}}{Loans_{i,t}} - \frac{\sum_{t=1}^T \left( \sum_{i=1}^N \left( \frac{P_{i,t}}{Loans_{i,t}} \right) / N_t \right)}{T} \quad (5)$$

where  $L_{i,t}$  is cash and deposits;  $E_{i,t}$  refers to total equity;  $A_{i,t}$  stands for total assets;  $P_{i,t}$ , and  $Loans_{i,t}$  are loan loss provisions and total loans, respectively.  $N_t$  denotes the number of banks.

To capture the business cycle and economy demands, the growth rate of gross domestic product ( $GDPG_t$ ) is also included (Jimborean, 2009). Moreover, this proxy could reflect the cyclical changes and account for the interest-based components of monetary policy (Cantero-Saiz et al., 2014). The economic growth could raise the credit demands through numerous profitable projects and hence boost the banks' lending activities (Wu et al., 2011). This expectedly leads to the positive sign of  $\beta_9$ .

It is worth noting that since the banking crisis from 2011 to 2014, the Vietnamese banking system has been undergoing substantial changes (Huynh et al., 2020; D. P. D. P. Nguyen et al., 2018). For most Vietnamese commercial banks, fast lending expansion has resulted in an asset-quality crisis and thereby Vietnam's recent financial crisis (Pham et al., 2021). To control the impact of this crisis, we use the dummy variable, CRISIS, which takes the value of 1 for the 2011–2014 crisis period and 0 otherwise. All specifications are tested with and without CRISIS to provide the evidence of consistent and robust findings.

### 3.4. Econometric estimation method

The two-step system generalized method of moments (GMM) estimator is applied to capture the dynamic panel data (Arellano & Bover, 1995; Blundell & Bond, 1998), which consists of the standard specifications in first-difference with an appropriate lagged level as instruments, and the additional specifications in levels with appropriately lagged first differences as instruments. Following the approach of Jimborean (2009), the proxies for monetary policy and macro-economy are treated as exogenous; meanwhile bank idiosyncratic characteristics and interaction terms are considered as endogenous in current research. System GMM estimator would suit a panel data with large cross-sections (N) and small time periods (T).

Bank-level individual proxies and lagged dependent variables included in the model could cause an issue of endogeneity, which makes regression estimates biased (Khan et al., 2016). Furthermore, monetary policy could have an implication for bank loan supply; however, the real context of the banking industry might have an impact on choosing the appropriate implementation of monetary policy. This reversal linkage could cause the acute problem of endogeneity (Cantero-Saiz et al., 2014).

There are two selections for dealing with the cross-sectional fixed-effects, such as “difference” approach and “orthogonal deviations” approach. The former indicates the use of first-differenced data for the estimation process while the latter capture the alternative method of excluding the individual levels (Zhan et al., 2021). This research utilizes both approaches to test the robustness of main findings across the use of different options. Additionally, instruments used could not outnumber individual units (Dang & Dang, 2021b). Two diagnostic tests, such as Hansen test and Arellano-Bond test, are employed to check the validity of instruments and the absence of serial association of second-order with the error term, respectively.

## 4. Empirical results

In this subsection, we first provide the descriptive statistics and the correlation matrix (Sub-section 4.1) to have preliminary understandings of all studied variables, followed by the baseline regression findings and more discussion (Sub-section 4.2). These results are confirmed based on the

robustness test with an alternative variable for the monetary policy instrument (Sub-section 4.3). Going a step further, we test the joint effect of financial development and bank individual characteristics on the bank lending channel (Subsection 4.4).

#### 4.1. Descriptive statistics

Table 2 shows the statistical descriptive for the research sample of Vietnamese commercial banks. The growth rate of bank loans ranging from  $-49.16\%$  to  $295.1\%$  is distributed with an average value of  $33.62\%$  and a standard deviation of  $58.86\%$ . This suggests a high fluctuation in the values of bank loan supply across commercial banks. In terms of monetary policy instruments, the large values of standard deviation and the wide ranges of these instruments ( $\Delta REFI$ ,  $\Delta REDIS$ ,  $\Delta VNIBOR$ , and  $\Delta LEND$ ) signal the critical interventions of the SBV into the banking market. Concerning the financial development, the capital market development takes the mean of  $33.95\%$  with the standard deviation of  $19.17\%$  and the wide range of distribution from the minimum value of  $12\%$  to maximum value of  $87.7\%$ . A similar pattern is observed for the ratio of domestic credit to the private sector over GDP as well, which falls into the range of  $82.9\%$ – $148.8\%$  (from minimum to maximum).

Table 3 reports the matrix of each pair of correlations between studied variables. In general, all values of pairwise correlations are highly less than the threshold of 0.8, suggesting the absence of severe multicollinearity. Except for correlations of dependent variables and proxies of financial development, these variables do not enter into the same model, which is prudent for the estimation results. One should note that the high value of pairwise correlations among monetary policy indicators possibly shows the simultaneous implementation of monetary policy navigated by the SBV.

#### 4.2. Baseline estimation results

This subsection reports the driving role of financial development in the impact of monetary policy shocks on the growth rate of bank loans. Each table shows the estimation results for each instrument of monetary policy, such as refinance rate ( $\Delta REFI$ ), rediscount rate ( $\Delta REDIS$ ), and interbank interest rate ( $\Delta VNIBOR$ ) combined with two variables of financial development. Furthermore, the regression results across the GMM options of fixed-effects handling and the different proxies of financial development are also reported to robust the main research findings.

**Table 2. Statistical descriptive for all variables**

Variable	Mean	Std. Dev.	Min	Max	p25	p75
LG	33.62	58.86	−49.16	295.1	8.74	36.0
$\Delta REFI$	−0.21	2.58	−4.00	5.33	−2.00	0.00
$\Delta REDIS$	−0.18	2.76	−4.43	5.75	−1.50	0.00
$\Delta VNIBOR$	−0.33	2.90	−5.34	6.14	−1.82	0.71
$\Delta LEND$	−0.30	2.73	−5.72	4.60	−1.71	0.34
CAP	10.22	5.05	4.28	26.62	6.68	12.15
SIZE	11.24	1.26	8.68	13.89	10.22	12.10
LIQ	20.04	10.33	5.80	50.59	12.52	26.92
LLP	0.658	0.713	0.00	3.9	0.234	0.825
CMD	33.95	19.17	12.0	87.7	21.0	43.80
CPS	112.1	19.22	82.9	148.8	96.8	130.7
GDPG	6.01	1.06	2.91	7.13	5.42	6.81

Note: For the comprehensive interpretation, the descriptive statistics of control variables such as CAP, SIZE, LIQ, and LLP are shown in the standard form before the normalization. The definitions for all variables are reported in Table 1.

**Table 3. The matrix of correlation coefficients**

	LG	$\Delta$ REFI	$\Delta$ REDIS	$\Delta$ VNIBOR	$\Delta$ LEND	CAP	SIZE	LIQ	LLP	CMD	CPS	GDPG
LG	1											
$\Delta$ REFI	-0.073	1										
$\Delta$ REDIS	-0.077	0.998***	1									
$\Delta$ VNIBOR	-0.052	0.895***	0.908***	1								
$\Delta$ LEND	-0.069	0.892***	0.910***	0.932***	1							
CAP	0.040	0.014	0.017	0.040	0.024	1						
SIZE	-0.242***	-0.011	-0.010	-0.031	0.001	-0.696***	1					
LIQ	0.269***	-0.018	-0.019	-0.010	-0.038	0.250***	-0.372***	1				
LLP	-0.185***	-0.032	-0.032	-0.035	-0.037	-0.033	0.238***	-0.349***	1			
CMD	-0.086	-0.208***	-0.161**	-0.092	0.057	0.072	0.036	-0.009	0.036	1		
CPS	-0.068	-0.178***	-0.147**	-0.061	0.056	0.058	0.040	0.004	0.044	0.917***	1	
GDPG	0.157**	0.112*	0.099*	0.091	0.078	-0.044	-0.055	0.006	-0.035	-0.163***	-0.0857	1

Note: For the comprehensive interpretation, the descriptive statistics of control variables such as CAP, SIZE, LIQ, and LLP are shown in the standard form before the normalization. \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively. The definitions for all variables are reported in Table 1.



All tables report the appropriate results of testing diagnostics in which the values of AR(1) and AR (2) are statistically significant and insignificant, respectively. These results show the absence of first-order and the presence of second-order correlation with the error term, respectively. Additionally, the Hansen test provides the absence of invalid instruments, ensuring the consistency of the GMM estimator. Besides, the lagged dependent variable reflecting the dynamic feature of panel data shows the significant signs in a consistent way. These results could qualify the estimation methodology and justify the regression settings utilized in this research.

Tables 4–6 displays the estimation results for the sensitivity of bank loan supply to different monetary policy instruments contingent on the both proxies of financial development. Tables 4, 5 and 6 show the similar story with the different monetary policy included such as refinance rate ( $\Delta REFI$ ), rediscount rate ( $\Delta REDIS$ ), and interbank rate ( $\Delta VNIBOR$ ), respectively. Specifically, for all three tables, monetary policy through three interest rate-related tools show a statistically negative impact on bank loan supply, which is evidenced by the negative coefficients of all proxies of monetary policy ( $\Delta REFI$ ,  $\Delta REDIS$ , and  $\Delta VNIBOR$ ) on granted bank loan at least 5% significant level. Therefore, there is the presence of the bank lending channel in Vietnam, statistically supported by the significantly negative coefficients on interest rates of monetary policy, irrespective of monetary policy instruments included. This is consistent with the Vietnam's scenario when the financing sources from banks are more prominent (Vo & Nguyen, 2014), similar to other emerging markets (Brissimis & Delis, 2009; Kashyap & Stein, 1995; Khan et al., 2016; Milcheva, 2013; Sanfilippo-Azofra et al., 2018; Zulkhibri, 2013). Therefore, prominence of the bank lending channel is confirmed in the emerging scenarios. Our finding is consistent with the empirical evidence of Modugu and Dempere (2022) who show the support of an additional mechanism such as bank lending as a critical conduit of monetary policy transmission, as discussed in the theoretical perspective of Keeton (1979) and Stiglitz and Weiss (1981). This result also highlights the existence of the bank lending channel (which forms the credit channel as indicated in the work of Mishkin (1995)), especially in countries characterized by asymmetric information, excessive contract enforcement in financial markets (Modugu & Dempere, 2022), and a bank-based framework (Huan et al., 2021); Vo & Nguyen, 2014). It is suggested that the bank-lending channel appears to be the pivotal conduit for efficient monetary policy implementation in developing economies, as these countries are predominantly bank-dependent and have other under-developed frameworks, such as bond markets and stock markets, on which the other transmission mechanisms are deemed to operate (Fiador et al., 2022). One should note that it can come from the financial markets' rigidities and depend on the incompatibility of bank loans and privately issued debt. The bank lending channel, as opposed to the conventional interest channel, emphasizes the unique role that banks play in the financial system as well as the close relationship between bank deposits and loan supply (Bernanke & Blinder, 1988). From the perspective of the bank lending channel, monetary policy restrictions can diminish bank reserves and hence deposits, which make up the supply of loanable funds.

More importantly, the interaction terms between the monetary policy and financial development are statistically positive across all specifications of Tables 4, 5 and 6. This reveals that as the financial development proceeds, there is less response of commercial banks to monetary policy shocks, implying the ineffectiveness of monetary policy implementation in case of the development of financial markets. As expected, this result is supported by the fact that because of financial development, Vietnamese commercial banks could be exposed to a variety of financial instruments and financing sources, which might insulate them from the reduction of bank loan supply caused by shocks of monetary policy tightening. As noted previously, Modugu and Dempere (2022) confirm the presence of the bank lending mechanism in the context of African countries where under-developed financial markets and other constraints are observed. From the weak point of ignoring the effect of financial advancement on the bank lending channel of monetary policy pass-through, we add interactive terms between financial development and monetary policy and shed further light on the weakening effect of financial development on the response of bank loan supply to monetary policy transmission. One should mention that by employing the Chinese bank-level data of the 2010–2018 period, Zhan et al. (2021) indicate that the money market (one of the

**Table 4. The impact of proxies for financial development on the bank lending channel using  $\Delta REFI$  as the monetary policy instrument**

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Lag.LG	0.194*** [4.92]	0.215*** [6.61]	0.203*** [11.51]	0.177*** [7.19]	0.225*** [5.27]	0.223*** [10.31]
$\Delta REFI$	-4.185*** [-3.67]	-4.180*** [-3.74]	-3.514*** [-4.52]	-5.243*** [-6.17]	-23.56*** [-3.93]	-16.66*** [-3.28]
FD	-0.333*** [-4.28]	-0.321*** [-4.27]	-0.342*** [-4.13]	-0.213** [-2.25]	-0.278*** [-3.91]	-0.356*** [-4.74]
FD*AREFI	0.156*** [3.30]	0.164*** [3.62]	0.0806** [2.22]	0.221*** [5.47]	0.220*** [3.65]	0.154*** [3.09]
SIZE	0.909 [0.62]	-0.0641 [-0.04]	2.804 [1.54]	2.191 [1.22]	2.381 [1.15]	7.585*** [3.17]
LIQ	0.504*** [2.79]	0.426** [2.52]	0.150 [0.90]	-0.00429 [-0.03]	0.406** [2.58]	0.0301 [0.16]
CAP	4.030*** [9.14]	3.523*** [6.56]	4.659*** [11.87]	4.584*** [9.46]	4.392*** [8.06]	5.643*** [9.55]
LLP	9.795*** [5.12]	10.75*** [5.91]	9.376*** [4.70]	9.817*** [4.42]	10.69*** [4.33]	9.330*** [3.85]
GDPG	3.511*** [2.90]	2.674** [2.35]	1.490* [1.70]	1.855* [2.00]	4.877*** [4.35]	2.418* [2.03]
CRISIS		-6.598** [-2.51]		-8.149*** [-2.98]		-9.542*** [-2.96]
CONS	25.19*** [3.21]	30.15*** [4.19]	33.77*** [4.65]	32.39*** [5.56]	36.65*** [4.09]	46.37*** [5.86]
GMM option	OD	OD	FOD	FOD	OD	FOD
Banks	30	30	30	30	30	30

(Continued)

Table 4. (Continued)

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Instruments	28	29	28	29	28	29
AR(1) test	0.001	0.001	0.009	0.007	0.001	0.014
AR(2) test	0.274	0.361	0.609	0.641	0.385	0.763
Hansen test	0.362	0.303	0.413	0.240	0.406	0.429

Note: The estimation findings are obtained employing a two-step system GMM estimator with two options (difference deviation—FOD and orthogonal deviation—OD). The dependent variable and explanatory variables of interest are loan growth (LG) and interbank interest rate ( $\Delta REFI$ ), respectively. The main independent variable of interest accounting for the level of financial development, CMD and CPS, refers to the stock market development and domestic credit to the private sector, respectively. The control variables are capitalization (CAP), scale (SIZE), liquidity (LIQ), loan loss provision (LLP), and the growth rate of gross domestic product (GDPG). All detailed variables are defined in Table 1. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

Table 5. The impact of proxies for financial development on the bank lending channel using  $\Delta REDI$  as the monetary policy instrument

	CMD		CMD		CPS		CPS	
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Log.LG	0.231*** [5.58]	0.232*** [6.05]	0.195*** [11.77]	0.193*** [11.62]	0.213*** [5.11]	0.215*** [5.39]	0.212*** [8.22]	0.211*** [15.08]
$\Delta REDI$	-4.543*** [-2.91]	-4.707*** [-3.00]	-4.758*** [-4.33]	-4.309*** [-4.15]	-31.07*** [-3.57]	-36.18*** [-4.12]	-15.93*** [-2.57]	-13.41** [-2.24]
FD	-0.285*** [-5.00]	-0.300*** [-5.09]	-0.362*** [-3.78]	-0.332*** [-3.41]	-0.312*** [-3.56]	-0.374*** [-4.03]	-0.320*** [-3.68]	-0.314*** [-3.72]
FD $\Delta REDI$	0.159** [2.13]	0.187** [2.51]	0.164*** [3.52]	0.155*** [3.34]	0.300*** [3.38]	0.353*** [3.95]	0.149** [2.38]	0.123** [2.05]
SIZE	1.968 [1.16]	0.981 [0.56]	3.515* [1.80]	2.602 [1.34]	2.343 [1.13]	1.093 [0.59]	2.687 [1.35]	2.083 [1.12]
LIQ	0.378** [2.24]	0.393** [2.30]	0.114 [0.60]	0.0442 [0.28]	0.456*** [3.08]	0.485*** [3.33]	0.0841 [0.44]	-0.0472 [-0.29]
CAP	3.861*** [8.36]	3.436*** [6.24]	4.975*** [10.39]	4.648*** [9.09]	4.468*** [8.04]	3.574*** [6.33]	4.919*** [9.14]	4.709*** [8.61]
LLP	11.46*** [6.18]	11.65*** [6.07]	10.23*** [4.57]	10.29*** [4.94]	9.967*** [3.60]	10.35*** [3.43]	10.64*** [4.34]	10.87*** [6.33]
GDPG	2.776** [2.50]	2.147** [2.12]	2.641** [2.49]	2.313** [2.34]	5.339*** [4.73]	3.562*** [3.46]	2.899** [2.37]	2.206** [2.12]
CRISIS		-6.774* [-2.03]		-7.142** [-2.44]		-13.83*** [-2.86]		-8.067** [-2.73]
CONS	26.21*** [3.37]	31.47*** [4.42]	29.86*** [4.13]	32.17*** [4.39]	38.09*** [4.21]	58.61*** [5.04]	52.20*** [3.89]	57.10*** [4.48]
GMM option	OD	OD	FOD	FOD	OD	OD	FOD	FOD
Banks	30	30	30	30	30	30	30	30

(Continued)

Table 5. (Continued)

	CMD		CMD		CPS		CPS	
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Instruments	28	28	28	29	28	28	28	29
AR(1) test	0.001	0.001	0.007	0.008	0.001	0.001	0.013	0.013
AR(2) test	0.365	0.423	0.688	0.690	0.400	0.53	0.710	0.766
Hansen test	0.351	0.373	0.185	0.173	0.352	0.318	0.286	0.377

Note: The estimation findings are obtained employing a two-step system GMM estimator with two options (difference deviation—FOD and orthogonal deviation—OD). The dependent variable and explanatory variables of interest are loan growth (LG) and interbank interest rate ( $\Delta REDI$ ), respectively. The main independent variable of interest accounting for the level of financial development, CMD and CPS, refers to the stock market development and domestic credit to the private sector, respectively. The control variables are capitalization (CAP), scale (SIZE), liquidity (LIQ), loan loss provision (LLP), and the growth rate of gross domestic product (GDPG). All detailed variables are defined in Table 1. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

**Table 6. The impact of proxies for financial development on the bank lending channel using  $\Delta$ VNIBOR as the monetary policy instrument**

	CMD		CMD		CPS		CPS	
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Log.LG	0.271*** [8.56]	0.253*** [7.57]	0.195*** [6.98]	0.201*** [7.54]	0.179*** [3.96]	0.201*** [4.84]	0.124*** [4.27]	0.133*** [4.49]
$\Delta$ VNIBOR	-3.661*** [-5.84]	-3.160*** [-4.53]	-2.578*** [-4.40]	-2.404*** [-4.51]	-17.70*** [-7.18]	-19.51*** [-6.70]	-14.65*** [-6.32]	-12.15*** [-3.83]
FD	-0.170** [-2.67]	-0.211*** [-3.37]	-0.0985 [-1.56]	-0.149** [-2.55]	-0.268*** [-3.43]	-0.405*** [-4.71]	-0.307*** [-3.84]	-0.268*** [-2.77]
FD* $\Delta$ VNIBOR	0.100*** [4.72]	0.0839*** [3.71]	0.0598*** [3.09]	0.0475*** [2.97]	0.172*** [7.21]	0.189*** [6.60]	0.140*** [6.31]	0.115*** [3.67]
SIZE	1.680 [1.33]	0.333 [0.24]	2.107 [1.15]	1.412 [0.79]	1.953** [2.08]	0.185 [0.21]	3.287** [2.26]	1.985 [1.28]
LIQ	0.364* [1.87]	0.333* [1.71]	0.0334 [0.20]	0.0158 [0.10]	0.407* [2.00]	0.354* [1.77]	0.0837 [0.39]	-0.0412 [-0.18]
CAP	3.745*** [7.20]	3.588*** [6.87]	4.763*** [8.94]	4.428*** [8.57]	4.130*** [7.97]	3.366*** [7.00]	5.233*** [7.24]	5.052*** [6.79]
LLP	9.374*** [4.36]	7.442*** [2.81]	8.999*** [4.33]	9.724*** [5.20]	9.636*** [4.58]	8.419*** [3.36]	8.750*** [3.33]	9.654*** [3.83]
GDPG	1.808*** [3.14]	1.234* [2.02]	1.512** [2.55]	1.722*** [2.85]	1.583** [2.37]	1.073* [1.75]	2.028*** [3.79]	2.143*** [3.86]
CRISIS		-6.080** [-2.69]		-7.276*** [-3.79]		-12.66*** [-3.86]		-8.621* [-1.77]
CONS	22.29*** [4.60]	29.42*** [5.10]	23.86*** [5.43]	26.01*** [5.43]	52.26*** [6.21]	72.63*** [7.37]	55.97*** [6.35]	53.45*** [4.98]
GMM option	OD	OD	FOD	FOD	OD	OD	FOD	FOD
Banks	30	30	30	30	30	30	30	30

(Continued)

**Table 6. (Continued)**

	CMD		CMD		CPS		CPS	
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Instruments	28	28	28	29	28	28	28	28
AR(1) test	0.001	0.001	0.010	0.008	0.001	0.001	0.011	0.011
AR(2) test	0.376	0.342	0.526	0.616	0.286	0.446	0.533	0.592
Hansen test	0.485	0.562	0.408	0.429	0.311	0.359	0.275	0.242

Note: The estimation findings are obtained employing a two-step system GMM estimator with two options (difference deviation—FOD and orthogonal deviation—OD). The dependent variable and explanatory variables of interest are loan growth (LG) and interbank interest rate ( $\Delta VNI\text{BOR}$ ), respectively. The main independent variable of interest accounting for the level of financial development, CMD and CPS, refers to the stock market development and domestic credit to the private sector, respectively. The control variables are capitalization (CAP), scale (SIZE), liquidity (LIQ), loan loss provision (LLP), and the growth rate of gross domestic product (GDPG). All detailed variables are defined in Table 1. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.



critical components of financial markets) displays a nonsignificant impact on the potency of monetary policy pass-through via the bank lending channel. Our research differs from the case of Vietnamese commercial banks and proxies for financial development (including stock market and bank system development), showing the significantly weakening impact of financial development on the bank lending mechanism.

Based on the case of commercial banks in Vietnam, we find the existence of the bank lending channel, which lends support to prior studies such as Mishra et al. (2016), among others. This is consistent with the perspective that, due to a high level of financial frictions, the credit channel may be more prominent in the potency of monetary policy transmission than the interest rate mechanism (Mishra et al., 2016; Zhan et al., 2021). Moreover, our results show a unique perspective on the different monetary proxies employed. These instruments of monetary policy can be harmoniously used to obtain desired macroeconomic objectives. This highlights the effectiveness of various interest rate-related tools of Vietnam's monetary policy in practice, which might be relatively different from other emerging countries.

In addition, the weakening impact of financial development on monetary policy bank lending mechanism in our research is in accordance with most theoretical and empirical analyses, which suggest that decreased financial frictions driven by the development of financial markets could help banks insulate the impact of monetary policy shocks (Aysun et al., 2013). To support this perspective, for a case of five Asian countries, Lerskullawat (2017) uses bank-level datasets to show that financial development demonstrates a greater ability of banks to make loan applications and to get easy access to external funding opportunities, consequently reducing the effectiveness of monetary policy.

For a series of bank individual characteristics, we observe that these variables have the same positive signs. Therefore, other factors being equal, banks with large-sized, more liquid, and well-capitalized features could stimulate the bank loan disbursement, which are in line with the previous research works (Kashyap & Stein, 1995; Kishan & Opiela, 2006). The unexpected coefficients on credit risk show the fact that the high level of credit risk leads to increase in loan supply of Vietnamese commercial banks because banks noticing the risk of revenue loss from the increase in probability of non-performing loans could increase bank loan supply more in order to cover the decrease in profit (Vo & Nguyen, 2014), which could hamper the soundness of commercial banks.

With respect to the macroeconomic variable, the growth rate of GDP has a positive impact of bank loan supply, implying that the bank lending activities increase with the development of economy, which is in line with previous studies (Bashir et al., 2020; Jimborean, 2009; Sanfilippo-Azofra et al., 2018). In addition, we also observe the negative impact of the Vietnamese banking financial crisis on bank loan supply for all estimating models, showing the possibility that Vietnamese commercial banks are more risk-averse in a time of banking crisis.

#### **4.3. Robustness test**

In this subsection, the robustness test is employed using the alternative measures of monetary policy such as lending rate, which is widely used in previous research (Dang, 2020; Dang & Dang, 2021a, 2021b; Dang & Nguyen, 2020). Lending rate refers to the bank rate that frequently serves the short-term and long-term financing requirements of the private sector. The changes in lending rate could well reflect the monetary policy adjustments (Chen et al., 2017; Yang & Shao, 2016). In practice, the central bank normally takes into account this rate to assess the monetary policy implementation. Based on the alternative proxy for monetary policy, we revisit the baseline model aforementioned.

At the bottom of Table 7, the significance values of Hansen test for the instruments' validity and Arellano Bond test for the absence of second-order correlation with the error term are statistically qualified. Table 7 shows the similar pattern reported previously. For more details, the findings

confirm the inertia of bank loan supply and the presence of the bank lending channel. In addition, financial development could weaken the impact of monetary policy on bank loan disbursement, supporting the banks' ability to raise loanable funds from financial markets.

Concerning the control variables, banks with more capitalization and high crediting risk could increase the bank loan supply while there is weak evidence on the positive impact of banks' liquidity on bank lending activities. Turning to the macroeconomic variable, the economic growth could stimulate the bank loan supply due to the increase in the economy's credit demands followed by the prosperous conditions of the real economy.

#### **4.4. Further investigation for the joint effect of financial development and bank-specific characteristics on the bank lending channel**

From the theoretical perspective, due to complicated issues of asymmetric information (Flannery, 1995), the balance sheet items could be utilized to assess the virtual management information of a given company (Townsend, 1979) before the financing capital is provided. The financial market could affect the incentive structure of financial credit contracts (Freixas & Rochet, 2008). Accordingly, the development of the financial market could improve the external financing market for banks, leading to the less response of loanable funds to bank-specific characteristics under the monetary policy shocks (Zhan et al., 2021). In this regard, the response of bank loan supply to monetary policy shocks conditional on bank individual characteristics could be affected by the development of financial markets, which leads to changes in loanable funds for financing demands of banks. To the best of our knowledge, from the empirical perspective, only the research of Zhan et al. (2021) considers the joint impact of financial development and bank characteristics on the sensitivity of bank lending activities to the monetary policy, which is captured by the cubic-interactive terms. These terms could be found in the work of Akinci et al. (2013) regarding the bank-lending channel in Turkey; however, these terms only denote the product of bank characteristics and short-term interbank money market rate and are statistically insignificant. H. H. H. H. Nguyen et al. (2022) also employ the cubic-interaction terms between pandemic crisis, monetary policy proxies, and bank's balance sheet items to test the effect of bank individual characteristics on the sensitivity of bank performance and risk to monetary policy shocks. Given aforementioned arguments and the empirical research using cubic-interaction terms, it gives us rise to revisit the above findings from an additional perspective in which the joint effect of bank-specific characteristics and financial development may have a significant effect on the response of bank loan supply to monetary policy transmission.

This paper takes a further step to examine the impact of financial development on the marginal effect of monetary policy on bank loan supply via banks' idiosyncratic characteristics, which is an additional innovation of our paper. To this end, the cubic-interaction terms among monetary policy instruments ( $\Delta \text{VNIBOR}$ ,  $\Delta \text{LEND}$ ,  $\Delta \text{REFI}$ , and  $\Delta \text{REDI}$ ), bank-specific features ( $\text{CAP}$ ,  $\text{SIZE}$ ,  $\text{LIQ}$ , and  $\text{LLP}$ ), and financial development ( $\text{CMD}$  and  $\text{CPS}$ ) are employed rather than the conventional interaction terms. This approach is currently applied by Zhan et al. (2021). Consequently, we add these cubic-interaction terms into baseline model (1) to form the model (2) as follows:

$$\begin{aligned} \Delta \ln(\text{loans})_{i,t} = & \beta_0 + \beta_1 \Delta \ln(\text{loans})_{i,t-1} + \beta_2 \Delta i_t + \beta_3 \text{FD}_t + \beta_4 (\Delta i_t * \text{FD}_t) + \beta_5 \text{CAP}_{i,t-1} + \beta_6 \text{SIZE}_{i,t-1} \\ & + \beta_7 \text{LIQ}_{i,t-1} + \beta_8 \text{LLP}_{i,t-1} + \beta_9 \text{GDPG}_t + \beta_{10} (\Delta i_t * \text{FD}_t * \text{CAP}_{i,t-1}) + \beta_{11} (i_t * \text{FD}_t * \text{SIZE}_{i,t-1}) \\ & + \beta_{12} (\Delta i_t * \text{FD}_t * \text{LIQ}_{i,t-1}) + \beta_{13} (\Delta i_t * \text{FD}_t * \text{LLP}_{i,t-1}) + \varepsilon_{i,t} \end{aligned}$$

Tables 8–11 display the regression results of the response of bank loan disbursement to the different monetary policy instruments influenced by the joint effect of bank characteristics and financial development. The correctness of the models is confirmed based on the qualified values of Hansen test and Arellano–Bond test for all cases. It is expected that the Wald-test at the bottom of each table shows the testing of the null hypothesis  $H_0: \beta_{10} = \beta_{11} = \beta_{12} = \beta_{13} = 0$ , indicating the insignificant joint impacts of bank characteristics and the financial development on the bank lending channel, are strictly rejected. For the bottom line of Tables 8–11, all F-statistic values from the Wald test are significant at least at 10% level, suggesting the rejection of null hypothesis. This implies the

**Table 7. The impact of proxies for financial development on the bank lending channel using  $\Delta LEND$  as the monetary policy instrument**

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Log.LG	0.244*** [8.36]	0.225*** [6.35]	0.181*** [7.17]	0.177*** [7.37]	0.270*** [7.50]	0.184*** [5.91]
$\Delta LEND$	-8.668*** [-5.32]	-9.227*** [-5.05]	-8.240*** [-6.29]	-8.538*** [-4.83]	-23.68*** [-5.63]	-21.88*** [-6.21]
FD	-0.322*** [-5.64]	-0.345*** [-6.13]	-0.225*** [-5.36]	-0.255*** [-5.11]	-0.187** [-2.70]	-0.133** [-2.19]
FD* $\Delta LEND$	0.347*** [4.73]	0.377*** [4.51]	0.333*** [5.51]	0.345*** [4.26]	0.224*** [5.42]	0.208*** [5.60]
SIZE	1.342 [1.21]	0.509 [0.44]	2.039 [1.20]	0.876 [0.48]	1.166 [1.21]	1.817 [1.02]
LIQ	0.413** [2.14]	0.386* [1.92]	0.0883 [0.52]	-0.0272 [-0.17]	0.414** [2.25]	0.183 [1.10]
CAP	3.808*** [8.75]	3.504*** [7.74]	4.928*** [9.66]	4.213*** [9.12]	3.363*** [9.18]	4.501*** [9.22]
LLP	9.952*** [4.28]	8.674*** [3.26]	11.09*** [5.45]	11.56*** [4.91]	10.52*** [4.87]	11.09*** [5.40]
GDPG	2.011*** [3.51]	1.486** [2.13]	1.878*** [2.99]	1.884*** [3.01]	3.121*** [6.17]	2.582*** [4.24]
CRISIS		-5.718* [-1.85]		-13.05*** [-4.09]		-5.777* [-1.96]
CONS	27.39*** [5.15]	32.96*** [5.12]	27.75*** [4.84]	31.33*** [5.73]	29.21*** [4.18]	29.95*** [4.11]
GMM option	OD	OD	FOD	FOD	OD	FOD
Banks	30	30	30	30	30	30

(Continued)

Table 7. (Continued)		CMD			CPS		
		Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Instruments		28	28	28	28	28	28
AR(1) test		0.001	0.001	0.012	0.008	0.001	0.001
AR(2) test		0.367	0.355	0.631	0.736	0.366	0.414
Hansen test		0.472	0.435	0.389	0.309	0.236	0.163

Note: The estimation findings are obtained employing a two-step system GMM estimator with two options (difference deviation—FOD and orthogonal deviation—OD). The dependent variable and explanatory variables of interest are loan growth (LG) and interbank interest rate ( $\Delta$ LEND), respectively. The main independent variable of interest accounting for the level of financial development, CMD and CPS, refers to the stock market development and domestic credit to the private sector, respectively. The control variables are capitalization (CAP), scale (SIZE), liquidity (LIQ), loan loss provision (LLP), and the growth rate of gross domestic product (GDPG). All detailed variables are defined in Table 1. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

	CMD				CPS			
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Lag_LG	0.254*** [5.50]	0.253*** [6.12]	0.181*** [4.50]	0.182*** [5.84]	0.262*** [6.03]	0.275*** [6.28]	0.168*** [4.32]	0.283*** [6.07]
ΔLEND	-7.285** [-2.61]	-8.480*** [-2.78]	-6.786*** [-3.34]	-6.982*** [-3.39]	-22.36*** [-3.65]	-25.62*** [-3.95]	-18.67*** [-3.33]	-11.85** [-2.31]
FD	-0.303*** [-4.83]	-0.333*** [-5.56]	-0.191*** [-3.20]	-0.209*** [-3.34]	-0.204** [-2.55]	-0.281*** [-3.10]	-0.126* [-1.84]	-0.271*** [-3.65]
FD * ΔLEND	0.246* [1.93]	0.286** [2.11]	0.228** [2.37]	0.230** [2.33]	0.201*** [3.40]	0.233*** [3.72]	0.168*** [3.04]	0.0915* [1.77]
SIZE	0.658 [0.45]	-0.483 [-0.31]	1.132 [0.64]	0.561 [0.31]	0.822 [0.51]	-0.685 [-0.40]	1.740 [1.00]	0.220 [0.13]
LIQ	0.530*** [2.48]	0.384* [1.79]	0.176 [0.90]	0.0686 [0.38]	0.565*** [2.64]	0.374 [1.61]	0.255 [1.36]	-0.203 [-1.11]
CAP	3.745*** [7.74]	3.299*** [6.15]	4.839*** [7.92]	4.696*** [6.77]	3.242*** [8.86]	2.836*** [6.64]	4.658*** [8.02]	4.790*** [7.02]
LLP	10.43** [2.58]	11.08** [2.41]	12.00*** [3.22]	12.68*** [3.71]	10.07** [2.58]	8.255* [2.04]	11.45*** [2.95]	11.30*** [3.21]
FD * ΔLEND* SIZE	0.015 [1.14]	0.0201 [1.55]	0.0064 [0.39]	0.00801 [0.49]	0.0028 [0.89]	0.00393 [1.16]	0.0015 [0.39]	0.000172 [0.05]
FD * ΔLEND* CAP	-0.0070* [-1.92]	-0.00562 [-1.32]	-0.0080** [-2.16]	-0.00731* [-1.89]	-0.0019** [-2.42]	-0.00132 [-1.51]	-0.0016* [-1.96]	-0.00204** [-2.21]
FD * ΔLEND* LIQ	0.0003 [0.17]	-0.00117 [-0.63]	-0.0005 [-0.29]	-0.00121 [-0.74]	0.0001 [0.40]	-0.000304 [-0.08]	-0.00003 [-0.11]	-0.000454 [-1.39]
FD * ΔLEND* LLP	-0.078** [-2.25]	-0.0850** [-2.16]	-0.082*** [-3.81]	-0.0897*** [-5.27]	-0.022*** [-3.19]	-0.0221*** [-2.93]	-0.021*** [-4.52]	-0.0281*** [-6.16]

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Table 8. (Continued)

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
GDPG	1.862** [2.17]	1.410 [1.61]	1.778** [2.16]	2.966*** [4.24]	2.223*** [2.99]	2.378*** [3.22]
CRISIS		-10.13** [-2.32]		-6.487*** [-2.96]	-10.80** [-2.16]	-27.03*** [-5.39]
CONS	28.66*** [4.29]	34.70*** [5.42]	28.25*** [4.47]	33.29*** [4.25]	47.86*** [4.99]	57.88*** [6.26]
GMM option	OD	OD	FOD	OD	OD	FOD
Banks	30	30	30	30	30	30
Instruments	28	28	28	28	28	28
AR(1) test	0.000	0.000	0.013	0.001	0.000	0.004
AR(2) test	0.413	0.525	0.656	0.384	0.525	0.648
Hansen test	0.296	0.221	0.252	0.128	0.147	0.359
Wald-test (F-statistics) H <sub>0</sub> : $\theta_{10} = \theta_{11} = \theta_{12} = \theta_{13} = 0$	4.78***	6.60***	6.92***	6.17***	6.21***	17.07***

Note: All detailed variables are defined in Table 1. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

[illegible]

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Table 9. (Continued)

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
GDPG	1.341* [1.91]	0.806 [1.08]	1.973*** [3.15]	2.259*** [4.00]	1.615** [2.46]	1.578* [1.92]
CRISIS		-10.54*** [-5.05]		-8.539*** [-3.46]		-18.31*** [-4.20]
CONS	30.65*** [4.74]	34.98*** [5.41]	16.51*** [4.07]	20.43*** [4.96]	66.61*** [5.19]	82.01*** [4.76]
GMM option	OD	OD	FOD	FOD	OD	FOD
Banks	30	30	30	30	30	30
Instruments	28	29	29	30	28	27
AR(1) test	0.000	0.000	0.012	0.018	0.001	0.013
AR(2) test	0.319	0.326	0.748	0.682	0.434	0.773
Hansen test	0.296	0.242	0.209	0.266	0.337	0.164
Wald-test (F-statistics) H <sub>0</sub> : $\theta_{10} = \theta_{11} = \theta_{12} = \theta_{13} = 0$	3.51**	2.79**	13.86***	10.57***	4.69***	3.72**

Note: All detailed variables are defined in Table 1. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

**Table 10. Dynamic GMM estimation findings from the augmented model using  $\Delta REFI$  as the monetary policy instrument**

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Log.LG	0.168*** [3.20]	0.159*** [3.39]	0.0904* [1.92]	0.0846** [2.05]	0.139** [2.60]	0.127** [2.62]
$\Delta REFI$	-4.452*** [-3.21]	-4.906*** [-4.59]	-4.454*** [-3.29]	-4.212*** [-3.18]	-32.33*** [-3.46]	-40.04*** [-4.88]
FD	-0.189** [-2.32]	-0.177** [-2.32]	-0.507*** [-3.94]	-0.500*** [-3.49]	-0.329*** [-3.35]	-0.342*** [-3.61]
FD* $\Delta REFI$	0.109* [2.02]	0.155*** [3.25]	0.120** [2.64]	0.138*** [3.12]	0.291*** [3.13]	0.368*** [4.51]
SIZE	2.208 [1.07]	2.040 [1.16]	2.952 [1.34]	0.460 [0.20]	2.123 [1.02]	0.440 [0.25]
LIQ	0.257 [1.13]	0.234 [1.06]	0.313 [1.38]	0.334 [1.43]	0.590** [2.56]	0.452** [2.12]
CAP	3.998*** [6.51]	3.798*** [6.37]	4.792*** [5.33]	3.963*** [4.07]	3.995*** [6.03]	3.563*** [5.12]
LLP	0.0849 [0.03]	0.00439 [0.00]	8.813*** [3.24]	9.070*** [3.14]	10.35** [2.49]	9.503** [2.10]
FD * $\Delta REFI$ * SIZE	0.025 [0.34]	0.0334 [0.55]	0.016 [0.90]	0.0127 [0.78]	-0.001 [-0.13]	-0.00222 [-0.28]
FD * $\Delta REFI$ * CAP	0.0012 [0.08]	0.0034 [0.30]	-0.0027 [-0.40]	-0.0045 [-0.77]	-0.0051 [-1.54]	-0.0061* [-1.92]
FD * $\Delta REFI$ * LIQ	0.0002 [0.10]	0.0006 [0.28]	0.0022 [0.83]	0.0029 [1.04]	0.00004 [0.05]	-0.0002 [-0.31]
FD * $\Delta REFI$ * LLP	-0.057* [-1.82]	-0.0530* [-1.71]	-0.089** [-2.20]	-0.0573 [-1.43]	-0.025** [-2.68]	-0.0231* [-2.03]

(Continued)

Table 10. (Continued)

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
GDPG	5.442*** [3.53]	4.806*** [3.04]	3.396** [2.09]	3.210* [2.04]	4.856*** [2.76]	3.281* [1.75]
CRISIS		-4.017 [-1.20]		-8.656** [-2.75]		-10.73** [-2.42]
CONS	3.582 [0.38]	8.886 [0.91]	34.09*** [2.86]	36.80*** [3.16]	43.60*** [3.57]	57.91*** [4.12]
GMM option	OD	OD	FOD	FOD	OD	OD
Banks	30	30	30	30	30	30
Instruments	28	29	28	29	28	29
AR(1) test	0.002	0.001	0.010	0.009	0.002	0.002
AR(2) test	0.227	0.248	0.562	0.519	0.388	0.482
Hansen test	0.272	0.211	0.152	0.132	0.182	0.210
Wald-test (F-statistics) H <sub>0</sub> : $\theta_{10} = \theta_{11} = \theta_{12} = \theta_{13} = 0$	3.20**	2.13*	2.17*	1.71*	5.77***	5.6***
					7.71***	12.41***

Note: All detailed variables are defined in Table 1. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

Table 11. Dynamic GMM estimation findings from the augmented model with using  $\Delta REDI$  as the monetary policy instrument

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
Log.LG	0.212*** [3.91]	0.210*** [4.09]	0.192*** [3.88]	0.189*** [4.28]	0.230*** [4.45]	0.216*** [4.03]
$\Delta REDI$	-9.310*** [-3.45]	-9.918*** [-3.57]	-4.818** [-2.70]	-4.125** [-2.40]	-32.92*** [-3.18]	-20.93*** [-2.26]
FD	-0.214** [-2.23]	-0.177* [-1.82]	-0.463*** [-4.88]	-0.463*** [-4.04]	-0.341*** [-3.68]	-0.527*** [-4.95]
FD * $\Delta REDI$	0.229* [1.94]	0.296** [2.41]	0.147** [2.34]	0.141** [2.27]	0.303*** [2.88]	0.185* [1.96]
SIZE	0.817 [0.38]	-0.719 [-0.38]	3.640* [1.72]	2.986 [1.26]	2.489 [1.08]	7.639*** [2.82]
LIQ	0.350 [1.55]	0.265 [1.24]	0.225 [1.05]	0.184 [0.85]	0.423* [2.02]	0.201 [1.00]
CAP	3.744*** [5.28]	3.356*** [5.61]	5.068*** [8.22]	4.830*** [7.41]	4.358*** [7.67]	5.783*** [9.87]
LLP	5.755 [0.93]	6.830 [0.98]	8.648*** [2.77]	8.199** [2.59]	8.640** [2.39]	7.797* [1.76]
FD * $\Delta REDI$ * SIZE	0.0348 [0.40]	0.0308 [0.40]	0.035 [0.71]	0.0329 [0.67]	0.0099*** [2.98]	0.00970*** [2.79]
FD * $\Delta REDI$ * CAP	0.0016 [0.10]	0.00246 [0.16]	-0.0018 [-0.18]	-0.00147 [-0.15]	-0.0004 [-0.39]	-0.000573 [-0.57]
FD * $\Delta REDI$ * LIQ	-0.004 [-1.13]	-0.00272 [-0.71]	0.002 [0.72]	0.00202 [0.85]	-0.0006 [-1.34]	-0.000824* [-1.82]
FD * $\Delta REDI$ * LLP	-0.355*** [-3.35]	-0.319*** [-2.83]	-0.095** [-2.61]	-0.0717** [-2.10]	-0.030*** [-3.91]	-0.0281*** [-3.06]

(Continued)

Table 11. (Continued)

	CMD			CPS		
	Baseline	Crisis effect	Baseline	Crisis effect	Baseline	Crisis effect
GDPG	1.621* [1.78]	1.035 [1.27]	3.590** [2.39]	3.291** [2.17]	5.224*** [3.29]	2.846* [1.99]
CRISIS		-8.991*** [-2.92]		-7.238** [-2.05]		-10.66*** [-2.80]
CONS	29.16*** [4.59]	34.70*** [5.81]	28.44** [2.38]	31.76** [2.57]	40.61*** [3.99]	75.68*** [4.38]
GMM option	OD	OD	FOD	FOD	OD	FOD
Banks	30	30	30	30	30	30
Instruments	28	29	28	29	28	29
AR(1) test	0.000	0.000	0.011	0.010	0.001	0.017
AR(2) test	0.640	0.719	0.775	0.711	0.590	0.982
Hansen test	0.370	0.360	0.134	0.134	0.358	0.271
Wald-test (F-statistics) H <sub>0</sub> : $\theta_{10} = \theta_{11} = \theta_{12} = \theta_{13} = 0$	6.84***	5.78***	3.03**	2.23*	6.76***	6.90***

Note: All detailed variables are defined in Table 1. Diagnostic checks are reported with p-values. The validity of the instrument is checked by the Hansen test while the reported values of AR(1) and AR(2) are to test the first- and second-order autocorrelation in error terms. Dummy variable, CRISIS, is employed to control the impact of the Vietnamese banking financial crisis. Standard errors are in brackets and \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively.

existence of the joint effect of financial development and bank-specific profiles. Therefore, the inclusion of cubic-interaction terms is statistically appropriate.

We revisit the aforementioned findings in Sections 4.2 and 4.3 with the inclusion of cubic interactive term. The Table 8, 9, 10, and 11 differ from each other by the alternative of monetary policy instrument such as lending rate ( $\Delta LEND$ ), interbank rate ( $\Delta VNIBOR$ ), refinance rate ( $\Delta REFI$ ), and rediscount rate ( $\Delta REDI$ ), respectively. All remaining information and its representation in these tables are relatively similar. The main results for the presence of bank lending mechanism of monetary policy are necessarily identical to those reported previously. More concretely, all coefficients on monetary policy instruments such as  $\Delta LEND$ ,  $\Delta VNIBOR$ ,  $\Delta REFI$ , and  $\Delta REDI$  (in Tables 8, 9, 10, and 11, respectively) are statistically negative. It means that there is strong evidence of the existence of a bank lending mechanism of monetary policy transmission in Vietnam. In addition, the weakening effect of the financial market on the bank lending channel of monetary policy transmission is also statistically evidenced. For other control variables, well-capitalized banks could boost the bank loan supply; however, banks with high credit risk also stimulate the bank lending activities. The economic growth could be favorable in the supply of bank loans due to the increase in the economy's demand side.

For the significant coefficients on the cubic-interactive terms between monetary policy, financial development, and banks' balance sheet items, the findings reported in Table 8–11 show that financial development has a weakening impact on the response of the bank lending channel to bank-specific features (such as the loan loss provision ratio and the bank capital ratio) and has a very weak effect on the sensitivity of the bank lending mechanism to the rest of bank individual characteristics. This also highlights the significant approach of using the cubic-interactive terms to examine the heterogeneous impact of financial development on the existence of the bank lending channel conditional on banks' characteristics. In the work of Zhan et al. (2021), the effect of bank-specific characteristics on the development of money market (a possible proxy for financial development) is generally significant, but different patterns for the impact of each bank balance sheet item is statistically observed. For more details, the finding show that when experiencing monetary restrictions, money market development can weaken the effect of bank liquidity on bank loan supply, but the impacts on the bank size and the capitalization are statistically insignificant. On the contrary, we observe that for Vietnamese commercial banks, financial development shows a weakening effect on the sensitivity of bank capitalization and credit risk to the bank lending mechanism of monetary policy transmission but has very weak effect on the response of bank size and liquidity. This difference may be attributed to the inconsistent proxy for financial development and monetary policy and a different sample and research period. However, we share a similar idea with Zhan et al. (2021) for the weakening effect of financial development on the response of bank's characteristics to bank lending mechanism of monetary policy pass-through. This implies that the development of financial markets demonstrate the convenience of external financing sources for commercial banks, potentially stimulating the alternative of the external and internal financing sources of banks. Taken together, the bank lending channel does matter in the case of an emerging market such as Vietnam; however, its intensity is different with the joint effect of financial development and bank idiosyncratic characteristics.

## 5. Conclusion

With the dominant role of the banking system in emerging markets, the central bank usually affects the real economy through the transmission of monetary policy via the bank lending channel. The empirical research on determinants of monetary policy transmission through the bank lending channel have rather ignored the driving role of financial development. The development of the financial sector with the expansion of financial instruments and financing opportunities could have a significant impact on the response of bank loan supply to monetary policy shocks (Sanfilippo-Azofra et al., 2018; Zhan et al., 2021). The development of the financial market could lead to changes in the way that financial intermediaries operate, thus shaping the transmission of monetary policy into the real economy (Altunbas et al., 2009; S Singh et al., 2008). This

gives rise to the investigation of the influence of financial development on the bank lending channel.

To address the limited evidence on the critical role of financial development on the bank lending channel, this paper examines the sensitivity of bank lending activities to monetary policy conditional on the level of financial development in an emerging country with a unique multiple-tool regime. Besides, we further investigate the response of bank loan supply to monetary policy shocks depending on the joint effect of financial development and bank-specific characteristics. Employing the two-step system GMM estimator for a comprehensive sample of Vietnamese commercial banks, the findings confirm the persistence of bank loan supply and the existence of the bank lending channel. Furthermore, it is evidenced that financial development could reduce the potency of monetary policy transmission through the bank lending mechanism. One could explain this finding is that financial development with greater chances for financing sources and financial instruments could make these commercial banks less financially constrained. This might shield banks from the reduction in bank loan supply caused by the monetary restrictions. In addition to the direct impact of financial development on the bank lending channel, the response of bank loan supply caused by monetary policy to different bank individual characteristics are indirectly shaped by the financial development. These findings remain consistent across the alternative indicator for financial development, the array of monetary policy instruments, the two choices of GMM handling fixed-effects and the inclusion of a time event such as the 2011–2014 banking crisis.

A deeper understanding of the transmission of monetary policy through the bank lending channel depending on the level of financial development might be a prerequisite to implementing the monetary policy. Policy practitioners should be vigilant with regard to the benefits and drawbacks of financial development. Accordingly, financial market development could positively generate financial innovation and financing opportunities for economic agents; however, from the view of monetary policy initiated by the central banks, financial market development could decrease the potency of monetary policy via bank lending mechanism.

Furthermore, the bank lending channel could be indirectly influenced by financial development through bank-specific characteristics from the balance sheet items such as loan loss provision or bank capital. Therefore, policy-makers should focus their attention on both the joint effect of bank-specific characteristics and financial development to design the adaptive monetary policy transmitted via the bank lending channel, facilitating the banking system and real economy.

In addition, our empirical results might offer insightful implications for other countries with the same institutional background in which the financial environments are in progress of transformation. Specifically, less financially developed economies inherently depending on the credit supply of the banking system could lead a change to become more financially developed ones in which monetary policy transmission via the bank lending channel could be affected.

This research could not avoid the limitations, which provide several directions for the future investigation. First, this study could have a main focus on Vietnam as a typical emerging country, which might not be a representative case. The next research could extend to a group of other emerging ones to make more comparison with these results reported in this research. Second, proxies for financial development are diverse, which suggests the idea to combine these measures into a single one using the approach of principal component analysis (PCA) in order to capture the broad dimensions of financial development. Third, due to data's availability, we could not delve into the structure of financial systems such as the money market. The future study could consider this point to have a deeper understanding of the implication of sub-markets' developments for the bank lending channel of monetary policy transmission.



We approach the disaggregate bank-level dataset to test the dependence of the monetary policy bank lending mechanism on the development of financial markets through interactive terms between financial development proxies and interest rate instruments of monetary policy. This research can be extended by using the aggregate time series data (instead of the bank-level database in the current study) with high-frequency observations (monthly or quarterly) by using innovative techniques such as regime-switching models and smooth transition models. The former is employed for series that are thought to transition over a finite collection of unobserved states using the Markov process, which allows the process to develop differently in each state. The latter is used to illustrate the transition function, which is a function of the financial development indicator. These approaches may shed further light on the role of financial development in monetary policy transmission at an aggregate level.

Moreover, following the outbreak of the coronavirus, banks have faced significant challenges in terms of profitability and risk management (H. H. H. Nguyen et al., 2022; Wei & Han, 2021). Central banks have established monetary policy, which has a direct influence on bank performance and risk, in order to insulate the banking system against this adverse shock and accomplish the necessary macroeconomic goals. This may be a potential direction for future research to investigate the effectiveness of monetary policy with sufficient high-frequency observations.

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#### Author details

Thanh Phuc Nguyen<sup>1</sup>  
 E-mail: [phucnguyen.ncs2019033@st.ueh.edu.vn](mailto:phucnguyen.ncs2019033@st.ueh.edu.vn)  
 ORCID ID: <http://orcid.org/0000-0001-7137-8236>  
 Thi Thu Hong Dinh<sup>1</sup>  
 Ngoc Tho Tran<sup>1</sup>

<sup>1</sup> School of Finance, University of Economics Ho Chi Minh City, Ho Chi Minh City, Vietnam.

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### Appendix A: The commercial banks in the study sample

No.	Banks	Full names
1	ABB	An Binh Commercial Joint Stock Bank
2	ACB	Asia Commercial Bank
3	BAB	North Asia Commercial Joint Stock Bank
4	BAOVIET	Bao Viet Joint Stock Commercial Bank
5	BIDV	The Joint Stock Commercial Bank for Investment and Development of Vietnam
6	BVB	Viet Capital Bank
7	CTG	Vietnam Joint Stock Commercial Bank for Industry and Trade
8	EIB	Vietnam Export Import Commercial Joint Stock Bank
9	HDB	Ho Chi Minh City Housing Development Joint Stock Bank
10	KLB	Kienlong Commercial Joint Stock Bank
11	LVP	Lien Viet Post Joint Stock Commercial Bank
12	MBB	Military Commercial Joint Stock Bank
13	MSB	Vietnam Maritime Commercial Joint Stock Bank
14	NAB	Nam A Commercial Joint Stock Bank
15	OCB	Orient Commercial Joint Stock Bank
16	PGB	Petrolimex Group Commercial Joint Stock Bank
17	PVCOM	Vietnam Public Bank
18	SCB	Sai Gon Joint Stock Commercial Bank
19	SEA	Southeast Asia Commercial Joint Stock Bank
20	SGB	Saigon Commercial Bank
21	SHB	Saigon—Ha Noi Commercial Joint Stock Bank
22	STB	Saigon Thuong Tin Commercial Joint Stock Bank
23	TCB	Vietnam Technological and Commercial Joint Stock Bank
24	TPB	Tien Phong Commercial Joint Stock Bank
25	VAB	Vietnam Asia Commercial Joint Stock Bank
26	VBB	Vietnam Thuong Tin Commercial Joint Stock Bank

(Continued)

<i>(Continued)</i>		
<b>No.</b>	<b>Banks</b>	<b>Full names</b>
27	VCB	Joint Stock Commercial Bank for Foreign Trade of Vietnam
28	VIB	Vietnam International Commercial Joint Stock Bank
29	VNB	National Citizen Commercial Joint Stock Bank
30	VPB	Vietnam Prosperity Joint Stock Commercial Bank



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