Received: 14 May 2023 | Revised: 27 February 2024 | Accepted: 4 April 2024

DOI: 10.1002/ijfe.2990

RESEARCH ARTICLE

WILEY

Market power, optimal scale and competition promotion in banking: Analysis in the GCC region

Sara Alfaihani[1] | **Oleg Badunenko**[2] | **Shabbar Jaffry**[3]

[1]Department of Economics and Finance, College of Business Administration, University of Bahrain, Shakir, Bahrain

[2]Department of Economics and Finance, College of Business, Arts and Social Sciences, Brunel University London, Uxbridge, UK

[3]Economics and Finance Subject Group, Faculty of Business and Law, University of Portsmouth, Portsmouth, UK

Correspondence
Shabbar Jaffry, Economics and Finance Subject Group, Faculty of Business and Law, Richmond Building, Portland Street, Portsmouth, PO1 3DE, UK.
Email: shabbar.jaffry@port.ac.uk

Abstract

We propose an approach to identify optimally scaled banks and analyse the competition levels among banks in different stages of production in six countries of the Gulf region. The empirical results show that the global financial crisis curbed the rise in the market power of banks, but the market power continued to increase straight after 2009. Also, we show that the existing methods fail to identify that a significant proportion of banks across different countries, up to 90%, are operating at an optimal scale. Finally, we discuss the misclassification of banks by the traditional approach to scale analysis and its implications for decision-making by competition authorities and central banks that assess and promote competition in banking. We advocate a more nuanced approach to competition policy that recognizes the potential impact of various phases of banks' production process on the competition.

KEYWORDS

banking, competition policy, GCC, Lerner index, market power, optimal scale

1 | INTRODUCTION

The degree of competition in the marketplace can have substantial implications for both the business environment and social welfare. For banking markets, extensive research has explored the degree of competition and market power (e.g., Bikker & Haaf, 2002; Delis et al., 2016; Schaeck et al., 2009). Market power and structure are important for bank stability (Anginer et al., 2014; Boyd & De Nicoló, 2005; Keeley, 1990) and efficiency (Asongu & Odhiambo, 2019). Moreover, competition in banking is brought in relationship with the cost of credit (Fungáčová et al., 2017), the firm's access to finance (Love & Martínez Pería, 2015), and credit constraints (Leon, 2015).

Banks, however, can be different not only in terms of their mark-ups. They could be different in terms of market share or have other nuances. Distinguishing the performance of banks with a 'one size fits all' approach can, therefore, prove to be not informative since banks are heterogeneous in terms of scale. One way to distinguish banks' performance is to conduct the scale economies analysis to identify their position on the technology, that is, stage of production.

Economies of scale describe a circumstance in which a firm's long-run average costs fall with output expansion but are still larger than marginal costs. In this circumstance, the firm enjoys economies of scale and will improve its performance by increasing its scale. The opposite case is diseconomies of scale, where output expansion results in average costs being lower than the marginal costs. In this case, the firm would benefit from downscaling. In between these two cases, a firm is optimally scaled and it is said to have the most productive

scale size (MPSS). The MPSS concept was introduced by Banker (1984) and discussed in Banker et al. (2011). Analysis of firm scale in an industry provides important insights that can explain industry dynamics, such as entries and exits as well as mergers and acquisitions. For example, Badunenko (2010) shows that the German chemical manufacturing firms were too large at the beginning of the 1990s and had to downsize to stay productive.

The existence of economies of scale can be viewed by banks and regulators as an invitation to grow. However, if the bank has already large market power, its growth can pose even greater challenges for the banking system, its stability, and the banking regulators. There is, therefore, a need for a proper measurement of the economies of scale in conjunction with the measurement of the market power. Currently, banks are classified as either in economies of scale or diseconomies of scale. We propose a method to measure the above-mentioned MPSS where a bank is optimally scaled, that is, there is no need to change the scale of operation from a productivity and efficiency viewpoint. As a result, the existing economies of scale analysis is enriched by a three-way classification that covers all theoretically possible stages of production whereby a bank can be optimally scaled in addition to existing classifications of economies of scale or diseconomies of scale.

We demonstrate the usefulness of the proper classification of firms into the stages of production by applying the proposed method to the six banking markets of the Gulf Cooperation Council (GCC) region. The banking sector, which dominates the financial sector, is seen as a crucial sector of the region and has been a key driver for the GCC's economies and an important factor in achieving these plans (Abuzayed et al., 2018). As a result, we aim to provide answers to key questions for the GCC banking markets. First, how competition and market power of banks have been developing over time? Second, do scale economies interplay with the amount of market power a bank possesses? Lastly, what happens to the analysis of competition in banking if optimally scaled banks are identified?

The empirical analysis shows that the market power of banks has been growing over time, which implies that the competition level in the GCC banking markets is declining. Moreover, the levels of market power and competition levels differ a lot among banks in the different stages of production. It seems that competition is highest for banks in the diseconomies of scale, lowest for banks in the economies of scale, and at average levels for banks in the optimal scale. Finally, banks in the optimal scale region are misclassified under the traditional classification method which in turn may lead to inappropriate actions and policies.

This study is organized as follows: Section 2 reviews the related literature. Section 3 explains the data preparation, whereas Section 4 discusses the econometric methodology. Section 5 presents and discusses the empirical results and Section 6 concludes.

2 | LITERATURE REVIEW

From an economic perspective, the presence of market power within firms tends to drive up prices and decrease the quantity of goods or services available. This, in turn, translates to reduced well-being for both consumers and society at large when compared with a scenario characterized by perfect competition. As a result, policymakers place significant emphasis on addressing market power issues and striving to mitigate its effects. In banking, where institutions play a vital role in providing credit, facilitating transactions, executing monetary policies and upholding financial stability, the apprehension regarding the existence of market power is particularly heightened (Shaffer & Spierdijk, 2020).

The academic literature on banking competition and economic outcomes, such as financial stability, bank efficiency and economic growth, has revealed the emergence of several contrasting themes—for instance, the competition-financial stability relationship. The 'competition-stability' view demonstrates that a high degree of competition between banks has a positive relationship with financial stability, while the 'competition-fragility' predicates the opposite. A comparable level of uncertainty pertains to the competition-efficiency relationship where the 'efficient-structure hypothesis' predicts a positive relation, but the 'quite-life hypothesis' assumes otherwise. Moreover, the competition-growth relation follows two stands whereby the 'partial equilibrium models' imply an inverse relationship and the 'general equilibrium models' assume a positive one. The lack of clarity in this area has led to numerous studies exploring how the degree of competition among banks affects economic outcomes (see Coccorese, 2017; Degryse et al., 2014, for an overview of this literature).

The aforementioned studies have utilized different measures to estimate market power and competition in banking markets. Early empirical estimates were based on structural measures, such as market shares, k-bank concentration ratios (CR_k), and the Herfindahl–Hirschman Index (HHI). However, the majority of studies have considered non-structural measures, such as the Panzar–Rosse H-statistic, the Boone indicator, and the Lerner index. Table 1 provides a list of banking studies that have applied non-structural measures of competition in the last decade. While all approaches have been

TABLE 1 Recent literature on banks' market power.

Author(s)	Classification(s)	Period	Country/region
Panel A: Overall market power			
Andrikopoulos and Dassiou (2022)	Overall market	2008–2017	24 countries
Hossain et al. (2020)	Overall market	2005–2014	59 countries
Segev and Schaffer (2020)	Overall market	1994–2008	USA
Kanas et al. (2019)	Overall market	2009–2015	USA, UK, Canada
Shamshur and Weill (2019)	Overall market	2015	9 EU countries
Silva-Buston (2019)	Overall market	2000–2007	25 EU countries
Clark et al. (2018)	Overall market	2005–2013	10 countries
Cubillas et al. (2017)	Overall market	1989–2007	104 countries
Delis et al. (2017)	Overall market	2000–2010	USA
Leroy and Lucotte (2017)	Overall market	2004–2013	97 large European Banks
Amidu and Harvey (2016)	Overall market	2002–2009	29 African countries
Inklaar et al. (2015)	Overall market	1996–2006	Germany
Schaeck and Cihák (2014)	Overall market	1995–2005	10 E.U. countries
Beck et al. (2013)	Overall market	1994–2009	79 countries
Panel B: Market power by events			
Events (Okolelova & Bikker, 2022)	Establishment of a single supervisory mechanism by the ECB	2013–2016	5 EU countries
Davis et al. (2020)	2007-09 GFC	1999–2015	112 countries
Glass et al. (2020)	2007-09 GFC	1994–2015	USA
Saif-Alyousfi et al. (2020)	2007-09 GFC	1998–2016	GCC countries
Davis and Karim (2019)	2007-09 GFC	1998–2012	27 E.U. countries
Deli et al. (2019)	Formal enforcement actions	1997–2014	USA
Spierdijka and Zaourasa (2018)	2007-09 GFC	2000–2014	USA
Apergis et al. (2016)	2007-09 GFC, adoption of euro	1996–2011	E.U. countries
Chronopoulos et al. (2015)	2007-09 GFC, 2 deregulation acts	1984–2010	USA
Duygun et al. (2015)	2007-09 GFC	2005–2008	34 countries
Efthyvoulou and Yildirim (2014)	2007-09 GFC	2002–2010	17 CEE countries
Panel C: Market power by output structure			
Shaffer and Spierdijk (2020)	Loans, securities, OBS items	2011–2017	USA
Wang et al. (2020)	Loans, deposits	2006–2015	19 EU countries
Degl'Innocenti et al. (2018)	Loans, customer deposits	1993–2011	Italy
Forssbæck and Shehzad (2015)	Loans, deposits	1995–2007	48 countries
Leroy and Lucotte (2015)	Consumer loans, real estate loans, firm loans, firm deposits, household deposits	2003–2010	11 Eurozone countries
Buch et al. (2013)	Loans, securities, OBS items	2003–2006	Germany
Panel D: Market power by ownership type			
Mamatzakis and Vu (2018)	City, regional I, regional II	2000–2014	Japan
Delis et al. (2016)	Foreign, domestic	1997–2009	131 countries
Tan (2016)	State, joint-stock, city	2003–2011	China
Kick and Prieto (2015)	Saving, cooperative, regional, large	1994–2010	Germany
Efthyvoulou and Yildirim (2014)	Foreign, domestic	2002–2010	17 CEE countries

(Continues)

TABLE 1 (Continued)

Author(s)	Classification(s)	Period	Country/region
Panel E: Market power by income-group			
Davis et al. (2020)	Advanced, emerging	1999–2015	112 countries
Clerides et al. (2015)	Low income, lower-middle income, upper-middle income, high income, OECD member	1997–2010	148 countries
Mirzaei and Moore (2014)	Developed, emerging, developing	1999–2011	146 countries
Panel F: Market power by stages of production			
Spierdijka and Zaourasa (2018)	Economies of scale, diseconomies of scale	2000–2014	USA

Note: This table provides a limited selection of recent studies (published in the last decade) on market power in banking at several levels: overall market, events, output types, bank ownership structure, country income-group and bank stages of production. All studies listed use non-structural competition measures, namely: the Lerner index, Boone indicator and Panzar-Rosse *H*-statistic. Studies appearing multiple times have utilized several classifications of market power. GFC is the 'global financial crisis'; OBS is the 'off-balance sheet'; ECB is the 'European central bank'.

criticized for shortcomings in determining the level of market power in specific cases, the structural measures are widely considered to fail as an accurate proxy for market power (Matthews et al., 2007; Shaffer, 2004). As a result, non-structural measures, mainly the Lerner index, have become the most popular measure of market power and competition (Blair & Daniel Sokol, 2014; Spierdijka & Zaourasa, 2018). It has been widely applied for competition studies in banking (e.g., Angelini & Cetorelli, 2003; Berger et al., 2009; Cubillas et al., 2017; de Guevara et al., 2007; Deli et al., 2019; Delis et al., 2017; Leroy & Lucotte, 2015; Okolelova & Bikker, 2022).

The existing literature on market power in banking is extensive and focuses particularly on the overall market (Panel A of Table 1). Market power for the banking market in a certain country is usually calculated as the average market power of all banks in a certain country. This estimation assumes all banks are homogeneous in one market, which is not necessarily true. Another strand of the literature has been looking at the changes in market power around certain events. For instance, a large volume of published studies has described how the market power of banks has changed before and after the 2007–2009 global financial crisis (Panel B of Table 1). More recently, studies focused on the analysis of the differences of market power levels across several criteria. This includes the estimation of market power separately for different output types (Panel C of Table 1), for a group of banks based on ownership structure (Panel D of Table 1), for a group of countries based on income-group (Panel E of Table 1), and lastly for a group of banks based on stages of production (Panel F of Table 1). The latter group has received rather scant attention in the banking literature.

In this article, we classify the market power of banks according to the three stages of production (economies of scale, optimal scale and diseconomies of scale). While Spierdijka and Zaourasa (2018) have considered the stages of production, this is done for only two (economies of scale and diseconomies of scale) out of the three theoretically possible stages of production. The focus of the current study is the analysis of market power that accounts for scale in banking in the GCC countries.

2.1 | Literature on the GCC

GCC is a union of six oil-exporting countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The creation of the GCC in 1981 was a result of shared features, such as religion, culture, language and coordinated policies. Collectively, these nations possess significant natural resources, strategic geographical locations and diverse cultures, making them prominent players in regional and global affairs (Gerged et al., 2023).

The economies of the six GCC countries heavily rely on the gas and oil sectors, highlighting the crucial role of oil for these nations. Fluctuations in oil prices have a profound impact on these economies (Rutledge & Polyzos, 2023). In particular, Ibrahim (2019) provides evidence that a rise in oil prices positively contributes to banks' profits and output growth. However, sharp declines in oil prices have a detrimental effect on the credit quality and economic growth of the GCC countries. Additionally, Maghyereh & Ziadat (2023) highlight a significant and direct relationship between oil prices and the sovereign credit risk of GCC countries. Further, shocks in oil prices and supply are observed to increase the stress of the GCC financial markets (Elsayed et al., 2022) and to amplify the systemic risk of banks (Maghyereh & Abdoh, 2021).

In the GCC, both conventional and Islamic banks offer very similar banking services. Islamic banks follow

the Sharia principle, which precludes receiving or paying interest. Instead, the banks recompense depositors with non-definite returns while borrowers pay using a cost-plus principle or by sharing profit on loans (Kabir et al., 2017). It is estimated that more than a fifth of all assets are within the Islamic banks in the GCC (Basu et al., 2018). Moreover, except for Bahrain, most banks are retail banks in the GCC banking markets. In Bahrain, however, retail and wholesale[i] banks coexist with relatively equal market shares.

The literature regarding banking competition or scale economies of banks in GCC countries is rather small. Examples of the competition studies include Al-Muharrami et al., 2006, Turk-Ariss, 2009, Mirzaei & Moore, 2014, Clerides et al., 2015 and Delis et al., 2016. Some studies include GCC in a wider set of countries. The Panzar–Rosse analysis suggests that GCC banking markets are operating within monopolistic to perfect competition conditions (Al-Muharrami et al., 2006; Turk-Ariss, 2009). Similarly, the Lerner index estimates show low to moderate levels of market power for GCC banks, which implies that the competition level is quite high (Clerides et al., 2015; Delis et al., 2016; Mirzaei & Moore, 2014).

For scale economies of GCC banks, Al-Jarrah et al. (2021) estimate economies of scale and then relate them to bank characteristics following Beccalli et al. (2015) with some emphasis on the sizes of the banks and the 'Too Big To Fail argument'. The results imply that banks in all GCC countries appear to operate under economies of scale. The economies of scale stage is the highest among banks in Bahrain and UAE, and the lowest in Oman and Saudi Arabia. Also, they find that more important/larger banks operating in the GCC do not exploit their scale economies. Bank size appears to be a substantial determinant of bank profitability in the GCC region (Al-Matari, 2023). However, the divergences of competition and market power levels among banks in different stages of production have not yet been investigated. To provide more evidence on the relationship, the article focuses on estimating the market power of banks in the GCC region and subsequently categorizing the market power based on the three stages of production (i.e., economies of scale, optimal scale and diseconomies of scale).

3 | DATA

The sample utilized in this research is unique as it includes all national retail banks that have operated in the GCC between 2000 and 2017. To certify this, the list of operating banks was retrieved from the central bank of each country. Table A1 in the Appendix provides the list of all 79 operating banks in the GCC that were included in the sample of this article. This comprehensive dataset was combined from four different sources to ensure full coverage and to cross-validate the data. The four sources are Bloomberg, S&P Global Market Intelligence, BankScope and annual reports of banks. The annual reports were used to fill the gap of missing data and as a reliable source for cross-validation.

To ensure data reliability, three selection criteria were applied (similar strategies are followed, for example, in Clerides et al. (2015)). First, for consistency purposes, the sample focuses on banks that engage in the traditional intermediation function of a bank. Thus, the sample includes both national conventional retail and national Islamic retail banks. Banks that perform diversified functions or have decidedly other structures are not in the sample. For example, investment banks and wholesale banks are not considered. Foreign banks are also excluded, as they play a marginal role in the banking systems of these countries and mainly focus on investment activities (Alfaihani et al., 2021; Al-Jarrah et al., 2021).

Second, special care is taken of mergers and acquisitions (M&A). More precisely, banks are not included twice in the sample after the consolidation. For example, the UAE had a regional consolidation in 2007, when the Emirates NBD Bank was formed with the merger of two banks: National Bank of Dubai and Emirates Bank International. Hence, these two banks appeared in the sample only until the merger in 2006. After that, only Emirates NBD is included.

Third, the sample contains all national retail banks from 2000 through 2017. In addition, the individual bank's data were re-examined one by one and compared with actual data from annual reports and are updated accordingly. To further clean the data and avoid multiple counting, the selection relies on consolidated financial statements that include the statements of subsidiaries and branches. This is a crucial process for data reliability and for avoiding sample biases.

The above procedure allowed us to have a sample of GCC banks that is trustworthy and serves as a solid foundation for reliable empirical results. As a final step of the data cleaning process, we trimmed all variables at the 1st and 99th percentiles and excluded outliers and unreasonable values. Hence, the final sample includes an unbalanced panel of 981 bank-years corresponding to the 79 banks in the Gulf region between 2000 and 2017. This is the largest detailed, comprehensive sample for the national retail banks in the GCC, which operate homogeneously and are not mixed with the other types of banks. It is, therefore, a very significant step towards crystallizing the computation of competition indices.

TABLE 2 Data definition.

Variable	Measure	Notation
Total operating costs	Natural log of deflated total interest expenses and total non-interest expenses	TC_{it}
Bank's single output	Natural log of deflated total assets	Y_{it}
Price of deposits	Total interest expense/total customer deposits	ω_d
Price of labour	Personnel expenses/total assets	ω_l
Price of physical capital	(Operating expenses – personnel expenses)/fixed assets	ω_k
Output price	Total income/total assets	P

Table 2 clarifies the construction of cost function variables. The sample statistics for each country are given in Table 3. Throughout the region, Saudi Arabia has on average the largest banks, while the smallest banks are in Bahrain and Oman. Consequently, Saudi Arabia has the highest average total costs, whereas Bahrain and Oman enjoy the lowest levels of average total costs. The price of physical capital appears to be the largest component of the banks' total costs in all of the countries. In terms of the output price, this is similar across countries in the region, with an average of 5.8%.

4 | ECONOMETRIC METHODOLOGY

4.1 | Market power

The Lerner index measures the departure of the output price from the marginal cost (MC) pricing, which is viewed as the socially desired outcome in a perfectly competitive market (Lerner, 1934). It became established to be the standard measure of market power (Blair & Daniel Sokol, 2014). The Lerner index for each bank i at year t is computed as (Jiménez et al., 2013):

$$L_{it} = \frac{P_{it} - \mathrm{MC}_{it}}{P_{it}}, \tag{1}$$

where P_{it} and MC_{it} are output price and the marginal cost of the bank i in time t, respectively. The output price is the bank's average revenue proxied as the ratio of its total revenues to total assets (e.g., Beck et al., 2013). Marginal costs are not directly observable in the data and hence must be estimated from a cost function. We follow vast banking literature as early as (Sealey & Lindley, 1977) to the more recent application (e.g., Casu et al., 2013, to name a few) to assume the transcendental logarithmic (translog thereafter; see e.g., (Berndt & Christensen, 1973)) specification of the cost function, viz.,

$$\begin{aligned}\ln tc_{it} &= \alpha_i + \beta_y \ln Y_{it} + \frac{1}{2}\beta_{yy} \ln Y_{it}^2 + \sum_{j=2}^{3} \beta_{j,p} \ln \omega_{j,it} \\ &+ \frac{1}{2}\sum_{j=2}^{3}\sum_{r=2}^{3} \beta_{jr,pp} \ln \omega_{j,it} \ln \omega_{r,it} + \sum_{j=2}^{3} \beta_{j,py} \ln \omega_{j,it} \ln Y_{it} \\ &+ \beta_{t,y} t \ln Y_{it} + \beta_{tt,y} t^2 \ln Y_{it} + \beta_t t + \beta_{tt} t^2 + \varepsilon_{it},\end{aligned} \tag{2}$$

where t is a time trend and ε_{it} is the usual symmetric error component. The technology employs three inputs (deposits, labour and physical capital) to produce its single output (total assets) (similar to Casu et al., 2004). The bank's total costs TC_{it} are measured as the sum of all interest and non-interest expenses, while the bank's single output factor is its total assets (Y_{it}). The prices of the three inputs are as follows. The price of physical capital ($\omega_{k,it}$), deposits ($\omega_{d,it}$), and labour ($\omega_{l,it}$) are obtained by dividing capital expenditures, total interest expenses and expenses on personnel by fixed assets, total customer deposits and total assets, respectively. The homogeneity of degree one is imposed on the total costs and input prices by normalizing the total costs, the prices of deposits and physical capital with the price of labour. More specifically, in Equation 2, $\omega_{1,it} = \omega_{d,it}/\omega_{l,it}$, $\omega_{2,it} = \omega_{k,it}/\omega_{l,it}$ and $tc = \mathrm{TC}/\omega_{l,it}$. Given specification 2, the marginal costs (MC) are calculated as (similar to Anginer et al., 2014):

$$\begin{aligned}\mathrm{MC}_{it} &= \mathrm{AC}_{it} \\ &\times \left(\beta_y + \sum_{j=2}^{3} \beta_{j,py} \ln \omega_{j,it} + \beta_{yy} \ln Y_{it} + \beta_{t,y} t + \beta_{tt,y} t^2\right).\end{aligned} \tag{3}$$

4.2 | Categorization of stages of production

The analysis of scale economies is only applicable when firms are operating with the U-shaped AC curve. Therefore, the coefficients β_{yy} in Equation 2 must be positive and significant. If this is the case, one can proceed with classifying firms into the different stages of production.

TABLE 3 Sample summary statistics.

	Bahrain				Kuwait				Oman			
	Mean	**Std. dev.**	**Min.**	**Max.**	**Mean**	**Std. dev.**	**Min.**	**Max.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Total assets	10,897	13,222	1380	57,937	26,407	20,605	6290	119,147	12,210	12,271	1536	66,275
Price of output	5.6%	1.7%	3.0%	13.3%	5.6%	1.4%	3.7%	9.4%	6.0%	1.6%	2.9%	9.9%
Total costs	368.3	403.3	59.0	2227.1	852.1	720.8	188.6	3836.2	396.1	327.6	94.1	1612.8
Average costs	3.9%	1.5%	1.6%	8.1%	3.4%	1.4%	1.3%	12.3%	3.7%	1.2%	2.1%	7.4%
Price of deposits	4.2%	3.1%	0.7%	20.5%	3.3%	1.9%	0.7%	10.2%	2.5%	1.5%	0.4%	9.1%
Wage rate	1.0%	0.3%	0.4%	2.2%	0.6%	0.2%	0.4%	1.1%	1.1%	0.3%	0.6%	2.0%
Price of physical capital	0.93	0.95	0.21	7.47	0.81	1.45	0.07	15.44	0.98	0.49	0.25	2.35
# bank-years	130				119				108			
	Qatar				**Saudi Arabia**				**UAE**			
	Mean	**Std. dev.**	**Min.**	**Max.**	**Mean**	**Std. dev.**	**Min.**	**Max.**	**Mean**	**Std. dev.**	**Min.**	**Max.**
Total assets	19,279	19,213	1284	145,923	55,074	33,875	5576	160,372	22,745	25,027	1807	122,592
Price of output	5.6%	1.9%	2.9%	15.2%	5.4%	1.8%	2.6%	18.5%	6.0%	1.7%	2.9%	12.4%
Total costs	493.3	452.3	46.6	2428.5	1375.5	689.9	164.5	4661.9	669.9	628.9	59.4	2777.0
Average costs	3.0%	1.2%	1.3%	7.7%	2.9%	1.1%	1.3%	6.2%	3.3%	1.1%	1.7%	6.9%
Price of deposits	2.7%	1.6%	0.7%	11.6%	1.6%	1.3%	0.0%	6.0%	2.5%	1.3%	0.5%	7.7%
Wage rate	0.7%	0.2%	0.3%	1.9%	0.9%	0.4%	0.5%	2.3%	1.0%	0.4%	0.4%	2.4%
Price of physical capital	0.83	0.52	0.21	3.09	0.91	0.43	0.24	3.47	0.71	0.45	0.02	2.63
# bank-years	141				168				315			

Note: All bank-level variables are in real millions of USD.

The stages of production for each bank-year are categorized as (1) economies of scale for bank-years with $MC < AC$; (2) diseconomies of scale for bank-years with $MC > AC$; and (3) optimal scale for bank-years with $MC = AC$. A significant contribution of this article is that we propose to identify optimally scaled banks operating under the most productive scale size (MPSS) by employing a simple testing procedure. The previous literature only considered the first two categories: economies and diseconomies of scale (e.g., Spierdijka & Zaourasa, 2018). The literature did not consider the third category 'optimally scaled' since the marginal and average costs are both continuous and the probability of observing a bank with exactly the same marginal and average costs is zero. We categorize banks by checking whether MC is different from AC in a statistical sense, whereby the null hypothesis $H_0 : MC - AC = 0$ against the alternative hypothesis $H_a : MC - AC \neq 0$ is tested. The testing procedure is operationalized by obtaining a statistic that is equal to the predicted values of $(MC - AC)$ divided by the standard error of $(MC - AC)$[ii] and comparing the absolute value of the resulting statistic to 1.96.[iii] If the absolute value of the statistic is smaller than 1.96, we categorize the bank to be scale-optimal. If the absolute value of the statistic is larger than 1.96 and $(MC - AC) < 0$, the bank is said to have economies of scale, and diseconomies of scale otherwise.

The proposed testing procedure enables the identification of optimally scaled banks, which is not possible with the traditional numerical categorization whereby the value of MC is compared with that of AC (Spierdijka & Zaourasa, 2018). Also, the proposed method ensures that the categorization of banks into the stages of production avoids misspecification of the production stages. Once the bank is assigned into a category, we investigate whether the market power of banks differs according to their stages of production. *Does the stage of production really matter? Does this necessarily imply that large-sized banks who reached the diseconomies of scale stage enjoy higher market power? What stage of production results in most competitive banking markets?* The next section addresses these questions.

5 | EMPIRICAL RESULTS AND DISCUSSION

5.1 | Market power and competition over time

The first section of the empirical results discusses the level of market power and competition in the GCC region over the sample period. The empirical results of the cost function (Equation 2) used for the estimation of the Lerner Index are shown in Appendix (Table A2). Here, we only note that we estimate Equation 2 separately for each of the six GCC countries to avoid imposing the same technology structure on all countries in our sample.

Figure 1 shows the average Lerner Index weighted by total assets[iv] for each GCC country over the period 2000–2017. Predominantly, the market power of GCC banks demonstrates a growing trend over the sample period. This also implies that, in general, the banking markets of the GCC countries were highly competitive in the 2000s, yet less competitive by 2017.

Between 2000 and 2005, banks had low market power and started to gain more towards 2005. After that, the market power declined and reached a trough in 2008, the time of the global financial crisis. The largest trough was in Kuwait where banks lost substantial market power and the average Lerner index was around 10% only. This can be due to the notable losses suffered by one of the largest local banks (Gulf Bank) in Kuwait during 2008 as a result of its trading in financial derivatives and foreign currencies. Moreover, the local banks of Kuwait reported a decelerated growth of the total aggregate balance sheet during that year (Central Bank of Kuwait, Economic Report (2008)). Following the global financial crisis, GCC banks restored their market power and the GCC banking markets became less competitive till a peak in market power was reached in 2015. However, the market power of GCC banks started to decline afterward. By 2017, the average market power of banks was 32% in Kuwait, 37% in Oman, 41% in Bahrain, 43% in Qatar, 48% in Saudi Arabia and 49% in UAE. Therefore, the most competitive banking markets in the GCC region are Kuwait, Oman and Bahrain, whereas the least competitive markets are UAE, Saudi Arabia and Qatar.

5.2 | Market power and competition under different stages of production

We now consider the market power of banks under the different stages of production. Here, we answer the question of whether scale economies play a role in the amount of market power a bank possesses. However, the scale economies analysis is only viable if banks have U-shaped AC. The empirical estimation of Equation 2 reveals that the banking markets of the GCC countries are operating with U-shaped AC since β_{yy} is positive and statistically significant at a 5% level for all countries (Table A2 in Appendix). The estimated values of β_{yy} are 0.06 for Bahrain, 0.09 for Kuwait, 0.05 for Oman, 0.04 for the UAE and 0.08 for Qatar and Saudi Arabia.

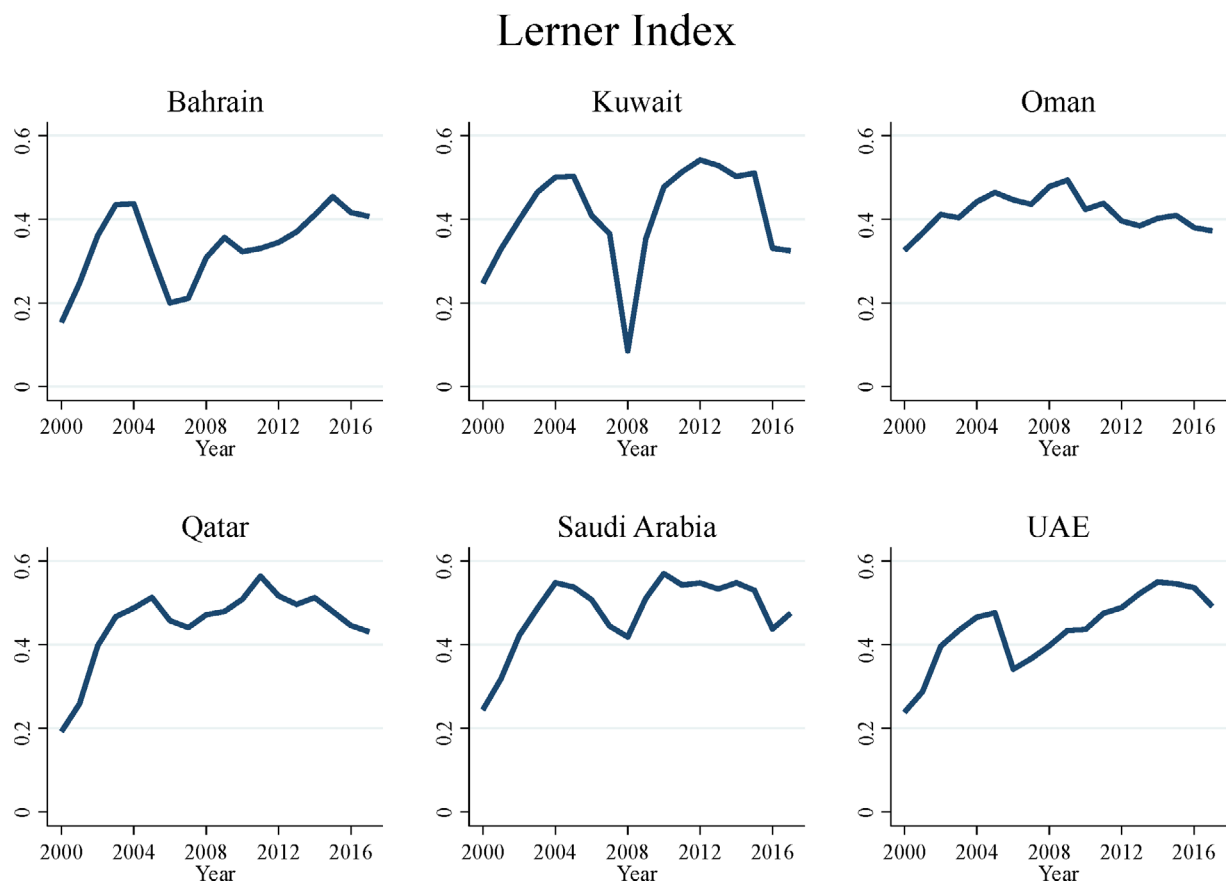

FIGURE 1 Aggregate Lerner over time. The figure shows the empirical estimations of Lerner indices for GCC countries over the period 2000–2017. Lerner equals to $(P - \mathrm{MC}/P)$. The reported values represent the sample averages weighted by total assets. [Colour figure can be viewed at wileyonlinelibrary.com]

This indicates that the scale economies analysis of the GCC banking sectors is of particular relevance.

In Figure 2, we classify the empirical estimations of the Lerner Index into three stages of production: economies of scale, optimal scale and diseconomies of scale. The categorization of banks into different stages of production is conducted according to the proposed testing method in Section 4.2. We additionally break down the graph by the periods that can be inferred from Figure 1. The evolution of competition should be considered in 3 periods: 2000–2007, 2008 (trough of the market power) and 2009–2017. There seems to be a local peak in 2016, after which the Lerner index went down. The results of Figure 2 show that market power and competition levels do vary between banks within a country depending on which stage of production the bank is functioning. There is also a lot of variation over time. The differences in market power and competition among banks are the highest for small to medium-sized markets (Bahrain, Kuwait and Oman), whereas the differences become smaller in large markets (Qatar, Saudi Arabia and UAE). For some countries, some stages of production are not represented. For example, during 2008, there are no banks in the economies of scale stage. In the same period, in Oman, Qatar and Saudi Arabia, there are no banks in the diseconomies of scale stage. In 2008, all banks were optimally scaled in UAE. The most consistent pattern of the composition of stages and importance of market power is in Bahrain. The most time-varying pattern is in UAE banking. We will use these periods in the next section to discuss the implications of not performing the scale analysis accounting for the possibility of the presence of optimally scaled banks.

The results in Figure 2 suggest that banks operating under economies of scale are the ones with the highest market power and lowest competition. This is not the case for some periods and countries, but the overall pattern is implied. More specifically, considering the whole period the weighted-average Lerner index for banks under economies of scale is between 45% and 55%. A possible explanation for this finding is that since banks in economies of scale can grow and increase production while enjoying lower costs, this can facilitate the possession of high market power. In contrast, banks operating

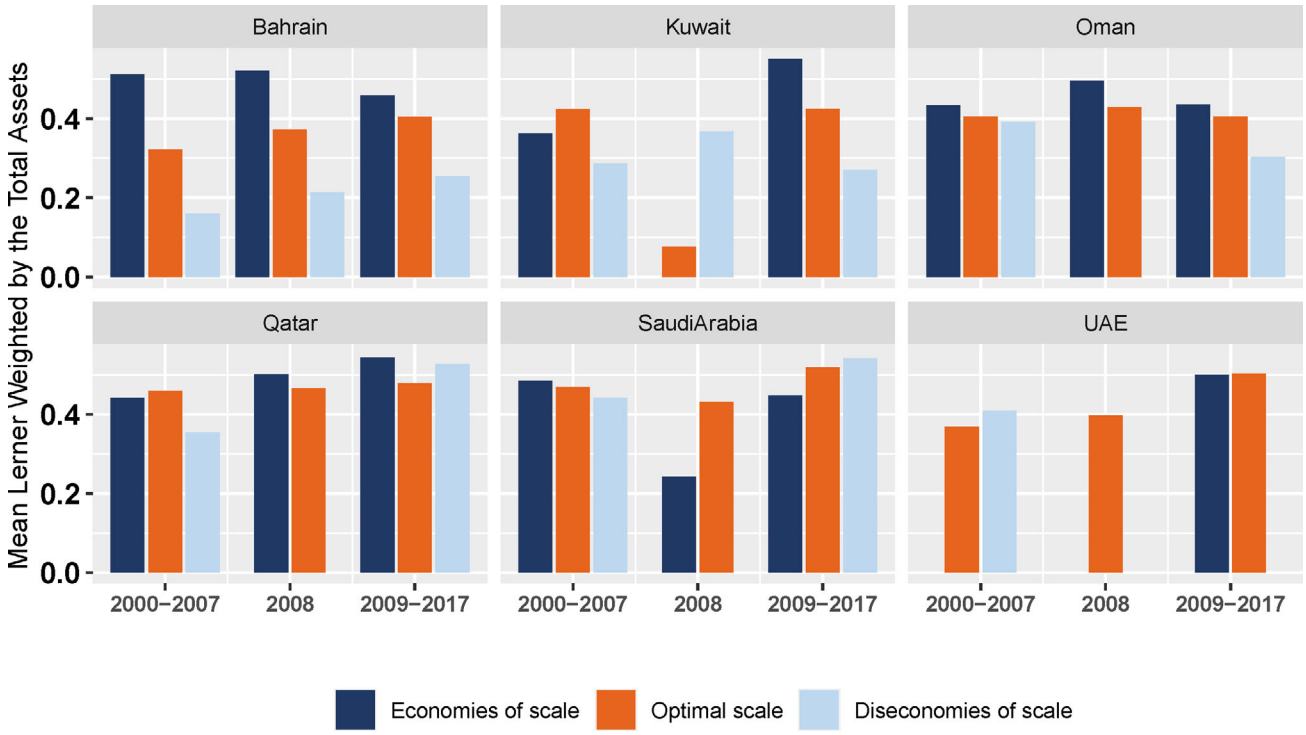

FIGURE 2 The market power of banks under different stages of production. The figure shows the levels of market power and competition of GCC banks operating under the three stages of production: economies of scale, diseconomies of scale, and optimal scale over the period 2000–2017. The competition is measured by the Lerner Index that equal to $(P - \mathrm{MC}/P)$. The reported values represent the sample weighted averages. [Colour figure can be viewed at wileyonlinelibrary.com]

under diseconomies of scale seem the least controllers of the market and the competition is the highest. Considering the whole period, the weighted-average Lerner index varies among countries and goes down to less than 20%. This is likely to be related to the cost restrictions faced by large-sized banks where expanding output may trigger record-level costs. Lastly, banks operating under the optimal scale are the average controllers of the market. They possess more control than large banks in the diseconomies of scale, yet less control than banks in the economies of scale.

However, it is worth mentioning that the differences in market power levels for banks functioning in different stages of production vary highly among the six GCC countries. The market power level is extremely different between individual banks in small- to medium-sized markets (Bahrain, Kuwait and Oman). Apparently, in such markets, banks that have the leverage of increasing production with reduced costs, are the largest controllers of the market. Nevertheless, this difference diminishes with market size. Moreover, the results for the largest market in the region, Saudi Arabia, exhibit contrasting themes as banks in diseconomies of scale are the major controllers of the market and with the highest market power levels. Yet, the differences in market power levels do not vary highly across Saudi banks functioning in different stages of production.

Altogether, in general, the highest competition and minimum market power is between the diseconomies of scale banks. This is followed by average competition and average market power between the optimally scaled banks, while the least competition and maximum market power are among the economies of scale banks. The conclusion here is that the average competition level of a country does not specifically reflect individual banks, as such competition level can vary a lot depending on the production stage of each bank in the country as well as the market size.

5.3 | Misclassification and its consequences

The last section of the empirical results discusses how the proposed method can be used to determine the actual stage of production and, more significantly, to identify the optimally-scaled banks and any miscategorization of banks' operations.

Table 4 shows the classifications of banks into the stages of production under the traditional method, the

TABLE 4 The Lerner index mean values and *t*-tests of equality of the mean values of the Lerner index of banks that are correctly classified and misclassified to have economies and diseconomies of scale.

	Classified ES[a,b]		True[c]		Misclassified[d]		*p*-value of the *t*-test. H_A:	
	N^{ES}	$\overline{L}^{ES}$	$N^{ES,t}$	$\overline{L}^{ES,t}$	$N^{ES,m}$	$\overline{L}^{ES,m}$	$\overline{L}^{ES,t} < \overline{L}^{ES,m}$	$\overline{L}^{ES,t} > \overline{L}^{ES,m}$
t-test for ES Lerner								
Bahrain	84	0.378	64	0.393	20	0.330	0.920	0.080
Kuwait	77	0.451	23	0.542	54	0.412	0.988	0.012
Oman	68	0.413	49	0.427	19	0.377	0.956	0.044
Qatar	82	0.494	19	0.516	63	0.487	0.803	0.197
Saudi Arabia	78	0.445	16	0.446	62	0.445	0.513	0.487
UAE	164	0.478	34	0.508	130	0.470	0.942	0.058
	Classified DS[e,f]		**True[g]**		**Misclassified[h]**		***p*-value of the *t*-test. H_A:**	
	N^{DS}	$\overline{L}^{DS}$	$N^{DS,t}$	$\overline{L}^{DS,t}$	$N^{DS,m}$	$\overline{L}^{DS,m}$	$\overline{L}^{DS,t} < \overline{L}^{DS,m}$	$\overline{L}^{DS,t} > \overline{L}^{DS,m}$
Bahrain	46	0.245	17	0.155	29	0.297	0.004	0.996
Kuwait	42	0.366	4	0.299	38	0.373	0.099	0.901
Oman	40	0.368	12	0.320	28	0.389	0.028	0.972
Qatar	59	0.453	15	0.458	44	0.452	0.586	0.414
Saudi Arabia	90	0.482	8	0.483	82	0.481	0.514	0.486
UAE	151	0.426	40	0.412	111	0.431	0.172	0.828

Note: N^{ES} stands for the number of those banks, classified based on table note *a*; $\overline{L}^{ES}$ is the average Lerner index for those banks. $N^{ES,t}$ stands for the number of those banks, classified based on table note *c*; $\overline{L}^{ES,t}$ is the average Lerner index for those banks. $N^{ES,m}$ stands for the number of those banks, classified based on table note *d*; $\overline{L}^{ES,m}$ is the average Lerner index for those banks. N^{DS} stands for the number of those banks, classified based on table note *e*; $\overline{L}^{DS}$ is the average Lerner index for those banks. $N^{DS,t}$ stands for the number of those banks, classified based on table note *g*; $\overline{L}^{DS,t}$ is the average Lerner index for those banks. $N^{DS,m}$ stands for the number of those banks, classified based on table note *h*; $\overline{L}^{DS,m}$ is the average Lerner index for those banks.

[a]Classified using a traditional method whereby MC < AC.

[b]Economies of scale.

[c]MC < AC and the null hypothesis $H_0 : MC - AC = 0$ is rejected.

[d]MC < AC and the null hypothesis $H_0 : MC - AC = 0$ is not rejected.

[e]Classified using a traditional method whereby MC > AC.

[f]Diseconomies of scale.

[g]MC > AC and the null hypothesis $H_0 : MC - AC = 0$ is rejected.

[h]MC > AC and the null hypothesis $H_0 : MC - AC = 0$ is not rejected.

proposed testing procedure and the number of misclassified observations when the two methods are compared. Table 4 suggests that a large portion of banks would be misclassified if the proposed testing method is ignored. The upper part of Table 4 shows the classifications into the economies of scale stage, whereas the lower part demonstrates the classifications into the diseconomies of scale stage. In Kuwait, for instance, the traditional method would suggest that 77 observations are classified in economies of scale. At the same time, the proposed testing method implies that only 23 observations are in economies of scale. This leaves 54 misclassified observations. The percentage of misclassified observations is quite high and reaches 48%. This percentage aggravates in the case of diseconomies of scale, where the traditional method asserts that 42 observations are in diseconomies of scale, while in fact only 4 observations are truly specified and the rest 38 observations are misclassified. These misclassified observations are to be classified as banks in the optimal scale stage. The tendency to misclassification is similar across all GCC countries.

Figure 3 further emphasizes the advantage of the proposed testing method: the quite sizeable orange bar shows the proportion of optimally scaled banks when the proposed procedure is applied and does not exist when the traditional method is used. The traditional method, therefore, fails to identify an entire stage of production, the optimal scale stage.

We additionally break down the misclassification by the time periods that we discussed in the previous section. The proportions of the economies of scale-related misclassification are presented in Figure 4. The dark blue colour bars show the proportion (and the number) of those banks that are correctly classified by economies of

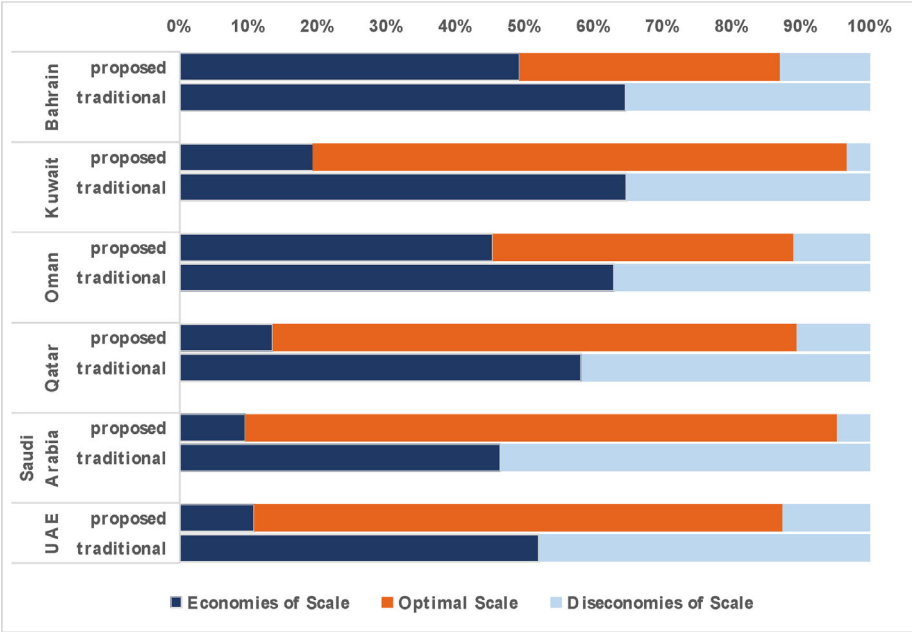

FIGURE 3 Classifications of stages of production: Traditional versus proposed methods. The figure shows the classification of banks into the three technological stages. (proposed) display the classification according to the new proposed approach in this paper which classifies observations based on statistical testing, whereas (traditional) displays the classification based on the traditional approach that classifies observations based on the numerical difference. [Colour figure can be viewed at wileyonlinelibrary.com]

scale, and the light blue colour shows the proportion of banks that the traditional method identified as economies of scale, while they are classified to be optimally scaled banks by the proposed methodology.

In all countries, nearly all banks classified to be in economies of scale by the traditional methods, are actually optimally scaled. This is remarkable as it implies that these banks should *not* have been upsizing. Their upsizing may have led to worse performance of the entire banking sector. In 2008, the traditional method did better, whereby the proportions of misclassification went down, probably because it now classifies the banks to be in diseconomies of scale (which we discuss below). Starting from 2009, the traditional method was misclassified much less than before 2008, but it comes at a price as we will see later. All in all, it seems that 2008 has been a period where the scale has been corrected and the estimation picks up this trend and identifies economies of scale banks as truly economies of scale.

Figure 5 shows the proportion and number of banks classified by the traditional method as diseconomies of scale, which may be either a misclassification—where the banks are indeed optimally scaled,—or a correct classification confirmed by our proposed methodology. The picture here is even direr than with the misclassification of the economies of scale. The traditional method nearly completely misclassified banks in 2008. It improves only slightly for the period from 2009 for some countries. Thus, the better classification of the economies of scale from 2008 and later, makes the classification of banks in diseconomies of scale. The misclassified in terms of economies of scale banks are more competitive over the whole period than those that are truly economies of scale. If they are allowed to up-scale they would enter the diseconomies of scale area, which are less efficient and have more market power. Since they are optimally scaled, they should stay in that stage of production and should neither down- nor up-scale. To reiterate the importance of the stages of production analysis, the traditional method would fail to identify optimally scaled banks and would not allow us to perform this type of analysis.

5.4 | Discussion

Previous literature on competition in GCC banking markets is quite sparse. Above all, Clerides et al. (2015) found weak market power and more competitive practices within the GCC between 1997 and 2010. Al-Muharrami et al. (2006) show that the conditions in the banking markets of Kuwait, Saudi Arabia and the UAE were close to perfect competition; Qatar and Bahrain were under monopolistic competition and Oman was closer to monopoly. The inconsistency in previous literature may be due to the differences in the sample period examined and in the competition measure applied.

The empirical results of this study provide important insights into the level of competition in the GCC banking markets. The high level of market power in the UAE can be attributed to the two mergers of the four largest banks in the country. These mergers were designed to increase cost efficiency and to create large competitive banks in an international arena. The first case is the 2007 merger of NBD and Emirates International Bank, which yielded

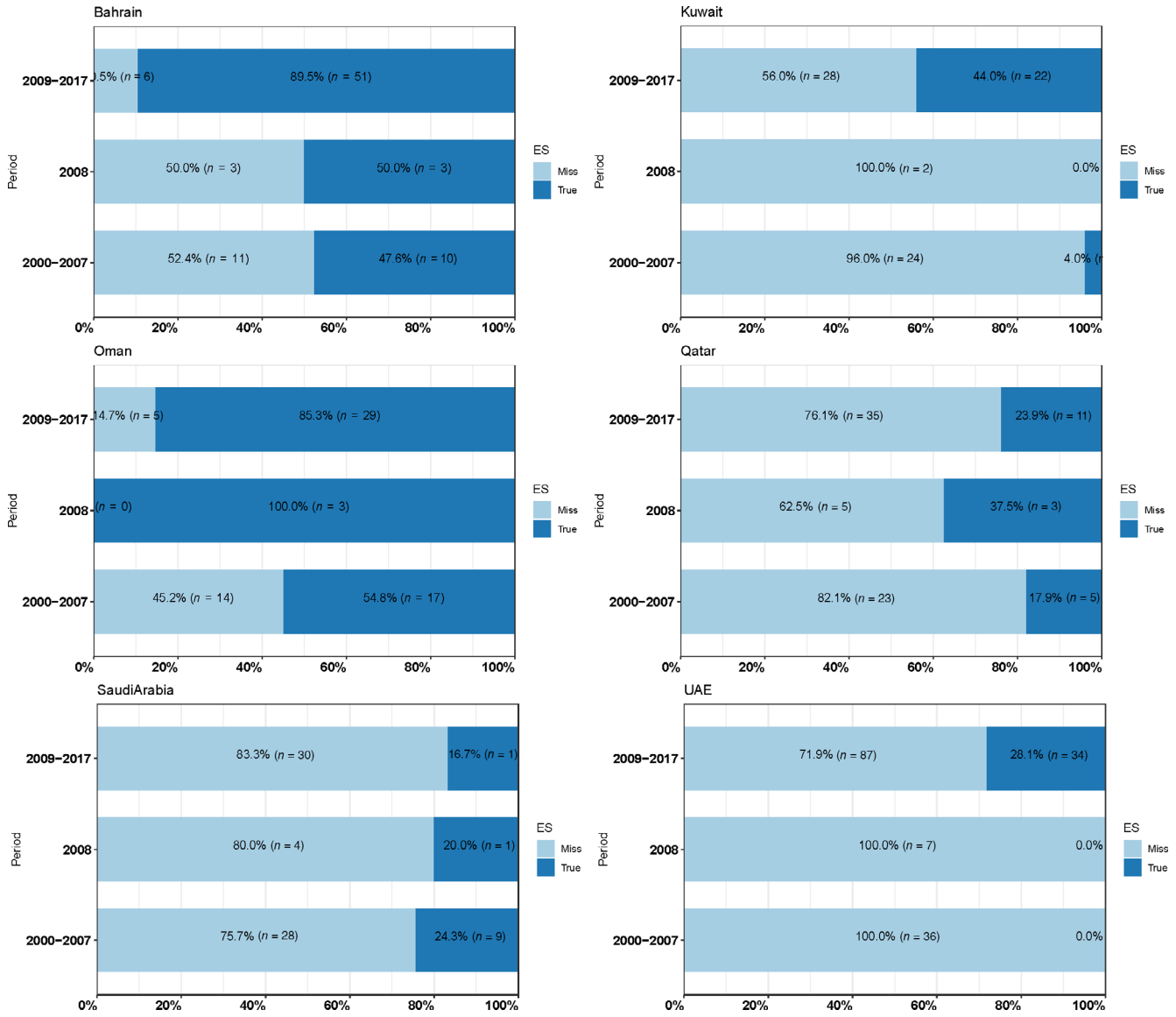

FIGURE 4 Misclassified economies of scale. [Colour figure can be viewed at wileyonlinelibrary.com]

the largest bank in the UAE at that time: Emirates NBD. The second case is when two of the top banks merged in 2017 producing another giant bank, First Abu Dhabi Bank. Such mergers may have reduced the already low level of competition. Qatar followed suit. The low level of banking competition and consequently high market power can be attributable to the high concentration levels, where one bank owns half of the total banking assets. The percentage is over 70% for the top three banks in the country, leaving the remaining banks with less than 30% (see Table A3 for details about market structure measures for all GCC countries).

For Saudi Arabia, even though its banking market exhibits the lowest concentration levels in the region, it also exhibits the lowest level of banking competition. This could be a result of the restricted banking regulations that have limited the operation of foreign bank branches in the country for a long time. On the contrary, the fewer restrictive regulations and the financially liberalized banking markets may be a possible explanation for the high banking competition in Bahrain. Kuwait and Oman are also in the process of enhancing financial regulations and liberalizations, which may explain their position coming closer to monopolistic competitive banking markets, as the Lerner index values are in between the two market extremes: perfect competition and monopoly.

The empirical results about the market power of banks operating in different stages of production emphasize the importance of this granular analysis because market power and competition of banks are linked to financial stability (e.g., Beck et al., 2013; Davis

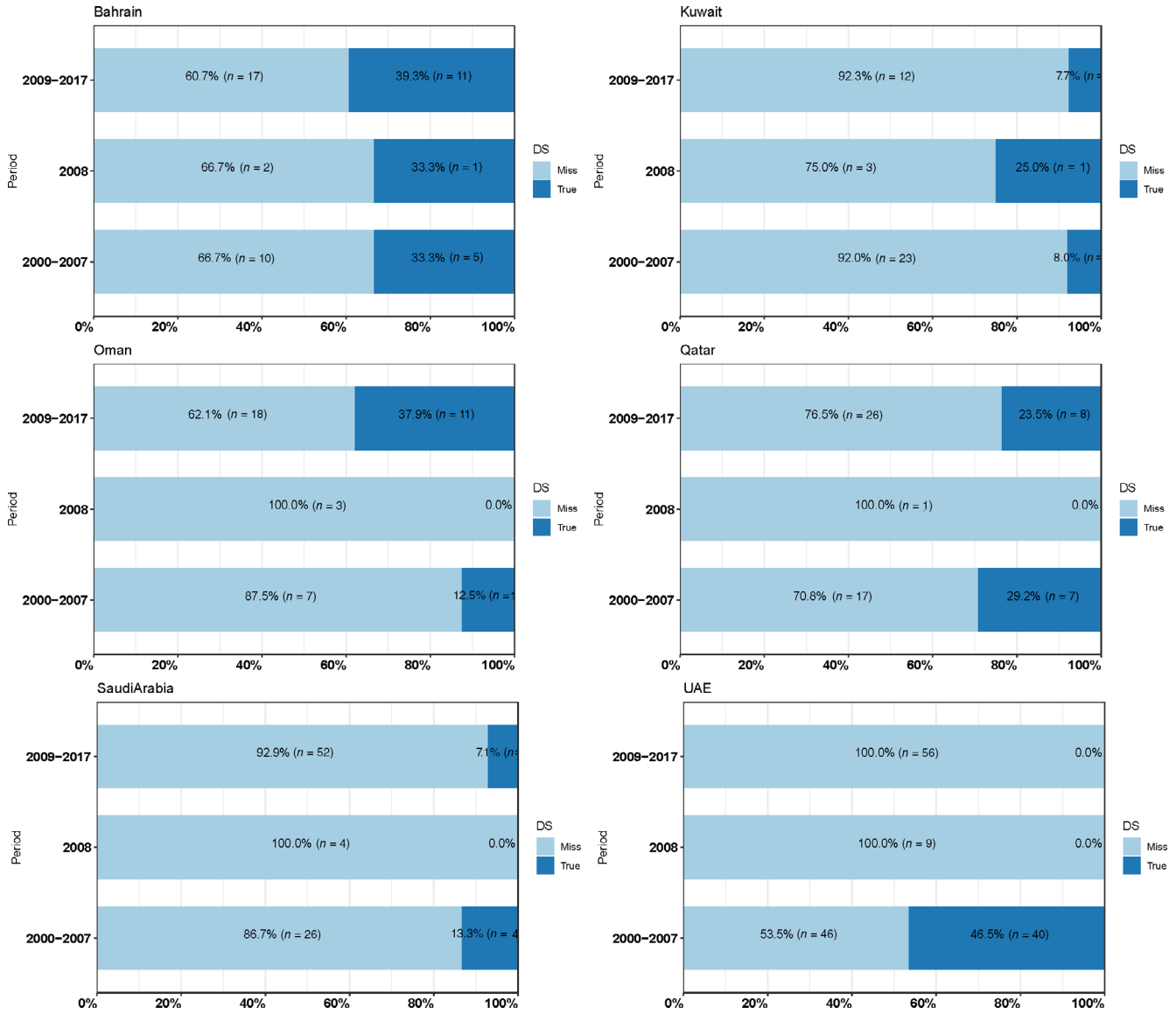

FIGURE 5 Misclassified diseconomies of scale. [Colour figure can be viewed at wileyonlinelibrary.com]

et al., 2020; Kick & Prieto, 2015) and approvals of M&A requests. Therefore, considering the current stages of production for each bank when looking at competition levels will provide useful insights about potential policies that could be implemented for the sake of promotion of competition and stability.

If, however, the analysis can be done incorrectly, then the stages of production are misspecified (e.g., Spierdijka & Zaourasa, 2018). Why does this matter? The answer here is that the misclassification of banks categorization affects the estimations of the market *standing* (a combination of market power and stage of production) of banks, which may lead to incorrect policy implications. Table 4 indicates that in the case of economies of scale, the values of the Lerner index are larger for the truly specified observations when compared with the misclassified ones. For the diseconomies of scale, the situation is the opposite. The Lerner index values are lower for truly specified observations than the misspecified ones. This denotes that the market power of banks in economies of scale is understated, whereas it is overstated for banks in diseconomies of scale. Hence, the misspecification in classifications leads to eliciting incorrect levels of market power and the standing of a bank.

While the cost of misspecification of the economies of scale banks may result in inefficient growth of the banking sector, the cost of misclassification in terms of diseconomies of scale lies in erroneous advice to downscale when the bank is in fact optimally scaled and does not have to reduce its scale. This may have detrimental effects, for example, banks losing markets as soon as a bank downscales. Both are a deviation of the optimal

path of the banking sector development and both should be avoided by employing the proposed methodology.

The empirical analysis in this article raises a number of economic and policy-related concerns as the banking markets are significantly associated with local economies (Hasan et al., 2019). It has been shown that high concentration levels can be associated with the effectiveness of central bank policy and can indicate the high potential for systemic risk (Al-Muharrami et al., 2006). Moreover, changes in the level of market power and M&As in the local banking markets can have adverse effects on the economy (Bernini & Brighi, 2018). Further, the market power and competition of banks are tightly associated with the stability of the financial sector (Boyd & De Nicoló, 2005; Keeley, 1990). Given these repercussions, this article suggests two important takeaways. First, the overall market competition may misrepresent the individual bank's market standing as it depends on the stage of production. Second, the misspecification of classification can lead to false conclusions about the actual market standing of a bank.

6 | CONCLUSION

This article contributes to the current literature in several ways. First, we suggest a new way to identify banks under optimal scale and the most productive scale size. Second, we use this proposed method to differentiate the market power of banks operating under the three stages of production, that is, economies of scale, diseconomies of scale and optimal scale. Third, we demonstrate that the traditional method misclassifies banks into the stages of production and examine the effect of such misclassifications on crucial decisions and policies where we discuss relevant policy implications for banking and antitrust authorities that foster competition.

We apply the proposed method to the banking markets of six GCC countries that pursue major diversification policies and give emphasis on the banking sector as a key driver for such policies. We show that over the sample period, the level of competition between banks has been declining. We show further that the market power is different among banks in the same country depending on the stage of production. For instance, banks in the economies of scale have the strongest market power and weakest competition. However, the lowest market power and highest competition are observed among banks in the diseconomies of scale region. Also, the banks in the optimal scale region have average market power and competition levels.

We suggest that the two important principles for policymakers wishing to promote competition are considered. First, the classifications should consider the proposed statistical testing method to ensure accurate outcomes. Second, the competition analysis should take into account the stages of production. The implications of applying these two principles would lead to a better understanding of how the individual bank's market power can be highly different from the overall market power and suggest more efficient implementation of policies by competition authorities and central banks.

ACKNOWLEDGEMENTS

We are indebted to the editor and three anonymous referees for invaluable comments and suggestions.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in S&P Global Market Intelligence at https://www.spglobal.com/marketintelligence/en/campaigns/commercial-banks?cq_cmp=1709481058&cq_plac=&cq_net=g&cq_pos=&cq_plt=gp&utm_source=google&utm_medium=cpc&utm_campaign=Banking_Global_Search_Google&utm_term=banking%20sector%20data&utm_content=5540476.

ORCID

Shabbar Jaffry https://orcid.org/0000-0002-2234-9575

ENDNOTES

[i] Volume 1-LR1.2.2 of the Central Bank of Bahrain Rulebook, states that, the wholesale banks are further broken down into the offshore and investment banks.

[ii] Standard errors of the $(MC - AC)$ are obtained using the Delta method.

[iii] The test is performed at the 5% level.

[iv] We thank the anonymous reviewer for this suggestion.

REFERENCES

Abuzayed, B., Al-Fayoumi, N., & Molyneux, P. (2018). Diversification and bank stability in the GCC. *Journal of International Financial Markets, Institutions and Money*, *57*(November), 17–43. https://doi.org/10.1016/j.intfin.2018.04.005

Alfaihani, S., Badunenko, O., & Jaffry, S. (2021). Market size and market structure in banking. *Journal of International Financial Markets, Institutions and Money*, *72*(May), 101342. https://doi.org/10.1016/j.intfin.2021.101342

Al-Jarrah, I. M. W., Al-Abdulqader, K., & Hammoudeh, S. (2021). How do bank features and global crises affect scale economies? Evidence from the banking sectors of oil-rich GCC emerging markets. *Emerging Markets Finance and Trade*, *57*(3), 891–913. https://doi.org/10.1080/1540496X.2019.1602765

Al-Matari, E. M. (2023). The determinants of bank profitability of GCC: The role of bank liquidity as moderating variable—further analysis. *International Journal of Finance and Economics*, *28*(2), 1423–1435. https://doi.org/10.1002/ijfe.2485

Al-Muharrami, S., Matthews, K., & Khabari, Y. (2006). Market structure and competitive conditions in the Arab GCC banking system. *Journal of Banking and Finance*, *30*(12), 3487–3501. https://doi.org/10.1016/j.jbankfin.2006.01.006

Amidu, M., & Harvey, S. K. (2016). The persistence of profits of banks in Africa. *Review of Quantitative Finance and Accounting*, *47*(1), 83–108. https://doi.org/10.1007/s11156-014-0495-8

Andrikopoulos, A., & Dassiou, X. (2022). Bank market power and performance of financial technology firms. *International Journal of Finance and Economics*, *1–16*, 1141–1156. https://doi.org/10.1002/ijfe.2727

Angelini, P., & Cetorelli, N. (2003). The effects of regulatory reform on competition in the banking industry. *Journal of Money, Credit and Banking*, *35*(5), 663–684. https://doi.org/10.1353/mcb.2003.0033

Anginer, D., Demirguc-Kunt, A., & Zhu, M. (2014). How does competition affect bank systemic risk? *Journal of Financial Intermediation*, *23*(1), 1–26. https://doi.org/10.1016/j.jfi.2013.11.001

Apergis, N., Fafaliou, I., & Polemis, M. L. (2016). New evidence on assessing the level of competition in the European Union banking sector: A panel data approach. *International Business Review*, *25*(1), 395–407. https://doi.org/10.1016/j.ibusrev.2015.07.003

Asongu, S. A., & Odhiambo, N. M. (2019). Testing the quiet life hypothesis in the African banking industry. *Journal of Industry, Competition and Trade*, *19*(1), 69–82. https://doi.org/10.1007/s10842-018-0278-3

Badunenko, O. (2010). Downsizing in the German chemical manufacturing industry during the 1990s. Why is small beautiful? *Small Business Economics*, *34*(4), 413–431. https://doi.org/10.1007/s11187-008-9142-x

Banker, R. D. (1984). Estimating most productive scale size using data envelopment analysis. *European Journal of Operational Research*, *17*(1), 35–44. https://doi.org/10.1016/0377-2217(84)90006-7

Banker, R. D., Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). Returns to scale in DEA. In W. W. Cooper, L. M. Seiford, & J. Zhu (Eds.), *Handbook on Data Envelopment Analysis* (Vol. 164, pp. 41–70). Springer. https://doi.org/10.1007/978-1-4419-6151-8_2

Basu, R., Prasad, A., & Rodriguez, S. (2018). Monetary operations and islamic banking in the GCC: Challenges and options. *Journal of Governance and Regulation*, *7*(1), 49–63. https://doi.org/10.22495/jgr_v7_i1_p4

Beccalli, E., Anolli, M., & Borello, G. (2015). Are European banks too big? Evidence on economies of scale. *Journal of Banking and Finance*, *58*, 232–246. https://doi.org/10.1016/j.jbankfin.2015.04.014

Beck, T., De Jonghe, O., & Schepens, G. (2013). Bank competition and stability: Cross-country heterogeneity. *Journal of Financial Intermediation*, *22*(2), 218–244. https://doi.org/10.1016/j.jfi.2012.07.001

Berger, A. N., Klapper, L. F., & Turk-Ariss, R. (2009). Bank competition and financial stability. *Journal of Financial Services Research*, *35*(2), 99–118. https://doi.org/10.1007/s10693-008-0050-7

Berndt, E. R., & Christensen, L. R. (1973). The translog function and the substitution of equipment, structures, and labor in U.S. manufacturing 1929-68. *Journal of Econometrics*, *1*(1), 81–113. https://doi.org/10.1016/0304-4076(73)90007-9

Bernini, C., & Brighi, P. (2018). Bank branches expansion, efficiency and local economic growth. *Regional Studies*, *52*(10), 1332–1345. https://doi.org/10.1080/00343404.2017.1380304

Bikker, J., & Haaf, K. (2002). Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking and Finance*, *26*(11), 2191–2214. https://doi.org/10.1016/S0378-4266(02)00205-4

Blair, R., & Daniel Sokol, D. (Eds.). (2014). *The Oxford Handbook of International Antitrust Economics*. Oxford University Press.

Boyd, J. H., & De Nicoló, G. (2005). The theory of bank risk taking and competition revisited. *Journal of Finance*, *60*(3), 1329–1343. https://doi.org/10.1111/j.1540-6261.2005.00763.x

Buch, C. M., Koch, C. T., & Koetter, M. (2013). Do banks benefit from internationalization? Revisiting the market power-risk nexus. *Review of Finance*, *17*(4), 1401–1435. https://doi.org/10.1093/rof/rfs033

Casu, B., Ferrari, A., & Zhao, T. (2013). Regulatory reform and productivity change in Indian banking. *Review of Economics and Statistics*, *95*(3), 1066–1077. https://doi.org/10.1162/REST_a_00298

Casu, B., Girardone, C., & Molyneux, P. (2004). Productivity change in European banking: A comparison of parametric and non-parametric approaches. *Journal of Banking & Finance*, *28*(10), 2521–2540. https://doi.org/10.1016/j.jbankfin.2003.10.014

Chronopoulos, D. K., Liu, H., McMillan, F. J., & Wilson, J. O. S. (2015). The dynamics of US bank profitability. *European Journal of Finance*, *21*(5), 426–443. https://doi.org/10.1080/1351847X.2013.838184

Clark, E., Radić, N., & Sharipova, A. (2018). Bank competition and stability in the CIS markets. *Journal of International Financial Markets, Institutions and Money*, *54*(May), 190–203. https://doi.org/10.1016/j.intfin.2017.12.005

Clerides, S., Delis, M. D., & Kokas, S. (2015). A new data set on competition in national banking markets. *Financial Markets, Institutions and Instruments*, *24*(2–3), 267–311. https://doi.org/10.1111/fmii.12030

Coccorese, P. (2017). Banking competition and economic growth. In J. Bikker & L. Spierdijk (Eds.), *Handbook of Competition in Banking and Finance* (pp. 230–263). Edward Elgar Publishing. https://doi.org/10.1108/jes-09-2015-0169

Cubillas, E., Fernández, A. I., & González, F. (2017). How credible is a too-big-to-fail policy? International evidence from market discipline. *Journal of Financial Intermediation*, *29*, 46–67. https://doi.org/10.1016/j.jfi.2015.11.003

Davis, E. P., & Karim, D. (2019). Exploring short- and long-run links from bank competition to risk. *European Financial Management*, *25*(3), 462–488. https://doi.org/10.1111/eufm.12176

Davis, E. P., Karim, D., & Noel, D. (2020). The bank capital-competition-risk nexus—A global perspective. *Journal of International Financial Markets, Institutions and Money*, *65*(March), 101169. https://doi.org/10.1016/J.INTFIN.2019.101169

de Guevara, F., Juan, J. M., & Pérez, F. (2007). Integration and competition in the European financial markets. *Journal of International Money and Finance*, *26*(1), 26–45. https://doi.org/10.1016/j.jimonfin.2006.10.008

Degl'Innocenti, M., Mishra, T., & Wolfe, S. (2018). Branching, lending and competition in Italian banking. *European Journal of Finance*, *24*(3), 208–230. https://doi.org/10.1080/1351847X.2017.1303526

Degryse, H., Morales-Acevedo, P., & Ongena, S. (2014). Competition in banking. In A. N. Berger, P. Molyneux, & J. O. S. Wilson (Eds.), *The Oxford Handbook of Banking* (2nd ed.). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199688500.013.0025

Deli, Y. D., Delis, M. D., Hasan, I., & Liu, L. (2019). Enforcement of banking regulation and the cost of borrowing. *Journal of Banking and Finance*, *101*, 147–160. https://doi.org/10.1016/j.jbankfin.2019.01.016

Delis, M. D., Kokas, S., & Ongena, S. (2016). Foreign ownership and market power in banking: Evidence from a world sample. *Journal of Money, Credit and Banking*, *48*(2–3), 449–483. https://doi.org/10.1111/jmcb.12306

Delis, M. D., Kokas, S., & Ongena, S. (2017). Bank market power and firm performance. *Review of Finance*, *21*(1), 299–326. https://doi.org/10.1093/rof/rfw004

Duygun, M., Shaban, M., & Weyman-Jones, T. (2015). Measuring competition using the Boone relative profit difference indicator. *Economics Letters*, *132*, 117–120. https://doi.org/10.1016/j.econlet.2015.04.022

Efthyvoulou, G., & Yildirim, C. (2014). Market power in CEE banking sectors and the impact of the global financial crisis. *Journal of Banking and Finance*, *40*(1), 11–27. https://doi.org/10.1016/j.jbankfin.2013.11.010

Elsayed, A. H., Downing, G., Lau, C. K. M., & Sheng, X. (2022). Exploring the role of oil shocks on the financial stability of Gulf Cooperation Council countries. *International Journal of Finance and Economics*, *1–16*, 1804–1819. https://doi.org/10.1002/ijfe.2757

Forssbæck, J., & Shehzad, C. T. (2015). The conditional effects of market power on bank risk-cross-country evidence. *Review of Finance*, *19*(5), 1997–2038. https://doi.org/10.1093/rof/rfu044

Fungáčová, Z., Shamshur, A., & Weill, L. (2017). Does bank competition reduce cost of credit? Cross-country evidence from Europe. *Journal of Banking & Finance*, *83*(October), 104–120. https://doi.org/10.1016/j.jbankfin.2017.06.014

Gerged, A. M., Beddewela, E. S., & Cowton, C. J. (2023). Does the quality of country-level governance have an impact on corporate environmental disclosure? Evidence from Gulf Cooperation Council Countries. *International Journal of Finance and Economics*, *28*(2), 1179–1200. https://doi.org/10.1002/ijfe.2469

Glass, A. J., Kenjegalieva, K., & Weyman-Jones, T. (2020). The effect of monetary policy on bank competition using the Boone index. *European Journal of Operational Research*, *282*(3), 1070–1087. https://doi.org/10.1016/j.ejor.2019.10.022

Hasan, I., Jackowicz, K., Kowalewski, O., & Kozłowski, Ł. (2019). The economic impact of changes in local bank presence. *Regional Studies*, *53*(5), 644–656. https://doi.org/10.1080/00343404.2018.1475729

Hossain, S., Galbreath, J., Hasan, M. M., & Randøy, T. (2020). Does competition enhance the double-bottom-line performance of microfinance institutions? *Journal of Banking and Finance*, *113*(April), 105765. https://doi.org/10.1016/j.jbankfin.2020.105765

Ibrahim, M. (2019). Oil and macro-financial linkages: Evidence from the GCC countries. *The Quarterly Review of Economics and Finance*, *72*(May), 1–13. https://doi.org/10.1016/J.QREF.2019.01.014

Inklaar, R., Koetter, M., & Noth, F. (2015). Bank market power, factor reallocation, and aggregate growth. *Journal of Financial Stability*, *19*, 31–44. https://doi.org/10.1016/j.jfs.2015.05.004

Jiménez, G., Lopez, J. A., & Saurina, J. (2013). How does competition affect bank risk-taking? *Journal of Financial Stability*, *9*(2), 185–195. https://doi.org/10.1016/j.jfs.2013.02.004

Kabir, M., Farooque, A., Sabur Mollah, M., Hassan, K., Al Farooque, O., & Mobarek, A. (2017). The governance, risk-taking, and performance of Islamic banks. *Journal of Financial Services Research*, *51*(10), 195–219. https://doi.org/10.1007/s10693-016-0245-2

Kanas, A., Hassan Al-Tamimi, H. A., Albaity, M., & Mallek, R. S. (2019). Bank competition, stability, and intervention quality. *International Journal of Finance and Economics*, *24*(1), 568–587. https://doi.org/10.1002/ijfe.1680

Keeley, M. (1990). Deposit insurance, risk, and market power in banking. *American Economic Review*, *80*(5), 1183–1200. https://www.jstor.org/stable/2006769

Kick, T., & Prieto, E. (2015). Bank risk and competition: Evidence from regional banking markets. *Review of Finance*, *19*(3), 1185–1222. https://doi.org/10.1093/rof/rfu019

Leon, F. (2015). Does bank competition alleviate credit constraints in developing countries? *Journal of Banking & Finance*, *57*-(August), 130–142. https://doi.org/10.1016/j.jbankfin.2015.04.005

Lerner, A. (1934). The concept of monopoly and the measurement of monopoly power. *Review of Economic Studies*, *1*(3), 157–175. https://doi.org/10.2307/2967480

Leroy, A., & Lucotte, Y. (2015). Heterogeneous monetary transmission process in the Eurozone: Does banking competition matter? *International Economics*, *141*, 115–134. https://doi.org/10.1016/j.inteco.2015.01.006

Leroy, A., & Lucotte, Y. (2017). Is there a competition-stability trade-off in European banking? *Journal of International Financial Markets, Institutions and Money*, *46*, 199–215. https://doi.org/10.1016/j.intfin.2016.08.009

Love, I., & Martínez Pería, M. S. (2015). How bank competition affects firms' access to finance. *World Bank Economic Review*, *29*(3), 413–448. https://doi.org/10.1093/wber/lhu003

Maghyereh, A., & Abdoh, H. (2021). The effect of structural oil shocks on bank systemic risk in the GCC countries. *Energy Economics*, *103*(November), 105568. https://doi.org/10.1016/j.eneco.2021.105568

Maghyereh, A., & Ziadat, S. A. (2023). Oil price shocks and financial stress: Who is the influencer? *International Journal of Finance & Economics*, 1–19. https://doi.org/10.1002/ijfe.2883

Mamatzakis, E. C., & Vu, A. N. (2018). The interplay between quantitative easing, risk and competition: The case of Japanese banking. *Financial Markets, Institutions and Instruments*, *27*(1), 3–46. https://doi.org/10.1111/fmii.12092

Matthews, K., Murinde, V., & Zhao, T. (2007). Competitive conditions among the major British banks. *Journal of Banking and Finance*, *31*(7), 2025–2042. https://doi.org/10.1016/j.jbankfin.2006.11.009

Mirzaei, A., & Moore, T. (2014). What are the driving forces of bank competition across different income groups of countries? *Journal of International Financial Markets, Institutions and Money*, *32*(1), 38–71. https://doi.org/10.1016/j.intfin.2014.05.003

Okolelova, I., & Bikker, J. A. (2022). The single supervisory mechanism: Competitive implications for the banking sectors in the euro area. *International Journal of Finance and Economics*, *27*(2), 1818–1835. https://doi.org/10.1002/ijfe.2244

Rutledge, E., & Polyzos, E. (2023). The rise of GCC-east Asian trade: A cointegration approach to analysing trade relationships. *The World Economy*, *46*(7), 2231–2246. https://doi.org/10.1111/twec.13368

Saif-Alyousfi, A. Y. H., Saha, A., & Md-Rus, R. (2020). The impact of bank competition and concentration on bank risk-taking behavior and stability: Evidence from GCC countries. *North American Journal of Economics and Finance*, *51*, 100867. https://doi.org/10.1016/j.najef.2018.10.015

Schaeck, K., & Cihák, M. (2014). Competition, efficiency, and stability in banking. *Financial Management*, *43*(1), 215–241. https://doi.org/10.1111/fima.12010

Schaeck, K., Cihák, M., & Wolfe, S. (2009). Are more competitive banking systems more stable? *Journal of Money, Credit and Banking*, *41*(4), 711–734. https://doi.org/10.1111/j.1538-4616.2009.00228.x

Sealey, C. W., & Lindley, J. T. (1977). Inputs, outputs, and a theory of production and cost at depository financial institutions. *Journal of Finance*, *32*(4), 1251–1266. https://doi.org/10.1111/j.1540-6261.1977.tb03324.x

Segev, N., & Schaffer, M. (2020). Monetary policy, bank competition and regional credit cycles: Evidence from a quasi-natural experiment. *Journal of Corporate Finance*, *64*, 101494. https://doi.org/10.1016/J.JCORPFIN.2019.101494

Shaffer, S. (2004). Comment on "What drives bank competition? Some international evidence" by Stijn Claessens and Luc Laeven. *Journal of Money, Credit and Banking*, *36*(3), 585–592. http://www.jstor.org/stable/10.2307/3838955

Shaffer, S., & Spierdijk, L. (2020). Measuring multi-product banks' market power using the Lerner index. *Journal of Banking and Finance*, *117*(August), 105859. https://doi.org/10.1016/j.jbankfin.2020.105859

Shamshur, A., & Weill, L. (2019). Does bank efficiency influence the cost of credit? *Journal of Banking and Finance*, *105*-(August), 62–73. https://doi.org/10.1016/j.jbankfin.2019.05.002

Silva-Buston, C. (2019). Systemic risk and competition revisited. *Journal of Banking and Finance*, *101*, 188–205. https://doi.org/10.1016/j.jbankfin.2019.02.007

Spierdijka, L., & Zaourasa, M. (2018). Measuring banks' market power in the presence of economies of scale: A scale-corrected Lerner index. *Journal of Banking and Finance*, *87*(February), 40–48. https://doi.org/10.1016/j.jbankfin.2017.09.022

Tan, Y. (2016). The impacts of risk and competition on bank profitability in China. *Journal of International Financial Markets, Institutions and Money*, *40*, 85–110. https://doi.org/10.1016/j.intfin.2012.12.001

Turk-Ariss, R. (2009). Competitive behavior in Middle East and North Africa banking systems. *Quarterly Review of Economics and Finance*, *49*(2), 693–710. https://doi.org/10.1016/j.qref.2008.03.002

Wang, X., Han, L., & Huang, X. (2020). Bank market power and SME finance: Firm-bank evidence from European countries. *Journal of International Financial Markets, Institutions and Money*, *64*(January), 101162. https://doi.org/10.1016/j.intfin.2019.101162

How to cite this article: Alfaihani, S., Badunenko, O., & Jaffry, S. (2024). Market power, optimal scale and competition promotion in banking: Analysis in the GCC region. *International Journal of Finance & Economics*, 1–22. https://doi.org/10.1002/ijfe.2990

APPENDIX A

TABLE A1 List of GCC banks.

	Bank name	Data available from[a]	Establishment date
1	National Bank of Bahrain	2000	1957
2	Bank of Bahrain & Kuwait	2000	1971
3	Bahrain Islamic Bank	2000	1978
4	Shamil Bank	2000–2009[b]	1982
5	Bahraini Saudi Bank	2000–2008[c]	1983
6	Al Baraka Islamic Bank	2007	1984
7	Ahli United Bank	2000	2000
8	Kuwait Finance House	2002	2002
9	Khaleeji Commercial Bank	2005	2003
10	BMI Bank	2005–2013[c]	2004
11	Future Bank	2005	2004
12	Al-Salam Bank	2006	2005
13	Ithmaar Bank[d]	2010	2010
Kuwait			
1	National Bank of Kuwait	2000	1952
2	Commercial Bank of Kuwait	2000	1960
3	Gulf Bank	2000	1960
4	Al Ahli Bank of Kuwait	2000	1967
5	Al Ahli United Bank	2000	1971
6	Kuwait International Bank	2000	1973
7	Burgan Bank	2000	1977
8	Kuwait Finance House	2000	1977
9	Boubyan Bank	2005	2004
10	Warba Bank	2011	2010
Oman			
1	HSBC Bank Oman	2000	1948
2	National Bank of Oman	2000	1973
3	Oman Arab Bank	2000	1973
4	Bank Muscat	2000	1982
5	Bank Dhofar	2000	1990
6	Ahli Bank	2000	1998
7	Bank Sohar	2007	2007
8	Bank Nizwa	2012	2012
9	Al Izz Islamic Bank	2013	2012
Qatar			
1	Qatar National Bank	2000	1965
2	Commercial Bank	2000	1975
3	Doha Bank	2000	1979
4	Qatar Islamic Bank	2000	1983

(Continues)

TABLE A1 (Continued)

Qatar			
5	Al Ahli Bank	2000	1984
6	Qatar International Islamic Bank	2000	1991
7	International Bank of Qatar	2001	2000
8	Masraf Al Rayan	2006	2006
9	Al Khalij Commercial Bank	2007	2007
10	Barwa Bank	2010	2009
Saudi Arabia			
1	Al Awwal Bank[e]	2000	1926
2	The National Commercial Bank	2000	1953
3	Riyad Bank	2000	1957
4	Al Rajhi Bank	2002	1957
5	Bank AlJazira	2000	1975
6	Saudi Investment Bank	2000	1977
7	Banque Saudi Fransi	2000	1977
8	The Saudi British Bank	2000	1978
9	Arab National Bank	2000	1979
10	Samba Financial Group	2000	1980
11	Bank AlBilad	2005	2004
12	Alinma Bank	2009	2008
United Arab Emirates			
1	National Bank of Dubai	2000–2006[f]	1963
2	Mashreq Bank	2000	1967
3	National Bank of Abu Dhabi	2000–2016[g]	1968
4	Commercial Bank of Dubai	2000	1969
5	Bank of Sharjah	2000	1973
6	Arab Bank for Investment & Foreign Trade	2000	1975
7	United Arab Bank	2000	1975
8	Invest Bank	2000	1975
9	Dubai Islamic Bank	2000	1975
10	National Bank of Ras Al Khaimah	2000	1976
11	First Gulf Bank	2000–2016[g]	1979
12	Emirates Bank International	2000–2006[f]	1979
13	National Bank of Fujairah	2000	1982
14	National Bank of Umm Al Qaiwain	2000	1982
15	Union National Bank	2000	1982
16	Abu Dhabi Commercial Bank	2000	1985
17	Commercial Bank International	2000	1991
18	Abu Dhabi Islamic Bank	2000	1997
19	Sharjah Islamic Bank	2002	2002
20	Emirates Islamic Bank	2004	2004
21	Emirates NBD Bank	2007	2007
22	Al Hilal Bank	2008	2008

TABLE A1 (Continued)

United Arab Emirates			
23	Noor Islamic Bank	2011	2008
24	Ajman Bank	2010	2009
25	First Abu Dhabi Bank	2017	2017

[a]The sample included is until the year 2017 unless stated otherwise.
[b]Shamil Bank merged with its parent company Ithmaar Bank in 2010.
[c]Al-Salam Bank acquired the Bahraini Saudi Bank in 2009 and acquired BMI Bank in 2014.
[d]Ithmaar Bank was operating in Bahrain as an investment bank and converted into a retail bank in 2010.
[e]Al Awwal Bank was formerly known as the Saudi Hollandi Bank and rebranded to Al Awwal Bank in 2016.
[f]National Bank of Dubai & Emirates International Bank merged in 2007 to create Emirates NBD Bank.
[g]National Bank of Abu Dhabi & First Gulf Bank merged in 2017 to create First Abu Dhabi Bank.

TABLE A2 Empirical estimations of the translog cost function.

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
$\ln(Y_{it})$	0.390	0.215	0.908***	0.335	0.464	0.791***
	(1.42)	(0.48)	(4.63)	(1.21)	(1.28)	(4.91)
$\ln(Y_{it})^2$	0.0595**	0.0933**	0.0522*	0.0773**	0.0778**	0.0375*
	(2.35)	(2.11)	(1.93)	(2.14)	(2.05)	(1.84)
$\ln\omega_d$	−0.161	−0.000516	1.370***	1.921***	0.143	0.334***
	(−0.70)	(−0.00)	(7.18)	(8.64)	(1.02)	(3.86)
$\ln\omega_k$	0.772***	−0.00383	0.815***	0.110	0.309	0.0138
	(2.63)	(−0.02)	(3.90)	(0.42)	(1.45)	(0.17)
$\ln(\omega_d)^2$	−0.0168	0.152***	0.254***	−0.0498	0.143***	0.166***
	(−0.47)	(3.48)	(9.01)	(−0.91)	(19.17)	(10.45)
$\ln(\omega_k)^2$	−0.0942***	0.120***	−0.0284	−0.0760*	0.0676**	0.0242*
	(−2.61)	(7.26)	(−0.63)	(−1.69)	(2.16)	(1.94)
$\ln\omega_d \times \ln\omega_k$	−0.0979***	−0.0425	−0.0842***	−0.158***	0.0211	0.0321***
	(−3.38)	(−1.44)	(−3.15)	(−4.14)	(1.49)	(3.14)
$\ln(Y_{it}) \times \ln\omega_d$	0.109***	0.0551	−0.0883***	−0.0604**	0.00736	−0.0145
	(5.10)	(1.16)	(−3.77)	(−2.50)	(0.51)	(−1.52)
$\ln(Y_{it}) \times \ln\omega_k$	−0.0233	−0.0356	−0.0621*	0.0508*	−0.0516**	−0.0126
	(−0.74)	(−1.58)	(−1.94)	(1.86)	(−2.37)	(−1.26)
$\ln(Y_{it}) \times t$	−0.00117	−0.0202	−0.0157	−0.0412***	−0.0131	−0.00885*
	(−0.05)	(−1.18)	(−1.58)	(−3.43)	(−1.05)	(−1.81)
$\ln(Y_{it}) \times t^2$	0.000102	0.000929	0.000626	0.00148***	0.000577	0.0000391
	(0.11)	(1.28)	(1.50)	(2.81)	(1.11)	(0.20)
t	−0.0251	0.200	0.143	0.333***	0.146	0.0629
	(−0.13)	(1.18)	(1.64)	(3.06)	(1.13)	(1.41)

(Continues)

TABLE A2 (Continued)

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
t^2	0.000591	−0.00908	−0.00582	−0.0119**	−0.00634	0.000575
	(0.07)	(−1.27)	(−1.56)	(−2.41)	(−1.15)	(0.31)
Constant	2.578	4.412*	−1.163	1.972	2.641	1.448**
	(1.40)	(1.77)	(−1.14)	(1.41)	(1.46)	(2.11)
Observations	130	119	108	141	168	315

Note: This table contains the regression estimations of the translog cost function for the GCC banking markets over the period 2000–2017. We estimate the cost function separately for each of the six GCC countries to avoid imposing the same technology structure on all countries in our sample. Homogeneity of degree one is imposed on the total costs and input prices by normalizing the total costs, the prices of deposits, and physical capital with the price of labour before taking their logarithmic transformation to assure linear homogeneity. $\ln(Y_{it})$ is the natural log of deflated total assets; $\ln\omega_d$ is the natural log of the deflated price of deposits and equals to total interest expense over total customer deposits; $\ln\omega_k$ is the natural log of the deflated price of physical capital that is equal to (Operating expenses–Personnel expenses)/Fixed assets; t is a time trend to account for technological change. t-statistics in parenthesis.

*$p < 0.1$.

**$p < 0.05$.

***$p < 0.01$.

TABLE A3 Market structure indices of GCC banking sectors in 2017.

	CR1, %	CR2, %	CR3, %	CR5, %	HHI	Total banking Assets (Billion $)
Bahrain	44	57	68	85	2400	76
Kuwait	34	57	66	80	1935	254
Oman	38	52	64	82	2165	77
Qatar	53	63	72	85	3885	418
Saudi Arabia	20	35	46	64	1156	593
UAE	27	46	57	71	1113	668