Int. Journal of Economics and Management 14 (2): 279-289 (2020)

IJEM
International Journal of Economics and Management
Journal homepage: http://www.ijem.upm.edu.my

The Intertemporal Impacts of Market Power on Bank Risk: Evidence from the Indonesian Banking Industry

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ABSTRACT

Using a sample of listed banks in Indonesia from 2000 to 2016, we find that the nexus between market power and bank risk tends to be dynamic intertemporally. More specifically, we find that in the short-run, higher market power is associated with higher bank risk, while the impact is the opposite in the long-run. By decomposing the component of banks' Z-scores, we find two plausible channels to explain our main results. First, we find that an increase in market power is associated with an increase in the volatility of bank profit in one year lag, which might imply a tendency for 'gamble for-profits' in the short-run. Second, an increase in market power is associated with a higher capital ratio in two years lag, which suggests that banks might offset the increase in the short-term risk with more cushion. Moreover, we also find some evidence that an increase in market power is associated with a higher deposits growth in two years lag. This might suggest an indirect market discipline, in which depositors respond to the long-run impact of bank market power on bank risk. Our results are robust on several alternative econometric specifications.

JEL Classification: G21, G28

Keywords: Bank market power, Indonesia, intertemporal effect, risk-taking

Article history:
Received: 24 February 2020
Accepted: 25 August 2020

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INTRODUCTION

Bank consolidation is one of the major banking reforms to restore financial stability in dealing with financial crises. Consolidation in the banking industry, which increases bank market power, is expected to be able to increase bank franchise value. Banks with more market power will have higher franchise values to lose if they take excessive risk, and hence, market power increases their stability (e.g. Keeley, 1990; Berger et al., 2009; Turk-Ariss, 2010). This traditional 'franchise-value hypothesis' thus advocates the importance of bank consolidation to enhance banking system stability.

Boyd and De Nicolo (2005) offer the competing competition-stability hypothesis. They contend that banks with higher market power can extract more economic rents from their borrowers by charging higher lending rates. Consequently, the borrowers will respond to undertake investments with higher risks to offset the higher costs of borrowing. This, in turn, will increase the credit risk borne by the banks. Moreover, an increase in bank market power (for example through bank consolidation) may create too-big-to-fail banks. This can be detrimental for the banking system stability as these banks are prone to moral hazard, potentially exploiting government bailouts.

Given the unclear consequences of increasing market power in bank risk, some developed countries are not always in favor of bank consolidation. For instance, the Bank of England has been actively involved in the debates whether UK large banks should be split up to reduce public finance risk, while the Wall Street Reform and the Consumer Protection Act (Dodd-Frank Act) does not allow M&As in banking when the total liabilities of merged banks exceed 10% of the US financial system's total liabilities (Bertay et al., 2013). On the flip side, most developing countries still adopt regulatory-driven bank consolidation post the Asian financial crisis (AFC) of 1997/1998. This is shown by the rapid growth of bank M&As in Asia, reaching more than 25% per year since 2003 (Santoso, 2009).

As one of the developing countries whose hardest hit by the AFC[1], Indonesia has also promoted bank consolidation policy (namely the 'Indonesian Banking Architecture') to reform its banking industry after the crisis. This initiative has then been reinforced by a series of other regulatory reforms such as (1) minimum capital requirements, (2) foreign ownership limitation, (3) the establishment of anchor banks consisting of high performing banks that may acquire smaller banks, and (4) the single presence policy preventing investors to become controlling shareholders in more than one commercial bank (Hadad et al., 2013).

With the ongoing policy agenda of bank consolidation in developing countries, while the existing literature continues with the debate among the franchise-value hypothesis versus the competition-stability hypothesis, more empirical evidence is still much needed. The Indonesian banking industry is particularly suitable to test the empirical relationship between market power and bank risk for several reasons. First, Indonesia is the largest economy in Southeast Asia,[2] and hence, its banking industry has an important contribution to the developing countries' economy.[3] Second, the Indonesian banking industry has the highest net interest margin compared to other banks in Asia and is characterized by several banks having major market shares despite many numbers of banks in the industry (e.g. Yusgiantoro et al., 2019; Trinugroho et al., 2014). Third, there have been waves of bank M&As in Indonesia post the AFC and the recent global financial crisis, which is endorsed largely by the financial service authority.[4]

This paper aims to fill the gap in the literature by providing novel empirical evidence from the Indonesian banking industry. Different than most of the previous studies, using a sample of Indonesian listed banks from 2000 to 2016, we provide evidence that the relation between market power and bank risk tends to be dynamic intertemporally. More specifically, we find that in the short-run, higher market power is associated with higher bank risk, while the impact is the opposite in the long-run.

By decomposing the component of banks' Z-scores, we find two plausible channels to explain our main results. First, we find that an increase in market power is associated with an increase in the volatility of bank profit in one year lag, which might imply a tendency for 'gamble for-profits' in the short-run. Second, an increase in market power is associated with a higher capital ratio in two years lag, which suggests that banks

[1] During the AFC, Indonesia bears fiscal cost of more than 50% of gross domestic product as documented in Laeven and Valencia (2013).
[2] From the World Bank's data as of December 2019. See the following link from the World Bank: https://www.worldbank.org/en/country/indonesia/overview.
[3] The Indonesian banking industry has a return on equity (ROE) of more than 20% in 2014, which accounts for the highest ROE in the Asia-Pacific region (Vinayak et al., 2016).
[4] For example, see RHB (2019).

might offset the increase in the short-term risk with more cushion. Moreover, we also find some evidence that an increase in market power is associated with a higher deposits growth in two years lag.

The rest of this paper is organized as follows. Section 2 provides a literature review. Section 3 presents our data, variables, and methodology. Section 4 presents our empirical findings and some robustness checks. Section 5 concludes.

REVIEW OF LITERATURE

Extensive studies using a cross-country setting or a single-country setting, taking developed or developing countries into consideration, remain inconclusive regarding the impact of bank consolidation or market power on financial stability. There are two major hypotheses on the link between bank market power and financial stability: (1) the franchise value hypothesis, and (2) the competition-stability hypothesis.

According to the franchise value hypothesis, bank market power is a self-disciplining factor of risk-taking, as banks with higher market power tend to have greater franchise value. Hence, these banks tend to behave prudently due to the higher cost of failure when they default (e.g. Turk-Ariss, 2010; Fungacova and Weill, 2009; Beck et al., 2006; Keeley, 1990). Meanwhile, the competition-stability hypothesis suggests that both credit and deposit markets are characterized by the presence of asymmetric information (Boyd and De Nicolo, 2005). In this regard, banks with higher market power can charge higher lending rates to their borrowers. This will induce the borrowers to take higher risks in their investments, which then increases bank credit risk. Some empirical studies also support the competition-stability hypothesis (e.g. Fu et al., 2014; Soedarmono and Tarazi, 2016; Liu et al., 2012; Uhde and Heimeshoff, 2009; Boyd et al., 2006).

Another strand of literature extends the bank competition-stability literature in several ways. Berger et al. (2009) suggest that the franchise value hypothesis and the competition-stability hypothesis can occur simultaneously. In their findings, although bank market power is positively linked to non-performing loans (following the competition-stability hypothesis), bank market power is also positively linked to bank solvency ratio because higher market power increases bank capitalization (following the charter value hypothesis). Tabak et al. (2012) find a non-linear relationship between bank market power and financial stability. Meanwhile, Beck et al. (2013) report that the link between competition and stability in banking is conditional on the country-specific environment, including the depth of credit information sharing. Soedarmono et al. (2013) show that a financial crisis and the extent to which the banking industry benefits from the too-big-to-fail' effects can also alter the relationship between bank competition and stability.

Despite all of these findings, recent literature in developed and developing countries still finds mixed results. Using a sample of commercial banks in GCC (Gulf Cooperation Council) countries, Saif-Alyousfi et al. (2020) document that both concentration and competition can exacerbate bank risk-taking in the aftermath of the 2008 global financial crisis. Danisman and Demirel (2019) investigate the interplay of bank market power, regulation, and risk-taking in developed countries. Although their findings confirm the charter-value hypothesis in general, the role of bank market power in affecting risk-taking is also conditional on the stringency of prudential regulations. Specifically, higher capital requirements and activity restrictions tend to diminish bank risk-taking along with an increase in bank market power, while higher supervisory power exacerbates risk-taking when bank market power increases. Regarding a closely related issue about bank competition, Ariefianto et al. (2020) find that from a sample of countries around the world, higher market power proxied by net interest margins in banking tend to increase with higher bank solvency.

Using a sample of banks in the transition markets of the Commonwealth of Independent States (CIS), Clark et al. (2018) assess the nexus between bank competition and financial stability by incorporating the impact of borrowers' legal rights and supervisory power. Their findings are in favor of the competition-stability hypothesis. Using a sample of developed countries and emerging markets, Natsir et al. (2019) point out that in emerging markets, higher bank concentration exacerbates credit risk one year ahead, but reduces credit risk one year ahead when the number of foreign bank branches increases.

In the meantime, previous studies on the nexus between bank competition and risk-taking in emerging markets tend to use a cross-countries setting. Using a sample of conventional and Islamic banks in MENA countries during the 2006-2015 period, Albaity et al. (2019) find a U-shaped relationship between bank competition and stability, while the charter value hypothesis is more pronounced for Islamic banks than coventional ones. In the Asian context, Islam et al. (2020) use a sample of 63 banks in ASEAN from 2002 to 2017 and find that the effect on bank stability of higher Lerner index as a proxy of market power is different among ASEAN countries. Meanwhile, from a sample of commercial banks in four selected East Asian countries (Malaysia, Vietnam, China, Hong Kong) during 2004-2014, Phan et al. (2019) suggest that the link between bank competition and stability follows the charter value hypothesis in which higher competition leads to financial fragility.

Still in the Asian context, Soedarmono and Tarazi (2016) use a sample of Asian banks and find that higher competition in banking is beneficial for financial stability and intermediation. Fu et al. (2014) find that bank concentration and competition might affect financial stability differently depending on the measurement of bank concentration and competition. Nguyen et al. (2012) investigate the interplay of bank market power and revenue diversification on risk in South Asian banks and find that banks with higher market power tend to become more stable when revenue diversification increases.

To our knowledge, there are still relatively few studies on the bank competition-stability nexus using a single country setting from Asian countries. Jeon and Lim (2013) analyze the impact of competition on risk-taking in South Korean banks and document that commercial banks and saving banks pursue different risk-taking behavior when bank competition increases. Next, using a sample of 122 commercial banks in Indonesia, Yusgiantoro et al. (2019) support the charter-value hypothesis in general, although this finding depends on bank ownership type. Specifically, state-owned banks and small private-owned banks tend to pursue higher risk-taking when market power measured by the Lerner index increases. This finding is in line with Jimenez et al. (2013) who also investigate the bank competition-stability nexus using a single country setting, but using a developed country data. More specifically, they show that in general, the charter value hypothesis occurs in Spanish banks when the Lerner index is used to reflect bank market power in the loan market. Meanwhile, in the deposits market, the impact of bank market power on risk-taking is ambiguous. Goetz (2018) also investigates the competition-stability nexus in banking using a single-country setting focusing on the US banking industry, in which higher market contestability improves bank stability.

RESEARCH METHODOLOGY

Data

To conduct this study, we use indicators from the balance sheets and income statements of 43 publicly listed banks in Indonesia (listed on the Indonesia Stock Exchange) during the 2000-2016 period, retrieved from the Thomson-Reuters Datastream International. We focus on a sample of publicly listed banks because Hadad et al. (2011) document that market discipline is more pronounced for listed banks and hence, they are more prone to risk-taking issues than non-listed banks.[5]

Focusing on a sample of listed banks in Indonesia also enable us to understand the risk-taking behavior of large banks, given the fact that large important banks tend to suffer from moral hazard issues to exploit the presence of deposit insurance and government subsidies for banks with the too-big-to-fail effects (Soedarmono et al., 2013). Yet, several regulatory initiatives have been introduced by the regulatory authorities since 2005 to encourage large banks to acquire small banks (Hadad et al., 2013).

Variables

As a dependent variable, we initially consider the Z-score index (*ZSCORE*) for each bank *i* and year *t*, which is calculated as follows based on Barry et al. (2011).

$$ZSCORE_{i,t} = \frac{AVROA_i + AVEQTA_i}{SDROA_{it}}$$

AVROA is the average value of the return on assets (*ROA*) for bank *i* from 2000 to 2016, in which *ROA* is calculated as the ratio of net income to total assets. Meanwhile, *SDROA* is the standard deviation of *ROA* for bank *i* during the 2000-2016 period calculated on five-years rolling window. *AVEQTA* is the average value

[5] As of December 2019, the largest 29 banks of these publicly listed banks have about 76.9% of market shares of assets of the entire banking industry in Indonesia (Bloomberg and Bank of Indonesia's data).

of the ratio of total equity to total assets for bank *i* during the 2000-2016 period. Higher *ZSCORE* means that banks can cover income volatility by increasing return and capitalization. Accordingly, banks with higher *ZSCORE* exhibit lower insolvency risk.

As an alternative measure of bank risk, we also use a proxy of bank credit risk (*LLPTA*) as a dependent variable for robustness consideration. *LLPTA* is the ratio of loan loss provisions to total assets. Higher *LLPTA* means that banks exhibit higher credit risk.

Moreover, we also follow Barry et al. (2011) by examining the impact of bank market power on the decomposition of *ZSCORE* to identify channels through which bank market power can affect bank insolvency risk. These include *SDROA* and the following indicators (*ZP* and *ZCAP*).

$$ZP_{i,t} = \frac{AVROA_i}{SDROA_{it}}; \quad ZCAP_{i,t} = \frac{AVEQTA_i}{SDROA_{it}}$$

ZP is the measure of risk-adjusted profit, while *ZCAP* is the measure of risk-adjusted bank capital. Higher *ZP* and *ZCAP* are associated with lower bank riskiness, while higher *SDROA* reflects higher bank profits volatility due to risk-taking.

As an additional analysis, we also assess whether market discipline occurs in Indonesian banking due to changes in bank market power. For this purpose, we consider two measures of deposits growth as a proxy to assess the existence of market discipline following Soedarmono and Tarazi (2016). Specifically, we calculate deposits growth weighted by total assets (*DDEPO*) and actual deposits growth (*GDEPO*) as in the following formula in which *D* and *TA* represent total deposits and total assets, respectively.

$$DDEPO_{i,t} = \left(D_{i,t} - D_{i,t-1}\right) / 0.5\left(TA_{i,t} + TA_{i,t-1}\right)$$
$$GDEPO_{i,t} = \left(D_{i,t} - D_{i,t-1}\right) / D_{i,t-1}$$

For the main explanatory variable, we compute bank market power using the Lerner index (*LERNER*). Higher *LERNER* means bank higher market power. *LERNER* is constructed as follows, in which *i* and *t* represent bank index and time index, respectively.

$$LERNER_{i,t} = \frac{Price_{i,t} - MC_{i,t}}{Price_{i,t}}$$

Price is defined as the ratio of total revenue to total assets, in which total revenue is the sum of total interest revenue and non-interest revenue. Meanwhile, banks' marginal cost (*MC*) is calculated as follows:

$$MC_{i,t} = \frac{TC}{TA}\left(\propto_1 + \propto_1 \ln(TA) + \sum_{j=1}^{2} \gamma_j \ln(W_j)\right)$$

TC is calculated as the sum of interest expenses and non-interest expenses. Regarding the marginal cost measurement, two input factors following Fu et al. (2014) are considered due to data availability. These two input factors are represented by W_j. Specifically, W_1 is the cost of deposits measured by the ratio of interest expenses to total customer deposits (i.e. savings, current account, and demand deposits), and W_2 is the ratio of total non-interest expenses to total assets. Eventually, *TC* is represented by the following formula:

$$\ln(TC) = \propto_0 + \propto_1 \ln(TA) + \frac{1}{2}\propto_2 (\ln(TA))^2 + \sum_{j=1}^{2} \beta_j \ln(W_j) + \sum_{j=1}^{2}\sum_{k=1}^{2} \beta_{jk} \ln(W_j) \ln(W_k) + \sum_{j=1}^{2} \gamma_j \ln(TA) \ln(W_j) + \varepsilon$$

Moreover, we also incorporate bank-level indicators as control variables. These include: (1) the cost-to-income ratio (*CTI*) calculated as the ratio of total operating expenses to total operating income, (2) the ratio of total equity to total assets (*EQTA*), (3) the ratio of total loans to total assets (*LTA*) and (5) the logarithm of bank total assets (*SIZE*).

CTI is the measure of bank efficiency. Higher efficiency is likely to strengthen bank stability since higher efficiency contributes to increasing profitability that enables banks to maintain sufficient levels of capitalization. *EQTA* is the measure of bank capital ratio, which is expected to positively affect bank stability. On the contrary, *LTA* can be a source of bank riskiness following prior literature highlighting that excessive lending is associated with higher bank risk-taking (e.g. Foos et al., 2010; Soedarmono et al., 2017). Finally, *SIZE* is incorporated to control for the extent to which bank moral hazard occurs, because of the expectation that large banks will be rescued by the government in case of failure (Beck et al., 2013).

Methodology

Regarding research methodology, we conduct our analysis in several stages. First, we regress bank risk measures on bank market power (*LERNER*) and a set of control variables as shown in Eq. (1).

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 LERNER_{it} + \beta_3 CTI_{it} + \beta_4 EQTA_{it} + \beta_5 LTA_{it} + \beta_6 SIZE_{it} + \varepsilon_{it} \quad (1)$$

Second, we repeat the first stage, but we replace the contemporaneous *LERNER* variable with *LERNER(-1)* and *LERNER(-2)* to take into account the dynamic intertemporal impacts of market power on bank risk as in Eq. (2).

$$Y_{it} = \alpha_0 + \alpha_1 Y_{it-1} + \alpha_2 LERNER_{it-1} + \alpha_3 LERNER_{it-2} + \alpha_4 CTI_{it} + \alpha_5 EQTA_{it} + \alpha_6 LTA_{it} + \alpha_7 SIZE_{it} + \varepsilon_{it} \quad (2)$$

This approach follows Foos et al. (2010) who consider the effect of bank loan growth on riskiness from one year to four years lags, though we only consider one to two year lags due to data limitation. In Eq. (1) and Eq. (2), *Y* represents one of the dependent variables reflecting bank risk measures (*ZSCORE*, *LLPTA*).

In estimating Eq. (1) and Eq. (2), we use a two-step dynamic panel data model or the so-called the system GMM (generalized methods of moments) following prior literature on bank riskiness (e.g. Foos et al., 2010; Soedarmono et al., 2017). This is because bank risk is likely dependent on its past value and using the two-step GMM estimator developed by Arrelano and Bover (1995) and Blundell and Bond (1998) is more efficient than the standard GMM estimator (Hadad et al., 2011; Baltagi, 2005). Moreover, because *LERNER* is based on econometric estimation affected by bank-level variables, we consider *LERNER* as a predetermined variable because *LERNER* might be affected by other bank-specific factors.

Considering the system GMM estimation also enables us to measure the contemporaneous impact, as well as the dynamic intertemporal effects of market power on bank risk. We use the orthogonal transformation of instruments to account for bank-specific characteristics, in addition to incorporating time-specific dummy variables. To ensure the robustness of our results, we also implement the first difference transformation of instruments based on Arellano and Bond (1991). Overall, the system GMM is reliable when the AR(2) test and the Hansen-J test are both not significant.

RESULTS AND DISCUSSIONS

Market power and bank risk

Table 1 presents the descriptive statistics of dependent and independent variables as stated earlier, while Table 2 shows the structure of correlation among variables. In Table 1, we have already eliminated outliers in *LTA* (the loan-to-asset ratio), because total loans cannot exceed total assets. We also notice that the correlation of independent variables is not strong enough, suggesting that multicollinearity issues are less likely to occur.

Table 1 Descriptive statistics

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
ZSCORE	Solvency ratio	265	40.29453	64.8036	-1.59559	563.5978
ZP	Portfolio risk	265	3.645247	8.590535	-50.1368	78.6934
ZCAP	Leverage risk	265	36.64928	58.39538	0.159647	507.21
SDROA	Income volatility	265	0.015786	0.030862	0.000149	0.23958
LLPTA	Ratio of loan loss provisions to total assets	428	0.02143	0.060238	-0.43509	0.4984
LERNER	Bank market power	543	0.316903	0.134752	-0.04511	0.58597
CTI	Ratio of total cost to total gross income	543	0.091612	0.028828	0.01044	0.26966
EQTA	Ratio of total equity to total assets	550	0.124915	0.080822	-0.27488	0.88859
LTA	Ratio of total loans to total assets	503	0.58038	0.160565	0.08489	0.93661
SIZE	Logarithm of total assets	550	30.22067	1.904143	23.8498	33.4837

Source and notes: Authors' calculation.

Table 2 Correlation matrix

Variables	*ZSCORE*	*ZP*	*ZCAP*	*SDROA*	*LERNER*	*LLPTA*	*CTI*	*EQTA*	*LTA*	*SIZE*
ZSCORE	1									
ZP	0.7714	1								
ZCAP	0.9956	0.7083	1							
SDROA	-0.2527	-0.1765	-0.2543	1						
LERNER	-0.1108	0.084	-0.1353	-0.2641	1					
LLPTA	-0.0932	-0.0986	-0.0889	0.1364	0.1064	1				
CTI	-0.1022	-0.1588	-0.09	0.2084	-0.3041	0.1219	1			
EQTA	-0.0793	-0.0965	-0.0738	-0.1533	0.3277	-0.0068	-0.2288	1		
LTA	-0.0583	-0.0588	-0.056	0.0243	0.1896	-0.2587	0.0851	0.1803	1	
SIZE	-0.1352	0.1211	-0.1679	-0.013	0.6927	0.1882	-0.2397	-0.0224	0.0868	1

Source and notes: Authors' calculation.

In Table 3, we document that higher market power measured by *LERNER* is associated with lower *ZSCORE*, suggesting that market power adversely affects bank stability (or increases bank risk). This result is consistent with the competition-stability hypothesis (Boyd and De Nicolo, 2005) in the Asian context (e.g. Soedarmono and Tarazi, 2016). However, when we consider the lagged values of *LERNER*, we find that higher *LERNER* is associated with higher bank stability (*ZSCORE*) and lower credit risk (*LLPTA*) within a time lag of two years. Our results are therefore consistent with the charter-value hypothesis (Turk-Ariss, 2010; Fungacova and Weill, 2009; Berger et al., 2009; Keeley, 1990), in which higher market power is associated with lower bank risk. These findings are robust regardless of whether we consider orthogonal deviation transformation of instruments or first difference transformation of instruments. Overall, our findings in Table 3 are also valid, because the AR(2) test and the Hansen-J test as validity tests for the system GMM are not statistically significant.

Table 3 Market power and bank risk

Explanatory variables	Dependent variables							
	Orthogonal deviation				*First difference*			
	ZSCORE	*ZSCORE*	*LLPTA*	*LLPTA*	*ZSCORE*	*ZSCORE*	*LLPTA*	*LLPTA*
Dep. var(-1)	0.45164***	0.45475***	-0.00232	-0.09722	0.45963***	0.47083***	-0.01306	-0.09929**
	(0.010)	(0.016)	(0.016)	(0.138)	(0.012)	(0.014)	(0.020)	(0.037)
LERNER	-37.24602*		0.19061***		-41.11692*		0.11619***	
	(21.592)		(0.057)		(24.664)		(0.039)	
LERNER(-1)		-34.47142**		0.09404		-51.07124**		0.05608
		(15.204)		(0.229)		(19.279)		(0.064)
LERNER(-2)		40.24939***		-0.07942**		59.45336***		-0.06713***
		(13.276)		(0.034)		(12.385)		(0.022)
CTI	-150.00438*	-132.05123	0.30262***	0.30380**	-169.37287**	-89.39300	0.37080***	0.34153***
	(75.768)	(104.671)	(0.092)	(0.117)	(66.622)	(87.031)	(0.075)	(0.058)
EQTA	18.51391	-7.27493	-0.13411**	0.04797	3.85543	-10.58986	-0.07509	0.06621
	(21.196)	(27.072)	(0.057)	(0.194)	(20.192)	(26.163)	(0.045)	(0.070)
LTA	27.46226**	20.25086**	-0.08393***	-0.04504	32.49820***	16.41481*	-0.07529***	-0.04731***
	(10.365)	(9.793)	(0.017)	(0.048)	(8.226)	(9.523)	(0.016)	(0.017)
SIZE	-0.03380	-2.05980	-0.00382	0.00325	1.08784	-1.71303	0.00047	0.00608*
	(1.601)	(2.173)	(0.003)	(0.010)	(1.608)	(2.095)	(0.002)	(0.003)
Observations	211	211	382	376	211	211	382	376
Number of banks	31	31	38	38	31	31	38	38
AR(2) test	0.551	0.551	0.379	0.500	0.532	0.472	0.347	0.280
Hansen-J test	0.786	0.787	0.998	0.996	0.699	0.620	0.998	0.998

Source and notes: Authors' calculation. Regressions are carried out using the system GMM model taking into account time-specific characteristics. Standard errors are in parentheses. *** indicates significance at the 1% level, while ** and * indicate significance at the 5% and 10% levels, respectively.

In the next turn, Table 4 presents whether bank market power also affects the decomposition of *ZSCORE* comprising *SDROA*, *ZP* or *ZCAP* to examine channels through which bank market power can affect risk-taking. We show that higher market power exacerbates the volatility of bank profit (*SDROA*) in one year, but bank market power can no longer affect it in two years lag. Aside from *SDROA*, *ZCAP* is also positively affected by bank market power with a time lag of two years. In other words, banks might offset the increase in the short-term risk with more cushion in two years. Our regression models in Table 4 are also valid because the AR(2) test and the Hansen-J test are not statistically significant.

Table 4 Market power and the decomposition of bank *ZSCORE*: Orthogonal deviation transformation of instruments

	Dependent variables					
	Orthogonal deviation					
Explanatory variables	*SDROA*	*SDROA*	*ZP*	*ZP*	*ZCAP*	*ZCAP*
Dep. var(-1)	0.69383***	0.82441***	0.35886***	0.38356***	0.43186***	0.42675***
	(0.052)	(0.032)	(0.068)	(0.078)	(0.012)	(0.015)
LERNER	-0.04974		-7.95035		-30.74682	
	(0.032)		(7.290)		(22.005)	
LERNER(-1)		0.03367**		-7.64116		-23.00823
		(0.013)		(6.379)		(14.281)
LERNER(-2)		-0.00148		-7.44205		46.27677***
		(0.006)		(6.636)		(12.765)
CTI	0.07956**	0.06401***	-24.67500**	-19.38798	-132.65318*	-179.57501*
	(0.034)	(0.019)	(11.852)	(19.706)	(70.820)	(103.318)
EQTA	0.05245	-0.01430*	3.32134	4.31086	13.81026	-29.80689
	(0.039)	(0.008)	(5.192)	(8.855)	(19.227)	(26.376)
LTA	0.00430	-0.00595	2.96900	3.84398	26.59707**	17.05597
	(0.011)	(0.004)	(2.250)	(3.367)	(10.144)	(10.716)
SIZE	0.00273*	-0.00189**	0.59351	0.58334	-0.29112	-2.50839
	(0.002)	(0.001)	(0.447)	(0.519)	(1.300)	(2.057)
Observations	211	211	211	211	211	211
Number of banks	31	31	31	31	31	31
AR(2) test	0.548	0.479	0.616	0.610	0.596	0.577
Hansen-J test	0.882	0.937	0.940	0.773	0.861	0.653

Source and notes: Authors' calculation. Regressions are carried out using the system GMM model taking into account time-specific characteristics. Standard errors are in parentheses. *** indicates significance at the 1% level, while ** and * indicate significance at the 5% and 10% levels, respectively.

For a robustness check regarding the impact of bank market power on the decomposition of *ZSCORE*, we repeat regression models presented in Table 4, but we now consider the first difference transformation of instruments instead of using orthogonal deviation transformation. Table 5 presents these findings using the first difference transformation of instruments. Our previous results in Table 4 are not altered and all regressions in Table 5 are valid, as the AR(2) test and the Hansen-J test are not statistically significant. In summary, our findings suggest that the nexus between market power and bank risk tends to be dynamic intertemporally. In other words, the competition-stability hypothesis and the charter-value hypothesis might co-exist and dynamically interchanges intertemporally.

Table 5 Market power and the decomposition of bank *ZSCORE*: First difference transformation of instrument

	Dependent variables					
	First difference					
Explanatory variables	*SDROA*	*SDROA*	*ZP*	*ZP*	*ZCAP*	*ZCAP*
Dep.var(-1)	0.77508***	0.91793***	0.35952***	0.37613***	0.44558***	0.45519***
	(0.097)	(0.017)	(0.011)	(0.096)	(0.015)	(0.014)
LERNER	-0.06073		-6.85262			
	(0.044)		(2.808)			
LERNER(-1)		0.02679***		-4.36539		-38.28763**
		(0.008)		(19.463)		(16.627)
LERNER(-2)		-0.02117***		-3.60546		62.06619***
		(0.004)		(19.695)		(13.054)
CTI	0.03224	0.04578***	-19.45957**	-16.54446	-175.71524***	-74.48732
	(0.037)	(0.015)	(7.558)	(80.535)	(61.403)	(80.880)
EQTA	0.05818	0.00512	6.13793***	2.88049	-2.31237	-14.39525
	(0.043)	(0.005)	(1.296)	(25.531)	(19.286)	(22.885)
LTA	0.00771	0.00094	2.50547**	3.35660	32.85388***	13.78948
	(0.017)	(0.003)	(1.070)	(29.271)	(7.747)	(9.194)
SIZE	0.00299	-0.00041	0.59495***	0.11106	0.32506	-3.14177*
	(0.002)	(0.001)	(0.146)	(0.615)	(1.398)	(1.562)
Observations	211	211	211	211	211	211
Number of banks	31	31	31	31	31	31
AR(2) test	0.530	0.491	0.531	0.663	0.588	0.485
Hansen-J test	0.921	0.839	0.579	0.052	0.721	0.614

Source and notes: Authors' calculation. Regressions are carried out using the system GMM model taking into account time-specific characteristics. Standard errors are in parentheses. *** indicates significance at the 1% level, while ** and * indicate significance at the 5% and 10% levels, respectively.

As additional robustness checks, we also modify regression models in several ways[6]. First, we exclude all control variables and our previous findings describing that higher bank market power reduces risk-taking after two years are not altered. Second, we exclude *SIZE* as a control variable, because all listed banks are considered as large banks that are not substantially different. By doing so, our findings discussed earlier regarding the intertemporal effects of bank market power on risk-taking remain consistent. Finally, we repeat all the regression models from Table 3 to Table 5, but we consider the one-step GMM estimation instead of the system GMM. Using this specification, all the findings presented earlier are also relatively consistent.

Additional analysis: Bank market power and market discipline

In order to assess the presence of market discipline in the nexus between bank market power and risk-taking, we use *DDEPO* or *GDEPO* as dependent variables. Because higher market power can reduce bank risk-taking with a time lag of two years, we directly assess whether *LERNER* with a time lag of one to two years can affect the deposit growth following Eq. (2). Table 6 documents that higher market power is indeed associated with higher deposit growth two years ahead. Accordingly, we characterize the presence of market discipline by depositors in Indonesian banking after two years following an increase in bank market power. Specifically, bank depositors tend to react positively by increasing their deposits in the banking system along with higher bank market power after two years, because higher bank market power reduces risk-taking in two years lag as discussed earlier from Table 3 to Table 5. In summary, this finding might suggest an indirect market discipline, in which depositors respond to the long-run impact of bank market power on bank risk. All models presented in Table 6 are also robust because the AR(2) test and the Hansen-J test are not statistically significant.

Table 6 Market power and bank deposits growth: Additional analysis

	Dependent variables			
	Orthogonal deviation		*First difference*	
Explanatory variables	*DDEPO*	*GDEPO*	*DDEPO*	*GDEPO*
Dep.var(-1)	0.20006***	0.12975*	0.18928***	0.19013**
	(0.066)	(0.066)	(0.062)	(0.081)
LERNER(-1)	0.24818	0.42415**	0.13358	0.23484
	(0.162)	(0.192)	(0.159)	(0.224)
LERNER(-2)	0.37974***	0.23867*	0.38086**	0.18356
	(0.140)	(0.126)	(0.152)	(0.165)
CTI	-3.34961***	-3.15919***	-3.96898***	-3.78663***
	(0.605)	(0.817)	(0.659)	(0.803)
EQTA	-0.76046***	-1.35200***	-0.87762***	-1.30426***
	(0.251)	(0.384)	(0.304)	(0.413)
LTA	-0.17278**	-0.12091*	-0.22796**	-0.16354
	(0.069)	(0.061)	(0.091)	(0.104)
SIZE	-0.06100***	-0.06444***	-0.05549***	-0.04997***
	(0.009)	(0.010)	(0.010)	(0.012)
Observations	420	398	420	398
Number of index	40	39	40	39
AR(2) test	0.654	0.175	0.820	0.347
Hansen-J test	0.570	0.836	0.595	0.504

Source and notes: Authors' calculation. Regressions are carried out using the system GMM model. Standard errors are in parentheses. *** indicates significance at the 1% level, while ** and * indicate significance at the 5% and 10% levels, respectively.

CONCLUSIONS

This paper contributes to prior literature on the effect of bank competition on financial stability by investigating whether there is a dynamic intertemporal effect of bank market power on bank risk. Using a sample of 43 listed banks in Indonesia from 2000 to 2016, we find that the nexus between market power and bank risk tends to be dynamic intertemporally. More specifically, we find that in the short-run, higher market power is associated with higher bank risk, while the impact is the opposite in the long-run.

By decomposing the component of banks' Z-scores, we find that an increase in market power is associated with an increase in the volatility of bank profit in one year lag, but is associated with a higher

[6] The results of these robustness checks are not presented in this present paper for brevity, but are available on request to the authors.

capital ratio in two years lag. This might suggest that banks offset the increase in the short-term risk with more cushion.

Moreover, we also find some evidence that an increase in market power is associated with a higher deposits growth in two years lag. This might suggest an indirect market discipline, in which depositors respond to the long-run impact of bank market power on bank risk.

To summarize, our findings support the bank consolidation agenda in developing countries to enhance the banking system stability and encourage market discipline by depositors in the long-run.

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