



Received: 11 May 2020
Accepted: 08 November 2020

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Multimarket contacts and bank profitability: do diversification and bank ownership matter?

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Abstract: This study investigates the impact of multimarket contacts on bank profitability in the Vietnamese banking system from 2006 to 2015 using the system GMM. The findings indicate in general no evidence of the mutual forbearance hypothesis in this sector. However, we do find evidence of tacit collusion for the case of foreign-owned banks and newly combined banks with greater multimarket contacts. Finally, this study reveals that on average the most profitable banks are less geographically diversified, more technically efficient, and have lower credit risk. Regarding the role of bank ownership, more profitable banks are state-owned commercial banks, listed banks, and non-merged banks.

Subjects: Economics; Banking; Credit & Credit Institutions

Keywords: Multimarket contact; diversification; bank ownership; profitability; Vietnam; GMM

Subjects: G21; G28; G30

1. Introduction

The banking sector has long been limited both geographically and in scope by strict regulations and controls. The structural reform and liberalization process in the Vietnamese banking system in the last two decades have impacted the competitive conditions. Especially, Decision No. 13/2008/QĐ-NHNN was introduced by the State Bank of Vietnam in 2008 to remove the geographical constraints of commercial banks by loosening the capital requirements on opening branches and/or additional

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PUBLIC INTEREST STATEMENT

The structural reform and liberalization process in the banking system in the last two decades have impacted the competitive conditions. When banking firms vie for potential customers in multiple local markets, they may meet their rivals in other markets. This may lead to a decrease in competitive intensity among rivals due to the fear of retaliation by firms engaged in other common markets according to the mutual forbearance or linked oligopoly hypothesis. Consequently, this may affect bank profitability. However, the evidence of the effects of multimarket contacts on banks' competitive behavior is inconclusive. One of the possible reasons is that the channels through which geographical diversification can affect a bank's performance have not yet been fully investigated. This study attempts to verify whether the bank's synergies can be generated via both intra-industry diversification and collusive behavior resulting from multimarket contacts.

branches in different provinces. Indeed, although there was a reduced number of banks from 2006 to 2015 due to several merger and acquisition activities, the total number of bank branches in 2015 was more than twice as high as that in 2006 (Le et al., 2019). This thus allows banks to establish diverse branch networks across different regions within the country. In another word, the competition among geographically diversified banks in more than one geographical market is increased.

When banking firms vie for potential customers in multiple local markets, they may meet their rivals in other markets. Mutual forbearance or linked oligopoly as proposed by Edwards (1955) emphasizes that the decrease in competitive intensity among rivals due to the fear of retaliation by firms engaged in other common markets. However, the debate on the effects of multimarket contacts on banks' competitive behavior is continued because of the conflicting results of prior empirical studies. One of the possible reasons is that the channels through which geographical diversification can affect a bank's performance have not yet been fully investigated (Degl'Innocenti et al., 2014). This study attempts to verify whether the bank's synergies can be generated via both intra-industry diversification and collusive behavior resulting from multimarket contacts. Our study also aims to test whether multimarket contacts can favor information sharing via the observation of the strategies of rivals in common markets, which is proved to improve bank performance.

Specifically, this study contributes to the extant literature in several ways. Many studies have been conducted in developed markets, mainly the US and Europe where larger markets and a number of banks have facilitated economic modeling. The evidence of the effect of multimarket contacts in emerging is limited, especially in the Asia-Pacific region [a study by Le et al. (2019) in Vietnam may be one of the exceptions]. In contrast to Le, Tran and Nguyen's study where their main focus is on the correlation between multimarket contacts and bank stability, our test of the mutual forbearance hypothesis is carried out using bank profitability measures. We also verify the possibility of an interaction between multimarket contact and market concentration may affect banks' behavior. Mester (1987) and Degl'Innocenti et al. (2014) argue that in a context of high concentration, firms have the incentive to mislead other firms about their production costs and output to earn more profits. This study is the first attempt to extend the role of bank ownership in examining the relationship between multimarket contacts and bank profitability (state-owned commercial banks (SOCBs) vs privately owned commercial banks (POCBs), listed versus non-listed banks, foreign-owned versus domestic banks). Moreover, due to the structural changes in the Vietnamese banking system recently regarding M&A activities, we further examine whether this link may vary between merged and non-merged banks. All in all, this thus would provide a better understanding of multimarket contact characteristics in the Vietnamese banking system.

In this study, we use a unique dataset highly representative of the universe of Vietnamese banks over 2006–2015 where there was a significant change in bank regulation on branch network as stated earlier and this period allows us to examine the effect of restructuring program on bank performance. The Vietnamese market is an ideal candidate for the analysis of multimarket contact for the following reasons. First, due to the liberalization process, POCBs have operated more actively and have gradually gained a large market share in terms of both deposits and credit market shares. Some POCBs have mainly focused on providing universal banking services in particular regions, while others have maintained large branch networks that allow them to operate on multiregional or national bases. The sector also went through a significant transformation 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. This further increases competition in the market. Because of the diversified bank structure, this allows us to examine whether the link between multimarket contact and bank profitability may vary among bank ownership. Second, Vietnam has emerged as one of the fast-growing economies in the world¹ and is considered as Asia's next dragon. Under this stellar of performance, the banking system is the backbone of the economy with the total bank assets, and total credit advanced in the economy in 2015 was more than six times as high as that in 2006. Last but not least, multimarket contacts on average have grown by approximately 12.3% while the total bank branches amounted to 11.4% over the same period.

Our findings show a negative relationship between multimarket contacts and bank profitability in general, thus rejecting the mutual forbearance hypothesis in the Vietnamese banking system. More profitable banks are associated with less geographically diversified, more efficient, and have better credit risk profile. Similar results are true for the case of state-owned commercial banks, listed banks, and non-merged banks. Foreign-owned banks on average are less profitable than their local counterparts. Finally, we do find evidence of pro-competitive effects derived from the combination of high market concentration and high contact.

The remainder of this study is organized as follows: Section 2 presents the literature review on the relationship between multimarket contact 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 literature on bank multimarket contacts can be divided into two strands. The first strand is to investigate the effect of multimarket contacts on bank stability (Kasman & Kasman, 2016; Le et al., 2019). These studies conclude that multimarket contacts generally improve bank stability. The second strand is to test the mutual forbearance hypothesis by relating the level of multimarket contact to prices or profits. The mutual forbearance hypothesis proposes that multimarket contacts may have the adverse effect of fostering incentives for tacit collusion thereby weakening competition. Therefore, multimarket firms could earn higher profits because of anti-competitive effects in addition to tie-in sales and exclusive dealing arrangements. Multimarket contacts, however, may lead to the intensity of competition, which reduces 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 still limited, perhaps, due to the unavailability of data used to estimate the index of multimarket contacts.² Overall, the evidence is ambiguous and both theoretical and empirical research tends to provide conflicting findings.

Most studies on the later strand are conducted in the developed markets. More specifically, the earlier studies such as Pilloff (1999) and Whalen (1996) in the US found that greater bank profitability is associated with higher multimarket contacts along with higher concentration. The similar results are confirmed by Coccoresse and Pellicchia (2009) and Coccoresse and Pellicchia (2013) in Italy. However, others provide the opposite findings. Rhoades and Heggstad (1985) using the US data suggest that the relationship between multimarket contacts on bank profits and prices is ambiguous. Latter, Mester (1987) indicates that high concentration accompanied by higher multimarket contact promotes rather more competitive than collusion. Using the Italian data, De Bonis and Ferrando (2000) indicate that the increasing competition and lower lending rates are related to greater geographical overlaps.

For further analysis of single-market and multimarket banks, several studies show that multimarket banks seem to enjoy a competitive advantage over single-market counterparts due to their geographic expansion, thus lowering deposit interest rates offered by single-market banks in the same market (Hannan & Prager, 2004) or resulting in a reduction in revenue and an increase in costs for single-market banks (Berger et al., 2007).

Regarding diversification, multimarket contact, and the mutual forbearance hypothesis, there are also two distinct streams of research that offering contrasting results on the effect of diversification. First, firms can benefit from exploiting excess resources through a diversification process. Diversification improves the extent to which firms meet in multiple markets which can affect the competitive behavior of rivals by favoring collusion (Gimeno & Woo, 1999). Another school of thought contends that focused firms can perform better than their diversified counterparts since diversification can induce value loss due to learning costs (Deng & Elyasiani, 2008) and lack of lending experience (Acharya et al., 2006; DeLong, 2001). Hence, our study accounts for the effect of geographic diversification in the model when controlling for multimarket contacts.

Since bank profits can also be affected by bank structure and the findings are also mixed,³ we contend that the effect of multimarket contacts on bank profitability may vary among bank ownership. In the context of Vietnam where POCBs are serving customers on a national basis and gradually capturing market share from SOCBs,⁴ they tend to meet SOCBs in most of the markets. The question raised is that whether mutual forbearance between them may exist.

Furthermore, one may argue that foreign banks may not only transfer knowledge and better managerial skills to local partners but also provide the necessary capital for them. This may encourage foreign-owned banks to expand their branch networks to other markets, thus increasing multimarket contacts. However, there exists a condition imposed by the government that the total shares of foreign investors must not exceed 30% of the charter capital of a local bank. This thus may induce foreign-owned banks to collude due to the fear of retaliation by banks engaged in other markets.

Also, listed banks may have easier access to funds, for instance, by issuing shares on the stock exchange to finance their lending activities and investments. They may find it easier to meet the capital requirements to open additional branches. Additionally, a lack of transparency in the Vietnamese banking system⁵ limits domestic banks to attract more investors. 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. All in all, listed banks may compete with non-listed banks in many markets. However, these banks may face constraints to maintain a reasonable level of profitability to attract investors. This may cause collusive behaviors of listed banks.

From 2011 through 2015, the Vietnamese banking system witnessed several merger and acquisition activities.⁶ The primary goals of these mergers were to improve the efficiency and competitiveness of consolidated banks while maintaining the branch networks of each merging banks. It is argued that the new-combined banks may compete with their counterparts in other markets.

Taken together, the following hypotheses are proposed

H₁: There is no impact of multimarket contacts on bank profitability

H₂: There is no impact of geographic diversification on bank profitability

H₃: The profitability of SOCBs with greater multimarket contacts is not different from that of those with less multimarket contacts and POCBs with greater/less multimarket contacts.

H₄: The profitability of foreign-owned banks with greater multimarket contacts is not different from that of those with less multimarket contacts and domestic banks with greater/less multimarket contacts.

H₅: The profitability of listed banks with greater multimarket contacts is not different from that of those with less multimarket contacts and non-listed banks with greater/less multimarket contacts.

H₆: The profitability of merged banks with greater multimarket contacts is not different from that of those with less multimarket contacts and non-merged banks with greater/less multimarket contacts.

The literature also suggests that bank profitability is influenced by other bank-specific and macroeconomic factors. The following section only considers common factors that have been found in prior studies.

Bank efficiency. The efficiency-structure hypothesis suggests that efficient banks enjoy lower production costs which are translated into lower pricing by applying better management or more advanced production technologies. As a result, this increases sales and market share, which ultimately generates greater profitability (Berger, 1995; Sharma et al., 2013).

Credit risk. Credit risk is related to low profitability (Athanasoglou et al., 2008; Dietrich & Wanzenried, 2014; Miller & Noulas, 1997). Other studies, however, show that banks with more risky assets may require a greater profit to compensate for their greater risk (Figlewski et al., 2012).

Bank capitalization. The signaling hypothesis suggests that banks may disclose information to the market about their prospects and capacity to generate profits. Hence, a signaling equilibrium may exist where banks that expect to have better future performance will exhibit a greater level of capital (Saona, 2016). Several studies, however, indicate that a positive impact of capital on bank profitability may not hold beyond a certain threshold (Le & Nguyen, 2020a). Also, a bank with an excessively high capital ratio is operating over-cautiously and ignoring opportunities for profitable growth, and therefore increasing opportunity costs of capital (Berger, 1995; Sharma et al., 2013).

Market concentration. Market concentration may influence bank profitability. The structure-conduct-performance hypothesis argues that banks with market power collude to charge high fees on loans and advances and non-traditional activities and lower rates on customer deposits, thus earning higher profits (Dietrich & Wanzenried, 2014; Saona, 2016). Several studies, however, show opposite findings (Bolarinwa & Obembe, 2017; Le & Ngo, 2020; Mirzaei et al., 2013).

Bank reforms. Banking literature suggests that bank performance is also influenced by bank reforms (Lin & Zhang, 2009). In this study, we consider the effect of the restructuring program in the response to the GFC for the period of 2011–2015. Its key terms of reference included reassessing the financial health of credit institutions in terms of bad debt and capital requirements. Accordingly, banks were mainly required to address their non-performing loans and improve their lending procedures, thus restricting to advance more loans as before. Therefore, this restriction may reduce bank profitability in Vietnam.

Economic growth. Several studies indicate that economic growth has either no significant impact (Sharma et al., 2013) or a negative impact on bank profitability (Tan & Floros, 2012). Economic growth, however, may increase demand for financial products and services offered by banks during cyclical upswings, thus improving bank profitability (Dietrich & Wanzenried, 2014).

3. Methodology and data

3.1. Data

Bank-specific information as shown in Table 1 was manually collected from annual reports and the audited financial statements of individual Vietnamese banks from 2006 to 2015 according to the Vietnamese Accounting Standards.⁷ The data on economic growth was obtained from the World Bank database. Furthermore, only domestic banks are considered in our study since they are main-active players while foreign bank affiliates, 100% foreign-owned banks, and joint-venture banks are somewhat limited to operate in the Vietnamese market.⁸ Therefore, this arrives at a total of 319 observations for an unbalanced panel data of 40 banks. The sample includes five SOCBs⁹ and 35 POCBs¹⁰ which together accounted for more than 80% of total assets in the industry.

Prior studies defined a single-market bank as the one which operates in one market (or province) (Berger et al., 2007). There was such no single-market bank over the examined period that existed in the Vietnamese banking system. As a consequence, only multimarket banks are considered in our study.

Table 2 indicates the descriptive statistics of the variables used in this study. When observing multimarket contact measures, there appear large volatilities (i.e. high standard deviations) in MMC1 and MMC2, reflecting the fact that several banks have operated in many markets while others have focused on serving in their niche markets. However, smaller volatility in MMC3 could be

Table 1. Definitions of variables

Variable		Definition	Expected sign
RAR_{ROE}	Risk-adjusted returns on equity	RAR_{ROE} is the risk-adjusted return on equity as measured by the ratio of the return on equity (ROE) to the standard deviation of ROE	Dependent variable
RAR_{ROA}	Risk-adjusted returns on assets	RAR_{ROA} is the risk-adjusted return on assets as measured by the ratio of the return on assets (ROA) to the standard deviation of ROA	Dependent variable
π_{t-1}	Persistence of profitability	A lagged variable of bank profitability	+
MMC1	Average multimarket contact	Calculated as the total number of contacts of bank i divided by the number of banks that bank i meets in each local market (see Appendix 1)	±
MMC2	Weighted multimarket contact	The number of contacts between two banks is weighted by an index measuring their similarity regarding market shares in all local markets where they meet each other	±
MMC3	Alternative weighted multimarket contact	The multimarket contact index further accounts for the size of the rival	±
GEODIV	Geographic diversification	Calculated as: $GEODIV_i = \sum HHI_j \left(\frac{d_{ij}}{d_i} \right)$ where HHI_j is the Herfindahl–Hirschman Index in market j and d_{ij} and d_i are a number of branches of bank i in market j and the total number of branches of bank i , respectively	±
INEFF	Technical inefficiency	$1 - \hat{\theta}_{DEA}$ where $\hat{\theta}_{DEA}$ is bias-corrected technical efficiency derived from the bootstrap DEA under variable returns to scale assumption	-
LLP	Credit risk	The ratio of loan loss provisions to total loans	-
EQTA	Bank capitalization	The ratio of equity over total assets	±
OWNER	Bank ownership	A dummy variable takes a value of 1 for a state-owned commercial bank, 0 otherwise	±
LISTED	Public bank	A dummy variable takes a value of 1 for a listed commercial bank, 0 otherwise	±
FOREIGN	Foreign ownership	The actual percentage of foreign ownership over the capital of a local bank	±
MERGER	Bank consolidation	This variable takes a value of 1 for a merged bank, 0 otherwise	±
HHI	Market concentration	The Herfindahl–Hirschman index in terms of total assets	±
RF	Bank reform	A dummy variable that takes a value of 1 for the restructuring program period of 2011–2015, 0 otherwise	-
GDP	Economic growth	The annual economic growth	±

explained by how this variable is measured when the size of rivals is considered. According to the size classification based on total assets, there is not a large difference in bank size among banks in our sample, except for four state-owned banks.

3.2. Methodology

The purpose of this study is to investigate the effect of multimarket contacts on bank profitability in Vietnam. Taking into account the existing literature along with Vietnamese banks' characteristics, both bank-specific and macroeconomic factors are considered.

Table 2. Descriptive statistics of variables used in the system GMM

	OBS	Mean	SD	Min	Max	Sources
RAR _{ROE}	319	2.216	1.772	-2.537	13.49	Author's estimate
RAR _{ROA}	319	2.288	2.283	-2.208	18.416	Author's estimate
MMC1	319	14.599	7.542	1	34.148	Le et al. (2019)
MMC2	319	13.931	6.958	0.910	31.275	Le et al. (2019)
MMC3	319	0.336	0.446	0.003	2.865	Le et al. (2019)
GEODIV	319	0.095	0.038	0.042	0.26	Author's estimate
INEFF	319	0.123	0.081	0.029	0.467	Author's estimate
LLP	319	0.009	0.009	0.001	0.11	Author's estimate
EQTA	319	0.126	0.094	0.011	0.661	Author's estimate
OWNER	319	0.153	0.361	0	1	Author's estimate
LISTED	319	0.194	0.396	0	1	Author's estimate
FOREIGN	319	0.057	0.079	0	1	Author's estimate
MERGER	319	0.041	0.198	0	1	Author's estimate
HHI	319	0.082	0.021	0.062	0.139	Author's estimate
RF	319	0.514	0.501	0	1	Author's estimate
GDP	319	0.061	0.006	0.053	0.071	The World Bank

One is endogeneity: as an example, more profitable banks may increase their capital ratios by retaining earnings. They could also spend more on advertising campaigns and increase their size, which in turn may affect profitability. However, more profitable banks may hire more professional staff, thus resulting in a reduction in their operating efficiency.¹¹

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, bank profitability may be persistent for Vietnamese banks.

To deal with three potential problems together and following prior studies such as Saona (2016) and Dietrich and Wanzenried (2014), the Generalised Method of Moments (GMM) system as proposed by Arellano and Bover (1995) is employed. 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 exogenous.¹² 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.

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

$$\begin{aligned} \pi_{i,t} = & \alpha_0 + \alpha_1\pi_{i,t-1} + \alpha_2MMC_{i,t} + \alpha_3GEODIV_{i,t} + \alpha_4INEFF_{i,t} + \alpha_5LLP_{i,t} + \alpha_6EQTA_{i,t} + \alpha_7OWNER_{i,t} \\ & + \alpha_8LISTED_{i,t} + \alpha_9FOREIGN_{i,t} + \alpha_{10}MARGER_{i,t} + \alpha_{11}HHI_t + \alpha_{12}RF + \alpha_{13}GDP_t + \varepsilon_{i,t} \end{aligned} \tag{1}$$

Following Stiroh (2004a), Le (2017c), and Le et al. (2019), two performance measures based on accounting ratios include risk-adjusted returns on equity (RAR_{ROE}) and risk-adjusted returns on assets (RAR_{ROA}) are used. $RAR_{ROE_{i,t}} = \frac{ROE_{i,t}}{\sigma_{ROE_t}}$; $RAR_{ROA_{i,t}} = \frac{ROA_{i,t}}{\sigma_{ROA_t}}$, 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.¹³ In this study, RAR_{ROE} is our main dependent variable as indicated in Section 4 and RAR_{ROA} is used as a robust check as shown in Appendix 2.

For explanatory variables as indicated in Table 1, π_{t-1} is used to measure the persistence of profits in the industry. Nonetheless, as discussed in section 2, this has seldom been included in studies of multimarket contact. Following Kasman and Kasman (2016), $GEODIV$ is used to control for the effect of geographic diversification. $GEODIV_i$ ranges from 0 to 1 and is equal to 1 if a bank is diversified. MMC is the multimarket variable computed following the procedure described in Appendix 1.¹⁴ This allows us to test the mutual forbearance hypothesis that may exist if banks are less incentive to compete aggressively because of the threat of punishment by their rival in other common markets.

$INEFF$ is used to test the efficiency channel and derived from the bootstrap DEA under variable returns to scale assumption as proposed by Simar and Wilson (1998; 2000)). This approach measures how well the observed bank manages its costs to the best-practice bank in the sample.¹⁵ We also employ two alternative proxies for risk, namely LLP as a measure of credit risk and $EATA$ as a measure of bank capitalization. Following Le (2020b) and Le et al. (Forthcoming), $OWNER$ is used to control for the effect of bank ownership. Additionally, the increasing role of privatization, and in particular diffused ownership, is investigated by incorporating $LISTED$ in the model. $FOREIGN$ is used to control for the effect of foreign ownership.¹⁶ We further use the interaction terms to extend the role of bank ownership in investigating the relationship between multimarket contacts and bank profitability as follows¹⁷:

$$\begin{aligned} \pi_{i,t} = & \alpha_0 + \alpha_1\pi_{i,t-1} + \alpha_2MMC_{i,t} + \alpha_3GEODIV_{i,t} + \alpha_4INEFF_{i,t} + \alpha_5LLP_{i,t} + \alpha_6EQTA_{i,t} + \alpha_7OWNER_{i,t} \\ & + \alpha_8LISTED_{i,t} + \alpha_9FOREIGN_{i,t} + \alpha_{10}MERGER_{i,t} + \alpha_{11}MMC_{i,t} * OWNER_{i,t} + \alpha_{12}MMC_{i,t} * LISTED_{i,t} \\ & + \alpha_{13}MMC_{i,t} * FOREIGN_{i,t} + \alpha_{14}MMC_{i,t} * MERGER_{i,t} + \alpha_{15}HHI_t + \alpha_{16}RF + \alpha_{17}GDP_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

4. Empirical analysis

4.1. The base models

For ease of exposition, we focus on the general interpretation of key variables. In general, there appears a negative relationship between multimarket contacts and bank profitability as shown in Table 3. Also, $MMC2$ is highly correlated to $MMC1$, confirming the validity of this alternative proxy. $MMC3$ is weakly correlated to $MMC1$ and $MMC2$, indicating that the variable weaknesses as an alternative proxy form of MMC .¹⁸ Furthermore, there is a high correlation between $MMC3$ and $GEODIV$ so we run them in a separate model. Because of the high potential endogeneity between variables used as explained above, the system GMM should be employed.

Table 4 indicates the results of the impact of multimarket contacts on bank profitability in the Vietnamese banking system between 2006 and 2015 using the system GMM.¹⁹ The result of the Hansen test is also reported to investigate 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.²⁰ Therefore, there is no evidence of over-identifying restrictions, which means that all conditions for the moments are satisfied and the instruments are accepted. Furthermore, the hypothesis of the non-existence of the first-order autocorrelation between the first residual differences is rejected. This, however, does not imply that estimates are inconsistent. Inconsistency would be concluded if the second-order autocorrelation is present (Arellano & Bond, 1991). Since p -values of $AR2$ in our all models are statistically not significant, this suggests that the moment conditions of the model are met.²¹ As a result, we conclude that the estimated model meets diagnostic tests.

A number of the regression models are run. Table 4 indicates that the coefficient of π_{t-1} is positive and significant in all models, suggesting the persistence in bank profitability. Besides, two out of three measures of multimarket contacts ($MMC1$ and $MMC2$) are in general negatively and significantly associated with bank profitability, implying that higher contacts among banks may

Table 3. Correlation matrix of variables used in this study

	RAR _{ROE}	RAR _{ROA}	MMC1	MMC2	MMC3	GEODIV	INEFF	LLP	EQTA	LNBR	HHI	GDP
RAR _{ROE}	1											
RAR _{ROA}		1										
MMC1	-0.078	-0.094	1									
MMC2	-0.085	-0.102	0.993	1								
MMC3	0.184	0.129	0.517	0.459	1							
GEODIV	0.067	0.028	0.577	0.530	0.831	1						
INEFF	-0.000	-0.000	-0.071	-0.057	-0.136	-0.1	1					
LLP	-0.062	-0.025	0.346	0.342	0.303	0.282	-0.129	1				
EQTA	-0.097	-0.010	-0.487	-0.487	-0.359	-0.283	-0.06	-0.172	1			
HHI	0.092	0.123	-0.294	-0.326	0.243	0.297	0.135	-0.11	0.146	-0.22	1	
GDP	0.124	0.084	-0.082	-0.103	0.235	0.154	-0.098	-0.070	-0.042	-0.088	0.491	1

Table 4. The results of the impact of multimarket contacts on bank profitability in Vietnam using RAR_{ROE}

π	RAR_{ROE}						
π_{t-1}	0.252*** (0.044)	0.272*** (0.071)	0.278*** (0.04)	0.247*** (0.058)	0.593*** (0.131)	0.419*** (0.074)	0.237*** (0.042)
MMC1	-0.077*** (0.013)	-0.091** (0.042)					
MMC2			-0.066*** (0.022)	-0.199*** (0.052)			
MMC3					0.345 (0.795)	1.025 (1.383)	
GEODIV	-9.979*** (2.593)	-31.347*** (8.864)	-14.351*** (4.313)	-20.376* (10.275)			-20.73*** (2.465)
INEFF	-3.376*** (0.812)	-0.874 (1.093)	-1.679*** (0.534)	-0.792 (0.918)	-11.964*** (4.228)	-5.521*** (1.32)	-2.402*** (0.424)
LLP	-13.55* (7.053)	-2.673 (6.166)	-13.362 (8.881)	1.272 (11.442)	-53.456** (25.661)	-6.214 (13.236)	-11.11** (5.121)
EQTA	-7.509*** (1.939)	-7.555*** (2.084)	-7.852*** (1.945)	-6.088*** (1.802)	-3.763 (3.796)	-8.51*** (2.425)	-8.544*** (1.866)
OWNER	0.666 (0.478)	-1.187 (1.816)	3.36*** (0.773)	1.554 (1.746)	-1.235 (1.507)	-1.058 (0.812)	1.23** (0.337)
LISTED	2.485*** (0.464)	5.469*** (1.906)	2.146*** (0.552)	5.741*** (2.075)	0.639 (1.541)	3.552** (1.359)	1.152*** (0.419)
FOREIGN	-7.659 (5.282)	-3.238 (11.143)	-15.702*** (3.613)	3.417 (11.83)	-25.345** (10.892)	-17.389* (9.251)	-11.848*** (3.413)
MERGER	-1.382* (0.786)	-6.007*** (1.336)	1.153 (0.768)	-6.022*** (1.839)	-8.533*** (2.913)	-1.908 (2.221)	-1.727*** (0.556)
MMC*OWNER		0.066 (0.05)		-0.049 (0.074)		-0.049 (1.373)	
MMC*LISTED		-0.127* (0.073)		-0.107 (0.083)		-3.106** (1.286)	
MMC*FOREIGN		0.29 (0.404)		0.534 (0.544)		36.77*** (13.127)	
MMC*MERGER		0.268*** (0.058)		0.316*** (0.081)		-6.232 (14.154)	
HHI	15.864*** (4.653)	24.399** (10.216)	13.8741** (6.291)	18.023* (9.751)	-7.088 (8.923)	0.008 (4.521)	6.533* (3.636)
RF	0.202 (0.126)	-0.027 (0.2)	0.075 (0.136)	0.029 (0.216)	0.023 (0.339)	-0.679** (0.267)	-0.581*** (0.099)
GDP	-0.964 (4.055)	2.166 (9.335)	-6.499 (6.259)	9.249 (0.296)	-3.836 (28.475)	-18.067*** (6.5)	-4.495 (3.929)
Constant	3.53*** (0.364)	3.979*** (1.044)	4.2*** (0.43)	3.429*** (1.003)	5.824*** (1.922)	4.483*** (1.101)	5.354*** (0.354)
No. Obs	278	278	278	278	278	278	278
No. Groups	41	41	41	41	41	41	41
AR1 (p-value)	0.001	0.002	0.001	0.001	0.002	0.001	0.000
AR2 (p-value)	0.926	0.622	0.894	0.452	0.744	0.526	0.745

(Continued)

π	RAR _{ROE}						
Hansen test (p-value)	0.941	0.981	0.977	0.992	0.581	0.645	0.886

Notes: 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 per cent levels, respectively.

lower bank profitability. This somewhat does not support the mutual forbearance hypothesis for the Vietnamese banking system that multimarket contacts do not affect the potential for collusion in the local markets that banks enter.

Also, it seems clear that geographic diversification (*GEODIV*) is usually negative and significant. This implies that smaller and less diversified banks often have an established reputation in the local community and a specific (and long-term) knowledge of local consumers which cannot easily be imitated by competitors. Nonetheless, this somewhat supports the findings of Le et al. (2020) who suggest that global expansions tend to reduce bank risk-adjusted-performance. Concerning cost management, the coefficient of *INEFF* is generally negative and significant, suggesting that more efficient banks can utilize their loanable resources effectively, thus enhancing their profitability. This supports the earlier findings of Berger (1995) in the US and Sharma et al. (2013) in Fiji. When observing the risk channel using *LLP*, we find that, as expected when significant it appears to reduce profits. This is in line with the findings of Le (2018) in Vietnam who found that banks with greater credit risk have lower performance. The same sign is also true for bank capitalization (*EQTA*). This implies that a higher level of bank capital ratio may prevent banks from benefiting from alternative profitable opportunities.

Regarding bank ownership, the coefficient of *OWNER* is positive and significant, suggesting that SOCBs are more profitable than POCBs. This is in line with the findings of Le and Nguyen (2020b). This can be explained by two main reasons. Firstly, SOCBs have benefited from government subsidies. Second, SOCBs are usually considered as safe banks because of their government ownership in the Vietnamese banking system. Consequently, depositors are willing to accept lower deposit interest rates offered by SOCBs, thus enhancing their profitability (Le et al., 2019).

LISTED is positively and significantly associated with bank profitability, indicating that listed banks are more profitable than non-listed banks. Because shareholders have their capital at risk at the bank, they have more incentive to monitor its management to ensure the bank operates effectively. As a result, listed banks may have better asset quality which ultimately improves their profitability. Listed banks also may have easier access to funds, thus, lowering the cost of borrowing funds and enhancing their profitability. It is true for the case of the Vietnamese banking system where there is a lack of transparency.²² Listed banks seem to prefer by depositors and investors because they must follow the regulations of the stock market regarding disclosure of their operating activities. The findings also indicate that the coefficient of *FOREIGN* is generally negative and significant, suggesting that foreign ownership seems to reduce bank profitability. A possible explanation is that they may seek growth opportunities so they may invest higher-risk assets. Nonetheless, this supports the findings of Naaborg and Lensink (2008) in transition economies.

When looking at the effect of bank consolidation, *MERGER* is generally negatively and significantly related to bank profitability, implying that newly combined banks are less profitable than non-merged peers.²³ The possible reason is that M&As increase operating costs in the short-term for a consolidated bank, thus reducing their profitability.

When examining the effect of interaction between bank ownership and multimarket contacts, the findings show that the coefficient of *MMC*LISTED* is negative and significant, suggesting that listed

banks seem to aggressively compete with their competitors in other local markets where they operate to gain market shares. Thus, this may affect their profit adversely. However, *MMC*MERGER* is found to affect bank profitability positively. This may reflect that newly combined banks with greater contacts seem to pursue the collusion strategy in the short-term post-merger. The same result is obtained in the case of the interaction between *MMC* and *FOREIGN*, demonstrating that foreign-owned banks with higher multimarket contacts tend to collude due to the fear of retaliation by banks engaged in other markets. This may reflect the fact that the cap of total shares of foreign investors in a local bank may limit their ability to transfer technology and bring in capital infusion. Hence, they may not compete against their competitors aggressively in many markets.

Last, the findings show a positive relationship between market concentration (*HHI*) and bank profitability. This implies banks that operate in an increasingly competitive market tend to earn less profit. Nonetheless, this finding is in line with those of Mirzaei et al. (2013) and Le (2020a). Note that this also suggests that the increasing concentration in the Vietnamese banking system does not necessarily reflect a reduced competition itself and even competition may be more intense in some provinces where oligopolies prevail. The coefficients of *GDP* and *RF* are not significant in most of our base models. Nonetheless, a negative relationship between *GDP* and bank profitability supports the early findings of Tan and Floros (2012) in China. There also appears a decrease in bank profitability during the restructuring period. Accordingly, banks were required to strict their lending procedure until their bad debts are under control and reviewed by the State Bank of Vietnam as well as increase their capital to meet minimum charter capital requirements.

4.2. Robust checks

To provide additional empirical support to our findings, we further test whether a bank's behavior is affected by an interaction effect between high market concentration and multimarket contact. The coefficient of *MMC*HHI* is generally negative and significant in 2 models as shown in Table 5. This may suggest banks with greater multimarket contacts that operate in greater market concentration tend to compete aggressively against their competitors in this market. Nonetheless, this supports the early findings of Mester (1987) who found evidence of pro-competitive effects derived from the combination of high market concentration and high contact.

Following Kasman and Kasman (2016) and Le et al. (2019), we then construct a subsample of banks by excluding banks below the lower quartile to provide a robust check as indicated in Table 6. The findings show that the coefficients of *MMC1* and *MMC2* are negative and significant. Our main findings as above are thus confirmed.

We further examine whether the impact of multimarket contacts on bank profitability may differ between small and large banks. Following Le (2019) and Le et al. (2019), large and small banks are defined as those with total assets above and below the median, respectively. Then, *LARGE*, a dummy variable that takes a value of 1 for a large bank and 0 otherwise is used because the small sample size is employed in the system GMM estimator.²⁴ In general, the data shown in Table 7 indicates that larger banks are less profitable than smaller counterparts. This may be because smaller banks are easier to be managed and their focus is on serving specific regions. The coefficient of *MMC*LARGE* is positive and significant, suggesting that larger banks with greater multimarket contacts may not aggressively compete against their competitors in common local markets.

5. Conclusion

This study investigated the relationship between multimarket contacts and bank profitability in the Vietnamese banking system between 2006 and 2015 by using the system GMM. Our main results offer in general no evidence of tacit collusion in this sector, thus rejecting the assumption that mutual forbearance affects market conditions through greater multimarket contacts. The study also provides no support to the assumption that similarity among banks facilitates collusive

Table 5. Interaction effect of market concentration and multimarket contact

π	RAR_{ROE}	RAR_{ROE}	RAR_{ROE}
π_{t-1}	0.339*** (0.052)	0.304*** (0.05)	0.545*** (0.149)
<i>MMC1</i>	0.104 (0.082)		
<i>MMC2</i>		0.015 (0.065)	
<i>MMC3</i>			3.018 (5.886)
<i>GEODIV</i>	-3.906 (6.514)	6.706 (5.503)	
<i>INEFF</i>	-3.122*** (0.957)	-3.367** (1.285)	-9.716** (4.778)
<i>LLP</i>	-14.066** (6.943)	-24.54** (11.341)	-56.391* (32.814)
<i>EQTA</i>	-10.412*** (2.303)	-4.171 (2.895)	-3.635 (3.972)
<i>OWNER</i>	1.624* (0.919)	0.022 (0.614)	-0.681 (1.619)
<i>LISTED</i>	1.086 (0.722)	2.48*** (0.72)	-0.176 (1.818)
<i>FOREIGN</i>	-13.245** (5.545)	-5.106 (5.066)	-22.554* (11.396)
<i>MERGER</i>	-1.536 (1.129)	-1.893** (0.808)	-8.651*** (2.767)
<i>HHI</i>	12.915 (12.898)	9.465 (9.595)	-2.755 (12.17)
<i>RF</i>	-0.609*** (0.209)	-0.68*** (0.167)	0.076 (0.359)
<i>GDP</i>	-4.04 (7.951)	21.268*** (9.356)	1.286 (28.306)
<i>MMC*HHI</i>	-1.602* (0.808)	-1.621*** (0.439)	-26.316 (54.042)
Constant	3.822*** (1.009)	1.301 (1.204)	4.726** (2.105)
No. Obs	278	278	278
No. Groups	41	41	41
AR1 (p-value)	0.000	0.000	0.013
AR2 (p-value)	0.407	0.160	0.964
Hansen test (p-value)	0.615	0.621	0.410

Notes: 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 per cent levels, respectively.

behavior. When examining the interaction effect of multimarket contacts and bank ownership however we do find evidence of tacit collusion for the case of foreign-owned banks and newly combined banks, especially in the short-term post-merger.

Table 6. The results of robust checks

π	RAR_{ROE}	RAR_{ROE}	RAR_{ROE}
π_{t-1}	0.547*** (0.059)	0.545*** (0.059)	0.659*** (0.127)
<i>MMC1</i> ≥ 9	-0.036** (0.017)		
<i>MMC2</i> ≥ 9		-0.078** (0.03)	
<i>MMC3</i> ≥ 0.07			0.62 (0.497)
<i>GEODIV</i>	-13.938* (6.964)	-14.247** (6.731)	
<i>INEFF</i>	-3.074** (1.221)	-1.884 (1.17)	-6.495* (3.223)
<i>LLP</i>	6.028 (11.807)	15.131 (13.456)	-37.063* (18.683)
<i>EQTA</i>	-5.442*** (1.431)	-6.787*** (1.933)	-7.904*** (2.862)
<i>OWNER</i>	2.664*** (0.96)	2.303** (1.060)	-1.282 (0.873)
<i>LISTED</i>	0.866 (0.567)	1.549** (0.633)	0.583 (0.925)
<i>FOREIGN</i>	-3.177 (3.252)	-1.005 (3.767)	-14.113* (7.426)
<i>MERGER</i>	-0.169 (0.605)	-0.358 (0.608)	-3.526** (1.659)
<i>HHI</i>	3.863 (6.8)	7.192 (8.166)	-2.228 (7.729)
<i>RF</i>	-0.275** (0.125)	-0.047 (0.141)	-0.164 (0.256)
<i>GDP</i>	-7.264 (10.515)	-1.675 (9.939)	-17.989 (10.678)
Constant	3.471*** (0.701)	3.138*** (0.531)	4.993*** (1.524)
No. Obs	225	222	207
No. Groups	34	34	32
AR1 (p-value)	0.000	0.000	0.003
AR2 (p-value)	0.202	0.441	0.341
Hansen test (p-value)	0.999	0.998	0.545

Notes: 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 per cent levels, respectively.

The negative impacts of geographic diversification (*GEODIV*) and credit risk (*LLP*) on risk-adjusted returns suggest that more profitable banks are less geographically diversified, and have a lower credit risk. The same is true for state-owned commercial banks and non-merged banks. The findings indicate that efficient banks can generate greater bank profitability, suggesting that bank managers should implement superior management practice in their daily operations and minimize input usage, thus improving bank profitability. Also, listed banks seem more profitable

Table 7. The relationship between multimarket contacts and bank profitability in a subsample

π	RAR _{ROE}	RAR _{ROE}	RAR _{ROE}
π_{t-1}	0.359*** (0.052)	0.446*** (0.064)	0.557*** (0.102)
MMC1	-0.269*** (0.047)		
MMC2		-0.274*** (0.053)	
MMC3			4.513 (4.45)
LARGE	-3.408*** (0.952)	-2.229*** (0.753)	0.023 (1.78)
MMC*LARGE	0.236*** (0.049)	0.222*** (0.058)	-3.22 (5.246)
GEODIV	-4.289 (6.031)	-6.266 (7.245)	
INEFF	-2.729*** (1.01)	-1.123 (1.282)	-2.79* (1.477)
LLP	-3.619 (12.449)	8.301 (11.308)	-19.584* (11.539)
EQTA	-11.309*** (3.136)	-14.584*** (3.547)	-7.336* (3.99)
OWNER	0.192 (0.847)	-1.75 (1.046)	-1.74 (2.126)
LISTED	3.739*** (0.787)	3.157*** (0.543)	1.133 (1.892)
FOREIGN	-6.394 (4.677)	-7.687 (6.002)	-1.172 (10.272)
MERGER	-1.792*** (0.638)	-2.289*** (0.818)	-1.199 (3.925)
HHI	10.4 (8.756)	6.931 (12.297)	-6.371 (23.399)
RF	0.116 (0.172)	-0.295* (0.151)	-0.676** (0.282)
GDP	-6.534 (4.6)	-5.215 (8.331)	-48.293 (35.863)
Constant	5.908*** (1.189)	6.522*** (0.917)	5.59*** (1.617)
No. Obs	278	278	278
No. Groups	41	41	41
AR1 (p-value)	0.03	0.001	0.000
AR2 (p-value)	0.879	0.635	0.268
Hansen test (p-value)	0.976	0.980	0.654

Notes: 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 per cent levels, respectively.

than non-listed banks, suggesting that local banks should be encouraged to list on the stock market, thus enhancing the transparency of the banking system. Furthermore, a negative impact of capital ratio on bank performance implies that banks with an excessively high capital ratio may ignore opportunities for profitable growth, thus lowering their profits. Foreign-owned banks on average seem less profitable than domestic counterparts. Concerning the macroeconomic factors, our findings support the structure-conduct-performance hypothesis that banks with market power tend to collude to charge high fees on loans and non-traditional activities and lower rates on customer deposits, thus earning higher profits.

The study may suffer some limitations. Our study only investigates this link in one country within a limited period, implying that future research needs to examine this relationship in other emerging markets that have a similar banking structure for robust checks.

Acknowledgements

This research is funded by the University of Economics and Law, Vietnam National University, Ho Chi Minh, Vietnam.

Funding

This work was supported by the University of Economics and Law, Vietnam National University - Ho Chi Minh City [N/A].

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Citation information

Cite this article as: Multimarket contacts and bank profitability: do diversification and bank ownership matter?, Tu Dq Le, *Cogent Economics & Finance* (2020), 8: 1849981.

Notes

1. The average annual economic growth of approximately 6.2% over the examined period, just behind China.
2. Please see Yu and Cannella (2013) for the review of empirical studies on the impact of multimarket contacts in other industries.
3. Please see Le (2017a) for a more comprehensive overview of the literature on the relationship between bank ownership and profitability.
4. For more discussion, please see Le et al. (2019).
5. Vietnamese commercial banks are encouraged to publish their annual reports but not obliged.
6. Please see Le (2017b).
7. Unfortunately, the Global Bank Focus does not provide the data on bank branches. Since 2016, there have been substantial missing data on bank branches in each market. Therefore, we could not calculate the MMC values of the individual bank from the year 2016 and onward.
8. This exclusion from the sample is necessary to ensure the homogeneity of the sample when estimating relative bank efficiency using the bootstrap DEA. More importantly, the data of these banks are mostly unavailable.
9. They include Bank for Investment and Development, Foreign Trade Bank, Bank of Industry and Trade, Housing Bank of Mekong Delta, Agriculture and Rural Development Bank.
10. They include An Binh Bank, Asia Bank, Bao Viet Bank, Construction Bank, Dong A Bank, First Bank, Global Petrolimex Bank, Great Asia Bank, Hanoi Building Bank, HCM Development Bank, Kienlong Bank, Lien Viet Post Bank, Mekong Development Bank, Military Bank, Nam A Bank, National Citizen Bank, Ocean Bank, Orient Bank, Petrolimex Group Bank, Saigon-Hanoi Bank, Saigon Bank for Industry and Trade, Saigon Commercial Bank, Saigon Thuong Tin Bank, South-East Asia Bank, Southern Bank, TienPhong Bank, Viet A Bank, Technological Bank, Bank for Private Enterprise, Export-Import Bank, Vietnam International Bank, Maritime Bank, Tin Nghia Bank, Western Bank.
11. Another example is that banks with poor management may fail to control operating costs, thus lowering bank profitability. The ownership may be also endogenous because investors may decide to invest in riskier banks to maximize their expected utility (Gugler & Weigand, 2003).
12. It is assumed that strictly exogenous variables are not correlated to the individual effects while the endogenous variables are predetermined.
13. One of the main reasons for using risk-adjusted returns measure is that the traditional measures completely ignores risk. Since returns can be enhanced by taking more risk, at least in the short run, this is a critical limitation of using traditional measures. Risk-adjusted returns estimates are analogous to a market-derived Sharpe ratio, which defines risk-adjusted returns as market returns (less the risk-free rate) divided by the standard deviation of returns. For further discussion, please see Stiroh (2004a; 2004b) and among others. Besides, our results do not alter when profits after tax is used to measure ROE and ROA in the formula of risk-adjusted returns. Nonetheless, we also use the traditional measures of bank profitability such as average return on assets, the average return on equity, and pre-provision profit. Similar results are obtained although they cannot present here due to the length restrictions. They are available upon request.
14. For definitions of the similarity index and weights in calculating two alternative indices, MMC2 and MMC3 are comprehensively presented in Coccoresse and Pellicchia (2009).
15. The procedure is not repeated here for want of space. According to the intermediation approach in which banks act as intermediaries between depositors and borrowers, a 3×2 set of inputs and outputs is used. Following prior studies such as Le (2017b), Le et al. (2019) inputs include fixed assets, operating expenses, and loanable funds while outputs include loans and other earning assets. Because of the unavailability of data on either a number of employees or labor expenses in many banks in the sample, operating expenses are used to proxy for labor costs.

16. To provide robust checks, we also use a dummy variable takes a value of 1 for a local bank that has foreign participation in its capital and 0 otherwise, independently of how large it is. Similar findings are obtained although it cannot be presented here due to length restrictions.
17. We thank an anonymous referee for this clarification.
18. We thank an anonymous referee for this suggestion.
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 above 0.05 that instruments are still valid.
22. Vietnamese commercial banks are encouraged to publish their annual reports but not obliged.
23. Non-merged banks include those which are not engaged in any M&A activity and those which are merging banks during the pre-merger period.
24. Initially, we considered several measures of bank size (the natural logarithm of total assets, the natural logarithm of bank branches, and LARGE) in our base models. There appear high correlations between these measures and MMC variables, EQTA (>0.7). Therefore, these measures of bank size are excluded from our base model.

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Appendices

Appendix 1

Following Coccoresse 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 . In this study, the province is considered as the local market. The MMC1 index lies between 1 and a total number of local markets which is 63. MMC1 equals 1 in the case of single-market banks.

However, not every rival can have the same importance for a bank. For robust checks, two other indices of multimarket contacts are estimated. MMC2, 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.

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

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

The literature suggests that the symmetry among banks can increase their collusion. The incentive of collusion may depend upon the size of the rival. MMC3 is calculated when taking into account the size of the rival as follows:

$$MMC3_i = \frac{\sum_{i \neq j} ij \bar{\gamma}_{ij}}{\sum_{i \neq j} \bar{\gamma}_{ij}} \quad (5)$$

where $\bar{\gamma}_{ij} = 1$ if $ij > 0$, and $\bar{\gamma}_{ij} = 0$ if $ij = 0$

MMC₂ and MMC₃ indicate that the increase in the similarity of the banks should improve the impact of multimarket contacts.

Appendix 2

The results of the impact of multimarket contacts on bank profitability in Vietnam using RAR_{ROA}

π	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
π_{t-1}	0.214*** (0.079)	0.363*** (0.134)	0.21*** (0.069)	0.362*** (0.128)	0.611*** (0.11)	0.589*** (0.099)	0.239*** (0.052)
MMC1	-0.002 (0.028)	0.072 (0.067)					
MMC2			-0.006 (0.033)	-0.008 (0.063)			
MMC3					1.303 (0.866)	4.938 (3.261)	
GEODIV	-10.646*** (3.245)	-13.76** (5.335)	-9.647*** (3.5)	-11.818* (6.322)			-8.021* (4.719)
INEFF	-1.841*** (0.667)	-1.693 (1.234)	-1.414** (0.641)	-1.259 (1.339)	-4.243 (5.014)	-3.151** (1.382)	-2.499*** (0.832)
LLP	10.3 (9.314)	3.78 (11.111)	14.661 (9.875)	8.204 (14.986)	-19.625 (37.641)	-19.299** (8.965)	27.968*** (7.883)
EQTA	2.531 (2.398)	7.56 (5.051)	3.016 (2.519)	6.592 (4.333)	-0.002 (3.367)	5.979** (2.402)	-0.162 (2.942)
OWNER	2.368*** (0.37)	1.222 (1.395)	2.397*** (0.519)	2.015 (1.339)	-1.386 (1.204)	0.561 (1.641)	1.854*** (0.387)
LISTED	-1.895 (1.217)	3.628 (2.229)	-1.675 (1.03)	2.396 (2.132)	1.077 (1.121)	3.07 (1.965)	-0.556 (0.405)
FOREIGN	-6.987* (3.867)	0.645 (10.381)	-1.024 (5.09)	-0.133 (14.698)	-6.739 (9.648)	34.466 (28.149)	-5.931 (4.191)
MERGER	-1.668** (0.705)	-4.605** (1.77)	-1.45** (0.664)	-4.607*** (1.585)	-4.367 (2.902)	-13.711* (8.101)	-2.851*** (1.011)
MMC*OWNER		0.069* (0.039)		0.036 (0.045)		-3.262 (3.316)	
MMC*LISTED		-0.212** (0.081)		-0.145 (0.088)		-3.032 (1.939)	
MMC*FOREIGN		-0.286 (0.476)		0.208 (0.657)		-44.549 (44.071)	
MMC*MERGER		0.155 (0.103)		0.158* (0.089)		30.093 (29.549)	
HHI	3.026 (5.808)	20.73* (11.016)	4.688 (6.39)	15.773 (10.553)	-3.158 (6.289)	-0.037 (6.604)	-1.202 (6.279)
RF	-0.02 (0.203)	-0.171 (0.29)	-0.3128 (0.164)	-0.075 (0.246)	-0.148 (0.415)	0.003 (0.272)	-0.25 (0.175)
GDP	12.404** (6.048)	15.243 (12.03)	16.297** (6.798)	19.674 (11.827)	-9.972 (2.249)	-24.959 (22.289)	10.914 (8.322)
Constant	2.092** (0.919)	-1.584 (2.22)	1.31 (1.003)	-0.712 (1.833)	2.463 (2.249)	-0.567 (1.466)	2.299** (1.094)
No. Obs	278	278	278	278	278	278	278
No. Groups	41	41	41	41	41	41	41
AR1 (p-value)	0.001	0.010	0.001	0.000	0.002	0.004	0.000

(Continued)

π	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
AR2 (p-value)	0.363	0.281	0.202	0.278	0.302	0.289	0.299
Hansen test (p-value)	0.704	0.583	0.638	0.649	0.744	0.564	0.529

Notes: 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 per cent levels, respectively.



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