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The Effect of Lending Structure Concentration on Credit Risk: The Evidence of Vietnamese Commercial Banks

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Abstract

This paper examines whether lending structure can lower credit risk by employing econometric techniques of panel data for the Vietnamese banking system at the bank level used by economic sectors from 2011 to 2016. New light is being shed on assessing the impact of each industry's debt outstanding on credit risk. Adopting findings from previous studies, we assess credit risk from two different sources, including loan loss provision and non-performing loan. Moreover, we also focus on observing lending structure in many different aspects, from concentrative levels to the short-term and long-term stability levels of lending structure. The Generalized Method of Moments (GMM) estimator was applied to analyze the relationship between concentration and banking risks. In general, the results show that lending concentration may decrease credit risk. It is interesting to observe that the Vietnamese commercial bank lending portfolios have, on average, higher levels of diversity across different sectors. In particular, the increase in hotel and restaurant lending contributes to decrease credit risk while the lending portfolios of banks in agriculture, electricity, gas and water increase credit risk. This study suggests the need for further analysis and research about portfolio risks in lending activities for maintaining efficiency and stability in the commercial banking system.

Keywords : Financial Economics, Lending Structure, Bank Risks, Credit Risks, Commercial Banks.

JEL Classification Code: G21, G23, G32, H21

1. Introduction

The subject of bank risks is an important issue that was re-emphasized during the financial crisis of 2007. It forces banking systems to face major challenges in the form of increased bank risks, concentration, and restructuring. Therefore, examining the sources of bank risks (Tran & Nguyen, 2020) is essential for bank regulators and investors. Many notable exposures have triggered a lot of research to investigate the lending structure to reduce bank risks. Importantly, most researchers have put the focus on developed markets (Bassett, Demiralp, & Lloyd, 2020; Rossi, Schwaiger, & Winkler, 2009; van der Veer & Hoeberichts, 2016) where banks are at a mature development stage or in Islamic countries (Abdul-Rahman, Sulaiman, & Mohd Said, 2018; Rahman, 2010) where banks are operating in a different type of markets. In contracts, banks in emerging markets are currently at an earlier stage of development and bank risk is not a priority.

Similar to many emerging markets, the Vietnamese equity market is small and fragile to even minor shocks (Vo, 2015). Because of this, Vietnam is considered a bank-based economy where most of the firm financing is from bank credit (Vo, 2017). In other words, loans are the most important types of assets that banks hold. In these conditions, Vietnamese banking specialists claim that credit has been growing, reaching nearly 20 percent in the last three years (Vietnamnet, 2017). However, according to data published by the State Bank Vietnam, Vietnamese market banks continue to grapple with growing credit exposure, reporting that credit exposure in the banking system was only 3.5% (USD4 billion) as of 30 June 2011. Bank exposure due to the problematic real-estate sector and securities sector accounted for 12% (USD12 billion) of the total loan book of the banking system. High sector concentration in lending

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portfolios arises from excessive exposure to a single sector or several highly correlated sectors. Some international institutions such as the World Bank and the International Monetary Fund are concerned that rapid bank loans with high sector concentration in Vietnam would bring high risks to the economy. This issue highlights the high level of risks in Vietnamese bank portfolios in the context of increased risk-taking by banks.

This paper contributes to the literature on several fronts. Firstly, it extends the current literature by providing more explanation for the issue of credit risk by critically reviewing previous studies (Onyiriuba, 2016; Rahman, 2010; Rossi et al., 2009; Tabak, Fazio, & Cajueiro, 2011). Also, a large set of risks are taken into consideration while being compared with those by Rahman (2010), Acharya, Hasan, and Saunders (2006) and Chen, Wei, and Zhang (2013). Besides, more robustness and reliable results in the relationship between lending structure concentration and credit risk can be produced with the use of different measures explaining credit risk. Finally, yet importantly, the number of indicators representing concentration was used to explore lending structures. The specialization index in the paper, similarly to the Herfindahl-Hirschman Index, is the most utilized concentration measure in the field of industrial organization. Especially, in this study, lending composition change index and variance of traditionality index were used, allowing for the examination of short-term and medium-term stabilities in the lending structure. More importantly, the effect of sector concentration in loan portfolios on credit risk was also highlighted. Therefore, it can be stated that there is a positive correlation between concentration measures and reliability of the results.

In the current bank risk-related literature, the relationship between concentration and credit risk has been theoretically highlighted. For example, concentration in economic sectors decreases credit risk and enhances banking efficiency (Rossi et al., 2009). Meanwhile, the impact of lending structure concentration in economic sectors on the bank risk in Malaysian commercial banks in the short term, medium term and long term is carefully noted by Rahman (2010). In addition, Tabak et al. (2011) suggested that lending structure concentration in economic sectors has contributed to the increase in profits and the reduction in credit risk for the Brazilian commercial banking system. Moreover, the influential intensity negatively affected banks' focus on lending structures by scale or in the form of ownership, especially after the world financial crisis. Therefore, the impact of lending structure concentration on credit risk, considering the short-term, as well as long-term impacts on commercial banks, needs to be assessed. However, these issues have not been addressed to any extent in the context of the Vietnamese banking system. In addition, the consideration of specific impacts of economic sectors on credit risk needs to identify the sectors on which banks should place more focus, underlying the important role in developing banks' business strategies. Therefore, this study is expected to provide empirical evidence on the impact of a lending strategy on bank risks.

2. Literature Review

2.1 Lending Structure Concentration

The traditional banking theory suggests that banks should diversify their loan portfolios in order to reduce credit risks. This theoretical suggestion also corresponds to the portfolio theory by Markowitz (1959). Grounded on the theory of asymmetric information, Diamond (1984) states that diversification allows banks to transform monitored debt into unmonitored debt because every concentrated bank would be more vulnerable to economic downturns when they expose themselves to few sectors. Moreover, the increased diversification efforts in terms of industry and sizes of the borrowing companies lead to lowering future provisions, which could result in a reduction of realized risks (Berger & DeYoung, 1997; Rossi et al., 2009).

Furthermore, the view that firms concentrate their activities in a specialized sector for comparative benefits because diversification can result in increasing competition, making diversification strategies less attractive, is supported by the theory of corporate finance (Acharya et al., 2006; Behr, Kamp, Memmel, & Pfingsten, 2007; Kahn & Winton, 2004; Tabak et al., 2011). Acharya et al. (2006) find that, for a high-risk bank, loan expansion to new industries usually results in riskier loans. By using the seasonal data of borrowers for determining the degree of diversification in bank credit portfolios, Behr et al. (2007) empirically support this view, stating that specialized banks have lower relative loan loss provisions and lower shares of non-performing loans. More recently, Silva, Alexandre, and Tabak (2018) highlight empirical evidence supporting the claim that more diversified portfolios of banks would contribute to higher sector risk levels. In the same vein, in Vietnam, Batten and Vo (2015) note that bank diversification may also be associated with higher risks. Although a few investigations have been conducted into banks in Vietnam, this effect should need to be more intensively examined.

2.2 Credit Risks

Policymakers and supervisors who are responsible for maintaining financial stability focus on credit risks (Haq & Heaney, 2012; Stiroh, 2004). It is also assumed that bank concentration has a negative effect on growth in financially dependent industries (Diallo, 2017). By examining the effect of lending structure concentration on credit risks (Acharya et al., 2006; Tabak et al., 2011) the researchers show evidence that non-performing loans can be reduced by loan portfolio concentration. In addition, Acharya et al. (2006) point out two reasons to explain why an increase in diversification might also raise the risk of bank loan portfolios. The first reason is that banks may suffer from lower monitoring efficiency if they expose their loans to new sectors. The second reason is that diversification can lead to increasing a bank's scope, subjecting it to scale inefficiencies.

In Vietnam, the number of studies have focused on diversification (Batten & Vo, 2016; Vo, 2017). For example, Batten and Vo (2016) investigated risk shifting in commercial banks in the emerging market where banks fund domestic asset portfolios almost exclusively from deposits and with the limited issuance of securities. The findings support the importance of linking deregulation with financial market openness and transparency to enhance and stimulate international portfolio investments. In additions, Vo (2017) investigated how the stock market values bank diversification within the social context, stating that there is a negative relationship between bank diversification and stock market valuation. However, there are no published findings on lending structure concentration and bank risks, which is specific to Vietnam's banking settings.

2.3 The Relationship between Lending Structure Concentration and Credit Risks

The number of studies suggests that concentration not only reduces risks, but also decreases the greater risk for banks. For example, Acharya et al. (2006) find that diversification does not bring superior and safer performance for banks, whereas concentration takes advantages of favorable conditions in one existing industry instead of new industries. Tabak et al. (2011) also find that a focus on credit portfolios increases bank efficiency and reduces loss rates. However, Rahman (2010) argues that concentration into the number of industries such as real-estate in the portfolio may lead to an increase in loan losses dues to the effects of banking risks. Showing the same tendency, Blasko and Sinkey (2006) suggest that lending structure concentration in the real-estate industry can lead to many difficulties in managing interest rate risks. In addition, Diallo (2017) provides evidence that lending structure concentration has an adverse impact on the development of the financial-dependent industry. Overall, these studies show that diversification is significantly related to banking risks both positively and negatively. In this study, the positive effect of lending structure concentration is expected on the banking risks.

H1: There exists a negative relationship between concentration of lending structure and the credit risks.

Moreover, Onyiriuba (2016) classifies an asset by its maturity. Therefore, strategies to diversify bank credit portfolios need to be considered not only in short terms, but also in a longer vision. Unsurprisingly, the State Bank of Vietnam adjusts its monetary policy. For example, when the State Bank lowers lending rates for some government-oriented industries, commercial banks can obtain lower profits than those in other sectors. Consequently, some banks tend to lower credit standards for some industries causing the lending structure to be riskier in the future. Therefore, maintaining the strategy of lending structure concentration over the medium and long-term can make banks more vulnerable to unpredictable macroeconomic fluctuations.

H2: There exists a positive relationship between short-term stability in lending composition and credit risks.

H3: There exists a positive relationship between lending composition change in the variance of traditionality in the medium and/or long term and credit risks.

3. Model and Estimation Methods

3.1 Model

The economic approach is similar to those of Abdul-Rahman et al. (2018), Chen et al. (2013), Tabak et al. (2011), Luong, Nguyen, and Nguyen (2020). An estimation which consists of the Generalized Method of Moments (GMM) estimators is proposed as in the following equation

$$Y = b0 + b1X + b2TL + b3TE + b4INV + b5LTA + b6NONII + b7GDP + b8INTEXP + \varepsilon, \quad (1)$$

where Y represents credit risk with the four measures including two measures of credit risk, and X respectively is outstanding loans by economic sectors (RISKY1, RISKY2, RISKY3, RISKY4, RISKY5, RISKY6, RISKY7, RISKY8, RISKY9), Lending concentration (SPEC), Lending composition change (LCC) and Variance of traditionality index (VART).

ε is the error term

3.2. Variable Description

3.2.1. Dependent Variable – Credit Risk

Following the approach of Ozili and Outa (2017), credit risks and the ratio of total loan loss provisions to total loan are identified at the end of the fiscal year. Besides, the ratio of loan loss provisions (LLP) to total loan is usually a measure of expected credit risk; the paper also considers other measures of unexpected credit risks measured as the standard deviation of non-performing loan ratio (STDNPL) (Acharya et al., 2006).

3.2.2. Independent Variables

Depending on the matching of bank portfolio structure, and similar to Kildegaard and Williams (2002), Nepp, Lavysh, Kuprina, and Nikonov (2012) and Chen et al. (2013), in this study, nine industries were selected.

Risky sector (RISKY)

Attempts were made at studying the impact of sector concentration in loan portfolios on credit risk. Slightly different to Nepp et al. (2012), this study used nine lending measures such as wholesale and retail trade ($RISKY_1$); agriculture ($RISKY_2$); mining and quarrying ($RISKY_3$); manufacturing ($RISKY_4$); electricity, gas and water ($RISKY_5$); transport and communications ($RISKY_6$); construction and real estate ($RISKY_7$); hotels and restaurant ($RISKY_8$); other community, social and personal services ($RISKY_9$).

Lending concentration (SPEC)

Similar to Berger, Minnis, and Sutherland (2017) and Dao and Nguyen (2020), SPEC is constructed as in this equation

$$SPEC_{i,t} = \sum_{i=1}^{9} S_{jit}^2 \tag{2}$$

where Sj,i, t is the amount of annual lending of sector j of bank i in year t. A score approaching 1 indicates the high level of lending concentration while a score approaching 0 indicates a high level of diversity in loan portfolios across different sectors.

Lending composition change (LCC)

LCC refers to the short-term stability in the lending composition. LCC is generated by using the equation

$$LCC_{i,t} = \sum_{j=1}^{9} \min(S_{j,i,t}, S_{j,i,t-1}) \tag{3}$$

where $S_{j,i,}$ and $S_{j,i,\ t-1}$ are the contribution to the amount of annual lending of bank i industry j in year t and t-1. It takes a maximum value of 1 if there is no change in the composition of the lending and the minimum value of 0 if the portfolio of lending through financial sectors is not given in the previous year. Therefore, a high LCC value indicates the short-term stability of the lending composition.

Variance of traditionality index (VART)

VART represents the stability of the medium-term lending structure. It is the variance of traditionality index (TI) that is calculated by using three-year intervals for each of the sectors involved. TI for 2011 is calculated using the data from 2010 to 2012, while TI for 2012 uses the 2011-2013 data. In order to optimize observations with data particularly, this study chose three years intervals for calculating TI. The formula for TI is as in this equation

$$TI_{j,i,t} = \frac{\sum_{t=t-1}^{t=t+1} C_{j,i,t}}{3} \tag{4}$$

where accumulated lending for each industry, $C_{i,j,t}$, is constructed as the following equation

$$C_{j,i,t} = \frac{e_{j,i,t}}{\sum_{t=t_0}^{t_1} e_{j,i,t}} \tag{5}$$

where t_0 and t_1 are the beginning and end of the period for the data, and *ej,i,t* is lending sector j of bank i in year t. VART is the variance of the entire TI, showing different lending patterns in the following 3 years.

3.2.3. Control Variables

Our control variables were selected based on the bank-specific effects. As suggested by the literature, credit risk is driven by certain bank characteristics identified. Among those, LTA is the logarithm of the bank total assets at the end of the fiscal year. TL is the ratio of total loan to total asset at the end of the fiscal year. TE measures the financial strength, calculated as total equity divided by total asset. INTEXP and NONII are the ratios of income structures evaluating the effect of non-interest and interest activities on the trade-off in a bank's profitability and risk, calculated as interest expenses divided by total asset and noninterest expense divided by total asset at the year end respectively. INV is the proportion of investment except for bank loans to total asset. In the context of high competition, bank investment plays an important role in increasing bank profitability because banks generate more profits through finance diversity.

With regards to macroeconomic factor, the GDP is measured by the growth of Gross Domestic Product. GDP is commonly used as an indicator of the economic health of a country and this variable may be a key proxy of bank studies to measure the demand for banking services such as deposits and loans.

3.3 Data

Ten traded commercial banks in Vietnam over the period from 2011 to 2016, listed in the Ho Chi Minh City and Hanoi stock exchanges were first examined. For measuring VART, data of two additional years (2010 and 2017) for sector loans from financial statements were obtained because several variables used in our analyses were calculated by three-year intervals.

4. Empirical Results

The descriptive statistics of our sample are presented in Table 1. In particular, the number of observations, mean, standard deviation, and minimum, maximum for two samples with dependent and independent variables a year from 2011 to 2016 is reported in Table 1. The descriptive statistics were conducted to examine the statistical characteristic of each variable in the model. Mean value refers to the average value of the variables for the entire sample.

Before conducting panel regression estimations, correlation analysis was run to ensure the data are free from severe multicollinearity issue. Table 2 shows the correlation matrix between the dependent variables and independent variables. In general, the coefficient correlations for all variables are < 0.8, conjecturing that multicollinearity problem is not severe for the data sets.

The GMM estimation (Arellano & Bover, 1995) was applied to analyze the relationship between concentration and banking risks of eight Vietnamese commercial banks in the period from 2011 to 2016. The estimations have passed the Sargan and Hassan tests on the limit of over-determination and accepted the hypothesis of H0 in the Arellano-Bond test of the autocorrelation phenomenon. Therefore, the estimated results are reliable (sees Table 3 and Table 4).

Table 1: Summary statistics of all variables over the period 2011-2016

Variable	Obs	Mean	Std. Dev.	Min	Max
LLP	48	0.0135	0.0047	0.0080	0.0254
STDNPL	48	0.1155	0.2398	0.0050	0.7425
$RISKY_1$	48	0.2041	0.0868	0.0027	0.3574
$RISKY_2$	48	0.0616	0.0601	0.0000	0.2250
$RISKY_3$	48	0.0276	0.0272	0.0000	0.0918
$RISKY_4$	48	0.1904	0.1005	0.0194	0.3699
$RISKY_5$	48	0.0414	0.0350	0.0000	0.1185
$RISKY_6$	48	0.0379	0.0216	0.0089	0.1003
$RISKY_7$	48	0.1442	0.0902	0.0430	0.3824
$RISKY_8$	48	0.0143	0.0085	0.0006	0.0301
$RISKY_9$	48	0.2784	0.1947	0.0356	0.7511
LCC	48	0.9166	0.0629	0.6863	0.9824
SPEC	48	0.2534	0.1045	0.1447	0.5798
VART	48	0.0527	0.0362	0.0000	0.1291
TL	48	0.5685	0.0977	0.3600	0.7000
TE	48	0.0818	0.0213	0.0426	0.1476
INV	48	0.1528	0.0504	0.0691	0.2769
LTA	48	12.177	0.888	9.980	13.760
NONII	48	0.0031	0.0025	0.0000	0.0086
GDP	48	5.8683	0.5367	5.0300	6.6800
INTEXP	48	0.0513	0.0176	0.0236	0.0873

Note: Variable definitions STDNPL= the standard deviation of non-performing loan ratio, LLP = the ratio of loan loss provisions to total loans, RM = market risk, RSS = idiosyncratic risk, $RISKY_1$ (trade), $RISKY_2$ (agriculture), $RISKY_3$ (mining), $RISKY_4$ (manufacturing), $RISKY_5$ (electricity), $RISKY_6$ (transport), $RISKY_7$ (con-real estate), $RISKY_8$ (transport), $RISKY_9$ (other), LCC = Lending composition change, SPEC = Lending concentration, VART = variance of traditionality index, TL = total loan/total asset, TE = total equity/total asset, INV = investment/total asset, LTA = logarithm of total assets, NONII = non-interest/total income, GDP = growth of Gross Domestic Product, INTEXP = interest/total income.

Table 2: Correlation matrix for all banks

	LLP	**STDNPL**	**$RISKY_1$**	**$RISKY_2$**	**$RISKY_3$**	**$RISKY_4$**
LLP	1					
STDNPL	0.2049	1				
$RISKY_1$	0.3161	0.1688	1			
$RISKY_2$	-0.1138	-0.1087	-0.2653	1		
$RISKY_3$	0.4925	0.1544	0.3439	0.2642	1	
$RISKY_4$	0.4630	0.0163	0.5326	-0.1390	0.5884	1
$RISKY_5$	0.2042	0.4155	0.4632	0.0334	0.5022	0.3882
$RISKY_6$	0.2339	0.6306	0.0117	-0.1295	0.4014	0.1728
$RISKY_7$	-0.0434	0.0147	-0.5401	0.3075	-0.0828	-0.3003
$RISKY_8$	-0.3656	-0.3926	0.2534	0.0047	0.1298	0.0435
$RISKY_9$	-0.4405	-0.2062	-0.5324	-0.2901	-0.7810	-0.7451
LCC	0.0353	-0.0763	0.2430	0.0172	0.0362	0.2157
SPEC	-0.2266	-0.2813	-0.5276	-0.4516	-0.6024	-0.4884
VART	0.0150	-0.0328	-0.3242	-0.0930	-0.3881	-0.2325
TL	0.3102	-0.2957	0.1606	0.0038	-0.0068	0.2912
TE	0.0246	0.0870	-0.3863	-0.0989	-0.2232	-0.1641
INV	0.0714	0.4752	0.0640	-0.4111	-0.0615	0.0033
LTA	0.3307	-0.0167	0.7742	-0.1124	0.4366	0.7367
NONII	0.2151	0.4891	0.6905	-0.6105	0.1386	0.3758
GDP	-0.2752	0.0038	0.0522	-0.0472	-0.1655	-0.1556
INTEXP	0.2620	-0.2392	-0.2561	0.1520	-0.0830	-0.1313

Table 2: Correlation matrix for all banks (next)

	$RISKY_6$	**$RISKY_7$**	**$RISKY_8$**	**$RISKY_9$**	**LCC**	**SPEC**	**VART**
$RISKY_6$	1						
$RISKY_7$	-0.0033	1					
$RISKY_8$	-0.0527	-0.1949	1				
$RISKY_9$	-0.2530	-0.0948	-0.1071	1			
LCC	-0.2869	-0.4209	-0.1799	-0.0251	1		
SPEC	-0.1967	-0.1063	-0.2292	0.8848	-0.0026	1	
VART	-0.0609	0.0737	-0.3140	0.4045	-0.0596	0.3877	1
TL	-0.3306	-0.0729	-0.2604	-0.1130	0.4431	-0.0113	-0.1538
TE	0.1089	-0.1603	-0.3317	0.4066	0.1071	0.4376	0.3044
INV	0.2494	0.1446	-0.0193	0.0071	-0.2906	-0.0454	-0.0408
LTA	-0.0942	-0.2096	0.1763	-0.7292	0.3499	-0.6137	-0.5111
NONII	0.3454	-0.6409	0.0284	-0.1649	0.1688	-0.1069	-0.2043
GDP	-0.0070	0.2047	0.1210	0.0155	-0.1152	-0.0426	-0.2805
INTEXP	-0.0534	-0.0549	-0.1660	0.2341	-0.0998	0.2610	0.5009

Table 2: Correlation matrix for all banks (next)

		TL	**TE**	**INV**	**LTA**	**NONII**	**GDP**	**INTEXP**
TL		1						
TE		0.0767	1					
INV		-0.1766	-0.1304	1				
LTA		0.4208	-0.4808	-0.0051	1			
NONII		0.0146	-0.0834	0.3006	0.4209	1		
GDP		0.2052	-0.2892	0.1590	0.1669	0.0502	1	
INTEXP		-0.0930	0.3269	-0.4118	-0.4203	-0.2911	-0.6884	1

Table 3: Relationship between credit risks (measured by LLP) and lending structure concentration by GMM model in period 2011-2016

	X*					
	$RISKY_1$	**$RISKY_2$**	**$RISKY_3$**	**$RISKY_4$**	**$RISKY_5$**	**$RISKY_6$**
X*	0.0424**	0.0350***	0.1653**	0.0434**	0.0845*	0.1797***
	(0.020)	(0.012)	(0.073)	(0.020)	(0.047)	(0.053)
L.LLP	-0.7764***	0.1067	-0.6461*	-0.8999**	-0.2937	-0.2262
	(0.214)	(0.247)	(0.374)	(0.365)	(0.438)	(0.201)
NONII		1.8182***		-0.0520		1.1162**
		(0.440)		(1.275)		(0.529)
INTEXP	0.3484***	0.2111***	0.1594***	0.2324**	0.1911***	0.2456***
	(0.060)	(0.034)	(0.061)	(0.114)	(0.053)	(0.028)
TL			0.0220	0.0294	0.0202	0.0518**
			(0.023)	(0.022)	(0.019)	(0.021)
L.TL	0.0420**					
	(0.019)					
TE						
INV	0.0092		0.0069			
	(0.033)		(0.032)			
GDP		0.0018				
		(0.001)				
L.GDP					0.0009	
					(0.001)	
Constant	-0.0266	-0.0174	-0.0040	-0.0107	-0.0130	-0.0356***
	(0.018)	(0.012)	(0.019)	(0.013)	(0.009)	(0.011)
Observations	40	40	40	40	40	40
Number of idbank	8	8	8	8	8	8
Wald test	Wald chi2(5) = 94.08 Prob > chi2 = 0.000	Wald chi2(5) = 347.15 Prob > chi2 = 0.000	Wald chi2(5) = 493.23 Prob > chi2 = 0.000	Wald chi2(5) = 28.38 Prob > chi2 = 0.000	Wald chi2(5) = 54.50 Prob > chi2 = 0.000	Wald chi2(5) = 1954.43 Prob > chi2 = 0.000
Endogenous variables	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)
Instrument variables	L. $RISKY_1$	L. $RISKY_2$	L. $RISKY_3$	L. $RISKY_4$	L.LTA	L. $RISKY_6$
Number of instruments	8	8	8	8	8	8

	X*					
	$RISKY_1$	$RISKY_2$	$RISKY_3$	$RISKY_4$	$RISKY_5$	$RISKY_6$
Arellano-Bond test	**Arellano-Bond test for AR(1) in levels:**					
	z = 1.82 Pr > z = 0.069	z = 1.82 Pr > z = 0.069	z = 1.37 Pr > z = 0.170	z = 1.67 Pr > z = 0.095	z = 1.57 Pr > z = 0.117	z = 1.56 Pr > z = 0.118
	Arellano-Bond test for AR(2) in levels:					
	z = 1.72 Pr > z = 0.085	z = 1.46 Pr > z = 0.144	z = 1.30 Pr > z = 0.194	z = 1.40 Pr > z = 0.161	z = 1.29 Pr > z = 0.196	z = 0.93 Pr > z = 0.353
Sargan test of overid	**Sargan test of overid. restrictions:**					
	chi2(2) = 0.56 Prob > chi2 = 0.757	chi2(2) = 8.70 Prob > chi2 = 0.013	chi2(2) = 0.21 Prob > chi2 = 0.902	chi2(2) = 0.62 Prob > chi2 = 0.735	chi2(2) = 3.39 Prob > chi2 = 0.184	chi2(2) = 1.02 Prob > chi2 = 0.601
Hansen test of overid	**Hansen test of overid. restrictions:**					
	chi2(2) = 0.22 Prob > chi2 = 0.897	chi2(2) = 5.33 Prob > chi2 = 0.070	chi2(2) = 0.15 Prob > chi2 = 0.926	chi2(2) = 0.49 Prob > chi2 = 0.782	chi2(2) = 1.77 Prob > chi2 = 0.413	chi2(2) = 1.18 Prob > chi2 = 0.555
Hansen test of overid	**Difference-in-Hansen tests of exogeneity of instrument subsets:**					
	Hansen test excluding group:					
	chi2(1) = 0.04 Prob > chi2 = 0.833	chi2(1) = 3.28 Prob > chi2 = 0.070	chi2(1) = 0.10 Prob > chi2 = 0.753	chi2(1) = 0.32 Prob > chi2 = 0.572	chi2(1) = 0.03 Prob > chi2 = 0.868	chi2(1) = 0.12 Prob > chi2 = 0.731
	Difference (null H = exogenous):					
	chi2(1) = 0.17 Prob > chi2 = 0.677	chi2(1) = 2.05 Prob > chi2 = 0.152	chi2(1) = 0.05 Prob > chi2 = 0.815	chi2(1) = 0.17 Prob > chi2 = 0.678	chi2(1) = 1.74 Prob > chi2 = 0.187	chi2(1) = 1.06 Prob > chi2 = 0.304

Table 3: Relationship between credit risks (measured by LLP) and lending structure concentration by GMM model in period 2011-2016 9 (next)

	$RISKY_7$	$RISKY_8$	$RISKY_9$	LCC	SPEC	VART
X*	-0.0395*	-0.2281**	-0.0208***	0.0425*	-0.0245**	-0.0577***
	(0.021)	(0.114)	(0.006)	(0.025)	(0.010)	(0.020)
L.LLP	0.0589	-0.1469	-0.4728**	-0.4386	-0.4890**	0.3041
	(0.359)	(0.205)	(0.199)	(0.288)	(0.243)	(0.237)
NONII		0.9085***	0.6234	0.0566	1.0053	1.8186***
		(0.281)	(0.519)	(0.691)	(0.612)	(0.363)
INTEXP	0.3562***	0.2029***	0.2008***	0.2468***	0.2827***	0.4364***
	(0.114)	(0.060)	(0.056)	(0.057)	(0.056)	(0.085)
TL			0.0244*		0.0350*	
			(0.014)		(0.021)	
L.TL						
TE	-0.2856**					
	(0.137)					

	$RISKY_7$	$RISKY_8$	$RISKY_9$	LCC	SPEC	VART
INV						
GDP	0.0025			0.0014		0.0061***
	(0.003)			(0.002)		(0.002)
L.GDP		0.0013*				
		(0.001)				
Constant	0.0097	-0.0021	-0.0000	-0.0412	-0.0104	-0.0505***
	(0.021)	(0.009)	(0.007)	(0.033)	(0.011)	(0.017)
Observations	40	40	40	40	40	40
Number of idbank	8	8	8	8	8	8
Wald test	Wald chi2(5) = 24.46 Prob > chi2 = 0.000	Wald chi2(5) = 492.59 Prob > chi2 = 0.000	Wald chi2(5) = 36.78 Prob > chi2 = 0.000	Wald chi2(5) = 56.27 Prob > chi2 = 0.000	Wald chi2(5) = 33.70 Prob > chi2 = 0.000	Wald chi2(5) = 127.52 Prob > chi2 = 0.000
Endogenous variables	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)
Instrument variables	L.ROA	L. $RISKY_8$	L. $RISKY_9$	L.LCC	L.SPEC	L.VART
Number of instruments	8	8	8	8	8	8
Arellano-Bond test	**Arellano-Bond test for AR(1) in levels:**					
	z = 1.81 Pr > z = 0.071	z = 2.43 Pr > z = 0.015	z = 1.96 Pr > z = 0.050	z = 1.53 Pr > z = 0.126	z = 1.79 Pr > z = 0.074	z = 1.96 Pr > z = 0.050
	Arellano-Bond test for AR(2) in levels:					
	z = 1.67 Pr > z = 0.096	z = 1.68 Pr > z = 0.093	z = 1.45 Pr > z = 0.147	z = 1.39 Pr > z = 0.163	z = 1.57 Pr > z = 0.117	z = 0.35 Pr > z = 0.727
Sargan test of overid	**Sargan test of overid. restrictions:**					
	chi2(2) = 0.90 Prob > chi2 = 0.639	chi2(2) = 4.88 Prob > chi2 = 0.087	chi2(2) = 1.18 Prob > chi2 = 0.555	chi2(2) = 3.22 Prob > chi2 = 0.20	chi2(2) = 0.86 Prob > chi2 = 0.650	chi2(2) = 0.89 Prob > chi2 = 0.642
Hansen test of overid	**Hansen test of overid. restrictions:**					
	chi2(2) = 0.18 Prob > chi2 = 0.915	chi2(2) = 2.69 Prob > chi2 = 0.261	chi2(2) = 1.23 Prob > chi2 = 0.539	chi2(2) = 2.18 Prob > chi2 = 0.336	chi2(2) = 0.96 Prob > chi2 = 0.619	chi2(2) = 0.40 Prob > chi2 = 0.817
Hansen test of overid	**Difference-in-Hansen tests of exogeneity of instrument subsets:**					
	Hansen test excluding group:					
	chi2(1) = 0.05 Prob > chi2 = 0.820	chi2(1) = 2.33 Prob > chi2 = 0.127	chi2(1) = 0.34 Prob > chi2 = 0.559	chi2(1) = 1.24 Prob > chi2 = 0.265	chi2(1) = 0.20 Prob > chi2 = 0.652	chi2(1) = 0.29 Prob > chi2 = 0.588
	Difference (null H = exogenous):					
	chi2(1) = 0.13 Prob > chi2 = 0.723	chi2(1) = 0.36 Prob > chi2 = 0.549	chi2(1) = 0.89 Prob > chi2 = 0.345	chi2(1) = 0.94 Prob > chi2 = 0.333	chi2(1) = 0.75 Prob > chi2 = 0.385	chi2(1) = 0.11 Prob > chi2 = 0.740

Table 4: Relationship between credit risks (measured by STDNPL) and lending structure concentration by GMM model in period 2011-2016

	X*					
	RISKY$_1$	**RISKY$_2$**	**RISKY$_3$**	**RISKY$_4$**	**RISKY$_5$**	**RISKY$_6$**
X*	-0.0677**	0.1030***	-0.9362**	-0.0032**	0.0149*	0.0571
	(0.034)	(0.022)	(0.405)	(0.001)	(0.008)	(0.053)
L.STDNPL	0.9932***	1.0009***	1.1103***	1.0014***	1.0027***	1.0080***
	(0.009)	(0.012)	(0.091)	(0.006)	(0.002)	(0.014)
NONII	3.0419	2.1642			-1.2299***	
	(1.959)	(1.338)			(0.265)	
INTEXP						0.1445*
						(0.088)
LTA			-0.0254**			
			(0.010)			
TL	-0.0123***	-0.0443*	0.0263	-0.0074***		
	(0.005)	(0.026)	(0.106)	(0.002)		
INV	-0.0386					-0.0233
	(0.025)					(0.022)
TE		-0.1391*				-0.1393**
		(0.083)				(0.058)
GDP			-0.0018			
			(0.002)			
Constant	0.0198***	0.0254*	0.3138***	0.0055***	0.0046***	0.0062
	(0.005)	(0.014)	(0.087)	(0.001)	(0.001)	(0.006)
Observations	40	40	40	40	40	40
Number of idbank	8	8	8	8	8	8
Wald test	Wald chi2(5) = 1.41e+06 Prob > chi2 = 0.000	Wald chi2(5) = 46071.13 Prob > chi2 = 0.000	Wald chi2(5) = 1014.85 Prob > chi2 = 0.000	Wald chi2(3) = 70615.73 Prob > chi2 = 0.000	Wald chi2(3) = 3.68e+06 Prob > chi2 = 0.000	Wald chi2(5) = 268592.10 Prob > chi2 = 0.000
Endogenous variables	NONII, lag(3 3)	TL, lag(3 3)	TL, lag(3 3)	TL, lag(3 3	NONII, lag(3 3)	INTEXP, lag(3 3)
Instrument variables	LTA	LTA	L.GDP	L.RISKY4	L.LTA	L.INTEXP
Number of instruments	8	8	8	8	8	8
Arellano-Bond test	**Arellano-Bond test for AR(1) in levels:**					
	z = 0.89 Pr > z = 0.376	z = 1.51 Pr > z = 0.131	z = 1.62 Pr > z = 0.106	z = 0.47 Pr > z = 0.635	z = 0.79 Pr > z = 0.432	z = 0.79 Pr > z = 0.431
	Arellano-Bond test for AR(2) in levels:					
	z = 0.80 Pr > z = 0.425	z = 1.21 Pr > z = 0.228	z = 1.62 Pr > z = 0.106	z = 1.48 Pr > z = 0.138	z = 0.18 Pr > z = 0.860	z = 0.42 Pr > z = 0.671

	X*					
	RISKY$_1$	RISKY$_2$	RISKY$_3$	RISKY$_4$	RISKY$_5$	RISKY$_6$
Sargan test of overid	**Sargan test of overid. restrictions:**					
	chi2(2) = 0.07 Prob > chi2 = 0.963	chi2(2) = 0.50 Prob > chi2 = 0.779	chi2(2) = 2.59 Prob > chi2 = 0.273	chi2(4) = 1.65 Prob > chi2 = 0.800	chi2(4) = 1.23 Prob > chi2 = 0.873	chi2(2) = 1.91 Prob > chi2 = 0.385
Hansen test of overid	**Hansen test of overid. restrictions:**					
	chi2(2) = 1.31 Prob > chi2 = 0.519	chi2(2) = 0.57 Prob > chi2 = 0.752	chi2(2) = 1.81 Prob > chi2 = 0.404	chi2(4) = 1.58 Prob > chi2 = 0.813	chi2(4) = 3.86 Prob > chi2 = 0.425	chi2(2) = 1.87 Prob > chi2 = 0.392
	Difference-in-Hansen tests of exogeneity of instrument subsets:					
	Hansen test excluding group:					
	chi2(1) = 0.05 Prob > chi2 = 0.830	chi2(1) = 0.00 Prob > chi2 = 0.960	chi2(1) = 0.16 Prob > chi2 = 0.685	chi2(3) = 1.57 Prob > chi2 = 0.667	chi2(3) = 1.16 Prob > chi2 = 0.762	chi2(1) = 1.87 Prob > chi2 = 0.171
	Difference (null H = exogenous):					
	chi2(1) = 1.26 Prob > chi2 = 0.261	chi2(1) = 0.57 Prob > chi2 = 0.451	chi2(1) = 1.65 Prob > chi2 = 0.199	chi2(1) = 0.01 Prob > chi2 = 0.929	chi2(1) = 2.70 Prob > chi2 = 0.100	chi2(1) = 0.00 Prob > chi2 = 0.977

Table 4: Relationship between credit risks (measured by STDNPL) and lending structure concentration by GMM model in period 2011-2016 (next)

	X*					
	RISKY$_7$	RISKY$_8$	RISKY$_9$	LCC	SPEC	VART
X*	0.0381**	-0.1375**	-0.0014	-0.0125**	-0.0358**	-0.0132**
	(0.017)	(0.062)	(0.005)	(0.006)	(0.014)	(0.006)
L.STDNPL	0.9970***	0.9911***	1.0024***	1.0021***	1.0846***	1.0066***
	(0.004)	(0.013)	(0.007)	(0.004)	(0.063)	(0.004)
NONII	1.5954*			-0.2594		
	(0.853)			(0.265)		
L.NONII					-7.9578*	
					(4.678)	
INTEXP	0.1069***		0.0789**	0.0832***	-0.1261	0.1683***
	(0.041)		(0.038)	(0.027)	(0.106)	(0.051)
LTA		0.0004	0.0004	0.0016***		
		(0.001)	(0.001)	(0.000)		
TL		-0.0055				
		(0.015)				
INV	-0.0300*	0.0077	0.0078**			-0.0094
	(0.016)	(0.025)	(0.004)			(0.006)
GDP					-0.0012	0.0017**
					(0.001)	(0.001)
Constant	-0.0094**	0.0008	-0.0091	-0.0106	0.0390**	-0.0155**
	(0.005)	(0.011)	(0.015)	(0.008)	(0.017)	(0.006)

	X*					
	RISKY$_7$	**RISKY$_8$**	**RISKY$_9$**	**LCC**	**SPEC**	**VART**
Observations	40	40	40	40	40	40
Number of idbank	8	8	8	8	8	8
Wald test	Wald chi2(5) = 29933.52 Prob > chi2 = 0.000	Wald chi2(5) = 2.08e+06 Prob > chi2 = 0.000	Wald chi2(5) = 310084.55 Prob > chi2 = 0.000	Wald chi2(5) = 32495.57 Prob > chi2 = 0.000	Wald chi2(5) = 415110.83 Prob > chi2 = 0.000	Wald chi2(5) = 29933.52 Prob > chi2 = 0.000
Endogenous variables	INV, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INTEXP, lag(3 3)	INV, lag(3 3)
Instrument variables	L.RISKY8	L.GDP	GDP	ROA	L.GDP	L.RISKY8
Number of instruments	8	8	8	8	8	8
Arellano-Bond test	**Arellano-Bond test for AR(1) in levels:**					
	z = 0.16 Pr > z = 0.874	z = 0.34 Pr > z = 0.736	z = 0.16 Pr > z = 0.872	z = -0.23 Pr > z = 0.821	z = 1.31 Pr > z = 0.189	z = 0.25 Pr > z = 0.805
	Arellano-Bond test for AR(2) in levels:					
	z = 0.17 Pr > z = 0.866	z = 0.47 Pr > z = 0.639	z = 0.96 Pr > z = 0.336	z = 0.26 Pr > z = 0.796	z = 1.28 Pr > z = 0.200	z = 0.92 Pr > z = 0.359
Sargan test of overid	**Sargan test of overid. restrictions:**					
	chi2(2) = 2.35 Prob > chi2 = 0.308	chi2(2) = 1.53 Prob > chi2 = 0.465	chi2(2) = 4.04 Prob > chi2 = 0.133	chi2(2) = 2.83 Prob > chi2 = 0.243	chi2(2) = 1.16 Prob > chi2 = 0.560	chi2(2) = 2.55 Prob > chi2 = 0.280
Hansen test of overid	**Hansen test of overid. restrictions:**					
	chi2(2) = 2.40 Prob > chi2 = 0.301	chi2(2) = 1.46 Prob > chi2 = 0.482	chi2(2) = 3.01 Prob > chi2 = 0.222	chi2(2) = 3.12 Prob > chi2 = 0.211	chi2(2) = 0.88 Prob > chi2 = 0.643	chi2(2) = 3.04 Prob > chi2 = 0.219
	Difference-in-Hansen tests of exogeneity of instrument subsets:					
	Hansen test excluding group:					
	chi2(1) = 2.01 Prob > chi2 = 0.156	chi2(1) = 1.46 Prob > chi2 = 0.227	chi2(1) = 2.76 Prob > chi2 = 0.096	chi2(1) = 2.81 Prob > chi2 = 0.094	chi2(1) = 0.04 Prob > chi2 = 0.846	chi2(1) = 3.04 Prob > chi2 = 0.081
	Difference (null H = exogenous):					
	chi2(1) = 0.39 Prob > chi2 = 0.535	chi2(1) = 0.00 Prob > chi2 = 0.987	chi2(1) = 0.24 Prob > chi2 = 0.622	chi2(1) = 0.31 Prob > chi2 = 0.580	chi2(1) = 0.85 Prob > chi2 = 0.358	chi2(1) = 0.00 Prob > chi2 = 0.968

For this sample, estimations were separately run for different independent variables (measured by RISKY1, RISKY2, RISKY3, RISKY4, RISKY5, RISKY6, RISKY7, RISKY8, RISKY9, SPEC, LCC, VART). It is found that most of the coefficients for the main independent variables focusing on two measures of credit risks are statistically significant.

It is evident that the impacts of loan portfolio concentration vary across economic sectors. It is interesting to observe that there are significant positive correlations between variables (RISKY2, RISKY5, respectively) with LLP and STDNPL. This provides strong evidence to argue that an increase in bank lending for the agriculture, electricity, gas and water contributes to the bank's exposures to credit risks. Meanwhile, the negative relationship of RISKY8 with both LLP and STDNPL is noted, suggesting that bank lending concentration into hotels and restaurants reduces credit risk. However, this result shows that variables RISKY1, RISKY3, RISKY4, RISKY7 and LCC have a negative correlation with STDNPL, but a positive correlation with LLP.

More importantly, it is also pointed out that the coefficient of SPEC and VART is negative and significant with LLP and STDNPL. That means an increase in bank lending concentration in certain economic sectors reduces credit risk. This is consistent with the findings of Acharya et al. (2006).

The finding from the lagged control variables (L.LLP and L.STDNPL) also shows that credit risk in the previous year impacts credit risk in the current year. In addition, the positive impact of non-interest income (measured by NONII) on STDNPL and LLP suggests that low levels of non-interest income are risk-reducing (Lepetit, Nys, Rous, & Tarazi, 2008). Therefore, non-interest income may increase the volatility of banking income because lending operations need lower operating leverage than fee collection activities (DeYoung & Roland, 2001).

The coefficient of INTEXP, STDNPL and LLP are positively significant in almost all models. This result suggests that credit-expanding strategies are considered less risky. However, this result is contradictory to the findings of Lepetit et al. (2008) and Stiroh (2004), suggesting that greater reliance on non-interest income is associated with higher risk and lower risk-adjusted profit. It implies that the banks play a key role in Vietnam's financial market. And it mainly focuses on mobilizing deposits and making loans.

Meanwhile, it is noted that there is a positive relationship between variables (RISKY2, RISKY4, RISKY6, RISKY7, RISKY8 and RISKY9) and RSS, suggesting that a decrease in lending in agriculture, manufacturing, transport and communication, construction and real estate, hotels and restaurants, and other community reduces credit risk.

5. Conclusion

The study applies the GMM estimation method to assess the impact of concentrated loan structure on credit risks of Vietnamese commercial banks in the period from 2011 to 2016. The results show that commercial banks with a low level of concentration may cause greater credit risk.

Considering the impact of outstanding loans of each economic sector on credit risk, the research results suggest that Vietnam's commercial banks should expand credit for the hotel and restaurant sector. However, credit expansion should be considered with strict restrictions for economic sectors with a high requirement for capital, such as agriculture, electricity, gas and water. This evidence implies the importance of lending concentration in decreasing credit risk. The study also shows that boosting credit growth in economic sectors can reduce bad debts. This implies that the banks should revolve credit quickly by replacing old debts with new ones. However, the growth of outstanding loans is potentially risky, so the growth must rely on credit efficiency. As a result, when banks increase credit balance, they may increase the provision of credit risk.

From the results and policy implications mentioned above, the current paper equips bank managers with a good understanding of lending structure concentration and credit risk to deal with loan expansion and monitoring efficiency when determining credit risk exposure. Moreover, it also provides policymakers with better analyses, which can help them achieve the best possible credit policy transmission mechanism.

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