Could Non-bank Financial Institutions be a Threat to Financial Stability? Evidence from Vietnam

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This study investigates the relationship between the development of non-bank financial institutions (NBFIs) and financial stability in Vietnam. Applying the autoregressive distributed lag (ARDL) approach to the annual data series between 2000 and 2018, our empirical results confirm the positive comprehensive effects of the growing presence of NBFIs on financial stability. Through the breakdown of impacts by each NBFI category, we demonstrate that the asset size of securities, finance and finance leasing firms is positively correlated with stock market volatility, while the expansion of insurance firms is associated with a reduction in both stock market fluctuations and banking system's non-performing loans. A possible explanation for these findings is that the insurance market on the rise tends to supply effective hedging instruments for the stock market and credit insurance products to restrict bad debts for banks.

Key words: *Non-bank Financial Institutions, Financial Stability, Autoregressive Distributed Lag, Vietnam.*

Introduction

During the process of economic reform and transformation, along with banking institutions, there exists another form of financial intermediaries playing an equally crucial role in the process of capital transfer from lenders to borrowers, widely known as 'non-bank financial institutions' (NBFIs). 'Non-bank financial institution' has become a widespread term since the introduction of the Annunzio-Wylie Anti-Money Laundering Act in 1992, which extended the definition of 'financial institutions' as stated in the Bank Security Act (BSA) far beyond the scope of traditional institutions. According to Vietnam's 2010 Law on Credit Institutions, non-bank credit institutions (otherwise known as NBFIs) are organisations that

carry out banking operations, except for taking deposits from public and providing payment services through customers' accounts.

From the traditional perspective in banking and finance, NBFIs consist of securities companies, insurance companies, finance and finance leasing companies and investment funds (Nguyen, 2016). NBFIs are established with a mission to: (1) open up greater opportunities for business entities to seek profits, which could be shared between both sides thanks to the economies of scale, the dispersion of risks and the diversification of portfolios; (2) provide a larger range of financial services, foster competitive pressure with commercial banks, thus providing clients with higher-quality and more diverse options; and (3) fulfill potential needs of individuals, households and businesses in respect to financial investment, hedging and risk diversification.

Over the past few years, the role of banks as financial intermediaries in the developed world has weakened somewhat with the emergence of the NBFIs and debt markets, giving businesses direct access to personal savings (Pham et al., 2019; Pham & Hoang, 2019). The history of world economic development has witnessed financial development initiated from banking institutions, which subsequently became closely linked with NBFIs. Since then, the contribution of the NBFIs to general development appears predominant as compared to what had been achieved before by the banks. In reality, the coexistence of banks and NBFIs appears important and competition between the two could help promote economic development as well as the operating efficiency of these organisations (Hossain & Shahiduzzaman, 2005; Dang & Pham, 2020).

Financial stability is among the most widely discussed issues in modern economics. It was first regarded during the Asian financial crisis in the late 1990s, and became more of a concern during the aftermath of the 2007-2008 financial crisis. However, due to the complexity of the financial system with a diverse range of institutions, infrastructures, participating organisations, products and markets, a globally accepted definition of financial stability has not been reached so far (Kawai & Morgan, 2012). Within the scope of research, this study accepts the European Central Bank's definition of financial stability. Specifically, financial stability is defined as a state in which the formation of systemic risks is prevented. Herein, systemic risk is described as being the risk that the provision of necessary financial products and services of the financial system will be weakened to such an extent that economic growth and welfare will be severely affected. Systemic risk may be derived from three main sources: internal financial imbalances, the boom of financial cycles leading to the amplification of shocks into the economy, or the spread of risks within the financial system between markets, intermediaries and infrastructure.

Figure 1. NBFIs' assets as compared to banking system's assets and GDP
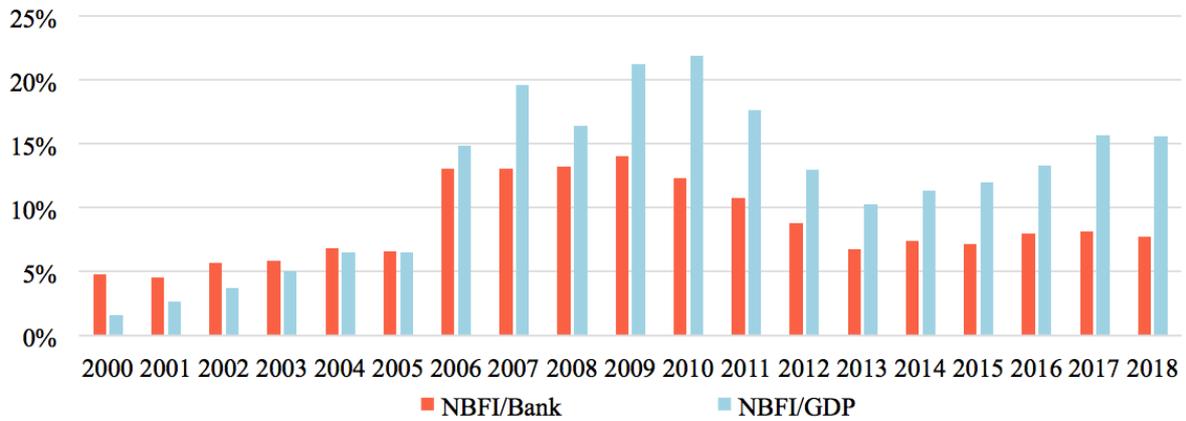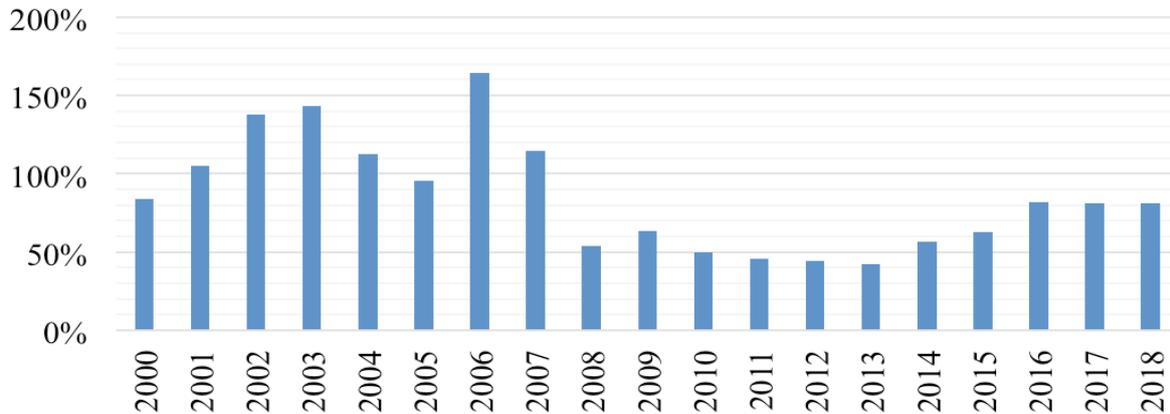

Source: Authors' calculations using data from State Bank of Vietnam and Ministry of Finance of Vietnam.

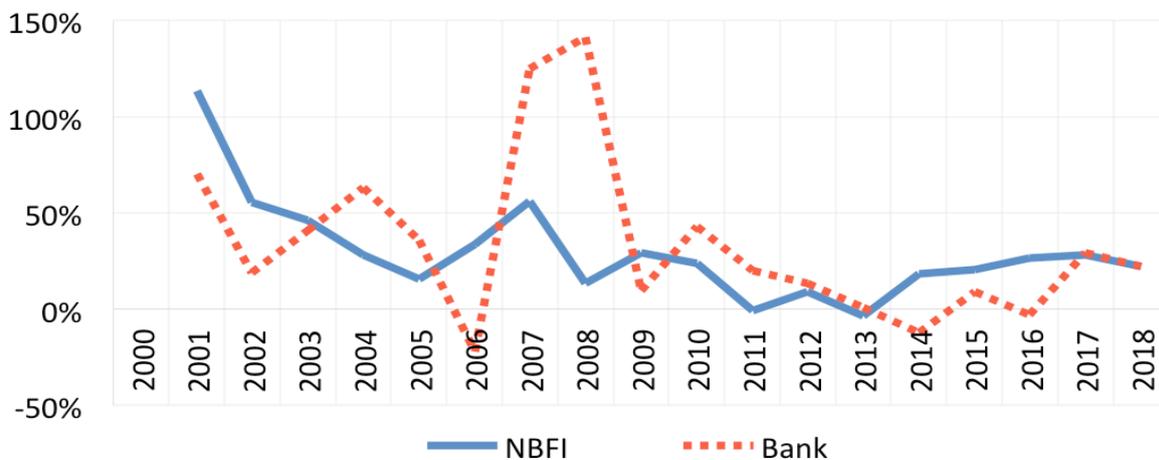**Figure 2.** Assets growth rate of NBFIs and banking system
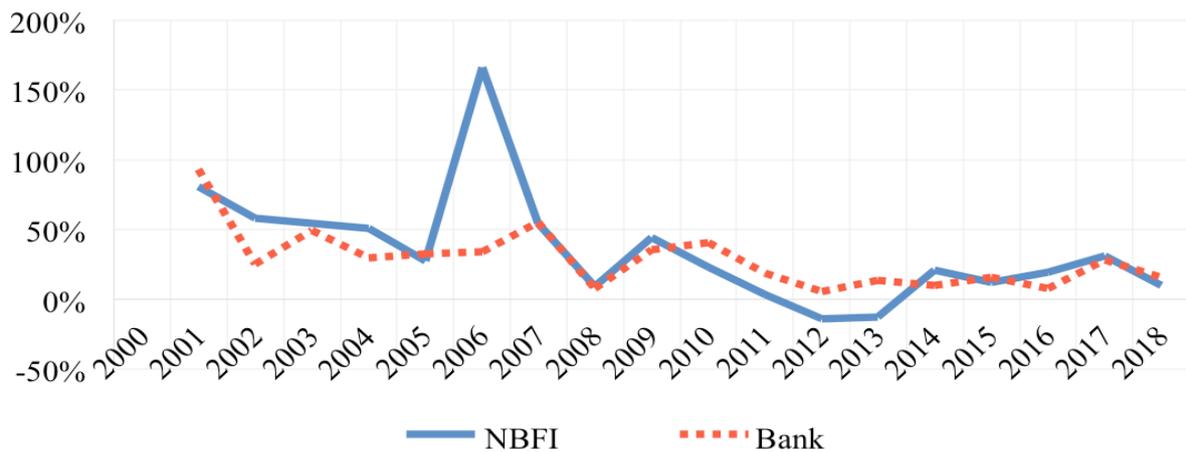
Source: Authors' calculations using data from State Bank of Vietnam and Ministry of Finance of Vietnam.

Figure 3. NBFIs' revenue to banks' revenue

Source: Authors' calculations using data from State Bank of Vietnam and Ministry of Finance of Vietnam.

Figure 4. Revenue growth of NBFIs and banking system

Source: Authors' calculations using data from State Bank of Vietnam and Ministry of Finance of Vietnam.

Current practices during recent years have shown that NBFIs are an important link in causing and transmitting risks, which leads to financial crisis. In order to develop countermeasures to cope with financial crises, policy makers have focused on clarification of the nature and role of NBFIs, as well as the risks derived from their impacts on the stability of the financial system. Previous literature suggests that there exist three risk transmission channels as follows:

First, NBFIs pose product-related risks through the development of structured products, especially securitised ones. The recent financial crisis has clearly indicated that, due to a lack of understanding of the risks associated with securitised assets, a large number of banks and NBFIs had held much riskier assets than their initial expectations.

Second, there is a close linkage between banks and NBFIs. Such linkage implies that financial stress facing a single NBFIs could absolutely be transferred to other financial institutions (banks and non-banks) through counterparty risks, causing the whole financial system to fall into crisis.

Third, as some NBFIs operate on a large scale, any financial hardship arising from them could quickly transfer to financial tensions for the entire financial system.

For over 20 years of development of Vietnam's financial market, the non-bank financial sector has experienced impressive growth on numerous aspects. Total assets of NBFIs increased in both absolute volume and relative scale as compared to the size of GDP and total assets of the banking system. From a negligible 1.5 percent in 2000, the NBFIs' total assets-to-GDP has soared to an approximate 16 percent in the following 18 years. Distinctively for the period 2006-2010, to keep up with the rapidly-growing stock market, NBFIs relentlessly expanded their asset size, which sometimes reached up to 20 percent of GDP. Alongside this dramatic expansion of assets, the sales revenue of NBFIs rose accordingly, especially during the last decade. For instance, when the stock market was first launched in 2000, the revenue of securities companies accounts for just 1 percent of the banking system. Yet, for nearly two decades of development, securities companies constituted an equivalent 7 percent share of the banking system in terms of revenue. Besides rapid growth in size, several limitations exposed in corporate governance and risk management might also make NBFIs more vulnerable to market fluctuations and shocks, and thus, financial instability is highly likely to occur (Pham & Hoang, 2019). Therefore, in ensuring the safety of banking operation in particular and the sustainability of the financial system in general, it is crucial to determine the strength and tendency of influence under such an interaction mechanism, owing to which, a more solid philosophical foundation for non-bank financial regulators could be drawn.

Literature Review

A broad range of empirical studies have been conducted on a single country case or larger-scale basis regarding the impact of the development of NBFIs on financial stability.

First, the development of the non-bank financial sector has a positive effect not only on economic development in general but also on the financial system. Carmichael and

Pomerleano (2002) affirm that owing to NBFIs development, countries would access finance more widely and the financial system would become more competitive, more diverse, and especially less vulnerable. Without the strict rules as in banking institutions, NBFIs could provide a variety of financial services and tools for individuals and small and medium-sized businesses (Noeth & Sengupta, 2011), therefore, enhancing economies access to capital. In contrast, the growth of financial services creates more job opportunities and strengthens social stability. On a microeconomic level, the growth of NBFIs promotes competition in the financial sector, challenges the banking system's capacity to meet market demands, improves quality of financial products and services and relieves the vulnerability of the financial system (Carmichael & Pomerleano, 2002).

Islam and Osman (2011) tested the long-term relationship between real per capita income and the development of NBFIs in Malaysia using the ARDL contour method for the period 1974 – 2004. Their results confirmed a long-term, stable relationship between GDP per capita and NBFIs, investment, labour and trade openness – specifically, NBFIs tend to promote the GDP. The authors emphasise that NBFIs are an important component of the financial sector through which financial resources are transmitted effectively from savers to users in the economy.

However, the operation of NBFIs can sabotage national financial stability from various angles. Using cross data for both developed and developing countries, the research of Liang and Reichert (2012) indicates the negative impact of NBFIs on economic growth. NBFIs operate largely in the areas of investment and insurance that might pose risk to the financial sector as well as the economy, particularly during the 2007 – 2009 crisis period.

Meanwhile, in justification of the contribution of every single component of the financial system to economic growth, Cheng and Degryse (2010) employed an SGMM model with a data set for 27 provinces in China between 1995 and 2003. They conclude that the formal financial sector (i.e. banking sector) appears to be the key driver of economic growth, while the contributions of NBFIs are trivial.

In addition, several studies have found the development of non-traditional financial institutions increases the risk to financial systems. In fact, non-traditional financial institution activities are often linked with commercial banking operations. Thus, the crisis within NBFIs would likely spread to the banking sector. Employing a systematic risk assessment model, Maeno et al. (2014) prove that the proportion of assets of non-traditional financial institutions in the economy recorded at more than 50 percent could lead to a bank collapse. The reality also reveals that the development of NBFIs increased the complexity of the financial system in the US (Fischer, 2015). When a bank provides loans directly to businesses and households, the cash flow is transferred through intermediaries in a simple manner. However, the

development of NBFIs expands the circulation of capital which involves both commercial banks and NBFIs. Subsequently, the complex-capital flows make the financial system more vulnerable. A shock in the non-bank financial sector could adversely affect the whole system, such as happened in the global financial crisis. In a study of money market funds in Europe during the global financial crisis, Bengtsson (2013) also points out that the distress in those funds spread to the banking system and contributed to the instability of the whole financial system. In an in-depth assessment of the relationship between underground banks and financial stability in China, Zou et al. (2012) also reach the same conclusion as Bengtsson (2003). Specifically, the rapid development of NBFIs in China, where the financial market had remained poorly developed, may pose more risks and cause the financial system to be more vulnerable.

Briefly, empirical evidence on the impact of NBFIs development on financial stability appears ample and multidimensional. This stresses the need for an in-depth study of these effects in the financial system of an emerging economy such as Vietnam. The rest of our paper focuses on addressing this objective through employment of an ARDL bounds testing method.

Methodology and Data
Model Specification

An auto-regressive distributed lag (ARDL) cointegration procedure is adopted to examine the impact of the development of NBFIs on financial stability. Integrated between vector auto-regressive (VAR) and ordinary least-squares (OLS) models, this well-tested econometric approach: (1) guarantees robust results; (2) fits perfectly with small sample sizes; (3) estimates for a single equation instead of a set of equations as in the Engle-Granger or Johansen testing procedures; (4) permits handling of a diverse range of optimal lags for different variables, regardless of whether the underlying regressors are either purely I(0), I(1), or mutually cointegrated; (5) evaluates the short-term effects based on the ECM model through linear transformations without sacrificing degrees of freedom (Pesaran et al., 2001). To ensure reliability of the ARDL results, time series variables require stationarity properties and determined optimal lag length, and simultaneously, the model must be free from autocorrelation, heteroskedasticity and form misspecification (Gurajati, 2003). These criteria will be stringently tested during the model regression process.

Selection of variables for our regression model is primarily based on previous literature, viz.: (1) variables representing the development of every single NBFI category as suggested in Islam and Osman's (2011) study regarding the effects of the NBFIs development on economic development in Malaysia; (2) variables on financial stability as derived from the

European Commission's (2012) study. Our model is constructed based on a set of five baseline equations as follows:

$$Y(VNI, ZS, NPL)_t = \alpha_1 + \sum_{i=1}^{a1} b_{1i} RTAN_{t-i} + \sum_{j=1}^{a2} c_{1j} RREN_{t-j} + \varepsilon_{1t} \qquad (1)$$

$$Y(VNI, ZS, NPL)_t = \alpha_1 + \sum_{i=1}^{a1} b_{1i} SEC_{t-i} + \varepsilon_{1t} \qquad (2)$$

$$Y(VNI, ZS, NPL)_t = \alpha_1 + \sum_{l=1}^{a4} e_{1l} FUND_{t-l} + \varepsilon_{1t} \qquad (3)$$

$$Y(VNI, ZS, NPL)_t = \alpha_1 + \sum_{j=1}^{a2} c_{1j} INSUR_{t-j} + +\varepsilon_{1t} \qquad (4)$$

$$Y(VNI, ZS, NPL)_t = \alpha_1 + \sum_{k=1}^{a3} d_{1k} FINLS_{t-k} + \varepsilon_{1t} \qquad (5)$$

Dependent variable Y is a 3-component vector reflecting the degree of financial stability, which corresponds to the key components of the International Monetary Fund (IMF)'s Global Financial Stability Reports, namely:

- VNI: VN-Index's stock price volatility, which is measured by the 360-day moving average of Vietnam's daily stock index fluctuations.
- ZS: Bank's Z-score, reflecting the resilience of banks to risks. A higher Z-score achieved implies that the probability that the whole banking system falls into bankruptcy reduces. This indicator could be calculated as follows:

$$Bank's\ Z - score = \frac{ROA + \frac{Shareholder's\ Equity}{Total\ Assets}}{sd(ROA)}$$

Where, sd(ROA) denotes the standard deviation of ROA.

- NPL: Non-performing loan (NPL) ratio of the banking system, measured by the ratio of non-performing loans to total outstanding loans. The banking system is deemed secure in operation once its NPL ratio is maintained at low levels.

The group of explanatory variables characterising the development of NBFIs encompasses:

- RTAN: NBFIs' annual asset growth, expressed by the total assets of the NBFIs as a percentage of Vietnam's gross domestic product (GDP).

- RREN: NBFIs' annual sales growth, measured by the total sales revenue of the NBFIs as a percentage of Vietnam's GDP.

- SEC, INSUR, FINLS and FUND: Indicators of asset growth of every single component in the NBFIs system, including securities companies (SEC), insurance companies (INSUR), finance and finance leasing companies (FINLS) and investment funds (FUND). As for each category, these variables represent their corresponding asset size as a share in Vietnam's GDP.

Equation (1) is applied to gauge the comprehensive effect of the NBFIs development (including asset growth and sales growth) on financial stability. We hypothesise that there exists a positive link between the NBFIs development and the stability of Vietnam's financial system. Meanwhile, equations (2), (3), (4) and (5) are tested to yield a separate assessment of the role of NBFIs development by category (that is, securities companies, insurance companies, finance and finance leasing companies, and investment funds).

Data

The quantitative model uses secondary data from various sources. First, as regards data reflecting Vietnam's financial stability, VN-Index's stock price volatility (VNI) and bank's Z-score (ZS) are extracted from the IMF's Financial Development Database, the NPL ratio of the banking system is aggregated from the annual reports of the State Bank of Vietnam (SBV) and the IMF's reports. Second, data on the development of NBFIs such as the size of total asset and revenue of each group (i.e. securities companies, insurance companies, investment funds, and finance and finance leasing companies) are recorded from reports of specialised management agencies such as the State Securities Commission for securities companies and investment funds, Insurance Administration Department under the Ministry of Finance of Vietnam for insurance companies, and SBV for finance and finance leasing companies.

Our data was collected for each year of the period 2000 – 2018. The stock market was kickstarted in Vietnam in 2000, followed by the rapid development of NBFIs, typically the securities firms and investment funds. Although the insurance companies and finance and finance leasing companies have been present in Vietnam for nearly 25 years, their operation during the early stages seems rather unpretentious, hence, data associated with this group are scarce prior to the year of 2000. For this reason, the study period from 2000 to 2018 is selected for the empirical procedure. The use of quarterly data to upscale the number of

observations for the model had also been considered for this research, however, due to restrictions on quarterly published data for the variables, we determine to opt for fiscal annual time-series.

Results and Discussion
Results

The ARDL testing approach includes four phases: (1) testing for cointegration using bounds test and F-statistics; (2) estimating the conditional ARDL model with the optimal number of lags in accordance with Akaike Info Criterion (AIC); (3) assessing the studied effects derived from the optimal model results; (4) checking for stability and compatibility of the model through ARCH test for heteroskedasticity, the Breusch-Godfrey Lagrange multiplier test for nth order autocorrelation, Ramsey's RESET test for model specification, and cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUM-SQ) tests for stability (Kumar, 2013).

To begin with, conventional unit root tests are implemented to check whether time series variables are stationary in levels I(0) or first differences I(1) - which is a prerequisite for making the bounds testing procedure feasible. As revealed in the augmented Dickey-Fuller (ADF) test results (see Table 1), stationarity properties of all variables in the model are satisfactorily met. Subsequently, having carried out bounds test, we perceived that the F-statistics obtained is greater than the critical value at the 1 percent significance level (see Table 2), thus, we reject the null hypothesis and accept an alternative hypothesis, that a long run cointegration relationship does exist between variables in the model.

Table 1: Summary statistics

Criteria	Dependent variables (Y_i)			Explanatory variables (X_i)					
	VNI	**ZS**	**NPL**	**RTAN**	**RREN**	**SEC**	**FUND**	**INSUR**	**FINLS**
Mean	24.92	12.31	3.43	0.12	0.02	0.02	0.03	0.04	0.04
Maximum	85.41	15.35	8.60	0.22	0.04	0.05	0.05	0.07	0.08
Minimum	11.56	7.09	1.55	0.02	0.01	0.01	0.00	0.01	0.01
Standard error	16.34	2.84	2.07	0.06	0.01	0.02	0.02	0.01	0.02
ADF - I(0) test	-3.70**	-1.59	-2.00	-1.74	-1.93	-1.69	-1.70	-1.30	-1.60
ADF - I(1) test	-	-4.37***	-3.25**	-3.11**	-3.39**	-3.37**	-4.57***	-2.65*	-3.75**

Note: ***,**,* Significance at 1%, 5% and 10% level.
Source: Authors' calculations.

Details of the alternative tests for stability and reliability of the ARDL model are presented in Appendices 1 and 2. Accordingly, these test results confirm that our specification framework appears perfectly suitable for testing the relationship between the NBFIs development and financial stability. Based on AIC results, the ARDL model with the optimal lag length corresponding to every single equation is specified in Table 3.

Table 2: Bounds test results

Model	F-statistic	k	Significance level	I(0) bound	I(1) bound
(1a)	6.33	2	1%	3.17	4.14
(1b)	5.80	2	1%	3.79	4.85
(1c)	6.09	2	1%	3.14	4.67

Source: Authors' calculations.

Table 3: Lag length selection for ARDL model

	Model	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)	(5a)	(5b)	(5c)
Dependent variables	VNI	1			1			1			1			1		
	ZS		2			2			2			2			2	
	NPL			1			1			1			1			1
Explanatory variables	RTAN	0	0	0												
	RREN	0	0	0												
	SEC				4	4	4									
	FUND							1	1	1						
	INSUR										0	0	0			
	FINLS													4	4	4

Source: Authors' calculations.

Estimation results from the optimal ARDL specification are reported in Table 4.

Table 4: Estimated ARDL results

	Model	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)	(5a)	(5b)	(5c)
	Dependent variables	*VNI*	*ZS*	*NPL*	*VNI*	*ZS*	*NPL*	*VNI*	*ZS*	*NPL*	*VNI*	*ZS*	*NPL*	*VNI*	*ZS*	*NPL*
Explanatory variables	VNI(-1)	-0.11			0.55*			0.04			-0.12			0.51		
	ZS(-1)		0.48*			0.82***			0.24			0.71**			0.94***	
	ZS(-2)		0.10			-0.29			-0.02			0.02			-0.38**	
	NPL(-1)			0.62***			0.30			0.84***			0.62***			0.26
	RTAN	170.55	25.07**	3.47												
	RREN	-2220.77*	-118.64	-110.94*												
	SEC				313.89**	25.95	-37.99**									
	SEC(-1)				-182.46	-36.77	19.47									
	SEC(-2)				128.73	35.16	3.38									
	SEC(-3)				-18.90	7.00	9.50									
	SEC(-4)				-124.10	-25.76	-2.25									
	FUND							-141.21	42.18	-8.99						
	FUND(-1)							3.96	66.74*	15.36						
	INSUR										-619.66*	11.42	-41.87*			
	FINLS													208.90*	14.24	-24.63**
	FINLS(-1)													-85.20	18.73	9.34
	FINLS(-2)													-43.08	-46.34*	16.20*
	FINLS(-3)													48.21	42.45*	2.91
	FINLS(-4)													-48.45	-0.59	-7.49
	Constant	60.34**	5.20**	3.30*	6.65*	5.08**	1.92**	27.21**	7.09***	0.10	53.52***	3.12*	2.78*	7.48*	4.93***	1.94**

Note: ***,**,* Significance at 1%, 5% and 10% level.

Source: Authors' calculations.

Discussion

Our regression results suggest that the development of NBFIs has a positive impact on the stability of Vietnam's financial market during the period studied. Quantitative results could be analysed in detail as follows:

Equation (1) evaluates the impact of two variables representing the development of NBFIs, namely RTAN (NBFIs' total assets compared to GDP) and RREN (NBFIs' total revenue compared to GDP) on financial stability indicators, including fluctuations of VNINDEX (VNI), Bank Z-score (ZS) and NPL. The regression results show that the growth of NBFIs assets has a positive effect on the Z-score at 5 percent significance level, when an increase in the assets of NBFIs would reduce the risks of the banking system. Regarding VNI or NPL variables, the impact of RTAN does not show statistical significance. However, for VNI and NPL, the RREN variable that represents NBFI's revenue growth indicates certain effects. RREN negatively affects the VNI and NPL, showing that an increase in income of NBFIs stablises the stock market and reduces the bad debt ratio at the banks.

The combination of equations (2), (3), (4) and (5) evaluates the impact of each organisation group in NBFI on the situation of financial stability. Regression coefficients of the SEC, INSUR, FINLS and FUND variables illustrate a certain positive influence by NBFI organisations on the financial stability of Vietnam. Securities companies and finance and finance leasing companies have quite similar effects on financial stability. The total assets of securities companies as well as finance and finance leasing companies are positively related to the market volatility of VNINDEX. This means that the assets of securities companies and finance and finance leasing companies increase dramatically when the market fluctuates sharply. Asset growth of these firms have a negative relationship with bad debts. The increase in the management assets of the investment fund is positively related to the Bank Z-score. Meanwhile, the development of assets of insurance companies has controlled stock market fluctuations as well as non-performing loans of the banking system. This seems reasonable due to the emerging insurance market providing effective hedging instruments on the stock market, as well as credit insurance products, to limit bank's non-performing loans.

The above results are consistent with the view of some previous studies (e.g. Vittas, 1997; Carmichael & Pomerleano, 2002; Cummins & Weiss, 2014). Specifically, Vittas (1997) argues that NBFIs promote competition among financial intermediaries, gradually improving the organisational structure in order to operate more effectively and meet the needs of customers. This author also asserted that the development of NBFIs helps stimulate capital market development by creating abundant long-term financial resources, and also creating new supply and demand for the market. Regarding the development of the non-bank financial sector, Carmichael and Pomerleano (2002) argue that this area is encouraged for development

because countries will benefit from wider access to financial services with a more competitive, more diverse financial system with lower levels of vulnerability. At the micro level, the growing presence of NBFIs is highly likely to promote rivalry in the financial sector, threaten the dominance of banking products and services in the market, enhance the quality and diversity of financial products and services in general and relieve the vulnerability of the banking system (Carmichael & Pomerleano, 2002). A study conducted by Cummins and Weiss (2014) also insists that the insurance industry could bring a large range of benefits to financial market stability.

Conclusion

The role of banks as financial intermediaries in developed countries has so far diminished due to the growing presence of NBFIs, which allow businesses to directly access personal savings. Global economic history records that the financial development started out with banking institutions and subsequently expanded to NBFIs. Throughout that flow, the role of NBFIs in Vietnam has improved, yet alongside exist concerns about risks and the instability of the financial system.

From the quantitative results of the study, it is concluded that the synergistic effects of NBFIs' development on the stability of Vietnam's financial system reveal some signs of improvement rather than deterioration as in our expectations. Our analysis based on the decomposition of impacts by NBFI group suggests the asset size of securities, finance and finance leasing companies is positively correlated with the stock market volatility. Concurrently, the expansion of insurance firms is paired with lower degrees of stock market volatility and lesser amounts of non-performing loans at banks. This seems reasonable since an emerging insurance market might create more effective hedging tools for the stock market as well as credit insurance products to curb bad debts for banks. On the other hand, though the current operational situation of some NBFI categories may pose potential risks during distinct phases, these seem not considerable enough to affect Vietnam's banking system in particular and financial stability as a whole.

At the early stage of the study process, in order to produce a reliable and precise assessment of the relationship between NBFIs development and financial stability, we projected to incorporate 'financial stability index' as a dependent variable for our empirical model. However, due to the reality that the data series of Vietnam's financial system appears not long enough, the authors constructed a composite index for the period 2010 – 2018 in an attempt to fight off such challenges. We are hopeful that this limitation could be resolved by more effective approaches in future research.

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APPENDICES

Appendix 1. Diagnostic tests results

Diagnostic tests	Model (1a)		Model (1b)		Model (1c)	
	F-statistics	p-value	F-statistics	p-value	F-statistics	p-value
Heteroskedasticity	0.480	0.488	0.100	0.750	2.540	0.221
Breusch-Godfrey LM	0.302	0.580	0.301	0.583	1.339	0.247
Ramsey RESET	4.230	0.322	0.070	0.973	0.800	0.519
CUSUM	Stable		Stable		Stable	
CUSUM-SQ	Stable		Stable		Stable	