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# The impact of uncertainty on credit risk: The case of Vietnam commercial banks

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# Abstract

The increasing trend of credit risk in the Vietnamese commercial banking system has recently been the focus of many domestic economic forums and conferences. The purpose of this study is to analyze the impact of uncertainty regarding total bank assets and other factors causing credit risk in Vietnamese commercial banks. The paper employs the two-step SGMM estimation method and a sample of 30 Vietnamese commercial banks during the period 2006–2021. The research results indicate that uncertainty about total assets causes bank credit risk. In addition, factors such as bank size, economic growth (GDP), and inflation also affect bank credit risk. Meanwhile, our research results do not find evidence that credit growth and credit risk have a supporting correlation. These findings provide bank managers with a better understanding of total asset uncertainty, which serves as a basis for management efforts to enhance credit risk management.

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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.

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# 1. Introduction

In the digital age, many scholars are interested in the impacts of uncertainty on economic activities in the fields of production, investment, consumption and international trade. Research results often point to the impact of economic uncertainty on reducing the investment incentives of businesses, increasing precautionary savings, and reducing the number of businesses and the volume of international trade [1-3]. In the financial sector, the impact of uncertainty on commercial banks is especially complex [4]. Uncertainty is related to bank risk [5]. Studying the impact of uncertainty on the financial system, especially on the operations of the banking system, is an emerging area in the recent literature [6, 7]. Uncertainty involves the ambiguity of future policies and has long-term effects. In particular, uncertainty in developing and emerging economies is significantly higher than in developed countries [8]. Researching uncertainty in the banking sector, especially through the credit channel in emerging markets to gain insight into the operating mechanism and risk management in the credit channel is very important for both scholars, policy makers and practitioners [9, 10].

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Bank credit channels play an important role in the economy and banking system, through which macroeconomic shocks or shocks from banking activities spread to credit activities [11, 12]. On the other hand, the bank credit channel contributes to increased risks due to bank managers' risk-taking from excessive credit-granting activities [13, 14]. High credit risk can lead to high potential risks for the entire financial system, the worst case can cause a financial crisis [9, 10]. Meanwhile, the impact of uncertainty on commercial banks is particularly complex [4]. Uncertainty in developing and emerging economies is significantly higher than in developed countries [8]. In Vietnam, as an emerging market economy, the Vietnamese Government has the ability to strongly intervene in economic activities, therefore policy factors play an important role in the development of the economy. By liberalization reforms, the Vietnamese Government often adjusts its economic policies to take advantage of appropriate economic development methods. Faced with a complex internal and external environment, especially after the global financial crisis, the Vietnamese Government introduces and adjusts economic policies more frequently, leading to adjustment requirements for financial markets, thereby leading to higher levels of economic and financial uncertainty. In the banking sector, these reforms involve reducing state ownership, easing restrictions on the activities, entry and opening of branches of foreign banks, and encouraging foreign ownership in a domestic bank, stimulating banks to list on the stock exchange and increase bank capital. Therefore, Vietnam is a good representative sample that can be used to analyze uncertainty and its effects.

On the other hand, the Vietnamese banking system is operated by the government, which is some extent obliged to combine more political goals and purely commercial decisions. Therefore, Vietnamese banks may be more sensitive for uncertainties related to policy changes than Western counterparts, which facilitates the observation and assessment of the impact for uncertainty on banking business. Vietnam's banking market is led by a few large state-owned banks while others are competing with smaller market shares [15, 16]. In addition, the banking system in Vietnam is gradually having to comply with international standards in both risk management and corporate governance, which unintentionally makes the banking system more volatile.

For this paper, we hope to study whether the presence of greater banking uncertainty leads to higher credit risk. Microuncertainties that firms face include dispersion in analyst forecasts, volatility of stock returns, changes in input/output prices, and total productivity, etc. Among these, an important micro scale emerged, associated with the banking sector. It is a scale based on the dispersion of shocks to key observable bank-level variables such as returns or asset growth [17].

The author conducted research with a sample of Vietnamese commercial banks during the period 2007-2021. Vietnam is a country with an emerging economy, often characterized by underdeveloped capital markets, and banks are still the main capital channel for the economy, with large international trade openness, and at the same time, pursuing many economic policy reforms. This makes the uncertainty shock even more apparent. On the other hand, the Vietnamese banking system gradually applies international standards in business activities, thereby creating a basis for the level of uncertainty in the Vietnamese commercial banking system to fluctuate widely, the most obvious being the shocks on the asset side that may be associated with an increase in credit risk. This is the scale chosen for use in this study.

# 2. Literature Review

Most of the prior research concerned with uncertainty has focused on its impact on real economic activity, depending on the irreversibility of investment framework [18, 19]. The decline in output stems from reduced corporate investment and employment until the uncertainty disappears. Recently, views have emerged that view financial friction as a key mechanism that transmits and even amplifies the impact of uncertainty on economic activity. However, these do not address the hypothesis of whether economic uncertainty has any impact on the risk profile of commercial banks, especially banking risk [5]. The impact of economic uncertainty on banks' risk is not theoretically consistent, due to the debate of conflicting views. On the one hand, the Real Options theory formulated by Pindyck [20] suggests that financial stability can be strengthened during periods of increased instability. Similar to businesses, commercial banks also face irreversible investment (credit) problems and can therefore apply a "wait and watch" strategy when uncertainty increases. As the value of waiting increases, banks may foresee increased instability, with banks enhancing stability primarily by promoting high capital ratios, and make better decisions, more multidimensional information will be increased until uncertainty declines [21]. On the other hand, Real Options theory implies that, with greater bank stability amid greater uncertainty, excessive optimism in typical economic activities during periods of low volatility causes Banks to promote credit granting, thereby leading to high risks for credit activities. With the above argument, bank credit risk is negatively correlated with the level of uncertainty. On the other hand, the forces associated with economic uncertainty are likely to cause higher risks in banks. The recessionary impact of this uncertainty on aggregate demand directly increases the likelihood of borrower default. This leads to a decline in the quality of banking assets, and then to insolvency in both interest-generating and non-interest-generating banking activities.

Besides, economic uncertainty can create incentives for banks to accept higher risks through the impact on interest rates. Contingent savings in an uncertain context reduce risk-free interest rates, which can put pressure on reducing loan interest rates that commercial banks charge borrowers. Businesses reduce investment and employ less workers in times of uncertainty, and interest rates decline due to reduced demand for credit, including a decline in international banking activity. Meanwhile, banks are more likely to be affected by major adverse shocks in times of uncertainty, causing donors to demand a higher funding premium from banks, leading to an increase in funding costs [22, 23]. These forces contribute to narrowing banks' interest rate spreads and eroding their main source of profits. However, shareholders' profit targets may not change immediately when peer-to-peer profits decline, which may be due to a slower adjustment in shareholders' expectations, which is leverage for banks to focus on high-risk-high-return businesses [24, 25]. The fact that banks are motivated to seek profits amid economic uncertainty is consistent with the argument that banks increase their holdings of risky assets when faced with less profitable environments [26, 27]. In addition, from another perspective, there is a relationship between economic

uncertainty and the lending behavior of commercial banks. Increased uncertainty leads to a decrease in the proportion of loans in banks' portfolios [17, 28]. The Valencia [22] similarly confirms that banks are hesitant to sign credit supply contracts when faced with more uncertainty, especially banks with highly leveraged operations. Uncertainty becomes even more important for banks with small capital and long geographical distances. Banks even become less sensitive to changes in interest rates, which hinders lending through monetary policy channels [29]. The view is that excessive investment in banking activities, low equity capital, high concentration and bad macroeconomic conditions affect loans, increasing the risk of bank default during a financial crisis. They found that economic uncertainty plays an important role in banking stability but largely ignored uncertainty in total assets [30, 31]. Based on empirical and theoretical studies, the author expects that uncertainty contributes to bank credit risk.

# 3. Variables, Models, and Research Methods

## 3.1. Measuring Credit Risk Variables

This scale is determined by the Z-score index [32]. This index measures the risk of loss when the amount due to non-recovery of granted credits exceeds equity and is determined through the formula,  $Z - score = \frac{ROA + E/T}{\partial ROA}$ , where: ROA and  $\delta$ ROA are the rate of return on total assets and the standard deviation of this rate of return, respectively, E/T is the ratio of equity to total assets. The higher the Z-score, the higher the stability and the lower the risk [33, 34], and is commonly used in experimental studies such as [34-37].

### 3.2. Measuring Explanatory Variables

#### 3.2.1. Measuring Banking Uncertainty Variable

Most previous studies focus on aggregate uncertainty scales such as economic policy uncertainty, financial and monetary uncertainty [23, 29]. This study determines the uncertainty scale according to total assets at the banking industry level, according to the perspective of [17]. The choice of this scale is due to the fact that aggregate uncertainty can increase uncertainty in the banking industry and banks immediately adjust their behavior higher as a consequence of this uncertainty. This is the core point that the author wants to convey when studying uncertainty in the banking sector and its effects. Using the industry uncertainty scale through individual bank data can provide a message about the level of isolated uncertainty in the commercial banking system, thereby proposing policy suggestions that are scientifically based and more complete information.

According to Buch, et al. [17] the uncertainty of the banking industry in time t is estimated in a two-step sequence:

(i) Determine the shock in year t of banks with total assets:

 $Log(Total \ assets)_{i,t} - log(Total \ assets)_{i,t-1} = \Delta log(Total \ assets)_{i,t} = \alpha_i + \beta_t + \epsilon_{i,t} \ (1)$ 

In there,  $\Delta log(Total \ assets)_{i,t}$  is the growth in total assets of bank *i* in year *t*,  $\alpha_i$  are bank fixed effects,  $\beta_t$  is the time fixed effects and  $\varepsilon_{it}$  are residuals indicating the shock that needs to be collected to create a distribution across the cross-section of the shock.

(ii) The level of uncertainty in the banking industry in year *t* is the deviation of the residual after calculating total asset growth and is determined as follows:  $Uncertt = \delta(\varepsilon_{i,t})$ ,

# 3.2.2. Control Variables

The control variables Scale, Equity, Credit Growth, GDP Growth, and Inflation in the research model are often popularly used in previous studies [38-41].

*Bank size (Size):* This factor can impact bad debt in both a positive and negative direction and is determined logarithmically by the bank's total assets. Credit activities are always governed by industry regulations, so it does not always mean low quality [34]. Large banks often have more experience and risk management capacity than small banks [42]. Therefore, scale and risk will have an inverse relationship. However, the theory of Too Big to Fail of Berger and DeYoung [43] suggests that large commercial banks will tend to easily accept more credit risk. On the other hand, market discipline will not be imposed on large commercial banks, and the government often has policies to protect large banks if there is a risk of bankruptcy [44]. Larger banks will have loan portfolios with higher levels of risk [45].

*Equity (Cap):* This variable is calculated as the ratio of equity to total assets [33, 46, 47]. Capital requirements are increasingly stricter with high equity ratios, banks are more cautious in lending behavior. Opposite, the low capital ratios lead to increased bad debt because bank managers easily encourage moral hazard, increasing loan portfolios while banks have insufficient capital [48].

*Loan growth (Lgr):* To measure bank activities affecting credit risk, the author includes the bank's abnormal loan growth rate. This scale is the difference between a bank's loan growth and the average loan growth of all banks in the same country during the year [32]. This takes into account of the fact that high rates of loan growth do not necessarily reflect excessive risk-taking if all other banks have similarly high growth rates [32]. However, if banks raise lending by lowering their lending standards, relaxing collateral requirements, or a combination of both, higher rates of loan growth are associated with greater risk [32, 49] even has a long-term impact on liquidity risk [38, 39].

*Macroeconomic:* To assess the possible influence of the business cycle on banks' risk-taking, we include the annual economic growth rate (GDP) and the annual inflation rate (INF). The varying impact of macroeconomic conditions on banking risk has been documented in empirical studies [38-40].

#### 3.2.3. Model and Data Research

Similar to the study of Bilgin, et al. [28] this article examines the impact of uncertainty on banking risk in international banking operations by estimating the following empirical model:

 $Risk_{i,t} = \alpha_0 + \alpha_1 Risk_{i,t-1} + Uncert_{t-1} + Controlbank_{i,t-1} + Controlmacro_{t-1} + \varepsilon_{i,t} (2)$ 

In which risk is the dependent variable, measuring credit risk. Dynamic panel data models are used where bank risk is persistent and driven by the prior year's risk-taking behavior. Uncertainty is a measure of banking uncertainty, captured by the dispersion of banking shocks. Again, this study highlights banking uncertainty on the total asset side [17]. Control bank is a variable that controls bank characteristics, including size, loan growth rate, and bank capital. Control macros are macroeconomic control variables that include annual economic growth and the annual inflation rate [50, 51]. These control variables are factors that contribute to explaining bank risk, consistent with the banking literature.  $\varepsilon$  is the error component. To reduce the endogeneity problem between variables in the research model, the author takes all independent variables with a one-year lag [32, 49, 52].

The author collected dynamic table data of 30 Vietnamese commercial banks from 2006 to 2021 from audited financial statements and eliminated commercial banks with not enough 5 years of consecutive reporting, and the most recent reporting year is less than 2020. Macroeconomic data is collected from the International Monetary Fund (IMF) and converted to USD at the VND/USD exchange rate.

The article uses the two-stage SGMM estimation method for the model (\*) to overcome the problems of endogeneity, heteroskedasticity, the influence of unobservable factors and autocorrelation [53, 54]. Test the appropriate estimation model to satisfy the condition that the number of years of research must always be less than the number of research units, the number of instrumental variables does not exceed the number of research units, the Sargan/Hansen test has p-value > 0.05, the second-order correlation of AR (2) residuals has p-value > 0.05 [55].

# 4. Research Results and Discussion

#### 4.1. Descriptive Statistics

Descriptive statistics are presented in Table 1. The average and standard deviation of Z-score are 3.85 and 3.18, respectively. The minimum value is -0.22 and the maximum is 5.61. The average standard deviation of uncertainty is 0.35 and 0.115, the lowest value is 0.17 and the highest is 5.57. Bank size has an average value of 3.49 and a standard deviation of 1.19, with a minimum value of 2.19 and a maximum value of 9.15. The average total equity to total assets is 0.09, with a standard deviation of 0.08; the lowest value is 4.11 and the highest value is 27.56. Loan growth has an average value of 0.02, and the standard deviation of 0.05, with the lowest value being 0.01 and the highest value being 0.94. GDP growth has an average value of 5.24 and a standard deviation of 0.61. The highest inflation was 0.23 in 2008.

#### (Billion VND) Variable Obs. Mean (time) Std. Dev. Min. (time) Max. (time) Z-score 440 3.85 3.18 -0.22 5.61 406 Uncert 5.57 0.35 0.11 0.17 Size 355 3.49 1.19 2.19 9.15 Cap 0.09 27.56 440 0.08 4.11 Lgr 440 0.02 0.05 0.01 0.94 GDP 455 5.24 4.20 6.00 0.61 -9.23 0.23 IFR 455 0.02 0.62

Table 1.

Descriptive statistics of variables.

Source: Bank data from annual audited financial statements, macroeconomic data are IMF, and own calculations.

# 4.2. Research Results and Discussion

Table 2 presents the correlation coefficients between the dependent and independent variables in the research model (\*), and shows that they are all quite small, below 0.8, meaning there is no possibility of multicollinearity between the independent variables in the model, except for the pairs of variables Cap and Z-score, and Lgr and Cap. The Z-score, Cap, and Lgr are endogenous variables [32, 49, 52, 56]. Therefore, choosing the two-stage SGMM estimation method is appropriate to minimize possible endogeneity problems between them and other influencing factors.

Table 3 shows the impact of uncertainty on banking risk. The research results indicate that the Hansen test of overidentification is under the null hypothesis that all instruments are valid. It is uncorrelated with the error term. The AR(2) also has a value greater than 0.05, so the research model does not exhibit second-order autocorrelation, and the number of bank groups (32) is larger than the number of instrumental variables (25). Therefore, the research model satisfies the conditions for System GMM estimation (Table 3).

### Table 2.

Correlation coefficient matrix between variables in the research model.

Tên biến	Zscore	Uncert	Size	Сар	Lgr	GDP	IFR
Zscore	1.00						
Uncert	-0.04	1.00					
Size	-0.27	0.20	1.00				
Сар	0.95	-0.04	-0.22	1.00			
Lgr	0.77	-0.03	-0.09	0.81	1.00		
GDP	-0.03	0.00	-0.15	-0.04	-0.01	1.00	
IFR	-0.02	0.10	0.07	-0.02	0.00	0.00	1.00

Table 3.

Research model estimation results.

Variables	System GMM			
Z-score <sub>(t-1)</sub>	0.0345			
Uncert <sub>(t-1)</sub>	-0.2753*			
Size (t-1)	-0.2397***			
Cap <sub>(t-1)</sub>	30.6083***			
Lgr (t-1)	3.9667			
GDP <sub>(t-1)</sub>	0.0033***			
IFR <sub>(t-1)</sub>	0.2471***			
Constant	1.8680***			
No. of Observations	316			
Number of groups	32			
Number of instruments	25			
Test for $AR(1)$ (p-value) <sup>1</sup>	0,1605			
Test for $AR(2)$ (p-value) <sup>1</sup>	0,5096			
Hansen test	211,020			
Hansen test $(n_value)^2$	0.2218			

Note: AR(1), and AR(2) are tests for first- and second-order serial correlation in the first-differenced residuals, under the null of no serial correlation. <sup>2</sup> Hansen test of overidentification is under the null that all instruments are valid. Symbol: \*\*\*/\*\* indicates significance at the 1%-/5%-/10%-level.

Uncertainty (Uncert): The impact of scale uncertainty on risk has an estimated coefficient that is negative and statistically significant, suggesting that in times of higher uncertainty, stability tends to increase (Table 3), To explain this, the uncertainty about the larger scale of banks may come from the motivation to take risks to maximize profits, so the uncertainty is worse due to the "too big to fail" and the assumption of government bailout when they fall into difficulty [57]. This research result is the same research results of [5, 58].

Last year credit risk ( $Zscore_{t-1}$ ): The Previous period's credit risk affects the current period's Z-score in the same direction but is not statistically significant. The consequences of the economic crisis and the COVID-19 pandemic have hurt banking operations, resulting in an increase in bad debt of banks, leading to credit risks that have consequences in the future. Therefore, the results of this study may be a concealment of performance reporting in some banks.

Bank size (Size): the debate on the too-big-to-fail issue in commercial banks across countries [59]. Support for the toobig-to-fail opinion, and the basis for increased risk for the bank. Research results show that an increase in scale is related to an increase in bank risk. Increasing 1 unit of scale will increase the bank's risk (Z-score) by 0.23 at the 1% significance level. This research result is similar to the research results of [33, 58, 60]. It can be explained that to achieve profit and market share goals, banks take more risks, relax lending requirements, and even increase their scale beyond the capacity of managers. This leads to increased credit risk.

Equity (Cap): This factor strongly affects bank risk. The research results show that there is an inverse relationship between equity ratio and credit risk (the higher the Z-score index, the higher the stability, the lower the risk) at the 1% significance level. Research results show that banks seem to increase their shareholdings during periods of uncertainty. Financial frictions caused by uncertainty in mobilizing external financing may cause banks to insure themselves against future shocks by maintaining more capital [61]. Banks with high capital ratios are generally considered more conservative and less vulnerable to shocks. Capital serves as a safety net for banks during times of crisis, which reduces the bank's risk. This confirms the results of Imbierowicz and Rauch [62], in which the equity-to-assets ratio is negatively correlated with the probability of bank bankruptcy.

Credit growth (Loans): Although this factor affects the Z-score index in the same direction, it is not statistically significant. It seems that credit growth does not affect credit risk. This further supports [49] 's view that high credit growth does not necessarily mean excessive risk-taking when all other banks have similarly high growth rates. On the other hand, credit growth is an important channel for banks to take risks. The [62] shows that banks with stable resources during the crisis continued to lend, unlike those without. This confirms the results of [63]. However, reality shows that the State Bank

also limits excessive lending through the limit on bad debt, whereby banks' bad debt cannot exceed 3% by the end of 2025 [64]. Therefore, if abnormal loan growth continues for a long time, it leads to an increase in bank risk [38, 39].

GDP growth coefficient and Inflation have a positive impact on the Z-score index. This helps reduce bank credit risk. The research results further confirm the research of Srairi [65] and the study of [66]. The results described above show that total asset uncertainty and bank size, equity, and macroeconomic factors all affect bank credit risk. This result confirms the author's expectations.

# **5.** Conclusion

Total asset uncertainty is the most important factor for bank credit risk. This article studies the impact of uncertainty on bank credit risk using a panel data set of 30 Vietnamese commercial banks for the period 2006–2021. Furthermore, we find that total asset uncertainty has a significant impact on bank credit risk. Therefore, the estimated results show the importance of total asset uncertainty in understanding the credit risk of Vietnamese commercial banks.

The findings of this study have some interesting policy implications. First, these findings provide some recommendations for bank management and Vietnamese banking supervisory authorities. Under the economic shock, it has been shown that the credit risk of banks is due to the large investment portfolio, which can cause uncertainty in total assets, including equity, bank size, and credit growth.

This result can help regulators, policymakers, and banking authorities better understand the uncertainty of total assets, the excessive size and credit risk, as well as the behavior of banks regarding credit risk and this uncertainty. Second, the results of this research imply that joint management of total asset uncertainty in banks can significantly reduce credit risk. Finally, our results support recent regulatory efforts that place greater emphasis on the importance of managing the overall risk of total asset uncertainty and credit risk.

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