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INDONESIAN CAPITAL MARKET REVIEW

Financial Innovation and Restriction Hypothesis in the Banking Industry: Evidence from ASEAN- 5

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This study investigates the financial innovation impact on bank market power in ASEAN banking from 2008 to 2018. It uses income diversification as a representative of financial innovation. The impact of countries' development of financial innovation on market power is measured by the number of ATM, internet, and cellular phone users. The data panel regression model reveals that diversified banks may enjoy higher market power. This result rejects the banking restriction activity hypothesis, which states that a bank that diversifies its income stream results in increased competition. A higher number of available ATMs and more internet users lowers the percentage disparity of price and marginal cost and consequently increases the market competitiveness. Nevertheless, an increasing number of cellular users in the country increases market power. Conjecturally, more people use the online bank platform on their cellular phones, which creates a greater flow of fees to the bank.

Keywords: ASEAN; Banking Competition; Diversification; Financial Innovation; Market Power; Restriction Hypothesis.

JEL Classification: G21, G28, O31

Introduction

Financial deregulation and liberalization of the banking system started in the US and rapidly spread globally to other continents. Banks have the autonomy to expand their branches and set a competitive price on its deposit services (Keeley, 1990). Deregulation also provides significant power to other financial services to compete with banks and sell bank-like products such as deposits and investments offered by insurance firms and investment banking. Moreover, rapid changes in technology comple-

mented with artificial intelligence (AI) and the Internet of Things (IoT) have already disrupted the bank monopoly in gathering funds from depositors and disbursing their loans to borrowers (Shy, 2019; Thakor, 2020). As explained by Frame, Wall, and White (2019), the advanced development of technology has become the locomotive to financial innovation that changes the way banks bundle their products, services, production process, and organizational structure to compete in the market. Such a strategy is ultimately expected to lower the cost of production and risk and spur social welfare.

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Today, not only do insurance firms and broker firms erode the banking business, but also the new business model of financial technology earns some revenues from traditional banking products (Mariotto & Verdier, 2015). The banking industry has responded to these competitive challenges by widening its services, including diversifying its products to non-traditional products that generate non-interest income (Bustaman et al., 2017; DeYoung & Rice, 2004; Stiroh & Rumble, 2006). These non-traditional products, including derivative transactions, trading, and insurance products, have expanded rapidly and generated additional income to cover the decreased revenue from traditional products. This topic of study has been covered widely by prior researchers for example in the US (Allen & Jagtiani, 2000; DeYoung & Rice, 2004; Rogers & Sinkey, 1999), in Europe (Carbó-Valverde & Rodríguez-Fernández, 2007; Lepetit, Nys, Rous, & Tarazi, 2008a, 2008b), in Mexico (Maudos and Solís, 2009)(Maudos and Solís, 2009) in ASEAN countries (Bustaman, Ekaputra, Prijadi, and Husodo, 2016; Nguyen, Skully, and Perera, 2012a) and Australian banking (Williams, 2016).

Some studies examined the relationship between diversification and bank market power. For example, Nguyen et al. (2012b) found a non-linear association between revenue diversification and market power in ASEAN. In addition, this study revealed that banks focus on their non-traditional markets when they are less powerful in loan and deposit markets. Another study by Lin et al. (2021) found that income and asset diversification increase bank market power in China. However, most studies on market power focused on its impact on net interest margin (Bustaman et al., 2016; Carbó-Valverde & Rodríguez-Fernández, 2007; Maudos and Solís, 2009). Meanwhile, other studies relate banking competition to banking stability (for example, see Bustaman et al., 2017; Keeley, 1990; Smith, 1984; Williams, 2016). The study by Repullo (2010) provides new insight into the relationship between banking competition and the risk of bank failure. Martinez-Miera and Repullo (2010) found a U-shaped relationship between competition and risk. Thus, an increase

in competition influences the risk in two directions. Additionally, higher market power and more capital for the bank can facilitate more innovative products and the bargaining power to bundle the products that generate more non-interest income (Lepetit et al., 2008b; Nguyen, Skully, and Perera, 2012b). In contrast, less attention is given to the impact of financial innovation through income diversifications that generate non-interest income and the development of financial innovation on bank market power. Some scholars explain that a more concentrated banking market produces more power that leads to monopoly. Conversely, lower market power brings a more competitive banking system. Thus, we observe an opposite direction between market power and competition (Berger, Hasan, and Zhou, 2010; Berger, Klapper, and Turk-Ariss, 2017).

Studies related to financial innovation mostly emphasize bank diversification to generate more returns and manage risks. For example, research focuses on geographic diversification (Jouida, Bouzgarrou, and Hellara, 2017; Meslier, Morgan, Samolyk, and Tarazi, 2016; Zouaoui and Zoghlami, 2020), product diversification (Bustaman et al., 2017; Nguyen, Perera, & Skully, 2016; Williams, 2016), mergers and acquisitions (Laeven et al., 2007; Schmid and Walter, 2009), and securities activities (Kwan, 1997).

In contrast, fewer articles analyze the relationship between bank diversification as an impact of financial innovation and market power. Carbó-Valverde and Rodríguez-Fernández (2007) comprehensively investigate the impact of diversification on bank market power in the European banking system. They find a paradoxical trend in which the diversified bank gains more market power amid the declining interest margin. Banks may find a trade-off between declining interest income and increases in non-interest income as a new source of income and power. Current literature reveals the opposite results; Zouaoui and Zoghlami (2020) studied banking in MENA countries and discovered that more activities in seeking non-interest income lowered the market power of the bank. It appears that banks selling more variety of

innovative products lowered their bargaining position with the customer in writing the contracts. However, they did not explore the effects of financial innovation on market power. In addition, this study used various financial innovation measures such as the number of ATMs, internet users, and smartphone users.

This specific topic, explored by Carbó-Valverde and Rodríguez-Fernández (2007), is rarely analyzed regarding banks in ASEAN countries. Nguyen et al. (2012a) investigated the impact of market power on product diversification. Thus, it is not on the same framework as Carbó-Valverde and Rodríguez-Fernández (2007). Meanwhile, Bustaman et al. (2016, 2017) examined the impact of product diversification on net interest margins and banking stability in ASEAN countries. Furthermore, the quiet life hypothesis, which explores the effect of market power and bank efficiency, was studied by Viverita (2014) for the Indonesian banking sector.

Thus, this paper aims to examine the association between income diversification on market power, as the restriction activity hypothesis argues that less activity restriction of banking activity develops more banking competitiveness (Barth, Caprio, and Levine, 2004; Claessens and Laeven, 2004). In line with this study, a new empirical study from Ghosh (2018) proves that financial innovation through more diversification in non-traditional products either increases bank competition or lowers market power.

Specifically, this paper aims to answer the following research questions: Firstly, does financial innovation through income diversification affect bank market power? Secondly, does countries' development of financial innovation affect market power?

This study finds that a diversified bank that produces non-interest income may enjoy higher market power. It examines decreases in market power when the bank is more focused on selling loans, in contrast to the findings by Zouaoui and Zoghلامي (2020). The source of market power flows from non-traditional products' revenue generation. This result rejects the banking restriction activity hypothesis, which states that a bank that diversifies its income stream results

in increased competition. Countries' financial innovation variables show that having a better number of ATMs available and more internet users lowers the percentage disparity of price and marginal cost borne by the bank and consequently makes the market more competitive. However, a greater number of users in the country increases market power. Conjecturally, this might be because more people use the online bank platform on their cellular phones, which creates greater flow of fees to the bank.

The paper contributes to the existing banking literature in two ways. First, it expands upon the current literature on product diversifications and the latest development of country financial innovation on the bank market power in ASEAN countries. Secondly, it provides the latest empirical evidence on the impact of financial innovation on market power in the ASEAN banking industry.

The remainder of the paper is organized as follows. Relevant literature and hypothesis development are discussed in Section 2, followed by research methodology in Section 3. Findings and discussion are presented in Section 4, and conclusions are provided in Section 5.

Literature Review

Banking Restriction Activity Hypothesis

The restriction activity hypothesis stipulates that banks that diversify their income stream and also their loan portfolio experience increased competition. Subsequently, the performance and stability of the bank follow (Barth et al., 2004). Therefore, the bank has the freedom and ability to be involved in securities market transactions, insurance, and real estate business. A study of 50 countries' banking systems by Claessens and Laeven (2004) proves this hypothesis.

Additionally, Barth et al. (2004) suggested that these findings from 107 countries' banking database arise when the market for securities exists in the country. Similarly, using banking data from 106 developing countries, Ghosh (2018) applied the Lerner Index as a measurement of competition and the portion of non-in-

terest income as a dimension of diversification and found that wider diversification promotes competitive behavior in the banking system. Studies in MENA countries by Zouaoui and Zoghلامي (2020), using the same framework as previous researchers, documented the same evidence. However, Carbó-Valverde and Rodríguez-Fernández (2007) disclosed opposite results, stating that banks in the European zone that expand their activities to non-traditional banking products produce more market power. Banks become competitive in traditional banking products, yet the bank gains the source of market power from providing other services from non-core banking activities.

Financial Innovation, Banking Competition, and Market Power

Continuous changes in technology, the Internet of Things (IoT), and Artificial Intelligence (AI) have already altered the landscape of competition in a wide range of businesses, including in the banking industry. Financial innovation, as defined by Frame et al. (2019), reduces cost and risk and provides an improved product or service or instrument that better satisfies financial system participants' demand. Accordingly, the concept of financial innovation by Tufano, Tufano, and Coleman (2002) focused on research and development, which includes the invention of products and technology as well as the diffusion of new product services and ideas. Furthermore, Tufano's concept is followed by Beck, Chen, Lin, and Song (2016) and is used as a framework for their study related to financial innovation and bank growth.

Financial innovation, as explained by Frame et al. (2019), Beck et al. (2016) and Lee, Wang, and Ho (2020) provides new products and services. Therefore, it can improve the quality and variety of banking services such as ATMs, debit cards, product income-diversifications, e-money, and internet banking (Mariotto & Verdier, 2015; Jouida et al., 2017). Risk-sharing is also facilitated by financial innovation (Bustaman et al., 2017; DeYoung & Torna, 2013), and improve allocation efficiency in banking operation (Beck et al., 2016a, Lee et al., 2020, Duygun,

Sena, & Shaban, 2013). It also provides new production processes such as credit scoring (Berger & Udell, 2006), online clearinghouse, asset securitization, the online platform for banking and fin-tech, blockchain, and big data (Thakor, 2020; Frame et al., 2019; Elul, 2015).

Additionally, Frame et al. (2019) and Mariotto and Verdier (2015) asserted that the advanced invention in technology offered local banks a significant opportunity to compete nationwide and even internationally with other banks, thus spurring more competition in financial services. Beck et al. (2016) refer to this positive development of the financial innovation growth view as the bright side of financial innovation. However, these potential benefits of innovation development also attract other financial institutions, organized to provide technology and financial service, or fintech. It increases the competition in the market, not only offering the speed of processing loans and deposits but also charging lower fees and ultimately eliminating the need for trusted third parties like banks.

Moreover, some scholars cast doubt on the expediency of these innovations. Some bankers have already exploited the use of this innovation to increase systemic risk in the financial system (Brunnermeier, Dong, & Palia, 2012) and becoming the root cause of the global financial crisis (Murray, 2009). Likewise, a new study by Beck et al. (2016) finds that the dark side of financial innovation leads to greater instability in the banking system, even though financial innovation facilitates faster bank growth.

Abundant literature has emerged stating that financial innovation is an essential factor that influences the growth and fragility of the banking industry. This condition worsened during the financial crisis, which impacted the deteriorating performance of banks (Beck et al., 2016). Continuing this study, Lee et al. (2020) evaluated the combination of the role of institutional and financial innovation on bank growth coverage in 40 countries (OECD and non-OECD countries) using observations over a 13-year period (1989-2011). They recorded that financial innovation links to the growth of bank assets and loans as well as the ability of banks to generate profit. However, some insti-

tutional roles such as bank regulation, country governance, and reformation issued by regulators tend to weaken the relationship between financial innovation and growth. Belleflamme and Naricyn (2015) provide further explanation of product innovation and reveal that firms that can differentiate their products from their competitors' bring an increase in their price margin that ultimately increases their market power. Meanwhile, another aspect of technological innovation is the process innovation that impacts the cost reduction that alters its production function, which allows the firm to offer a lower price than its competitors (Senarathne & Wei, 2018).

Moshirian (2014) uncovers that financial innovation in the banking sector becomes a necessity when they target financial growth amid higher market competition. Banks create a more competitive position through product innovation, considerably increasing their cost and profit efficiency in UK commercial banks (Duygun et al., 2013). This finding is in line with the concept of the relationship between technological innovation and competition of the Schumpeterian hypothesis, under which innovation creates market power. The firm offers differentiated creative products or uses better processing technology, and the system is more efficient and productive. Thus, they enjoy higher market power. Subsequently, firms that maintain their market share and market power lead to monopolies (Dhanora et al., 2018; Jouda et al., 2017; Niwa, 2016).

Technological development followed by deregulation and financial innovation has already changed the variety of banking products and services, such as its production process as well as the organization structure, including market competition (Frame et al., 2019). This evolving innovation endorses banks to diversify their products from traditional banking products to non-traditional products, which increases income through non-interest income. Thus, our hypothesis is as follows:

H1: Financial innovation affects bank market power.

The relationship between bank diversifica-

tion as an impact of financial innovation and market power was analyzed comprehensively by Carbó-Valverde and Rodríguez-Fernández (2007) and Maudos and Fernández de Guevara (2004) within the European banking system. They found a paradoxical trend in which the diversified bank gains more market power amid the declining interest margin. The bank that diversified its source of income might be in a strong position to grab the market of the specialized bank by lowering its lending rate and increasing its deposit rate. Thus, it may find a trade-off between declining interest income and non-interest income. On the one hand, banks are more competitive in traditional activities (they lower their market power), and on the other hand, banks generate other sources of market power by offering innovative products that provide non-traditional banking services. Contrasting results were found by Zouaoui and Zoghalmi (2020), who studied banking in MENA countries. They discovered that more activities in seeking non-interest income lowered the market power of the bank. It appears that banks that sell a greater variety of innovative products lowered their bargaining position with customers in writing the contracts.

Nguyen et al. (2012a,b) and Nguyen et al. (2016) followed the work of Carbó-Valverde and Rodríguez-Fernández, (2007) in the South Asian, ASEAN-5, and Africa's banking industries respectively. Their discussions focused more on the role of market power in generating non-interest income. It seems that banks in South Asian countries have not yet exploited their market power to seize the potential flow of income flow from non-traditional products. Banking managers who possess market power might be satisfied enough with the profit generated from traditional loans. Using a non-linear regression model that relates market power and diversification in ASEAN countries, the author documents that, at a lower market power, bank managers have the incentive to explore opportunities to sell more non-traditional products. Thus, it will increase bank non-interest income. However, at higher market power, banks tend to be more focused on selling loans and deposits. Different findings were documented for

banking in Africa; higher market power enables banks to exploit their capacity to find opportunities to expand their products and bargaining to grasp more non-interest income (Nguyen et al., 2016). Consistent with Nguyen et al. (2016), Zouaoui and Zoghalmi (2020) investigated the nexus between market power and revenue diversification in MENA countries. Thus, the hypothesis is:

H2: Diversification income affects bank market power.

Research Methods

Data

This study uses quarterly data from the individual publicly listed bank financial statements for the period of 2008 to 2018 from ASEAN 5 banks. The data was retrieved from the Osiris-Bureau Van Dijk database. The sample includes commercial banks; thus, the Islamic Bank is excluded from our sample because it has a different structure of financial statements from commercial banks. The data is also filtered, and banks that are missing three consecutive years of data are excluded from the sample. Additionally, banks that do not have the main variables on their financial report such as loan, interest income, and interest expenses as well as a negative value on its assets, loan, and equity, interest income are omitted from the sample.

Consequently, this restriction reduces the sample of unbalanced-panel data to 67 banks from 5 countries or a total of 2,948 observations. In terms of the number, data is dominantly come from Indonesia, consisting of 32 publicly listed banks, even though the size of the banks are relatively smaller than their peers from other countries. Table 1 provides the descriptive statistics of the data.

Countries' level of financial innovation data that generate new financial transactions from the infrastructures provided such as the number of ATMs, internet users, and mobile phone users were downloaded from the world bank's database (<http://data.worldbank.org>).

Methodology

The model to investigate the influence of banking diversification and financial innovation on bank market power or bank-level competition is using the following regression equation.

$$MP_{i,t,j} = \alpha + \beta_1 NIITI_{i,t,j} + \sum_{k=1}^2 \gamma_{k,t} FInv_{i,t,j} + \sum_{n=1}^3 \delta_{n,t} CFInv_{n,i,t} + \sum_{m=1}^5 \theta_{m,t} BS_{m,i,t} + \varepsilon_{i,t,j} \quad (1)$$

Where *i* represented the individual bank, *t* is time, and *j* is the host country where the bank is located. The independent variable *MP* is the market power of the individual bank. This study uses the Lerner Index as a measurement of bank market power. The higher value of Lerner Index indicates that the bank has higher market power in the system or less competition in the market (Berger, Klapper, and Turk-Ariss, 2009; Turk Ariss, 2010). The source of financial innovation data such as R&D expenses, license fee expenses, and other investments in technology remains a challenge in the banking industry. Thus, this study uses income diversification activities to gauge individual bank financial innovation. Net interest income over total income (NIITI) is a measurement of bank income diversification, measured by the ratio of net interest income over total income (Bustaman et al. 2016). NIITI is then disaggregated into the ratio of commission fee over the total asset (COMMTA) and trade income fee over total assets (TRADETA), included in vector *Finv*.

Similarly, the data on bank competitors such as the yearly development of fintech, volume transactions in the fintech industry, and e-commerce platform, are less readily available. Thus, there are three measurement variables in the vector country level of financial innovation (*CFin*): the number of ATM per hundred thousand people, internet users, and smartphone users over a hundred thousand people. Vector of bank-specific factors (*BS*) as control variables include equity measurement, the ratio of total bank equity over total assets, bank liquidity measured by the ratio of cash and due from of total assets, proportion of loan to total assets, the

ratio of loan loss provision to the total asset as the measurement of bank risk, and profitability ratio using the return of an asset and measured by net income over total assets. Those ratios were used by some scholars when they include these bank-specific variables as part of the determinant variables of market power (Carbó-Valverde & Rodríguez-Fernández, 2007).

Banking Competition Measurement

The paradigm of Structure-Conduct-Performance (SCP) states that the higher market concentration, accompanied by some obstacles for new players to enter the market, reduces the cost of interbank collusion, which leads to higher profits for all banks in the market. The level of concentration shows the magnitude of market power; the higher the concentration of banking, the greater the market power (monopoly), and conversely, the lower the market concentration, the more competitive the banking system.

Market concentration ratios measured by the Herfindahl-Hirschman Index (HHI) and k-concentration (k-CR), which are widely used as a measure of market power, have been challenged by many researchers who oppose the claim that the concentration ratio is not an appropriate proxy to gauge banking competitiveness. Claessens and Laeven (2004) stated that the concentration to measure market structure is not related to the level of competition in the banking industry. These authors do not find empirical evidence to support the inverse relationship between concentration and competition in the banking industry. Those two terminologies can explain the different characteristics of the banking system. The competition is likely determined by the factor of reducing barriers to operating and barriers to entry into a foreign market than other factors such as capital market, insurance firm, and now e-commerce and financial technology platforms.

In line with this study, Cetorelli (1999) states that, by merely looking at the market structure, the level of competition cannot be determined. Therefore, it is necessary to analyze the behavior of individual banks accurately. The level of concentration tends to overestimate the level

of competition in a small country that has a small number of banks (Bikker & Haaf, 2002). Furthermore, Schaeck et al. (2009) added that concentration does not imply a lack of competition in the market, because some other factors trigger competition. For example, when a policymaker issues regulation to increase the amount of the bank's capital, it causes a merger between several banks to meet these requirements, which will increase concentration in the industry. However, Cetorelli (1999) finds the different impacts of a bank merger. Thus, it will break up collusion between banks and increase competition.

This study uses a method that directly measures the individual level of banking competition. It was adapted from the new empirical industrial organization (NEIO) approach that measures market power by testing the observed deviation of marginal cost pricing without explicitly using market structure indicators. There are two methods of measuring the level of competition from NEIO, namely Panzar-Rosse H-Statistics (PR-H) and the Lerner Index (LI). Both measurements use bank-level data to measure the level of competition. Panzar-Rosse produces a degree of competitiveness from the banking system. Thus, by using bank-level data, measurement of the level of competition in the banking system with PR-H allows the measurement of the level of competition in the banking system, even though there are different types of banks, both in terms of size of assets and differences in ownership (Claessens and Laeven, 2004). Meanwhile, the disadvantage of using this PR-H competition level measure is that banks are assumed to be in a long-term equilibrium condition.

Meanwhile, the Lerner Index is a proxy for individual bank market power. Some banking literature recorded that market power has an inverse relationship with the level of competition (e.g., Matthews and Thompson, 2005). When the bank has higher market power, then the level of banking competition is low, and vice versa. The Lerner Index represents the markup price of marginal cost, which is an indicator of market power (Berger et al., 2009; Turk-Ariss, 2009). Beck et al. (2013) stated that the Lerner

Index (LI) is a proxy of current and future profits derived from pricing power both in terms of assets (credit) and in terms of funding (liability). Another benefit of using the Lerner Index is that it does not require a geographical definition of the market. The Lerner Index is a picture of the markup of product prices against the marginal cost of the bank for each time t . This study calculated market power using this conventional Lerner Index formula:

$$\text{Lerner Index} = \frac{P_{i,t} - MC_{i,t}}{P_{i,t}} \quad (2)$$

P_i is proxied as total income over asset. The total income consists of interest income generated from traditional bank activities, and non-interest income results from non-traditional activities such as commission fees, trade fees from trading securities, and other financial derivative products. The marginal cost (MC_{it}) is derived from the translog cost function for each bank in each country and calculated separately. Some variations of translog equations have been used by previous scholars to capture bank specificities and fixed effects (Turk-Ariss, 2010; Zoulaoui and Zoghalmi, 2020; Nguyen et al., 2016). This study follows the model from Berger et al. (2009):

$$\begin{aligned} \ln Cost_{i,t} = & \beta_0 + \beta_1 \ln Q_{i,t} + \frac{\beta_2}{2} \ln Q_{i,t}^2 \\ & + \sum_{k=1}^3 \gamma_{k,t} \ln W_{k,i,t} \\ & + \sum_{k=1}^3 \phi_{k,t} \ln Q_{i,t} \ln W_{k,i,t} \\ & + \sum_{k=1}^3 \sum_{j=1}^3 \ln W_{k,i,t} \ln W_{j,i,t} \end{aligned} \quad (3)$$

Thus, the total cost is a function of the output represented by the total asset ($\ln Q_{it}$), as used by Berger et al. (2009), Beck et al. (2016), and Carbó-Valverde and Rodríguez-Fernández (2007). Three input prices are represented from W_1 to W_3 , where W_1 is the cost of bank personnel scale by total asset, W_2 is the price of the fund (interest expenses over total asset), and W_3 is the cost of fixed administration and operational over the total asset.

Then the Marginal Cost MC_{it} is computed for each bank using this equation.

$$MC_{i,t} = \frac{Cost_{i,t}}{Q_{i,t}} \left[\beta_{i,t} + \beta_2 \ln Q_{i,t} + \sum_{k=1}^3 \phi_k \ln W_{k,i,t} \right] \quad (4)$$

There are several reasons to use the Lerner Index to gauge the market power or bank competition; firstly, the level of competition provides more opportunities to capture the long-term imbalance of the banking industry. Second, the Lerner Index accommodates the unique abilities of individual banks, the size of the bank, and the operational scope of the bank, so that the level of competition per individual bank will be different (Berger et al., 2009). Third, not all banks can compete internationally, offering derivative products (off-balance sheet) or banking products needed by large corporations. Some banks only distribute products to small and medium enterprises, while other banks have more significant coverage operations in terms of geographical areas; others cover operations nationally and internationally. Thus, the interest rates and fees charged to customers can differ. The impact of market power levels differs for each bank. The Lerner Index has been used in various studies including Berger et al. (2009), Maudos and Solis (2009), Carbó-Valverde and Rodríguez-Fernández (2007), Beck et al. (2013), Nguyen et al. (2012a, 2016), Zoulaoui and Zoghalmi (2020), and Yang and Shao (2016) as a measurement of the level of banking competition in the same discussion as this research.

Results and Discussions

Descriptive Statistics

Table 1 presents the descriptive statistics of all data used in this study. It shows that the mean of percentage disparity between price and marginal cost scale by price or Lerner Index (LERNER) for banking in this area is 32.27 percent. This number falls in the moderate range of market power. The level of income diversification is still low; the average portion of non-interest income over total income (NIITI) is less than twenty percent (18.97%). This study also disaggregates the non-interest income

Table 1. Descriptive Statistics

VARIABLES	Mean	Maximum	Minimum	Std. Dev.
Dependent Variable				
LERNER	0.3227	0.9493	0.0019	0.1346
Diversification and Financial Innovation Variables				
NIITI	0.1897	0.6824	0.0000	0.1177
COMMTA	0.0064	0.0296	0.0001	0.0050
TRADETA	0.0001	0.0136	-0.0041	0.0017
ATM	44.7820	116.9871	13.0655	27.1945
CELLUAR	118.5229	180.1826	59.7012	28.2034
INTERNET	40.9795	94.8667	6.9200	26.2901
Bank Specific Variables				
CASHDUE	0.0906	0.3523	0.0017	0.0617
DEPTA	0.7359	0.9235	0.0686	0.1214
EQUITY	0.1176	0.8900	0.0239	0.0534
LLPTA	0.0040	0.0816	-0.2862	0.0141
ROA	0.0111	0.0439	-0.0659	0.0087
LOANTA	0.6779	0.9790	0.0686	0.1516
CRISIS	0.1818	1.0000	0.0000	0.3858

sources into two sources of income: fee and commission over the total asset (COMMTA) and trade fee over the total asset (TRADETA). Table 1 shows that some banks experience loss in trading reflected from the negative sign of minimum value, and commission and fees are relatively higher than income from trading. Our study also uses countries' measurement of financial innovation; because of the lack available of data on financial innovation, we use some data from the World Bank to measure the level of financial development. We gather the number of ATMs available in the banking system per one hundred thousand adults, cellular phone (CELLULAR) per hundred people, and internet users (INTERNET) as the percentage of the population. The data shows that people in this region on average have more than one cellular phone. Bank-specific variables show that the bank has maintained 9.06 percent of its asset to the need for liquidity (CASHDUE) and the primary source of its financing majority from the deposit (DEPTA) with a mean value of around 73.6 percent. The ratio of equity of bank (EQUITY), about 11.8 percent, is slightly higher than the minimum 8 percent equity required by the regulator. Loan loss provision (LLPTA) is around 0.4 percent, and the majority of bank assets to generate income is the loan (LOANTA) with 67.8 percent proportion of assets. Thus, our analysis proves that the majority of bank sources of income come from loans in this region.

Before estimating the regression model, we check our data from heteroskedasticity. Table 2 shows that our data is free from the heteroskedasticity problem.

Empirical Analysis

The results of the regression are exhibited in Table 3. The dependent variable is the Lerner Index as a measurement of the individual market power of each bank in the countries. Panel data regression mode (1) is estimated using one period lag of independent variables. The impact of financial innovations in the banking sectors and countries' development of technology innovation, as well as other bank-specific variables, take a while before they affect the bank market power. However, there is no literature available to explain how long the lagged time of development of financial innovation impacts the market power of the banking industry. Additionally, we assess the static panel data using the EGLS model to reduce the existence of heteroskedasticity and autocorrelation problems.

There are six columns in Table 3. Columns 1 to 4 show the impact of bank financial innovation through product diversification and the country's development of technology innovation on market power. We separate NIITI and its disaggregates (COMMTA and TRADETA) to evade the multicollinearity problem. Columns 5 and 6 report the complete variables, including the bank-specific factors and year crisis. The

Table 2. Coefficient Correlation

	LERNER	NIITI	COMMTA	TRADETA	CASHDUE	DEPTA	EQUITY	LLPTA	LOANTA	ROA	CELLUAR	ATM	INTERNET
LERNER	1.0000												
NIITI	0.3283	1.0000											
COMMTA	0.1232	0.2133	1.0000										
TRADETA	0.1779	0.3093	-0.0798	1.0000									
CASHDUE	-0.0326	-0.0144	-0.1649	0.3740	1.0000								
DEPTA	0.0878	-0.0196	-0.0753	0.0881	0.2439	1.0000							
EQUITY	-0.0372	-0.1087	0.2559	0.2155	0.3313	0.0326	1.0000						
LLPTA	-0.0618	0.0956	0.1835	0.3723	0.3893	0.1549	0.1637	1.0000					
LOANTA	0.0562	0.0056	0.3710	-0.3653	-0.4845	0.3922	-0.0774	-0.2158	1.0000				
ROA	0.4141	0.2125	0.2606	0.2869	0.0469	-0.0563	0.2602	0.0141	-0.0182	1.0000			
CELLUAR	0.1070	0.2237	0.2090	-0.2949	-0.2604	-0.1681	0.0458	-0.3081	0.2816	-0.0906	1.0000		
ATM	0.0693	0.1727	0.3608	-0.3591	-0.6373	-0.2433	-0.1526	-0.3771	0.5150	-0.1032	0.7293	1.0000	
INTERNET	0.2569	0.4124	-0.2117	0.1459	0.3279	0.1141	-0.0481	0.2453	-0.1997	-0.0496	0.2724	-0.1213	1.0000

results demonstrate that banks diversify their sources of income by selling non-interest income (NIITI) products, and consistently show a positive impact on their market power. Unswervingly, commission (COMMTA) and trade (TRADETA), which derive from NIITI, prove the increases of market power when a bank accolades its services with non-traditional products. This finding reveals that the restriction activity hypothesis cannot be accepted in this banking system environment.

This study reveals that diversified banks become more reliable in the bargaining position relative to their customers in terms of pricing of credit, because the bank also offers a complement of bundle innovation products to provide convenience for their customers and keep them loyal. Additionally, the bank may charge a higher fee if the customer wants to switch to another bank. In another way, the diversified bank lowers its interest margin. However, the bank might compensate for the decreased income in intermediary businesses by offering a business that generates fees. These services force the rival who specializes in offering traditional loans and deposits out of the competition in this region. This finding implies that diversification increases market power. This result does not support the restriction activity hypothesis, under which the bank that diversifies its income stream increases competition. This phenomenon may arise due to the limited ability of the banks to expand their business to non-traditional markets. However, this finding is in line with the findings of Carbo-Valverde and Rodriguez-Fernandez (2007) and the co-

existence with increasing diversification business and increasing the market power of banks in some European banks (Maudos & Fernández de Guevara, 2004). Nevertheless, the opposite impact of diversification on market power was found by Zouaoui and Zoghلامي (2020), who studied the banking system in MENA countries.

Countries' financial innovation environment factors are represented by the existence of ATM facilities, internet facilities, and the number of the cellular phones people use in each country. Internet facilities and ATMs show negative associations with market power. This technological innovation increases the competition (decrease market power) among banks in the system. Logically, spreading the ATM facility over the operational region of bank branches and the availability of internet connection (INTERNET) help banks to distribute their services with lower prices as well as lower costs. Today, banks not only use ATMs to serve their customers but also use the link of collaboration, allowing every customer to use any single ATM available nearby without concern about which bank owns the ATM. Thus, collaboration decreases the cost of bank investment and lower operational costs. Cellular phone (CELLULAR) users have a positive relationship with market power. We conjecture that more customers use bank applications on their cell phones to increase non-interest income for the bank and ultimately increase the total percentage of disparity between price and marginal cost or Lerner Index.

There is evidence that almost all bank-specific variables display a negative impact

Table 3. The Regression Results, Lerner Index as Dependent Variables

	1	2	3	4	5	6
C	0.2794*** 0.0000	0.3186*** 0.0000	0.2307*** 0.0000	0.2749*** 0.0000	0.4459*** 0.0000	0.3533*** 0.0000
NIITI(-1)	0.1647 0.0000***		0.1380*** 0.0000			0.0970*** (0.0049)
COMMTA(-1)		2.1845* 0.0847		1.5080 (0.1553)	3.7037*** (0.0062)	
TRADETA(-1)		0.0926*** 0.0000		0.0890*** 0.0000	0.0861*** (0.0015)	
ATM(-1)			0.0000 (0.9551)	-0.0005** (0.0389)	-0.0006** (0.0434)	0.0001 (0.5746)
CELLUAR(-1)			0.0006*** (0.0003)	0.0007*** 0.0000	0.0005** (0.0127)	0.0002 (0.1210)
INTERNET(-1)			-0.0004*** (0.0823)	-0.0003 (0.1038)	0.0000 (0.7666)	-0.0001 (0.5219)
CRISIS					-0.0292*** (0.0001)	-0.0341*** 0.0000
CASHDUE(-1)					-0.2006*** (0.0006)	-0.2279*** 0.0000
DEPTA(-1)					-0.0861*** (0.0002)	-0.0061 (0.8431)
EQUITY(-1)					-0.2183*** (0.0100)	0.1149* (0.0999)
LLPTA(-1)					-0.0913*** (0.0017)	-0.0348 (0.2428)
ROA(-1)					-0.0645 (0.9688)	0.6713 (0.6181)
LOANTA(-1)					-0.0701*** (0.0029)	-0.1064*** 0.0000
R-squared	0.018743	0.0446	0.04444	0.0644	0.1018	0.081694

Number in parentheses is p value, asterisk indicates the significance level; * significant at 10%, **significant at 5% and *** significant at 1%.

on market power. Thus, an increase in those variables results in a more competitive environment. Firstly, deposits (DEPTA) and loans (LOANTA) both have negative signs. It seems that specialized banks selling only traditional products lose their market power, and their income deteriorates for the one who finds new power by selling other services beyond loans and deposits. Alternatively, banks focus on selling more traditional loan products that offer an advantage from the information on relationship lending. Thus, the interest cost for a loan can be lowered, and the bank could maintain its competitive position (lower market power).

Second, liquidity (CASHDUE) has a negative relationship with market power. Thus, we inference that less stream cash flow from holding more liquid assets ruins bank market power. Third, higher EQUITY is better for banking risk perception and creates a more competitive position, yet it is also costly for the bank,

which causes lower market power. Bank risk represented by loan loss provision (LLPTA) negatively impacts market power, and higher prediction of loan default causes a loss of market power in the system. The last bank-specific variable, the profitability measured by ROA, does not significantly influence the bank's position in the market. This study also investigates the year crisis and its impact on bank market power, and this variable consistently shows a negative significant impact on bank market power. In the crisis year, it is not easy for the bank to maintain its source of market power to engender higher profit compared to competitors, probably the best strategy for banks in this challenging time is to maintain a good relationship with the customers.

Considering that Singapore is categorized as a developed country, the infrastructure level and the playing level of market competition are different from the rest of the four countries.

Table 4. Regression Result Lerner Index as Dependent Variable, Asean minus Singapore

	1	2	3	4	5	6
C	0.2574*** (0.0001)	0.3210*** (0.0001)	0.2131*** (0.0001)	0.2775*** (0.0001)	0.3995*** (0.0001)	0.2742*** (0.0001)
NIITI(-1)	0.3087*** (0.0001)		0.2858*** (0.0001)			0.2778*** (0.0001)
COMMTA(-1)		2.2914** (0.0481)		1.8473* (0.0805)	4.2976*** (0.0006)	
TRADETA(-1)		0.0945*** (0.0001)		0.0955*** (0.0001)	0.0925*** (0.0001)	
ATM(-1)			0.0000 (0.9293)	-0.0005** (0.0197)	-0.0006** (0.0288)	0.0001 (0.4539)
CELLUAR(-1)			0.0004*** (0.0015)	0.0006*** (0.0001)	0.0003* (0.0511)	0.0001 (0.4556)
INTERNET(-1)			-0.0001 (0.5426)	-0.0001 (0.5617)	0.0004*** (0.0059)	0.0002 (0.1375)
CRISIS					-0.0304*** (0.0001)	-0.0291*** (0.0001)
CASHDUE(-1)					-0.2506*** (0.0001)	-0.2545*** (0.0001)
DEPTA(-1)					-0.0345 (0.1152)	0.0396 (0.1414)
EQUITY(-1)					-0.2688*** (0.0052)	0.1316* (0.0597)
LLPTA(-1)					-0.0904*** (0.0001)	-0.0535** (0.0334)
ROA(-1)					0.1798 (0.9118)	0.3955 (0.7702)
LOANTA(-1)					-0.0507** (0.0461)	-0.0788*** (0.0001)
R-squared	0.0618	0.0625	0.0825	0.0829	0.1294	0.1240

Number in parentheses is p value, asterisk indicates the significance level; * significant at 10%, **significant at 5%, and *** significant at 1%.

This paper also tests whether there is a different result if data from Singapore is excluded from the sample. Table 4 exhibits the regression results with the Lerner Index (market power) as a dependent variable. Generally, there are no significant differences in results between the ASEAN 5 and ASEAN without Singapore. Diversifications, as a product of financial innovation, become a new source of market power for banks amid tight competition in intermediary activities. However, an increasing number of people with access to the internet (INTERNET) results in tight competition in the market (lower market power) that leads to a decrease in the margin disparity (Lerner Index).

Additionally, this study investigates the different impacts of financial innovation on market power for each country (ASEAN 5 minus Singapore). Table 5 reveals the results that non-interest income (NIITI) has a positive impact on market power, except for Malaysian bank-

ing, which does not show a significant nexus between diversified income activities and market power. Thus, it cannot prove that the restriction activity hypothesis is applied in the region.

Commission fees are becoming sources of market power in Indonesia and Thailand. Meanwhile, the Malaysian and the Philippine banks are in a better position regarding income from trading that positively increase their market power. The ATM infrastructure in both Malaysia and Thailand provides more fees for the bank, which result in increased market power. However, in Indonesia and the Philippines, when banks provide ATMs as well as collaborate with the ATM provider network, they increase the competition. Moreover, more users on cellular phones and better access to the internet become bargaining positions for banks in Indonesia and the Philippines to increase their market power. However, better internet access makes the banking system more competitive.

Table 5 Regression Result Lerner Index as Dependent Variable

	INDONESIA		MALAYSIA		THAILAND		THE PHILLIPINE	
C	0.1084 (0.0001)	0.1198*** (0.0001)	0.2669*** (0.0001)	0.3406*** (0.0001)	0.2537*** (0.0001)	0.2740*** (0.0001)	0.2036*** (0.0001)	0.2865*** (0.0001)
NIITI(-1)	0.3499*** (0.0001)		-0.0113 (0.7063)		0.2412*** (0.0001)		0.2537*** (0.0001)	
COMMTA(-1)		5.4829*** (0.0038)		-12.2744*** (0.0001)		4.3235*** (0.0001)		-1.8410 (0.2288)
TRADETA(-1)		1.5460 (0.7110)		14.1007*** (0.0001)		5.0136 (0.3187)		0.0824*** (0.0001)
ATM(-1)	-0.0016*** (0.0001)	-0.0039*** (0.0001)	0.0037*** (0.0001)	0.0033*** (0.0001)	0.0005* (0.0879)	0.0004 (0.2049)	-0.0165*** (0.0001)	-0.0117*** (0.0003)
CELLUAR(-1)	0.0010*** (0.0001)	0.0020*** (0.0001)	-0.0001 (0.8100)	0.0002 (0.3607)	0.0003 (0.3512)	0.0005 (0.1611)	0.0020*** (0.0004)	0.0015** (0.0106)
INTERNET(-1)	0.0018*** (0.0001)	0.0014*** (0.0095)	-0.0004 (0.2038)	-0.0009** (0.0128)	-0.0010 (0.2727)	-0.0013* (0.0709)	0.0037*** (0.0001)	0.0027*** (0.0001)
R-squared	0.0960	0.12512	0.1786	0.3022	0.1139	0.0931	0.2629	0.2541

Number in parentheses is p value, asterisk indicates the significance level; * significant at 10%, ** significant at 5%, and *** significant at 1%.

Conclusions

This study analyzes the relationship between financial innovation in banking through product diversification and the countries' development of innovation on bank market power. Empirical tests for this study are conducted for the sample of banks located in 5 ASEAN countries: Indonesia, Malaysia, Singapore, Thailand, and the Philippines. This study gathered 2,948 observations during the period from 2008 to 2018. Static panel data regression is used to estimate the coefficients relationship between financial innovation, bank-specific factors, and market power. Lerner Index is used to proxy the measurement of market power.

Meanwhile, income diversification activities are used to gauge individual bank financial innovation. The source of data remains a challenge for banking financial innovation, such as R&D data and other technology investment costs, and patent or license fee expenses are unfortunately not available in the bank financial report. Similarly, the data for bank competitors such as yearly development of fintech, volume transactions in the fintech industry, and e-commerce platform are less available. Hence, this study uses some countries' development financial innovation data from the World Bank, namely the number of ATMs, internet users, and cellular phone users. In addition to bank-specific factor variables, we also included a dummy variable for the global crisis year in 2008.

Our results suggest that banks that diversify their sources of income from mainly selling loans that produce interest income to provide other services that create non-interest income may enjoy higher market power. The results also show that the source of market power comes from non-traditional revenue-generating products. This assertion relates to decreases in market power when the bank is more focused on selling loans (LOANTA), as the rivals force the bank to cut its loan prices to stay competitive in the market. Countries' financial innovation variables show that having a higher number of available ATMs and more internet users lowers the percentage disparity of price and marginal cost earned by the bank and consequently makes it more competitive in the market. However, an increasing number of cellular phone users in the country increases the market power, and conjecturally it might be because more people use the online bank platform on their cellular phones, which creates more income from fees to the bank.

Other interesting findings from this study are the relationship between other bank-specific factors and the negative market power, which are quite different from previous empirical evidence that shows some positive impact on market power. Bank liquidity, capital, risk, and deposit all have a negative sign with market power. More liquid banks, better capitalization, higher risk perception, and a more significant proportion of deposits make the bank unable

to grab its market power by producing greater margins. Less income is probably created from liquid assets, as a higher degree of cost uses more capital to finance the assets. Additionally, a higher risk perception bank has to pay more to attract its customers to stay with the banks. Likewise, the deposit should offer higher interest to entice depositors.

Consequently, the bank ruins its market power and lowers its margin to keep rivals at bay. Lastly, the dummy variable for the year of crisis seems to impact bank market power negatively. This means that, during difficult periods, banks try to remain competitive and lower their margins. There are some policy implications from our findings; first, financial innovation, especially for income diversification, does not increase competition in the banking industry as the theory stated. A diversified bank could earn a greater margin from its customers. On the other side, diversification is costly for households and firms and leads to the reduction of social welfare. Thus, it becomes an alarm for

the policymaker. Second, to increase the market competition, the government needs to provide a better infrastructure for financial innovation development so that the ultimate goal of social welfare improvement can be achieved.

There are still limited studies on the impact of financial innovation on the bank market power, primarily due to the limited data source of financial innovation on the bank level and the country level. Thus, this study still lacks financial innovation data. Thus, for further studies, we recommend including data on fintech and e-commerce transactions as part of financial innovation that will impact banking competition. Therefore, a more precise determinant analysis can be obtained. Secondly, market power may help the bank identify a new source of income by exploring other activities that generate more income than interest income. Therefore, Granger Causality could be applied to measure the two methods of impact between financial innovation and market power.

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