The impact of real estate default risk on bank efficiency and financial stability: Evidence from Vietnam

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Abstract

The purpose of this study is to examine the impact of real estate default risk on the efficiency and stability of Vietnamese commercial banks during the period from 2007 to 2022. By applying the two-step System Generalized Method of Moments (SGMM) regression method, Panel Vector Autoregression (PVAR), and Granger Causality tests, combined with unbalanced panel data, the author investigates how real estate default risk influences the profit efficiency and stability of 35 Vietnamese commercial banks over this period. The research results indicate that real estate default risk negatively affects the profit efficiency and stability of Vietnamese banks. Additionally, there is a causal relationship between profit efficiency and bank financial stability. Control variables such as bank capital, size, bad debts, technology, the impact of COVID-19, economic growth, and inflation all influence profit efficiency and bank stability. Meanwhile, non-interest income primarily affects the financial stability of Vietnamese commercial banks. The findings of this study have significant practical implications for investors, business managers, banks, and policymakers, providing valuable insights into the factors affecting bank performance and stability in Vietnam.

Keywords: Bank efficiency, Default risk, Financial stability, Real estate, X-SCORE.

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Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

1. Introduction

In addition to being considered the lifeblood of the economy Triner [1] the real estate sector also plays a crucial role in the economic development of most countries worldwide, promoting growth, creating jobs, and attracting investment resources [2]. However, over-reliance on the real estate sector has led to significant financial losses, especially for the banking system, as banks' investment portfolios and lending activities are often closely tied to the real estate market, whether directly or indirectly [2, 3]. Bank performance and stability are susceptible to real estate default risks [4, 5]. The

Asian financial crisis of 1997–1998 and the global financial crisis of 2007–2008 demonstrated the importance of default risk in the real estate sector, while increasing concerns about the negative impact of this risk on the banking system and economies of countries around the world [6, 7].

Vietnam's real estate market has undergone a notable decline in purchasing power, causing a mismatch between supply and demand. Businesses in the industry face a series of difficulties, including legal issues, restricted access to bank credit, bond issuance, and capital mobilization. As a result, liquidity has weakened, cash flow and profits have dropped sharply, while pressure to repay due debts has increased, thereby raising the risk of default. Many real estate businesses have fallen into a state of loss, been forced to dissolve, suspend operations, or downsize. This is evidenced by the fact that, as of November 2024, approximately 1,137 real estate businesses had been dissolved in Vietnam, placing the sector third among all industries in business closures [8]. The Vietnamese real estate market continues to show negative signs: businesses are facing mounting challenges, the market remains stagnant, and many firms have lost liquidity and are unable to repay bank loans. Real estate currently serves as the main collateral for credit. When the real estate market declines, asset quality—or the value of collateral—also falls. Meanwhile, real estate lending still accounts for a large share of banks' credit growth [7, 9]. Real estate loans are typically medium- and long-term; therefore, banks tend to avoid allowing them to grow too rapidly within their credit portfolios. According to the results of a banking sector survey conducted by Vietnam Report in May 2024, the safety level of the Vietnamese banking system is showing signs of decline. The industry is currently facing major challenges, particularly the negative impact of a weakening real estate market, rising non-performing loans, and increasing risks to overall financial system stability.

In this context, a critical question arises: is the Vietnamese real estate market repeating the crisis cycle that occurred during 2009–2013? And will the growing default risk in this sector significantly affect the effective and stability of the banking system, given the close link between real estate and banking in the real economy? Although numerous studies have examined the relationship between real estate and banking performance, to date, no research has thoroughly analyzed the impact of real estate default risk on the efficiency and financial stability of commercial banks in emerging markets such as Vietnam. Furthermore, no study to date has simultaneously employed two quantitative approaches—namely, the two-step System GMM (SGMM) panel regression and the Panel Vector Autoregression (PVAR) model combined with the Granger causality test—to assess this relationship.

Based on the academic and practical context in Vietnam, this study aims to help fill the gap in the academic literature while providing empirical evidence on the impact of risks in the real estate sector on the effective and stability of the banking system in emerging economies like Vietnam. Accordingly, the research offers practical implications for corporate managers, credit institutions, and policymakers.

2. Literature Review

2.1. Real Estate Default Risk

Default risk refers to a situation in which a business is unable to meet its debt payment obligations when they come due [10]. According to the Trade-off Theory proposed by [11] default risk arises when a business fails to make timely payments, prompting lenders to demand higher returns to compensate for the increased credit risk. For real estate businesses, default risk is often asymmetric across the economic cycle: when the economy is growing, default risk tends to be low; conversely, during recessions, this risk increases significantly [12].

Regarding the measurement of a business's default risk, there are several approaches, such as the Z-SCORE, S-SCORE, O-SCORE, X-SCORE, H-SCORE, and G-SCORE models. However, in the case of the real estate sector, the Zmijewski X-SCORE approach has been shown to be highly effective. Studies by Andriani and Sihombing [13] confirmed its superiority over other models, with an accuracy rate of up to 90% in empirical studies of Indonesia's real estate sector, a Southeast Asian country with a context similar to that of Vietnam.

Therefore, in this study, the default risk of the real estate sector is assessed using the Zmijewski [14] as defined by the following formula:

$$Xscore = -4{,}336 - 4{,}513X1 + 5{,}679X2 - 0{,}004X3 \qquad (2.1)$$

In this model: X_1 represents profit over total assets; X_2 represents debt over total assets; and X_3 represents short-term assets over short-term debt. When the X-score is greater than 0, the enterprise is financially healthy and has a low risk of default. When the X-score is approximately 0, it indicates a neutral financial position and requires further monitoring. If -0.25 < X-score < 0, the enterprise is at risk of default. When the X-score is less than -0.25, the enterprise approaches a high-risk default threshold. Studies by Andriani and Sihombing [13] and Citra [15] have shown that the Zmijewski X-score model may overestimate the default risk in the real estate sector.

2.2. Banking Efficiency

According to the cost approach, bank efficiency refers to the optimal combination of inputs required to produce a unit of output [16-18].

At the microeconomic level, bank efficiency is influenced by increased competition resulting from the growing presence of foreign banks. From a macroeconomic perspective, it relates to reduced financial intermediation costs and enhanced stability of the financial system [19].

From a profitability perspective, modern economists argue that profit reflects a bank's ability to generate earnings, primarily through total profit and profit margins [20].

This study focuses on profit efficiency and employs the Return on Assets (ROA) ratio to measure bank profitability. ROA is a comprehensive financial indicator used to evaluate how efficiently a bank manages its total assets to generate

profit [21]. A higher ROA indicates greater efficiency in asset utilization and reflects a stronger financial position. One advantage of ROA is that it is less affected by high equity levels, whereas Return on Equity (ROE) can be misleading as it does not account for risks associated with financial leverage and debt.

2.3. Banking Financial Stability

Financial stability reflects a bank's ability to effectively perform key functions such as allocating resources, managing and dispersing risks, and maintaining sufficient capacity to absorb shocks and minimize the risk of bankruptcy, thereby avoiding negative impacts on the real economy [22].

To measure the level of financial stability in banks, the Z-score index is widely used. Originally proposed by Roy [23] the index has been further developed through subsequent studies [24-27]. Today, the Z-score has become a commonly used tool by the World Bank and in many international studies to assess the stability of banking systems, such as those conducted by Fernández [28]; Ali and Puah [29]; Nguyen [30] and Sysoyeva [31]. A higher Z-score indicates greater financial stability, and vice versa [27]. The Z-score is calculated using the following formula:

$$Z - score_{i,t} = \frac{ROA_{it} + EA_{i,t}}{\sigma ROA_{it}}$$

Where: ROA denotes net profit over total assets; EA represents equity over total assets; and σ is the standard deviation of ROA.

2.4. Impact of Default Risk on Banking Efficiency and Stability

According to the theory of socio-economic shocks developed by scholars such as Stiglitz [32]; Klein [33] and Edwards and Montes [34] shocks arising from default risk in the real estate sector can directly affect the banking system through two main channels: (i) an increase in credit risk associated with real estate-related loans; and (ii) a decline in the value of real estate collateral, thereby reducing banks' ability to recover debts. When the real estate market enters a crisis and default risk rises, the operational efficiency and financial stability of banks tend to deteriorate significantly [35, 36].

In addition, the Financial Instability Hypothesis proposed by Minsky [37] posits that during periods of robust growth in the real estate market, businesses in this sector often experience high operational efficiency, rising profitability, and low default risk. In such a context, commercial banks tend to increase credit supply to the real estate sector and are often willing to finance new projects at preferential interest rates to promote business activity [38]. When credit expansion is conducted in a controlled manner and credit quality is maintained, bank profitability tends to improve, thereby contributing to enhanced financial stability.

During periods of credit expansion, the demand for loans to invest in real estate increases sharply, driven by investors' expectations that real estate prices will continue to rise and surpass the cost of borrowing. This situation contributes to the expansion of credit volume as well as bank profitability. However, credit imbalances and the formation of real estate bubbles can lead to serious consequences for the banking system.

Similar to previous periods of overheated growth, banks often continue to expand credit to the real estate sector, even when some loans exhibit high-risk characteristics [39]. The rapid increase in real estate prices, far outpacing economic fundamentals, results in the formation of asset price bubbles. When the economy enters a recession and the bubble bursts, real estate prices are no longer sufficient to cover borrowing costs [40]. Borrowers begin to sell off assets to minimize losses, triggering market panic and a chain reaction of sell-offs. As a result, default risk rises, and many businesses and individuals fall into bankruptcy [41].

In this context, borrowers lose their repayment capacity, leading to a sharp increase in the non-performing loan (NPL) ratio within the banking system, which in turn results in a significant decline in bank profits. When real estate companies default en masse, banks not only face growing levels of bad debt but also liquidity risks, further amplifying financial instability [41]. To mitigate risk, banks often tighten credit conditions or suspend lending, especially for loans with lax terms. This restricts real estate firms' access to new capital, hinders their ability to refinance, and increases the likelihood of further defaults.

The global financial crisis of 2007–2008 serves as a typical example of the link between instability in the real estate sector and the collapse of the banking system, as a series of traditional banks went bankrupt due to the spillover effects of real estate-related credit risks [42]. Since real estate often accounts for a large proportion of banks' asset portfolios, numerous studies have been conducted to clarify the relationship between these two sectors from various perspectives. Specifically, Li, et al. [43] analyzed the impact of systemic real estate risks on bank profitability in China; Lee, et al. [44] assessed the effect of real estate risk on bank stock returns; Zurek [45] investigated real estate lending risks and the potential for risk transmission to the banking sector; Mokas and Nijskens [46] examined the effect of real estate credit risk on financial stability; while Banai and Vágó [47] evaluated the impact of housing price fluctuations on banking risk.

The spillover effects from the real estate sector continue to deteriorate asset quality and the performance of the banking system, thereby posing a threat to the financial stability of the entire sector. In more severe cases, these effects can lead to bank failures, financial crises, and systemic disruptions to the broader economy [48].

Based on the foregoing discussion regarding the impact of real estate default risk on bank performance and financial stability, this study proposes the following research hypotheses:

H₁: Real estate default risk has a negative impact on bank performance.

H₂: Real estate default risk has a negative impact on bank stability.

3. Research Model, Method, and Data

3.1. Research Model

Building upon the foundational works of Ok, et al. [40]; Ali and Puah [29] and Zhong and Zhong [41] and incorporating appropriate adjustments to reflect the specific operational context of commercial banks in Vietnam, this study proposes the following research model:

$$\text{ROA}_{it} = \alpha_i + \alpha_1 X - \text{score}_{it} + \alpha_2 Z - \text{score}_{it} + \sum_{j=1}^{8} \alpha_j X_{it} + \varepsilon_{it} \qquad (1)$$

$$Z - \text{score}_{it} = \beta_i + \beta_1 X - \text{score}_{it} + \beta_2 \text{ROA}_{it} + \sum_{j=1}^{8} \beta_j X_{it} + \upsilon_{it} \qquad (2)$$

In this model, ROA represents the bank's profitability, while Z-score serves as an indicator of financial stability. The variable X-score measures the real estate default risk of 56 real estate firms listed on Vietnam's stock exchanges, including HOSE, HNX, and UPCOM, during the period 2007–2022. The term Xit denotes a set of control variables, comprising both bank-specific and macroeconomic factors.

The bank-specific control variables include equity, bank size, non-interest income, and non-performing loans. These variables are derived from the CAMELS framework and are grounded in the findings of Ali and Puah [29]; Ali and Dhiman [49]; Lee, et al. [50]; Rahmawati and Mardanugraha [51]; Vu and Nahm [52] and Havrylchyk [53].

The macroeconomic control variables consist of GDP growth, inflation, the impact of the Covid-19 pandemic, and technological factors. These are included based on the studies of Ali and Puah [29]; Sahul Hamid and Ibrahim [54] and Carbó, et al. [55].

In the model, i and t represent the cross-sectional (bank) and time dimensions, respectively. The coefficients α and β are the parameters to be estimated, while ε and υ denote the stochastic error terms.

3.2. Research Method

This study employs a quantitative research approach to examine the impact of default risk in the real estate sector on the profitability and financial stability of commercial banks in Vietnam. To enhance the robustness and reliability of the findings, the analysis is conducted using two complementary methodological frameworks.

First, the study utilizes the two-step System Generalized Method of Moments (2S-GMM) technique for panel data regression, as proposed by Arellano and Bover [56] and further developed by Blundell and Bond [57] to estimate models (3.1) and (3.2). This method is particularly effective in addressing key econometric issues commonly found in panel data, such as autocorrelation, heteroscedasticity, and endogeneity among explanatory variables. By correcting for these issues, the 2S-GMM approach enhances both the efficiency and consistency of parameter estimates.

Second, to verify the robustness of the main results, the study applies a Panel Vector Autoregression (PVAR) model combined with Granger causality tests. The PVAR framework models the system of endogenous interactions among three key variables: profitability (ROA), financial stability (Z-score), and real estate default risk (X-score). The general form of the PVAR model is specified as: $Z_{i,t} = [\text{ROA}_{it}, Z - \text{score}_{it}, X - \text{score}_{it}]'$. Where: A_{0i} is a (k × 1) vector of bank-specific, time-invariant intercepts, A_{0i} is a (k × k) matrix of lagged coefficients, defined as $A(\ell) = \sum_{j=1}^{p} A_j \ell^{j-1}$, which captures both individual and cross-variable lag effects of the endogenous variables, ε_{it} is a (1 × k) vector of random error terms. This modeling approach facilitates an in-depth analysis of the dynamic interrelationships among the variables, thereby offering more comprehensive empirical insights into the potential spillover effects of real estate default risk on the performance and stability of the banking sector.

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3.3. Research Data

Data pertaining to bank-specific variables were collected from the audited financial statements of 35 commercial banks in Vietnam over the period 2007–2022. In parallel, macroeconomic variables, including GDP growth and inflation, were sourced from the International Monetary Fund (IMF) database.

To ensure the representativeness and temporal reliability of the dataset, the study excluded banks that had fewer than five consecutive years of financial reports or lacked data beyond the year 2020. The rationale for these exclusions was to mitigate potential analytical bias arising from insufficient observation periods, which may fail to capture the long-term characteristics of banking operations in a comprehensive and consistent manner.

All variables employed in the research model are clearly defined and measured in Table 1.

Table 1.
Description of how the variables used in the study were measured.

Variable names	Symbols	Formulas	Expectations ROA	Expectations Z-score	Theoretical basis
Dependent variable					
Profit	ROA	Return on Assets			Jahan [21] and Ali and Dhiman [49]
Risk	Z-score	$Zscore_{i,t} = \dfrac{ROA_{it} + EA_{i,t}}{\sigma ROA_{it}}$			Fu, et al. [27] and Nguyen [30]
Independent variable					
Real estate default risk	X-score	Calculate by formula (2.1)	-	-	Zmijewski [14]
Control variables					
Equity	Equity	Equity to total assets ratio	+	+	Rahman, et al. [58]
Scale	Size	Log(total assets)	+	+	Fu, et al. [27]
Non-interest income	Div	Non-interest income to total income ratio	+	+	Rahman, et al. [58]
Bad debt	NPL	Bad debt to total outstanding credit ratio	-	-	Vu and Nahm [52] and Havrlchyk [53]
Time to implement digital technology innovation	Tech	Equal: 1: 2019-2022 0: Remaining years	+	+	Author's suggestion
Covid-19	Covid-19	Equal: 1: 2020-2021 0: Remaining years	-	-	
Economic growth	GDP	Annual GDP growth	+	+	Adusei [59] and Ali and Puah [29]
Inflationary	INF	Annual inflation rate	+	+	Adusei [59]

4. Research Results and Discussion

4.1. Descriptive Statistics

Table 2 presents the descriptive statistics of the variables included in the research model. The average return on assets (ROA) of Vietnamese commercial banks in the sample is 0.016, a figure comparable to that reported by Shen, et al. [60] who found an average ROA of 0.015 for Chinese banks, a country with a banking system relatively similar to that of Vietnam. When compared with the industry benchmark for ROA in the Vietnamese banking sector (ranging from 0.01 to 0.02), this result suggests that the sampled banks operate with stable and satisfactory performance. The average Z-score is 11.636, indicating a relatively low risk of financial distress. In contrast, the average X-score is -0.34 (i.e., below zero), clearly signaling heightened default risk in Vietnam's real estate sector, surpassing the financial safety threshold.

Empirical evidence from the Vietnamese real estate market shows an increasing trend in default risk, gradually approaching or surpassing the warning level. Between 2007 and 2010, risk levels increased due to the formation of a real estate bubble preceding the global financial crisis. From 2011 to 2013, a significant number of real estate firms became insolvent, resulting in a sharp rise in the X-score toward the warning threshold. During the 2014–2018 period, the real estate market showed signs of recovery, reflected in a decline in the average X-score, indicating financial improvement among firms. However, from 2019 to 2022, particularly in 2021 default risk resurged due to the pressures of maturing corporate bonds, rising interest rates, and government-imposed restrictions on credit access in the real estate sector. Consequently, the average X-score of many firms exceeded the critical safety threshold, placing them in a high-risk zone.

Table 2.
Descriptive statistics of variables used in the study.

Variable	Obs.	Mean	Std. dev.	Min.	Max.	Variable	Obs.	Mean	Std. dev.	Min.	Max.
ROA	354	0.016	0.009	0.000	0.036	NII	354	0.268	0.013	0.241	0.292
Z-score	354	11.636	11.306	2.040	93.601	NLP	354	0.038	0.010	0.017	0.059
X-score	354	-0.340	0.133	-0.896	1.200	GDP	354	0.059	0.015	0.026	0.080
Equity	354	0.092	0.015	0.071	0.127	IFR	354	0.069	0.053	0.006	0.186
Size	354	23.896	9.314	9.584	42.989						

4.2. Estimation Results and Discussion

Table 3 presents the correlation coefficients between variables in the research model, showing that there is no possibility of multicollinearity because most of the correlation coefficients between variables are quite small.

Table 3.
Correlation coefficient matrix between variables.

Variable	Obs.	Mean	Std. dev.	Min.	Max.	Variable	Obs.	Mean	Std. dev.	Min.	Max.
ROA	354	0.016	0.009	0.000	0.036	NII	354	0.268	0.013	0.241	0.292
Z-score	354	11.636	11.306	2.040	93.601	NLP	354	0.038	0.010	0.017	0.059
X-score	354	-0.340	0.133	-0.896	1.200	GDP	354	0.059	0.015	0.026	0.080
Equity	354	0.092	0.015	0.071	0.127	IFR	354	0.069	0.053	0.006	0.186
Size	354	23.896	9.314	9.584	42.989						

4.2.1. Two-step SGMM Regression Results

Table 4 presents the estimation results based on the two-step System Generalized Method of Moments (SGMM) approach, which examines the impact of real estate default risk on the profitability and financial stability of Vietnamese commercial banks. The findings indicate that real estate default risk, proxied by the X-score, exerts a statistically significant and negative effect on bank profitability (ROA) at the 1% significance level. Notably, the X-score also demonstrates a strong negative influence on financial stability (Z-score), with an estimated coefficient of -2.183, significant at the 5% level. These results provide empirical support for Hypotheses H_1 and H_2 and align with the theoretical frameworks of financial-social shock theory and financial instability theory.

Table 4.
SGMM 2-step regression results on the impact of default risk on efficiency and financial stability

Variable name	ROA			Variable name	Z-score		
X-score	-0.0175***	NLP	-0.138***	X-score	-2.183**	NLP	-59.22***
	[6.54]		[2.91]		[2.19]		[4.31]
Equity	0.262***	Tech	0.0114***	Equity	65.23***	Tech	-1.927***
	[-3.54]		[4.49]		[3.75]		[-3.76]
Size	0.000236***	Covid19	-0.0192***	Size	-0.158***	Covid19	4.567***
	[2.96]		[-4.83]		[-5.76]		[5.05]
NII	0.0259	GDP	-0.0943***	NII	63.77***	GDP	10.46**
	[0.39]		[-7.38]		[2.93]		[2.45]
Z-score	0.000191***	IFR	-0.0151**	ROA	99.68***	IFR	-3.261**
	[3.89]		[-2.69]		[7.30]		[-2.05]
_cons	0.0333				-11.90*		
	[1.37]				[-1.76]		
Number of obs.	287				287		
Number of groups	35				35		
Number of instruments	33				34		
AR(1) p-value	Prob > chi2 = 0.244				Pr > z = 0.083		
AR(2) p-value	Pr > z = 0.544				Pr > z = 0.777		
Sargan test	Prob > chi2 = 0.233				Prob > chi2 = 0.216		
Hansen test	Prob > chi2 = 0.463				Prob > chi2 = 0.644		

Note: *, **, *** represent significance levels of 10%, 5% and 1%, respectively

Furthermore, the findings are consistent with the perspectives of Zhang, et al. [61] and Aida, et al. [62] who argue that banks are vulnerable to systemic default waves triggered by borrowers' insolvency. This contagion effect can accelerate the accumulation of non-performing loans, diminish profitability, erode equity capital, and contribute to increased financial system instability. Empirical evidence from Vietnam during the period 2020–2022 reinforces these concerns, as real estate firms experienced a pronounced deterioration in both capital and liquidity positions. This was manifested in significant

reductions in cash reserves, limited access to new funding sources, a sharp decline in bond issuance activities, and a rising number of firms forced to liquidate assets or temporarily suspend operations.
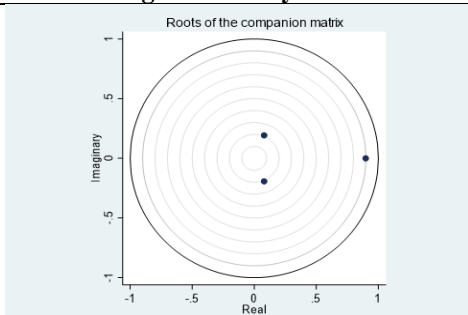
The severe capital shortage in the economy is primarily attributable to weak cash flows, high financial leverage, shortcomings in the legal framework, and increasingly restrictive credit policies. In the context of the global economic downturn and rising inflationary pressures in 2022, the State Bank of Vietnam implemented a series of monetary policy measures aimed at controlling inflation and supporting economic growth, including a reduction in lending rates. However, capital inflows into the real estate sector have yet to show significant improvement. Access to credit from the banking system remains constrained due to the weakening debt repayment capacity of enterprises, as well as the tightening of credit conditions by commercial banks in an effort to manage risk.

In addition, the two-step System GMM estimation results indicate that the control variables are statistically significant and aligned with the initial theoretical expectations. Specifically: (i) the variables Equity, Size, Tech, Covid-19, and GDP exert significant effects on both bank profitability (ROA) and financial stability (Z-score); (ii) the variables NPL (non-performing loans) and IFR (non-financial risk) negatively affect both profitability and financial stability; (iii) the variable NII (net interest income) has a positive effect solely on financial stability; and (iv) there is empirical evidence supporting a bidirectional and positive relationship between bank profitability (ROA) and financial stability (Z-score). These findings are consistent with prior studies, including those by Adusei [59]; Ongore and Kusa [63]; Ayaydin and Karakaya [64]; Marlina [65]; Katusiime [66]; Wang, et al. [67] and Ochenge [68] thereby reinforcing the argument for a reciprocal relationship between performance and stability in the banking sector.

4.2.2. PVAR Regression Results and Granger Causality Test

Table 5.
Presents the results of the tests for the PVAR model.

Optimal delay testing							Testing the stability of PVAR
Lag	CD	J	J pvalue	MBIC	MAIC	MQIC	
1	-2.771	0.000	0.00	0.000	0.000	0.000	
2	-5.262	0.000	0.000	0.000	0.000	0.000	
3	-6.789	0.715	0.869	-12.58	-5.284	-8.216	
4	-8.832	0.695	0.874	-12.60	-5.304	-8.235	
Unit root test							
Biến			ADF		P-value		
ROA			15.828		0.000		
Xscore			50.832		0.000		
Zscore			19.813		0.000		

The optimal lag is selected as 1, based on the minimum criteria of MBIC, MAIC and MQIC indices, and the CD value reaches the maximum. The unit root test results of the characteristic polynomial show that all roots are stationary (p-value < 0.05) and lie inside the unit circle, thereby confirming that the PVAR model meets the stability requirements and can be used in empirical analysis.

Table 6.
Granger causality test results.

Dependent variable: ROA		Independent variable: X-score		Dependent variable: Z-score	
ROA$_{(t-1)}$	0.755***	ROA$_{(t-1)}$	-0.793***	ROA$_{(t-1)}$	-72.16***
	[6.35]		[-6.03]		[-3.72]
X-score$_{(t-1)}$	-0.0137**	X-score$_{(t-1)}$	0.0565***	X-score$_{(t-1)}$	14.89 **
	[-0.41]		[0.60]		[0.72]
Z-score$_{(t-1)}$	0.00108***	Z-score$_{(t-1)}$	-0.00223***	Z-score$_{(t-1)}$	0.245***
	[-9.79]		[-9.46]		[8.06]

Note: *, **, *** represent significance levels of 10%, 5% and 1%, respectively

The Granger causality test results presented in Table 6 show that, at the 5% statistical significance level, the hypothesis of "no causality from independent variables to dependent variables" is rejected. This implies that default risk in the real estate sector has a causal relationship with the profitability and financial stability of commercial banks (CBs) in Vietnam. This finding is consistent with previous studies such as Igan and Pinheiro [4]; Zhang, et al. [69]; Li [70] and Chen [71] thereby strengthening the empirical evidence of spillover effects from the real estate sector to the banking system. In addition, the results also indicate the existence of a bidirectional causality between the profitability and financial stability of Vietnamese commercial banks.

4.3. Impulse Response Function
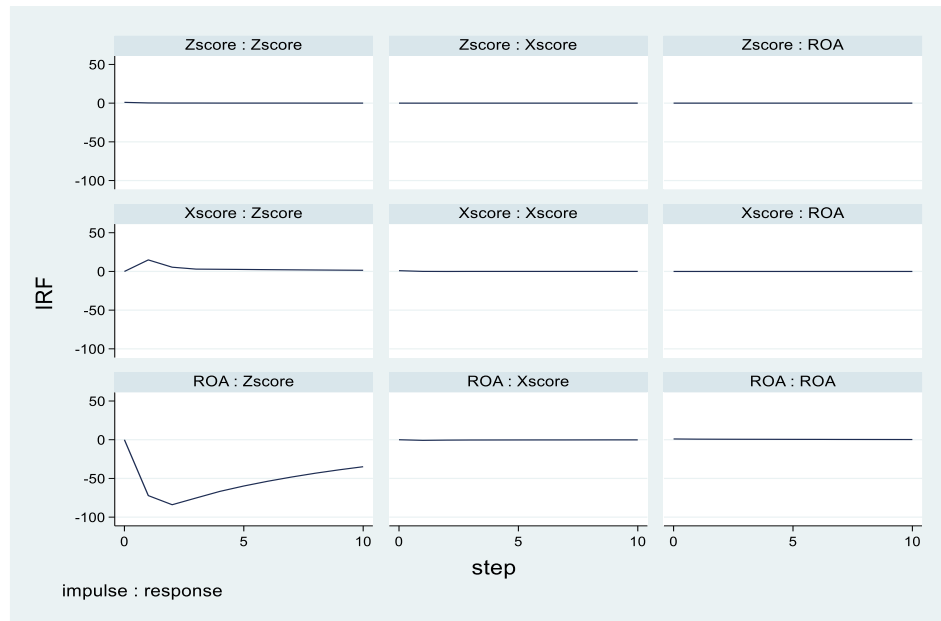
Figure 1.
Impulse response function results.

Figure 1 shows that real estate default risk (X-score) has a negative (albeit small) impact on bank financial stability (Z-score) (left corner, second row, Figure 1). A decline in ROA has a significant negative impact on Z-score in the short term, but tends to recover later (left corner, third row, Figure 1). There is no strong response from Z-score to ROA or Xscore, indicating neutrality or high lag in the transmission of the impact. The financial system is highly stable, but is sensitive to profits and real estate default risk to a certain extent.

The results obtained from two methodological approaches: panel regression using the two-step System GMM and the PVAR model combined with the Granger causality test, provide consistent evidence of a negative impact of default risk in the real estate sector on bank profitability and financial stability. Furthermore, there is a bidirectional and positive causal relationship between profitability and bank stability. Additionally, control variables capturing the internal characteristics of banks and macroeconomic conditions exhibit significant effects on operational efficiency and financial stability within the SGMM framework. The consistency of estimation results across both approaches reinforces the robustness and reliability of the study's findings.

5. Conclusion and Implications

This study aims to assess the impact of default risk in the real estate sector on the performance and financial stability of 35 Vietnamese commercial banks over the period 2007–2022. Bank performance is measured by return on assets (ROA), while financial stability is assessed using the Z-score. Real estate default risk is captured by the X-score, calculated based on the Zmijewski [14].

Using a combination of the two-step System GMM regression, the PVAR model, and the Granger causality test, the findings indicate that the average real estate default risk (X-score) is -0.34, reflecting a significant level of risk in this sector. Meanwhile, the mean values of ROA and Z-score are 0.016 and 11.636, respectively, suggesting that Vietnamese commercial banks operate with relatively low risk, stable profitability, and a solid capital base.

The regression results confirm that real estate default risk exerts a negative impact on both bank profitability and financial stability. Furthermore, there exists a bidirectional causal relationship between profitability and financial stability within the banking system. In addition, control variables such as Equity, Size, NPL, Tech, Covid-19, GDP, and IFR all exhibit significant effects on both profitability and financial stability, whereas NII has a positive effect only on the financial stability of Vietnamese commercial banks.

The results of this study provide valuable empirical evidence to support policy recommendations for investors, bank managers, and policymakers. To minimize the adverse impact of default risk in the real estate sector on operational efficiency and financial stability, Vietnamese commercial banks should enhance credit risk management for real estate enterprises, ensure the alignment between funding and lending maturities, strengthen risk management capacity, develop early warning systems, increase equity capital, address non-performing loans, improve credit quality, modernize banking technologies, and diversify income sources.

For real estate enterprises, it is essential to proactively undertake comprehensive restructuring efforts, diversify funding sources, reorganize asset portfolios, prioritize the implementation of highly feasible projects, complete legal documentation, and promote project transfers to maintain liquidity.

From the government's perspective, it is crucial to implement coordinated measures to address legal obstacles in real estate projects, stabilize the corporate bond market, unlock credit flows, and support enterprises in enhancing liquidity and

meeting debt repayment obligations. Additionally, promoting economic growth while maintaining inflation control and conducting monetary policy in a flexible and consistent manner will contribute to strengthening macroeconomic stability and increasing the resilience of the financial and banking system.

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