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**Article**

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## FINANCIAL ECONOMICS | RESEARCH ARTICLE

# Market discipline and the regulatory change: Evidence from Vietnam

Tu Dq Le<sup>1,2\*</sup>

**Abstract:** Following the recent global financial crisis, Vietnamese banks experienced changes in the minimum capital adequacy requirement following the Basel framework. We examine the impact of the regulatory change on market discipline between 2006 and 2015. The findings show a weakening of market discipline when the minimum capital adequacy requirement of 9% is imposed. The same is true for foreign-owned commercial banks during the period of implementing new capital regulation. Also, there is no evidence of the difference in market discipline between bank ownership and risks in the Vietnamese banking system. Our research has implications for bank supervisors, policy-makers, and bank managers.

**Subjects:** Macroeconomics; Banking; Credit & Credit Institutions

**Keywords:** market discipline; capital regulation; bank risk-taking; system GMM; Vietnam

**JEL Classification:** G21; G28; G30

### 1. Introduction

The global financial crisis (GFC) 2007–08 suggests that it is necessary to improve the effectiveness of all disciplining factors of bank risk-taking. These factors involve regulatory discipline, bank capital charter (so-called bank self-discipline), and market discipline (Gueyie & Lai, 2003). Market

### ABOUT THE AUTHOR

Dr. Tu Le is a researcher at the Institute for Development & Research in Banking Technology, University of Economics and Law, Vietnam. He is currently working on several projects in the emerging markets in several fields – including banking and finance, manufacturing sector, e-commerce, and Fintech. This paper is under the project entitled “what we know about the Vietnamese banking system”. Several papers related to this project have been published in *Managerial Finance*, *International Journal of Managerial Finance*, *Australasian Accounting Business and Finance Journal*. In contrast, the current research is looking at the different issue named “market discipline”. This research attempts to investigate the determinants of market discipline in the Vietnamese banking system.

### PUBLIC INTEREST STATEMENT

For the past decades, the global banking system saw the emergence of financial instability as a key policy concern. Especially, the global financial crisis (GFC) 2007-08 emphasizes it is crucial to enhance the effectiveness of all disciplining factors of bank risk-taking. In response efforts intensified to put in place an effective prudential framework. Market discipline is also one of the three pillars in the capital adequacy framework of the Basel Accord. Market discipline is considered as a market-based promotion of the transparency and disclosure of the risks associated with a bank. It works along with regulatory systems to improve safety and soundness of the market. With the importance of market discipline in ensuring the financial stability, this paper attempts to investigate the factors affecting the market discipline in Vietnam. In addition, when the Vietnamese banking system is characterized by different types of bank ownership, market discipline may vary among them. This is quite interesting to look at this issue.

discipline is also one of the three pillars in the capital adequacy framework of the Basel Accord.<sup>1</sup> Therefore, the role of market discipline in controlling bank risk is emphasized by many studies conducted in both developed and developing countries. We continue the research by investigating how regulatory changes affect market discipline following the GFC. Hence, our results provide important insights for banking regulators in developing policies responses to potential financial shocks.

This study aims to examine market discipline on Vietnamese banks, especially to investigate whether the regulatory changes affect market discipline. Vietnam offers a unique setting because the Vietnamese government announced the restructuring program in response to the GFC for the period of 2011–2015. One of the key references is the imposition of new minimum capital adequacy of 9% on Vietnamese banks. Besides, the Vietnamese banking system is primarily dominated by state-owned commercial banks (SOCBs) and privately owned commercial banks (POCBs). In which, largest SOCBs had long served as a lending arm of state-owned enterprises (SOEs) while POCBs have mainly concentrated on providing universal banking services in particular regions. POCBs have operated more actively and have gradually gained a large market share in terms of both deposit and credit market shares. Also, domestic banks are encouraged to be listed in the stock exchange to enhance the transparency and disclosures of the banking system. During the period, the Vietnamese banking system is more open to foreign banks. In particular, the share of foreign ownership in the local banks is reconsidered to be lifted.<sup>2</sup> This setting provides an opportunity to evaluate the impact of regulatory change and bank ownership on market discipline.

This study contributes to the literature in several ways. First, the literature on market discipline is dominated by studies in developed markets in the US and Europe where larger markets and number of banks that have facilitated the economic modeling (Demirgüç-Kunt & Huizinga, 2004; Distinguin et al., 2013; Hasan et al., 2013). The evidence of market discipline in emerging markets is limited, especially in the Asia-Pacific region [a study by Hadad et al. (2011) in Indonesia may be one of the exceptions]. Our study in Vietnam would increase our understanding of the market discipline in this region. In contrast to Hadad et al.'s study where the impact of reduced minimum capital adequacy of 4% from 8% on market discipline, our study examines whether the increased minimum capital adequacy of 9% from 8% could provide market discipline. Second, this study is the first attempt to assess the market discipline in Vietnam using the system Generalized Method of Moments (GMM) as suggested by Arellano and Bover (1995). We also extend the role of bank ownership in explaining market discipline (SOCBs versus POCBs, listed versus non-listed banks, foreign-owned versus domestic banks).

The findings show the evidence of market discipline in the Vietnamese banking system since higher deposit rates are related to greater liquidity risk and higher default risk, and an inverse association is found between the deposit interest rates and the regulatory change. Finally, we do not find any evidence in market discipline for different types of bank ownership.

The remainder of this paper is constructed as follows: Section 2 indicates the literature review. Section 3 discusses the methodology and data used. Section 4 discusses the findings while Section 5 concludes.

## 2. Literature review

The existing literature suggests that market discipline is affected by holders of uninsured deposits, including large certificates of deposits (CDs), subordinated notes and debentures (SNDs), and large retail customer deposits (Hadad et al., 2011). In this study, we only focus on market discipline from the customers' deposits perspective since the data on CDs and SNDs are very limited.

Studies on the role of large deposits in disciplining banks can be grouped into two groups. The first group evaluates the link between the amount of uninsured deposits and bank risk (Distinguin et al., 2013; Goldberg & Hudgins, 1996; Hasan et al., 2013; Khorassani, 2000). The second group is

complementary to the first one by adding the analysis of the relationship between bank risk and the interest rate paid to depositors (Demirgüç-Kunt & Huizinga, 2004; Hadad et al., 2011; Martinez-Peria & Schmukler, 2001; Park & Peristiani, 1998). Both these studies emphasize that uninsured depositors discipline banks by withdrawing deposits and/or demanding higher interest rates.

Furthermore, there is a need to investigate whether unsophisticated markets provide market discipline and whether deposit insurance weakens market discipline. When market conditions are not well developed or in the presence of deposit insurance, market discipline may not emerge. Caprio and Honohan (2004) demonstrate that market discipline is unlikely to exist in the absence of a relevant market and information infrastructure. Several studies also indicate that market discipline does not exist or is less evident under deposit insurance (Demirgüç-Kunt & Huizinga, 2004). Other studies, however, show the opposite results. Distinguin et al. (2013) found that market discipline has been effective in Central and Eastern Europe since the implementation of explicit deposit insurance. In the same vein, Martinez-Peria and Schmukler (2001) state that market discipline may exist in Argentina, Chile, and Mexico when a deposit insurance scheme is not credible.<sup>3</sup>

To strengthen the Vietnamese banking system, the government announced the new minimum capital adequacy of 9% for the period of 2011–2015. As banks' financial soundness improved, consistent with Demirgüç-Kunt and Huizinga (2004), we argue that market discipline plays a lesser role.

The literature further suggests that bank ownership may affect the presence of market discipline. Ghosh (2007) found that financial liberalization promotes market discipline for state-owned and old private banks. In contrast, state-owned banks are not disciplined because they receive benefits from implicit insurance (Distinguin et al., 2013). Hadad et al. (2011) also highlight that market discipline is more pronounced in listed banks than unlisted banks and foreign banks than domestic ones. It is anticipated that greater transparency of listed banks and better governance of foreign banks will allow market discipline to better function at them.

Taken together, the following hypotheses are proposed:

H1: During the minimum CAR of 9% period, market discipline does not exist.

H2: There is no difference in market discipline between foreign-owned banks and domestic banks.

H3: There is no difference in market discipline between listed banks and non-listed banks.

H4: There is no difference in market discipline between SOCBs and POCBs.

### 3. Methodology and data

#### 3.1. Methodology

This study uses a dynamic panel data method because market discipline varies over time and intuitively. This method also can provide more reliable and accurate results than a static panel that often employs the fixed and/or random effects models.<sup>4</sup> Furthermore, Baltagi (2008) suggests that the use of fixed and/or random effects models may produce biased and inconsistent estimators since the error term may be correlated with the lagged variables. To deal with this issue, instrument variables should be used. Following Arellano and Bover (1995), the system Generalized Method of Moments (GMM) is used in this study.

The system GMM accounts for endogeneity by using the lagged values of the dependent variable and the lagged value of other regressors which are potentially suffering from endogeneity as

instruments. We instrument for all regressors except for those which are clearly exogenous.<sup>5</sup> We use the one-year lagged values of the presumably endogenous variables as instruments. More lags of these variables are not introduced in the regressions because they are weak instruments. The GMM system also controls for unobserved heterogeneity and the persistence of the dependent variable. All in all, this estimator yields consistent estimations of the parameters. The estimated coefficients are also more efficient using an ampler set of instruments (Baltagi, 2008).

The application of a dynamic model takes the following form:

$$\begin{aligned} INTDEPO_{i,t} = & \alpha_0 + \alpha_1 INTDEPO_{i,t-1} + \alpha_2 LLRTA_{i,t} + \alpha_3 LATA_{i,t} + \alpha_4 ZSCORE_{i,t} \\ & + \alpha_5 NIETA_{i,t} + \alpha_6 LNNTA_{i,t} + \alpha_7 FOREIGN_{i,t} + \alpha_8 LISTED_{i,t} + \alpha_9 OWNER_{i,t} \\ & + \alpha_{10} GDP_t + \alpha_{11} INF_t + \alpha_{12} HHA_t + \alpha_{13} CAR9_t + \alpha_{14} MCAP_t + \alpha_{15} RATE_t + \varepsilon_{i,t} \end{aligned} \quad (1)$$

To investigate market discipline, prior studies attempted to explore the relationship between bank risk and the uninsured deposits and/or between bank risk and the interest rates on uninsured deposits (Hadad et al., 2011). Given the availability of data, we cannot distinguish the interest expense paid by banks on uninsured deposits. Hence, following Demirgüç-Kunt and Huizinga (2004) and Hadad et al. (2011), we use an implicit interest rate. The implicit rate is calculated by dividing total interest expenses by total deposits (INTDEPO).

For measures of bank risk, we employ several accounting ratios including LLRTA, the ratio of loan loss reserves to total assets as a proxy for credit risk (Altunbas et al., 2007; Le, 2018); LATA, the ratio of liquidity assets to total assets as a proxy for liquidity risk (Le, 2017b). Following Lepetit and Strobel (2013), ZSCORE is included to control for insolvency risk. The Z-score of a bank is measured as  $Z-score_{i,t} = \frac{ROA_{i,t} + EQUITY_{i,t}}{\sigma_{ROA}}$ , where  $\overline{ROA}$ , the mean of ROA over the sample period; EQUITY, the ratio of total equity to total assets;  $\sigma_{ROA}$ , the standard deviation of ROA that is calculated based on the observations of ROA over the examined period. Since the distribution of Z-scores is highly skewed, the natural logarithm of Z-scores is used to mitigate this issue. For brevity, we still use the label, “ZSCORE”, to represent the natural logarithm of the Z-score in the remainder of this study. A positive sign for LLRTA and a negative sign for both LATA and ZSCORE are expected.<sup>6</sup>

NIETA, as measured by the ratio of non-interest expenses to total assets, is used to control for bank efficiency effects (Ghosh, 2007). Depositors may exercise the market discipline by requiring a higher interest rate on inefficient banks—thus, a positive sign is expected. LNNTA, the natural logarithm of total assets, is used to control for the effect of bank size. The mixed results are found in several studies such as a negative sign (Flannery & Sorescu, 1996) or a positive sign (Hadad et al., 2011). We, therefore, do not have any a priori sign on this variable.

General macroeconomic conditions including the Gross Domestic Product growth rate (GDP), the inflation rate (INF) and the annual average of VND/USD exchange rate (RATE) are also used as control variables. As Vietnam experienced the volatile economic conditions during this study, the expected specific signs for these variables are ambiguous.

Furthermore, other control variables are used: (1) the Hirsch-Herfindahl Index in terms of total assets (HHA) variable to control for the effect of market concentration (2) a market capitalization over GDP (MCAP) variable to control for the effect of capital market competition (3) bank ownership variables (foreign-owned versus domestic banks (FOREIGN), listed versus unlisted banks (LISTED), and state-owned versus privately owned commercial banks (OWNER)) (4) regulatory variable—the minimum capital adequacy requirement of 9% (CAR9). Again, we do not expect a specific sign for these variables, except for CAR9.

To examine the impact of regulatory changes on the extent of market discipline, we interact CAR9 with bank risk variables (LLRTA, LATA, and ZSCORE) and bank ownership variables (FOREIGN, LISTED and OWNER). Market discipline is presented when the dummy interaction with LLRTA shows

**Table 1. Descriptive statistics of variables used**

Variables	Obs	Mean	Std	Min	Max
INTDEPO	336	0.074	0.032	0.001	0.182
LLRTA	336	0.007	0.013	0.0001	0.221
LATA	336	0.351	0.142	0.041	0.816
ZSCORE	336	2.939	0.582	0.995	5.049
NIETA	336	0.018	0.009	0.001	0.08
LNTA	336	17.508	1.468	13.012	20.59
FOREIGN	336	0.355	0.479	0	1
LISTED	336	0.1875	0.391	0	1
OWNER	336	0.146	0.354	0	1
GDP	336	0.061	0.006	0.052	0.071
INF	336	0.104	0.070	-0.002	0.227
HHA	336	0.084	0.022	0.063	0.139
CAR9	336	0.488	0.501	0	1
MCAP	336	17.387	9.73	0	26.846
RATE	336	18.881	2.193	15.994	21.698

Notes: INTDEPO, the ratio of interest expenses to total deposits; LLRTA, the ratio of loan loss reserve to total assets; LATA, the ratio of liquid assets to total assets; ZSCORE, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; NIETA, the ratio of non-interest expenses to total assets; LNTA, the natural logarithm of total assets; FOREIGN, a dummy variable that takes a value of 1 for a foreign-owned bank, 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank, 0 otherwise; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank, 0 otherwise; GDP, the growth rate of gross domestic products; INF, the inflation rate; HHA, the Hirsch-Herfindahl Index in terms of total assets; CAR9, a dummy variable that takes a value of 1 for the period of implementing the minimum capital adequacy requirement of 9% (1 = 2011–2015), 0 otherwise; MCAP, a market capitalization over GDP; RATE, the annual average of the VND/USD exchange rate.

a positive sign or the dummy interaction variables with LATA and ZSCORE indicate a negative sign. The same interpretation also applies when the interaction variables between ownership and bank risk show a significant sign.

### 3.2. Data

The financial data from 2006 to 2015, the most comprehensive time frame for which data on the concerned variables are available, are sourced from the banks' audited financial statement according to Vietnamese Accounting Standard, particularly for the December (or year-end position). Macroeconomic data such as the inflation rate, the GDP growth rate, and market capitalization are collected from the World Bank database while the annual average Vietnamese/USD exchange rate data are obtained from the Asian Development Bank database.

Only commercial banks are selected in this study since they are mainly active players while foreign banks affiliated and joint-venture banks are somewhat limited to operate in the Vietnamese banking system. These banks included in this analysis must be active from 2011 to 2015 when the minimum capital adequacy of 9% is implemented. This, therefore, provides us with an unbalanced panel of banks, which comprises five SOCBs and 32 POCBs. These banks together accounted for over 80% of total assets in the industry. Table 1 provides descriptive statistics for the raw variables used in this study.

## 4. Findings

### 4.1. Correlation matrix

Table 2 reports the correlation matrix between considered variables excluding the measure of the regulatory change in capital adequacy during the study period. LATA is significantly related to the

**Table 2. Correlation matrix**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A. INTDEPO	1.000													
B. LLRTA	-0.008	1.000												
C. LATA	-0.185***	-0.138**	1.000											
D. ZSCORE	0.049	-0.036	-0.048	1.000										
E. NIETA	0.224***	0.007	-0.121**	0.018	1.000									
F. LNTA	-0.054	0.193***	-0.016	-0.226***	-0.062	1.000								
G. FOREIGN	0.006	0.065	0.014	-0.154***	0.008	0.289***	1.000							
H. LISTED	-0.072	0.014	-0.138**	-0.025	0.013	0.432***	0.265***	1.000						
I. OWNER	-0.034	0.181***	-0.129**	0.002	0.010	0.517***	-0.131**	0.147***	1.000					
J. GDP	-0.280***	0.003	-0.005	0.027	-0.214***	-0.185***	-0.065	-0.055	0.013	1.000				
K. INF	0.632***	-0.029	0.146***	0.078	-0.026	-0.190***	-0.027	-0.098*	-0.012	-0.081	1.000			
L. HHA	-0.276***	-0.032	-0.041	0.140***	-0.151***	-0.435***	-0.126**	-0.176***	0.020	0.538***	-0.014	1.000		
M. MCAP	-0.025	-0.009	-0.042	-0.155***	0.135**	0.440***	0.113**	0.191***	-0.015	-0.539***	-0.385***	-0.820***	1.000	
N. RATE	0.079	0.041	-0.051	-0.146***	0.271***	0.499***	0.138**	0.220***	-0.003	-0.301***	-0.328***	-0.723***	0.700***	1.000

Notes: INTDEPO, the ratio of interest expenses to total deposits; LLRTA, the ratio of loan loss reserve to total assets; ZSCORE, the ratio of liquid assets to total assets; ZSCORE, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; NIETA, the ratio of non-interest expenses to total assets; LNTA, the natural logarithm of total assets; FOREIGN, a dummy variable that takes a value of 1 for a foreign-owned bank, 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank, 0 otherwise; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank, 0 otherwise; GDP, the growth rate of gross domestic products; INF, the inflation rate; HHA, the Hirsch-Herfindahl Index in terms of total assets; MCAP, a market capitalization over GDP; RATE, the annual average of the VND/USD exchange rate. \*, \*\*, \*\*\*Significant at 10, 5, and 1 per cent levels, respectively.



dependent variable as expected, suggesting the presence of market discipline on Vietnamese banks. The correlation between NIETA and INTDEPO is significant in the expected direction. INTDEPO is also strongly correlated with general macroeconomic variables (GDP, INF, and HHA). To ensure that these correlations will not lead to multicollinearity, the variance inflation test (VIF) is used. The results indicate that VIF of the regression is below 10, implying that multicollinearity is not a serious problem.<sup>7</sup>

#### 4.2. Regression results

In Table 3, the results of the Hansen test are reported to test the validity of the dynamic panel model. Since the  $p$ -value of the Hansen test is statistically not significant in any of the models, the null hypothesis cannot be rejected. This means that there is no evidence of over-identifying restrictions. Hence, all conditions for the moments are met and the above instruments are accepted. The first- and second-order autocorrelation is also conducted between the first residual differences. In the first-order autocorrelation (AR1), the hypothesis of the non-existence of the first-order autocorrelation between the first residual differences is rejected. However, this does not suggest that estimates are inconsistent. Inconsistency would be implied if the second-order autocorrelation is present (Arellano & Bond, 1991). As can be seen in Table 3, the  $p$ -values of AR2 are statistically not significant, implying that the moment conditions of the model are satisfied. All in all, the estimated model meets diagnostic tests in this study.

The base model (Model 1) indicates the presence of market discipline as LATA and ZSCORE affect INTDEPO negatively, respectively. Thus, depositors may discipline the banks by requiring higher interest rates on banks with greater liquidity risk and insolvency risk. The coefficient of NIETA is positive and significant, suggesting that depositors may exercise the market discipline by demanding greater interest rates on less efficient banks. LNTA is also negatively and insignificantly associated with INTDEPO in most models, suggesting the effect of too-big-to-fail does not exist in the Vietnamese banking system. This somewhat does not support the early findings of Flannery and Sorescu (1996) in the US. But, this is partly comparable to those of Hadad et al. (2011) in Indonesia.

However, the coefficient of CAR9 is negative and significant, indicating that the market is requiring a lower interest rate when the new capital adequacy requirement is implemented. This weakening of market discipline is consistent with the regulators closely monitoring the level of insolvency risks of banks. Model 2 also indicates that none of the three interaction variables exhibit coefficients with a high degree of significance.

For macroeconomic conditions, GDP is negatively and significantly associated with INTDEPO, suggesting that depositors in the good economic condition can earn a higher income, thus having extra funds to make deposits in banks. INF is, however, positively and significantly related to INTDEPO, implying that the depositors are requiring higher interest rates to compensate for the depreciation of money value. A negative relationship between HHA and INTDEPO highlights that the more concentrated market is, the lower interest rate deposits. Therefore, there is a lack of market discipline. Furthermore, a positive link between RATE and INTDEPO suggests that a higher interest rate tends to attract foreign investments—increasing the demand for the VND, which leads to an increase in the value of VND. The findings also show a negative impact of MCAP on INTDEPO, implying that banks could access more funds easier when a capital market development becomes deeper, therefore, paying lower interest rates.

For the property of bank ownership, we first investigate whether there is any difference in market discipline between different types of ownership during the CAR9 period. Model 2 shows that only FOREIGN\*CAR9 is negatively and significantly associated with INTDEPO, which may suggest the weakening of market discipline. Since foreign-owned banks are considered as being

**Table 3. Regression results**

INTDEPO	Expected signs	Model 1	Model 2	Model 3
Constant		0.141(0.11)	0.159(0.127)	0.202*(0.117)
INTDEPO <sub>t-1</sub>		0.184**(0.077)	0.214**(0.093)	0.172**(0.078)
LLRTA	+	-0.163(0.372)	-0.454(0.525)	-0.234(0.475)
LATA	-	-0.156*** (0.032)	-0.149*** (0.043)	-0.164*** (0.048)
ZSCORE	-	-0.037*** (0.011)	-0.044* (0.023)	-0.04** (0.015)
NIETA	+	1.092** (0.466)	1.232* (0.624)	0.831 (0.502)
LNTA	-	-0.002 (0.007)	-0.002 (0.01)	-0.006 (0.009)
FOREIGN		0.007 (0.008)	-0.004 (0.015)	0.004 (0.011)
LISTED		0.005 (0.01)	-0.005 (0.013)	0.004 (0.014)
OWNER		-0.006 (0.021)	0.005 (0.034)	-0.0001 (0.024)
GDP		-1.08** (0.499)	-0.872 (0.658)	-1.127** (0.528)
INF		0.267*** (0.043)	0.27*** (0.058)	0.271*** (0.044)
HHA		-0.515*** (0.181)	-0.472* (0.279)	-0.434** (0.194)
CAR9		-0.04*** (0.007)	-0.034* (0.018)	-0.068 (0.048)
MCAP		-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)
RATE		0.012*** (0.002)	0.011*** (0.003)	0.013*** (0.004)
LLRTA*CAR9	+			-0.335 (0.953)
LATA*CAR9	-			0.012 (0.045)
ZSCORE*CAR9	-			0.01 (0.013)
FOREIGN*CAR9	+		-0.014** (0.007)	
LISTED*CAR9	-		0.014 (0.011)	
OWNER*CAR9	-		0.007 (0.02)	
No. of Obs		297	297	297
No. of groups		37	37	37
AR1 (p-value)		0.002	0.001	0.001
AR2 (p-value)		0.146	0.177	0.197
Hansen test (p-value)		0.610	0.554	0.487
INTDEPO	Expected signs	Model 4	Model 5	Model 6
Constant		0.429(0.35)	0.176(0.144)	-0.098(0.187)
INTDEPO <sub>t-1</sub>		0.238** (0.091)	0.179** (0.085)	0.309*** (0.113)
LLRTA	+	2.023 (1.515)	-0.307 (0.374)	-0.228 (0.476)
LATA	-	-0.173*** (0.045)	-0.157*** (0.032)	-0.193*** (0.039)
ZSCORE	-	-0.077* (0.044)	-0.031*** (0.011)	-0.024 (0.017)
NIETA	+	1.073** (0.499)	0.794* (0.469)	1.408** (0.595)
LNTA	-	-0.021 (0.02)	-0.002 (0.008)	0.013 (0.01)
FOREIGN		-0.122 (0.081)	-0.005 (0.008)	0.003 (0.01)
LISTED		0.01 (0.014)	-0.123 (0.141)	0.002 (0.014)
OWNER		0.038 (0.091)	-0.01 (0.02)	-0.1 (0.14)
GDP		-0.472 (0.548)	-0.675 (0.554)	-0.346 (0.646)
INF		0.354*** (0.047)	0.283*** (0.044)	0.274*** (0.054)
HHA		-0.161 (0.311)	-0.474* (0.26)	-0.467* (0.27)
CAR9		-0.032 (0.019)	-0.023* (0.013)	-0.03** (0.013)
MCAP		-0.001 (0.001)	-0.002** (0.001)	-0.002** (0.001)
RATE		0.015* (0.008)	0.008* (0.004)	0.007 (0.004)

(Continued)

INTDEPO	Expected signs	Model 1	Model 2	Model 3
FOREIGN*LLRTA	+	-2.343(1.602)		
FOREIGN*LATA	-	0.04(0.069)		
FOREIGN*ZSCORE	-	0.046(0.032)		
LISTED*LLRTA	+		1.482(2.617)	
LISTED*LATA	-		0.022(0.058)	
LISTED*ZSCORE	-		0.034(0.046)	
OWNER*LLRTA	+			-2.051(4.063)
OWNER*LATA	-			0.182(0.254)
OWNER*ZSCORE	-			0.004(0.051)
No. of Obs		297	297	297
No. of groups		36	36	36
AR1 (p-value)		0.001	0.002	0.003
AR2 (p-value)		0.146	0.115	0.150
Hansen test (p-value)		0.590	0.489	0.688

Notes: INTDEPO, the ratio of interest expenses to total deposits; LLRTA, the ratio of loan loss reserve to total assets; LATA, the ratio of liquid assets to total assets; ZSCORE, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; NIETA, the ratio of non-interest expenses to total assets; LNTA, the natural logarithm of total assets; FOREIGN, a dummy variable that takes a value of 1 for a foreign-owned bank, 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank, 0 otherwise; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank, 0 otherwise; GDP, the growth rate of gross domestic products; INF, the inflation rate; HHA, the Hirsch-Herfindahl Index in terms of total assets; CAR9, a dummy variable that takes a value of 1 for the period of implementing the minimum capital adequacy requirement of 9% (1 = 2011–2015), 0 otherwise; MCAP, a market capitalization over GDP; RATE, the annual average of the VND/USD exchange rate. The table contains the results estimated using the system GMM estimator following Arellano and Bover (1995). Robust standard errors are in parentheses. \*, \*\*, \*\*\*Significant at 10, 5, and 1 per cent levels, respectively.

less risky, possibly because of their diversified loan portfolio, they may pay lower interest rates than their counterparts.

We further examine whether there is any difference in market discipline between different types of bank ownership and bank risk. Models 4–6 indicate that none of the interaction variables between ownership and bank risks exhibits coefficients with a high level of significance, and therefore there is no evidence of market discipline.

#### 4.3. Robustness check

For robustness, we run several regressions excluding several independent variables that are highly correlated. We exclude MCAP from the regressions since it is strongly correlated with RATE and HHA (above 70%).

The results shown in Table 4 (Model 7) confirm our main findings that there is a lack of market discipline when the new minimum capital adequacy of 9% is implemented. LLRTA is also significantly and positively associated with INTDEPO as expected while LNTA shows a negative and significant sign. However, GDP and HHA no longer have a significant sign. When the interaction variables are used, the coefficients of these variables are not significant although the table of results cannot be presented due to the limited space.

Following Le (2017a) and García-Herrero et al. (2009), FOREIGNA, the share of foreign ownership in the local bank is used and the same results are also obtained as shown in Model 8.<sup>8</sup>

We also use the growth of deposits (DEPOGR) as an alternative measure of bank market discipline. It is important to note that the expected signs should be opposite to when the interest

**Table 4. Robustness results**

INTDEPO	Expected signs	Model 7	Model 8	Model 9	Model 10
Constant		0.284**(0.124)	0.226(0.212)	0.384**(0.184)	0.149(0.118)
INTDEPO <sub>t-1</sub>		0.217*** (0.079)	0.284*** (0.085)	0.292*** (0.082)	0.165* (0.083)
LLRTA	+	0.704*** (0.239)	-0.454(0.803)	-0.407(0.625)	-0.326(0.267)
LATA	-	-0.092*** (0.032)	-0.125** (0.047)	-0.142*** (0.044)	-0.155*** (0.026)
ZSCORE	-	-0.032** (0.012)	-0.021(0.03)	-0.031(0.024)	-0.032*** (0.01)
NIETA	+	0.909* (0.514)	2.069** (0.963)	0.584(0.715)	0.934*** (0.338)
LNTA	-	-0.014** (0.007)	-0.013(0.012)	-0.008(0.017)	-0.00002(0.007)
FOREIGN		0.004(0.011)	0.001(0.024)	0.002(0.013)	
FOREIGNA					-0.024(0.04)
LISTED		0.012(0.011)	0.009(0.018)	0.004(0.014)	0.007(0.009)
OWNER		0.032(0.025)	-0.008(0.043)	0.01(0.038)	-0.009(0.017)
GDP		-0.273(0.477)	0.68(0.542)	0.86** (0.423)	-1.137** (0.433)
INF		0.369*** (0.027)	0.323*** (0.043)	0.243*** (0.034)	0.259*** (0.039)
HHA		-0.027(0.146)	-0.291(0.184)	-0.525*** (0.149)	-0.516*** (0.189)
CAR9		-0.02*** (0.005)	-0.007(0.011)	-0.065(0.041)	-0.032*** (0.007)
RATE		0.011*** (0.003)	0.004(0.004)	-0.006(0.006)	0.01*** (0.002)
FOREIGN*CAR9			-0.015* (0.008)		
LISTED*CAR9			0.019(0.02)		
OWNER*CAR9			0.006(0.026)		
LLRTA*CAR9				1.142(1.543)	
LATA*CAR9				0.062(0.051)	
ZSCORE*CAR9				0.022(0.014)	
MCAP					-0.002*** (0.001)
No. of Obs		297	290	290	297
No. of groups		35	37	37	37
AR1 (p-value)		0.004	0.002	0.001	0.002
AR2 (p-value)		0.113	0.728	0.123	0.203
Hansen test (p-value)		0.341	0.822	0.469	0.550

Notes: INTDEPO, the ratio of interest expenses to total deposits; LLRTA, the ratio of loan loss reserve to total assets; LATA, the ratio of liquid assets to total assets; ZSCORE, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; NIETA, the ratio of non-interest expenses to total assets; LNTA, the natural logarithm of total assets; FOREIGNA, the share of foreign ownership in the local bank; LISTED, a dummy variable that takes a value of 1 for a listed bank, 0 otherwise; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank, 0 otherwise; GDP, the growth rate of gross domestic products; INF, the inflation rate; HHA, the Hirsch-Herfindahl Index in terms of total assets; CAR9, a dummy variable that takes a value of 1 for the period of implementing the minimum capital adequacy requirement of 9% (1 = 2011-2015), 0 otherwise; MCAP, a market capitalization over GDP; RATE, the annual average of the VND/USD exchange rate. The table contains the results estimated using the system GMM estimator following Arellano and Bover (1995). Robust standard errors are in parentheses. \*, \*\*, \*\*\*Significant at 10, 5, and 1 per cent levels, respectively.

rate of deposit (INTDEPO) is used as a dependent variable. The regression results (not reported)<sup>9</sup> indicate that for the full period, only LLRTA shows an expected negative and significant sign. FOREIGN also affects DEPOGR negatively. The regulatory variable (CAR9) does not have any significant impact on market discipline. Overall, these results suggest that market discipline in the Vietnamese banking system is seemingly reflected more in the price of deposits rather than in the volume of deposits.

For comparative purposes, we also use static panel data procedures. We still find a weakening of market discipline during the period of implementing the new capital adequacy. However, our confidence in the results is much lower than with the dynamic panel data analysis because the nature of data makes the later approach more appropriate.

## 5. Conclusion

This study investigated the impact of increased minimum capital adequacy on market discipline in the Vietnamese banking system from 2006 to 2015 using system GMM. The findings show evidence of market discipline because higher deposit rates are associated with greater liquidity risk and higher insolvency risk. A negative relationship between CAR9 and INTDEPO supports the view that the higher capital adequacy to strengthen the banks' financial soundness results in a weakening of market discipline. The same is true for foreign-owned banks since an increased minimum capital adequacy of 9% is implemented as these banks that have better governance and a more diversified portfolio may pay lower interest rates than their counterparts. Hence, regulators should encourage more foreign-owned banks to be presented in the financial markets. Finally, we do not find any evidence in the difference in market discipline between other types of bank ownership. Nonetheless, our findings suggest that integrating market discipline with regulatory discipline is essential.

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### correction

This article has been republished with minor changes. These changes do not impact the academic content of the article.

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### Notes

1. For more information, please see BIS (2001). Later, Basel III reemphasizes the importance of market discipline (see, <https://www.bis.org/bcbs/basel3.htm>).
2. During the period, the maximum share of foreign ownership in a local bank is 30%. Merger and acquisition activities between local banks and foreign banks in the form of strategic partners are strictly supervised by the banking authorities.
3. A lack of credibility of deposit insurance programs is explained by (1) many governments have reneged on their promise in the past (2) the schemes tend to be undercapitalized (3) depositors are concerned about the cost of repayment—typically in the form of delays via the deposit insurance funds.
4. Prior studies examining the presence of market discipline use a dynamic panel data such as Hadad et al. (2011) in Indonesia and Maechler and McDill (2006) in the US or the same methodology in addition to a static

panel data (both fixed and random effects models) in Brazil.

5. It is assumed that strictly exogenous variables do not correlate with the individual effects while the endogenous variables are predetermined.
6. During the crisis periods, although bank regulators can reduce credit and insolvency risk, the restructuring program may delay depositor payment and liquidity risk is not mitigated.
7. Gujarati (2003) suggests the VIF cut-off is 10. If the estimated VIF is greater than 10, there may be an indication of multicollinearity.
8. Once again, the interaction variables are also used and the same results of these variables are found although the table of results cannot be presented due to the length restriction.
9. It is available upon request.

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