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Bank lending in an emerging economy: How does central bank reserve accumulation matter?

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Abstract

Purpose — The paper examines the impacts of the central bank's foreign exchange reserves on bank lending, captured by the dimensions of quantity (loan growth) and quality (credit risk).

Methods — This research analysis is based on bank-year observations in Vietnam during 2007–2019 and employs the two-step system Generalized Method of Moments in dynamic panels.

Findings — This study finds that banks tend to increase their loan growth rate in response to reserves accumulation. Banks also expand loans and cash items on their asset structure while subsequently slashing total security investments and disaggregate government bond holdings. Our results also indicate that the central bank reserves accumulation is associated with less credit risk and more financial stability of the banking system.

Implication — This paper supports the notion that reserve accumulation could be a complementary monetary policy tool for lending navigation and economic growth. Besides, reserve interventions may be used for financial stability, given the finding that it is found to curtail bank credit risk and financial instability.

Originality — This paper contributes to the literature by focusing on critical aspects of bank lending, including quantity and quality, to paint a bigger picture of the benefits and costs of reserve accumulation and decompose bank asset portfolios into disaggregate components, thereby providing more insight into bank responses.

Keywords — Bank lending, bank risk, central bank, foreign exchange reserves.

Introduction

Foreign exchange interventions relate to purchases (or sales) of foreign currency denominated assets and sales (purchases) of local currency assets, performed by central banks. In this regard, reserve accumulation could be seen as foreign savings financed by domestic borrowings of central banks. To neutralize the adverse impacts of foreign reserve purchases on money supply and interest rates in the market, central banks have to prevent excessive liquidity. It is established in the literature that most foreign exchange reserves were sterilized, with the sterilization instruments (commonly via the issuance of central bank securities) mainly held by domestic banks (Aizenman & Glick, 2009).

Foreign reserve accumulation may drive the safety and soundness of the financial system in multiple routes. When it comes to the bright side, with the precautionary motive, central banks

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hoard foreign reserves to guard against the likelihood of stuck international capital flows in future stressed times (Jeanne, 2007). It is found that during the global financial crisis, countries holding considerable foreign reserves may well circumvent exchange rate depreciations (Aizenman & Hutchison, 2012). Similarly, the central banks' foreign reserve holdings may improve market liquidity and cushion liquidity shocks that can hurt the financial market (Akdoğan, 2012). In a long-standing view, increased foreign exchange reserves allow the central bank to have wider and stronger interventions, thereby leaving the money supply unaffected and causing little effect on the exchange rate (Sarno & Taylor, 2001). Besides, one could usually argue that central banks engage in holdings of reserves for the mercantilist motive (Aizenman & Lee, 2007).

Another common literature stream emphasizes the dark side of foreign reserves. In this vein, the direct costs describe reserve holdings' financing costs (Adler & Mano, 2020). Also, indirect costs of reserve accumulation seem to be excessive. The over-accumulation of foreign reserves may initiate distortions in the market and wipe out the accumulation of other assets necessary for economic growth (Cook & Yetman, 2012). If reserves are extensively sterilized by increased reserve requirements or issued sterilization instruments purchased by banks, offsetting decisions made by these banks might hamper the financial system's overall riskiness. For instance, sterilization may result in persistent interest rate differentials and then persistent capital inflows, which is considered a contributing factor to the financial crisis (Cavoli & Rajan, 2006).

Despite the popularity of the reserve accumulation policy, the empirical literature has mainly focused on the macro benefit-cost tradeoff of reserve holdings, while the linkage between reserve accumulation and bank activities has been given little attention. This is surprising when commercial banks play a pivotal role in central banks' policy transmission, and the literature also implies that central banks' borrowings may induce profound implications in altering credit allocation and bank behaviors. For instance, banks might prefer to enhance their asset portfolios' risk levels to compensate for the influences of low-yield sterilization assets they are required to hold (Adler & Mano, 2020). In contrast, banks in markets with heavy sterilized reserves tend to hoard more safe sterilization securities than risky assets (Cook & Yetman, 2012). Hence, reserve accumulation may mitigate bank exposure to risk. Additionally, when central banks finance foreign reserve purchases by domestic borrowings, commercial banks are left with fewer funds and tend to cut loans granted to the real sectors (Yun, 2020). Being aware of the critical potential effects of reserve accumulation on the domestic banking system, we aim to fill this literature gap in the present study.

Despite the scarcity, some documents highlight the impacts of foreign reserves on bank investments, and our paper is relatively related to them. Through a panel of 20 Asian countries during 1980–2008, Lee and Choi (2010) display that foreign reserve accumulation, captured by the reserves-to-GDP ratio, may depress domestic investment rates. Cook and Yetman (2012) utilize a sample dataset of 55 Asian banks and conclude that bank loan growth declines in response to increased foreign exchange reserves. This result is repeated in Yun (2020)'s work, which demonstrates a crowding-out effect of reserve accumulation in Korea. Focusing on banks in Colombia, Hofmann, Shin, and Villamizar-Villegas (2019) reveal that foreign exchange reserves' sterilized buildup considerably alleviates new corporate lending.

This paper investigates the impacts of reserve accumulation on bank lending. Comprehensively, bank lending is captured by two dimensions of quantity (loan growth) and quality (credit risk). We also pay attention to components of bank asset portfolios, including bank loans, cash components, security investments, and even decomposed government bond holdings, to explore the sterilization practice. To deepen our findings, we analyze the heterogeneity effects across different banks according to their standard bank-specific characteristics. Specifically, the aspects of bank size, capitalization, and bank return are explored as inspired by the former literature, expecting to indicate whether different bank groups could be affected differently by central bank reserve accumulation. We employ the two-step system generalized method of moments (GMM) in dynamic panels with bank-level data during 2007–2019 for Vietnam, an emerging market that has grown rapidly over the years, to display evidence for the impacts of reserve accumulation. Vietnam offers a favorable case to test our research issues. Vietnam's economic growth is largely financed by bank lending, which is considered a core economic

indicator (Dang & Dang, 2020). Vietnam appears to be open to capital inflows and targeting exchange rates through foreign exchange interventions has been regularly used here. The scale of foreign exchange reserves has changed and grown dramatically in Vietnam over the past decade (see section 3). The State Bank of Vietnam (SBV) usually declared that it had sterilized most foreign exchange purchases to absorb excessive liquidity. Besides, the Vietnamese banking system is also featured by various reforms recently, which leads to significant changes in the industry with high differentiation among participants (Dang & Huynh, 2020).

Sharing a similar topic with the works mentioned above, however, our paper with a different setting and startling results still adds important contributions to the literature. We focus on two key aspects of bank lending, including quantity and quality, to paint a bigger picture of the benefits and costs of reserve accumulation, which previous studies have not exploited. We also decompose bank asset portfolios into disaggregate components to offer more insight into bank responses. In this regard, our essential contribution to the current debate is to shed light on the expansionary effects of reserve accumulation on credit conditions so that foreign exchange intervention could complement monetary policy in credit supply, economic growth, and financial stability. The main findings of this study challenge those obtained previously in other markets and thus balance the understanding of the topic. Notably, the present paper offers in-depth conclusions by exploiting the heterogeneity effects across different banks; this is a special note as well as an innovation of this study.

Methods

Estimation Strategies

To explore the impact of reserve accumulation on bank lending in Vietnam, we specify the model equation as follows:

$$Y_{i,t} = a_0 + a_1 \times Y_{i,t-1} + a_2 \times FXR_{t-1} + a_3 \times X_{i,t-1} + a_4 \times Z_{t-1} + \varepsilon_{i,t} \quad (1)$$

where i and t express banks and years, respectively. The dependent variable Y is either the quantity of bank lending, captured by the growth rate of loans, or the quality of bank lending, measured by the loan loss provision ratio and the non-performing loan ratio. The lagged dependent variable is included in the right-hand side of the specification to adopt the dynamic feature in bank lending. FXR is the measure of reserve accumulation, while X contains bank-specific controls, and Z is a vector of macroeconomic variables. $\varepsilon_{i,t}$ is the error term. The lags of independent variables are preferred as bank lending may not react immediately to changes in both macro- and micro-events.

As a straight-forward approach, we use the natural logarithm of the SBV's foreign exchange reserves (*lnFXR*) to reflect our primary explanatory variable (reserve accumulation exhibited in US dollars). In addition to this baseline variable, we also employ an additional proxy allowing for the size of the economy and the floating/fixed exchange rate regime (Chen, Wu, Jeon, & Wang, 2017). The equation to compute the alternative proxy for reserve accumulation is written as follows:

$$FXR/GDP = \left(\frac{fxr}{GDP}\right) \times \frac{\sigma(fxr)}{\sigma(fxr) + \sigma(eer)} \quad (2)$$

where *fxr* represents the SBV's foreign exchange reserves, *GDP* captures the gross domestic products, *σ(fxr)* and *σ(eer)* indicate the standard deviations of monthly indexed foreign exchange reserves and effective exchange rates, respectively. The identical estimation results from our two explanatory variables of main interest as set up above would signify the robustness of our findings.

To draw a comprehensive picture of reserve accumulation's impact on bank activities, we utilize an additional measure to display bank financial stability. This measure has been widely employed in the banking literature in the form of the Z-score index (Ngambou Djatche, 2019; Niu, 2012), via the formula specified as:

$$Z = \frac{ROA + capital}{\sigma(ROA)} \quad (3)$$

where *ROA* denotes return on assets, *capital* represents the capital ratio and *σ(ROA)* indicates the standard deviation of *ROA* over the entire period under research. Inspired by the former literature, we take the natural logarithm of the Z-score index in the regression stage (Ngambou Djatche, 2019).

Additionally, to control for other potential factors that may drive loan growth and bank risk, we incorporate some standard variables commonly suggested by the existing literature (Dang & Dang, 2020; Delis & Kouretas, 2011; Khan, Ahmed, & Gee, 2016; Yang & Shao, 2016). For bank-specific control variables, we include bank size, capital equity, and bank return; for macroeconomic factors, we include inflation and economic cycle. Specific definitions of all variables are given in Table 1.

With the presence of the lagged dependent variable among our independent variables, we employ the GMM estimator to perform regressions. This GMM estimator is also suited for dealing with omitted variables, reverse causality, and measurement errors (Arellano & Bover, 1995; Blundell & Bond, 1998). Following Roodman (2009), we apply the procedure to curb the proliferation of instruments used for small samples. To assure the consistency of the GMM estimation, we perform the Hansen test of valid instruments and the AR(1)/AR(2) tests for the first- and second-order serial correlation.

Data

We collect bank-level data from the financial reports published by Vietnamese commercial banks for the period 2007–2019. According to the banking regulation of Vietnam, the structure of commercial banks' financial reports has been strictly standardized in a consistent form since 2007, which has to be audited. Moreover, before 2007, only a few large banks fully published their financial reports. We eliminate banks that provide insufficient information for the calculation of required variables. For the macroeconomic data, we source the foreign exchange reserves from the International Financial Statistics (IFS), while the GDP growth rate and the inflation rate are obtained from the World Development Indicators (WDI). Our final sample covers 31 Vietnamese banks and constitutes an unbalanced panel with 391 bank-year observations, making up on average 90% of the Vietnamese banking system's total assets.

Results and Discussion

Preliminary Results

Table 1 reports the descriptive statistics for all variables. In general, through the values of standard deviations and the spreads of extreme values, we can observe a wide dispersion across banks in the working and outcome of lending activities.

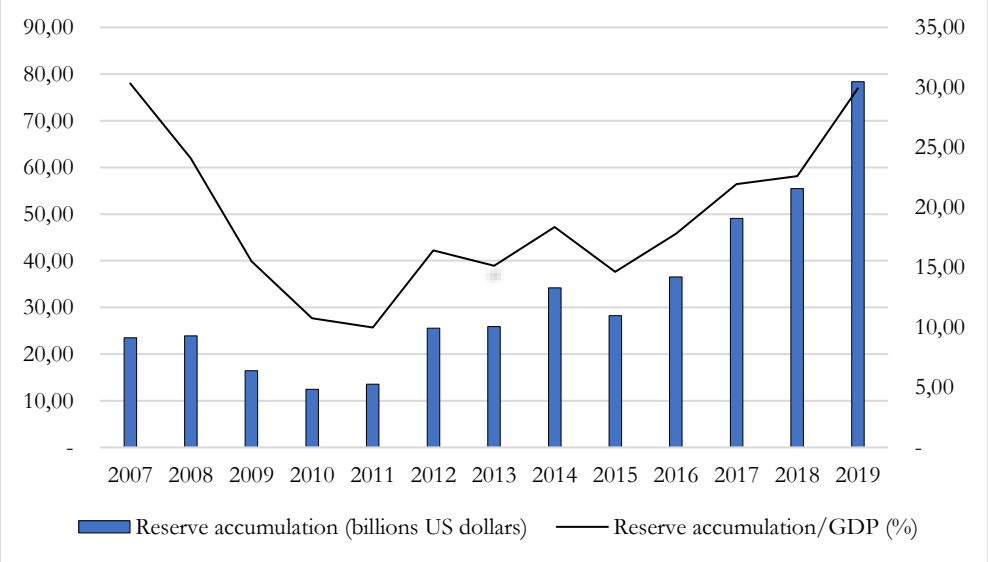

Figure 1. The evolution of the average reserve accumulation over the sample period of 2007–2019

Regarding the evolution of the SBV's foreign exchange reserves, Figure 1 depicts the average reserve accumulation over our sample period from 2007 to 2019. After a period of alternate downward and upward trends from 2007 to 2014, since 2015, we could observe substantial increases in overall central bank reserves. The increases led to the fact that Vietnam's reserve accumulation almost tripled from 23.5 billions USD (2007) to 78.3 billions USD (2019). Compared to the SBV's foreign exchange reserve scale, the reserve accumulation relative to Vietnam's GDP displayed a slightly different pattern. Experiencing a period of significant fluctuations up and down, which highlights the U-shape pattern, the rate in 2019 (29.91%) was almost the same as in 2007 (30.33%). Though, we still observe the continuous increase of this rate since 2015, similar to the reserve scale. Bearing in mind the difference in the changes of the relative and absolute foreign exchange reserves, we expect the identical results in the regression section from the two main explanatory variables could highlight the robustness of our findings.

Table 1. Definitions and summary statistics of variables employed

	Mean	SD	Min	Max	Definitions
Bank lending and investment variables					
Loangrowth	29.533	29.671	−5.159	111.120	The annual growth rate of bank loans (%)
Loanshare	54.724	12.645	31.227	74.392	The ratio of bank loans to total assets (%)
Cash	17.442	9.603	5.570	38.193	The ratio of liquid assets (cash plus due from other institutions) to total assets (%)
Securities	16.813	7.364	4.470	31.980	The ratio of security investments to total assets (%)
Governbonds	8.615	4.696	1.606	18.851	The ratio of government bond holdings to total assets (%)
Bank risk measures					
lnZscore	2.867	0.488	1.915	3.662	Natural logarithm of the Z-score index
LLP	1.253	0.509	0.502	2.499	The ratio of loan loss provisions to total gross loans (%)
NPL	2.147	1.187	0.495	5.159	The ratio of non-performing loans to total gross loans (%)
Bank-level characteristics					
Capital	10.072	4.647	4.939	21.884	The ratio of bank equity to total assets (%)
Size	31.972	1.233	29.943	34.269	Natural logarithm of total assets
ROA	0.911	0.656	0.038	2.279	The ratio of net return on total assets (%)
Macroeconomic factors					
lnFXR	24.074	0.521	23.246	25.084	Natural logarithm of the SBV' foreign exchange reserves
FXR/GDP	17.498	6.361	7.632	29.460	The SBV' foreign exchange reserves as a fraction of GDP, taking into account the exchange rate regime (%)
GDP	6.245	0.642	5.247	7.130	The annual growth rate of GDP (%)
Inflation	7.495	6.226	0.631	23.115	The annual inflation rate (%)

The sample covers 31 commercial banks in Vietnam over the period 2007–2019, with a total number of 391 observations, forming an unbalanced panel data.

We now move on to the estimation parts obtained using the consistent GMM estimator, which is validated by the Hansen test results of valid instruments and the AR(1)/AR(2) tests for the first second-order serial correlation. Some reliable and interesting findings have emerged.

Central Bank Reserve Accumulation and Loan Growth

We report the baseline estimation results for the linkage between reserve accumulation and bank loan growth in Table 2. Both columns 1 and 2 presenting the estimation results for alternative reserve accumulation variables indicate that the coefficient of reserve accumulation is significantly positive at the 1% level. This result shows that reserve accumulation induces a significant positive effect on bank lending growth in Vietnam; in other words, we find that the overall bank loan growth rate increased significantly after reserve accumulation from the central bank.

Quantitatively, our results are also economically significant. Based on the coefficient of column 1 (Table 2), we could infer that an increase of one standard deviation in the reserve accumulation (0.521) is associated with an increase in the loan growth rate of 6.53 percentage points. Such an effect is reasonable given the mean value of the loan growth rate is 29.53%.

Table 2. Reserve accumulation and bank loan growth

	(1) Loangrowth	(2) Loangrowth
Lag of Loangrowth	0.199***	0.109***
	(0.014)	(0.015)
lnFXR	12.539***	
	(0.924)	
FXR/GDP		0.623***
		(0.049)
Capital	1.107***	1.088***
	(0.173)	(0.168)
Size	−1.804***	−1.605**
	(0.610)	(0.665)
ROA	−2.747***	−2.999***
	(0.938)	(1.116)
GDP	−7.473***	−7.161***
	(0.508)	(0.609)
Inflation	1.023***	0.705***
	(0.082)	(0.089)
Observations	360	360
Banks	31	31
Instruments	29	29
AR(1) test	0.001	0.001
AR(2) test	0.168	0.120
Hansen test	0.149	0.144

Notes: The dependent variable is the growth rate of bank loans. Symbols *** and ** indicate significance at the 1% and 5% levels, respectively.

Table 3. Reserve accumulation and bank portfolio components (using the natural logarithm of foreign exchange reserves)

	(1) Loanshare	(2) Cash	(3) Securities	(4) Governbonds
Lag of Loanshare	0.604***			
	(0.030)			
Lag of Cash		0.420***		
		(0.042)		
Lag of Securities			0.692***	
			(0.035)	
Lag of Governbonds				0.656***
				(0.043)
lnFXR	3.204***	2.362***	−1.557***	−1.103***
	(0.642)	(0.512)	(0.223)	(0.172)
Capital	−0.030	−0.126*	0.025	−0.069***
	(0.050)	(0.069)	(0.040)	(0.024)
Size	2.008***	−1.792***	−0.353***	0.090
	(0.342)	(0.339)	(0.134)	(0.057)
ROA	−0.238	7.465***	−0.675***	−0.972***
	(0.310)	(0.926)	(0.138)	(0.151)
GDP	1.031***	−0.414*	−1.882***	−0.450***
	(0.188)	(0.234)	(0.262)	(0.116)
Inflation	0.199***	−0.112**	−0.166***	−0.049***
	(0.030)	(0.051)	(0.019)	(0.010)
Observations	360	360	360	360
Banks	31	31	31	31
Instruments	29	29	29	29
AR(1) test	0.001	0.000	0.000	0.001
AR(2) test	0.436	0.915	0.443	0.779
Hansen test	0.281	0.286	0.161	0.336

Notes: The dependent variables are loans, cash and due, total security investment, and sovereign bond holdings, divided by total assets (the variables of Loanshare, Cash, Securities, and Governbonds are exhibited respectively at the top of each column). Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

To deepen our findings, we pay attention to the components of bank asset portfolios. We now turn to use new indicators as the dependent variables, including bank loans, cash components (cash and due from other institutions), and security investments, all computed as a share of total assets. We also decompose the security investments to take government bond holdings to explore the sterilization conducted and absorbed. We redo our estimations with the new dependent variables using the system GMM estimator and report all results in Tables 3 – 4.

Table 4. Reserve accumulation and bank portfolio components (using the foreign exchange reserves as a fraction of GDP)

	(1) Loanshare	(2) Cash	(3) Securities	(4) Governbonds
Lag of Loanshare	0.559***			
	(0.024)			
Lag of Cash		0.549***		
		(0.027)		
Lag of Securities			0.678***	
			(0.037)	
Lag of Governbonds				0.651***
				(0.045)
FXR/GDP	0.148***	0.103***	−0.059***	−0.053***
	(0.031)	(0.015)	(0.021)	(0.013)
Capital	0.058	0.063	0.003	−0.084***
	(0.052)	(0.052)	(0.043)	(0.025)
Size	2.238***	−1.031***	−0.548***	−0.036
	(0.294)	(0.162)	(0.113)	(0.063)
ROA	−1.184***	1.960***	−0.378**	−0.731***
	(0.265)	(0.221)	(0.150)	(0.122)
GDP	1.398***	0.178	−1.992***	−0.509***
	(0.189)	(0.159)	(0.281)	(0.133)
Inflation	0.128***	−0.074**	−0.149***	−0.036***
	(0.032)	(0.035)	(0.016)	(0.010)
Observations	360	360	360	360
Banks	31	31	31	31
Instruments	29	29	29	29
AR(1) test	0.001	0.000	0.000	0.002
AR(2) test	0.624	0.973	0.498	0.751
Hansen test	0.241	0.220	0.145	0.320

Notes: The dependent variables are loans, cash and due, total security investments, and sovereign bond holdings, divided by total assets (the variables of Loanshare, Cash, Securities, and Governbonds are exhibited respectively at the top of each column). Symbols *** and ** indicate significance at the 1% and 5% levels, respectively.

We notice that the coefficients on accumulated reserves are significantly positive in the function of bank loans and cash share but significantly negative in the equation of total securities and disaggregate sovereign bonds holdings. This set of results implies that in response to the accumulation of foreign exchange from the central bank, the proportion of loans and cash on the bank asset structure tends to be enlarged, in contrast to security investments. Interestingly, a deeper pattern reveals that banks have decreased the holdings of government bonds subsequently.

Our findings strongly challenge those obtained previously in other markets, highlighting another cost of foreign exchange reserves in decreasing bank credits to the real sectors (Cook & Yetman, 2012; Hofmann et al., 2019; Yun, 2020). In turn, we lend support to the work of Chen et al. (2017), which posits that unless thoroughly sterilized, foreign exchange intervention may modify the monetary base and play a role similar to monetary policy. Overall, some mechanisms could be used to explain our main findings so far. Accumulation of foreign reserves by the central bank may enhance bank liquidity positions. According to the "portfolio balance" channel (Tobin, 1969), banks do not consider cash as a perfect substitute for the assets they sell to the central bank. Thus, they are incentivized to use the cash received to invest in high-return assets. To avoid excessive

liquidity in the economy, the central bank is supposed to sterilize the reserves accumulation. However, sterilization may be incomplete. For instance, if sterilization bills and money share the feature of close substitutes, then more holdings of sterilization bills (mostly in the form of government bonds via open market operations in Vietnam) are not ideal to accepted by banks, and it may not offset the expansionary influences of foreign exchange reserves (Cook & Yetman, 2012). Hence, banks may choose to invest more in higher-yield items such as loans or possibly keep their money received in cash and deposits at other institutions.

Central Bank Reserve Accumulation and Bank Risk

Table 5 reports the estimation results for how central bank reserve accumulation drives bank riskiness, captured by the measures of credit risk and overall risk (or bank financial stability). We document that the coefficients associated with loan loss provisions and non-performing loans are significantly negative at the 1% level, while those associated with the Z-score measure are significantly positive at the 1% level. These results demonstrate that banks suffer less credit risk and become more financially stable after the central bank accumulates more foreign exchange reserves.

In some detail, using the face value of coefficients in column 2 (Table 5), we could calculate that an increase of one standard deviation in reserve accumulation may cause a decline of 0.42 percentage points in the non-performing loan ratio. Simultaneously, the coefficients in column 6 reveal that an increase of one percentage point in the reserve accumulation relative to GDP is associated with a rise of 0.002 percentage points in the measure of bank financial stability. The magnitudes of coefficients all outline the economic plausibility of our findings.

Table 5. Reserve accumulation and bank riskiness

	(1) LLP	(2) NPL	(3) lnZscore	(4) LLP	(5) NPL	(6) lnZscore
Lag of LLP	0.579***			0.664***		
	(0.032)			(0.032)		
Lag of NPL		0.540***			0.547***	
		(0.035)			(0.026)	
Lag of lnZscore			0.979***			1.005***
			(0.018)			(0.027)
lnFXR	−0.253***	−0.801***	0.032***			
	(0.016)	(0.065)	(0.006)			
FXR/GDP				−0.014***	−0.037***	0.002***
				(0.002)	(0.003)	(0.001)
Capital	−0.015***	−0.017		−0.020***	−0.024***	
	(0.003)	(0.011)		(0.002)	(0.009)	
Size	0.027*	−0.110***	0.036***	−0.039***	−0.188***	0.038***
	(0.014)	(0.035)	(0.005)	(0.011)	(0.028)	(0.005)
ROA	−0.002	−0.223***		0.050***	−0.094**	
	(0.017)	(0.047)		(0.017)	(0.038)	
GDP	0.055***	0.290***	0.059***	0.073***	0.276***	0.054***
	(0.008)	(0.034)	(0.007)	(0.014)	(0.029)	(0.010)
Inflation	0.006***	−0.002	−0.001	0.007***	0.006	−0.002*
	(0.002)	(0.006)	(0.001)	(0.002)	(0.005)	(0.001)
Observations	360	360	360	360	360	360
Banks	31	31	31	31	31	31
Instruments	29	29	27	29	29	27
AR(1) test	0.000	0.000	0.001	0.000	0.000	0.001
AR(2) test	0.241	0.101	0.509	0.257	0.106	0.518
Hansen test	0.291	0.155	0.162	0.387	0.153	0.150

Notes: The dependent variables are the loan loss provision ratio, the non-performing loan ratio, and the natural logarithm of the Z-score index (the variables of LLP, NPL, and lnZscore are exhibited respectively at the top of each column). Symbols ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. When performing estimations in the Z-score measure model, we exclude capital and return variables to avoid spurious regressions since these variables are the main factors in computing the Z-score index.

Generally, we gain strong evidence to prove that reserve accumulation has protected the Vietnamese banking system from credit risk and financial instability. Although banks do not show absolute improvement in the underlying liquidity position after large-scale reserve accumulation (holdings of money increase but securities decrease), non-easy gains from holdings of government securities (as sterilization instruments) may encourage banks to become more efficient in other operations (Mohanty & Turner, 2006), especially credit segments. This argument is entirely consistent with our finding obtained previously. Furthermore, increasing foreign exchange reserves could enable the central bank to have broader and more powerful interventions, thereby leaving the money supply unaffected and inducing little effect on the exchange rate (Sarno & Taylor, 2001). This long-standing view indicates safer asset portfolios of banks.

Heterogeneity Effects

In this subsection, we try to offer more insight into our findings by identifying the effects of reserve accumulation on bank lending while taking into account differences across banks. The literature inspires our strategy on monetary policy transmission via the bank lending channel and the bank risk-taking channel. Accordingly, these literature strands have shown that monetary shocks exert stronger impacts on banks that are more vulnerable (i.e., smaller banks, lower-capitalized banks, or less liquid banks that have limited access to non-deposit funding) (Delis & Kouretas, 2011; Khan et al., 2016; Yang & Shao, 2016). If similar mechanisms still work when financial conditions are adjusted generally, central bank reserve accumulation that relaxes money supply would be expected to produce more pronounced effects on financially weaker banks.

Table 6. Heterogeneity in the impact of reserve accumulation on bank loan growth

	The dependent variable is the growth rate of bank loans					
	(1)	(2)	(3)	(4)	(5)	(6)
Lag of Loangrowth	0.152***	0.169***	0.187***	0.154***	0.094***	0.151***
	(0.019)	(0.015)	(0.018)	(0.020)	(0.020)	(0.022)
lnFXR	11.083***	16.105***	10.113***			
	(0.964)	(1.908)	(1.377)			
lnFXR*Capital	−0.089***					
	(0.007)					
lnFXR*Size		−0.155**				
		(0.064)				
lnFXR*ROA			−0.651***			
			(0.096)			
FXR/GDP				2.290***	0.700***	1.701***
				(0.178)	(0.059)	(0.184)
FXR/GDP*Capital				−0.220***		
				(0.021)		
FXR/GDP*Size					−0.005**	
					(0.002)	
FXR/GDP*ROA						−0.829***
						(0.133)
Capital	2.118***	1.091***	0.670***	2.497***	1.029***	1.131***
	(0.157)	(0.173)	(0.163)	(0.170)	(0.166)	(0.247)
Size	−4.063***	1.654	−2.968***	−5.590***	−1.574***	−1.292
	(0.484)	(2.206)	(0.629)	(1.081)	(0.546)	(0.859)
ROA	−0.745	−2.325**	−9.514***	−0.603	−3.319**	9.367**
	(1.085)	(1.059)	(1.191)	(1.433)	(1.292)	(3.654)
GDP	−5.997***	−6.577**	−9.217***	−4.987***	−6.284***	−7.117***
	(0.509)	(0.529)	(1.116)	(0.664)	(0.546)	(0.634)
Inflation	0.982***	0.929***	0.738***	0.862***	0.696***	0.787***
	(0.089)	(0.112)	(0.130)	(0.088)	(0.088)	(0.062)
Observations	360	360	360	360	360	360
Banks	31	31	31	31	31	31
Instruments	30	30	30	30	30	30
AR(1) test	0.001	0.001	0.000	0.001	0.001	0.001
AR(2) test	0.272	0.171	0.198	0.525	0.119	0.142
Hansen test	0.154	0.160	0.146	0.174	0.151	0.131

Notes: Symbols *** and ** indicate significance at the 1% and 5% levels, respectively.

Aligning our present paper to the former literature, we explore the following bank-specific characteristics that can modify the linkage between reserve accumulation and bank lending: bank capital, bank size, and bank return. Regarding the econometric approach, we extend the baseline model by interacting reserve accumulation variables with different bank-specific characteristics separately. The interaction terms allow us to verify the heterogeneity in how bank lending reacts to reserve accumulation. The estimation results for the function of bank loan growth and bank risk (only captured by the loan loss provision ratio for the sake of brevity, while other variables still yield the same results) are presented in Tables 6–7.

Table 7. Heterogeneity in the impact of reserve accumulation on bank risk

The dependent variable is the ratio of loan loss provisions to total gross loans						
	(1)	(2)	(3)	(4)	(5)	(6)
Lag of LLP	0.561***	0.569***	0.623***	0.673***	0.670***	0.665***
	(0.035)	(0.031)	(0.032)	(0.040)	(0.029)	(0.034)
lnFXR	−0.262***	−0.356***	−0.251***			
	(0.016)	(0.037)	(0.014)			
lnFXR*Capital	0.001***					
	(0.000)					
lnFXR*Size		0.003***				
		(0.001)				
lnFXR*ROA			0.006***			
			(0.001)			
FXR/GDP				−0.012***	−0.150***	−0.014***
				(0.002)	(0.025)	(0.002)
FXR/GDP*Capital				0.001***		
				(0.000)		
FXR/GDP*Size					0.004***	
					(0.001)	
FXR/GDP*ROA						0.001
						(0.001)
Capital	−0.019***	−0.017***	−0.020***	−0.016***	−0.021***	−0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
Size	0.047***	−0.065**	0.009	−0.047***	−0.113***	−0.039***
	(0.015)	(0.030)	(0.012)	(0.010)	(0.023)	(0.014)
ROA	0.004	−0.001	−0.055***	0.056***	0.050***	0.045***
	(0.016)	(0.016)	(0.019)	(0.017)	(0.018)	(0.015)
GDP	0.054***	0.052***	0.052***	0.104***	0.069***	0.071***
	(0.009)	(0.009)	(0.010)	(0.013)	(0.012)	(0.016)
Inflation	0.007***	0.007***	0.006***	0.008***	0.008***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	360	360	360	360	360	360
Banks	31	31	31	31	31	31
Instruments	30	30	30	30	30	30
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.217	0.254	0.405	0.265	0.292	0.262
Hansen test	0.356	0.449	0.364	0.315	0.344	0.378

Notes: Symbols *** and ** indicate significance at the 1% and 5% levels, respectively.

For both measures of reserve accumulation, we find that the regression coefficients on interaction terms across different aspects of bank balance sheets are significantly negative in the equation of loan growth (Table 6) and significantly positive in the bank risk specification (Table 7). All signs of these coefficients are opposite to those of stand-alone reserve accumulation variables. These results suggest that the impacts of central bank reserve accumulation on bank lending, both in dimensions of quantity and quality, vary according to bank-specific characteristics. More precisely, weaker banks (i.e., smaller banks, lower-capitalized banks, and less profitable banks) are more sensitive to the impacts of reserve accumulation on bank lending.

On the one hand, in case of reserve accumulation, financially stronger banks have incentives as well as are encouraged to cooperate with the central bank on sterilization. If these stronger banks take over more sterilization securities, they will be less able to increase loans. In this scenario, more sterilized intervention could also modify bank behavior in the mechanism that easy profits from holdings of sterilization securities could weaken banks' pressures to become more efficient in monitoring and supervising loans (Mohanty & Turner, 2006). On the other hand, foreign reserve decumulation of the central bank leads to a fall in the volume of loanable funds and may subsequently contract lending of banks. Such a contraction may be more pronounced at weaker banks, as they find it more challenging and expensive to reach external funds to finance their lending. Moreover, reserve decumulation is typically done in periods of extended uncertainty (Yun, 2020), when weaker banks are more vulnerable. This situation makes the riskiness of these banks increase to a higher level.

Conclusion

The study examines the impacts of central bank reserve accumulation on lending activities in the banking industry, captured by two dimensions of quantity (loan growth) and quality (credit risk). Using bank-level data and foreign exchange reserves during 2007–2019 in Vietnam — an emerging market that has tripled its reserves over the past decade, we document multiple interesting findings. In response to the reserve accumulation, banks increase their loan growth rate. Our additional analysis reveals that loans and cash items on the bank asset structure tend to be expanded in this vein, while total security investments and the holdings of government bonds may be narrowed subsequently. Our results also indicate that foreign reserves drive bank risk profiles in the way that banks suffer less credit risk after the reserve accumulation of the central bank. Focusing on a broader aspect of bank riskiness, we further find that bank financial stability tends to be improved when the central bank in Vietnam increases its foreign exchange reserves. Most interestingly, as a special note to the findings of this study, our results reveal that weaker banks (i.e., smaller banks, lower-capitalized banks, and less profitable banks) are more responsive to how central bank reserve accumulation affects bank lending. This pattern firmly holds for the dimensions of loan growth and credit risk across alternative measures of reserve accumulation.

This paper offers some policy implications. The empirical evidence presented displays that reserve accumulation has expansionary effects, i.e., banks increase loans to the economy and hold less risk-free securities. This supports the notion that reserve accumulation could be a complementary monetary policy tool for lending navigation and economic growth. Besides, reserve interventions may be used for the purpose of financial stability, given the finding that it is found to curtail bank credit risk and financial instability. However, monetary authorities should be concerned about the dark side of excessive liquidity after accumulating foreign exchange reserves since our findings cast some doubt on the effectiveness of the sterilization operations in Vietnam. Additionally, our study also calls for policy measures that pay attention to heterogeneous responses of different bank groups to central bank reserve accumulation.

We acknowledge that our paper is refined to a small single country with a limited sample size using yearly observations. We expect our work could be expanded to other countries/regions, which may enrich the current knowledge. Besides, we realize that there are several potential channels through which central bank reserves can alter bank lending's working and efficiency, albeit it is challenging to be sure about their significance based on empirical evidence in the present research. Hence, we leave the more rigorous empirical analysis of precise channels to future research to fully explain the impact of central bank reserves on bank lending.

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