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Competition in dual markets: Implications for banking system stability

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ABSTRACT

This paper investigates whether Islamic and conventional banks' stability is differently impacted by competition in dual markets where the two bank types operate alongside each other. Using a sample of 123 Islamic and 647 conventional banks from 29 countries for a period between 2010 and 2018, we find robust evidence that competition erodes the stability of conventional banks only. The stability of Islamic banks is not impacted specifically where religion is more prevalent. Focusing more deeply on religiosity and the institutional environment, such as the ease of doing business and economic freedom, we also find that such factors matter in differently shaping the competition-fragility nexus for the two types of banks.

1. Introduction

There is an intense debate in the banking literature on the relationship between competition and stability. A seminal paper by Keeley (1990) initiated the debate by showing that a high level of competition erodes the charter or franchise value (present value of future profitability), which therefore reduces banks' incentives to behave prudently. Under this 'competition-fragility' view, banks cannot earn monopoly rents in a competitive market and hence suffer from weaker profits and lower stability. This hypothesis is supported by some works (Hellmann, Murdock, & Stiglitz, 2000; Jiménez, Lopez, & Saurina, 2013; Repullo, 2004). Boyd and Nicoló (2005) challenge this argument by promoting the 'competition-stability' hypothesis. Increased competition in the banking market will force banks to give a lower loan rate to the borrower. Accordingly, banks' probability of default is reduced because borrowers have a higher probability of loan repayment. Boyd, De Nicoló, and Jalal (2006) and Schaeck, Cihak, and Wolfe (2009), among others, support this view.

In the present paper, we address the relationship between competition and stability in the dual banking market where Islamic and conventional banks operate alongside one another by specifically focusing on the role played by religiosity and the institutional environment. This is a major issue in banking studies because in twelve of the countries that have successfully adopted a dual banking

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system, Islamic banking has been categorized as systematically important as the market share of Islamic banks has reached 15% (Islamic Financial Service Board, 2018). The remarkable growth of Islamic banks in dual markets is likely to have an impact on banks' stability. Are Islamic banks more stable than conventional banks? Does the banking system respond positively to the intensified competition between the two bank types? Do religiosity and the institutional environment play a role in shaping such responses? This paper aims to answer these questions. Additionally, the issue of competition and stability in a dual banking market is interesting because in such banking systems, two types of banks compete to attract customers. Despite the fact that Islamic banks are relatively new to the market, conventional banks' behavior in the dual market has changed in reaction to this situation. A recent study by Meslier, Risfandy, and Tarazi (2017) shows that conventional banks counter Islamic banks' competitive pressure by setting higher deposit rates when their market power is lower. The behavior of conventional banks, in this case, could jeopardize their financial stability.

Despite the importance of the competition-stability nexus in the dual banking system, this issue is still relatively unexplored in the literature. Most of prior works investigate competition and stability separately. Some papers look at competition in the dual banking system per se (Cupian & Abduh, 2017; Hamza & Katchouli, 2014; Turk-Ariss, 2010; Weill, 2011). Others focus on the risk and stability of Islamic banks (Abedifar, Molyneux, & Tarazi, 2013; Beck, Demirgüç-Kunt, & Merrouche, 2013; Fakhfekh, Hachicha, Jawadi, Selmi, & Idi Cheffou, 2016). A few papers have however started to investigate both dimensions simultaneously. By using data on Islamic and conventional banks from 16 countries over the 2000–2012 period, Kabir and Worthington (2017) find that a one standard deviation shock to the Lerner index results in an increase in stability of both Islamic and conventional banks. Their result indicates that lower competition is associated with higher stability. Albaity, Mallek, and Noman (2019) also find that banks facing higher competition tend to be less profitable and more exposed to default and credit. Furthermore, Alam, Hamid, and Tan (2018) find a positive relationship between competition and bank fragility. Conversely, the results of Azmi, Ali, Arshad, and Rizvi (2019), show no impact of competition on bank stability possibly because of no differences in the business models of Islamic and conventional banks. Last, Ibrahim, Salim, Abojeib, and Yeap (2019) provide evidence supporting the competition-stability nexus in the case of Malaysia, particularly for the conventional banking sector.

To investigate the competition-stability issue in dual markets, we employ a dataset containing 123 Islamic and 647 conventional banks from 29 countries where the dual banking market applies for the 2010–2018 period. We use a z-score to proxy bank stability following prior studies (Beck et al., 2013; Cihák & Hesse, 2007; Fiordelisi & Mare, 2014; Fu, Lin, & Molyneux, 2014; Hassan, Khan, & Paltrinieri, 2019; Laeven & Levine, 2009) and different proxies of competition. The efficiency-adjusted Lerner index proposed by Koetter, Kolari, and Spierdijk (2012) has been widely used (Tabak, Fazio, & Cajueiro, 2012; Tan & Floros, 2018) as a proxy of banks' competitivity or market power. We also use a concentration ratio as a market-level measure of competition following Akins, Li, Ng, and Rusticus (2016) in order to complement the bank-level adjusted Lerner index that we use. We use the adjusted Lerner index rather than the conventional measure of Lerner because the former considers that banks could fail to fully exploit output pricing opportunities due to market power, unlike the latter that assumes full efficiency (Koetter et al., 2012). It is therefore argued that the adjusted Lerner index is a more accurate competition proxy than the conventional one (Tan & Floros, 2018).

Our baseline result shows that in the dual market, competition differently impact the stability of Islamic and conventional banks. More specifically, competition in the dual market erodes conventional banks' stability but not that of Islamic banks, supporting the competition-fragility hypothesis especially in the case of conventional banks. This result supports Meslier et al.'s (2017) finding that the way in which Islamic banks compete with their peers in the dual banking market could be very specific. Moreover, Demirgüç-Kunt, Klapper, and Randall (2013) and Gheeraert (2014) show a form of asymmetric competition in which Islamic banks only compete with other Islamic banks but conventional banks compete with both bank types. This is possibly because Islamic banks' function is mainly to fulfill the need of religious customers who hesitate to use conventional banking products (Demirgüç-Kunt et al., 2013; Gheeraert, 2014). Islamic banks might benefit from captive clients, making them more stable even in a highly competitive market. This empirical evidence suggests that: (1) the competitive conditions in dual banking markets is complex and of high degree; (2) because the religious environment exerts a significant impact on dual market competitive conditions, it may also differently shape stability for Islamic and conventional banks.

In what follows, we therefore investigate whether the competition-fragility nexus is altered by religious penetration in countries with a dual banking system. This investigation is also motivated by several prior works highlighting the benefits of religiosity to Islamic banks (Bitar, Hassan, & Walker, 2017; Bitar & Tarazi, 2019; Meslier et al., 2017; Meslier, Risfandy, & Tarazi, 2020). Following Abedifar, Hasan, and Tarazi (2016) and Meslier et al. (2017, 2020), Muslim population and Islamic banks' market share are used to proxy Islamic presence at a country-level. We therefore empirically find that conventional banks' stability diminishes with an increase in Muslim population. Interestingly, the high level of Muslim population turns out to promote conventional banks' stability especially in the less competitive markets. This evidence suggests that the adverse impact of Islamic penetration on conventional banks' stability is not always present, as prior literature suggests that, e.g., the efficiency of conventional banks increases because of Islamic penetration (Abedifar et al., 2016; Gheeraert & Weill, 2015). Regarding Islamic banks, the latter exhibit higher stability in countries with more concentrated and higher Islamic banking market shares. Competition could exert a less negative impact on Islamic banks' stability when there is a larger share of Islamic banks in the banking market. Our result therefore emphasizes the role of Islamic presence in countries with a dual banking system by showing that it can differently shape the relationship between competition and fragility.

Besides religious factors, in this paper we also investigate the role of institutional factors because a certain level of institutional development is empirically found to be a precondition for increasing competition in banking markets (Delis, 2012). Recent works also indicate that country-level factors such as culture, regulatory environment, rule of law, and other institutional quality factors could significantly impact the soundness of banks in dual markets (Bitar et al., 2017). We therefore account for such factors by considering the doing business index (index which captures the ease of doing business) and the economic freedom index (index showing the degree of freedom in performing an economic activity) to represent the institutional environment by following prior works (Anginer,

Demirguc-Kunt, & Zhu, 2014; Meslier et al., 2020; Soedarmono, Machrouh, & Tarazi, 2011; Sufian & Habibullah, 2010). Our empirical findings show that those two institutional factors significantly alter the impact of competition on stability. Specifically, we find that in countries with higher freedom of doing economic activities, the adverse impact of market concentration on conventional banks' stability is reduced. Similarly, in countries where doing business is easier the negative impact of market concentration is lower. Our overall result supports the role of the institutional environment in promoting the stability of dual banking markets.

Our study contributes to the empirical literature on the relationship between competition and stability in several aspects. First, although most studies show that Islamic banks' performance (profitability and stability) does not differ much from that of conventional banks (Abedifar, Ebrahim, Molyneux, & Tarazi, 2015; Narayan & Phan, 2017), we stress that the two types of banks do behave differently particularly when they respond to intensified competition in dual banking markets. Second, we emphasize the role of religiosity that favor Islamic banks by showing that religiosity-related factors significantly weaken the adverse impact of dual market competition. Although this issue has been addressed in several prior works (Abedifar et al., 2016; Bitar & Tarazi, 2019; Meslier et al., 2017, 2020), the issue of how religiosity specifically affects the competition-stability nexus has not been uncovered yet. Third, in this paper we also highlight the role of institutional quality factors such as the ease of doing business and the freedom of performing economic activities that is still largely unexplored in the Islamic banking literature. As highlighted by Bitar et al. (2017), institutional factors should be a focus of current Islamic banking research and we follow this line of reasoning. Fourth, by using a larger sample and more recent dataset, we complement prior empirical works (Alam et al., 2018; Albaity et al., 2019; Ibrahim et al., 2019; Kabir & Worthington, 2017) supporting the competition-fragility hypothesis in dual banking markets where the two types of banks operate alongside each other.

The structure of our paper is as follows. Section 2 explains the data, variables, and methodology we use. Section 3 presents the results we obtain in this paper, including further analysis and robustness tests. Section 4 concludes the paper.

2. Data, variables, and methodology

2.1. Data

In this paper, we focus on countries with both Islamic and conventional banks for a period between 2010 and 2018. All of our bank-level variables are extracted from the Orbis BankFocus database whereas country-level data is extracted from various sources. The rates of inflation, the gross domestic products (GDP), the GDP growth, and the index of doing business are obtained from the World Bank website. In this paper, we also use the economic freedom index and percentage of the Muslim population that is retrieved from

Table 1
Variable explanations.

Variable	Explanations	Main reference(s)	Source(s)
LogZ	Log of z-score to proxy bank stability	Fu et al. (2014), Beck et al. (2013)	Bankscope, Authors calculation
LogZ_alt	Log of z-score as alternative proxy of bank stability	Lepetit and Strobel (2013)	Bankscope, Authors calculation
NPL	Non-performing loans to total assets ratio to proxy bank stability and distance-to-default	Schenck (2014), Albaity et al. (2019), Kasman and Kasman (2015)	Bankscope, Authors calculation
ELerner	Efficiency-adjusted Lerner index to proxy bank competition	Koetter et al. (2012), Tan and Floros (2018)	Bankscope, Authors calculation
Lerner	Lerner index using trans-log cost function with two-factor prices	Fu et al. (2014)	Bankscope, Authors calculation
Conc3	Total banks' deposits by the three largest banks within a country divided by total deposits that country	Akins et al. (2016)	Bankscope, Authors calculation
HHI	Herfindahl-Hirschman Index based on banks' deposits	Akins et al. (2016)	Bankscope, Authors calculation
MPOP	Ratio of Muslim population to total population	Meslier et al. (2017, 2020)	CIA World Factbook
ShareIB	Market share of Islamic banks	Meslier et al. (2017, 2020)	Bankscope, Authors calculation
EcoFree	Economic freedom index to measure human control on his or her own labor and property	Mirzaei and Moore (2014)	The Heritage Foundation
DoingBuss	Doing Business index to measure the ease of doing business	Meslier et al. (2020)	The World Bank
NIM	Net interest margins	Soedarmono et al. (2011), among many others	Bankscope, Authors calculation
EQTA	Equity to total assets ratio	Ibrahim et al. (2019), among many others	Bankscope, Authors calculation
LATA	Liquid assets to total assets ratio	Arif (2020) among many others	Bankscope, Authors calculation
LogTA	Logarithm of banks' total assets to proxy bank size	Ibrahim et al. (2019), among many others	Bankscope, Authors calculation
INFL	Inflation rate	Ibrahim et al. (2019), among many others	The World Bank Data
GDPGR	Growth of the GDP	Ibrahim et al. (2019), among many others	The World Bank Data
LogGDP	Logarithm of the GDP	Soedarmono et al. (2011), among many others	Bankscope, Authors calculation

the Heritage Foundation and CIA World Factbook respectively. Table 1 describes all variables used in this study and Table 2 presents the descriptive statistics of the bank-level variables after winsorizing extreme values at the 1% and 99% percentiles. Our final sample covers 123 Islamic banks and 647 conventional banks from 29 countries as illustrated in Table 3.

2.2. Dependent variable: z-score

We use the z-score, which has been extensively applied in the banking literature, to measure bank stability. The z-score measures the standard deviation that the banks' return has to diminish to deplete equity. The z-score is computed as follows.

$$Z_{it} = \frac{ROA_{it} + EQTA_{it}}{SDROA} \quad (1)$$

where ROA is return on assets for bank *i* and year *t*, *EQTA* is the capital asset ratio for bank *i* and year *t*, and *SDROA* is the standard deviation of *ROA* calculated over the full sample. According to Lepetit and Strobel (2013), the z-score computation method, as seen in Eq. (1), are practical because it provides a time-varying z-score without requiring initial observations to be dropped as in the rolling approach. The standard deviation of ROA (*SDROA*) that was computed over the full sample as in Eq. (1), after being tested by Lepetit and Strobel (2013), also provides a lower average RMSE (Root Mean Squared Error) than the rolling moment method. Moreover, our approach in Eq. (1) has also been used by many works previously (Beck et al., 2013; Čihák & Hesse, 2007; Fiordelisi & Mare, 2014; Fu et al., 2014; Hassan et al., 2019; Laeven & Levine, 2009). Because the distribution of the z-score is highly skewed, we use a logarithm of the z-score (Anginer, Demirgüç-Kunt, & Zhu, 2014; Berglund & Mäkinen, 2019; Laeven & Levine, 2009). A higher value of the z-score means a lower probability of insolvency risk and therefore better bank stability.

For robustness, we also use the time-varying z-score proposed by Lepetit and Strobel (2013). This measure uses the mean and standard deviation estimates of the return on assets calculated over the full sample period and combines these with the current value of the capital ratio. As argued by Lepetit and Strobel (2013), this is a very straightforward measure to implement within a more general approach.

2.3. Independent variables: concentration ratio and efficiency-adjusted Lerner index

The degree of competition in the banking market can be proxied based on either a traditional industrial organization approach or newer approaches. The former approach investigates the extent of market competition indirectly through the structural-conduct-performance (SCP) hypothesis, which explains that the bank's market power can be examined through the bank's performance. Researchers usually use the concentration ratio, market share, or Herfindahl-Hirschman Index (HHI). Following Akins et al. (2016), we use the concentration of banks' deposits as our traditional measure of competition. More specifically, our main variable *Conc3* is total banks' deposits by the three largest banks within a country divided by total deposits in that country. Alternatively, we also use HHI especially in the robustness section. HHI is the sum of the squared of the market share of each bank in a country.

The latter approach, which is a newer approach, stems from the inadequacy of traditional measurements because the measures of bank performance in the SCP paradigm do not appropriately capture the degree of bank market power (Claessens & Laeven, 2004). The popular measurements in a newer approach are the Panzar-Rosse (PR) model, the Lerner index, the efficiency-adjusted Lerner index, and the Boone index. The Panzar-Rosse (PR) model has several drawbacks. First, this proxy might not represent a continuous proxy of market competition and the interpretation of its value (*H*-Statistics) is less straightforward (Turk-Ariss, 2010). Second, the *H*-Statistics suffers from a degree of uncertainty because the PR model is based on a static model and the value of *H*-Statistics ranges between -∞ and 1 (Tan & Floros, 2018; van Leuvensteijn, Bikker, van Rixtel, & Sørensen, 2011). Third, PR *H*-Statistics is calculated at the aggregate level (year level across the sample or country levels across the year) and it therefore cannot be used to assess behavior at the bank level. Several prior empirical studies also note that although the Boone index could be the newest measure of market competition, it also suffers from several shortcomings: (1) the Boone index has an assumption that part of banks' efficiency gains will be passed on to consumers (Tabak et al., 2012); and (2) it suffers from a degree of uncertainty from idiosyncratic variation (Tan & Floros, 2018). Therefore, as suggested by Turk-Ariss (2010), the competitive behavior practically is better captured by the Lerner index because it

Table 2
Descriptive statistics.

Variable	Islamic banks					Conventional banks				
	Obs	Mean	S.D.	Min	Max	Obs	Mean	S.D.	Min	Max
LogZ	788	2.2708	0.6081	1.3230	3.8648	4112	2.3079	0.5125	1.3230	3.8648
LogZ_alt	788	2.2968	0.5883	1.4231	3.9135	4112	2.3121	0.4879	1.4231	3.9135
NPL	605	0.0312	0.0354	0.0013	0.1635	3498	0.0334	0.0367	0.0013	0.1635
ELerner	788	0.4628	0.2218	0.0959	0.8665	4112	0.4533	0.1966	0.0959	0.8665
Lerner	765	0.3779	0.2230	−0.1725	0.7400	3831	0.3360	0.2332	−0.1725	0.7400
NIM	788	0.0269	0.0262	−0.0408	0.2162	4112	0.0399	0.0276	−0.0408	0.2162
EQTA	788	0.1558	0.1311	0.0462	0.6718	4112	0.1477	0.1050	0.0462	0.6718
LATA	788	0.2311	0.1261	0.0408	0.7338	4112	0.2269	0.1641	0.0408	0.7338
LogTA	788	14.6852	1.6684	9.4398	18.3910	4112	14.7449	1.9954	8.5878	21.6059

Note: Please see Table 1 for the definition of variables.

Table 3
The country-level mean of the main variable of interest.

Country	# IB	# CB	*ELerner*	*Conc3*	*MPOP*	*ShareIB*	*EcoFree*	*DoingBuss*
Algeria	1	8	0.8086	0.6782	0.9900	0.0240	48.8796	47.0227
Bahrain	11	8	0.4195	0.5883	0.7370	0.3288	73.0858	67.3158
Bangladesh	9	45	0.2069	0.2736	0.8910	0.2010	53.8678	42.3306
Brunei Darussalam	1	1	0.2611	0.7331	0.7880	0.4302	67.7111	60.4769
Egypt	3	23	0.3340	0.5647		0.0524	55.2261	
Indonesia	11	97	0.3868	0.4288	0.8720	0.0351	59.4663	63.3517
Iraq	7	11	0.7648	0.5647	0.9800	0.1219		45.9212
Jordan	4	13	0.4760	0.6167	0.9720	0.1158	68.3846	57.5877
Kenya	2	31	0.4988	0.4598	0.1090	0.0056	55.7615	58.6161
Kuwait	5	5	0.3513	0.6431	0.7460	0.3809	63.1987	60.6899
Lebanon	1	33	0.4295	0.4221	0.6110	0.0009	58.1013	58.1869
Malaysia	18	27	0.4753	0.4362	0.6130	0.2114	70.1003	78.2806
Maldives	1	3	0.7560	0.7091	0.9900	0.1648	51.5300	55.2550
Mauritania	2	8	0.5409	0.6105	1.0000	0.1273	53.6705	45.6159
Nigeria	1	21	0.4969	0.5079	0.5350	0.0024	56.4489	49.3645
Oman	3	7	0.3261	0.6902	0.8590	0.0397	66.1321	67.1821
Pakistan	5	22	0.3442	0.4623	0.9640	0.0576	54.8420	52.3598
Philippines	1	24	0.5546	0.4950	0.0560	0.0001	61.4698	59.1554
Qatar	5	6	0.5656	0.6677	0.6770	0.2444	71.4432	66.6815
Saudi Arabia	4	7	0.7253	0.4958	0.9000	0.2526	62.4989	64.2056
Senegal	1	21	0.4466	0.5006	0.9590	0.0424	56.5038	46.9562
South Africa	1	14	0.2624	0.7923	0.0190	0.0013	62.4298	67.7766
Thailand	1	25	0.3754	0.4946	0.0430	0.0049	64.5590	74.1395
Tunisia	2	15	0.5396	0.4182	0.9910	0.0354	57.6160	66.7782
Turkey	5	29	0.4440	0.3804	0.9980	0.0466	63.8443	68.2190
United Arab Emirates	9	21	0.6549	0.5221	0.7600	0.2143	72.4198	75.2705
United Kingdom	5	87	0.5627	0.5235	0.0440	0.0008	75.9484	83.2268
United Republic of Tanzania	1	31	0.5207	0.5457	0.3520	0.0075	58.2994	53.8483
Yemen	3	4	0.3378	0.7508	0.9910	0.4302	55.4046	55.8909
Total	123	647						
Average			0.4549	0.4883	0.6230	0.0894	62.7507	64.3501

Note: Please see Table 1 for the definition of variables. IB = Islamic banks. CB = Conventional banks.

estimates the degree of competition at the bank level so that it can be matched with other bank-specific variables of interests. The accounting data used to compute the Lerner index is also easy to obtain, making the Lerner index the most popular measure of competition widely used in the study of the competition-stability nexus.

In the present paper, we focus on the efficiency-adjusted Lerner index (*ELerner*) proposed by Koetter et al. (2012) to measure market competition. Although the traditional Lerner index has several advantages over other measures, it is limited because it is based on given profit and cost efficiency assumptions. The Lerner index may therefore not reflect the actual market power of banks (Khan, Kutan, Ahmad, & Gee, 2017). Alternatively, the efficiency-adjusted Lerner index considers the possibility that banks fail to fully exploit output pricing opportunities due to market power, unlike the conventional Lerner index that assumes full efficiency (Koetter et al., 2012). For that reasons, the efficiency adjusted index is often preferred to the conventional index (Tan & Floros, 2018).

Similar to the conventional Lerner index, the efficiency-adjusted Lerner index also corresponds to banks' strength in influencing the price of their banking products. A higher value of *ELerner* indicates greater market power. Following several previous works (Kasman & Kasman, 2015; Khan et al., 2017; Tan & Floros, 2018), the index is computed by using the following equation.

$$ELerner_{it} = \frac{Net\ Income_{it} + Total\ Cost_{it} - (Marginal\ Cost_{it} * TotalEarningsAssets_{it})}{Net\ Income_{it} + Total\ Cost_{it}} \quad (2)$$

Total Cost is total interest expense and non-interest expense. Marginal cost is the first difference of the trans-log cost function following Fu et al. (2014) as follows.

$$Marginal\ Cost_{it} = \left(\beta_1 + \beta_2 lnTA_{it} + \sum_{j=1}^{2} \beta_{2j} lnW_{jit}\right) \frac{TC_{it}}{TA_{it}} \quad (3)$$

$$lnTC_{it} = \propto_0 + \sum_{j=1}^{2} \alpha_1 lnW_{j,it} + \frac{1}{2} \sum_{j=1}^{2} \sum_{k=1}^{2} \beta_{jk} lnW_{jit} lnW_{kit} + \beta_1 lnTA_{it} + \frac{1}{2} \beta_2 (lnTA_{it})^2 + \sum_{j=1}^{2} \beta_{2j} lnTA_{it} lnW_{jit} + \varepsilon \quad (4)$$

where W_j corresponds to (1) W_1: the price of labor and physical capital: the ratio of total interest expenses to total customer deposits; and (2) W_2: the price of labor and physical capital: the ratio of total non-interest expenses to fixed assets. The cost function in Eq. (4) is estimated at the country-level (country by country) using fixed effects estimator. To ensure that our results are robust, we also use the conventional Lerner index using two factor prices as in prior studies (Fu et al., 2014; Risfandy, Harahap, Hakim, Nugroho, & Trinugroho, 2019; Risfandy, Trinarningsih, Harmadi, & Trinugroho, 2017; Trinugroho, Risfandy, & Ariefianto, 2018).

2.4. Controls

We also include a set of bank-level and country-level controls in our analysis. First, we use net interest margins (*NIM*). To calculate *NIM*, we follow Trinugroho et al. (2014) by employing the ratio of net interest income to total earning assets. According to Fu et al. (2014), it is necessary to employ *NIM* because we need to control for banks' profitability, especially regarding a bank's investing and lending activities. Second, we employ *EQTA* (bank capitalization). Abedifar et al. (2013) mention that banks with a high capital ratio can have a higher risk-taking capacity, which therefore may influence their financial stability. Schliephake (2016) theoretically also documents the different effect of competition between high and low capitalized banking sectors. Third, we also introduce liquidity proxied by the ratio of liquid assets to total assets (*LATA*). We also control for bank size using a log of total assets (*LogTA*) as seen in Cihak and Hesse (2010), who observe the different performances of small and large Islamic and conventional banks in dual markets. To control for macroeconomic differences, we use inflation (*INFL*), log of gross domestic products (*LogGDP*), and GDP Growth (*GDPGR* as in Ibrahim et al. (2019) and Soedarmono et al. (2011). The summary of our variable definitions, the descriptive statistics of the bank-level variables, and the mean of several variables of interest are provided in Tables 1, 2, and 3 respectively.

2.5. Methodology

To investigate the impact of market competition on banks' stability, we construct the following equation:

$$LogZ_{it} = \alpha_0 + \beta_1 ELerner_{it} + \beta_2 Conc3_{jt} + \varphi X_{it} + \gamma C_{jt} + \varepsilon_{i,t} \quad (5)$$

where subscripts *i*, *j*, and *t* correspond to bank *i*, country *j*, and year *t*. *LogZ* is bank stability, *ELerner* is the efficiency-adjusted Lerner index as our measure of market competition, *Conc3* is concentration of bank deposits from the three biggest banks in the country as our second proxy of market competition, *X* is a vector of bank-level variables (*NIM, LATA, EQTA, LogTA*), and *C* is a vector of country-level variables (*INFL, LogGDP, GDPGR*). Eq. (5) will be estimated using fixed effects estimators with the robust standard error clustered at the bank levels to eliminate heteroscedasticity and autocorrelation problems in the model.

3. Empirical results

3.1. Baseline regression

We estimate Eq. (5) to test the competition-stability nexus in a banking market that adopts a dual banking system. We provide the results in Table 4.

Table 4 shows that our main variable of interest, *ELerner*, consistently and positively affects the stability of conventional banks but not of Islamic banks, either when we use the fixed effects or random effects methods. In other words, we *ELerner* differently impacts the stability of the two bank types; the stability of conventional banks increases with in increase in their market power, but market power is not significant for Islamic banks. From Table 4, we can also see that the stability of Islamic banks is affected by market concentration (*Conc3*). Especially for *Conc3*, we have to interpret the result cautiously because *Conc3* in column (2) is estimated using the random effects method. Theoretically, in our case, the fixed effects method is more appropriate because it allows for the presence of unobserved bank-level characteristics that is correlated with the explanatory variables (Wooldridge, 2016). Moreover, our Hausman tests shows that there are statistically significant differences in the coefficients on the time-varying explanatory variables, suggesting that the fixed effects method is preferable to the random effects technique. The result for *Conc3* might also suggest that concentration is a "poor" proxy for competition (Berger, Klapper, & Turk-Ariss, 2009) and therefore it cannot be used to estimate banks' stability correctly.

Our finding therefore supports the 'competition-fragility' hypothesis especially for conventional banks. As documented by Meslier et al. (2017), the way in which Islamic banks compete in the dual banking market is not necessarily similar to that of conventional banks. Demirgüç-Kunt et al. (2013) and Gheeraert (2014) show a form of asymmetric competition in which Islamic banks only compete with other Islamic banks but conventional banks compete with both Islamic and conventional banks. This is because the existence of Islamic banks is mainly to fulfill the need of religious customers who hesitate to use conventional banking products (Demirgüç-Kunt et al., 2013; Gheeraert, 2014). Conventional banks will face difficulties in finding religious depositors even after reducing their prices. Conversely, Islamic banks are able to attract both religious and conventional (non-religious) clients, especially when Islamic banks provide better prices. Ariff (2014) highlights that Islamic banks at present do not only focus on Muslims. Several Islamic banks even have non-Muslim clientele at approximately 40% (Ariff, 2014).

Our finding partially supports prior studies in dual banking markets that use different samples (Alam et al., 2018; Albaity et al., 2019; Kabir & Worthington, 2017). In line with prior empirical works, the presence of Islamic banks jointly with conventional banks in a single market has a high potential to erode stability. In dual banking markets, Islamic banks have to compete with both Islamic and conventional banks. Likewise, conventional banks also compete with their conventional and Islamic peers. This condition implies that the degree of competition in the dual banking market has been relatively high (Alam et al., 2018). Some studies either indirectly or directly show that heightened competition in the dual market influences Islamic or conventional banks' behavior. For instance, Charap, Cevik, and Charap (2015), Chong and Liu (2009), Ito (2013), and Saraç and Zeren (2014) highlight that a higher presence of Islamic banks in banking sectors tends to weaken Islamic banks' own stability. As a response to the competitive pressure of conventional banks, other studies show that Islamic banks adjust their rates of deposit for the sake of competition (Abedifar et al., 2016). Meanwhile, Conventional banks' efficiency is also found to be affected by the presence of large Islamic banks in the market (Abedifar

Table 4
Baseline regression result.

	Islamic banks		Conventional banks	
	FE	RE	FE	RE
	(1)	(2)	(3)	(4)
ELerner	0.0695	0.102	0.297***	0.310***
	(0.90)	(1.47)	(6.48)	(8.12)
Conc3	0.213	0.362***	0.0667	0.0492
	(1.34)	(2.88)	(1.23)	(1.12)
NIM	0.752	0.658	1.811***	1.873***
	(1.35)	(1.34)	(4.43)	(6.13)
EQTA	3.731***	3.915***	3.787***	3.899***
	(12.20)	(17.04)	(20.01)	(26.78)
LATA	−0.154	−0.119	−0.158***	−0.171***
	(−1.38)	(−1.08)	(−3.13)	(−3.98)
LogTA	−0.0435	0.00190	−0.0302	−0.00789
	(−0.95)	(0.12)	(−1.23)	(−1.31)
INFL	0.436	0.547**	−0.225*	0.0522
	(1.49)	(2.14)	(−1.69)	(0.50)
GDPGR	0.261	0.0528	0.191	0.115
	(1.22)	(0.24)	(1.53)	(0.95)
LogGDP	−0.130*	−0.0116	−0.120***	−0.0156***
	(−1.82)	(−0.75)	(−3.70)	(−2.97)
Constant	5.392***	1.525***	5.097***	2.004***
	(2.66)	(3.31)	(6.10)	(12.40)
N obs.	788	788	4112	4112
N banks	123	123	647	647
R-sq. within	0.742	–	0.728	–
R-sq. overall	–	0.874	–	0.843
Hausman tests fixed effects (FE) vs. random effects (RE)				
Chi-sq.	35.088***		43.909***	
P-value	0.0061		0.0004	

Note: This table presents regression results using Eq. (5). Please see Table 1 for the description of variables. Year fixed effects is included in all estimations. Robust t-statistics are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

et al., 2016). Meslier et al. (2017) also document that conventional banks' deposits in the dual banking market are influenced by Islamic banks' market power. Furthermore, Meslier et al. (2017) also argue that conventional banks' response to Islamic banks' competitive pressure could jeopardize their financial stability, especially when they intend to offer higher deposit rates than when their market power is lower.

Turning to the control variables, we observe significant coefficients for *NIM*, *EQTA*, *LATA*, and *INFL*. *NIM* positively affects conventional banks' stability, meaning that the higher profitability of banks will reduce banks' fragility. Banks that can generate more money from their investment and lending activities will be more stable. Interestingly, this effect is not prevalent in Islamic banks and this is possibly because of the complexities of the PLS (profit and loss sharing) arrangements used in Islamic banks. *EQTA* is positively related to stability. Banks with higher capital ratio, possibly with a higher capital buffer, will be less likely to fail when facing intensified competition in the dual market. Inflation surprisingly shows a positive impact on Islamic banks' stability. It might be associated with the rate offered to clients by the banks. In a high inflation period, banks charge high rates from their customers. The interest income will therefore increase, in addition to profitability. This condition will result in a lower volatility of profitability (better stability).

3.2. Islamic presence, competition, and bank stability

In the aforementioned baseline result, we find that dual market competition has no effect on Islamic banks' stability. This result somewhat supports the notion that Islamic banks' presence in the dual market is supported by their current environment by having customers with a high religiosity level.[1] Prior studies such as Meslier et al. (2017) highlight that because of the competitive environment in dual banking markets, especially in the countries with a high Islamic presence (high Muslim population and high share of Islamic banks), conventional banks set high deposit rates to attract more customers whereas Islamic banks' rate of deposits is not affected by the level of market competition. Bitar et al. (2017) find that Islamic banks outperform conventional banks in hybrid and *Shariah*-based legal systems. Bitar and Tarazi (2019) empirically show that positive association between creditor rights and capital ratios is only found in predominantly non-Muslim countries with less competitive markets. In this section, we further investigate

[1] Theoretically, in the environment with a high religiosity level, Islamic banks will always outperform conventional banks especially in attracting customers because religious customers conventional banks will not be a choice for them. See Meslier et al. (2017) for more details.

whether the Islamic environment is really beneficial for Islamic banks' stability by estimating the following model.

$$LogZ_{it} = \alpha_0 + \beta\ Competition + \theta\ Islamic\ presence + \chi\ Competition^{*}Islamic\ presence + \varphi X_{it} + \gamma C_{jt} + \varepsilon_{i,t} \quad (6)$$

Competition is a vector of our two competition measurements (*ELerner* and *Conc3*) whereas *Islamic presence* is either Muslim population or share of Islamic banks. The latter two variables have been used by several studies to proxy religious or Islamic penetration in countries adopting dual banking systems (Abedifar et al., 2016; Meslier et al., 2017, 2020). Our interest is in the interaction coefficient χ indicating whether country-level religiosity strengthens or weakens the competition-fragility nexus.

The estimation results of Eq. (6) are shown in Table 5. While we do not clearly observe any impact of *MPOP* on the competition-fragility nexus, we notice a negative impact of *MPOP* in the conventional banks' sample as depicted in column (6), suggesting that conventional banks' stability decreases with the increase in Muslim population. Interestingly, the impact turns out to be positive in the more concentrated market (medium and high concentration) as indicated in the marginal tests. This evidence suggests that the presence of Muslims could also be beneficial for conventional banks' stability particularly in the less competitive markets. This evidence somewhat supports Abedifar et al. (2016)'s finding that the Islamic banks' presence also assists conventional banks' efficiency.

Turning to the variable *ShareIB*, the interaction coefficients of *ELerner*ShareIB* and *Conc3*ShareIB* in Table 5 are negative and significant at the 1% level. This suggests that Islamic penetration proxied by the share of Islamic banks empirically lowers the impact of competition on stability especially in the case of Islamic banks. Another interesting result we could observe from the Table 5 is that in the marginal tests, *ELerner* is significant at the low and medium level of *ShareIB* but not at the high level of *ShareIB*. Therefore, the adverse impact of competition diminishes in the high Islamic banks' market share. Regarding our market structure variable in relation with the *ShareIB*, that is *Conc3*, the result in the Islamic banks sub-sample shows that Islamic banks enjoy better stability in the more concentrated market, supporting the competition-fragility nexus. This is also supported by the marginal tests showing that the impact is consistently persistent and positive at any level of Islamic banks' market share. On the conventional banks' side, while we do not find significant results from the interaction coefficients, the marginal tests show that *ELerner* consistently and positively impacts bank stability at the low, medium, and high levels of Islamic banks' share.

Overall, our results highlight the importance of Islamic penetration as major driver of banks' stability particularly in countries adopting dual banking systems. Several prior studies such as Abedifar et al. (2016), Meslier et al. (2017, 2020) also support this view.

3.3. Institutional environments, competition, and bank stability

Investigating the relation between the institutional environment and competition has recently become the focus of empirical works. In the broader context, not only for Islamic banks, Delis (2012) finds that a certain level of institutional development is a precondition for the success of financial reforms aimed at increasing competition and efficiency of banking markets. In the Islamic bank context, Bitar and Tarazi (2019) find that in countries with stronger creditor protection conventional banks hold more capital but this is not the case of Islamic banks. Meslier et al. (2020), by investigating the impact of *Shariah* board on equity financing of Islamic banks, find that the effect is reduced in a better banking environment. The role of *Shariah* board in enhancing Islamic banks' governance could hence possibly be replaced by a better institutional setting. Moreover, Bitar et al. (2017) highlight the importance of the institutional environment by focusing on the impact of political soundness on the stability of Islamic and conventional banks. They find that Islamic banks' stability is lower than that of their conventional counterparts in countries with a more democratic political system. In this subsection, we therefore examine the effect of institutional quality, as suggested by Bitar et al. (2017), in dual markets. To investigate this issue, in this subsection, we introduce economic freedom index (*EcoFree*) and the doing business index (*DoingBuss*) in the equation as institutional quality factors that could explain banks' stability. Our econometric setup is as follows.

$$LogZ_{it} = \alpha_0 + \beta\ Competition + \theta\ Institutional\ environment + \chi\ Competition^{*}Istitutional\ environment + \varphi X_{it} + \gamma C_{jt} + \varepsilon_{i,t} \quad (7)$$

Institutional environment is either *EcoFree* or *DoingBuss*. In the conventional banking literature, the economic freedom index associated with activities entrepreneurs can undertake (e.g., in starting a business) has been considered as one key factor affecting the competition-stability nexus. Greater economic freedom can lead to new investment opportunities, weaker bank activity restrictions, and higher sophistication in banking products, which can ultimately affect market competition (Soedarmono et al., 2011). Economic freedom has also been empirically found to exert a positive impact on bank performance (Sufian & Habibullah, 2010). We use the doing business index measuring the ease of doing business in a country following prior research such as Meslier et al. (2020) who find that countries with higher enforcing contracts[2] could be play a significant role in promoting equity financing from Islamic banks. More specifically, Anginer, Demirguc-Kunt, and Zhu (2014) show that the effect of investor protection (part of the doing business index) in enhancing bank stability is lower in the less competitive markets.

Table 6 shows the regression result using Eq. (7). Focusing on the impact of the economic freedom index, a negative value of *Conc3*EcoFree* in column (6) indicates that *EcoFree* reduces the impact of *ELerner* on *LogZ*. In other words, in countries with higher economic freedom, the adverse impact of market concentration on stability is reduced. This effect does not show in the Islamic banks' sub-sample. Moreover, in column (7), we also observe that countries with better doing business index show similar findings as

[2] According to the definition in the World Bank website, the enforcing contracts indicator as part of doing business index measures the time and cost for resolving a commercial dispute through a local first-instance court and the quality of judicial processes index. It evaluates whether each economy has adopted a series of good practices that promote quality and efficiency in the court system.(https://www.doingbusiness.org/en/data/exploretopics/enforcing-contracts).

Table 5
Islamic presence, competition, and bank stability.

	Islamic banks				Conventional banks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ELerner	0.208	0.0934	0.263**	0.0727	0.298***	0.294***	0.285***	0.291***
	(1.30)	(1.33)	(2.50)	(0.96)	(5.26)	(7.77)	(5.26)	(6.09)
MPOP	0.0943	0.0837			0.0501	−0.146**		
	(0.64)	(0.44)			(1.02)	(−2.27)		
Conc3	0.367***	0.479*	0.325**	0.487***	0.0661	−0.143*	0.0639	−0.00841
	(2.87)	(1.82)	(2.38)	(3.01)	(1.44)	(−1.84)	(0.87)	(−0.09)
ShareIB			0.441**	0.514**			−0.0843	−0.567
			(2.06)	(2.20)			(−0.42)	(−1.32)
ELerner×*MPOP*	−0.167				0.00125			
	(−0.76)				(0.01)			
Conc3 × *MPOP*		−0.159				0.400***		
		(−0.50)				(3.36)		
ELerner×*ShareIB*			−0.979***				0.0966	
			(−3.28)				(0.32)	
Conc3 × *ShareIB*				−0.914***				0.845
				(−2.76)				(1.49)
Constant	1.450***	1.473***	6.042***	5.643***	1.879***	1.895***	5.383***	5.283***
	(2.95)	(3.05)	(3.15)	(2.82)	(11.14)	(11.63)	(6.37)	(6.36)
N obs.	764	764	788	788	3956	3956	3829	3829
N banks	120	120	123	123	624	624	646	646
R-sq. within	–	–	0.746	0.747	–	–	0.724	0.726
R-sq. overall	0.656	0.664	–	–	0.716	0.736	–	–
Marginal tests: *ELerner*/*Conc3* when *MPOP*/*ShareIB* =								
Low (percentile 25)	0.200	0.472**	0.263**	0.486***	0.298	−0.126*	0.285***	−0.00779
	(1.32)	(1.88)	(2.50)	(3.01)	(5.56)	(−1.70)	(5.27)	(−0.09)
Medium (percentile 50)	0.0809	0.358***	0.225**	0.451***	0.299	0.160***	0.289	0.0246
	(1.12)	(2.78)	(2.34)	(2.96)	(6.41)	(3.05)	(5.81)	(0.31)
High (percentile 75)	0.0425	0.322**	0.0325	0.271**	0.299***	0.252***	0.308***	0.191*
	(0.43)	(2.10)	(0.50)	(2.37)	(4.80)	(3.58)	(4.61)	(1.71)
Marginal tests: *MPOP*/*ShareIB* when *ELerner*/*Conc3* =								
Low (percentile 25)	0.0633	0.0248	0.260	0.175	0.0503	0.00233	−0.0664	−0.254
	(0.55)	(0.25)	(1.38)	(1.04)	(1.47)	(0.09)	(−0.42)	(−1.10)
Medium (percentile 50)	0.0188	0.00600	−0.00115	0.0672	0.0507**	0.0496**	−0.0406	−0.154
	(0.22)	(0.07)	(−0.01)	(0.41)	(2.33)	(2.29)	(−0.36)	(−0.90)
High (percentile 75)	−0.0311	−0.0215	−0.294	−0.0910	0.0510	0.119***	−0.0117	−0.00743
	(−0.34)	(−0.24)	(−1.45)	(−0.54)	(1.48)	(4.22)	(−0.09)	(−0.07)

Note: This table presents regression results using Eq. (6). Please see Table 1 for the description of variables. Year fixed effects is included in all estimations. Control variables are not shown to save space. Robust t-statistics are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

*Conc3*DoingBuss* is always negative and significant. Again, this effect is prominent only in conventional banks. The marginal tests also show that the impact of market power (*ELerner*) and concentration (*Conc3*) is consistent across any level of institutional quality. Such findings show that the institutional environment can play a significant role in promoting stability in dual banking markets.

3.4. Capitalization of banks

Several prior studies have reported that bank capitalization matters in shaping different behaviors of Islamic and conventional banks. Bitar and Tarazi (2019) find robust evidence that stronger creditor rights are associated with higher capitalization for conventional banks but not for Islamic banks. Saeed, Izzeldin, Hassan, and Pappas (2020) find that the capitalization response to increases in insolvency risk is more pronounced for Islamic banks but has an approximately five-times smaller effect on risk mitigation compared to conventional banks. Louati, Gargouri Abida, and Boujelbene (2015) find a different impact of market competition between the two bank types. More specifically, Louati et al. (2015) find that competition has no significant effect on the relationship between weighted asset ratios and Islamic bank behavior. Schliephake (2016) also theoretically show that market competition does not play a role in well-capitalized banking sectors. Based on these studies, in this subsection we test whether, in our case, bank capitalization also matters in shaping different behaviors of Islamic and conventional banks. Our econometric setup is as follows.

$$LogZ_{it} = \alpha_0 + \beta\ Competition + \theta_1 EQTA_1 + \theta_2\ Competition{*}EQTA + \varphi X_{it} + \gamma C_{jt} + \varepsilon_{i,t} \quad (8)$$

Table 7 shows the results. The negative coefficients of the interaction terms *Conc3*EQTA* in column (2) and *ELerner*EQTA* in column (3) suggest that bank capitalization also reduces the impact of market competition on banks' stability. More specifically, in the marginal effect rows, we see that market competition positively affects banks' stability for low and medium bank capitalization levels. Such results strongly supports Schliephake (2016) that competition has no role to play regarding stability in the well-capitalized

Table 6
Institutional environments, competition, and bank stability.

	Islamic Banks				Conventional Banks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Elerner	−0.0271	0.0779	0.0918	0.0584	0.706**	0.298***	0.148	0.236***
	(−0.04)	(0.98)	(0.18)	(0.73)	(2.03)	(6.38)	(0.60)	(5.45)
EcoFree	0.000949	0.00613			0.00393	0.00791***		
	(0.19)	(0.84)			(1.36)	(2.74)		
Conc3	0.423***	0.951	0.187	1.015	0.0551	1.004***	0.0865	1.097***
	(3.00)	(1.05)	(1.18)	(1.58)	(1.03)	(2.63)	(1.59)	(3.79)
DoingBuss			0.00484	0.0116			−0.000851	0.00765***
			(0.88)	(1.57)			(−0.42)	(3.13)
ELerner×EcoFree	0.00157				−0.00627			
	(0.16)				(−1.28)			
Conc3 × EcoFree		−0.00841				−0.0150**		
		(−0.62)				(−2.57)		
ELerner×DoingBuss			−0.000516				0.00135	
			(−0.07)				(0.40)	
Conc3 × DoingBuss				−0.0135				−0.0162***
				(−1.22)				(−3.59)
Constant	7.124***	6.647***	2.761	2.119	4.992***	4.361***	5.504***	4.157***
	(3.40)	(3.07)	(1.28)	(0.92)	(5.94)	(5.12)	(5.61)	(4.14)
N obs.	752	752	716	716	4045	4045	3620	3620
N banks	116	116	120	120	636	636	623	623
R-sq. within	0.756	0.756	0.746	0.746	0.730	0.730	0.724	0.726
Marginal tests: *ELerner/Conc3* when *EcoFree/DoingBuss* =								
Low (percentile 25)	0.0573	0.500**	0.0679	0.390**	0.370***	0.198**	0.211**	0.350***
	(0.40)	(2.33)	(0.37)	(2.05)	(4.03)	(2.36)	(2.18)	(3.72)
Medium (percentile 50)	0.0702	0.431***	0.0597	0.175	0.318	0.0745	0.232***	0.0928*
	(0.80)	(2.92)	(0.62)	(1.08)	(5.49)	(1.34)	(4.44)	(1.67)
High (percentile 75)	0.0909	0.319*	0.0490	−0.106	0.235***	−0.124	0.260***	−0.243**
	(0.74)	(1.69)	(0.38)	(−0.32)	(5.19)	(−1.55)	(5.04)	(−2.32)
Marginal tests: *EcoFree/DoingBuss* when *ELerner/Conc3* =								
Low (percentile 25)	0.00124	0.00301	0.00475	0.00661	0.00276	0.00234	−0.000601	0.00167
	(0.34)	(0.95)	(1.01)	(1.45)	(1.28)	(1.56)	(−0.39)	(1.28)
Medium (percentile 50)	0.00166	0.00202	0.00461	0.00501	0.00109	0.000568	−0.000240	−0.000247
	(0.62)	(0.76)	(1.12)	(1.21)	(0.72)	(0.38)	(−0.20)	(−0.20)
High (percentile 75)	0.00213	0.000563	0.00446	0.00266	−0.000785	−0.00203	0.000164	−0.00304**
	(0.51)	(0.16)	(1.00)	(0.63)	(−0.41)	(−1.01)	(0.11)	(−2.03)

Note: This table presents regression results using Eq. (7). Please see Table 1 for the description of variables. Year fixed effects is included in all estimations. Control variables are not shown to save space. Robust t-statistics are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

banking sectors. From the perspective of policymakers, this result suggests that imposing capital requirements without considering the competitive environment and characteristics of the banking system can have adverse effects on stability. Our result applies to both Islamic and conventional banks.

3.5. Robustness checks

The prior literature also considers possible endogeneity issues involving banks' market power and stability (Beck, Demirgüç-Kunt, & Levine, 2006; Berger, Demirgüç-kunt, Levine, & Haubrich, 2004; Schaeck & Cihak, 2010; among others). On the one hand, a bank with a high degree of market power will also have better stability because it is able to determine the price of its products, which is far from marginal cost. On the other hand, if a bank increases its risk-taking, it will have a higher expected return, which can be converted into higher market power. To address this issue, in the robustness section, we firstly lag our main independent variable *ELerner*, and we secondly estimate the equation using the two-step Blundell and Bond's (1998) generalized method of moments (GMM) estimator. The estimation results are presented in Table 8. As in our main analysis, we find a positive impact of the lag of *ELerner* in the conventional banks' sub-sample but not for Islamic banks. Using the GMM method, our result also remains unchanged. The GMM diagnostic tests show that there is no presence of second-order autocorrelation (AR(2)) and the Sargan tests also fails to reject the null of correlation between instruments and error terms, suggesting the validity and consistency of the GMM we use.

In this robustness check, we also consider an alternative measure of bank stability. First, we change our stability proxy by an alternative z-score measure (*LogZ_alt*) proposed by Lepetit and Strobel (2013). They claim that their method is more robust and also free from potentially 'spurious' volatility related to the construction of time-varying z-scores. This measure is calculated using mean and standard deviation estimates of *ROA* that are calculated over the full sample and combines them with CAR's current values. Second, we also replace *LogZ* by the ratio of non-performing loans to total assets (*NPL*). Schenck (2014) empirically tests various proxies of distance-to-default measures and finds non-performing assets to be the most significant measure. By changing our dependent

Table 7
Capitalization of banks, competition, and bank stability.

	Islamic Banks		Conventional Banks	
	(1)	(2)	(3)	(4)
Elerner	0.0668	0.0507	0.539***	0.295***
	(0.57)	(0.67)	(7.10)	(6.47)
Conc3	0.214	0.732***	0.0576	−0.107
	(1.35)	(2.66)	(1.08)	(−0.87)
ELerner×EQTA	0.0138		−1.239***	
	(0.03)		(−4.20)	
Conc3 × EQTA		−3.488**		1.218
		(−2.01)		(1.50)
Constant	5.392***	3.999**	4.419***	5.389***
	(2.66)	(2.20)	(5.45)	(6.62)
N obs.	788	788	4112	4112
N banks	123	123	647	647
R-sq. within	0.742	0.755	0.738	0.729
Marginal tests: *ELerner/Conc3* when *EQTA* =				
Low (p. 25)	0.0677	0.496***	0.455***	−0.0245
	(0.70)	(2.70)	(7.43)	(−0.32)
Medium (p. 50)	0.0685	0.292**	0.383***	0.0467
	(0.82)	(2.09)	(7.42)	(0.88)
High (p. 75)	0.0727	−0.746	0.0137	0.409*
	(0.58)	(−1.44)	(0.17)	(1.71)
Marginal tests: *EQTA* when *ELerner/Conc3* =				
Low (p. 25)	3.728***	4.482***	4.184***	3.672***
	(10.67)	(8.72)	(20.09)	(20.09)
Medium (p. 50)	3.732***	4.069***	3.854***	3.816***
	(12.38)	(11.34)	(20.92)	(19.49)
High (p. 75)	3.736***	3.466***	3.483***	4.027***
	(12.56)	(12.08)	(17.86)	(14.34)

Note: This table presents regression results using Eq. (8). Please see Table 1 for the description of variables. Year fixed effects is included in all estimations. Control variables are not shown to save space. Robust t-statistics are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

variables, the result remains unchanged as depicted in Table 9 column (1)–(2) for the sample of Islamic banks and (5)–(6) for the sample of conventional banks.

After changing the dependent variable, we also change our competition proxies, that are *ELerner* and *Conc3*, by the conventional Lerner index (Fu et al., 2014; Risfandy et al., 2019; Trinugroho et al., 2018) and Herfindahl index (Akins et al., 2016) respectively. As we see from Table 9, the conventional Lerner index (*Lerner*) has significant impact only for conventional banks whereas the Herfindahl index (*HHI*) has a positive impact in the sub-sample of Islamic banks, similarly to the result we obtain in our baseline regression.

4. Conclusion

This paper investigates the role of competition on the stability of Islamic and conventional banks in countries where the two banks operate alongside one another. We specifically focus on the role played by religiosity and the institutional environment. We use a sample of 123 Islamic and 647 conventional banks from 29 countries and employ an efficiency-adjusted Lerner index to proxy banks' market power and the z-score to measure banks' stability. Our findings show that competition erodes stability for conventional banks case but not for Islamic banks. Focusing on the extent of religious penetration, we find that deeper penetration alters the negative impact of competition on stability. Besides religious factors, we also find that institutional quality factors such as the ease of doing business and the freedom of performing an economic activity also lessen the negative impact of market competition and promote stability in dual banking markets.

Taking all of the results altogether, this work has various policy implications. Regulators and supervisors should carefully monitor competitive conditions in a dual banking market. The heightened dual market competition could encourage banks, either Islamic or conventional, to take excessive risk that could jeopardize their financial stability. Islamic banks also need to have sufficient capital buffer because differently from their conventional peers, Islamic banks are subject to displaced commercial risk or the possibility that their depositors move to other banks because of low return payment (Daher, Masih, & Ibrahim, 2015).

Declarations of Competing Interest

None.

Table 8
Dealing with the endogeneity issue: Lag competition proxies and the GMM.

	Islamic Banks		Conventional Banks	
	(1)	(2)	(3)	(4)
	FE	GMM	FE	GMM
Lag LogZ		0.0808		0.153***
		(0.66)		(3.48)
Lag ELerner	0.0562		0.0663**	
	(1.60)		(2.46)	
ELerner		0.0237		0.203**
		(0.30)		(2.02)
Lag Conc3	0.0311		0.0907**	
	(0.26)		(2.08)	
Conc3		0.420*		−0.0916
		(1.89)		(−1.03)
NIM	0.158	1.498**	1.316***	2.138***
	(0.37)	(2.22)	(3.89)	(5.46)
EQTA	3.928***	3.936***	3.980***	4.016***
	(12.33)	(6.65)	(16.65)	(16.86)
LATA	−0.124*	0.157	−0.0905**	−0.164***
	(−1.85)	(1.16)	(−2.08)	(−2.70)
LogTA	−0.0933***	0.0238*	−0.0369	0.00959**
	(−2.83)	(1.77)	(−1.55)	(2.14)
INFL	0.103	−0.549	−0.459***	0.0245
	(0.45)	(−1.43)	(−4.41)	(0.17)
GDPGR	−0.0163	−0.472	0.137	−0.203
	(−0.10)	(−1.35)	(1.05)	(−0.89)
LogGDP	−0.0815	0.00458	−0.101***	−0.0130**
	(−1.59)	(0.28)	(−3.72)	(−2.56)
Constant	5.110***	–	4.788***	–
	(3.58)		(6.51)	
N obs.	667	675	3488	3477
N banks	122	121	631	631
R-sq. within	0.800	–	0.778	–
Diagnostic tests				
AR(2): p-value		0.507		0.239
Sargan: p-value		0.934		0.802

Note: This table presents regression results using Eq. (5) by using lagged value of *ELerner* and *Conc3* (column (1) and (3)) and the generalized method of moments (GMM) estimation (column (2) and (4)). Please see Table 1 for the description of variables. Year fixed effects is included in all estimations. Robust t-statistics are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

Table 9
Changing variables of interest.

	Islamic Banks				Conventional Banks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LogZ_alt	*NPL*	*LogZ*	*LogZ*	*LogZ_alt*	*NPL*	*LogZ*	*LogZ*
Conc3	0.0116	−0.0340	0.302***		0.0389	−0.0205*	0.0413	
	(0.09)	(−0.86)	(3.08)		(0.86)	(−1.78)	(0.87)	
Elerner		−0.0121		−0.0279		−0.0407***		0.0391
		(−0.57)		(−0.59)		(−5.38)		(1.39)
Lerner			0.0243				0.0687*	
			(0.55)				(1.82)	
HHI				0.303***				0.0398
				(3.09)				(0.75)
Constant	4.716***	−0.262	6.401***	6.623***	4.665***	−0.288	4.473***	4.705***
	(3.18)	(−0.53)	(3.90)	(4.21)	(6.81)	(−1.41)	(6.09)	(6.56)
N obs.	1021	605	765	788	4576	3498	3831	4112
N banks	159	107	121	123	715	568	619	647
R-sq. within	0.804	0.106	0.824	0.814	0.787	0.0901	0.781	0.784

Note: This table presents regression results using Eq. (5) with following modifications: replace *LogZ* by *LogZ_alt* (column (1) and (5)), replace *LogZ* by *NPL* (column (2) and (6)), replace *Elerner* by *Lerner* (column (3) and (7)), and replace *Conc3* by *HHI* (column (4) and (8)). Please see Table 1 for the description of variables. Year fixed effects is included in all estimations. Control variables are not shown to save space. Robust t-statistics are in parentheses. ***, **, and * denote significance at 1%, 5%, and 10% levels respectively.

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