The impact of multimarket contacts on bank stability in Vietnam

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Abstract

Purpose – The purpose of this study is to investigate the impact of multimarket contacts on bank stability in the Vietnamese banking system between 2006 and 2015.

Design/methodology/approach – The system generalized method of moments proposed by Arellano and Bover (1995) is used to examine the relationship between multimarket contacts and bank stability.

Findings – The findings show that multimarket contacts among Vietnamese commercial banks improve bank stability. In addition, more x-efficient banks appear to be more stable. The same is true for banks with less holding liquid assets, for those with less excessive lending, for smaller banks, for those with the greater level of intermediation and for those with a higher level of foreign ownership. Listed banks are found to be less-risk taking than unlisted banks.

Originality/value – This study is the first attempt to examine the relationship between multimarket contacts and bank stability in an emerging market in the Asia-Pacific region.

Keywords Vietnam, GMM, Bank stability, Multimarket contact, Mutual forbearance

Paper type Research paper

1. Introduction

The banking systems in both developed and developing countries have experienced significant structural changes due to globalization, liberalization and innovation of financial markets over the past decade. In fact, there is a dramatic reduction in the number of banks in most countries (DeYoung *et al.*, 2009). One of the main driving factors for this decline was deregulation, which removed geographical constraints of banks, thus allowing them to establish diverse branch networks across different regions within the country. Consequently, there appears the increasing competition among geographically diversified banks in more than one geographical market.

Factors such as market concentration, number of competitors, entry barriers and market size and growth are studied to investigate the competitive structure of a given local market. Features external to market are often excluded from this process (Pilloff, 1999). Omitting one such factor, the degree of contact outside a given market among banks competing in that given market, from the analysis may result in an incomplete assessment of the competition. Markets with banks that meet frequently in other markets may exhibit different levels of competition than markets with banks having no additional contacts – thus, having a different impact on bank stability. The mutual forbearance suggests that banks operating in the same geographical markets may have less incentive to compete fiercely in the given market if they fear rivals' retaliation not only in that market but also in all other markets in which they meet.

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This study investigates, the relationship between multimarket contacts on bank stability in Vietnam because the debate on this linkage has received much attention by academics and policymakers in recent years. The structural reform and liberalization process in the Vietnamese banking system in the past two decades have impacted the competitive conditions. These reforms have mainly focused on restructuring the four largest state-owned commercial banks (SOCBs) that had long served as a lending arm of state-owned enterprises. The rest of the banking system, approximately 50 per cent of total bank assets (KPMG, 2013) has a much-diversified structure. Privately-owned commercial banks are generally the most market-oriented and their equity ownership is mainly distributed among state, private and foreign investors. Privately owned commercial banks (POCBs) have operated more actively and have gradually gained a large market share in terms of both deposits and credit market shares. In fact, many POCBs have mainly concentrated on providing universal banking services in particular regions, while some POCBs maintain large branch networks that allow them to operate on multiregional or national bases. While there was a small change in the total number of commercial banks[1] in the sector from 39 in 2006 to 35 in 2015, the total number of branches significantly increased from 3,234 in 2006 to 8,276 in 2015[2]. Most banks are competing with more branches, suggesting that they have started to contact with each other in many geographical markets. This, thus, is one of the main motivations to conduct this study on the impact of multimarket contacts on bank stability in Vietnam.

Our study contributes to the literature in several ways. The literature on the relationship between multimarket contacts and bank performance is dominated by studies from the USA and Europe, where larger markets and number of banks have facilitated the economic modeling. One may argue that whether the evidence in developed markets reflects the true effect of multimarket contacts in other markets because of the substantial difference in institutional reality and financial environments. Unfortunately, there are so far no studies that are conducted in the emerging countries, especially in the Asia-Pacific region. Due to data reliability and availability constraints, this study focuses on Vietnam. Given the level of structural and performance comparability across the region, the findings will increase the validity of the impact of multimarket contacts on bank performance in the Asia-Pacific region. In addition, to the best of our knowledge, this study is the first attempt to investigate the relationship between multimarket contacts and bank stability in Vietnam. This, thus, would provide the better understanding of multimarket contacts characteristics in the Vietnamese banking system.

Our findings show that multimarket contacts among Vietnamese commercial banks improve bank stability. In addition, more x-efficient banks appear to be more stable. The same is true for banks with less holding liquid assets, for those with less excessive lending, for smaller banks, for those with the greater level of intermediation and for those with a greater level of foreign ownership. Listed banks are found to be less-risk taking than unlisted counterparts, suggesting that banks are encouraged to list in the stock market to enhance the transparency in the Vietnamese banking market. The results of robust checks confirm our main findings.

The remainder of this study is organized as follows: Section 2 presents the literature review on the relationship between multimarket and bank performance. Section 3 describes the methodology and data used. Section 4 discusses the empirical results, while Section 5 concludes.

2. Literature review

The linked oligopoly theory or mutual forbearance hypothesis suggests that geographically diversified banks may not have aggressive attitudes toward their multimarket competitors due to the fear of multipoint attach from their rivals. Hence, the multimarket firms could be

more profitable due to anti-competitive effects along with tie-in sales and exclusive dealing arrangements. Multimarket contacts, however, may lead to the intensity of competition, which in turn, reduce bank profitability. Although many studies have been conducted in many industries to test this hypothesis, the research in multimarket contacts in the banking system is very limited[3]. The literature on the relationship between multimarket contacts and bank performance indicates mixed findings.

The earlier studies in the USA suggest that greater bank profitability is related to higher multimarket contacts along with higher concentration (Pilloff, 1999; Whalen, 1996). The similar results are found in the study of Coccorese and Pellecchia (2009, 2013) using the Italian data. In contrast, the findings of Rhoades and Heggestad (1985) demonstrate that the relationship between multimarket contacts on bank profits and prices is ambiguous. In the same vein, Mester (1987) indicates high concentration accompanied by higher multimarket contact that results in more competitive. The findings of De Bonis and Ferrando (2000), using the Italian data also confirm that geographical overlaps tend to increase the competitions and lower lending rates. Furthermore, multimarket banks enjoy a competitive advantage over single-market counterparts due to their geographic expansion, thus reducing deposit interest rates offered by single-market banks in the same market (Hannan and Prager, 2004) or leading to a decline in revenue and an increase in costs for single-market banks (Berger *et al.*, 2007).

Recently, several studies have further examined the relationship between multimarket contacts and bank risk and show that an increase in multimarket contacts among banks tends to improve individual bank stability in the Turkish banking system (Kasman and Kasman, 2016). Their findings, however, indicate an inverse U-shape relationship between them.

This study attempts to fill some gaps. First, there is no such study that has been conducted in the emerging markets, especially in the Asia-Pacific region. Second, this study aims to investigate whether the positive relationship between multimarket contacts and bank stability still holds in the context of the Vietnamese banking system. The findings, thus, in this study can be applied to other countries in the same region.

3. Methodology and data

3.1 Methodology

This study primarily aims at investigating the relationship between multimarket contacts and bank stability in the Vietnamese banking system. Taking into account of the extant literature, as well as Vietnamese banks' characteristics, both bank-specific and macroeconomic factors are considered.

One is endogeneity, as an example, banks with poor management may fail to control operating costs; thus, resulting in higher risk. In addition, greater risk banks are also subject to more regulatory scrutiny – thus, they may be required to hold a greater level of liquid assets and to be prudent to advance new lending. The causality could also go in the opposite way because banks that face greater risk are required to use additional managerial efforts and additional resources to address these problems. This, thus, may increase banks' inefficiency. The ownership may be also endogenous as investors may decide to invest in riskier banks to maximize their expected utility (Gugler and Weigand, 2003).

Another critical issue is unobservable heterogeneity across banks, which could be very large in the Vietnamese banking system given differences in their corporate governance, which cannot be well-measured. Finally, the bank risk may be persistent for Vietnamese banks because of political interference[4]. This may be the case for SOCBs, which are targeted to have lower insolvency risk.

To deal with three potential problems together, we use the generalized method of moments (GMM) system proposed by Arellano and Bover (1995), which moves beyond the methodology currently as used in the current literature on bank risk, mainly the pooled ordinary least square[5]. This method 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[6]. It is noted that the variables treated as endogenous in our models are presented in italics in the tables of results below. The GMM system also controls for unobserved heterogeneity and for 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.

The above arguments suggest the application of a dynamic model that takes the following form:

$$\begin{aligned} Z-score_{i,t} = {} & \alpha_0 + \alpha_1 Z-score_{i,t-1} + \alpha_2 MMC_{i,t} + \alpha_3 EFF_{i,t} + \alpha_4 LATA_{i,t} + \alpha_5 TLTA_{i,t} \\ & + LNTA_{i,t} + \alpha_7 TDTL_{i,t} + +\alpha_8 OWNER_{i,t} + \alpha_9 LISTED_{i,t} \\ & + \alpha_{10} FOREIGN_{i,t} + \alpha_{11} HHI_{i,t} + \alpha_{12} GFC + \varepsilon_{i,t} \end{aligned} \tag{1}$$

When estimating bank risk, few measures can be used in the literature such as the ratio of loan loss provision to total loans (Williams, 2004); the ratio of loan loss reserves (Altunbas *et al.*, 2007; Le, 2018); the ratio of non-performing loans to total loans (Berger *et al.*, 2009); one or five-year expected default frequency (Fiordelisi *et al.*, 2011); and the Z-score (Demirgüç-Kunt and Huizinga, 2010; Fu *et al.*, 2015). The first three measures are subject to the managerial discretion and capture only credit risks[7]. The expected default frequency requires data on stock prices, but many Vietnamese banks do not hold publicly traded securities. Subsequently, this study uses the Z-score[8] as an inverse measure of overall bank risk. A larger value of Z-score implies the greater bank's stability and less overall bank risk.

Following Lepetit and Strobel (2013), the Z-score of a bank is measured as:

$$Z-score_{i,t} = \frac{\overline{ROA}_{i,} + EQUITY_{i,t}}{\sigma_{ROA_i}} \tag{2}$$

where $\overline{ROA}$, the mean of *ROA* over the sample period; *EQUITY*, the ratio of total equity to total assets; σ_{ROA}, the standard deviation of *ROA* that is calculated based on the observations of *ROA* over the examined period. As 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, "Z-score", to represent the natural logarithm of the Z-score in the remainder of this study.

Using existing literature, we use multimarket contacts (*MMC*), bank efficiency *(EFF)*, liquidity *(LATA)*, excessive lending *(TLTA)*, bank size *(LNTA)*, bank intermediation (*TDTL*), bank-specific concentration index (*HHI*), bank ownership (*OWNER* and *FOREIGN*), listed bank (*LISTED*) and global financial crisis (*GFC*) as control variables for bank risk.

To compute *MMC* for each bank, the province is considered as the local market. More specifically, there are 63 provinces in Vietnam. Following Coccorese and Pellecchia (2009), the *MMC* variable is computed as follows:

$$MMC1_i = \frac{\sum_{i \neq j} m_{ij} \gamma_{ij}}{\sum_{i \neq j} \gamma_{ij}} \quad (3)$$

where $\gamma_{ij} = 1$ if $m_{ij} > 0$ and $\gamma_{ij} = 0$ if $m_{ij} = 0$. m_{ij} represents the number of contacts between bank i and j. $\gamma_{ij} = 0$ means bank i does not contact with bank j. The index lies between 1 and a total number of local markets, which is 63 in this study. Therefore, *MMC*1 equals 1 in the case of single-market banks.

However, not every rival can have the same importance for a bank. For robustness checks, two other indices of multimarket contacts are estimated. *MMC*2, the number of contacts between two banks is weighted by an index measuring their similarity in terms of market shares in all local markets, where they meet each other:

$$MMC2_i = \frac{\sum_{ij} \overline{m}_{ij} \overline{\gamma}_{ij}}{\sum_{i \neq j} \overline{\gamma}_{ij}} \quad (4)$$

where $\overline{\gamma}_{ij} = 1$ if $\overline{m}_{ij} > 0$, and $\overline{\gamma}_{ij} = 0$ if $\overline{m}_{ij} = 0$.

The literature suggests that the symmetry among banks can increase their collusion. The incentive of collusion may depend upon the size of the rival. *MMC*3 is calculated when taking into account of the size of the rival as follows:

$$MMC2_i = \frac{\sum_{i \neq j} \overline{\overline{m}}_{ij} \overline{\overline{\gamma}}_{ij}}{\sum_{i \neq j} \overline{\overline{\gamma}}_{ij}} \quad (5)$$

where $\overline{\overline{\gamma}}_{ij} = 1$ if $\overline{\overline{m}}_{ij} > 0$, and $\overline{\overline{\gamma}}_{ij} = 0$ if $\overline{\overline{m}}_{ij} = 0$.

MMC_2 and MMC_3 indicate that the increase in the similarity of the banks should improve the impact of multimarket contacts[9].

EFF[10], technical inefficiency as derived from the bootstrap DEA under variable returns to scale assumption, is used to control for bank inefficiency. This approach measures, how well the observed bank manages its costs to the best-practice bank in the sample. The use of technical inefficiency is more advantageous over the traditional accounting ratios as measures of bank efficiency. A very common indicator – the cost to income ratio – may lead to a biased estimate of bank efficiency because the lending and deposit rates in the Vietnamese banking system are not yet fully liberalized. Another indicator – the ratio of operating expenses to total assets – is actually a component of the *ROA* as used to construct bank risk, so that including it as a regressor may create identification problems. Among the different methodologies used to estimate technical efficiency, we chose a non-parametric approach[11] – data envelopment analysis – works well with small sample size (Evanoff and Israilevich, 1991) and is less prone to specification error, thus is more flexible (Reinhard *et al.*, 2000). To overcome the disadvantages of conventional DEA, a bootstrap data envelopment analysis[12] as proposed by Simar and Wilson (1998, 2000) is used. As per the bad management hypothesis, banks with poor management may fail to control operating costs or monitor borrowers, thus, resulting in higher risk. Also, less efficient banks tend to be more prone to risk-taking due to a lower value of their charter capital. Alternatively, the skimping costs hypothesis suggests that banks tend to skimp on operating costs by reducing credit monitoring, collateral valuing and marketing activities to achieve short-run economic efficiency. These activities, however, would deteriorate loan quality thus, leading to higher risk.

LATA, the ratio of liquid assets to total assets, is used to control for bank liquidity. Liquid banks are expected to be safer and have less risky portfolios. Accordingly, more funds invested in liquid assets given their low return relative to other assets would reduce bank profitability. However, banks with higher liquidity levels have greater profitability (Bourke, 1989). According to the expected bankruptcy cost hypothesis, an increase in the relative liquid assets holdings of banks decreases its probability of default (Bordeleau and Graham, 2010). In other words, banks with liquidity problems may have to borrow from the market even at an exceptionally high rate, which ultimately results in a significant reduction in bank's earnings and higher risk.

TLTA, the ratio of total loans to total assets, is used to control for excessive lending. Banks may seek for new lending opportunities, and expand to new geographic markets and/or increase their market share within the existing market (Lepetit *et al.*, 2008; Rossi *et al.*, 2009). Under this presumption that new loans may be granted to borrowers who were previously rejected by other lenders because of too little collateral relative to their credit quality, excessive lending may increase bank risk.

LNTA, the natural logarithm of total assets, is used to control for bank size. As larger banks are able to invest in more advanced technology, they will have better risk management (Pennathur *et al.*, 2012). Also, a larger size allows banks to expand into more business lines and with a wider range of customers. On the other hand, larger banks have more incentive to increase their risk than smaller banks due to the effect of too-big-to-fail. Smaller banks could benefit both from a greater operating flexibility, for example, being capable of adapting their strategies very quickly to the changing economic condition, and from lower fixed operating costs (Chiorazzo *et al.*, 2008).

TDTL, the ratio of total deposits to total loans, is used to control for bank intermediation. Accordingly, banks with a higher level of intermediation of deposit to loans could obtain greater earning – thus, reducing bank risk.

Bank stability is also affected by bank ownership. *OWNER*, a dummy variable that takes a value of 1 for a SOCB and 0 otherwise, is used to control for the effect of state ownership. The increasing role of privatization, and in particular diffused ownership, is investigated by incorporating *LISTED*, a dummy variable that takes a value of 1 for a listed bank in the stock market and 0 otherwise. *FOREIGN*, the total share of foreign banks in the local bank is used to control for foreign ownership. Foreign banks[13] are able to transfer high technology, better managerial skills and a wide range of good financial services to local partners – thus, reducing banks' insolvency risk. Although local banks with foreign shareholdings have superior technical and financial resources, they may suffer from more severe information-asymmetry problems. These issues may arise due to the cultural differences between foreign and domestic shareholders. Therefore, foreign ownership may not improve banks' solvency Tacneng (2015).

A market-specific variable used in the regression is the Herfindahl–Hirschman concentration index (HHI)[14]. The structure-conduct-performance hypothesis posits that a highly concentrated banking system with greater market power and lower competitive pressure tends to increase profits and increase the franchise value. Consequently, this discourages bank managers to increase their risk-taking. *GFC*, a dummy variable that takes a value of 1 for years 2008-2009 and 0 otherwise, is used to control for the effects of the global financial crisis[15].

3.2 Data

Bank-specific information as shown in Table I was manually collected from annual reports and the audited financial statements of individual Vietnamese banks from 2006 to 2015

Variables	No. of obs	Mean	SD	Minimum	Maximum
Z-score	319	2.948	0.633	0.995	5.483
MMC1	319	14.599	7.542	1	34.148
MMC2	319	13.931	6.958	0.910	31.275
MMC3	319	0.336	0.446	0.003	2.865
EFF	319	0.877	0.081	0.533	0.972
LATA	319	0.351	0.141	0.061	0.816
TLTA	319	0.516	0.141	0.114	0.852
LNTA	319	17.616	1.403	13.135	20.590
TDTL	319	1.174	0.393	0.394	4.254
OWNER	319	0.154	0.361	0	1
LISTED	319	0.194	0.396	0	1
FOREIGN	319	0.057	0.079	0	0.3
HHI	319	0.095	0.038	0.042	0.260
GFC	319	0.219	0.415	0	1

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with current period value of EQUITY; MMC1, MMC2 and MMC3, the measures of multimarket contacts; EFF, the efficiency score of banks; LATA, the ratio of liquid assets to total assets; TLTA, the ratio of total loans to total assets; LNTA, the natural logarithm of total assets; TDTL, the ratio of total deposits to total loans; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank and 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank, and 0 otherwise; FOREIGN, the share of foreign ownership in the local banks; HHI, bank-specific concentration Herfindahl–Hirschman index in terms of bank branches; and GFC, a dummy variable that takes a value of 1 for years 2008-2009 and 0 otherwise

Table I.
Descriptive statistics of variables used in the system GMM

according to the Vietnamese Accounting Standards[16]. Since Vietnam's entry into the World Trade Organization in 2007, foreign banks have been allowed to acquire a certain amount of shares in the local banks. Only local banks are selected as they are main-active players while foreign bank affiliates and joint-venture banks are somewhat limited to operate in the Vietnamese market[17]. Therefore, we obtain an unbalanced panel data of 40 banks that include five SOCBs and 35 POCBs. These banks together accounted for more than 80 per cent of total assets in the industry. It is important to note that only multimarket banks are considered in this study because there was such no single-market bank over the examined period that existed in the Vietnamese banking system[18].

Figures 1 and 2 show the evolution of the number of branches and the average number of multimarket contacts in the Vietnamese banking system in the period of 2006-2015,

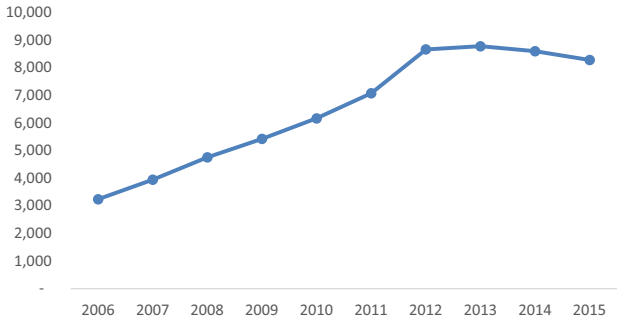

Figure 1.
The evolution of bank branches in Vietnam, 2006-2015

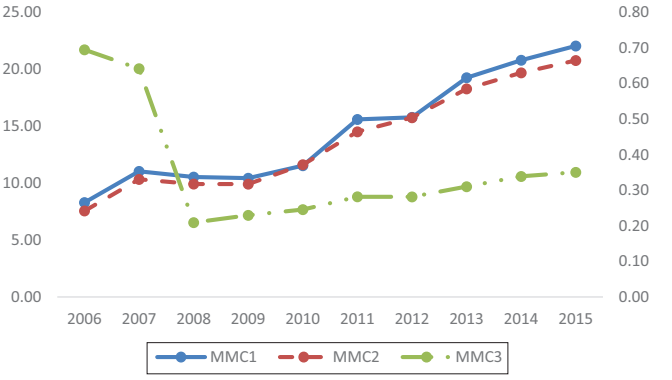

Figure 2.
The evolution of MMC1, MMC2 and MMC3 measures, 2006-2015

Note: The vertical axis on the right shows the range of MMC3 measure

respectively. When observing the multimarket contacts (*MMC*1 and *MMC*2), there appears an upward trend over the period of 2006-2015. The same is true for *MMC*3. The increase in multimarket contacts is accompanied by the growth of bank branches over the same period due to the consolidation process.

In addition, Table II also shows that the average yearly growth rate of the *MMC*1 values amounted to approximately 12.3 per cent (+ 11.4 per cent for bank branches).

4. Empirical analysis

4.1 The baseline models

For the ease of exposition, we focus on the general interpretation of key variables. In fact, there is a positive relationship between multimarket contacts and bank stability as shown in Table III. Because of the highly potential endogeneity between variables used as explained above, the system GMM should be used to investigate the impact of multimarket contacts on bank stability in Vietnam.

Table IV indicates the results of the impact of multimarket contacts on bank stability in the Vietnamese banking system between 2006 and 2015 using the system GMM[19]. More specifically, the result of Hansen test is reported to investigate the validity of the dynamic panel model. As the *p*-value of Hansen test is statistically not significant in any of the models, the null hypothesis cannot be rejected[20]. Therefore, there is no evidence of over-

Table II.
The growth rate of multimarket contacts and bank branches in Vietnam, 2007-2015

Year	MMC1 (%)	MMC2 (%)	MMC3 (%)	Branches (%)
2007	32.98	36.56	−7.64	21.92
2008	−4.53	−3.93	−67.38	20.52
2009	−0.97	−0.07	9.77	14.08
2010	10.54	17.21	6.99	13.65
2011	35.18	24.81	14.67	14.79
2012	1.19	8.52	−0.11	22.45
2013	22.03	16.08	10.16	1.29
2014	7.97	7.70	9.27	−2.04
2015	6.02	5.50	3.43	−3.69

Table III.
The correlation matrix between considered variables

Variables	Z-score	MMC1	MMC2	MMC3	EFF	LATA	TLTA	LNTA	TDTL	OWNER	LISTED	FOREIGN	HHI	GFC
Z-score	1													
MMC1	0.016*	1												
MMC2	0.003*	0.993*	1											
MMC3	0.129*	0.517*	0.459*	1										
EFF	0.087	0.071	0.057	0.136*	1									
LATA	0.066	−0.208*	−0.195*	−0.117*	0.119*	1								
TLTA	0.016	0.282*	0.253*	0.318*	0.111*	−0.812*	1							
LNTA	0.027	0.827*	0.818*	0.553*	0.098*	−0.056	0.119*	1						
TDTL	0.041	0.157*	0.175*	−0.037	−0.152*	0.454*	−0.579*	0.216*	1					
OWNER	0.149*	0.471*	0.424*	0.732*	0.179*	−0.131*	0.370*	0.524*	−0.177*	1				
LISTED	−0.003	0.409*	0.426*	0.095*	−0.083	−0.136*	0.106*	0.432*	0.022	0.142*	1			
FOREIGN	−0.166	0.199*	0.225*	−0.087	−0.142*	0.088	−0.103*	0.226*	0.10*	−0.198*	0.159*	1		
HHI	0.151*	0.577*	0.530*	0.831*	0.10*	−0.202*	0.417*	0.494*	−0.054	0.755*	0.112*	−0.141*	1	
GFC	0.056	−0.29*	−0.306*	−0.138*	−0.018	0.030	0.055	−0.238*	−0.092*	−0.015	−0.107*	−0.051	−0.17*	1

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with current period value of EQUITY; MMC1, MMC2 and MMC3, the measures of multimarket contacts; EFF, the efficiency score of banks; LATA, the ratio of liquid assets to total assets; TLTA, the ratio of total loans to total assets; LNTA, the natural logarithm of total assets; TDTL, the ratio of total deposits to total loans; HHI, bank-specific concentration Herfindahl–Hirschman index in terms of bank branches; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank and 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank and 0 otherwise; FOREIGN, the share of foreign ownership in the local bank; GFC, a dummy variable that takes a value of 1 for years 2008-2009 and 0 otherwise. *Significant at 10% level

Z-score	Model 1	Model 2	Model 3
$Z\text{-score}_{t-1}$	0.481** (0.204)	0.479*** (0.158)	0.495** (0.242)
MMC1	0.024*(0.012)		
MMC2		0.035*(0.019)	
MMC3			0.356* (0.207)
EFF	2.057*** (0.590)	2.295** (1.113)	2.363*** (0.682)
LATA	−2.705* (1.594)	−2.774 (1.864)	−1.852 (2.011)
TLTA	−3.412* (1.771)	−4.397** (2.006)	−2.060 (1.938)
LNTA	−0.510*** (0.110)	−0.631** (0.167)	−0.191 (0.125)
TDTL	0.846* (0.434)	0.447 (0.443)	0.575 (0.434)
OWNER	0.950** (0.414)	0.938** (0.442)	0.211 (0.434)
LISTED	0.993** (0.470)	1.073** (0.530)	0.604 (0.407)
FOREIGN	0.625 (1.162)	1.276 (1.374)	1.943* (1.087)
HHI	0.611 (4.480)	3.526 (5.771)	1.451 (5.652)
GFC	0.079 (0.117)	0.057 (0.097)	0.182 (0.111)
Constant	9.664*** (2.782)	12.169*** (3.428)	3.284 (2.951)
No. of obs	278	278	278
No. of groups	41	41	41
AR1 (p-value)	0.014	0.009	0.014
AR2 (p-value)	0.732	0.712	0.541
Hansen test (p-value)	0.995	0.975	0.998

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with current period value of EQUITY; MMC1, MMC2 and MMC3, the measures of multimarket contacts; EFF, the efficiency score of banks; LATA, the ratio of liquid assets to total assets; TLTA, the ratio of total loans to total assets; LNTA, the natural logarithm of total assets; TDTL, the ratio of total deposits to total loans; HHI, bank-specific concentration Herfindahl–Hirschman index in terms of bank branches; OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank and 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank and 0 otherwise; FOREIGN, the share of foreign ownership in the local bank; GFC, a dummy variable that takes a value of 1 for years 2008-2009 and 0 otherwise. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5 and 1% levels, respectively

Table IV.
The results of the impact of multimarket contacts on bank stability in Vietnam

identifying restrictions, which means that all conditions for the moments are satisfied and the instruments are accepted. Furthermore, 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 AR1 between first residual differences is rejected. This, however, does not imply that estimates are inconsistent. Inconsistency would be implied if the second-order autocorrelation (AR2) is present (Arellano and Bond, 1991). The AR2 shows that the moment conditions of the model are met as p-values are statistically not significant[21]. All in all, these conclude that the estimated model meets diagnostic tests.

A number of the regression models are run. For the ease of exposition, we focus on the general interpretation of interesting and significant variables. Table IV indicates that the coefficient of $Z\text{-score}_{t-1}$ is positive and significant in all models, suggesting the persistence in Z-score. In addition, three measures of multimarket contacts are positively and significantly associated with Z-score, implying that higher contacts among banks may result in greater bank stability[22].

These findings are in line with those of Kasman and Kasman (2016) in the Turkish banking system.

The results also indicate that the coefficient of *EFF* is positive and significant, suggesting that more efficient banks have greater bank stability. This is comparable with

the findings of Fiordelisi *et al.* (2011), who found that lower bank efficiency leads to higher risk. Nonetheless, this finding somewhat conflicts with those of Le (2018), suggesting that an improvement in Vietnamese bank efficiency precedes an increase in risk. The conflicting results can be explained by the fact that there are different choices of inputs and outputs used in DEA, where the DEA with the use of financial ratios as outputs is used in Le's (2018, 2019) study design. Also, we use Z-score as a proxy of bank risk, whereas the ratio of loan loss reserves to total assets is used as a measure of bank risk in Le's (2018, 2019) method.

LATA is in general negatively and significantly related to Z-score in one model, implying that liquid banks are more risk-taking. This can be explained by the fact that banks with a higher level of liquid assets (with a lower rate of returns) tend to generate lower income, which in turn, they may face greater risk (Delis and Staikouras, 2011). The coefficient of *TLTA* is negative and significant, suggesting that excessive lending may lead to greater bank risk. In fact, the accelerating pace of lending between 2007 and 2011, especially advancing to non-deposit sources, potentially exposed the Vietnamese banking sector to higher liquidity risk. This result supports the earlier findings of Amador *et al.* (2013) and arguing that significant credit expansions do not generate corresponding increases in bank safety margins.

LNTA is found to have a negative impact on bank stability, thus, supporting the "too-big-to-fail" effect. This suggests that large banks have more incentives to invest more in risky assets. This finding is comparable with those of Beck *et al.* (2006). *TDTL* is positively and significantly associated with Z-score, suggesting banks that have a higher level of intermediation of deposit to loans are able to generate greater earnings – thus, improving bank stability.

The coefficient of *OWNER* is positive and significant, suggesting that SOCBs are more stable than POCBs. This can be explained by the fact that SOCBs have benefited from the government subsidies and the banking reforms, which were mainly focused on them – thus, may result in better governance and better risk management. In addition to it, SOCBs are protected by implicit government guarantees. Because of the government ownership, SOCBs are considered as safe banks in the Vietnamese banking system. As a result, depositors are willing to accept lower deposit interest rates offered by SOCBs, thus, enhancing their profitability and reducing their risk (Nguyen *et al.*, 2014).

LISTED is positively and significantly related to Z-score, thus, supporting the market discipline hypothesis. As shareholders have their own capital at risk at the bank, they have the incentive to monitor its management to ensure the bank operate effectively. Hence, listed banks have better asset quality, which ultimately improves their bank stability. Listed banks also may have easier access to funds, for instance by issuing shares on the stock exchange to finance their lending activities and investments – thus, enhancing their profitability and reducing their risk. In fact, a lack of transparency in the Vietnamese banking system[23] may limit unlisted banks to attract more investors and depositors. In contrast, listed banks seem to be preferred by depositors and investors because they must follow the regulations of the stock market in terms of providing comprehensive information about their operating activities. Surprisingly, the findings indicate that the coefficient of *FOREIGN*[24] is generally positive and significant in one model, suggesting that foreign ownership seems to reduce bank risk. Although the condition imposed by the government that the total shares of foreign investors must not exceed 30 per cent of the charter capital of a local bank, foreign banks are still able to bring in need capital infusion, transfer knowledge and superior managerial skills to local partners. This is in line with those by ElBannan (2015) in Egypt and Tacneng (2015) in the Philippines.

Finally, the findings indicate that bank stability in Vietnam is not significantly affected by the recent global financial crisis. More importantly, the findings demonstrate that bank stability is not influenced by market concentration[25], suggesting that the Vietnamese banking system does not work according to the SCP paradigm. This is comparable to those of Coccorese and Pellecchia (2009) in Italia. Nonetheless, this finding suggests that the increasing concentration in the Vietnamese banking system does not necessarily imply a reduced competition itself and even competition may be more intense in some provinces where oligopolies prevail[26].

4.2 Robust checks

To provide robust checks, a number of regressions are run. First, we use an alternative measure of Z-score (AZ-score), which is computed as a standard deviation of *ROA* over the sample period, combined with current period values of *ROA* and *EQUITY* (Fu *et al.*, 2015; Laeven and Levine, 2009). The similar results are obtainable as presented in Table V. When using equity, the ratio of total equity to total assets, as a dependent variable, the positive impact of multimarket contact on bank equity is found[27].

We also examine whether or not multimarket contacts could enhance bank profitability [28]. Two performance measures based on accounting ratios include risk-adjusted returns on

AZ-score	Model 1	Model 2	Model 3
$AZ\text{-score}_{t-1}$	0.446** (0.202)	0.366*(0.218	0.495**(0.211)
MMC_1	0.028* (0.015)		
MMC_2		0.04*(0.023)	
MMC_3			0.036(0.305)
EFF	2.293* (1.308)	2.027(1.37)	2.063**(0.831)
LATA	−1.818 (1.845)	−2.478(1.931)	−1.499(2.161)
TLTA	−2.996 (2.384)	−3.549(2.315)	−2.227(1.909)
LNTA	−0.521*** (0.164)	−0.592***(0.163)	−0.374*(0.203)
TDTL	0.378 (0.495)	0.332(0.542)	0.488(0.358)
OWNER	0.898* (0.510)	0.986*(0.580)	0.602(0.717)
LISTED	1.025* (0.535)	1.076*(0.625)	0.901*(0.452)
FOREIGN	1.943 (1.316)	1.547(1.063)	2.661***(0.952)
HHI	0.991 (4.130)	1.189(5.759)	5.913(5.035)
GFC	0.072 (0.163)	0.072(0.134)	0.128(0.131)
Constant	9.632*** (3.550)	11.742***(3.88)	6.38(4.315)
No. of obs	278	278	278
No. of groups	41	41	41
AR1 (p-value)	0.059	0.088	0.053
AR2 (p-value)	0.490	0.489	0.367
Hansen test (p-value)	0.982	0.976	0.997

Notes: AZ-score, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; MMC1, the measure of multimarket contacts, EFF, the efficiency score of banks obtained from the bootstrap DEA; LATA, the ratio of liquid assets to total assets; TLTA, the ratio of total loans to total assets; LNTA, the natural logarithm of total assets; TDTL, the ratio of total deposits to total loans; HHI, bank-specific concentration Herfindahl–Hirschman index in terms of bank branches; OWNER, a dummy variable that takes the value of 1 for a state-owned commercial bank and 0 otherwise; LISTED, a dummy variable that takes a value of 1 for a listed bank and 0 otherwise; FOREIGN, the share of foreign ownership in the local banks; GFC, a dummy variable that takes a value of 1 for years 2008-2009 and 0 otherwise. The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5 and 1% levels, respectively

Table V.
The results of using alternative Z-score

equity (RAR_{ROE}) and risk-adjusted returns on asset (RAR_{ROA}). As in Stiroh (2004), these measures are defined as: $RAR_{ROE_{i,t}} = \frac{ROE_{i,t}}{\sigma_{ROE_i}}$; $RAR_{ROA_{i,t}} = \frac{ROA_{i,t}}{\sigma_{ROA_i}}$,where ROE is the returns (profits before tax) on equity, σ_{ROE} is the standard deviation of returns on equity over the examined period. ROA is the returns (profits before tax) on total assets, σ_{ROA} is the standard deviation of returns on assets over the examined period. The positive impact of multimarket contacts on bank profitability is also found as presented in Appendix 4. Nonetheless, this supports our main findings as above.

Second, following Kasman and Kasman (2016), we construct a subsample of banks by excluding the banks below the lower quartile to provide a robustness check. The results of the relationship between multimarket contacts and bank stability are presented in Table VI. The coefficients of *MMC* are generally positive and significant in two models. This, thus, confirms our main findings.

Third, we further examine whether the relationship multimarket contacts and bank stability in Vietnam differ between small and large banks. Following Berger and Bouwman (2009) and Le (2019), large and small banks are defined as those with total assets above and below than the median, respectively. We include *LARGE*, a dummy variable that takes a value of 1 for a large bank and 0 otherwise into the model[29]. The results of the impact of the interaction between bank size and multimarket contacts (*LARGE***MMC*) on bank stability are presented in Table VII. The results show that the coefficient of *LARGE***MMC* is generally negative and significant in two equations. This may suggest that Vietnamese authorities may support small banks to expand their businesses in many regions to increase their competitiveness – thus, improving the stability of the banking system.

5. Conclusion

This study investigated the impact of multimarket contacts on bank stability in the Vietnamese banking system between 2006 and 2015 by using the system GMM. The findings indicate that multimarket contacts among banks improve bank stability. This suggests that the Vietnamese authorities should further remove restrictions on the opening new branches – thus, improving the competitiveness of Vietnamese banks. The results of robust checks confirm our main findings.

Z-score	Model 1	Model 2	Model 3
MMC_1 (>9)	0.013** (0.006)		
MMC_2 (>9)		0.019** (0.009)	
MMC_3 (>1)			0.112 (0.147)
Constant	7.626*** (1.961)	9.758*** (2.313)	9.981*** (1.458)
No. of obs	225	222	203
No of groups	34	34	32
AR1 (*p*-value)	0.003	0.003	0.022
AR2 (*p*-value)	0.651	0.508	0.196
Hansen test (*p*-value)	0.999	0.997	0.987

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; MMC, the measures of multimarket contacts. The table contains the results estimated using the system GMM estimator. The same set of variables is used as discussed in the equation (1). Robust standard errors are in parentheses. **, ***Significant at 5 and 1% levels, respectively

Table VI. The results of robust checks

Z-score	Model 1	Model 2	Model 3
LARGE*MMC_1	−0.014* (0.008)		
LARGE* MMC_2		−0.014* (0.008)	
LARGE* MMC_3			−0.555 (3.166)
LARGE	−0.08 (0.239)	−0.007 (0.203)	−0.936 (1.945)
MMC1	0.012 (0.038)		
MMC2		0.008 (0.892)	
MMC3			0.214 (0.213)
Constant	3.111*** (0.788)	2.905*** (0.708)	3.263 (0.426)
No of obs	278	278	278
No of groups	41	41	41
AR1 (*p*-value)	0.407	0.003	0.062
AR2 (*p*-value)	0.644	0.318	0.733
Hansen test (*p*-value)	0.480	0.427	0.427

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; MMC, the measures of multimarket contacts; LARGE, a dummy variable that takes the value of 1 for a large bank and 0 otherwise; LARGE*MMC, the interaction between bank size and multimarket contacts. The table contains the results estimated using the system GMM estimator. The same set of variables is used as discussed in the equation (1). Robust standard errors are in parentheses. *, ***Significant at 10 and 1% level, respectively

Table VII. The results of the impact of multimarket contacts on bank stability for subsample of bank size

The findings also show that more x-efficient banks appear to be more stable, suggesting that bank managers should implement superior management practices in their day-to-day operations and minimize their input usage, thus, enhancing bank stability. The same is true for banks with less holding liquid assets, for those with less excessive lending, for smaller banks, and for those with a greater level of intermediation. Listed banks are less-risk taking than unlisted ones, suggesting that banks are encouraged to list in the stock market to enhance the transparency in the Vietnamese banking market. The positive relationship between foreign ownership and bank stability although this is relatively weak may suggest that the government should gradually remove restrictions on foreign investments in the banking system.

Notes

1. Just only for domestic commercial banks according to the reports of State Bank of Vietnam.
2. The estimates are based on the available data of domestic commercial banks.
3. It could be primarily due to the unavailability of data used to estimate the multimarket contacts index. For the review of empirical studies on the impact of multimarket contacts in other industries (Yu and Cannella, 2013).
4. Apart from the efforts of bank managers, banking reforms released by the State Bank of Vietnam are generally implemented to improve the banks' stability over time.
5. This method has been used in Tacneng (2015) and ElBannan (2015).
6. It is assumed that strictly exogenous variables are not correlated to the individual effects while the endogenous variables are predetermined.
7. There is substantial missing data on non-performing loans of banks in the sample.
8. For further discussions on the measures of Z-score,(Lepetit and Strobel, 2013, 2015).

9. For definitions of the similarity index and weights in calculating MMC_2 and MMC_3 are comprehensively presented in Coccorese and Pellecchia (2009).

10. Berger and Humphrey (1997) suggest that the intermediation approach is more appropriate for measuring bank efficiency, whereas the production approach is more suitable for measuring the efficiency of their branches. According to the intermediation approach in which banks acts as intermediaries between depositors and borrowers, a 3 × 2 set of inputs and outputs are used. Following prior studies such as Le (2017) and Nguyen and Simioni (2015), inputs include fixed assets, operating expenses, and loanable funds while outputs include loans and other earning assets. Due to the unavailability of data on either a number of employees or labor expenses in many banks in the sample, operating expenses are used to account for labor costs. In the Vietnamese banking system, labor costs accounted for approximately more than 50 per cent operating costs (KPMG, 2013). In addition, Vietnamese banks are less engaged in off-balance sheet activities and the report of off-balance sheet (OBS) items is not fully reported in many banks – thus, the impact of OBS activities is not considered in this study to maintain the consistency when using data envelopment analysis (DEA).

11. There is substantial missing data on either a number of employees or labor expenses in many banks in the sample used in a functional form of a parametric approach. Therefore, this would distort the accuracy of a parametric approach.

12. The bootstrap procedure of DEA is described in detail by Simar and Wilson (1998, 2000) and is not repeated here for want of space.

13. It is important to notice the foreign stakes in local banks that are included in our sample are considered as foreign banks.

14. The measure of market structure is calculated using the number of branches in every province. The bank-specific concentration measure, HHI is computed as follows:

$$HHI_i = \sum_{j \in m} HHI_j \left(\frac{d_{ij}}{d_i} \right).$$

where j, a market (province) from the set of market, m, in which bank i is active. HHI_j is the Herfindahl–Hirschman index in market j. d_{ij} and d_i are the number of branches of bank i in market j and the total number of branches of bank i, respectively. HHI_i index ranges from 0 to 1.

15. Bank for International Settlements (2010) identifies the pre-crisis period as from 2003 to June 2007 and the acute crisis period as from July 2007 to March 2009. Since only yearly data are available, we consider years 2008-2009 as the crisis period. This crisis period is also considered in several studies such as Le (2019).

16. Unfortunately, the Bankscope does not provide the data on bank branches.

17. This exclusion from the sample is necessary to ensure the homogeneity of the sample when estimating relative bank efficiency using the bootstrap DEA.

18. A single-market bank is defined as the one which operates in a one market (or province).

19. >We also conduct robustness checks with more rudimentary approaches for panel data using fixed effects. The results confirm our main findings and are available upon request.

20. Cameron and Pravin (2010) suggest that the value of Hansen test for over-identifying restrictions should exceed 0.05, thus, the null hypothesis cannot be rejected. Alternatively, there is no correlation between the instrument variables and the residuals.

21. Arellano and Bond (1991) demonstrate p-values of AR2 in excess of 0.05 that instruments are still valid.

22. The literature suggests that the non-linear relationship between multimarket contacts and bank stability. When incorporating the squared *MMC* in the model, the coefficients of squared *MMC* in three models are statistically not significant though negative. These findings suggest that the U-shape relationship between multimarket contacts and bank stability does not exist in the Vietnamese banking system. The results are presented in Appendix 1.
23. Vietnamese commercial banks are encouraged to publish their annual reports but not obliged.
24. When a dummy variable as a proxy for foreign ownership is used, the same result is obtainable and available upon the request.
25. We also use the Herfindahl–Hirschman index in terms of total assets (HHI-A) and total deposits (HHI-D) as a measure of bank concentration. The coefficients of HHI-A and HHI-D are statistically not significant. Nonetheless, this confirms our main findings. The table of results is indicated in Appendix 2.
26. We further investigate whether the interaction between the number of contacts and market concentration (*HHI*) could have an impact on bank stability (*MMC*HHI*). The coefficient of *MMC*HHI* is statistically not significant, thus, we can exclude this possibility. The table of results is presented in Appendix 3.
27. The results are available upon the request.
28. We thank an anonymous referee for their suggestion.
29. We thank an anonymous referee for their suggestion on this analysis.

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Appendix 1

Z-score	Model 1	Model 2	Model 3
MMC_1	0.011(0.022)		
$MMCSQR_1$	−0.0001(0.0003)		
MMC_2		0.037(0.076)	
$MMCSQR_2$		−0.001(0.002)	
MMC_3			0.969 (0.971)
$MMCSQR_3$			−0.271 (0.310)
Constant	6.573* (3.475)	7.344** (3.636)	4.404 (2.65)
No. of obs	278	278	278
No of groups	41	41	41
AR1 (*p*-value)	0.003	0.007	0.008
AR2 (*p*-value)	0.506	0.352	0.262
Hansen test (*p*-value)	0.996	0.981	0.997

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; MMC, the measure of multimarket contacts; MMCSQR, the squared MMC. The table contains the results estimated using the system GMM estimator. The same set of variables is used as discussed in the equation (1). Robust standard errors are in parentheses. *,** Significant at 10 and 5% levels, respectively

Table AI. The U-shape relationship between multimarket contacts and bank stability

Table AII.
The relationship between multimarket contacts and bank stability in Vietnam, using different measures of bank concentration

Z-score	Model 1	Model 2	Model 3	Model 4	Model5	Model 6
$Z\text{-score}_{t-1}$	0.475** (0.187)	0.445** (0.213)	0.426** (0.189)	0.354* (0.192)	0.468** (0.227)	0.465** (0.202)
MMC1	0.017 (0.013)	0.022* (0.011)				
MMC2			0.03* (0.016)	0.034** (0.015)		
MMC3					0.385* (0.216)	0.417* (0.233)
EFF	1.021***(0.97)	1.076 (0.975)	1.396 (0.93)	0.843(1.001)	1.809*(0.928)	1.837** (0.771)
LATA	−1.517 (1.759)	−1.067 (1.938)	−1.91 (2.597)	−1.454 (2.236)	−1.712 (2.181)	−1.603 (2.037)
TLTA	−1.97 (1.816)	−1.222 (1.716)	−2.296 (2.287)	−1.815 (1.867)	−1.569 (1.897)	−1.527 (1.787)
LNTA	−0.378** (0.155)	−0.466*** (0.158)	−0.484*** (0.157)	−0.574*** (0.161)	−0.231** (0.114)	−0.282* (0.141)
TDTL	0.637* (0.345)	0.671** (0.309)	0.635** (0.285)	0.483 (0.301)	0.818** (0.321)	0.784** (0.293)
OWNER	0.704* (0.388)	0.816* (0.461)	0.97*(0.547)	1.071** (0.504)	0.336 (0.508)	0.418 (0.57)
LISTED	0.926** (0.45)	0.883* (0.471)	0.776* (0.433)	0.893** (0.442)	0.582 (0.377)	0.538 (0.365)
FOREIGN	0.407 (1.278)	0.402 (0.82)	0.626 (0.999)	0.707 (1.143)	1.335 (1.839)	1.041(1.641)
HHI-A	0.814 (4.188)		0.587 (5.888)		−1.476 (4.932)	
HHI-D		−1.759 (3.047)		−2.601 (3.692)		−2.872 (3.789)
GFC	0.062 (0.092)	0.06 (0.122)	0.083 (0.115)	0.036 (0.089)	0.175 (0.113)	0.165 (0.106)
Constant	7.513*** (2.583)	8.681** (3.568)	9.338*** (3.333)	11.616*** (3.406)	4.176 (3.116)	5.235 (3.335)
No. of Obs	278	278	278	278	278	278
No. of groups	41	41	41	41	41	41
AR1 (p-value)	0.011	0.023	0.018	0.035	0.014	0.007
AR2 (p-value)	0.601	0.706	0.598	0.621	0.554	0.558
Hansen test (p-value)	0.996	0.991	0.982	0.944	0.998	0.996

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; MMC, the measures of multimarket contacts; HHI-A and HHI-D, Herfindahl–Hirschman index in terms of bank assets and total deposits, respectively. The table contains the results estimated using the system GMM estimator. The same set of variables is used as discussed in the equation (1). Robust standard errors are in parentheses. *, **, *** Significant at 10, 5 and 1% levels, respectively

Appendix 3

Z-score	Model 1	Model 2	Model 3
MMC_1	0.011 (0.033)		
MMC_1*HHI	0.044 (0.231)		
MMC_2		0.012 (0.04)	
MMC_2*HHI		0.089(0.351)	
MMC_3			0.268 (1.018)
MMC_3*HHI			0.238 (5.014)
HHI	3.542 (5.912)	3.9 (7.813)	4.708 (8.412)
Constant	7.414** (2.754)	8.446** (3.172)	0.908 (2.685)
No. of obs	278	278	278
No of groups	41	41	41
AR1 (p-value)	0.009	0.021	0.005
AR2 (p-value)	0.472	0.395	0.453
Hansen test (p-value)	0.988	0.975	0.999

Notes: Z-score, the mean returns on assets and the mean standard deviation of ROA over the sample period, combined with the current period value of EQUITY; MMC, the measures of multimarket contacts, MMC*HHI, the interaction between multimarket contacts and bank specific concentration in terms of bank branches. The table contains the results estimated using the system GMM estimator. The same set of variables is used as discussed in the equation (1). Robust standard errors are in parentheses. **Significant at 5% level

Table AIII. the impact of interaction between the number of contacts and market concentration on bank stability

Table AIV.
The impact of multimarket contacts on bank risk-adjusted returns

Dependent variable	RAR_{ROA}			RAR_{ROE}		
RAR_{ROAt-1}	0.312*** (0.043)	0.332*** (0.038)	0.282*** (0.028)			
RAR_{ROEt-1}				0.307*** (0.026)	0.34*** (0.031)	0.341*** (0.039)
MMC1	0.073* (0.038)			0.128***(0.037)		
MMC2		0.07* (0.036)			0.081** (0.032)	
MMC3			0.755** (0.299)			0.914** (0.43)
HHI	3.395 (7.842)	4.736 (8.262)	20.896*** (5.33)	−6.327 (8.441)	−9.22 (6.63)	−5.858 (5.226)
Constant	18.468*** (3.549)	18.738*** (5.376)	−2.091 (4.101)	16.248*** (5.127)	19.093*** (4.952)	0.019 (3.851)
No. of obs	278	278	278	278	278	278
No. of groups	41	41	41	41	41	41
AR1 (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
AR2 (*p*-value)	0.422	0.687	0.7125	0.362	0.346	0.474
Hansen test (*p*-value)	0.997	0.998	0.957	0.846	0.974	0.989

Notes: RAR_{ROA} is risk-adjusted return on equity as measured by the ratio of the return on assets (ROA) to the standard deviation of ROA; RAR_{ROE} is risk-adjusted return on equity as measured by the ratio of the return on equity (ROE) to the standard deviation of ROE; MMC, the measure of multimarket contacts; HHI, bank specific concentration in terms of bank branches. The table contains the results estimated using the system GMM estimator. The same set of variables is used as discussed in the equation (1). Robust standard errors are in parentheses. *, **,***Significant at 10, 5 and 1% levels, respectively