The Relationship between Market Power and Income Diversity with Ownership Structure as a Moderator – A Study of Vietnamese Commercial Banks

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The Project on Restructuring the Credit Institution System in the first period from 2011 to 2015 and the second period from 2016 to 2020 emphasizes the important role of reducing the relying on traditional activities and increase the share of income from non-credit services. The level of non-interest income, per contra, varies from bank to bank. The paper, therefore, was conducted to examine the relationship between market power and income diversity by using a sample of 26 commercial banks during 2007 to 2017. The market power was proxied by both conventional and adjusted Lerner index; the quotient of non-interest income to total operating income represents the income diversity; and ownership structure, treated as a dummy variable, plays a role as moderator this relationship. Additionally, bank characteristics and country characteristics were considered to be control and dummy variables in the research model. Based on panel data analysis with GMM estimator, the results point out that the bank with greater market power can generate more non-interest income. This relationship, moreover, is impacted by ownership structure, which explains the activities managers and owners do in a bank. For more specific, this paper also highlights the

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positive impact of state ownership on the association between bank market power and its income diversity. The findings are expected to add the gap in the existing literature, lacking of investigation the impact of market power on bank income diversity in Vietnamese banking sector and give some useful implications for investors, bank managers as well as policy makers to catch up the market fluctuations.

1. INTRODUCTION

After global financial crisis in 2008, the world banking system is in the line with financial deregulation, liberalization, and international economic integration, facing major changes from increased competition between domestic banks and new players as foreign banks to concentration and restructuring by the central bank's policies of each country. These boost an attention to bank non-interest income, considered to be a proactive strategy in response to market uncertainties as well as broadening their business to compete with other counterparts. The importance of non-interest income has been explored in developed countries for a long time as the U.S. [1,2] and Europe [3]. They all have the same implication of highlighting the spreading contribution of non-traditional activities. The gap of literature in developing or emerging markets has justified many researchers starting to investigate in Asian and Africa countries. They have figured out the relative relationship between market power and bank income diversity, adding the existing literature which mainly scrutinizes bank income diversity with bank size, net interest margin, and technology [4,5,2,3].

Until now, in Vietnam, there is not much noticed enough to clearly understand why non-interest income varies across banks even though its growing important role. In the modern economy, Vietnamese commercial banks act as intermediaries, carrying out mobilizing idle funds through deposits, current accounts or savings and providing these funds for those needing for production and business activities by loans to earn interest income, so-called the traditional activities. Harmony with the world banking system, the Vietnamese banking system has no exception in facing with many difficulties from increasing bad debts, lacking of information security losing money in customers' bank account, to mass prosecution of senior bankers, etc. Most of irregularities are related to granting loans without satisfying the safety regulations. Though the Vietnamese market has gradually recovered, leading the increase in credit demand, credit growth is expected to slow down from both the credit limit and the control of capital adequacy ratio (CAR) in accordance with the Basel II Accord along with the require reserve ratio, setting by the State Bank of Vietnam (SBV). Moreover, interest rate is more volatile under the changes of monetary policy from time to time. This is the reason why one of the contents in the Project on Restructuring the Credit Institution Systemin the period from 2011 to 2015 (was approved by the Prime Minister through Decision No. 254/QĐ-TTg dated on March 1st 2012) emphasizes: "Shifting the business model of commercial banks in the direction of reducing the dependence on credit activities and increasing income from non-credit services step by step", dragging on the waves of M&A in this sector since 2011. Recently, the remarkable point of the revised Law on Credit Institution, taking effect on January 15th 2018, stresses that there is no mandatory of buying out a credit institution at "0 VND". Instead, the Law authorizing bankruptcy of credit institutions is specifically controlled in Article 152. All of the revised regulations show the increasing importance of diversifying in the banks' income structure in the context of interest income generated by loans is not really stable, highly sensitive to interest-rate movements, and might contain many risks.

The paper's objective, therefore, aims to contribute the current literature by investigating the relationship between market power and income diversity among 26 Vietnamese commercial banks from 2007 to 2017. During this period, there is a fierce competition in the banking industry with the appearance of new both domestic and foreign players, as well as the accretion of existing banks, forcing the banks have to find a way to survive and compete their rivals. As a result, non-interest income seems to be the best choice recently, yet it still raises a question: *Could any bank can diversify their income structure easily?* Only banks with greater market power are believed to have greater bargaining capacity with their customers, leading opportunities to earn more non-interest income [6]; [7,8]. Moreover, different institutional settings

create different incentives in both bank market power and bank income structure. Thus, ownership structure should be concerned as moderator in this relationship with the comparison of two groups of Vietnamese commercial banks: state-owned banks (also called Big 4 banks) and privately-owned banks.

2. MATERIAL AND METHODS

2.1 Relevant Concepts and Theories

2.1.1 Market power

In a perfect market, there is the presence of perfect competition, which is defined as the balance between price and marginal cost, or the quantity supplied for products and services equals the quantity demand at the current market price. No firm has ability to affect the market price by its changing in products and services. If the opposite is true, meaning that the firm is able to raise its price over its marginal cost, it can be said that the firm has market power [9]. Measuring market power, or the degree of competition, has always been confused to use firm performance, but unfortunately the results can be bias due to the effects of bank-specific and country-specific characteristics [10]. From previous literatures, as in any other industries, there has been many ways of measuring competition in banking sector, and these methods can be classified into 2 mainly groups: structural approaches (including the number of firms, the concentration ratios and the HHI) and non-structural approaches (including the Lerner index, the Panzar and Rosse, the conjectural variation, and the Boone indicator).

2.1.2 Income diversity

Banks' revenues come from two primary sources, the one is so called traditional activities, generating interest income, and the other is non-traditional activities, generating non-interest income. Traditional activities of a bank are defined as the financing of loans with deposits, showing the intermediary role of the bank as transferring funds from depositors to borrowers [11,2]. On the other hand, the most common feature of non-traditional activities is producing fee-based, trading-based, and investment-based income [12,13,14,7,2,15]. Income diversity in banking sector refers to increasing share of non-interest income within net operating income and reducing the dependence on interest income of a bank.

2.1.3 Ownership structure

Ownership structure should be concerned to discuss the impact of market power on income diversity of a firm. It can explain the activities managers and owners do in a firm. Jesen & Meckling [16] also agree that organizational form influences operating behaviors, as it defines the nature of residual claims, which is also the motivation of the firm's owners. According to the prior theoretical and empirical literature, the agency problems and risk-taking behavior varies across firms due to the nature of shareholders, especially controlling shareholders, who enjoy significant shared control benefits [17,18]. There are several ways to classified ownership types in banking industry, but the most common classification is based on the ownership structure characteristics or types of shareholders as state (or public) ownership, domestic privately ownership and foreign ownership [19]. For instance, banks were considered to be state-owned if state shareholders controlled more than 50% of the shares; banks, conversely, with foreign shareholders control more than 50% of the stakes will be treated as foreign ownership [20].

2.2 Empirical Findings

2.2.1 Bank market power and income diversity

The prior empirical findings show the relationship between market power and income diversity has been explored already, yet it is still ambiguous [21]. By investigating several emerging markets as ASEAN, Africa, South Asia, some studies state that market power is a crucial factor, stimulating a bank to identify new growth opportunities to shift from traditional activities to non-traditional activities, thus increase the share of non-interest income in total operating income as well as deliver greater bargaining capacity with their customers [6,7,22,8]. In short, these results imply that higher market power generates higher income from non-traditional activities and attracts more non-interest income [4,5]. The relationship, moreover, also changes over times. Evidence from five ASEAN member countries consisting of 153 commercial banks data collection in the period from 1998 to 2008, M. Nguyen et al. [7] also figured out that during and after the Asian Financial Crisis (AFC - in 1997), banks tended to diversify their income into non-traditional services in order to compensate for credit losses. Then, when the market began to recover, interest-based income also plays more

important role in the banks' income structure. This is also consistent with the *competition-stability view*, supporting that market power and income diversity have a positive association when loan market power results in riskier loan portfolios [23,24]. The pilot, however, was different during Global Financial Crisis (GFC – in 2008 and 2009), holding more market power, banks was better able to manage their non-performing loans [22]. Simultaneously, SantiagoCarbó Valverde & FranciscoRodríguez Fernández [3] find that banks can increase their market power if they diversify their income into non-traditional activities.

Nevertheless, based on *quite life theory,* some researchers argue that banks with greater market power and earning higher interest margin may be discouraged from diversifying their income, especially when non-interest income might contain many risks; with the price above the marginal cost due to monopoly power, focusing on loans still generates sufficient profits and benefits from economies of scale when the marginal cost of additional loans is limited to interest expenses, and these banks always try to establish long-term lending relationship with their customers [25,4]; [26]. The results are also consistent with South Asian Banks. The greater market power banks focus more on traditional interest income generating activities [27].

2.2.3 Bank market power, income diversity and ownership structure

Many previous studies also took bank ownership into account when investigating the relationship between market power and income diversity. Banks with different ownership forms (foreign banks, state-owned banks, and privately-owned banks) may diversify their income differently for a given level of market power [28,6]. Arguably, state-owned banks, with the relatively bigger size, scope, financial sources, and customer base, can earn more non-interest income than privately-owned banks, they might obtain higher profits from setting lower deposit rates and charging higher interest rate as well as services fees [6,8,29]. However, some researchers argue that state-owned banks are less efficient and incentive to innovate to expand their business lines [30].

Similarly, foreign ownership also impacts on the association between market power and income diversity in two opposite ways, namely *the global advantage* and the *home field advantage*. The former shows the positive impacts when foreign banks have many advantages from superior managerial skills, advanced technology and well-trained human resources. The latter theory, on the other hand, states that foreign banks are less efficient because domestic banks have better information about their country's economy, language, laws, politics and local customers [6].

The relationship between market power and income diversity with moderating of ownership structure has already investigated, but the results are heterogeneous, which is the rationale and motivations for this paper. Moreover, the empirical findings show the simultaneous relationship between market power and income diversity. Thus, this paper will employ some methods to test the endogeneity in this relationship, presenting in the following section.

2.3 Data Sources

This paper uses both data of bank-level and country-level. Bank-level data is taken from Thomson Reuter database, financial statements (audited and consolidated) and annual reports of Vietnamese commercial banks in the period from 2007 to 2017, all other types of banks (including one-member limited liability commercial bank owned by the state, 100% foreign-owned banks, branches of foreign commercial banks, joint-venture banks, etc.) are excluded. Even though the authors want to collect all recent 31 commercial banks [1], there are only 26 banks have enough data at least eleven-year period of time (*listed in Appendix 1*). This period will help us investigate all events that have happened as before, during, and aftermath the Global Financial Crisis, especially the M&A waves in Vietnam (since 2011). For the country-level data, this paper, additionally, use secondary data from the State Bank of Vietnam, General Statistic Office, Vietstock.vn, etc. in order to meet the study's objectives.

2.4 Methodology

2.4.1 Selected variables

2.4.1 Dependent variable: Non-interest income

In order to capture the degree of *income diversity (IND)*, we use the ratio of net non-interest income to total operating income [6,22,8,31]. Net

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[1] *<https://www.sbv.gov.vn/>, accessed on 31st Dec. 2018.*

non-interest income includes net profit from services, net gain from trading gold and foreign currencies, net gain from investment and trading securities, net profit from other activities and income from capital contribution/equity investments. Meanwhile, total operating income is the sum of net interest income and net non-interest income [26,32].

2.4.2 Independent variable: Market power

The study uses Lerner index to measure banks' market power, which is widely accepted by many researchers, rather than HHI, concentration ratio, and H-statistics due to its advantages compared to the others. According to Blair & Sokol [33] the standard measure of market power, at least by economists, has come to be the Lerner index. It is more accurate than market concentration method and H-statistic because it takes the pricing power of the banks into account [34]. Coccorese [35] also supports that Lerner index is a true reflection of the banks' degree of market power when representing the behavioral departure from monopoly and perfect competition. Another reason to employ Lerner index is that it measures market power at a bank-year level so as to easily overcome the small sample bias problem [36] suitable for the scope of this study – only 26 commercial banks in the Vietnamese banking system recently as well as the structural panel data used in this study.

In this study, we use the calculation of Lerner index proposed by Berger, Klapper, & Turk-Ariss [23], also called *the conventional Lerner index (CMP)*, defined as the difference between the output price and the marginal cost over the output price, hence interpreted as the higher index presents the higher market power. It takes the form as:

$$Conventional\ Lerner\ index_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (1)$$

where P_{it} is the average price of bank production measured by the ratio of total income (including interest and non-interest income) to total assets for bank i at time t.

Similarly, MC_{it} is the marginal cost of total assets for bank i at time t. However, it cannot compute directly due to unavailable information. A popular approach is to obtain the marginal cost by taking derivative the following translogarithmic cost function:

$$lnTC_{it} = \alpha_0 + \alpha_1 \ln Q_{it} + \frac{1}{2}\alpha_2(\ln Q_{it})^2 + \sum_{k=1}^{3} \beta_k lnW_{k,it} + \frac{1}{2}\sum_{k=1}^{3} \gamma_k \ln Q_{it}\, lnW_{k,it} + \frac{1}{2}\sum_{k=1}^{3}\sum_{j=1}^{3} \delta_{kj}\, lnW_{k,it}lnW_{j,it} + \varphi_1 Trend + \frac{1}{2}\varphi_2 Trend^2 + \varphi_3 Trend \ln Q_{it} + \sum_{k=1}^{3} \mu_k Trend\, lnW_{k,it} + \varepsilon_{it} \quad (2)$$

where TC is the bank's total cost; Q is a proxy for the bank's output or bank's total assets; W denotes three input prices of labor (W_1), funds (W_2), and fixed capital (W_3); ε is an error term. Their calculations are as follows. Total cost is the sum of interest expenses, personnel expenses, other operating and administrative expenses. W_1, W_2, W_3 is the quotient of personnel expenses (or staff costs) to total assets, interest and similar expenses to deposits from customers, other operating and administrative expense to fixed assets, respectively. Trend (time trend) is to capture the influence of technical change over time, and ε is the error term. In order to estimate the cost function, fixed effects are employed with robust standard errors to capture the influence of possible unobserved variables. The estimation, as usual, is made under the imposition of restrictions of symmetry and of grade one homogeneity in input prices [23,37,38]. The bank's marginal cost (MC) is then computed as a first derivation of total cost function obtained from the equation (2).

$$MC_{TAit} = \frac{\partial TC_{it}}{\partial Q_{it}} = \frac{TC_{it}}{Q_{it}} \times \left[\alpha_1 + \alpha_2 \ln Q_{it} + \frac{1}{2}\sum_{k=1}^{3} \gamma_k lnW_{k,it} + \varphi_3 Trend\right] \quad (3)$$

Nevertheless, the conventional Lerner index assumes banks are able to achieve fully efficient; otherwise, the calculation of conventional approach might bias because banks may exploit pricing opportunities resulting from their market power. Therefore, we also estimate the equation (2) using a stochastic cost frontier approach that takes into account possible cost inefficiencies of banks, so called *the adjusted Lerner index (AMP)*, which uses maximum likelihood [39,40,41]. The main difference between two methods is mainly in their technical measurement of marginal cost. Despite the technical differences, they are expected to have the similar effects on the dependent variables, or in particular, bank income diversity. Based on the above findings in emerging markets like Vietnam and recent regulations of State Bank of Vietnam, market power and income diversity are expected to show a positive relationship.

2.4.3 Moderating variable: Ownership structure.

In the Vietnamese market, state-owned commercial banks are believed to be the biggest banks with strong financial resources, wide networks, and various customer base, so they might earn more non-interest income than privately-owned banks. However, they usually apply lower interests in both loans and deposits than the others, so they might mainly focus on traditional activities, being forced to lend to certain sector or industries for supporting their maximizing social welfare objectives, driving to have fewer incentives to innovate banking's services. Thus, the impacts of ownership structure are still ambiguous. In the scope of this study, for the comparison between government-linked banks and non-government-linked banks, we only concern two types of ownership: state and private ownership, excluding other types due to lack of data. Particularly, we focus 3 state-owned commercial banks (in Big 4 banks) and other 23 privately-owned commercial banks. *Ownership structure (OWN)* would be treated as a dummy variable.

2.4.4 Control and dummy variables

The paper uses some bank specifics and country specifics as control variables, consisting of bank size (SIZ), net interest margin (NIM), loans (LOA), deposit (DEP), cost efficiency (EFF), capital ratio (CAP), liquidity risk (LIQ), credit risk (CRE), bank age (AGE), GDP growth rate (GDP).

Firstly, bank size and cost efficiency are said to have positive relationship with income diversity with the rationale of bigger banks tend to have more non-traditional activities, and then generates more non-interest income than smaller banks because they have more opportunities to use new technology, hire and train employees well, and then result in cost savings and more efficiency gain [1,32,2].

Secondly, net interest margin, loans and deposit represent traditional activities, so they are expected to have a negative relationship with income diversity. A bank with high level of non-traditional activities, it may imply that the loans and deposits, the spread between their interest rates, or both are declining. In this scenario, the measure of non-traditional activities would be inversely related to a measure of profits from traditional activities [2].

The model also controls for bank risks, represented by insolvency risk associated with banks' equity capital, liquidity risk and credit risk. Banks with a higher capital ratio may also earn more income from non-traditional activities because the customers will seek the larger capital banks, which implies less risky banks, for consuming non-traditional services. On the other hand, liquidity ratio can impact on non-interest income in two opposite ways. If a bank needs a higher liquidity ratio to engage in higher levels of non-traditional activities, their relationship will be positive, otherwise, the bank holds less liquid assets for investing on non-traditional activities. The third one, credit risk is proxied by the ratio of loan-loss provision to total assets. The higher provision, the greater protection against loan losses and smoothing earnings. In this case, the provision and non-interest income are expected to have a positive sign [42,32,2].

The next one is bank age or the number of years of operating, also might impact on income diversity positively. The longer the bank operates, the higher experience, management skill and number of employees, bigger bank networks through opening more branches, transaction offices, so they might have more opportunities for cross-selling in non-traditional activities [43]. Lastly, GDP growth rate, is widely used to evaluate the market' overall economic conditions and it is also expected to have a positive relationship with income diversity because during economic boom banks have more opportunities to expand their services to customers.

This study also uses *listed (LIS), crisis years (CRI), merger and acquisition (MNA)* as dummy variables. In Vietnam, listed banks are usually considered to be the largest and best performing banks, so it will be expected to have a positive sign with income diversity [44,7]. In crisis years, banks tend to grant loans less and increase their non-traditional activities to compensate their credit loss due to non-performing loans, so there is an expectation of positive impact on non-interest income. Additionally, financial distress also negatively impacts on the ability of banks in attracting deposits from customers [6,7]. In recent years, Vietnam has witnessed many M&A deals in the banking sector, banks after the merger usually have larger capital, wider network, more customers as well as more bad debts. This also force the banks to diversify their income and reduce the relying on loans; therefore, a positive will be expected between M&A deals and income diversity.

2.4.2 The research models and econometric methodology

The association between market power and income diversity is investigated using the specific model as below to test hypothesis H_1: *Market power has a positive effect on bank's income diversity.*

Model 1: $IND_{it} = \alpha_0 + \beta_1 \times IND_{it-1} + \beta_2 \times CMP_{it} + \beta_3 \times SIZE_{it} + \beta_4 \times NIM_{it} + \beta_5 \times LOA_{it} + \beta_6 \times DEP_{it} + \beta_7 \times EFF_{it} + \beta_8 \times CAP_{it} + \beta_9 \times LIQ_{it} + \beta_{10} \times CRE_{it} + \beta_{11} \times AGE_{it} + \beta_{12} \times GDP_t + \beta_{13} \times LIS_{it} + \beta_{14} \times CRI_t + \beta_{15} \times MNA_{it} + \varepsilon_{it}$

Model 2: $IND_{it} = \alpha_0 + \beta_{16} \times IND_{it-1} + \beta_{17} \times AMP_{it} + \beta_{18} \times SIZE_{it} + \beta_{19} \times NIM_{it} + \beta_{20} \times LOA_{it} + \beta_{21} \times DEP_{it} + \beta_{22} \times EFF_{it} + \beta_{23} \times CAP_{it} + \beta_{24} \times LIQ_{it} + \beta_{25} \times CRE_{it} + \beta_{26} \times AGE_{it} + \beta_{27} \times GDP_t + \beta_{28} \times LIS_{it} + \beta_{29} \times CRI_t + \beta_{30} \times MNA_{it} + \varepsilon_{it}$

In order to investigate the moderating effects of ownership structure in the relationship between market power and income diversity, we interact market power with bank ownership dummies.

The following model is used in order to test the hypothesis H_2: *State ownership strengthens the relationship between market power and income diversity.*

Model 3: $IND_{it} = \alpha_0 + \beta_{31} \times IND_{it-1} + \beta_{32} \times CMP_{it} + \beta_{33} \times CMP_{it} \times OWN_{it} + \beta_{34} \times SIZE_{it} + \beta_{35} \times NIM_{it} + \beta_{36} \times LOA_{it} + \beta_{37} \times DEP_{it} + \beta_{38} \times EFF_{it} + \beta_{39} \times CAP_{it} + \beta_{40} \times LIQ_{it} + \beta_{41} \times CRE_{it} + \beta_{42} \times AGE_{it} + \beta_{43} \times GDP_t + \beta_{44} \times LIS_{it} + \beta_{45} \times CRI_t + \beta_{46} \times MNA_{it} + \varepsilon_{it}$

Model 4: $IND_{it} = \alpha_0 + \beta_{47} \times IND_{it-1} + \beta_{48} \times AMP_{it} + \beta_{49} \times AMP_{it} \times OWN_{it} + \beta_{50} \times SIZE_{it} + \beta_{51} \times NIM_{it} + \beta_{52} \times LOA_{it} + \beta_{53} \times DEP_{it} + \beta_{54} \times EFF_{it} + \beta_{55} \times CAP_{it} + \beta_{56} \times LIQ_{it} + \beta_{57} \times CRE_{it} + \beta_{58} \times AGE_{it} + \beta_{59} \times GDP_t + \beta_{60} \times LIS_{it} + \beta_{61} \times CRI_t + \beta_{62} \times MNA_{it} + \varepsilon_{it}$

where the subscript i denotes bank i while t denotes year t and t-1 is lagged variable, representing the previous year, $\alpha, \beta, \varepsilon$ is the intercept, the regression coefficient, and the error term, respectively. All variables are explained in Table 1.

Table 1. Variable definitions

| No.	Variables	Symbol	Calculations	Expected sign
Panel A: Dependent variable				
1.	Income diversity	IND	NNI/TOI	
Panel B: Independent variable				
2.	Market power	CMP	Conventional Lerner index	+
		AMP	Adjusted Lerner index	+
Panel C: Control variables				
Bank-specific variables				
3.	Bank size	SIZ	ln(total assets)	+
4.	Net interest margin	NIM	Net interest income/Total earning assets	-
5.	Loans	LOA	Loans to customers/Total assets	-
6.	Deposits	DEP	Deposits from customers/Total liabilities	-
7.	Cost efficiency	EFF	Total cost/Total income	-
8.	Capital ratio	CAP	Total equity/Total assets	+
9.	Liquidity risk	LIQ	Liquid assets/Total assets	+/-
10.	Credit risk	CRE	Provision for loan losses to total assets	+
11.	Bank age	AGE	ln(number or years since establishment)	+
Country-specific variable				
12.	GDP growth rate	GDP	Annual GDP growth rate	+
Dummy variables				
13.	Listed	LIS	1: Listed on HoSE or HNX; 0: otherwise	+
14.	Crisis years	CRI	1: in 2008 and 2009; 0: otherwise	+
15.	M&A	MNA	1: Bank merged; 0: otherwise	+
Panel D: Moderating variable				
16.	Ownership structure	OWN	1: State-owned banks 0: Private-owned banks	

Sources: Previous studies
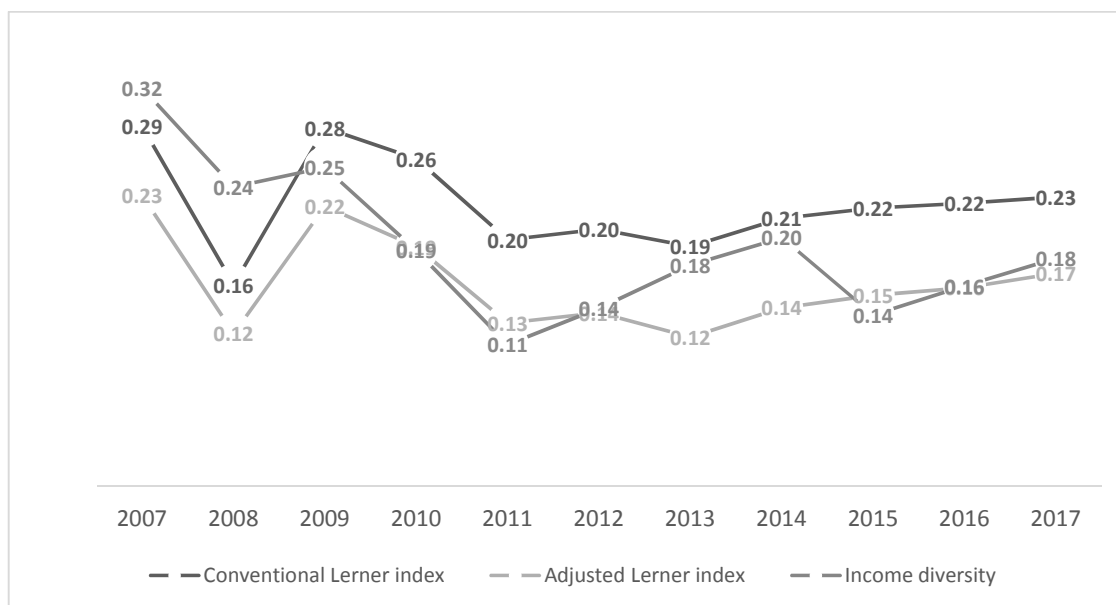
Fig. 1. Market power and income diversity of Vietnamese commercial banks
Sources: Authors' collections

First of all, we report the descriptive statistics of variables to have a deep understanding of the data set. Next, we conduct a wide of diagnostics including the correlation matrix and, of course, along with the Variance Inflation Factor for testing multi-collinearity among variable. Then, the paper employs a generalized method of moments (GMM), developed for dynamic panel modes by Arellano & Bover [45] and Blundell & Bond [46], to address the simultaneous relationship between market power and income diversity with potential endogeneity issues, indicating that independent variables are not strictly exogenous and might correlated with past and possibly current realizations of the error.

The GMM estimator combines moment conditions for the model in first differences with moment conditions for the model in levels. The GMM is really suitable for the study because the panel data has large N (26 banks) and small T (11 years), meaning few time periods and many individuals; moreover, there is a lag of income diversity in the model because it might be influenced by past one – a dynamic panel data, and its presence gives rise to autocorrelation. This also overcomes fixed effects, heteroskedasticity or autocorrelation within individuals (if any), which makes some traditional methods to analysis panel data as fixed effects, random effects and least squares dummy variable become ineffective and unreliable.

3. RESULTS AND DISCUSSION

3.1 Descriptive Statistics

As mentioned above, this study has the sample of 26 Vietnamese commercial banks over the 11-year period from 2007 to 2017, equivalent to 284 observations (TPB and LPB has data since 2008). Income diversity of Vietnamese commercial banks is not relatively high when non-interest income makes up around 23.56% (on average) in total operating income. This implies that income composition has not been diversified away from the main contribution of interest income.

The mean of conventional Lerner index in this period is 0.2236 (22.36%) while the adjusted Lerner index is 0.1603 (16.03%), both of them show a fierce competition among Vietnamese commercial banks. Before the M&A waves since 2011, the number of commercial banks in Vietnam increases dramatically, including banks' branches and transaction offices, along with the appearance of 100% foreign-owned banks. The merger of weak banks into big banks since 2011 does not reduce this number, in accordance to World Bank[2], there are over 3 bank branches per 100,000 adults in Vietnam during 2008 to 2015 (of which, the highest value was 3.876 in 2014). The descriptive results for the entire variables are presented in Table 2.

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[2]*<https://data.worldbank.org/indicator/FB.CBK.BRCH.P5?locations=VN&view=char/>, accessed on 31st Dec. 2018.*

3.2 Correlation Matrix

The correlation matrix of all variables defined, presented in Table 3, shows that there is a significant multicollinearity between CMP and AMP, but it is not a problem since these two variables will be used separately in order to test the difference of conventional Lerner index and adjusted Lerner index. Additionally, the highest correlations are also found for SIZ with CAP, LIS, and OWN, suggesting that in Vietnam, the bigger the banks are, the less capital ratio the banks have, and they are usually listed and state-owned banks; moreover, LOA is highly correlated with DEP and LIQ, implying that banks could grant more loans if they have sufficient deposits, which might face more liquidity risks. As a result, we should re-estimate 4 models without variable SIZ and LOA in order to avoid multicollinearity issues. After excluding these variables, a VIF test is also conducted to confirm that there is no multicollinearity among variables *(see more in Appendix 2).*

3.3 Regression Results

3.3.1 The relationship between market power and income diversity

As mentioned above, we apply GMM to address the problem of endogeneity in our research model – between market power and income diversity, so they will be treated as endogenous variables. The difference GMM in two steps is also introduced instead of the system GMM because of the small number of banks collected. Though the system GMM may increase more efficiency, it uses more instruments than the difference GMM, as consequently, the results might break the rule of thumb: *keep number of instruments smaller than number of groups*, which is not appropriate with our dataset. The bank age, the public status of the bank, M&A, or ownership structure as well as macroeconomic variables as GDP and crisis years are not affected by income diversity; therefore, all of them will be treated as exogenous variables.

In accordance with Arellano & Bover [45] and Blundell & Bond [46], we employ lagged values of both endogenous and exogenous variables as instruments. Finally, our models will be verified again by some diagnostics test as second-order autocorrelation in second differences – AR (2) and Sargan/Hansen test for over-identifying restrictions. The results are presented in Table 4.

The table presents the positive relationship with market power and income diversity for both conventional and adjusted Lerner index; however, adjusted Lerner index shows a higher significant coefficient, highlighting that Vietnamese commercial banks with greater market power can generate more non-interest incomes, specifically, when market power increases by 1%, resulting in an increase of income diversity by 1.16% (conventional Lerner) or 1.34% (adjusted Lerner). The results are consistent with the literature, which investigates this issue in emerging markets, thus, we strongly support for hypothesis 1 that market power has a positive effect on banks' income diversity.

3.3.2 Market power, income diversity and ownership structure

The Table 5 shows the impact of bank ownership structure on the relationship between market power and income diversity. Interestingly, this positive association has been enhanced due to state ownership. This is evident in the positive and statistically significant coefficient for both CMP and CPMxOWN or AMP and APMxOWN variables, indicating that state-owned banks, with the advantages of the relatively bigger size, scope, financial sources, and customer base, tend to diversify their income into non-traditional activities more than privately-owned ones.

Overall, a strong evidence has been found to support the hypothesis 2 that state ownership strengthens the relationship between market power and income diversity. The results are also in the line with [6,7,22,8], implying that market power helps banks to exploit growth opportunities in non-traditional businesses, leading to increase the proportion of fee-based incomes in banks' income structure, and fascinatingly, government-linked banks have taken advantages these opportunities and generated more non-interest income than their privately-owned counterparts.

3.3.3 Other results

Regarding to bank-specific variables as well as dummy variables, the results are found the same through 4 models. In general, the Table 4 and 5 show a negative and significant coefficient for NIM and DEP. As expected, a bank that focuses on non-traditional activities, *ceteris paribus,* the importance of traditional business lines will be reduced, and vice versa. The increase in non-interest income, however, does not fully offset reduction in total income when banks narrow their

interest margin in traditional lending and deposit market. This is consistent with most of previous studies [32,6,7,2]. Moreover, we also find out a negative relationship between IND and GDP, indicating the important roles of interest-based income during economic boom. It's understandable because the loan demands are higher when GDP grows faster, leading higher incomes from traditional activities.

In addition to these negative relationships, there is evidence of positive relationship between IND and EFF, CAP, and AGE. Except EFF, CAP and AGE are consistent with our prior expectation. Customers prefer less risky banks for consuming

non-traditional services because they believe that banks with large capital enough will have a high quality in financial services with advanced technologies employed to ensure safety. Similarly, the older banks have more opportunities for cross-selling, driving customer into using fee-based services with the advantages the higher experience, managerial skill and human capital, and wider bank networks. The expansion into non-interest income, however, also costs a lot, leading to a positive and significant coefficient of EFF, which is contradictory to the findings of Nguyen et al. [7]. The other variables as LIQ, CRE, LIS, CRE, MNA, unfortunately, have no significant coefficients.

Table 2. Descriptive statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
IND	284	0.2356	0.6990	−0.5516	11.6503
CMP	284	0.2236	0.1831	−0.6297	0.5689
AMP	284	0.1603	0.1354	−0.6241	0.5329
SIZ	284	17.9731	1.2848	14.5267	20.9075
NIM	284	0.0284	0.0119	−0.0075	0.0784
LOA	284	0.5185	0.1326	0.1138	0.8448
DEP	284	0.6757	0.1466	0.2689	0.9668
EFF	284	0.8070	5.0932	0.1619	86.3019
CAP	284	0.1089	0.0622	0.0350	0.4624
LIQ	284	0.3179	0.1315	0.0617	0.8160
CRE	284	0.0051	0.0044	−0.0048	0.0288
AGE	282	2.9028	0.5682	0.0000	4.0943
GDP	284	0.0610	0.0059	0.0525	0.0713
LIS	284	0.2746	0.4471	0.0000	1.0000
CRI	284	0.1831	0.3874	0.0000	1.0000
MNA	284	0.0915	0.2889	0.0000	1.0000

Sources: Authors' calculations

Table 3. The correlation matrix

	IND	CMP	AMP	SIZ	NIM	LOA	DEP	EFF	CAP
IND	1.0000								
CMP	−0.2257	1.0000							
AMP	−0.2954	0.9573	1.0000						
SIZ	−0.0329	0.6808	0.4845	1.0000					
NIM	−0.2829	0.2484	0.3942	−0.0991	1.0000				
LOA	−0.1863	0.2012	0.2419	0.1023	0.3183	1.0000			
DEP	−0.1594	0.1515	0.1321	0.2532	0.1875	0.5723	1.0000		
EFF	0.9705	−0.2946	−0.3680	−0.0455	−0.1908	−0.1723	−0.1583	1.0000	
CAP	−0.0513	−0.3492	−0.1458	−0.7215	0.3486	0.0591	−0.0556	−0.0452	1.0000
LIQ	0.1731	−0.0186	−0.0188	−0.1286	−0.2026	−0.7745	−0.5765	0.1661	−0.0523
CRE	−0.0272	0.3845	0.4285	0.3264	0.4786	0.3355	0.3561	−0.0236	−0.0784
AGE	−0.1698	0.3562	0.2853	0.4932	0.0231	0.3935	0.3222	−0.1889	−0.2479
GDP	0.0287	0.0843	0.1204	0.0536	−0.1347	0.1126	−0.0432	0.0081	−0.1294
LIS	−0.0373	0.4210	0.3256	0.5376	0.0171	0.1966	0.2085	−0.0366	−0.2941
CRI	−0.0001	−0.0140	0.0172	−0.2984	−0.0361	0.0354	−0.0594	−0.0317	0.2291
MNA	0.0201	0.0251	−0.0689	0.3115	−0.2240	0.0802	0.2051	−0.0131	−0.1973

	LIQ	CRE	AGE	GDP	LIS	CRI	MNA
LIQ	1.0000						
CRE	−0.2815	1.0000					
AGE	−0.4677	0.3624	1.0000				
GDP	0.0128	0.0585	0.0714	1.0000			
LIS	−0.2334	0.0230	0.3130	−0.0008	1.0000		
CRI	0.1010	−0.1938	−0.1624	−0.4540	−0.1210	1.0000	

Sources: Authors' calculations

Table 4. The relationship between market power and income diversity

	Model 1		Model 2	
	Coefficient	**t statistics**	**Coefficient**	**t statistics**
L.IND	0.0298	1.04	0.0172	0.88
CMP	1.1589***	3.21	-	-
AMP	-	-	1.3432***	3.17
NIM	-17.7995***	-4.69	-17.4418***	-5.02
DEP	-0.9926***	-2.87	-0.8717***	-3.17
EFF	0.1260***	7.84	0.1319***	7.91
CAP	4.3675**	2.20	3.9913**	2.20
LIQ	-0.0405	-0.06	-0.1242	-0.20
CRE	16.1699	1.02	11.0006	0.73
AGE	0.3859**	2.18	0.3369*	1.88
GDP	-5.4489*	-1.97	-6.0880**	-2.49
LIS	-0.0452	-0.72	-0.0330	-0.62
CRI	0.0195	0.51	-0.0158	-0.35
MNA	0.0478	0.45	0.0546	0.51
Observations	232		232	
Number of groups	26		26	
No. of instruments	22		22	
p-value:				
AR (1)	0.018		0.032	
AR (2)	0.735		0.740	
Sargan test	0.685		0.753	
Hansen test	0.421		0.612	

Sources: Authors' calculations

Note: The table also reports number of groups and number of instruments, the test statistics for first order (AR (1)) and second order (AR (2)) serial correlation, the Sargan/Hansen test for a validity of instruments.*, **, ***indicate significance at 10%, 5%, and 1% level, respectively.

Table 5. Market power, income diversity and ownership structure

	Model 3		Model 4	
	Coefficient	**t statistics**	**Coefficient**	**t statistics**
L.IND	-0.0095	-0.16	0.0009	0.02
CMP	1.3670***	3.72	-	-
CMPxOWN	5.6076**	2.29	-	-
AMP	-	-	1.4418**	2.56
APMxOWN	-	-	5.3883*	1.71
NIM	-17.4808***	-4.09	-14.0100***	-3.75
DEP	-1.0870***	-4.44	-0.6730**	-2.67
EFF	0.1523***	12.21	0.1488***	14.73
CAP	5.9819**	2.61	2.8505	1.29
LIQ	0.4535	0.80	0.0685	0.14
CRE	13.5215	1.52	2.2687	0.46
AGE	1.0044***	4.54	0.5711**	2.41
GDP	-8.3402**	-2.54	-7.0604**	-2.74
LIS	0.1089	1.38	0.1434	0.46
CRI	0.0475	1.35	0.0106	0.23

Dynamic panel-data estimation, two step difference GMM Dependent variable: IND				
	Model 3		Model 4	
	Coefficient	t statistics	Coefficient	t statistics
MNA	0.0838	0.59	0.0128	0.13
Observations	204		204	
Number of groups	26		26	
No. of instruments	26		26	
p-value:				
AR (1)	0.047		0.073	
AR (2)	0.146		0.164	
Sargan test	0.556		0.384	
Hansen test	0.913		0.762	

Sources: Authors' calculations

Note: The table also reports number of groups and number of instruments, the test statistics for first order (AR (1)) and second order (AR (2)) serial correlation, the Sargan/Hansen test for a validity of instruments. *, **, *** indicate significance at 10%, 5%, and 1% level, respectively.

4. CONCLUSIONS

The paper investigates the relationship between market power and income diversity and whether ownership structure moderates this relationship or not in the context of diversifying banks' income structure become a trend worldwide in the past 3 decades, which is also encouraged by the Governor in Vietnam recently. The research problems were explored using the data of 26 Vietnamese commercial banks from 2007 to 2017. The findings indicate that thanks to greater market power, Vietnamese commercial banks can earn more non-interest income than those with lesser market power due to identifying and executing more opportunities of non-traditional activities. Moreover, this positive association can be impacted by bank ownership structure. Specifically, the state-owned banks have actively diversified their income into non-traditional activities than the privately-owned banks. They are playing a role as pioneers in implementing the Government Project, launching new products and services to complete and strengthen role of banking industry to support a sustainable economic development as well as financial system stability. Moreover, they also take the advantages of large capital, wide branch networks along with product scopes, and big customer base to explore the opportunities for cross-selling, contributing the increase in share of non-interest income in the total income.

The research findings are consistent with prior studies in the emerging markets like ASEAN and African countries [6,7]; [22]; [8], followed by *the competition-stability view.* The banking operations in these countries and Vietnam are greatly influenced by the central bank's policies and dominated by largest banks. The findings may be helpful for investors, bank managers and policy makers for their own purposes. Investors should consider with the higher market power and income diversity when buying stocks in banking industry in the context of traditional business lines may contain many risks and unstable. Bank managers should reduce the relying on interest income, change the income structure followed the restructuring projects. To do so, they have to increase their banks' market power first. Moreover, they need control the cost when diversifying their income, especially operating cost, and use their capital effectively in order to invest in depth as developing advanced technology so as to reduce operating cost or develop more non-traditional products and services to serve more customers and earn more non-interest incomes. Bank managers in private ownership must have particular solutions to close the gap with their state-owned counterparts in diversifying the income structure. For policy makers, in the period of market recovering, they should have some encouragement to boost the commercial banks diversify their business lines instead of focusing on traditional activities, might lead to credit overheating growth with can *"boom"* anytime. In addition to bringing many benefits to banks, diversification in banking activities also brings great benefits to customers for both individuals and businesses. The increase of non-traditional activities as import and export financing, factoring, collections, etc., has boosted production growth, thereby, Vietnam economy would be able to stabilize and develop. Policy makers also need to pay attention to fees given by the banks to protect customers' interests. Some large banks tend to charge high fees from non-traditional activities.

The paper has some limitations. The study just conduct on an industry with small sample is 26 commercial banks in the short period from 2007-2017. Regardless of using Lerner index and GMM that fit the small sample size and avoid bias findings, this study still does not draw a panorama of Vietnamese banking industry. Further study should increase the sample size by extending to other players in the banking system. With different regulatory requirement and business orientations of foreign-owned banks, joined venture banks, and one-member limited liability commercial bank owned by the state, the investigation in the whole sector will expect to give an interesting result.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Appendix 1. List of Vietnamese commercial banks used in this study

No.	Name	ID	S.E.	No.	Name	ID	S.E.
1	JSC Bank for Investment & Development of Vietnam	BID	HoSE	14	Kien Long JSC Bank	KLB	UPCoM
2	Vietnam JSC Bank for Industry & Trade	CTG	HoSE	15	LienViet Post JSC Bank	LPB	UPCom
3	JSC Bank for Foreign Trade of Vietnam	VCB	HoSE	16	VN International JSC Bank	VIB	UPCom
4	Vietnam JSC Export Import Bank	EIB	HoSE	17	AnBinh JSC Bank	ABBank	OTC
5	Ho Chi Minh Development JSC Bank	HDB	HoSE	18	VN Maritime JSC Bank	MSB	OTC
6	Military JSC Bank	MBB	HoSE	19	Nam A JSC Bank	NamABank	OTC
7	Sai Gon Thuong Tin JSC Bank	STB	HoSE	20	Orient JSC Bank	OCB	OTC
8	VN Technological & Commercial JS Bank	TCB	HoSE	21	Petrolimex Group JSC Bank	PGBank	OTC
9	Tien Phong JSC Bank	TPB	HoSE	22	Saigon JSC Bank	SCB	OTC
10	VN Prosperity JSC Bank	VPB	HoSE	23	Southeast Asia JSC Bank	SeABank	OTC
11	Asia JSC Bank	ACB	HoSE	24	Saigon JSC Bank for Industry & Trade	SGB	OTC
12	National Citizen JSC Bank	NVB	HNX	25	VN Asia JSC Bank	VietABank	OTC
13	Saigon Hanoi JSC Bank	SHB	HNX	26	Viet Capital JSC Bank	VietCapital	OTC
Excluding							
No.	Name	ID	S.E.	Reasons of excluding			
27	Bao Viet JSC Bank	BaoVietBank	OTC	It's relatively a new player in Vietnamese banking sector, publishing data since 2009			
28	Vietnam Public JSC Bank	PVcomBank	OTC	It's resulted form the M&A deal between Western Bank and Petro Vietnam Finance Company, publishing data since 2013			
29	Bac A JSC Bank	BAB	UPCoM	It has only published data since 2012			
30	Vietnam Thuong Tin JSC Bank	Vietbank	OTC	It's a new player, publishing data since 2016			
31	Dong A JSC Bank	DongABank	OTC	It is under special control by the SBV and not publishing data since 2014			

Appendix 2. VIF test

Variable	VIF	1/VIF	Variable	VIF	1/VIF
CMP	2.26	0.442212	AMP	2.29	0.436196
NIM	2.09	0.479385	NIM	2.17	0.461618
CRE	2.06	0.485949	CRE	2.13	0.470030
LIQ	2.05	0.486908	LIQ	2.05	0.488095
AGE	1.75	0.572973	AGE	1.72	0.582789
CAP	1.72	0.582432	DEP	1.67	0.599912
DEP	1.67	0.600357	CAP	1.56	0.639404
LIS	1.56	0.639850	CRI	1.54	0.649685
CRI	1.51	0.660862	LIS	1.52	0.656765
GDP	1.37	0.731689	GDP	1.44	0.696712
EFF	1.27	0.784389	EFF	1.36	0.734621
MNA	1.20	0.835218	MNA	1.20	0.834704
Mean VIF	1.71		Mean VIF	1.72	

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