Print ISSN: 2288-4637 / Online ISSN 2288-4645
doi:10.13106/jafeb.2021.vol8.no3.1171

Multimarket Contact and Risk-Adjusted Profitability in the Banking Sector: Empirical Evidence from Vietnam

Oanh Le Kieu DAO[1], Tuyen Thi Ngoc HO[2], Hac Dinh LE[2], Nga Quynh DUONG[4]

Received: November 30, 2020 Revised: February 07, 2021 Accepted: February 16, 2021

Abstract

This study aims to investigate the impact of the multimarket contract on risk-adjusted profitability. Risk-adjusted profitability is measured in terms of risk-adjusted return on assets. This study employs dynamic panel data of 27 commercial banks in Vietnam using the GMM estimator to test the multimarket contact hypothesis in the Vietnamese banking sector. The results show that there is a negative impact of multimarket contact on the profitability of banks. Multimarket contact, deposit to asset ratio, non-interest income to total income, GDP growth rate, Worldwide Governance Indicator (WGI), and operating cost to assets are the major determinants of risk-adjusted profitability of commercial banks. Our main findings show that Vietnamese banks' focus to increase the multimarket contact may lead to lower profitability and there is evidence that supports theory predictions, since the average number of contacts among banks, bank size, and capitalization are positively related to risk-adjusted profitability. The study has policy implications for commercial banks in that they should not only focus on interest as a source of income and diversify their income source from non-interest income as well since it helps to improve risk-adjusted profitability for them.

Keywords: Multimarket Contact, Banking Performance, Risk-Adjusted ROA, GMM System Estimator

JEL Classification Code: G21, C33, L40

1. Introduction

Multimarket contact occurs when firms compete with the same rivals in multiple markets. When firms compete with each other in more than one market, their competitive behavior may differ from that of single-market rivals. When one large firm competes with another, they are likely to collide with each other in an impressive number of markets and the diversity of contact may weaken the edge of their competition. The oligopoly theory usually refers to the partial equilibrium study of markets in which the demand side is competitive, while the supply side is neither monopolized nor competitive. The mutual forbearance theory may be viewed as an extension of traditional oligopoly theory, which is a form of tacit collusion wherein firms avoid competitive attacks against those rivals they meet in multiple markets, and this happens because multi-market competition increases the familiarity between firms and their ability to deter each other. When the firms compete with each other at the same time in several distinctive markets, they may confront multimarket competition. The previous literature has generally studied multimarket contact as a determinant for mitigating competition and/or encouraging collusion in a market.

Banks can be seen as firms offering different or maybe homogeneous products in several local markets and hence they make the right choice for this empirical study and the hypotheses of this research. During the last decades, the banking industry of many countries has been characterized by an immense consolidation process, essentially due to technological progress, globalization, and deregulation. In the context of Vietnam's deeper international economic integration, various merger and acquisition deals will be seen in the country's banking industry to optimize profitability,

[1]First Author. Ho Chi Minh City Banking University, Vietnam. Email: oanhdlk@buh.edu.vn
[2]Ho Chi Minh City Banking University, Vietnam.
[3]Ho Chi Minh City Banking University, Vietnam
[4]Corresponding Author. Ho Chi Minh City Open University, Vietnam [Postal Address: 97 Vo Van Tan, Ward 6, District 3, Ho Chi Minh City 700000, Vietnam] Email: nga.dq@ou.edu.vn

diversify banking operations, mitigate risks and achieve Government-set objectives of restructuring the financial-banking system to assist unavoidable impacts of the global financial crisis. Therefore, questions have been raised about possible changes in the degree of competitiveness: according to the structure-conduct-performance (SCP) paradigm, market structure is a determinant of firm conduct, which in turn determines performance. Market structure can be measured by several factors such as the number of competitors in an industry, the heterogeneity of products, and the cost of entry and exit. Besides, mergers and acquisitions (M&A) have led to a larger convergence of branch networks, expanding the number of markets where banks meet. By way of consequences, if the multimarket contact hypothesis is maintained, the geographical branch structure of those banks that are involved in M&A operations becomes a key factor to be considered by the antitrust authorities.

The rationale for concentrating on the banking industry is twofold. First, banks can be considered as selling their goods in several local markets, thus, there are possible regional overlaps that make the banking industry the perfect test ground for empirical evaluation of this hypothesis. Second, there are important policy consequences for cross-market interaction between banks. Over the past few decades, a noticeable pattern of convergence has characterized many countries' banking markets, resulting from a variety of causes, such as technological changes, globalization, and deregulation. This phenomenon may have had major implications in terms of changing the degree of competition since it could be easier for firms to collide in more fragmented markets and thereby set higher prices. Besides, mergers and acquisitions (M&As) have resulted in a greater overlap of branch networks, increasing the number of markets where banks meet. Thus, if there is a multimarket contact theory, the regional branch organization of the banks engaged in M&A activities would become the main thing to be considered by the antitrust authorities (Coccorese, 2009).

In this paper, we test the theory according to which multimarket contact is an important factor to mitigate competition among firms because the phenomenon of mutual forbearance may reduce the market-level intensity of competition between two firms when the multimarket contact between them (the number of markets in which they compete) increases. We test this hypothesis using a two-equation model of competition for the Vietnamese banking industry in the years 2010–2018. Specifically, we used a GMM system estimator to measure the impact of multimarket contacts on the banks' profitability. The main result obtained is a negative and significant link between multimarket contact and the profitability measured by risk-adjusted ROA, which is also robust with respect to model specifications and multimarket contact measures. Thus, we find contrary to the theory that multimarket linkages reduce banks' profitability.

In what follows, section 2 surveys the studies on the assessment of the level of market competition as well as on the theory and empirics of multimarket contact, with a specific focus on banking. Section 3 shows how our multimarket contact measures are calculated and section 4 outlines the theoretical model. Section 5 concludes and draws some policy implications.

2. Literature Review

According to oligopoly theory, the multimarket contact among companies has an impact on the intensity of competition. Multimarket companies behave less aggressively towards their rivals in those markets they have a competitive advantage and because of the fear of retaliation in other markets. A higher number of markets creates extensive retaliation, multiple attacks and leads to notable losses, and as such, the overall degree of competition is reduced (Edwards, 1955). Reactions by companies in secondary markets can also be used as a more legitimate threat than overt revenge against rivals (Gilbert, 1984). Traditional analyses of industrial behavior typically link the exercise of market power in the industry to internal features such as demand conditions, concentration, and barriers-to-entry. Nevertheless, some economists have remained concerned that external factors, such as contact across markets, may also play a significant role in determining the level of competitiveness in any particular industry. Bernheim and Whinston (1990) examined the effect of multimarket contact on the degree of cooperation that firms can sustain in settings of repeated competition. They isolated conditions under which multimarket contact facilitates collusion and show that these collusive gains are achieved through modes of behavior that have been identified in previous empirical studies of multimarket firms. Real-world imperfections tend to make firms' objective function strictly concave and market super games 'interdependent': firms' payoffs in each market depending on how they are doing in others. Then, multimarket contact always facilitates collusion. It may even make it sustainable in all markets when otherwise it would not be sustainable in any. The effects of conglomeration are discussed. 'Multi-game contact' is shown to facilitate cooperation in non-oligopolistic super games as long as agents' objectives function is submodular in material payoffs (Spagnolo, 1999).

Calculating the degree of competitiveness of the financial sector is a major topic in economic literature, which is still split over whether or not banking competition encourages stability. What the NEIO (New Economic Institutions Institute) methodology has sought to address is the limitations of the SCP (structure-conduct-performance) approaches through creating methodologies that measure firms' behavior by the clear assessment of their actions, while eliminating

indirect (and often ambiguous) inferences regarding market influence dependent measures of concentration. The creation of NEIO needs exhaustive data for economic analysis.

One potential alternative is to use a simultaneous model that includes a behavior parameter that defines how firms act (and therefore the degree of their market power). It can be viewed as either a conjectural coefficient of variation or a variation from a demand schedule of a company's perceived marginal revenue schedule in the industry and can assume values that vary, in conjunction with the level of market power in the industry.

The traditional structure-conduct-performance (SCP) paradigm predicts that banks enjoy higher profits as highly concentrated markets are easier to collude with. Berger and Hannan (1989) stated that the commonly observed positive correlation between market concentration and profitability may be explained by non-competitive pricing behavior, as argued by the structure-performance hypothesis, or by the greater efficiency of firms with dominant market shares, as argued by the efficient-structure hypothesis. By examining the price-concentration relationship instead of the profit-concentration relationship, they tested the structure-performance hypothesis in a manner that excluded the efficient-structure hypothesis as an alternative explanation of the results. The results strongly supported the structure-performance hypothesis and are robust with respect to model specification, measurement of concentration, and econometric technique.

Pilloff and Rhoades (2002) used the structure-performance model and regression analysis to investigate several analytical issues that often arise in evaluating competition in connection with bank mergers and that are generally relevant to mergers in other industries. The most consistent and strongest finding was that the local market HHI is positively and significantly related to profitability. They also found that the number of organizations and the level of recent deposit growth may provide some additional information on the level of competition. Finally, several variables including market size, the number of large banking firms, deposits per office, and resident migration rates exhibit similar relationships to profitability in the bivariate analysis, suggesting that there may be some characteristics associated with market size, density, or attractiveness that is important for competition.

Thomas and Wilig (2006) found to the contrary that a strong force against strategic linkage results from imperfect monitoring of adherence to cooperation. With such imperfections, strategically linking markets can lower payoffs by permitting the impact of adverse shocks in one market to spread to others. Consequently, players of repeated games on more than one front may find it strictly advantageous to avoid linking strategies on a front with clear monitoring to outcomes on a front with error-prone monitoring. Sorenson (2007) explained how multimarket contact facilitates collusion when firms enjoy reciprocal advantages across markets: When there are reciprocal asymmetries between firms, multimarket contact allows them not only to develop spheres of influence but also to implement attractively simple strategies that are subgame perfect and weakly renegotiation proof. Hence, collusive equilibria are supported by fully credible punishments. A significant implication is, multimarket contact involving reciprocal differences between firms may be more facilitating to their cooperative efforts than multimarket contact based on other factors.

There are also theoretical findings supporting the hypothesis that multimarket contact increases competition. While discussing banks, Solomon (1970) maintained that the interconnection among markets may intensify competitive interaction if the interbank rivalry is intense in individual local markets throughout a given region. In many imperfect-information models in industrial organization, a firm is induced to take any action that does not maximize its first-period profit because other firms view this action as a signal about the firm's private information. In these models, because the opponent firms can correctly invert the firm's strategy, all information is revealed after the play in the first period, and in subsequent periods all firms play their single-period profit-maximizing strategies. Thus, behavior like limit pricing is observed only in the first period, and not in any subsequent period. Mester (1992) stated that perpetual signaling is obtained by allowing the variable about which firms have private information to vary through time. In a separating equilibrium, while a firm's action will perfectly reveal its private information in a period, it will not perfectly reveal the firm's private information in subsequent periods. Thus, the incentive to signal perpetuates through time.

Some previous studies have investigated the impact of the multimarket on profitability within manufacturing industries. Scott (1982) found that companies' higher profits (measured as the ratio between operating income and sales) derive from a combination of high multimarket contact and market concentration. At the company level, Feinberg (1985) stated that companies meeting rivals in more than one market will be able to facilitate collusion in one or all of those markets. At the company level, the evidence supports the theory, showing sales-at-risk, a measure of the importance of multimarket contacts, to increase price-cost margins in the moderate range of concentration where collusion is feasible but difficult to achieve without mutual forbearance. The industry-level results are weaker, casting some doubt on the hypothesis. The empirical results of Hughes and Oughton (1993) estimated the effects of diversification and multimarket linkages on profitability because diversification per se reduces profitability. There is also a positive impact of multimarket contact on both the price-cost margin and the rate of return of firms.

Strickland (1985) tested the hypothesis that conglomerate mergers lessen price competition through the creation of mutual forbearance behavior. This hypothesis is tested by estimating the impact of multi-market contacts on price competition in manufacturing industries. The empirical results did not support the mutual forbearance hypothesis and suggest that conglomerate mergers should not be proscribed on that basis. Pilloff (1999) found that multimarket contact is positively and significantly correlated to profitability (measured by ROA), especially for those banks with the largest exposures to outside contact.

Other studies investigated the linkage of the multimarket linkage and price, profitability in specific industries, such as Singal (1996) in the US airline firms; Busse (2000) investigated the US mobile telephony industry; Jan and Rosenbaum (1996) examined the US cement market; Fernandez and Marin (1998) analyzed the Spanish hotel industry; Fu (2003) considered 218 midwestern US newspapers. All of the results support evidence of a positive relationship between multimarket contact among firms and profitability (or prices), hence giving support to the mutual forbearance hypothesis. With specific reference to the banking industry, the results of the empirical studies are surely more ambiguous, so that it is not possible to give a definitive judgment on the role of multimarket contact on competition and profitability. In these studies, contact is usually measured with variables built on the number of links between a given group of banks (all those operating in a market, or a subset of leading institutions) or the amount of deposits involved in those links.

Heggestad and Rhoades (1978) tested one of the major hypothesized consequences of conglomerate dominance-the development of mutual forbearance. The hypothesis holds that conglomerate firms that meet in many markets will develop a "live and let live" philosophy since action initiated in any market may induce retaliation in other markets where they are more vulnerable. As a consequence, the prevalence of conglomerate firms will mean a reduction in rivalry even in markets with a relatively competitive structure based on traditional measures of market structure. The study developed a simple model that illustrates the implications of the mutual forbearance hypothesis and discussed the hypothesis in the context of commercial banking. It then sets out the estimating equation and develops a variable that is designed to capture the degree of Intermarket contact among dominant firms. Additional variables are developed and used along with the inter-market contact variable in a regression analysis that covers a sample of 187 major banking markets. Mester (1987) concluded that the multimarket links appear to have a pro-competitive effect. Whalen (1996) analyzed the deposit market of large, interstate US bank holding companies, and his results were generally consistent with the linked oligopoly theory. Analyzing growth in current markets and entry in new markets within the California savings and loan industry, Haveman and Nonnemaker (2000) and Fuentelsaz and Gomez (2006) found an inverted U-shape influence of multimarket contact on growth and entry and the strong impact of multimarket links on mutual forbearance when the markets are dominated by a few multimarket firms.

De Bonis and Ferrando (2000) did not find any significant statistical evidence for the multimarket contact theory when they estimated the effects of increasing multimarket contacts, concentration indicators, banks' costs, and loan growth on variations in market shares and interest rates in the Italian banking industry. Risk-adjusted return on assets (RAROA) defines an investment's return by measuring how much risk is involved in producing that return. It is the ratio of ROA to standard deviation of ROA over the sample period (Milani et al., 2008).

The literature and its synthesis suggest the conceptual model shown in Figure 1. And the following hypothesis.

H1: *Multimarket contact is positively related to Risk-adjusted return on assets (RAROA).*

3. Multimarket Contact Measures

The peculiarity of the banking sector is that one bank can enter another bank in a range of regional markets due to the likelihood of opening branch offices in a variety of cities or towns. We are following a method similar to and Kessides (1994) and Jans and Rosenbaum (1996) to build our multi-market contract measures.

Suppose that N banks operate in (some or all of) M regional markets. For the year in question, let $BR = [br_{ij}]$ be the $N \times M$ matrix describing the geographical distribution of banks' branches, whose generic element br_{ij} (where $i = 1, \ldots, N$ indexes banks, and $j = 1, \ldots, N$ indexes markets) is the number of branches of bank i in market j.

Beginning with matrix BR, we can build the $N \times M$ binary matrix $U = [u_{ij}]$ checking the presence of each bank in the various markets. In fact, it is $u_{ij} = 1 > 0$ (i.e, bank i operates in market j by means of one or more branches), while it is $u_{ij} = 0$ if $br_{ij} = 0$.

Matrix U allows constructing $N \times N$ the symmetric matrix $A = UU'$, whose generic element is

$$a_{kl} = \sum_{j=1}^{M} u_{kj} u_{lj}$$

Each off-diagonal element a_{kl} of matrix A measures the number of markets (region) in which banks k and l meet, while the generic diagonal element a_{kk} quantifies the number of markets (regions) where bank k operates.

If N_j is the number of banks operating in market j, the total number of possible pairings between these banks

(i.e. the overall number of contacts among them in this market) is given by $\frac{N_j\left(N_j-1\right)}{2}$.

Our first market-level measure of multimarket contact, $MMC1_j$ is measured as the average number of contacts in regions other than j ('non-home' regions) per contact in region j ("home" regions), as regards the banks operating in this region. Formally:

$$MMC1_j = \frac{\sum_{k=1}^{N-1}\sum_{l=k+1}^{N} a_{kl}u_{kj}u_{lj} - N_j\left(N_j-1\right)/2}{N_j\left(N_j-1\right)/2}$$

The numerator represents the number of times banks operating in region meet each other in regions other than j.

The limitation of this multimarket interaction calculation is that it takes only the number of contacts instead of the scale of the banks or the concentration prevailing in the markets. The higher the concentration (i.e. there are few banks with considerable market shares), the bigger the losses due to the retaliation from competitors. In contrast, in highly concentrated economies, banks can achieve implicit collusion more efficiently and less collaboration cost. We will need to build a modern multi-market touch index that also captures the ability of banks to leverage it. To this intent, in line with Jans and Rosenbaum (1996), we are designing two additional multi-market contact indicators.

The first multimarket contact indicator denoted as $MMC2_j$, takes into account banks' market shares (measured i percentage values). Let $MS = [ms_{ij}]$ be the $N \times M$ matrix whose generic element is the market share of bank i in region j. Our matrix MS is based on the geographical distribution of branches. Accordingly:

$$ms_{ij} = \frac{br_{ij}}{\sum_{i=1}^{N_j} br_{ij}} \times 100$$

For each market j, let $B^{(j)}$ denote the $N \times N$ symmetric matrix whose generic element $b_{kl}^{(j)}$ is given by the sum of market shares of banks k and l ain all "non-home" markets (other than j) in which they meet:

$$b_{kl}^{(j)} = \sum_{p \neq j}\left(ms_{kp} + ms_{lp}\right)u_{kp}u_{lp}$$

Our $MMC2_j$ the measure is then calculated as the average sum of market shares in markets other than j per contact in the same markets, as regards the banks trading in market j.

$$MMC2_j = \frac{\sum_{k=1}^{N-1}\sum_{l=k+1}^{N} b_{kl}^{(j)}u_{kj}u_{lj}}{\sum_{k=1}^{N-1}\sum_{l=k+1}^{N} a_{kj}u_{kj}u_{lj} - N_j\left(N_j-1\right)/2}$$

4. The Empirical Approach

This study follows an approach adopted by Coccorese (2013) who considered certain factors important to see the effect of multimarket contact on risk-adjusted profitability. To test the mutual forbearance hypothesis, we estimate the following equation:

$$\begin{aligned} RAROA_{it} = {} & \alpha + \beta_1 MMC_{it} + \beta_2 Size_{it} + \beta_3 EQTA_{it} \\ & + \beta_4\, NPL_{it} + \beta_5\, DEPOTA_{it} + \beta_6\, DIV_{it} \\ & + \beta_7\, OCA_{it} + \beta_8\, GDPGR_{it} + \beta_9\, INF_{it} \\ & + \beta_{10}\, WGI_{it} + \varepsilon_{(i,t)} \end{aligned}$$

With $i = 1, \ldots, N$ and $t = 1, \ldots, T$ (where N and T are the numbers of banks and periods, respectively).

The dependent variable RAROA ($\frac{ROA}{\sigma ROA}$, risk-adjusted return on assets, i.e. the ratio of ROA to its conditional volatility, measured as the ratio between the value of return on assets and standard deviation of ROA) is a measure of profitability, and is expected to be inversely related to the competition: hence, if the multimarket contact theory holds, banks characterized by a larger number of linkages should enjoy higher profits. This implies that MMC (a variable that measures banks' multimarket contact) should have a positive coefficient.

MMC1 and MMC2 are the multimarket contact variables computed following the procedure described in the section below. Total assets are used as a proxy of bank size (Size). Equity ratio (EQTA) determines the total owners' equity relative to total assets. The higher the equity ratio, the lower the degree of leverage. The nonperforming loan ratio (NPL) measures the rate at which a bank's loans are not repaid. It is widely used in the literature to measure banks' credit. A higher NPL ratio is presumably a result of more risk-taking of the banks. The deposit to assets ratio (DEPOTA) measures the magnitude of assets being funded by public deposits. The non-interest income to total income ratio (Div) is calculated based on non-interest operating income divided by the sum of net interest income and non-interest income. The operating cost to asset ratio (OCA) is an indicator to track the changes in operating cost with respect to changes in assets. The GDP growth rate (GDPGR) measures how fast a country's economy is growing. Our inflation rate calculator (INF) extracts the latest CPI data to calculate Vietnam inflation. The Worldwide Governance Indicator (WGI) is a research dataset summarizing the view on the quality of governance provided by a large number of firms, citizen and expert survey respondents in Vietnam. Finally, is an error term, with zero mean and finite variance.

To compute the contacts among banks and build the MMC variable, we consider the province as the relevant market.

Table 1: Definition of Variables

Variables		Definition	Expected sign
RAROA	Profitability		Dependent variable
MMC1	Multimarket measure #1 (based on the number of contacts	Calculated as the total number of contacts of firm *i* divided by the number of firms *i* that firm meets in each local market	+
MMC2	Multimarket measure #2 (based on the sum of market share)	The average sum of market shares other than *j* per contact in the same markets	
Size	Bank's size	Log of total assets	+
EQTA	Capitalization	The ratio of equity to total assets	–
DEPOTA	Magnitude of assets	Deposit to assets ratio	+
DIV	Non-interest income to total income ratio	Non-interest operating income divided by the sum of net interest income and non-interest income	+
OCA	Operating cost to asset ratio	Operating cost to asset ratio	+
NPL	Credit risk	Non-performing loans to total loans	–
GDPGR	The annual GDP growth rate		+
INF	Inflation rate		+
WFI	Worldwide Governance Indicator		+

Table 2: Sample Descriptive Statistics (2010–2018)

Variables	Mean	Standard deviation	Min	Max
RAROA	0.10	0.93	–0.82	0.345
MMC1	13.24	7.08	0.91	30.85
MMC2	0.27	0.39	0.00	2.86
SIZE	32.14	1.08	29.86	34.72
EQTA	26.37	30.04	0.48	239.51
NPL	4.21	13.78	0.00	91.54
DEPOTA	17.28	1.47	13.13	20.56
DIV	0.26	1.50	–21.30	0.99
OCA	0.01	0.00	0.00	0.07
GDPGR	6.00	0.52	5.24	6.81
INF	8.19	6.30	0.88	23.11
WGI	–1.41	0.04	–1.49	–1.35

For each year, the starting point is the $N \times K$ matrix that describes the geographical distribution of banks' branches (where K is the number of markets, i.e. province.

The original sample considered 27 Vietnamese banks and 63 provinces for the period 2010–2018. After dropping those cases for which variables were not available or misleading, our final sample consists of 216 observations regarding 27 banks.

The result shows the descriptive statistics of dependent and independent variables for the selected commercial banks. Cleary, risk-adjusted ROA ranges from minimum –0.82 to a maximum of 0.34 leading to an average of 0.1073 with a standard deviation of 0.93. MMC1 ranges from a minimum of 0.91 to a maximum of 30.85. Similarly, the MMC2 ranges from a minimum of 0.00 to a maximum of 2.86.

Person correlation coefficients are computed and the results of commercial banks are presented in Table 3. More specifically, it shows the correlation coefficients of dependent and independent variables for selected commercial banks.

Furthermore, MMC1 and MMC2 variables are expected to cause endogeneity problems. We also consider bank-specific controls as being endogenous due to potential omitted variable bias, which is likely to induce erroneous results with respect to the coefficient of multimarket contact variables. GMM methodology also allows for the definition of the lag length bound for each endogenous variable to produce GMM-style instruments. For better results, we opt for the first lag in all bank-specific controls as the minimum and maximum. However, we consider the possibility of the poor performance of GMM estimators when instruments are too many according to the literature. Thus, the result is tested thoroughly with additional lags of the dependent and independent variables as instruments or even fewer instruments according to the approach proposed by Roodman (2009).

Table 3: Correlation Matrix

	MMC1	MMC2	SIZE	EQTA	NPL	DEPOTA	DIV	OCA	GDPGR	INF
MMC1	1									
MMC2	0.4227	1								
SIZE	0.0319	0.0890	1							
EQTA	0.2379	0.0568	0.1855	1						
NPL	0.2150	0.1705	0.1910	–0.1541	1					
DEPOTA	0.6137	0.4626	0.0306	0.1515	0.0035	1				
DIV	0.0625	0.0794	0.0072	0.0410	0.1725	0.0339	1			
OCA	0.0676	0.0429	–0.0187	0.0578	0.1930	0.0137	0.4814	1		
GDPGR	–0.4092	0.1003	0.0113	0.1389	–0.0402	–0.3435	0.0713	0.0228	1	
INF	0.7031	0.5814	0.0069	–0.0925	0.1933	0.4506	0.0558	0.0339	–0.2247	1
WGI	–0.1151	0.1403	–0.2763	0.5239	–0.1314	0.0482	0.1337	0.1261	0.1953	0.0832

Table 4: Estimation Results

Variable	RAROA							
	MMC1				MMC2			
	Coef.	Std. dev	*t*	*P > t*	Coef.	Std. dev	*t*	*P > t*
RARROA	0.28001***	2.4283	0.12	0.009	0.01445	0.01931***	0.75	0.001
MMC1	–0.01576***	0.10448	–0.15	0.001				
MMC2					–0.00301***	0.00074	–4.04	0.000
SIZE	0.03588	0.46877	0.08	0.940	0.00458	0.01024	0.45	0.658
EQTA	0.10107***	0.91709	0.11	0.013	0.08649***	0.04287	2.02	0.004
NPL	–1.7312	15.773	–0.11	0.913	–0.09427	0.23407	–0.40	0.690
DEPOTA	–0.04297 **	0.56730	0.08	0.040	0.01159**	0.03665	0.32	0.050
DIV	2.0898**	26.457	0.08	0.038	0.37455***	0.64060	0.58	0.004
OCA	–0.11780**	0.71842	–0.16	0.001	–0.03743**	0.01564	–2.39	0.024
GDPGR	0.02704***	0.23727	0.11	0.010	0.00051**	0.00169	0.31	0.062
INF	$-4.37e^{-09}$	$4.09e^{-08}$	–0.11	0.916	$-1.38e^{-11}$	$2.57e^{-10}$	–0.05	0.958
WGI	0.17865***	1.1391	0.16	0.007	0.04070	0.00754***	5.39	0.000
Constant	0.01248	0.05498	0.23	0.002	0.00649	0.00148	4.38	0.000
F(21, 6)	83.21				89.65			
Prob > F	0.000				0.000			
AR(2)	0.311				0.164			
Sargan test Prob > chi2	0.005				0.001			
Hansen test Prob > chi2	0.815							

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Based on the above findings, the following regression has been developed:

$$\begin{aligned} RAROA_{it} = {} & 0.01 - 0.015MMC_1 + 0.358Size_{it} + \\ & 0.101EQTA_{it} - 1.731NPL_{it} \\ & + 0.042DEPOTA_{it} + 2.089DIV_{it} \\ & - 1.117OCA_{it} + 0.27GDPGR_{it} \\ & - 0.004INF_{it} + 0.178WGI_{it} \end{aligned}$$

$$\begin{aligned} RAROA_{it} = {} & 0.006 - 0.003MMC_2 + 0.004Size_{it} - \\ & 0.03EQTA_{it} - 1.731NPL_{it} \\ & + 0.0115DEPOTA_{it} + 0.374DIV_{it} - \\ & 0.037CA_{it} + 0.00051GDPGR_{it} \\ & - 0.001INF_{it} + 0.04WGI_{it} \end{aligned}$$

Coefficient regression in Table 4 shows Equity ratio (EQTA), Deposit to assets ratio (Depota), non-interest income to total income ratio (Div), GDP growth rate (GDPGR), and Worldwide Governance Indicator (WFI) have a significant positive impact on RAROA whereas MMC1, MMC2 and Operating cost to asset ratio (OCA) has a negative significant impact on RAROA and. But there is no significant impact of nonperforming loan ratio (NPL), bank size (Size), and Inflation Rate (INF) on RAROA in contradiction to correlation analysis. *F*-value and significance level off-test are 83.21 and 0.00 which states that this regression equation is acceptable and we could conclude that the *R*-square value is significantly different from zero.

The MMC1 and MMC2 variables have a negative and weak significant coefficient, so our result is in contrast with the findings of the Coccorese (2009) Pilloff (1999), and the mutual forbearance hypothesis. We can deduce that multimarket contact has a negative effect on the bank's profitability. The multimarket contact helps to mitigate rivalry between banks (Coccorese, 2013). The lowered competitive intensity leads to reduce effort and vigilance on the part of managers to increase or maintain efficiency thus leading to lower profitability of banks. The equity ratio (EQTA) has a positive impact on RAROA. This finding is consistent with Hafidiyah and Trinugroho (2016). The negative coefficient of the bank's size shows that the bigger the bank's size, the lower would be the RAROA. This finding is consistent with the findings of Stiroh (2004).

5. Conclusions

Firms' linkages across markets can represent an important factor weakening the intensity of competition. Particularly, they are generally thought to reduce the incentives to rivalry: the higher the number of markets in which a firm meets its rivals, the more it tends to facilitate collusion rather than vigorously compete because the prospect of gains in a local market is not worth the risk of warfare in all the other markets.

The major conclusion of the study is multimarket contact, deposit to asset ratio, non-interest income to total income, GDP growth rate, Worldwide Governance Indicator (WFI), and operating cost to assets are the major determinants of risk-adjusted profitability of commercial banks. There is a negative impact of multimarket contact on the profitability of banks. It shows that Vietnamese banks' focus to increase the multimarket contact may lead to lower profitability because the multimarket contact helps to mitigate rivalry between banks. So, it creates favorable conditions for higher lending rates and leading to an increase in credit risk due to ethical issues (Dao et al., 2020; Zhang, 2018; Tran, 2020) thereby reducing the bank's profitability. Economic growth has a positive impact on profitability. It means that in a developed economy, a high-income per capita lead to high consumption of goods and creates a good opportunity to expand the business and attract investment.

The study has policy implications for commercial banks in that they should not only focus on interest as a source of income and diversify their income source from non-interest income as well since it helps to improve risk-adjusted profitability for them. The Worldwide Governance Indicator has a positive impact on banks' profitability. The State needs to review and consolidate regulations, processes, and legal provisions related to the operation of commercial banks to minimize risks.

References

Berger, A. N., Klapper, L. F., Peria, M. S. M., & Zaidi, R. (2008). Bank ownership type and banking relationships. *Journal of Finance Intermediate, 17*(1), 37–62. https://doi.org/10.1016/j.jfi.2006.11.001

Berger, A. N., & Hannan, T. H. (1989). The price-concentration relationship in banking. *Review of Economics and Statistics*, *71*, 291–299. https://doi.org/10.2307/1926975

Bernheim, B. D., & Whinston, M. D. (1990). Multimarket contact and collusive behavior. RAND *Journal of Economics, 21*, 1–26. https://doi.org/10.2307/2555490

Busse, M. R. (2000). Multimarket contact and price coordination in the cellular telephone industry. *Journal of Economics and Management Strategy, 9*(3), 287–320. https://doi.org/10.1111/j.1430-9134.2000.00287.x

Coccorese, P. (2009). Market power in local banking monopolies. *Journal of Banking and Finance, 33*(7), 1196–1210. https://doi.org/10.1016/j.jbankfin.2008.12.013

Coccorese, P. (2013). Multimarket contact, competition, and pricing in banking. *Journal of International Financial Markets, Institutions, and Money, 37*, 187–214. https://doi.org/10.1016/j.jimonfin.2013.06.010

De Bonis, R., & Ferrando, A. (2000) The Italian banking structure in the 1990s: testing the multimarket contact hypothesis. *Economic Notes 29*, 215–241. https://doi.org/10.1111/1468-0300.00031

Dao, B. T. T., & Nguyen, D. P. (2020). Determinants of profitability in commercial banks in Vietnam, Malaysia, and Thailand. *The Journal of Asian Finance, Economics, and Business, 4*(4). https://doi.org/10.13106/jafeb.2020.vol7.no4.133

De Bonis, R., & Ferrando, A. (2000). The Italian banking structure in the 1990s: Testing the multimarket contact hypothesis. *Economic Notes, 29*(2), 215–241. https://doi.org/10.1111/1468-0300.00031

Edwards, C. D. (1955). Conglomerate bigness as a source of power. In G. Stigler (Ed.), *Business concentration and price policy* (pp. 331–359). Princeton: Princeton University Press.

Evans, W. N., & Kessides, I. N. (1994). Living by the 'Golden Rule': Multimarket contact in the U.S. airline industry. *Quarterly Journal of Economics, 109*(2), 341–366. https://doi.org/10.2307/2118466

Feinberg, R. M. (1985). 'Sales-at-risk': A test of the mutual forbearance theory of conglomerate behavior. *Journal of Business, 58*(2), 225–241. https://www.jstor.org/stable/2352972

Fernandez, N., & Marin, P. L. (1998). Market power and multimarket contact: some evidence from the Spanish hotel industry. *Journal of Industrial Economics, 46*, 301–315. https://doi.org/10.1111/1467-6451.00073

Fu, W. W. (2003). Multimarket contact of US newspaper chains: circulation competition and market coordination. *Information Economics and Policy, 15*, 501–519. https://doi.org/10.1016/S0167-6245(03)00025-8

Fungácová, Z., & Poghosyan, T, (2011). Determinants of bank interest margins in Russia: does bank ownership matter? *Economic Systems*, *35*(4), 481–495. https://doi.org/10.1016/j.ecosys.2010.11.007

Fuentelsaz, L., & Gomez, J. (2006). Multipoint competition, strategic similarity, and entry into geographic markets. *Strategic Management Journal, 27*, 477–499. https://doi.org/10.1002/smj.529

Gilbert, R. (1984). Bank market structure and competition: A survey. *Journal of Money, Credit and Banking, 16*, 617–645. https://doi.org/10.2307/1992096

Gimeno, J. (2002). The performance effects of unintended and purposive multimarket contact. *Managerial Decision Economics*, *23*, 209–224. https://doi.org/10.1002/mde.1062

Hafidiyah, M. N., & Trinugroho, I. (2016). Revenue diversification, performance and bank risk: Evidence from Indonesia. *Jurnal Dinamika Manajemen*, *7*(2), 139–148. https://journal.unnes.ac.id/nju/index.php/jdm/article/view/8198

Hannan, T. H. (1997). Market share inequality, the number of competitors, and the HHI: an examination of bank pricing. *Review of Industrial Organization*, *12*, 23–35. https://doi.org/10.1023/A:1007744119377

Haveman, H. A., & Nonnemaker, L. (2000). Competition in multiple geographic markets: The impact on growth and market entry. *Administrative Science Quarterly*, *45*, 232–267. https://doi.org/10.2307/2667071

Heggestad, A. A., & Rhoades, S. A. (1978). Multimarket interdependence and local market competition in banking. *Review of Economics and Statistics, 60*(4), 523–532. https://doi.org/10.2307/1924244

Hughes, K., & Oughton, C. (1993). Diversification, multimarket contact, and profitability. *Economica, 60*(238), 203–224. https://doi.org/ 10.2307/2554589

Jans, I., & Rosenbaum, D. I. (1996). Multimarket contact and pricing: Evidence from the U.S. cement industry. *International Journal of Industrial Organization, 15*(3), 391–412. https://doi.org/10.1016/0167-7187(95)00493-9

Matsushima, H. (2001). Multimarket contact, imperfect monitoring, and implicit collusion. *Journal of Economic Theory*, *98*(1), 158–178. https://doi.org/10.1006/jeth.2000.2708

Mester, L. J. (1987). Multiple market contact between savings and loans. *Journal of Money, Credit and Banking*, *19*(4), 538–549. https://doi.org/10.2307/1992620

Mester, L. J. (1992). Perpetual signaling with imperfectly correlated costs. *RAND Journal of Economics*, *23*(4), 548–563. https://doi.org/10.2307/2555905

Milani, C., Chiorazzo, V., & Salvini, F. (2008). Income diversification and bank performance: Evidence from Italian Banks. *Journal of Financial Services Research*, *33*(3), 181–203. https://doi.org/10.1007%2Fs10693-008-0029-4

Pilloff, S. J., & Rhoades, S. A. (2002). Structure and profitability in banking markets. *Review of Industrial Organization, 20*, 81–98. https://doi.org/10.1023/A:1013362913973

Pilloff, S. J. (1999). Multimarket contact in banking. *Review of Industrial Organization*, *14*, 163–182. https://doi.org/10.1023/A:1007779814751

Roodman, D. M. (2009). How to do Xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal, 9*(1), 86–136. https://doi.org/ 10.1177/1536867X0900900106

Scott, J. T. (1982). Multimarket contact and economic performance. *Review of Economics and Statistics, 64*(3), 368–375. https://doi.org/10.2307/1925934

Singal, V. (1996). Airline mergers and multimarket contact. *Managerial and Decision Economics*, *17*(6), 559–574. https://doi.org/10.1002/%28SICI%291099-1468%28199611%2917%3A6<559%3A%3AAID-MDE795>3.0.CO%3B2-K

Solomon, E. H. (1970). Bank merger policy and problems: A linkage theory of oligopoly. *Journal of Money, Credit and Banking, 2*(3), 323–336. https://doi.org/10.2307/1991012

Sorenson, T. L. (2007). Credible collusion in multimarket oligopoly. *Managerial and Decision Economics*, *28*(2), 115–128. https;//doi.org/10.1002/mde.1314

Spagnolo, G. (1999). On interdependent super games: Multimarket contact, concavity, and collusion. *Journal of Economic Theory, 89*, 127–139. https://doi.org/10.1006/jeth.1999.2548

Strickland, A. D. (1985). Conglomerate mergers, mutual forbearance behavior, and price competition. *Managerial and Decision Economics, 6*, 153–159. https://doi.org/10.1002/mde.4090060306

Stiroh, K. J., & Rumble, A. (2006). The dark side of diversification: The case of US financial holding companies. *Journal of Banking*

and Finance, 30(8), 2131–2161. https://doi.org/10.1016/j.jbankfin.2005.04.030

Thomas, C. J., & Willig, R. D. (2006). The risk of contagion from multimarket contact. *International Journal of Industrial Organization*, *24*, 1157–1184. https://doi.org/10.1016/j.ijindorg.2006.04.009

Tran, S., H., & Nguyen, T. L. (2020). Financial development, business cycle, and bank risk in Southeast Asian countries. *Journal of Asian Finance, Economics, and Business, 7*(3), 127 – 135. https://doi.org/10.13106/jafeb.2020.vol7.no3.127.

Whalen, G. W. (1996). Nonlocal concentration, multimarket linkages, and interstate banking. *The Antitrust Bulletin, 41*, 365–397. https://heinonline.org/HOL/LandingPage?handle=hein.journals/antibull41&div=16&id=&page=

Zhang, R., & Yin, H. (2018). Regional financial development, firm heterogeneity, and investment efficiency. *Journal of Asian Finance, Economics, and Business*, *5*(4), 73–83. http://doi.org/10.13106/jafeb.2018.vol5.no4.73