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Article

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Holdings of sovereign bonds by commercial banks in Vietnam

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Abstract: The study examines the bank-specific determinants of sovereign bond holdings and how such holdings affect bank lending of the banking market in Vietnam. Using annual financial data of commercial banks from 2007 to 2018 and alternative regression techniques for both dynamic and static models, we attribute the motives of sovereign bond holdings to the liquidity reserves, profitability improvement, and risk-shifting. At odds with our expectation, we find no evidence in favor that Vietnamese banks purchase government bonds to increase capital adequacy ratio. Furthermore, to clarify the economic impact of sovereign bond investment, we also offer evidence to reject the notion that purchases of government bonds are detrimental to banks' core function in normal times captured by bank lending and liquidity creation. All estimates are robust across alternative regression techniques in both dynamic and static panel models. Overall, our findings have important policy implications for Vietnam and some emerging economies with similar backgrounds.

Keywords: bank lending; emerging market; liquidity creation; liquidity reserves; sovereign bonds

Subjects: G01; G21; H63

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PUBLIC INTEREST STATEMENT

In this study, we study how internal characteristics captured by bank balance sheets affect the investments of sovereign bonds at commercial banks in Vietnam. Through multiple econometric approaches, we find that banks tend to purchase more sovereign bonds since they desire to improve their returns, shift risk-taking, and reserve liquidity. The data shows no evidence in favor that Vietnamese banks hold government bonds to boost the capital adequacy ratio. Further analysis indicates that banks do not expand lending activities at a slower pace after investing in sovereign bonds previously. We also use a quantitative measure of liquidity creation — a broader concept of bank lending — to demonstrate that sovereign bond holdings do not hurt banks' core function. Overall, our findings offer important policy implications for Vietnam and some emerging economies with similar backgrounds, where the government restricts banks from investing in sovereign bonds and disregards the banking system's motives before issuing sovereign bonds.

1. Introduction

During the last decade, the Vietnamese government has issued a great number of sovereign bonds to contribute to the state budget, serving the country's capital allocation needs. The market of sovereign bonds has attracted both domestic and foreign investors. For many years, however, the group of domestic commercial banks has always been the major holders of sovereign bonds. During 2008–2009, government bonds were a highly profitable investment channel with the yield sometimes reaching over 20% per year, thus increasing the sovereign debt exposure of banks. Following this momentum, by 2015, commercial banks held about 80% of total government bonds issued.[1] Concerned about the adverse effects of this trend on bank credit operations as well as the concentration of bondholders list, the policymaker has established regulations to limit the purchases of this risk-free asset. For example, banks can only use a maximum of 35% short-term funding for sovereign bond investment. As a result, the proportion of sovereign bonds held by banks decreased to 52% in 2017 and 47.8% in 2018.

The questions of considerable importance are what makes banks' exposure to sovereign bonds grow considerably, and whether this involvement hurts bank credit operations. Various documents have tried to answer these questions. However, so far, works have been done almost exclusively for the sovereign debt crisis in Europe (Acharya et al., 2014; Battistini et al., 2014; Ongena et al., 2019; Popov & Van Horen, 2015; V. V. Acharya & Steffen, 2015) or in countries with financial distress/sovereign defaults (Gennaioli et al., 2018) and leading developed economies (Ogawa & Imai, 2014). A significant difference between emerging and developed economies is that the holdings of sovereign bonds by banks operating in less financially developed markets in normal times of emerging countries are lower (Gennaioli et al., 2018). Given these contexts, it would be useful to know more about the holding behavior of government bonds from banks in emerging markets.

In this study, we aim to examine the determinants of sovereign bond holdings (alternatively, "government bonds" or "bondholdings") for the banking market in Vietnam, an emerging economy. In particular, we mainly focus on bank-specific factors instead of external and macroeconomic characteristics that have been extensively studied in existing literature (see Affinito et al., in press). Using the annual financial data of commercial banks from 2007 to 2018—a period covering the entire development progress of the Vietnamese government bond market after the global trade integration, we investigate many important factors simultaneously with regard to the precautionary motive, performance improvement goals, and compliance with regulatory requirements. Also, to clarify the economic impact of sovereign bonds investment, it is crucial to understand how it affects bank lending behavior. It has been argued that holdings of government bonds will adversely influence the banks' credit operations, leaving them distracted from their core mission. This situation, in turn, is very detrimental to a fast-growing economy that highly values bank credit (Dang, 2020; Vo, 2018). Our work goes one step further to shed light on this rigorously untested argument by using the loan growth rate along with the novel quantitative concept of liquidity creation.

Conducting an empirical study in the Vietnamese market is supported by multiple favorable conditions. The banking system's purchases of sovereign bonds have been prominent recently, especially in the context of the increased public debt of the Vietnamese government. The sovereign bonds channel is essential not only for holders and issuers themselves but also for policymakers. While the banking system has always played an integral role in the economy, the credit boom has placed numerous pressures on the whole system in the recent period. In this regard, the main pressures are the credit quality decline and the raising-capital requirement. Addressing the questions posed in this study is expected to provide useful implications for Vietnam as well as contribute to the related segment of existing literature. For the latter, our study is the first to comprehensively explore the structure of banks' financial statements to understand its impacts on sovereign bond holdings in an emerging market. Moreover, we also know of no prior studies that shed light on the argument on the adverse effect of bondholdings on bank output in normal times.

We proceed with our work as follows. In section 2, we review the related literature on factors affecting sovereign bonds holding and the impact analysis on bank lending. We then present the models, method, and data for estimation in section 3. Section 4 reports and discusses the estimation results of two model specifications. Finally, section 5 briefly concludes and draws some policy implications.

2. Related literature

2.1. Why do banks hold sovereign bonds?

This subsection reviews the motives of sovereign bond holdings proposed in the existing academic and practical debates. Instead of a systematic approach, prior scholars have presented different reasons separately to determine why banks expand exposures to sovereign debt.

2.1.1. Liquidity reserves

Liquidity reserves are considered as the major motive for banks' government bond holdings. From the perspective of cash flow management, it may be difficult for banks to disburse immediately into the economy without any mismatch after gaining the loanable funding. Accordingly, banks might choose, particularly right after raising funding, to temporarily invest in sovereign bonds with appropriate terms (Broner et al., 2014). This mechanism helps banks maintain better liquidity positions and maximize the efficiency of cash flow management. A theoretical model constructed by Gennaioli et al. (2014) shows that banks tend to keep an optimal amount of public bonds as a strategy to store liquidity to necessarily finance future investments. This precautionary hypothesis has also been proved in a recent study of Affinito et al. (in press) for the Italian banking market.

2.1.2. Performance improvement and risk-shifting strategies

Interest rates on government bonds are also essential in attracting banks to improve their operating profit (Battistini et al., 2014). As investors, banks appear to have wisdom in comparing cost-benefit nexus between credit operations and other investment channels to seize opportunities. If yields of sovereign bonds increase up to an appropriate threshold, banks will gain more exposure to this investment segment (Ogawa & Imai, 2014). Moreover, the motive of risk-shifting may be explicitly pronounced when it comes to the holdings of sovereign bonds, which are rated as risk-free. The declined credit quality makes banks more cautious with investment decisions, especially when their credit portfolios are subject to the strict supervision of regulatory agencies (Lamas & Mencia, 2018). Thus, it could be argued that the risk-return trade-off of sovereign bond holdings drives banks to invest in this segment. This argument is especially relevant to Vietnamese banks that have had difficult times with bad debts and low earnings.

2.1.3. Compliance with capital regulations or the "regulatory hypothesis"

Another critical driver of government bond holdings is related to compliance with bank capital adequacy regulations. In empirical studies, Bonner (2016) and Buch et al. (2016) find that the larger amounts of sovereign bonds are held by less capitalized banks, thus emphasizing on the regulatory treatments of bondholdings in terms of capital requirements. When determining the amount of risk-weighted assets to calculate capital adequacy ratio, sovereign bonds are assigned a zero risk-weight. This mechanism, therefore, creates strong incentives for banks to purchase sovereign bonds, especially undercapitalized banks, to comply with prudential regulations (Drechsler et al., 2016; V. V. Acharya & Steffen, 2015). In a more general manner, Altunbas et al. (2007) and Iannotta et al. (2007) suggest the "regulatory hypothesis" to interpret the compliance behavior of banks with the capital regulations. This "regulatory hypothesis" is suited and necessary to be verified in the Vietnamese banking market. After a period of unproductive credit growth, capital tensions have appeared and become increasingly more substantial, in a sense, as a result of the official implementation of the Basel II framework on capital standards. Earnings challenges and obstacles of raising equity capital are more likely to force banks to choose to improve capital adequacy ratio by decreasing risk-

weighted assets rather than increasing capital. In this way, one could argue that lower capitalized banks tend to increase the shift to government bonds, which have a zero risk-weight, thereby promoting capital adequacy ratios.

2.2. How do holdings of sovereign bonds drive bank lending?

The existing literature has paid little attention to the impact of bondholdings on bank lending in normal times. Gennaioli et al. (2018) empirically analyze the holdings of sovereign bonds by banks in 191 countries around the world, mainly focusing on the sovereign default cases from 1998 to 2012. The authors notice that increased exposures of pre-crisis banks to sovereign bonds could be a potential predictor of subsequent lending cuts. However, in the absence of sovereign defaults in some countries, the effect of government bond holdings on bank lending captured by the share of loans to total assets is initially positive. Gennaioli et al. (2018) also indicate that fewer investment opportunities during bad times encourage banks to store their funds in sovereign bonds.

Another strand of research conducted by Fratianni and Marchionne (2017) focuses on the relationship between loans and sovereign securities. A substantial substitution between two groups of assets is found, in line with the previous finding of Becker and Ivashina (2018). Such a substitution is interpreted by the adjustment of banks' overall credit risk. In practice, however, Vietnamese regulators seem to merely look at the straightforward relationship between banks' lending and sovereign bond holdings. After the sharp upsurge in government bond purchases, there were concerns that this increasing movement would worsen the function of the banking channel in terms of credit provision. Consequently, regulations on limiting the share of funding used for sovereign securities have been issued but neglect the real economic impact of bondholdings on bank lending.

3. Methodology and data

3.1. Model 1 specification

We first investigate the determinants of sovereign bond holdings through Model 1 specification. We begin our empirical analysis with the static panel data model as follows:

$$\begin{aligned} Sovereign\ Bonds_{i,t} = {} & \alpha_0 + \alpha_1 \times Loan\ to\ Deposits_{i,t-1} \\ & + \alpha_2 \times Securities\ Issued_{i,t-1} + \alpha_3 \times Deposits_{i,t-1} \\ & + \alpha_4 \times Capital_{i,t-1} + \alpha_5 \times ROA_{i,t-1} \\ & + \alpha_6 \times Yield\ Spread_{i,t-1} + \alpha_7 \times Loan\ Loss\ Provisions_{i,t-1} \\ & + \alpha_8 \times Size_{i,t-1} + \alpha_9 \times GDP_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where the dependent variable Sovereign Bonds captures sovereign bond holdings by bank i in year t, calculated by sovereign bond items divided by total assets on the balance sheets. The independent variables on the right-hand side of the equation are defined as follows. (1) LoantoDeposits is the ratio of loans to deposits, describing the percentage of deposits that banks use to make loans. (2) SecuritiesIssued is the ratio of total securities issued by each bank to total assets, reflecting the demand to refinance bank liabilities. (3) Deposits is the ratio of customer deposits to total assets, which is the most important and typical component of bank funding. (4) Capital represents the capital adequacy ratio, denoting the compliance with regulatory requirements. (5) ROA is computed by the ratio of net return to total average assets, a proxy for the overall bank profitability. (6) YieldSpread is the difference between the net interest margin (of interest-earning assets) and the yield rate of securities; in other words, this variable assesses the comparative advantage between lending activities and securities investment. (7) LoanLossProvisions measures bank credit quality, calculated by the rate of loan loss provisions divided by total gross loans. (8) Size is a proxy for bank size, computed by the natural logarithm of total assets. (9) GDP is the annual growth rate of gross domestic product (GDP), allowing for the business cycle of the economy. This factor controls

the external macroeconomic environment outside the banks, which might shape bank investment choices.

To obtain better estimation results, we employ independent variables with one-period lags. This specification reflects the latency of earlier decisions to bank output and mitigates the potential endogeneity problem as well. Furthermore, to increase the reliability of our study, we proactively address the endogeneity by applying the generalized method of moments (GMM) after adding a lagged dependent variable to the right-hand side of equation 1, which also motivates the dynamic nature of our panel. The first version of GMM in the dynamic panel is applied by differencing all regressors, called the difference GMM, and using the lagged levels of the regressors as the instruments (Arellano & Bond, 1991). The second version of GMM developed later employs two equations of the original equation in levels along with the transformed one in first differences and allows for the introduction of more instruments, known as the system GMM, thus could dramatically enhance the efficiency of estimates (Arellano & Bover, 1995; Blundell & Bond, 1998). Therefore, we choose the system GMM estimator to gain better results. Besides, we further use the two-step and standard error correction procedures following Windmeijer (2005) to curtail the downward bias in the system GMM estimator. We then perform the Hansen test of over-identifying restrictions to identify the validity of instruments and the Arellano-Bond test to detect the second-order autocorrelation in disturbances. Passing these tests ensures the reliability of our estimation results.

Based on the theoretical framework and findings from related empirical literature, we have expectations about the sign of regression coefficients in Model 1 specification. Regarding the group of proxies for the liquidity reserves motive, we expect the regression coefficient of LoantoDeposits to be negative. If banks utilize fewer deposits to make loans, they should invest the remaining funds in more government bonds. This mechanism itself is motivated if banks mobilize more deposits, which leads to an expected positive sign of the Deposits's coefficient. In stressed times of bank funding via the traditional deposit channel or equity capital, banks could issue securities to refinance liabilities. These new funding sources may be used to buy sovereign securities as liquidity reserves for future investments or to redeem maturing bonds. So, we expect SecuritiesIssued to have a positive effect on sovereign bond holdings.

Two variables of ROA and YieldSpread represent the profitability motive when banks approach the government bond channel. Less profitable banks tend to have greater incentives to purchase more high-yielding sovereign bonds to improve their earnings. Also, larger comparative advantages of sovereign bonds compared with lending segments will encourage banks to hold sovereign bonds. Thus, the expected signs of regression coefficients on these two profitability measures are negative. The LoanLossProvisions variable is employed to investigate the influence of credit quality. We expect it to be positively related to bank holdings of sovereign bonds, i.e., banks with higher credit risk are more likely to purchase more sovereign bonds due to lending aversion.

The Capital indicates compliance with capital adequacy regulations, which assign the zero risk-weight for government bonds. We expect a negative effect from bank capitalization if banks choose to enhance capital adequacy ratios by using government bonds to substitute loans as a way to reduce risk-weighted assets. The "regulatory hypothesis" might hold in this case. The Size and GDP variables are modeled as standard control factors. In the context of the Vietnamese banking market, large banks always dominate the credit segment, while small banks still struggle with this activity (Dang, 2019a, 2019b). This suggests that small banks are more likely to have more unused funding to invest in government bonds. Finally, during the economic upturns, banks tend to boost credit activities to amplify the business cycle (Bertay et al., 2015; Davydov et al., 2018; Zins & Weill, 2018). As a result, it might be evident that government bonds are no longer preferred. We thus expect the countercyclicality of sovereign bond holdings from banks.

3.2. Model 2 specification

With Model 2 specification, we analyze the holdings of sovereign bonds to understand how it affects bank output. To this end, we first build up the Lending variable, measured by the rate of annual loan growth, to capture the expansion behavior of bank lending. This is the most traditional and straightforward measure widely applied in works related to bank lending behavior (see Roulet, 2018 for a review). Besides, there have been a limited but growing number of recent studies exploring bank liquidity creation as a core function of financial intermediaries. Following the general mechanism that banks create liquidity when transforming liquid liabilities into illiquid assets and destroy liquidity when transforming illiquid liabilities or equity into liquid assets, Berger and Bouwman (2009) suggest a novel procedure to calculate bank liquidity creation. Many researchers have extensively considered this academic and quantitative measure as a broader concept of bank lending (Berger & Bouwman, 2009; Berger & Sedunov, 2017; Davydov et al., 2018). It is commonly acknowledged that bank liquidity creation favors economic growth (Berger & Sedunov, 2017; Fidrmuc et al., 2015). Accordingly, motivated by these ideas, we approach the following formula to calculate the liquidity creation of banks as a further check for bank output:

$$\begin{aligned}\text{Liquidity Creation } &= 0.5 \times (\text{Illiquid assets } + \text{ Liquid liabilities}) \\ &\quad - 0.5 \times (\text{Liquid assets} + \text{Illiquid liabilities and equity})\end{aligned} \tag{2}$$

For more explanation of the concept and the detailed breakdowns of items in equation 2, see Berger and Bouwman (2009). After calculating the value of liquidity creation, we complete the construction of the LCgrowth variable by the annual growth rate of liquidity creation.

The newly created variables are incorporated into Model 2 specification to examine the impact of government bond holdings on bank lending behavior as follows:

$$\text{BankOutput}_{i,t} = \alpha_0 + \alpha_1 \times \text{SovereignBonds}_{i,t-1} + \alpha_2 \times \text{Control}_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

where BankOutput is proxied by Lending and LCgrowth, separately; Control is a vector of control variables, including deposits, bank capital, credit quality, bank size and economic cycle based on the previous literature (e.g., Dang, 2020; Gambacorta & Mistrulli, 2004; Kim & Sohn, 2017; Vo, 2018). The definitions of these variables and the explanatory variable SovereignBonds of primary interest are similar to subsection 3.1. Regression procedures with static and dynamic panels remain unchanged.

Theoretically, for the structure of the asset portfolio of banks, government bonds and loans could be seen as two substitute channels. However, an alternative view could claim that holdings of sovereign bonds do not necessarily induce negative impacts on bank lending. Banks hold sovereign bonds for precautionary purposes, and they could liquidate those securities at short notice to reinvest if necessary. In sum, the sign of the sovereign bonds variable in the functions of bank lending and liquidity creation is ambiguous.

Regarding the role of bank capital, holding a more substantial capital buffer enhances the risk-bearing capacity and encourages banks to produce more loans (Coval & Thakor, 2005). For asset quality, a bank with high credit risk might focus on reinforcing risk supervision rather than granting expanded loans (Altunbas et al., 2010). Next, attracting more deposits creates banks' incentives to invest in the lending channel (V. Acharya & Naqvi, 2012). Besides, bank size and economic cycle also perform a significant impact on bank lending as discussed previously: large banks tend to dominate the lending segment, and during the economic upturns, banks may improve their lending activities.

3.3. Data

The study requires detailed data to measure various bank-level characteristics specified in the regression models. So, we manually extract data from the annual financial reports of Vietnamese commercial banks. These reports are published at banks' websites during the research period from 2007 to 2018. Although the Bankscope database is commonly used for banking studies, it cannot provide the required breakdowns in the case of Vietnam. We also confront the issue of missing data because some banks do not report observations covering all variables. As a result, our sample selection criteria lead to an unbalanced panel with a total of 349 observations from 30 banks, accounting for almost 90% of the banking system in Vietnam in terms of total assets. We then winsorize the variables at 2.5% and 97.5% to rule out the impacts of extreme outliers. Besides, the macroeconomic data are obtained from the World Development Indicator.

Table 1 presents the descriptive statistics of all variables used in the study. Looking at these statistics, we have some remarks as follows. With an average value of 8.66%, lower than the mean of 9.06% for non-default countries according to Gennaioli et al. (2018), we note that Vietnamese banks hold a relatively moderate proportion of government bonds in the asset portfolio even though they have been major investors in this market for many years. The average deposit-to-asset ratio is 61.44%, of which banks use up to 90.02% to lend to the economy on average. Meanwhile, funding from securities issued only accounts for 4.14% of total assets on average. Banks' average performance indicators are displayed by the capital adequacy ratio of 13.73%, return on assets of 0.81%, yield spread of 2.26%, and loan loss provision rate of 1.25%. The period under study also reveals that bank lending activities have expanded strongly illustrated by the loan growth rate of 26.79%, which potentially contributed to the economic growth of 6.17%, on average. In general, the data also indicate that banks in the system possess heterogeneous business outcomes and financial structures, displayed by the relatively large gaps between percentiles of variables.

Table 1. Summary statistics

Variables	Obs.	SD	Mean	10^{th}	25^{th}	Median	75^{th}	90^{th}
Sovereign Bonds	349	4.95	8.66	2.52	4.70	8.30	11.28	16.22
Loan to Deposits	349	20.82	90.02	63.70	75.89	86.75	101.37	115.30
Securities Issued	349	4.65	4.14	0.00	0.01	2.56	6.54	12.45
Deposits	349	13.36	61.44	40.48	53.07	63.24	71.03	78.48
Capital	349	4.70	13.73	9.32	10.33	12.50	15.55	20.10
ROA	349	0.55	0.81	0.10	0.38	0.73	1.20	1.65
Yield Spread	349	2.11	2.26	−0.81	1.11	2.22	3.36	5.21
Loan Loss Provisions	349	0.54	1.25	0.66	0.89	1.12	1.52	2.18
Size	349	1.20	31.91	30.30	30.88	31.94	32.80	33.62
GDP	349	0.62	6.17	5.39	5.42	6.21	6.67	7.07
Lending	319	23.89	26.79	2.51	12.11	19.91	34.65	65.16
LC growth	319	0.43	0.27	−0.22	0.04	0.17	0.38	0.92

The table shows the summary statistics of all variables. They are expressed in percentage (except for *Size* variable). *Sovereign Bonds* is the sovereign bond holding, calculated as sovereign bonds divided by total assets. *Loan to Deposits* is the ratio of loans to deposits. *Securities Issued* is the rate of total securities issued by each bank over total assets. *Deposits* is the ratio of customer deposits to total assets. *Capital* is proxied by the capital adequacy ratio. *ROA* is computed by the ratio of net return to total average assets. *Yield Spread* is the difference between the net interest margin (of interest-earning assets) and the yield rate of securities. *Loan Loss Provisions* is the proxy for bank credit quality measured by the rate of loan loss provisions divided by total gross loans. *Size* is the proxy for bank size, measured by the natural logarithm of total assets. *GDP* is the annual GDP growth rate. *Lending* is the rate of annual loan growth. *LC growth* is the annual growth rate of the liquidity creation measure developed by Berger and Bouwman (2009).

Source: Authors' calculation

Table 2. Correlation coefficients matrix

Variables	Sovereign Bonds	Loan to Deposits	Securities Issued	Deposits	Capital	ROA	Yield Spread	Loan Loss Provisions	Size	GDP	Lending	LC growth
Sovereign Bonds	1											
Loan to Deposits	−0.39	1										
Securities Issued	−0.36	0.24	1									
Deposits	0.36	−0.41	−0.62	1								
Capital	0.10	−0.05	−0.13	−0.04	1							
ROA	−0.07	0.27	0.27	−0.30	−0.01	1						
Yield Spread	0.07	0.18	0.07	−0.04	0.17	0.48	1					
Loan Loss Provisions	0.31	−0.16	−0.16	0.06	−0.14	0.02	0.04	1				
Size	0.16	0.04	−0.01	0.20	−0.52	0.02	−0.08	0.29	1			
GDP	0.03	0.07	−0.07	0.21	−0.08	−0.15	−0.08	−0.19	0.22	1		
Lending	−0.14	−0.07	0.20	−0.24	−0.01	0.06	−0.21	−0.05	−0.07	−0.13	1	
LC growth	−0.19	−0.07	0.12	−0.05	−0.09	−0.03	−0.02	−0.01	−0.02	−0.20	0.45	1

Source: Authors' calculation

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Table 2 presents the correlation coefficients matrix between each pair of variables. Looking at the correlation coefficients ranging from—0.62 to 0.48, we gain evidence that no severe multi-collinearity exists in the specifications.[2] Moreover, these coefficients also provide some preliminary results on the impact directions surveyed, somewhat in accordance with our initial prediction. To reliably validate these results, we now turn to the section of regression results.

4. Results

This section reports the regression results. Subsection 4.1 deals with the determinants of sovereign bond holdings. Subsection 4.2 analyses the effect of sovereign bond holdings on bank lending, in particular via the measures of loan growth and bank liquidity creation.

4.1. The bank-specific determinants of sovereign bond holdings

We report the analysis results of factors driving government bond holdings in Table 3 and Table 4, which are respectively estimated by the static and dynamic panel models. We conduct the Hausman (1978) test to determine whether bank-level effects could be captured in the fixed effects model (FEM) or the random effects model (REM). The unreported test cannot reject the null hypothesis, confirming that the REM assumption is our preferred approach. For the system GMM estimator, the results all pass the tests of Hansen for over-identifying restrictions and Arellano-Bond for the second-order autocorrelation. Our columns report different specifications obtained by changing the combination of regressors and dropping less significant ones. Multiple results consistent with initial predictions have appeared, besides some that are not statistically significant or contrary to our expectations.

Table 3. Estimation results for the determinants of sovereign bond holdings in static models

Regressor	(1)	(2)	(3)	(4)
Loan to Deposits	−0.068*** (0.017)	−0.066*** (0.017)	−0.065*** (0.017)	−0.064*** (0.017)
Securities Issued	−0.105 (0.070)	−0.107 (0.070)	−0.105 (0.070)	−0.111 (0.071)
Deposits	0.056* (0.034)	0.057* (0.034)	0.058* (0.034)	0.062* (0.034)
Capital	0.197** (0.091)	0.190** (0.090)	0.194** (0.089)	
ROA	−1.037* (0.560)	−1.028* (0.559)	−0.998* (0.557)	−0.695 (0.544)
Yield Spread	0.103 (0.125)	0.098 (0.124)		
Loan Loss Provisions	2.304*** (0.632)	2.205*** (0.604)	2.304*** (0.591)	2.393*** (0.595)
Size	0.909** (0.450)	0.936** (0.449)	0.954** (0.448)	0.429 (0.380)
GDP	0.207 (0.406)			
Observations	319	319	319	319
R-square	0.368	0.368	0.367	0.350
F-test (p-value)	0.000	0.000	0.000	0.000

The table reports the estimation results for determinants of sovereign bond holdings, using the generalized least squares (GLS) method in the static panel REM. The dependent variable is *Sovereign Bonds*, calculated by the ratio of sovereign bonds over total assets. Other explanatory variables are defined in Table 1. Standard errors are in parentheses. ***, ** and * correspond to the 1%, 5% and 10% significance level, respectively.

Source: Authors' calculation

Table 4. Estimation results for the determinants of sovereign bonds holding in dynamic models

Regressor	(1)	(2)	(3)	(4)
Lagged dependent variable	0.349*** (0.062)	0.335*** (0.054)	0.379*** (0.040)	0.336*** (0.062)
Loan to Deposits	−0.039*** (0.011)	−0.036*** (0.010)	−0.035*** (0.009)	−0.046*** (0.014)
Securities Issued	0.029 (0.030)	0.013 (0.032)	0.046** (0.020)	0.032 (0.028)
Deposits	0.060*** (0.015)	0.052*** (0.014)	0.069*** (0.014)	0.068*** (0.016)
Capital	0.073 (0.171)	−0.001 (0.140)	−0.039 (0.142)	
ROA	−1.226*** (0.225)	−1.157*** (0.223)	−0.902*** (0.278)	−0.927*** (0.301)
Yield Spread	−0.022 (0.068)	−0.021 (0.064)		
Loan Loss Provisions	2.415*** (0.848)	1.999*** (0.549)	1.649*** (0.282)	1.507*** (0.512)
Size	0.196 (0.835)	−0.003 (0.628)	−0.252 (0.631)	−0.438 (0.438)
GDP	0.113 (0.153)			
Observations	319	319	319	319
First-order autocorrelation (p-value)	−3.22 (0.001)	−3.24 (0.001)	−3.19 (0.001)	−3.00 (0.003)
Second-order autocorrelation (p-value)	0.36 (0.718)	0.22 (0.828)	0.15 (0.882)	−0.05 (0.964)
Over-identifying restrictions test (p-value)	15.48 (0.691)	15.08 (0.718)	20.58 (0.360)	22.28 (0.271)

The table reports the estimation results for determinants of sovereign bonds holding, using the two-step system GMM regressor in the dynamic panel model. The dependent variable is *Sovereign Bonds*, calculated by the ratio of sovereign bonds over total assets. Other explanatory variables are defined in Table 1. Standard errors are in parentheses. *** and ** correspond to the 1% and 5% significance level, respectively.

Source: Authors' calculation

First, the ratio of loans to deposits enters with negative and significant coefficients at the significance level of 1% in all columns in Table 3 and Table 4. Banks using less funding from deposits to make loans tend to buy more sovereign bonds. This finding supports the notion that the more the availability of the funding from deposits is, the more banks invest in sovereign bonds. Such a notion is also favored by the evidence of the positive regression coefficients of the Deposits variable, which have a higher level of significance in the dynamic model rather than the static one. Our findings are valid in terms of economic significance. For instance, based on column 1 of Table 3, we infer that a decrease of one standard deviation in LoantoDeposits (20.82 percentage points) contributes to an increase in SovereignBonds by 1.42 percentage points given its mean value is 8.66%. Taking column 1 of Table 4, we deduce that a rise of one standard deviation in Deposits (13.36 percentage points) leads to an increase in SovereignBonds by 0.80 percentage points. Hence, these findings confirm the motive of liquidity reserves, in line with the recent work of Affinito et al. (in press) for the Italian banking market.

Besides, our estimation results also verify other expectations related to the motive of improving overall profitability and credit quality. More precisely, banks with worse performance tend to hold more sovereign bonds, as indicated by the significant negative coefficient of the

ROA variable and the significant positive coefficient of the LoanLossProvisions variable. Banks may buy sovereign bonds to improve profitability, notably when their earnings have declined further (Battistini et al., 2014). Besides, a deteriorated credit portfolio makes banks more cautious with their investments, especially discouraging them from granting new loans and originating the holdings of risk-free bonds instead (Lamas & Mencia, 2018). These performance factors likewise induce economically significant impacts. For example, using column 2 of Table 4, we realize that a decrease of one standard deviation in ROA (0.55 percentage points) contributes to an increase in SovereignBonds by 0.64 percentage points; while referring to column 2 of Table 4, we note that an increase of one standard deviation in LoanLossProvisions (0.54 percentage points) is responsible for an increase in SovereignBonds by 1.08 percentage points.

With regard to the remaining variables, its estimation results do not concur with our expectations. The clearest cases belong to variables with no statistical significance, including YieldSpread and GDP. For the SecuritiesIssued variable, its regression coefficients are only statistically significant in one out of six different specifications, so we do not have sufficient confidence to conclude that the issuance of securities by banks could positively affect the holdings of government bonds. The variable of capital adequacy ratio offers regression results contrary to our expectations, thus implying that well-capitalized banks tend to purchase more government bonds. However, the statistical significance of this link is only confirmed with the REM static model, while it vanishes when moving to the dynamic model with the GMM estimator. Overall, we at least have a reason to believe that banks do not hold government bonds to comply with capital adequacy regulations, in accordance with Lamas and Mencia (2018), who cannot confirm the "regulatory hypothesis" in their work. Our pattern seems to value the "moral hazard hypothesis" which posits that undercapitalized banks may behave more recklessly due to the presence of deposit insurance policies and the intervention of bank shareholders (Demirgüç-Kunt & Kane, 2002; Holmstrom & Tirole, 1997). Similarly, the estimation results of bank size do not confirm the view that smaller banks engage more aggressively in the sovereign bonds market than larger counterparts. Even so, a positive correlation between bank size and bondholdings as exhibited accords with the previous finding of Gennaioli et al. (2018).

In sum, our findings confirm that the motives of sovereign bond holdings could be attributed to the liquidity reserves, profitability improvement, and risk-shifting. At odds with our expectation, we find no evidence in favor that Vietnamese banks purchase government bonds to increase capital adequacy ratio while approaching capital standards under Basel II guidelines.

4.2. The effects of sovereign bond holdings on bank lending and liquidity creation

With our Model 2 specification, we examine the impact of sovereign bond holdings on bank lending. Table 5 presents the estimation results. The Hausman (1978) test in this case leads to the choice of the FEM specification (columns 2 and 4). Once again, the Hansen test indicates no evidence against the instruments' validity, and there is also no second-order serial correlation shown by the Arellano-Bond test, thus justifying the use of the system GMM estimator (columns 1 and 3).

Based on our earlier findings that banks' bondholdings derives from the motives of bank return, credit risk, and especially precautionary tool, we tend to believe in a potential mechanism that banks may decide to hold government debt using the available funding, on the harmony basis of risk-return trade-off. Hence, we conjecture that the purchases of sovereign bonds do not impede bank lending in Vietnam. Consistently, the estimation results show that the coefficients of the SovereignBonds (columns 1 and 2) are positive and statistically significant at 1% in regressions of the Lending dependent variable. The result establishes that holdings of sovereign bonds do not alleviate the expansion of credit portfolio but promote this segment instead. This could be related to favorable supports of the sovereign bond channel for banks in terms of liquidity reserves, which avoids the waste from unused funding and further helps allocate credit more effectively thanks to

Table 5. Estimates for the impact of sovereign bond holdings on bank lending

Regressor	(1) Lending—GMM	(2) Lending—FEM	(3) LC growth—GMM	(4) LC growth—FEM
Lagged dependent variable	0.253*** (0.069)		−0.052** (0.024)	
Sovereign Bonds	0.753*** (0.160)	0.796*** (0.361)	0.007 (0.004)	0.010 (0.009)
Deposits	−0.216** (0.102)	0.075 (0.144)	−0.017*** (0.001)	−0.015*** (0.004)
Capital	−0.704 (0.941)	−0.341 (0.533)	−0.002 (0.012)	−0.016 (0.014)
Loan Loss Provisions	1.358 (4.888)	−6.849* (3.676)	0.001 (0.056)	0.077 (0.089)
Size	−8.825* (5.081)	−16.511*** (2.930)	0.005 (0.075)	−0.112 (0.069)
GDP	−3.682** (1.771)	−7.181*** (2.321)	0.041 (0.026)	−0.033 (0.055)
Observations	289	289	289	289
First-order autocorrelation (p-value)	−2.62 (0.009)		−2.73 (0.006)	
Second-order autocorrelation (p-value)	0.00 (0.998)		0.12 (0.901)	
Over-identifying restrictions test (p-value)	19.70 (0.290)		15.07 (0.591)	
R-square		0.282		0.145
F-test (p-value)		0.000		0.000

The table reports the estimation results for the impact of sovereign bond holdings on bank lending, using the two-step system GMM regressor in the dynamic panel model and the ordinary least squares (OLS) method in the static panel FEM. The dependent variables are *Lending* computed by the rate of annual loan growth, and *LC growth* calculated by the growth rate of liquidity creation measure proposed by Berger and Bouwman (2009). Other explanatory variables are defined in Table 1. The dependent variables, along with the regression methods, are shown at the top of each column. Standard errors are in parentheses. ***, ** and * correspond to the 1%, 5% and 10% significance level, respectively.

Source: Authors' calculation

the high liquidity of sovereign bonds. The empirical finding lends support to the theoretical model of Gennaioli et al. (2014) that banks may optimally choose to hold sovereign bonds to store liquidity to finance their investments in the future.

Moving on to the regression analysis in the function of the LCgrowth variable, we document that SovereignBonds does not have a statistically significant impact on bank liquidity creation. This finding indicates some differences compared to that obtained by the loan growth rate, given that liquidity creation is a broader concept than bank lending. Overall, according to the novel approach to the core function of financial intermediaries to create liquidity for the economy, our work does not confirm that more investments in government bonds damage bank core output. Our findings are robust to the change in estimation methods.

5. Conclusions

Commercial banks are the primary holders of sovereign bonds in Vietnam. However, regulators are concerned that the increased sovereign exposures are likely to adversely modify the credit function of banks and further the economic growth, thus restricting the purchases of government bonds by banks. The questions on motives of sovereign bond holdings and its impact on

bank credit remain open in the Vietnamese market. In the strands of literature on this topic, we notice a sizeable academic gap when existing studies do not fully understand the bank-level determinants of sovereign bond holdings and the impact of this investment channel on bank lending in emerging economies. Our research has attempted to fill this gap, and some expected results have appeared.

Using the data of commercial banks from 2007 to 2018 to capture the entire evolution of the sovereign bond market in Vietnam, we first find that the motive of liquidity reserves strongly drive banks' decision to hold sovereign debts. Specifically, banks that use fewer loanable funds to make loans or mobilize more deposits tend to purchase more government bonds. We then also gain evidence that banks increase the exposure to this risk-free investment channel to grow profitability and credit quality. The regression results show that banks with lower overall returns or higher levels of credit risk are more likely to invest in government bonds. These results are robust across alternative regression techniques for both dynamic and static models. Contrary to our expectation, the estimation results do not confirm the "regulatory hypothesis" which suggests that banks should raise the holdings of zero risk-weight government bonds to improve capital adequacy ratios. Precisely, the findings exhibit a positive association between capital adequacy ratio and bondholdings; this pattern is somewhat weak and sensitive to different estimators.

The remaining part of our study offers solid evidence to reject the notion that purchases of government bonds are detrimental to bank credit channels. Our estimation results display that sovereign bond holdings are positively correlated with subsequent lending expansion, while its link to bank liquidity creation is insignificant. So, investments in sovereign bonds might support bank lending activities as a result of an efficient cash flow management process for future reinvestment.

Our findings provide some insightful policy implications for Vietnam and other emerging countries with similar backgrounds. Given the result that holding sovereign bonds could support lending in the future, to make more informed decisions, policymakers should reconsider the present restrictions on this investment channel for banks. Given the finding on factors driving sovereign bond holdings, the government needs to carefully look into the motives of the banking system before designing the structure and the issuance plan of sovereign bonds appropriately.

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Notes
1. The data are obtained from the Vietnam Bond Market Association.
2. We further check the variance inflation factor (VIF), which also affirms this argument.

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