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## Article

# The bank lending channel of monetary policy transmission in Vietnam: Impacts of the COVID-19 pandemic and the financial crisis

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## BANKING & FINANCE | RESEARCH ARTICLE

# The bank lending channel of monetary policy transmission in Vietnam: Impacts of the COVID-19 pandemic and the financial crisis

Minh Thanh Loi<sup>1</sup> and Van Dan Dang<sup>2\*</sup>

**Abstract:** This paper aims to analyze changes in the transmission of monetary policy via bank lending when considering the impact of the COVID-19 pandemic and the financial crisis. Using bank-level data of 31 commercial banks in Vietnam from 2007 to 2021, we provide consistent evidence that the impact of monetary policy on bank lending tends to be more pronounced in the period of the COVID-19 pandemic. Besides, we document that the bank's loan supply is more sensitive to monetary policy adjustments during the global financial crisis. Thus, a general pattern can be detected, i.e. the monetary policy transmission through the bank lending channel is stronger under unfavorable macro contexts in Vietnam. Accordingly, it can be suggested that adjustments in the monetary policy of the central bank have still been effective in periods of macro difficulty and the implementation of unconventional monetary policy in Vietnam is not necessary yet. Regression results when using the sample-splitting technique are consistent with those using interactive variables, providing evidence to confirm the robustness of the findings obtained in the study.

**Subjects:** Banking; Credit & Credit Institutions

**Keywords:** Bank lending; COVID-19 pandemic; economic cycle; financial crisis; monetary policy

**JEL classification:** E52; G21

## 1. Introduction

During economic difficulties and disruptions caused by the global financial crisis or the outbreak of the COVID-19 pandemic, central banks have established monetary stimulus policies to cope with liquidity shortages and growing bankruptcies (Neaime & Gaysset, 2022). The key to these policies is the commercial banking system, which plays a major role in the transmission of monetary policy. Accordingly, the question is, how could the transmission potency of monetary policy be affected under the influence of the financial crisis or the health pandemic? Could funds guaranteed by the banks enter the economy as initially scheduled by central banks? This is an important issue, both academically and practically, which needs to be analyzed and answered thoroughly. Notably, many studies on the COVID-19 pandemic have focused on its economic impacts thus far (Hasan et al., 2021; Li et al., 2021; Çolak & Öztekin, 2021). While this unprecedented shock is likely to have

a massive effect on banks, little is known about how it could drive monetary policy transmission via the banking system.

This paper examines the transmission of monetary policy through the bank lending channel during the COVID-19 pandemic and compares it with the period of the financial crisis 2007–2009. To motivate our current empirical work, we should propose potential mechanisms through which the financial crisis and the COVID-19 pandemic alter the bank lending channel. In times of economic uncertainty, more deposits flow into banks (Acharya & Naqvi, 2012). In the context of the COVID-19 pandemic, the health crisis may weaken the bank lending channel through an increase in deposits, which ensures the finance of banks and thereby reduces the sensitivity of loanable funds to external shocks. In other words, banks are not highly dependent on monetary policy stance. Similarly, when facing financial crises, banks may hoard liquidity due to difficulty in accessing loanable funds in the market and then become less responsive to lending incentives (Diamond & Rajan, 2011). From this point, it is predicted that the impact of interest rate adjustments on bank lending during a recession or crisis may be weakened.

In sharp contrast, there is an opposing view that economic instability increases the funding costs used by banks to lend, which implies that banks may face challenges gaining alternative sources of funds, thereby enhancing the transmission effectiveness of the bank lending channel (Ehrmann, 2003; Kishan & Opiela, 2000). This mechanism is particularly relevant in times of crisis because banks' greater difficulties in raising funds in financial markets may make loan expansion more sensitive to market shocks (Gambacorta & Marques-Ibanez, 2011). Likewise, we can expect this pattern to occur amid the COVID-19 pandemic, thereby strengthening the pass-through of the bank lending channel.

This paper solves the research objectives through the data of the Vietnamese banking system in the period 2007–2021. Regressions by the generalized method of moments (GMM) and interactive variables are used to answer the empirical research questions, and some robustness testing techniques are applied. Vietnam provides an ideal context in which to perform the current study. For many years, economic growth has been a central goal of this country, in which the fueling role of the banking sector is indispensable. Commercial banks offer the primary source of funds for enterprises in Vietnam, given that the financial market here has not yet developed with various funding channels (Dang & Huynh, 2022; Huynh & Dang, 2022). This fact leads to a more explicit existence of a bank lending channel in monetary policy transmission (Anwar & Nguyen, 2018). From a macroeconomic perspective, the financial crisis of 2007–2009 led to a reduction in investment flows and put pressure on the trade of Vietnam, which is an open economy and was not immune to this enormous shock (Nguyen et al., 2021). Recently, the COVID-19 outbreak has had significant consequences on all aspects of the economy. While Vietnam successfully responded to COVID-19 in 2020, the fourth wave of the outbreak significantly increased infections and deaths in 2021, causing the most damaging and evident shock from the COVID-19 pandemic here (Vu et al., 2022).

The paper has several contributions. Most importantly, it expands the existing literature by examining the macroeconomic conditioning of the relationship between monetary interest rates and bank lending. Different from the rich literature on the heterogeneity of the bank lending channel between banks with different characteristics, the working of the bank lending channel in different macroeconomic contexts needs to be explored further. The study examines the impact of the financial crisis and the COVID-19 pandemic on the bank lending channel, which has been overlooked in previous studies. Interestingly, this study adds to the growing body of literature on the COVID-19 pandemic. Existing studies have mainly looked into the impact of the health crisis on bank performance and institutions' resilience to the pandemic. This paper focuses on the transmission of monetary policy through the bank lending channel while considering the pandemic shock, and this is an entirely novel research direction.

The rest of the paper is structured as follows. Section 2 reviews relevant documents on the bank lending channel and the influences of the financial crisis and the COVID-19 pandemic, theoretically and empirically. In section 3, we present the model, method, and data for empirical estimation. Section 4 reports the estimation results and conducts some robustness tests. Section 5 offers conclusions and draws some policy implications.

## 2. Related literature

### 2.1. *The bank lending channel of monetary policy transmission*

The bank lending channel was first described by Bernanke and Blinder (1988) that a relaxing (tightening) monetary policy may cause an increase (a decrease) in loanable funds and then a rise (a reduction) in credit supply to the real economy. In the bank lending channel framework, monetary policy drives bank lending by influencing the banks' funding costs (Disyatat, 2011). Accordingly, the subsequent work has mainly concentrated on examining the link between bank-specific characteristics (most commonly, including capitalization, liquidity, and bank size) and the bank lending channel (Dang & Dang, 2021). They show that banks with weaker balance sheets have difficulty raising funds due to high costs in the deposit market; hence they may boost their responsiveness of lending to monetary policy modifications compared to those with healthier balance sheets (Kashyap & Stein, 1995; Kishan & Opiela, 2006).

Some studies have shown the mediating roles of other bank-level factors on the bank lending channel. Bhaumik et al. (2011) find that newly established private banks are less responsive to monetary policy changes than foreign and long-founded private banks. Gambacorta and Marques-Ibanez (2011) show that banks with a greater approach to securitization tools are better able to protect their lending against monetary shocks. Perera et al. (2014) reveal that banks having more off-balance sheet activities can secure their loan supply regardless of any monetary policy shocks, thereby creating a buffer in the transmission of monetary policy. Recently, Fungáčová et al. (2022) find that bank efficiency impedes monetary policy transmission.

To offer a more profound identification of the bank lending channel, many scholars take into account the conditioning roles of macroeconomic factors. Banking market structure is demonstrated to be important to bank operation and can affect the effectiveness of monetary policy by enhancing or hindering the bank lending channel (Amidu & Wolfe, 2013; Khan et al., 2016; Yang & Shao, 2016). Sanfilippo-Azofra et al. (2018) examine how financial development affects the bank lending channels of developing countries. They indicate that the loan supply of banks operating in areas with less developed financial systems is not driven by alterations in monetary policy. Zhan et al. (2021) explore whether the development level of the money market could weaken the impact of the bank lending channel in China, and contrary to theoretical expectations, their impact found is trivial. Fabiani et al. (2022) exhibit that capital controls strengthen banks' lending in response to monetary shocks. Cheng and Wang (2022) observe that greater exposure to shadow banking may allow banks to undermine monetary policy transmission.

Overall, the relationship between monetary policy and bank lending behaviors may not only vary with bank-level characteristics but also with macroeconomic environments. While prior studies on the heterogeneity of the bank lending channel among banks with different characteristics are well established, the operation of the bank lending channel in unfavorable macroeconomic contexts is limited and thus needs further exploration. Therefore, more research is needed to fill this gap.

### 2.2. *The effects of COVID-19 pandemic and financial crisis*

Fundamentally, the supply of bank credit is reduced during crises. This decline may stem from shocks to borrowers' collateral, affecting firms' ability to raise funds, or it may be caused by adverse shocks to bank capital buffers (Ivashina & Scharfstein, 2010). Hasan et al. (2022) find that lending rates increased during the global financial crisis of 2007–2009, and the amount of corporate lending was tightened.

Regarding the impact of the COVID-19 pandemic, the spread of the virus has forced governments to implement a number of containment measures such as social distancing, lockdowns and business suspensions. This poses adverse economic effects on firms, increasing their likelihood of default (Lepetit & Fuentes-Albero, 2022). The impacts are likely to spread to banks, leading to loss of revenue and an increase in bad debts, which detrimentally affects bank profitability, solvency, and capital. Banks may face higher operational risk, which can cause systemic weakness and deterioration of the bank's lending function. In a recent empirical effort to verify the disadvantages of the COVID-19 pandemic, Çolak and Öztekin (2021) shows that it negatively influences lending through a global sample.

Some previous empirical research examines to what extent the financial crisis impairs the monetary policy transmission potency. Peek and Rosengren (2013) exhibit that liquidity crunches hurt the effectiveness of the bank lending channel during the 2007 financial crisis. Salachas et al. (2017) evaluate the transmission of monetary policy via the bank lending channel both before and after the financial crisis. While in the pre-crisis period, the bank lending channel was effective against changes in central banks' interest rates, this transmission mechanism has been damaged in the post-crisis time. Salachas et al. (2017) also add that the use of unconventional monetary policy has been effective in stimulating lending growth in the post-crisis period.

Meanwhile, the research segment on the ability of banks to expand lending in response to monetary policy shocks during the period of the COVID-19 pandemic has not been conducted empirically, although in theory Lepetit and Fuentes-Albero (2022) develop a model where they prove that monetary policy functions less effectively in a pandemic. Additionally, the crisis from the COVID-19 pandemic shares some similarities with the financial crisis of 2007–2009, as both caused severe consequences on the domestic and global economy. Nevertheless, the COVID-19 pandemic is a health crisis, different from past financial crises; hence we should not generalize previous results on the bank lending channel to the pandemic-induced crisis.

### 3. Data and empirical strategy

#### 3.1. Monetary policy indicators

Previous empirical studies have mainly relied on short-term interest rates to propose different monetary policy indicators. More precisely, they look at treasury bill interest rates, money market interest rates, or short-term lending rates (Altunbas et al., 2010; Chen et al., 2017; Khan et al., 2016; Yang & Shao, 2016). Based on the fact that there has been no consensus on the best indicator as well as given the availability of data, this study uses short-term lending rates to gauge the monetary policy stance. In the case of Vietnam, the State Bank of Vietnam (SBV) considers lending interest rates as an essential criterion for evaluating the implementation of monetary policy. We collect data on lending rates for Vietnam from the International Financial Statistics.

In addition, the study further examines policy rates announced by the SBV as the country's lender of last resort, namely, refinancing rates (employed when the SBV charges banks for short-term loans) and rediscounting rates (used in discounting transactions of the SBV) (Dang & Dang, 2020). We access these data sources from the SBV. A standard pattern for our monetary policy indicators is that increasing these interest rates signals a tightened monetary policy.

#### 3.2. Econometric model and method

Empirically, we develop our regression models by including interaction terms between interest rates and modifying factors to check our conjecture on the working of the bank lending channel amid macro shocks:

$$\Delta Lending_{i,t} = \alpha_0 + \alpha_1 \times \Delta Lending_{i,t-1} + \alpha_2 \times MP_t + \alpha_3 \times Macro_t + \alpha_4 \times MP_t \times Macro_t + \alpha_5 \times Control_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where  $i$  and  $t$  indicate banks and years.  $\Delta Lending$  is a measure of bank lending, captured by the annual growth rate of customer loans. Following previous studies, we consider loan growth with a one-year lag as an independent variable to adopt the dynamic nature of the lending model.  $MP$  includes separate variables of monetary policy as discussed above.  $Control$  consists of a set of bank-specific factors, motivated by the literature that establishes a model of bank loans regressed by a series of bank-level variables (Chakraborty et al., 2020; Zins & Weill, 2018). These controls include bank capital, liquidity, bank size, deposits, and bank return.  $Macro$  represents macro-environmental variables, namely the financial crisis (dummy variable, receiving the value of 1 for the period 2007–2009 and 0 otherwise), the business cycle (GDP growth), and the COVID-19 pandemic (dummy variable, having the value of 1 for the period 2020–2021 and 0 otherwise).  $MP \times Macro$  is an interactive variable to capture the marginal impacts of the COVID-19 pandemic and the financial crisis on the transmission of monetary policy through the bank lending channel. We lag all bank-specific variables by one year to (i) avoid any possible reverse causality bias and (ii) consider the lagged reactions in bank lending to inside shocks.

The research uses the two-step system GMM to solve the endogenous bias in the dynamic model (Blundell & Bond, 1998; Roodman, 2009). Several diagnostic tests are required to demonstrate the appropriateness of the GMM estimates: (i) the AR(1)/AR(2) tests for the null hypothesis that the errors display no autocorrelation, where we need results to exhibit the first- but no second-order autocorrelation, and (ii) the Hansen test for the null hypothesis that the instruments employed are not correlated with residuals, where we need to justify the set of instruments jointly employed.

### 3.3. Data

Bank-level data is collected from Vietnamese commercial banks for 2007–2021. This period provides a favorable time span for research related to (i) significant changes in the banking sector after Vietnam joined the World Trade Organization (WTO) in 2007, (ii) regular monetary policy adjustments of the SBV to navigate the economy, and (iii) the coverage of the financial crisis and the COVID-19 pandemic. When gathering data from banks, we remove those that have been compulsorily acquired or placed under special control by the SBV due to their vastly distinct business models (four banks), and we also exclude joint-venture banks due to their small size and lack of publication of necessary financial information (two joint-venture banks). As a result, the study obtains an unbalanced panel dataset comprising 31 banks with a total of 449 observations, representing more than 90% of the total assets of the banking sector in any given sample year. Our dataset considers both publicly listed and unlisted banks. Prior related studies are restricted to publicly listed banks, representing a relatively small share of the banking systems. Importantly, it should be noted that unlisted banks often make up a considerable proportion of the banking sectors. Table 1 reports the definitions of variables along with their summary statistics.

## 4. Empirical results and discussions

The estimates across all tables show that the lagged dependent variable is positive and statistically significant, confirming that the lending behavior of sample banks is persistent over time. This persistence justifies the choice of the dynamic model for empirical analysis. The statistics reported at the bottom of the tables (including the number of instruments, the AR(1)/AR(2) tests, and the Hansen test) support the validity of the GMM estimates.

### 4.1. Monetary policy transmission and COVID-19 pandemic

Before looking into the interaction term of main interest, the study also discusses the estimation results for the stand-alone monetary policy variables. Through column 1 (Table 2), the estimated results show that the coefficient on lending rates is negative and statistically significant at the level of 1%, thereby confirming the existence of the bank lending channel in monetary policy transmission in Vietnam. Besides, in columns 2 and 3 of Table 2, the coefficients of the remaining monetary policy indicators, including refinancing rates and rediscounting rates, are statistically significant with negative signs, which means loan growth slows down as policy rates rise.



**Table 1. Summary statistics**

	Mean	SD	Min	Max	Definitions
Loan growth	28.667	30.519	−5.823	135.578	Annual percentage change in customer loans (%)
Capital	9.915	4.864	4.422	25.642	The ratio of equity to total assets (%)
Liquidity	33.467	11.245	15.473	61.241	The ratio of cash and securities to total assets (%)
Size	32.110	1.315	29.453	34.754	Natural logarithm of total assets
Deposit	62.564	13.901	28.394	86.808	The ratio of customer deposits to total assets (%)
Return	0.854	0.615	0.016	2.393	The ratio of net return to total average assets (%)
Lending rates	10.056	3.233	6.960	16.954	Short-term lending rates (on average) (%)
Refinancing rates	7.521	2.733	4.000	15.000	Refinancing rates by the SBV (%)
Rediscounting rates	5.455	2.730	2.500	13.000	Rediscounting rates by the SBV (%)
Economic cycles	5.807	1.313	2.580	7.130	Annual GDP growth (%)
Financial crisis	0.185	0.389	0.000	1.000	Dummy variable that takes the value of 1 for the years 2007, 2008, and 2009 and the value of 0 otherwise
COVID-19 pandemic	0.127	0.333	0.000	1.000	Dummy variable that takes the value of 1 for the years 2020 and 2021 and the value of 0 otherwise

Next, the study focuses on the interactions between monetary policy variables and the COVID-19 pandemic. In column 1 (Table 2), the negative coefficient on the interaction term *Lending rates\*COVID-19 pandemic* suggests that the negative effect of monetary policy on bank lending is more pronounced during the COVID-19 pandemic. Regarding the economic significance, banks on average increase loan growth by about 7.852 percentage points ( $3.457 + 4.395 \times 1$ ) during the COVID-19 pandemic but only raise lending activities by around 3.457 percentage points during normal periods, given a one percentage point drop in lending rates.



**Table 2. Monetary policy transmission and COVID-19 pandemic**

	(1)	(2)	(3)
Lagged dependent variable	0.134*** (0.026)	0.074** (0.035)	0.070** (0.030)
Lending rates	−3.457*** (0.383)		
Lending rates*COVID-19 pandemic	−4.395*** (1.232)		
Refinancing rates		−2.949*** (0.327)	
Refinancing rates*COVID-19 pandemic		−10.362*** (1.725)	
Rediscounting rates			−3.959*** (0.426)
Rediscounting rates*COVID-19 pandemic			−12.897*** (3.734)
Capital	4.109*** (1.087)	−0.779 (0.524)	4.671*** (0.936)
Liquidity	1.325*** (0.258)	0.484** (0.212)	1.880*** (0.344)
Size	5.426** (2.627)	−7.579*** (1.959)	5.581** (2.572)
Deposit	0.331*** (0.106)	0.555*** (0.207)	1.029*** (0.233)
Return	−1.367 (2.845)	14.401*** (3.985)	11.823*** (4.269)
Economic cycles	−7.738*** (2.404)	−6.879*** (1.540)	−4.251* (2.282)
Financial crisis	−0.832 (3.830)	6.452** (2.993)	−3.384 (4.245)
COVID-19 pandemic	−7.786*** (1.411)	−3.335*** (1.231)	−9.752*** (1.497)
Constant	−174.769 (109.123)	276.490*** (69.732)	−289.428*** (104.287)
Observations	410	410	410
Number of banks	31	31	31
Number of instruments	30	31	30
AR(1) test	0.001	0.000	0.001
AR(2) test	0.395	0.309	0.508
Hansen test	0.113	0.106	0.171

Note: The table reports the GMM estimations for the bank lending channel in Vietnam during 2007–2021. Bank loan growth is the dependent variable. Standard errors are in parentheses, and GMM diagnostic tests are shown with p-values. \*  $p < 0.10$ , \*\*  $p < 0.05$ , and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.

In columns 2 and 3 (Table 2), we find that the interaction terms yield similar patterns. Accordingly, the negative and significant regression coefficients of the interaction variable between refinancing rates/rediscounting rates and the COVID-19 pandemic indicate that monetary policy transmission through the bank lending channel could be stronger during the pandemic. Quantitatively, it can be deduced that a one percentage point change in refinancing rates/rediscounting rates impacts loan growth at a rate higher than 10.362/12.897 percentage points during the COVID-19 pandemic compared to the non-pandemic period.

In sum, regardless of different interest rate variables, the results consistently suggest that the adjustment to loan growth during the COVID-19 pandemic tends to be more pronounced as banks react to monetary policy shocks. Facing the pandemic, most of the world's banks failed to take advantage of the loan stimulus program (Çolak & Öztekin, 2021). However, with the research results in the context of Vietnam, monetary policy seems to be more effective under the unprecedented health crisis in terms of altering bank lending activities. Empirically, our work does not verify the theoretical work of Lepetit and Fuentes-Albero (2022), who claim that the effectiveness of monetary policy is eliminated in a pandemic.

#### **4.2. Monetary policy transmission and financial crisis**

To confirm the bank lending channel, we look at the estimates for the stand-alone monetary policy variables. Through the results from columns 1–3 (Table 3), the coefficients of all interest rate variables are negative and statistically significant at the 1% level, thus once again validating the bank lending channel of monetary policy transmission in Vietnam.

Observing the interaction terms between the financial crisis and monetary policy indicators, we document a significant moderating role of the financial crisis. In column 1 (Table 3), the regression coefficient of the interactive variable is negative and statistically significant, suggesting that monetary policy transmission becomes stronger during the global financial crisis. In other words, the financial crisis amplifies the functioning of the bank lending channel. For economic magnitude, we can infer that during the crisis, banks on average cut lending by about 12.675 percentage points ( $3.21 + 9.465 \times 1$ ) for a one percentage point increase in lending rates, but only drop 3.21 percentage points ( $3.21 + 9.465 \times 0$ ) in loan growth in the non-crisis period.

Turning to the regression results in columns 2 and 3 (Table 3), when employing refinancing rates and rediscounting rates as monetary policy variables, it can be detected that the regression coefficient of the interaction variable is negative and statistically significant at the 1% level. Similar to the pattern for lending rates, the results for these policy rates further indicate that banks in times of financial crisis tend to be more affected by changes in monetary policy than in non-crisis times. Based on the face values of the estimates, we can also have confidence in the economic significance of the results.

Taken together, all of our findings support the notion that the effectiveness of monetary policy transmission through the bank lending channel is enhanced during the financial crisis. This notion is consistent with the view on the operation of the bank lending channel in monetary policy transmission. In the financial crisis, banks may face a funding shortage that limits the supply of loans because they cannot easily find alternative funding sources, such as deposits and other external sources of funding. This funding shortage may make bank lending more sensitive to any monetary shocks, thereby improving the transmission efficiency of the bank lending channel (Ehrmann, 2003; Kishan & Opiela, 2000).

From an empirical standpoint, our paper challenges other prior findings which exhibit that the effectiveness of the bank lending channel is undermined during the 2007 financial crisis

**Table 3. Monetary policy transmission and financial crisis**

	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>
Lagged dependent variable	0.267***	0.417***	0.241***
	(0.039)	(0.021)	(0.036)
Lending rates	−3.210***		
	(0.544)		
Lending rates*Financial crisis	−9.465***		
	(0.973)		
Refinancing rates		−3.350***	
		(0.404)	
Refinancing rates*Financial crisis		−28.181***	
		(1.977)	
Rediscounting rates			−2.515***
			(0.397)
Rediscounting rates*Financial crisis			−10.859***
			(1.002)
Capital	−0.344	−2.348***	0.237
	(0.506)	(0.649)	(0.472)
Liquidity	0.815***	0.191	1.018***
	(0.147)	(0.121)	(0.157)
Size	−6.759***	−8.173***	−6.648***
	(1.805)	(2.135)	(1.770)
Deposit	0.730***	−0.027	1.012***
	(0.184)	(0.101)	(0.197)
Return	20.882***	11.230***	13.178***
	(5.300)	(3.331)	(3.575)
Economic cycles	−10.011***	−4.704***	−4.847**
	(1.968)	(0.977)	(1.931)
Financial crisis	117.589***	265.770***	79.865***
	(14.575)	(19.069)	(10.677)
COVID-19 pandemic	−46.897***	−27.083***	−28.705***
	(8.691)	(5.075)	(8.381)
Constant	240.965***	338.728***	163.581***
	(64.514)	(78.562)	(59.918)
Observations	410	410	410
Number of banks	31	31	31
Number of instruments	30	30	30
AR(1) test	0.000	0.000	0.000
AR(2) test	0.721	0.348	0.832
Hansen test	0.358	0.307	0.275

Note: The table reports the GMM estimations for the bank lending channel in Vietnam during 2007–2021. Bank loan growth is the dependent variable. Standard errors are in parentheses, and GMM diagnostic tests are shown with p-values. \*\*  $p < 0.05$  and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.

(Peek & Rosengren, 2013; Salachas et al., 2017). Interestingly, Salachas et al. (2017) demonstrate that only unconventional monetary policy tools effectively improve loan growth in post-crisis times and restore the transmission channel of monetary policy. Adding to the findings of Salachas et al. (2017), the results from this paper suggest that the conventional monetary policy, through policy rates, can still guarantee the transmission potency of monetary policy through the bank lending channel during the financial crisis in a market like Vietnam.

#### 4.3. Robustness checks

Apart from our main analysis, we also carry out some robustness tests. First, the study goes a step further and investigates the link between the interaction of monetary policy with economic growth and bank lending. The core idea is that the consequences of both the pandemic and the financial crisis are already reflected in economic growth. The results presented in Table 4 show that the bank lending channel, determined through the negative correlation between interest rates and bank lending, is regulated by the business cycle. More specifically, the bank lending channel of monetary policy is less pronounced during periods of stronger economic growth but works more effectively when the economy decelerates. This set of results supports our present conclusion that the economic downturn strengthens the bank lending channel.

Second, additional regressions would be performed on the subsamples, including (i) the first subsample removing the 2007–2009 global financial crisis, (ii) the second subsample excluding the COVID-19 pandemic over the years 2020–2021, and (iii) the third subsample eliminating both the financial crisis and the COVID-19 pandemic. The regression techniques are repeated with the system GMM estimator and equation 1. For comparison purposes, the study performs baseline regressions for the 2007–2021 population sample period when excluding the interaction variables. In Tables 5–6, column 4 shows that the impact of lending rates on loan growth is negative and smaller (in absolute magnitude) than column 1 of the same table. Similarly, for two policy rates of refinancing rates and rediscounting rates, columns 5–6 show that the impact of interest rates on loan growth is negative and smaller (in absolute magnitude) than columns 2–3 of the same table. Notably, the regression coefficients of monetary policy variables are the smallest in Table 7, excluding the effects of the global financial crisis and the COVID-19 pandemic. In summary, when comparing different subsamples, it can be concluded that monetary policy transmission through the bank lending channel is weaker when not driven by the global financial crisis and/or the COVID-19 pandemic. Thus, regression results with subsamples are consistent with those using interactive variables.

Third, we use the least square dummy variable corrected (LSDVC) estimator as an alternative technique to confirm the GMM results (Bruno, 2005). This method is motivated by the fact that it may work remarkably well in the case of our study due to the small number of banks in the sample (31 banks) and the relatively long time span (15 years). Performing the regressions with the LSDVC estimator and reporting the results in Table 8, we can observe that all results are consistent with GMM regressions, thus the robustness of our findings is verified when utilizing alternative LSDVC estimates. As a note, the LSDVC version reported in the paper uses the dynamic bias-corrected estimations proposed by Anderson and Hsiao (1982), while other LSDVC versions by Arellano and Bond (1991) and Blundell and Bond (1998) yield unchanged results but are not displayed to save space.

**Table 4. Robustness tests by monetary policy transmission and economic cycles**

	(1)	(2)	(3)
Lagged dependent variable	0.091**	0.068***	0.100***
	(0.040)	(0.019)	(0.030)
Lending rates	−35.275***		
	(5.927)		
Lending rates*Economic cycles	4.811***		
	(0.933)		
Refinancing rates		−30.309***	
		(4.369)	
Refinancing rates*Economic cycles		4.317***	
		(0.698)	
Rediscounting rates			−58.728***
			(7.777)
Rediscounting rates*Economic cycles			8.770***
			(1.241)
Capital	−1.531***	2.746***	−0.898**
	(0.428)	(0.646)	(0.449)
Liquidity	0.704***	0.857***	0.903***
	(0.101)	(0.086)	(0.142)
Size	−9.472***	3.226*	−7.758***
	(1.854)	(1.789)	(1.567)
Deposit	0.180	0.095**	0.583***
	(0.214)	(0.043)	(0.217)
Return	35.561***	1.132	25.298***
	(5.246)	(2.224)	(4.511)
Economic cycles	−57.286***	−35.648***	−50.795***
	(8.127)	(5.100)	(5.349)
Financial crisis	1.177	8.119**	5.940
	(6.028)	(3.846)	(5.273)
COVID-19 pandemic	−95.344***	−84.574***	−125.990***
	(7.919)	(11.017)	(10.269)
Constant	691.716***	108.090	536.124***
	(45.556)	(79.564)	(42.654)
Observations	410	410	410
Number of banks	31	31	31
Number of instruments	30	31	30
AR(1) test	0.000	0.000	0.000
AR(2) test	0.313	0.107	0.270
Hansen test	0.227	0.109	0.178

Note: The table reports the GMM estimations for the bank lending channel in Vietnam during 2007–2021. Bank loan growth is the dependent variable. Standard errors are in parentheses, and GMM diagnostic tests are shown with p-values. \*  $p < 0.10$ , \*\*  $p < 0.05$ , and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.

Table 5. Additional tests excluding the COVID-19 pandemic period (2020–2021)

	(1)	(2)	(3)	(4)	(5)	(6)
Logged dependent variable	0.188*** (0.034)	0.101*** (0.026)	0.146*** (0.028)	0.147*** (0.056)	0.066** (0.033)	0.124*** (0.033)
Lending rates	–5.618*** (0.463)			–5.026*** (0.796)		
Refinancing rates		–3.424*** (0.324)			–2.933*** (0.487)	
Rediscounting rates			–4.542*** (0.250)			–3.682*** (0.504)
Capital	–0.782 (0.486)	–0.670 (0.555)	0.395 (0.414)	7.619*** (1.532)	4.999*** (1.059)	4.790*** (1.036)
Liquidity	0.658*** (0.068)	0.457*** (0.155)	0.775*** (0.070)	0.966*** (0.239)	1.335*** (0.163)	1.283*** (0.147)
Size	–7.468*** (1.729)	–6.687*** (1.811)	–3.777*** (1.131)	11.308** (4.699)	5.674** (2.564)	5.717** (2.444)
Deposit	0.076 (0.086)	0.069 (0.073)	0.175** (0.068)	0.300 (0.197)	0.881*** (0.168)	0.763*** (0.167)
Return	30.051*** (5.360)	4.466 (2.807)	11.758*** (3.300)	25.814*** (7.671)	7.630** (3.889)	6.924* (3.791)
Economic cycles	–11.044*** (1.663)	–4.715*** (1.774)	–4.495*** (1.644)	–3.327 (2.281)	–3.679** (1.852)	–3.095* (1.873)
Financial crisis	–5.462 (3.683)	7.362** (3.752)	1.277 (2.948)	–9.761* (5.443)	–0.942 (3.700)	–1.683 (3.887)
COVID-19 pandemic	–55.265*** (7.470)	–30.713*** (8.124)	–33.433*** (7.237)			

(Continued)

**Table 5. (Continued)**

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	340.913*** (66.044)	274.571*** (69.550)	146.011*** (41.244)	-414.201** (177.222)	-268.111*** (100.156)	-264.783*** (94.578)
Observations	410	410	410	353	353	353
Number of banks	31	31	31	31	31	31
Number of instruments	31	30	31	27	27	27
AR(1) test	0.000	0.000	0.000	0.007	0.002	0.001
AR(2) test	0.634	0.225	0.744	0.833	0.625	0.993
Hansen test	0.320	0.100	0.154	0.349	0.143	0.150

Note: The table reports the GMM estimations for the bank lending channel in Vietnam during 2007–2021 (columns 1–3) and 2007–2019 (columns 4–6). Bank loan growth is the dependent variable. Standard errors are in parentheses, and GMM diagnostic tests are shown with p-values. \*  $p < 0.10$ , \*\*  $p < 0.05$ , and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.



**Table 6. Additional tests excluding the financial crisis period (2007–2009)**

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged dependent variable	0.188*** (0.034)	0.101*** (0.026)	0.146*** (0.028)	0.276*** (0.043)	0.202*** (0.032)	0.345*** (0.040)
Lending rates	–5.618*** (0.463)			–4.475*** (0.511)		
Refinancing rates		–3.424*** (0.324)			–3.291*** (0.448)	
Rediscounting rates			–4.542*** (0.250)			–4.105*** (0.332)
Capital	–0.782 (0.486)	–0.670 (0.555)	0.395 (0.414)	–2.046*** (0.518)	0.784 (0.816)	–0.283 (0.479)
Liquidity	0.658*** (0.068)	0.457*** (0.155)	0.775*** (0.070)	0.763*** (0.109)	1.172*** (0.244)	0.761*** (0.084)
Size	–7.468*** (1.729)	–6.687*** (1.811)	–3.777*** (1.131)	–10.278*** (1.628)	–2.315 (2.218)	–5.868*** (1.737)
Deposit	0.076 (0.086)	0.069 (0.073)	0.175** (0.068)	0.381** (0.163)	0.520*** (0.121)	0.322*** (0.077)
Return	30.051*** (5.360)	4.466 (2.807)	11.758*** (3.300)	34.969*** (5.011)	20.551*** (3.221)	14.008*** (3.230)
Economic cycles	–11.044*** (1.663)	–4.715*** (1.774)	–4.495*** (1.644)	–13.285*** (1.172)	–7.538*** (2.060)	–6.683*** (1.302)
Financial crisis	–5.462 (3.683)	7.362** (3.752)	1.277 (2.948)			
COVID-19 pandemic	–55.265*** (7.470)	–30.713*** (8.124)	–33.433*** (7.237)	–61.939*** (5.363)	–48.605*** (8.213)	–37.439*** (5.576)

(Continued)

**Table 6. (Continued)**

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	340.913*** (66.044)	274.571*** (69.550)	146.011*** (41.244)	416.153*** (53.024)	70.082 (86.141)	213.832*** (58.512)
Observations	410	410	410	362	362	362
Number of banks	31	31	31	31	31	31
Number of instruments	31	30	31	29	28	29
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.634	0.225	0.744	0.884	0.743	0.492
Hansen test	0.320	0.100	0.154	0.497	0.245	0.269

Note: The table reports the GMM estimations for the bank lending channel in Vietnam during 2007–2021 (columns 1–3) and 2010–2021 (columns 4–6). Bank loan growth is the dependent variable. Standard errors are in parentheses, and GMM diagnostic tests are shown with p-values. \*\*  $p < 0.05$  and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.

**Table 7. Additional tests excluding both the financial crisis period (2007–2009) and the COVID-19 pandemic period (2020–2021)**

	(1)	(2)	(3)
Lagged dependent variable	0.317*** (0.034)	0.103*** (0.039)	0.169*** (0.044)
Lending rates	–2.317*** (0.341)		
Refinancing rates		–2.658*** (0.575)	
Rediscounting rates			–2.614*** (0.709)
Capital	0.912 (1.025)	1.197 (1.287)	4.341** (2.101)
Liquidity	0.780*** (0.157)	0.334 (0.213)	1.463*** (0.316)
Size	–2.749 (2.562)	–11.553*** (3.075)	3.752 (5.821)
Deposit	0.342*** (0.109)	0.377*** (0.130)	1.325*** (0.360)
Return	6.016** (3.045)	16.564*** (2.496)	21.864*** (5.774)
Economic cycles	–7.511*** (1.750)	–2.746 (2.055)	–2.251 (3.006)
Constant	111.913 (103.040)	371.110*** (124.302)	–264.342 (231.384)
Observations	305	305	305
Number of banks	31	31	31
Number of instruments	25	24	24
AR(1) test	0.001	0.003	0.006
AR(2) test	0.645	0.947	0.354
Hansen test	0.105	0.107	0.374

Note: The table reports the GMM estimations for the bank lending channel in Vietnam during 2010–2019. Bank loan growth is the dependent variable. Standard errors are in parentheses, and GMM diagnostic tests are shown with p-values. \*\*  $p < 0.05$  and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.

## 5. Concluding remarks

This study examines the impact of the macro environment, including the COVID-19 pandemic and the financial crisis, on the relationship between monetary policy and bank lending. Through data from 31 Vietnamese commercial banks in the period 2007–2021 and empirical analysis with the GMM regression on the dynamic panel model, the study finds significant results. First, by assessing the impact of monetary policy on bank loan growth, the study finds evidence that easing (or tightening) monetary policy tends to increase (or decrease) banks' lending growth. This result confirms the existence of the bank lending channel in monetary policy transmission in Vietnam. In addition, the presence of the bank lending channel is not suppressed in any given period when regressing with subsamples. Evidence is found through monetary policy indicators ranging from the market lending rates to measurements of monetary policy instruments such as refinancing rates and rediscounting rates. More importantly, we find that the impact of monetary policy on bank lending tends to be stronger during the global financial crisis. In other words, the bank's loan supply is more sensitive to monetary policy adjustments during the financial crisis. Similarly, during the COVID-19 pandemic, monetary policy transmission through the bank's lending channel is amplified in the Vietnamese market. Accordingly, the supply of bank loans is

**Table 8. Additional tests by LSDVC estimator**

	Monetary policy*Financial crisis			Monetary policy*COVID-19 pandemic		
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged dependent variable	0.267*** (0.039)	0.417*** (0.021)	0.241*** (0.036)	0.134*** (0.026)	0.103*** (0.027)	0.136*** (0.035)
Lending rates	-3.210*** (0.544)			-3.457*** (0.383)		
Lending rates*Macro	-9.465*** (0.973)			-4.395*** (1.232)		
Refinancing rates		-3.350*** (0.404)			-3.461*** (0.344)	
Refinancing rates*Macro		-28.181*** (1.977)			-7.839*** (2.036)	
Rediscounting rates			-2.515*** (0.397)			-3.942*** (0.286)
Rediscounting rates*Macro			-10.859***			-14.960***
Capital	-0.344 (0.506)	-2.348*** (0.649)	0.237 (0.472)	4.109*** (1.087)	-0.589 (0.521)	-1.455** (0.569)
Liquidity	0.815*** (0.147)	0.191 (0.121)	1.018*** (0.157)	1.325*** (0.258)	0.478*** (0.155)	0.385* (0.205)
Size	-6.759*** (1.805)	-8.173*** (2.135)	-6.648*** (1.770)	5.426** (2.627)	-6.072*** (1.720)	-10.650*** (2.058)
Deposit	0.730*** (0.184)	-0.027 (0.101)	1.012*** (0.197)	0.331*** (0.106)	0.076 (0.076)	0.412** (0.183)

(Continued)

Table 8. (Continued)						
	Monetary policy*Financial crisis			Monetary policy*COVID-19 pandemic		
	(1)	(2)	(3)	(4)	(5)	(6)
Return	20.882*** (5.300)	11.230*** (3.331)	13.178*** (3.575)	-1.367 (2.845)	5.005* (3.028)	13.686*** (3.244)
Economic cycles	-10.011*** (1.968)	-4.704*** (0.977)	-4.847** (1.931)	-7.738*** (2.404)	-5.088*** (1.798)	-6.361*** (1.405)
Financial crisis	117.589*** (14.575)	265.770*** (19.069)	79.865*** (10.677)	-0.832 (3.830)	7.152* (3.890)	3.604 (3.853)
COVID-19 pandemic	-46.897*** (8.691)	-27.083*** (5.075)	-28.705*** (8.381)	-7.786*** (1.411)	-3.401*** (1.241)	-2.050* (1.215)
Constant	240.965*** (64.514)	338.728*** (78.562)	163.581*** (59.918)	-174.769 (109.123)	255.155*** (65.833)	389.148*** (75.421)
Observations	410	410	410	410	410	410
Number of banks	31	31	31	31	31	31

Note: The table reports the LSDVC estimations for the bank lending channel in Vietnam during 2007–2021. Bank loan growth is the dependent variable. Macro factors are exhibited at the top of columns. Standard errors are in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , and \*\*\*  $p < 0.010$ . Please refer to Table 1 for variable definitions.

more responsive to monetary policy adjustments during the COVID-19 pandemic. Thus, it can be concluded that a consistent pattern is that the potency of monetary policy transmission through the bank lending channel is greater in unfavorable macro contexts in Vietnam. In an emerging market like Vietnam, firms can rely on other funding channels in a stable economic condition; however, when the economy faces uncertainty and instability, firms depend mainly on banks.

Given the finding that monetary policy transmission through the bank lending channel is strengthened in unfavorable economic conditions in Vietnam, it can be suggested that adjustments in the monetary policy of the SBV have still been effective in periods of macro difficulty, at least in ensuring that the bank's lending supply still reacts to the monetary policy changes. This mechanism implies that the SBV can feel secure in continuing to use conventional interest tools in operating monetary policy under unfavorable contexts. Accordingly, it can be seen that the implementation of unconventional monetary policy in Vietnam is not necessary yet, since from the perspective of the research results in this paper, it can be affirmed that the central bank can still induce an impact on the economy through the banking system using conventional interest rate instruments.

Regarding the limitation of the research, we acknowledge that our conclusions are often confined to Vietnam, and it is difficult to generalize to other markets, particularly developed ones. Consequently, future research may re-check the results of this study in other countries. Moreover, given that the development of central bank digital currencies could transform all aspects of the monetary system, we expect future work to explore the impact of central bank digital currencies on monetary transmission mechanisms through banking systems.

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#### Correction

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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