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SOVEREIGN BOND HOLDINGS UNDER BANK COMPETITION IN VIETNAM

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ABSTRACT

This article investigates the impact of bank competition on the holdings of sovereign bonds. Using bank-level data from Vietnam for 2007–2021, I design various proxies to indicate bank competition and apply the system generalised method of moments (GMM) to conduct main regressions. I find that banks are more likely to hold domestic treasury securities in response to greater market competition. I add strength to my analysis by conducting subsample checks to allow for potential structural breaks due to the financial and COVID-19 pandemic crises. In addition, I find that sovereign debt holdings are less prominent when banks are more inclined to search for higher income during periods of intense competition. Meanwhile, the risk profile of the financial institution does not modify the potency of the market competition-bond holding association. These results suggest that banks would retain more sovereign debt under competitive pressure for strategic rather than precautionary motives.

Keywords: Bank competition, Precautionary motive, Search for yield, Sovereign bonds, Vietnam

INTRODUCTION

Financial institutions frequently acquire substantial quantities of government debt, especially the bonds of their sovereigns. Why do banks purchase sovereign bonds? Most standard theories for justifications are centred around the idea that

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sovereign debt issued by governments has zero-risk weight; hence, banks would favour domestic treasury securities to conform to capital regulations more simply. Other advantages of sovereign bonds include their greater liquidity and safety compared to private sector credit, as well as their utility as collateral in interbank markets (Bolton & Jeanne, 2011; Gennaioli et al., 2014). However, investing heavily in government bonds has several disadvantages for banks. Funds allocated to government bonds are not available for potentially higher-yielding investments, such as loans to businesses and individuals, which can limit the bank's profitability and restrict economic expansion. Heavy reliance on government bonds can also expose banks to concentration risk, where adverse changes in government policies or fiscal health can negatively impact their financial stability (Chronopoulos et al., 2020). Several recent studies empirically test the determinants of sovereign bond holdings by looking at macroeconomic and bank-level data (Acharya et al., 2014; Affinito et al., 2022; Becker & Ivashina, 2018; Chronopoulos et al., 2020; Manna & Nobili, 2023).

This study complements the existing research stream by focusing on market competition when explaining the practice of banks buying government bonds. Competition is a crucial element affecting bank behaviour in light of the fact that financial innovation and deregulatory policies have made the global banking market more competitive. Competitive banks are more likely to extend credit, which can stimulate economic growth (Beck et al., 2004). Competition prevents any single bank from dominating the market, reducing the risk of monopolistic practices that could harm consumers and the economy. Nevertheless, under the pressure of competition, banks may engage in riskier lending practices to maintain or grow their market share, which can lead banks to lower their credit standards, extending loans to less creditworthy borrowers and increasing the likelihood of loan defaults (Berger et al., 2009). Findings from competition studies inform policymakers and regulators in crafting policies that promote a resilient banking sector. Against this backdrop, a substantial body of empirical research has examined the level of bank competition and attempted to clarify how it influences bank health and wealth. Present studies show that banking competition has a significant influence on financial stability (Nyangu et al., 2022), operational efficiency (El Moussawi & Mansour, 2022), and risk profiles (Khan & Ahmad, 2022). However, limited work has explored the relationship between bank competition and the holding of government bonds. This article intends to contribute to this underexplored area.

Bank competition influences sovereign bond investment through several mechanisms. On the one hand, high competition incentivises banks to utilise liquid assets for financing future projects, which helps banks avoid wasting financial resources and manage opportunity costs associated with holding cash

(Carletti et al., 2007). Additionally, increased competition can also exacerbate bank vulnerability, prompting institutions to maintain substantial government bond holdings as a safeguard against risks such as insolvency and bank runs (Holmstrom & Tirole, 1997). On the other hand, in concentrated markets with less competition, banks might prioritise safe investments, including sovereign bonds, to secure stable earnings (Ali et al., 2022). Thus, the relationship between bank competition and sovereign bond holdings is theoretically complex, with competition potentially increasing or decreasing these investments based on various strategic considerations and market dynamics. Given the importance of banks holding government bonds and the significant impact of bank competition, empirically studying this relationship is crucial. It provides valuable insights for regulators, policymakers and stakeholders, enabling them to design better frameworks that regulate competition while safeguarding the stability and resilience of the banking sector and the broader economy.

To provide a comprehensive picture of one additional dimension that drives banks' sovereign bond holdings, this study uses many different measures to assess the level of competition in the banking market. Despite being established for a long time, the literature on banking market structure has still exhibited no consensus on the best measure to capture competition. Motivated by this stylised fact and also to avoid dependence on a single metric of competitiveness that may provide misinformation (Khan et al., 2016), in this article, I consider a combination of five different approaches to capture bank competition, including the leading-bank concentration index, the Herfindahl-Hirschman index (HHI), the Lerner metric, the Boone index, and the H-statistic indicator. This measurement strategy is helpful to ensure the overall consistency of findings on the relationships under analysis. I choose to perform such analysis via a sample of commercial banks in Vietnam between 2007 and 2021. Moreover, I further examine the conditionality for the market competition-safe bond nexus, which may offer insight into the process that explains why banks opt to hold more sovereign bonds under competition. Specifically, I run many tests to determine the possible functions performed by the "search for yield" motivation and the conservative actions of financial institutions.

I should also explain why Vietnam has been chosen as the study sample. Vietnam's banking industry has been the primary source of capital for many areas of the economy. With the importance of commercial banks in Vietnam, any excessive accumulation of liquid assets might have a more adverse influence on economic growth (due to less loan availability) compared to less bank-dependent economies. Vietnam entered the World Trade Organisation (WTO) in 2007, and as a result, this country's banking sector has undergone significant changes. Encouragement of foreign penetration has led to dramatic transformations in the

makeup of the banking sector, with state-owned institutions losing their leading positions (Huynh & Dang, 2022). Numerous small private counterparts with less competitiveness have faced intense competition from both domestic and overseas rivals. In sum, I could notice a substantial shift in the banking market structure over time. Additionally, the Vietnamese government has released a large number of treasury securities to help fund the national budget and meet the country's capital management requirements in recent decades. This government bond market has lured both local and international participants. Prior to 2018, commercial banks maintained a substantial share of government bonds, representing 70%–80% of the entire market (Dang & Huynh, 2020). However, from 2018 to 2022, the proportion of government bond holdings by banks steadily declined, comprising only approximately 50% of the total government bonds issued (Please see in full detail: https://asianbondsonline.adb.org/vietnam/market_summary/vn_market_summary_202211.pdf). This trend offers a comprehensive depiction of the evolving investment patterns in government bonds by commercial banks, thereby enhancing the relevance and reliability of my analysis.

This work links to the vast empirical literature on holdings of government bonds (Acharya et al., 2014; Affinito et al., 2022; Becker & Ivashina, 2018; Chronopoulos et al., 2020; Manna & Nobili, 2023). The most crucial difference is that no research has focused on bank competition as a significant determinant of government bond purchases. Hence, a key contribution of this study is to offer novel evidence on the linkage between competition in the banking system and holdings of sovereign bonds. Interestingly, distinct from most of the extant investigation that identifies competition, I measure this aspect of bank market structure using five different strategies, given that there has been no consensus on the best proxy in the literature thus far (Khan et al., 2016). Furthermore, it could be argued that using multiple measures is also vital to robustness checks, and in my case, I only gain confidence as my estimates yield consistent patterns as a result of different methods of measuring bank competition. Beyond exploring whether there is a response of sovereign bonds to the evolutions in bank competition, I examine how bank incentives affect this form of investment under competition. Extending my analysis to answer whether the association between competition and sovereign bond holdings is essentially attributable to the search-for-yield incentive or the precautionary motive, I collect some outcomes signifying that the former is valid while the latter is not. In other words, I notice a conditionality that market competition forces banks to modify their investment strategies to less profitable segments. This conclusion may shed some light on how competitiveness is translated into bank investment behaviour.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

There are several theoretical routes through which competition may influence government bond holdings. One of the most critical processes is that the prospect of high competition raises the incentives for banks to employ liquid assets to finance future projects (Moritzen & Schandlbauer, 2020). In other words, when facing difficulties in the traditional credit business under competition pressure, a bank can take advantage of suitable profit opportunities to avoid wasting financial resources and allow for opportunity costs from purely holding cash (Carletti et al., 2007). As a result, when the degree of competition grows, banks move their focus from core lending divisions to sovereign bond investments. Banks hold liquid bonds to finance investments and hedge against illiquidity if securing funding takes longer. In this regard, market competition makes sovereign bond holdings valuable for future investments.

In line with the fragility assumption, increased competition exacerbates bank vulnerability by diminishing the capacity of capital to function as a shock-absorbing cushion (Petersen & Rajan, 1995). Banks could also encounter many risks in a competitive marketplace, such as insolvency, liquidity and even bankruptcy risks. Thereby, institutions operating in a competitive market maintain extensive holdings of government bonds, which protect against potential bank runs (Holmstrom & Tirole, 1997).

Based on the above arguments, a hypothesis is developed as follows:

H1: High competition increases the holding of government bonds by banks.

In complete contradiction to the relationship shown above, banks with improved competitiveness in concentrated markets are able to establish prices beyond marginal costs and intentionally generate sound earnings. This approach does not motivate bank managers to work harder or pursue riskier ideas (Ali et al., 2022). Thus, they are more concerned with safe goals, such as preserving safe bonds. Furthermore, according to the pricing assumption, increased competition may modify pricing strategies in the banking sector, where banks typically reduce loan rates (Beck et al., 2004). Consequently, this pricing channel boosts the amount of loans banks offer to the economy, leading to a decline in the holdings of government bonds. Under these arguments, the literature suggests that market competition leads to a reduction in sovereign bond holdings. Thus, I can develop the competing hypothesis as follows:

H2: High competition decreases the holding of government bonds by banks.

Although the current topic has been intensively debated with contradictory theoretical explanations, empirical research focusing on the connection between bank competitiveness and government bond holdings is absent. Regarding the linked body of research, some studies examine certain predictors of sovereign bond holdings but fail to emphasise the impact of market competition (Acharya et al., 2014; Affinito et al., 2022; Becker & Ivashina, 2018; Manna & Nobili, 2023). Only the research conducted by Chronopoulos et al. (2020) incorporates banking market structure in their econometric models, but solely as a control variable.

DATA AND METHODOLOGY

Competition Measurement

In this work, I apply a variety of structural and non-structural metrics to represent bank competition. Existing studies have used different indicators to evaluate the structure of the banking market, but these indicators do not represent bank competition consistently. For structural measurements, I create the Cr3 indicator defined by the aggregate assets of the top three banks in the industry. In a similar manner, I undertake sensitivity assessments on the five largest banks (Cr5). Besides, the HHI index is computed by adding the banks' squared asset market shares. Overall, greater Cr3/Cr5 and HHI values indicate more concentration and less competition in the banking market.

First among the non-structural metrics is the Lerner index, which also estimates banks' market power. A rise in this bank-level index indicates increased market dominance of banks or less competitive pressures of the market. In accordance with prior research (Berger et al., 2009). I construct the Lerner index for each bank-year observation as follows:

$$Lerner_{it} = \frac{OP_{it} - MC_{it}}{OP_{it}} \tag{1}$$

where OP_{it} represents the output price, which is derived by dividing total revenues by total assets, MC_{it} represents the marginal cost, which is estimated using the formula given as follows:

$$\ln TC_{it} = \beta_0 + \beta_1 \ln TA_{it} + \frac{\beta_2}{2} \ln TA_{it}^2 + \sum_{k=1}^{3} \gamma_{it} \ln IC_{k,it} + \sum_{k=1}^{3} \delta_{it} \ln TA_{it} \ln IC_{k,it} + \sum_{k=1}^{3} \sum_{j=1}^{3} \ln IC_{k,it} \ln IC_{j,it} + \varepsilon_{i,t} \quad (2)$$

In particular, TC_{it} and TA_{it} show total expenses and total assets, respectively. The input component IC consists of the costs of labour, resources and capital. Based on the coefficients acquired from the translog cost function, marginal costs can ultimately be computed using the following procedure:

$$MC_{it} = \frac{TC_{it}}{TA_{it}} \left[\beta_1 + \beta_2 \ln TA_{it} + \sum_{k=1}^{3} \delta_k \ln IC_{k,it} \right] \quad (3)$$

Next, the Boone indicator is another non-structural method that could emphasise the dynamic nature of bank competitiveness (Boone, 2008). This indication may be characterised as follows:

$$\pi_i = \alpha + \beta \ln(mc_i) \quad (4)$$

where π_i reflects the earnings bank i and mc_i denotes its marginal costs. I would pay close attention to the coefficient β that expresses the target Boone factor. Specifically, this coefficient's estimated absolute value indicates the level of market competition. Since it is theoretically anticipated that the coefficient of marginal costs would be negative, a rise in the coefficient suggests less intense banking competition. Inspired by Schaeck and Cihák (2014), I prioritise the system generalised method of moments (GMM) estimator for the Boone regression model.

The last measure of competition of interest is the H-statistic indicator, calculated by adding the elasticities of diminished revenue functions in conjunction with input price variables. Greater H-statistic indicators indicate an increase in competition. From an empirical standpoint (Claessens & Laeven, 2004), the H-statistic indicator is specified by the profit-maximising pattern formula as follows:

$$\ln GII_{it} = \alpha_0 + \alpha_1 \ln IC_{1,it} + \alpha_2 \ln IC_{2,it} + \alpha_3 \ln IC_{3,it} + \beta_1 \ln B_{1,it} + \beta_2 \ln B_{2,it} + \beta_3 \ln B_{3,it} + \delta T + \varepsilon_{i,t} \quad (5)$$

The regressors of the gross interest income function include input components ($IC_{1,it}$, $IC_{2,it}$ and $IC_{3,it}$), bank-level variables as controls (bank capitalisation, the size of loan portfolios and total assets), and a year dummy factor that affects the overall banking industry. In agreement with Claessens and Laeven (2004), I regress the

Panzar-Rosse model by applying the pooled ordinary least squares (OLS) method. The H-statistic index from the Panzar-Rosse framework is then calculated by summing the coefficients of three input price variables, with a greater value indicating a higher degree of competition. Crucially, the H-statistic estimation holds valid if the banking sector is in a condition of long-term equilibrium, which is guaranteed based on the present explicit instructions of Guidi (2021).

Model

To understand whether banking market structure has an impact on the incentives to increase purchasing government securities, I proceed with the following panel regression:

$$Sov_{i,t} = \alpha_0 + \alpha_1 \times Sov_{i,t-1} + \alpha_2 \times Com_{i,t-1} + \alpha_3 \times BF_{i,t-1} + \alpha_4 \times CF_{t-1} + u_i + \varepsilon_{i,t} \quad (6)$$

The dependent variable $Sov_{i,t}$ is the fraction of government bonds in total assets of bank i at year t. $Com_{i,t-1}$ indicates bank competition. The variable $Sov_{i,t}$ is additionally regressed on bank-level variables $BF_{i,t-1}$ and country-level factors CF_{t-1}. I analyse the explanatory variables with a lag to more accurately estimate the influence of banks' financial situations and macro shocks. This model incorporates bank-fixed effects u_i to compensate for unobserved heterogeneity. $\varepsilon_{i,t}$ is an idiosyncratic error term.

Similar to previous research (Affinito et al., 2022; Chronopoulos et al., 2020; Gennaioli et al., 2018), I examine whether the holdings of domestic treasury securities result from bank-specific characteristics. I examine the "meeting regulatory capital adequacy" argument using the equity ratio, given that banks employ sovereign debt to substitute loans and thus reduce risk-weighted investments and increase capital levels. The log of total assets serves to adjust for the influence of bank size on domestic sovereign bond proportion. I utilise the loan-to-deposit ratio to illustrate the significance of liquidity risk to the bank's activities. I also account for credit risk since a worsening loan portfolio reduces credit providers' earnings and makes credit less attractive. In addition, deposit costs may represent the impact of financing on the choice to acquire sovereign bonds, i.e., the cheaper this form of finance is, the more public debt instruments banks should hold. In addition, I control for monetary policy and macroeconomic shocks to capture country-specific events that may affect the allocation of sovereign portfolios. The list and specific description of control variables are presented in Table 1.

Holdings of sovereign bonds tend to persist over time due to a bank's choice to categorise them as held-to-maturity or available-for-sale assets (Chronopoulos et al., 2020). To allow for this possibility, I include a lagged dependent variable as a regressor to generate a dynamic model specification. With this nature of my model, the two-step system GMM is employed using the xtabond2 command in STATA (Roodman, 2009) with the option of correcting standard errors for a small panel (Windmeijer, 2005). I also ensure that the number of instruments cannot exceed the number of groups to avoid the adverse consequence of too many instruments on the GMM outcomes (Roodman, 2009). The explanatory factors at the bank level are considered endogenous variables and thus instrumented using the "GMM-style" tools (i.e., using their lags). Under the "iv-style" setting of the xtabond2 command, banking market structure and macro factors are handled as exogenous variables.

Data

Vietnamese commercial banks' annual financial reports provide us with bank-level information. Owing to the data availability, I choose the period from 2007 to 2021 for this study. Due to differences in business constraints and strategies, the study does not consider banks subject to special control or compulsory acquisition by the State Bank of Vietnam (SBV). I exclude joint-venture banks and branches of foreign banks from my analysis, as they constitute a minor segment of the Vietnamese banking industry and do not meet my data standards for analysis. There were years when some banks published their financial reports without enough necessary information, thus causing the problem of missing data in my sample. I winsorise the bank-level variables at the 2.5th and 97.5th percentiles to reduce the effects of outliers on the research results. I obtain monetary data from the SBV database. Consequently, my sample comprises 30 commercial banks, which cannot contain all banking institutions in Vietnam but make up more than 95% of the banking industry assets in any given year, offering a reliable representative.

According to the descriptive data in Table 1, the average share of domestic government debt in total assets is 9.54%, less than that of the banking markets based on an international sample (Chronopoulos et al., 2020). Despite being major investors in this bond market, Vietnamese banks hold a moderate fraction of government securities in their investment portfolio. Next, multiple market structure variables provide a varied image of sector competition. These

early findings are consistent with my approach of not merely concentrating on one competition metric since each emphasises a distinct component of the banking industry composition. Furthermore, my comprehensive market data for Vietnam vary from those of the European banking institutions presented in recent research (Căpraru et al., 2020), while they show certain parallels with previous descriptions of emerging economies (Mateev et al., 2022).

Table 1
Summary statistics

Variable	Mean	SD	Min	Max	Definition
Sov	9.537	4.908	0.000	17.341	The ratio of total government bonds to total assets.
Lerner	0.349	0.089	0.195	0.518	The ratio of the gap between price and marginal cost to output price.
Cr5	0.586	0.052	0.539	0.713	The aggregate assets of the top five banks in the industry.
Cr3	0.422	0.044	0.376	0.530	The aggregate assets of the top three banks in the industry.
HHI	0.088	0.015	0.075	0.125	All banks' squared asset market shares.
Boone	–0.075	0.002	–0.081	–0.070	The elasticity of bank return over the marginal cost.
Hindex	0.575	0.085	0.472	0.745	The elasticities of the diminished revenue function in conjunction with input price variables.
Cap	9.696	4.293	4.859	20.470	Equity capital as a share of bank assets.
Size	32.144	1.262	29.961	34.486	The logarithm of bank assets.
Llp	0.959	0.672	0.122	2.516	Loan loss provisions as a proportion of gross customer loans.
Ltd	70.607	16.068	41.921	99.451	The percentage of loans to deposits.
Dep	6.363	2.546	3.289	12.629	The ratio of interest expenses to interest-bearing funds.
Rfr	7.513	2.734	4.000	15.000	Refinancing rates.
Crisis	0.189	0.392	0.000	1.000	Dummy variable with a value of 1 if the observation year falls between 2007 and 2009 and 0 otherwise.
Cov19	0.130	0.337	0.000	1.000	Dummy variable with a value of 1 if the observation year falls between 2020 and 2021 and 0 otherwise.

Additionally, I also calculate the pairwise correlations. Overall, the results from the correlation matrix (not reported for brevity) and the descriptive statistics suggest that my final database does not suffer from severe problems such as limited heterogeneity, large outliers, or serious multicollinearity. I also check the VIF values of variables, and these results further offer solid support for my proceeding to the next regression stage, as discussed. Due to limited space, I do not report the VIFs results, but the test is always available upon request. As a note, my model specification does not include the controls of inflation and economic growth since the former is highly correlated with monetary policy rates and the latter reports an extremely high correlation coefficient with the COVID-19 pandemic. Such high correlations are likely to cause a problem of serious multicollinearity.

EMPIRICAL RESULTS

Baseline Results

Before entering the main regression results in Table 2, I should first pay attention to the diagnostic tests needed to justify the use of the GMM estimator. All the tests, including Hansen and AR(1)/AR(2), offer favourable results that jointly validate the set of instruments used and indicate that my model exhibits the first-order but no second-order autocorrelation in idiosyncratic residuals. Besides, the lagged dependent variables are statistically significant in all regressions, thereby revealing the persistent sovereign bond holdings of banks. Hence, I gain strong evidence to support the dynamic GMM validity that could yield reliable economic findings.

Table 2
Bank competition and sovereign bond holdings: Baseline regressions

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Sov	0.467***	0.435***	0.443***	0.653***	0.444***	0.422***
	(0.067)	(0.068)	(0.067)	(0.048)	(0.059)	(0.066)
Cr5	–38.629***					
	(7.565)					
Cr3		–37.279***				
		(7.491)				
HHI			–119.497***			
			(25.658)			
Lerner				–20.803***		
				(5.596)		

(*Continued on next page*)

Table 2 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Boone					–40.604	
					(131.218)	
Hindex						12.879**
						(5.323)
Cap	0.329	0.475*	0.440	0.247**	0.085	0.266
	(0.287)	(0.283)	(0.285)	(0.099)	(0.356)	(0.353)
Size	–0.001	0.308	0.348	0.637	–0.752	0.518
	(0.749)	(0.759)	(0.780)	(0.539)	(0.953)	(1.015)
Llp	2.761***	3.059***	2.582**	0.975***	2.539***	2.358***
	(1.034)	(1.153)	(1.035)	(0.247)	(0.830)	(0.825)
Ltd	–0.176***	–0.208***	–0.204***	–0.061***	–0.224***	–0.249***
	(0.037)	(0.040)	(0.040)	(0.024)	(0.043)	(0.046)
Dep	-0.025	-0.002	0.059	–0.026	0.320	0.548
	(0.304)	(0.310)	(0.320)	(0.093)	(0.391)	(0.429)
Rfr	–0.237	–0.275	–0.275	–0.150	–0.436*	-0.057
	(0.192)	(0.202)	(0.204)	(0.095)	(0.255)	(0.292)
Crisis	4.234***	3.330***	3.774***	1.359**	0.108	1.093
	(1.273)	(1.113)	(1.230)	(0.688)	(0.757)	(0.672)
Cov19	–2.720***	–2.671***	–2.487***	–0.681	–1.504***	–0.696
	(0.594)	(0.563)	(0.584)	(0.584)	(0.561)	(0.496)
Observations	409	409	409	409	409	409
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.298	0.245	0.267	0.265	0.278	0.215
Hansen	0.459	0.483	0.437	0.518	0.350	0.207
Banks	30	30	30	30	30	30
Instruments	28	28	28	28	28	28

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

I regress purchasing sovereign securities on alternative measures of bank competition, along with a vector of bank-level controls and macro covariates. I document that the concentration of the banking market through three structural variables (Cr5, Cr3 and HHI) is negatively associated with sovereign bond investments, demonstrating a greater propensity for banks to acquire more government bonds under greater competition. Next, the statistically significant parameter estimation on the Lerner indicates that holdings of sovereign bonds change as the degree of bank market power moves. In more detail, via a negative

coefficient, pressure on banks to buy sovereign bonds appears more intense when competitive conditions become more pronounced, given that the Lerner variable is a reverse proxy for bank competition (similar to three structural variables).

Domestic sovereign bonds are found to be positively correlated with the H-index variable. In other words, banks in highly competitive countries tend to hold more sovereign securities. This result is consistent with the above observed competition-bond nexus, where a decline in government debt values can be attributed to more concentrated markets with banks having better pricing power. Finally, in contrast to results obtained for other competition proxies, the Boone index is not significantly associated with banks' claims on government in the specification under consideration. I interpret this pattern as evidence that different scales capture different aspects of competition, and I should not rely on a single indicator to draw conclusions.

Overall, government bond purchases are more prevalent in banks facing tremendous pressure from competition, supporting H1. Specifically, banks hold 1.85% more domestic sovereign debt when the market competition by the Lerner index increases by one standard deviation (the coefficient for Lerner is –20.803 and its standard deviation is 0.089), whereas the shift may jump to 2% when using the Cr5 indicator (the coefficient for Cr5 is –38.629 and its standard deviation is 0.052). This finding offers the first comprehensive evidence of the banking competition effect on sovereign bond holdings. It complements the previous research of Chronopoulos et al. (2020), which indicates that with simply the Boone indicator, home bias diminishes as market competition intensifies. While the Boone proxy fails to significantly explain holdings of sovereign securities in this case, I still have sufficient evidence for the increase in this form of investment amid higher competition by various approaches to capture financial market structure.

Robustness Checks

It has been well established that banks hold more government bonds when confronting several types of competition. As proposed by other researchers, I now expand my competition assessment by modifying the design of competitiveness metrics. I begin by modifying the concentration measures' framework by centering on the credit and deposit sections (to replace my asset category). Next, I favour the funding-adjusted Lerner approach by removing the funding cost parameter from the translog-cost formula (Turk Ariss, 2010). For the variation of the Boone scale, I generate an alternative attribute by highlighting marginal costs by average costs and subsequently conduct regression analysis using the

pooled OLS method. To develop a new form of the H-statistics index, I construct a model of total revenues as a share of total assets (Claessens & Laeven, 2004). As the new dependent variable covers all sources of revenues, I could argue that my alternative H-statistics measure is more comprehensive to capture the overall competition picture in the banking industry. I again verify if the market is in equilibrium based on the same procedure as displayed previously. In Table 3, I demonstrate that while these alternatives seize other facets of competition, they still help me get a robust estimation of the effect of competition on government bond holdings.

For the next series of robustness checks, I evaluate the possibility of structural breaks and analye the subsample. While the whole sample spans from 2007 to 2021, my subsample excludes the financial crisis (2007 to 2009) and the COVID-19 pandemic (2020 to 2021) periods since I hypothesise that economic shocks from crises may affect the relationship between competitiveness and the storage of safe bonds. Table 4 presents the results for the subsample. Taken together, the consistency of the regression results in the subsample could be solid evidence to ensure the reliability of my research conclusions.

In addition, I change my econometric method. My motivation is that the least squares dummy variable corrected (LSDVC) estimator may work more effectively than other methodologies in dynamic models (i.e., my GMM setup) when the panel is limited and highly unbalanced (Bruno, 2005). Informed by this body of knowledge, I create LSDVC estimates in my investigation by extracting 100-repetition bootstrapped standard errors – a procedure developed by Bruno (2005). My estimations are equivalent to modifications in numerous LSDVC versions, demonstrating the solid competition-bond linkage, particularly the statistical significance of all regressions has improved substantially. Table 5 contains exclusively LSDVC findings with bias-corrected Blundell-Bond estimates to save space.

Table 3
Sensitivity checks with alternative bank competition measures

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged Sov	0.452***	0.452***	0.454***	0.479***	0.476***	0.473***	0.667***	0.450***	0.402***
	(0.058)	(0.057)	(0.059)	(0.060)	(0.060)	(0.059)	(0.057)	(0.057)	(0.071)
Cr5_loan	–17.127**								
	(8.101)								
Cr3_loan		–15.687*							
		(8.711)							
HHI_loan			–39.184*						
			(21.300)						
Cr5_dep				–27.869***					
				(7.495)					
Cr3_dep					–29.670***				
					(9.126)				
HHI_dep						–71.785***			
						(26.571)			
Lerner_adj							–34.374***		
							(6.176)		
Boone_adj								–54.830	
								(138.672)	
Hindex_adj									19.379***
									(7.140)

(Continued on next page)

Table 3 *(Continued)*

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	409	409	409	409	409	409	409	409	409
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.246	0.242	0.245	0.266	0.243	0.251	0.301	0.273	0.242
Hansen	0.313	0.313	0.316	0.285	0.302	0.299	0.537	0.343	0.189
Banks	30	30	30	30	30	30	30	30	30
Instruments	28	28	28	28	28	28	28	28	28

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4
Subsample checks

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Sov	0.334***	0.308***	0.323***	0.578***	0.366***	0.241***
	(0.075)	(0.081)	(0.079)	(0.046)	(0.062)	(0.074)
Cr5	–10.879*					
	(6.235)					
Cr3		–28.067*				
		(16.030)				
HHI			–119.098**			
			(48.597)			
Lerner				–10.383***		
				(3.933)		
Boone					–37.693	
					(185.670)	
Hindex						7.454***
						(2.742)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	298	298	298	298	298	298
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.113	0.136	0.122	0.112	0.127	0.147
Hansen	0.246	0.319	0.358	0.186	0.192	0.225
Banks	30	30	30	30	30	30
Instruments	22	22	22	22	22	22

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5
LSDVC checks

Variable	(1)	(2)	(3)	(4)	(5)
Lagged Sov	0.495***	0.473***	0.461***	0.623***	0.392***
	(0.057)	(0.062)	(0.060)	(0.032)	(0.057)
Cr5	–40.168***				
	(6.377)				
Cr3		–39.651***			
		(7.249)			
HHI			–124.742***		
			(23.037)		
Lerner				–14.271***	
				(4.229)	
Hindex					16.210***
					(4.531)
Bank controls	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes
Observations	409	409	409	409	409
Banks	30	30	30	30	30

Notes: Bootstrapped standard errors are presented in parentheses. The Boone variable is omitted in the LSDVC analysis as it is time-constant across the regression sample. *** $p < 0.01$.

Further Tests for The Search-For-Yield Incentive and The Precautionary Motive

Thus far, I have shown that domestic government bond holdings are linked to market competitiveness. To justify a credible interpretation of this outcome, I would first assess if "search for yield" evidence exists. As banks' high-yield investments continue to fall due to competition, they are constrained to participate in less lucrative initiatives. Nevertheless, this may depend on their existing wealth, with less profitable banks having an enormous incentive to pursue higher yields to achieve shareholder-required business objectives (Acharya & Steffen, 2015; Rajan, 2006; Wu et al., 2020). In response to competitive pressure, such banks tend to actively retain less low-yield sovereign debt assets and instead seek "high risk, high yield" ventures.

Inspired by studies on the "search for yield" motive (Wu et al., 2020), I use the difference of bank return on assets (ROA) from its mean value over the previous three years as an indicator of this motive. As it is typically considered that banks' operating objective is to maximise their profits, banks may be more (less) inclined to seek gain when their earnings are farther below (above) their preceding value. The return on equity (ROE) approach is also used as a sensitivity test. Thus, these two metrics I develop are inverse proxies for the motivation to seek yields. To undertake the test, I interact various competition measures with (dis)incentive search-for-yield metrics and incorporate them into my extended model.

If the ''search for yield'' hypothesis is valid, under-profitable institutions might have a larger motivation to seek yields and respond to increased competition by holding fewer government bonds than their peers. In this instance, the coefficient for the interaction term should have the same sign as the separate competition variable. Remarkably, as shown in Tables 6 and 7, this is the case with most statistically significant interaction coefficients. The impact of competition is mitigated at banks with lower SFYroa and SFYroe values – implying more search for yield motivation, as these two variables are the inverse proxy of the search for yield incentive. This suggests that these banks are more driven to look for yields. Thus, I have evidence to believe that banks buy government bonds under competitive pressure for strategic reasons and business opportunities.

Another critical reason banks purchase government bonds is for precautionary purposes (Affinito et al., 2022). For instance, banks may store public bonds if they fear they cannot get interbank financing due to temporary liquidity problems (Allen & Gale, 2004). The precautionary motive could become more relevant in times of high competition when banking operations are more vulnerable (Ali et al., 2022). In this vein, banks purchase government bonds to protect themselves against future forms of bank risk resulting from competition, following the competition–fragility hypothesis (Petersen & Rajan, 1995).

Table 6
Tests for the search for yield mechanism: The ROA approach

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Sov	0.668***	0.681***	0.672***	0.580***	0.464***	0.641***
	(0.078)	(0.085)	(0.085)	(0.043)	(0.084)	(0.086)
Cr5	–32.904***					
	(8.132)					
Cr5*SFYroa	–4.836**					
	(2.328)					

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Table 6 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Cr3		–21.928*				
		(12.968)				
Cr3*SFYroa		–9.989***				
		(3.560)				
HHI			–86.734**			
			(35.652)			
HHI*SFYroa			–44.214***			
			(16.097)			
Lerner				–16.103***		
				(5.555)		
Lerner*SFYroa				–11.571***		
				(3.555)		
Boone					–420.642*	
					(222.722)	
Boone*SFYroa					1,662.953	
					(1,564.623)	
Hindex						11.284
						(8.376)
Hindex*SFYroa						11.739***
						(2.943)
SFYroa	4.682***	4.531***	4.587***	4.052***	111.066	2.969**
	(1.211)	(1.339)	(1.222)	(1.350)	(109.923)	(1.201)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	380	380	380	380	380	380
AR(1)	0.001	0.001	0.001	0.001	0.000	0.001
AR(2)	0.139	0.174	0.172	0.129	0.105	0.331
Hansen	0.131	0.122	0.147	0.329	0.221	0.233
Banks	30	30	30	30	30	30
Instruments	28	28	28	28	28	28

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7
Tests for the search for yield mechanism: The ROE approach

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Sov	0.601***	0.633***	0.617***	0.628***	0.415***	0.595***
	(0.117)	(0.104)	(0.112)	(0.053)	(0.069)	(0.086)
Cr5	–53.909***					
	(13.857)					
Cr5*SFYroe	–0.619**					
	(0.255)					
Cr3		–66.057***				
		(12.107)				
Cr3*SFYroe		–0.913***				
		(0.348)				
HHI			–193.069***			
			(45.123)			
HHI*SFYroe			–4.936***			
			(1.666)			
Lerner				–12.819		
				(10.403)		
Lerner*SFYroe				–2.276***		
				(0.281)		
Boone					–168.806	
					(206.058)	
Boone*SFYroe					33.917	
					(105.087)	
Hindex						24.609***
						(7.790)
Hindex*SFYroe						3.751**
						(1.464)
SFYroe	0.292**	0.368***	0.307***	0.162	1.986	2.525***
	(0.121)	(0.118)	(0.119)	(0.159)	(7.414)	(0.751)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	380	380	380	380	380	380

(*Continued on next page*)

Table 7 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
AR(1)	0.001	0.000	0.001	0.002	0.000	0.000
AR(2)	0.134	0.121	0.136	0.163	0.155	0.500
Hansen	0.298	0.390	0.333	0.484	0.134	0.275
Banks	30	30	30	30	30	30
Instruments	28	28	28	28	28	28

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

To test whether the purchase of government securities could be bolstered in intense competition conditions by a rise in bank risk, I use the Z-score index to quantify banks' overall (reverse) risk. It is determined by dividing the sum of ROA and the equity ratio by the standard deviation of ROA. Frequently, a three-year rolling time frame is used to determine the ROA standard deviation, which reduces the number of applicable annual observations. Then, this index of overall bank risk interacts with competition and is included in my estimations. If the preventative motivation is at work, the interaction variable's regression coefficient would be significant and have the opposite sign to the isolated competition variable.

Table 8 summarises my findings. The standalone term of bank competition is statistically significant with unchanged signs, as previously shown. Nevertheless, the interaction term coefficient fails to demonstrate statistical significance in all assessments. This result recommends that the link between competitiveness and sovereign bonds does not differ for banks with varying risk profiles. To corroborate this conclusion further, I explore whether riskier banks with greater loan loss provisions hold more treasury securities in response to competitive pressures than less risky banks. I substitute loan loss provisions for the Z-score index in the interaction term and report the estimates in Table 9. The non-significance of the interaction term between the competition index and loan loss provisions again demonstrates that banks do not keep sovereign bonds for precautionary reasons. Hence, the precautionary motivation for acquiring sovereign bonds is not displayed at institutions with a greater risk profile in the face of heightened competition.

Table 8
Tests for the precautionary motive: The Z-score index

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Sov	0.485***	0.419***	0.452***	0.582***	0.490***	0.411***
	(0.065)	(0.061)	(0.068)	(0.029)	(0.065)	(0.095)
Cr5	–123.662***					
	(41.788)					
Cr5*Zscore	0.015					
	(0.014)					
Cr3		–79.406**				
		(37.372)				
Cr3*Zscore		0.029				
		(0.019)				
HHI			–480.042***			
			(182.029)			
HHI*Zscore			0.121			
			(0.099)			
Lerner				–5.514**		
				(2.741)		
Lerner*Zscore				-0.001		
				(0.014)		
Boone					–5.402	
					(152.387)	
Boone*Zscore					0.028	
					(0.076)	
Hindex						27.805**
						(11.455)
Hindex*Zscore						0.045
						(0.031)
Zscore	–0.008	–0.003	–0.004	–0.016***	–0.001	–0.035***
	(0.009)	(0.006)	(0.009)	(0.004)	(0.005)	(0.013)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	349	349	349	349	349	349

(*Continued on next page*)

Table 8 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.159	0.132	0.142	0.141	0.129	0.442
Hansen	0.368	0.143	0.313	0.457	0.335	0.106
Banks	30	30	30	30	30	30
Instruments	25	25	25	25	25	25

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

Table 9
Tests for the precautionary motive: The loan loss provision ratio

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Sov	0.377***	0.392***	0.409***	0.653***	0.397***	0.362***
	(0.069)	(0.065)	(0.072)	(0.042)	(0.077)	(0.080)
Cr5	–32.397***					
	(5.675)					
Cr5*Llp	1.877					
	(1.236)					
Cr3		–49.369**				
		(24.366)				
Cr3*Llp		27.557				
		(35.448)				
HHI			–124.580***			
			(21.275)			
HHI*Llp			0.682			
			(9.904)			
Lerner				–19.747**		
				(8.686)		
Lerner*Llp				6.254		
				(3.952)		
Boone					–94.965	
					(193.579)	
Boone*Llp					–16.507	
					(14.432)	

(*Continued on next page*)

Table 9 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Hindex						18.356***
						(6.516)
Hindex*Llp						2.179
						(1.357)
Llp	0.218*** (0.039)	0.254*** (0.041)	0.235*** (0.041)	0.053*** (0.018)	0.219*** (0.045)	0.259*** (0.048)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	409	409	409	409	409	409
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.210	0.281	0.371	0.170	0.233	0.148
Hansen	0.472	0.443	0.385	0.194	0.327	0.225
Banks	30	30	30	30	30	30
Instruments	28	28	28	28	28	28

Notes: The dependent variable is sovereign bonds. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

CONCLUSIONS

To explain sovereign bond holdings, most available research proposes macroeconomic variables and bank-specific factors. Prior studies disregard the structure of the banking market, represented by bank competition. This article sheds light on the issue by investigating the impact of bank competition on government bond purchases in Vietnam from 2007 to 2021. My findings from a variety of different competition proxies indicate that bank competition, especially in the dimensions of concentration ratios, the Lerner index, and the H-statistic index, is significant in explaining the acquisition of government bonds. If market competition is greater, banks are more likely to hold domestic treasury securities. My patterns regarding banking market structure and sovereign debt holdings are robust regardless of the fact that:

1. I modify the way I generate my competition measures.
2. I pay attention to the structural breaks caused by the financial and pandemic crises.
3. I perform regressions using alternative econometric techniques.

In addition, I investigate whether banks' government security holdings are influenced by the yield-seeking drive or the precautionary need. I find that sovereign debt holdings are less prominent when banks are more inclined to search for higher income during periods of intense competition. Meanwhile, the risk profile of the financial institution does not modify the strength of the competition-bond association. Overall, I assume banks would retain more sovereign debt in response to competitive pressure for strategic rather than precautionary reasons.

My research has policy implications. Though holding sovereign bonds can provide a safety net, an over-reliance on these assets may hinder banks' ability to contribute to economic growth. In this regard, the positive effect of competitive pressure on government security holdings suggests that increased market competition could impede banks' capacity to carry out their primary mission, which may not successfully enhance economic growth to the extent that bank core function favourably influences the real economy. Hence, to minimise the unfavourable effects of increased competition, I advocate for enhanced governance that takes the banking market structure into account. Further, financial authorities should recognise that banks' motivation to hold additional sovereign bonds in a competitive environment often stems from strategic choices rather than protective functions. By understanding these dynamics, regulators can design frameworks that encourage more productive investments while maintaining financial stability. Additionally, in an overly competitive environment, policies should encourage banks to diversify their assets rather than concentrate on government bond holdings, which can enhance their role in supporting broader economic activities. Along this line, increasing the monitoring and supervision of banks' investment strategies is crucial to ensure that strategic holdings of sovereign debt do not undermine their capacity to support the real economy.

I recognise that this conclusions, focusing solely on banks in Vietnam, may not be generalisable to a broad sample of countries due to certain database limitations. I encourage future research to explore this issue in different markets to either validate or challenge my findings, thereby broadening the scope of the subject.

DATA AVAILABILITY

The datasets used and/or analysed are available from the author upon reasonable request.

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The author declares no competing interests.

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