Measuring the Degree of Competition in the Arab Banking Systems

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Abstract

The Arab banking sectors are characterised by high level of concentration, which could have a negative impact on competition and the competitive behaviour of banks according to the Structure-Conduct-Performance paradigm. Using a flexible translog revenue function, we found that high concentration has not provided Arab banks with significant market power. Besides, we found a higher competitive behaviour of banks operating in Lebanon, Bahrain, Saudi Arabia and the UAE than in the other Arab countries.

Keywords: Banking; Competition; Panzar-Rosse Model, Market Structure.

1. Introduction

The banking sectors of the Arab countries have undergone substantial changes aiming at enhancing sectors solvency and improving their performance. This was done through implementing more efficient organisational solutions, greater variety of offered services and better exploitation of scale and scope economies. Additionally, the implementation of reform processes, including restructuring and the privatisation of state-owned banks, the closure of insolvent banks, the adoption of new prudential regulation and tighter supervision, the improvement of disclosure standards, the development of IT infrastructures, and the adoption of more advanced risk management systems, have all boosted banking intermediation.

Over the past three decades, banking industries in most Arab countries witnessed significant increase in concentration mainly due to a process of consolidation led by mergers – that in many occasions – were triggered by financial crises and/or regulatory tightening (e.g. Lebanon and Egypt). These developments have raised concerns about competition and financial stability and the potential for monopoly power the consolidation process may have produced. By the end of 2011, the concentrations in some of the Arab banking sectors (top 5 banks‘ assets divided by total sector assets) were as follow: Egypt 52.1%, Kuwait 90.7%, Qatar 77.7%, Oman 77.0%, Lebanon 67.4%, UAE 58.5%, KSA 67.1%, Morocco 89.9%, Bahrain 48.5%, Algeria 64.3%, and Tunisia 50.9%.

There is a trade-off between costs and benefits of competition. On one hand, competition may have an adverse impact on stability if it causes banks‘ charter value to drop, thus reducing the incentives for prudent risk-taking behaviour. On the other hand, a more concentrated system dominatedby few large banks, is more likely to display a too-big-to-fail problem, and consequently, large banks increase their

risk exposure anticipating the unwillingness of the regulator to let the bank fail in the event of insolvency problems (Hughes and Mester, 1998). Additionally, while competition could lowerthe costs of financial intermediation and improves economic efficiency, it could reduce market power and profitability of banks, weakening their ability to withstand adverse shocks. The degree of banking competition and its association with market concentration is of vital importance for welfare-related public policy towards market structure and conduct in the banking industry (Shaffer, 2004).

This paper addresses the impact of increasing concentration in the Arab banking sectors on bank behaviour and competition, and aims at adopting an appropriate model to assess the competitive structure of the Arab banking sectors.

The remaining of the paper is as follows. Section 2 presents an overview of the literature on the relationship between market structure and competition, and the empirical methods of measuring competition among banks. The empirical methodology is discussed is section 3. The exploited data set is presented and explained in section 4. The empirical results of the paper are included in section 5.

2. Review of the Literature

Due to the lack of detailed information on prices and costs of the various banking products, competition cannot be measured directly. Therefore, various indirect measurement techniques have been proposed, which are divided into two main streams: structural and non-structural approaches.

The structural methods have their roots in the theory of Industrial Organization that measures competitiveness following the Structure-Conduct-Performance (SCP) paradigm (where fewer and larger firms are more likely to engage in anticompetitive behaviour) and the alternative Efficiency Structure Hypothesis (ESH) paradigm (where high concentration endogenously reflects the market share gains of the efficient firms). While the SCP paradigm is used to investigate whether a highly concentrated market causes collusive behaviour among larger banks resulting in superior performance, the ESH investigates whether it is the efficiency of larger banks that enhances their performance

Basically, the SCP implies that concentration in the banking industry can generate market power, allowing banks to earn monopolistic profits through offering lower deposit rates and charging higher loan rates. The degree of competition in a market can be explained via the conduct of firms which is, in turn, determined by the structural characteristics of the market itself (e.g. number and size of firms, conditions of prices and demand...). According to this paradigm, structural changes that leadto a concentration in an industrial sector may facilitate collusive behaviour among firms and, therefore,lead to a reduction in the degree of competition.

In contrast with the SCP paradigm, the ESH state that greater concentration in an industry does not imply a reduction in competition but rather an increase in the level of efficiency in the sector as a whole. This is because the most efficient firms increase their market share at the expense of their less efficient competitors. According to this paradigm, greater concentration emerges as a consequence of a more vigorous competition among firms in the market.

Regarding the non-structural methods, it has been proposed in the context of the New Economic Industrial Organisation (NEIO) studies. In this context of studies, two empirical tests for the degree of competitive behaviour have been widely applied to the banking sector. This line of research bases the analysis of competition in markets on non-structural models that do not rely exclusively on information concerning the structure of markets. Studies developed within the scope of the NEIO approach use analytical techniques that are linked to two empirical methodologies: one is based on the

conjectural variations proposed by Lau (1982) and Bresnahan (1982), and the other focused on the use of a measure of banking competition, the so called ‒H-statistic‖ of Panzar and Rosse.

The model by Bresnahan (1982) and Lau (1982) allows estimating the competition degree using aggregate industry data, and the alternative Panzar and Rosse methodology employs bank-level data. While the first technique estimates demand, supply and price equations simultaneously, the second allows for bank-specific differences in production functions, provided that banks are examined under long-run equilibrium.

Moreover, the Bresnahan model uses the condition of general market equilibrium and rests on the idea that profit-maximising firms in equilibrium will choose prices and quantities in such that marginal costs equal their (perceived) marginal revenue, which coincides with the demand price under perfect competition, or with the industry‘s marginal revenue under collusion. This model generally uses industry aggregates (although firm-specific data is possible) and permits estimation of a measure of the degree of competition.

On the other hand, the Panzar and Rosse model takes a slightly different route and investigates the extent to which a change in factor input prices is reflected in (equilibrium) revenues earned by a specific bank in the context of a Chamberlainian equilibrium model. Similarly to previous model, the Panzar-Rosse approach allows estimating the degree of competition. The advantage of the latter is that it uses bank-level data, allows for bank-specific differences in the production function, and permits an analysis of the differences between types of banks in terms of size and ownership. The Panzar-Rosse approach relies on the hypothesis that banks will employ different pricing strategies in response to change in input costs depending on the market structure in which they operate. Therefore, whether a bank operates in a competitive market or exercises some monopoly power, this can be inferred from the analysis of that bank‘s total revenue as it responds to changing input prices.

Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987) constructed a measure of competition, called ‒H-statistic‖, which allows for a quantitative assessment of the competitive nature of banking markets and the market power of banks. This H-statistic is calculated as the sum of the elasticities of a bank's total revenue with respect to the bank's input prices and this measure can reflect the structure and conduct of the market to which the firm belongs. This measure is interpreted as follows.

Under monopoly, H-statistic is less than or equal to zero. This is due to the economic intuition that a monopolist‘s revenue will respond in the opposite direction to a change in input prices, as a 1% increase in input prices leads to a 1% increase in marginal costs, thus reducing equilibrium output and revenue. In other words, if the firm operates as a monopoly, the H-statistic will be negative since an upward shift in the marginal cost curve will be associated with a reduction in revenue as a result of the optimal condition for the monopolist. Secondly, positive values of H indicate a monopolistic competition but not with individual profit maximisation as under monopoly condition. Although banks behave like monopolists, the market entry or exit of other banks (that offer imperfect rival products) makes them always generate precisely zero profits. In this case, banks produce more and the price is less than would be optimal in each individual case. In other words, if the market structure is characterised by monopolistic competition, the H-statistic will lie between 0 and 1. In this case, an increase in input prices will lead to a less than proportional increase in revenues, as the demand for banking facing individual banks is inelastic. Thirdly, in the case of the monopolistic competition model, where banks‘ products are regarded as perfect substitutes of one another, the Chamberlainian model produces the perfectly competitive solution, as demand elasticity approaches infinity. In this perfect competition case, H is equal to 1. This occurs because an increase in input prices raises both marginal and average costs without (under certain conditions) changing the optimal output of any individual firm. Under long-run competitive equilibrium, any increase in input prices should lead to an equivalent increase in total revenues, and firms that cannot cover the increase in input prices will be forced to exit the market. As inefficient banks are forced to exit the market, the increased demandfaced by the remaining firms leads to an increase in output prices and revenues in the same proportion as costs, thereby implying a value of the H-statistic equal to one.

A large body of literature has adopted the Panzar-Rosse H-statistic. Regarding developed markets, an early study by Shaffer (1982) found that the competitive conduct of banks cannot be characterised as monopolistic or perfectly competitive in the long-run equilibrium. Nathan and Neave (1989) assessed the competition in different sectors of the Canadian financial services industry (i.e. banks, trust companies and mortgage companies), using cross-sectional data for 1982, 1983 and 1984. They also rejected the hypothesis of monopoly and perfect competition for Canadian banks, trust companies and mortgage companies and concluded that banks operate under monopolistic competition. Molyneux et al. (1994) used the same analysis for a sample of German, UK, French, Italian, and Spanish banks for the period 1986-1989. Their results suggest monopolistic competition in Germany, France, Spain and UK, and monopoly in Italy. Vesala (1995) applied a similar model to the Finnish banking sector and found monopolistic competition for the periods 1985-1988 and 1991-1992, and perfect competition for the 1989-1990 period. Molyneux et al. (1996) examined the competitivebehaviour of Japanese commercial banks and found monopoly in 1986 and monopolistic competitionin 1988.

De Bandt and Davis (2000) reported monopolistic competition for large banks and monopoly for small banks in Germany and France, and monopolistic competition for both large and small banksin Italy over the period 1992-1996. Bikker and Groeneveld (2000) found monopolistic competition of different levels for EU countries over the period 1989-1996. Bikker and Haff (2000) examined the competitive behaviour of banks in 23 developed countries over the period 1988-1999. They reported that, in general, the banking markets of industrialised countries could be characterised by monopolistic competition.

Coccorese (2005) assessed the market conduct of the largest Italian banks over the period 1988–2000 and found that in spite of their remarkable size and significant market share, those banks have been characterised by a competitive conduct. Trivieri (2005) also found that Italian banks operated under monopolistic competition. Nevertheless, Italian banks linked by cross-ownership behaved less competitively than credit firms not involved in the same phenomenon.

A growing part of a more recent literature has focused on emerging economies. For instance, Yildirim and Philippatos (2002) analysed the evolution of competitive conditions in the banking industries of fourteen Central and Eastern European transition economies over the period 1993-2000. Their results showed that the majority of banking markets of these countries cannot be characterised neither by perfect competition nor monopoly (except for Macedonia and Slovakia). Drakos and Konstantinou (2003) also evaluated the competitive conditions for a group of Central and Eastern European banking sectors over the period 1992–2000. They found evidence against perfect competition and monopoly for all countries, except for Latvia. Gelos and Roldos (2004) examined a sample of Latin America and Central and Eastern European countries over the period 1994-1999. Theirresults confirm the monopolistic competition hypothesis for all but two countries. Chun and Kim(2004) investigate the market structure of Korean banking industry and evaluate the evolution of the monopoly power of banks along with the increased market concentration after the 1997 financial crisis.They found out that market structure has changed from monopolistic competition to monopoly after thecrisis.

Al-Muharrami et al. (2006) examine the degree of competitiveness in the Gulf Cooperation Council region and show that, while banking concentration is high, most GCC markets operate under either monopolistically or perfectly competitive conditions. Finally, Turk-Ariss (2009) estimated a measure of competitiveness in 12 banking sectors in the MENA region, and relates it to a set of industry and contestability indicators to explain differences in the degree of competition across countries. Her findings reveal that banks in the Middle East were operating under monopolisticcompetition. She also found that high concentration did not adversely affect competitive conditions in the region. Furthermore, the general level of economic development had been a significant factor that explains differences in the degree of competitiveness in the MENA region.

3. Methodology

The Panzar-Ross Linear Model utilised to determine the level of banking competition is attractive since it provides a simple and easy to calculate competition measure. However, this model presents some inconvenience due to its rigidity. In fact, Panzar-Rosse statistics resulted from the linear model does not vary in function of production level (output) or of different production factors utilised in the production process (input). This rigidity leads to a constant elasticity of demand, which is not compatible with the structural models of competitive equilibrium, where the underlying elasticity of demand varies with the level of production of each bank. The constancy of Panzar Rosse statistic does not allow taking into consideration the fact that large banks may operate in markets different from those of smaller banks in terms of elasticity of demand and market power.

Our objective is to propose a flexible model that allows measuring the degree of competition in the Arab banking sectors. To solve the problems of the linear model rigidity, we propose, like Shaffer (1982) to transform the rigid model of Panzar and Rosse into a flexible econometric model that allows the degree of competition to vary in function of input prices and output levels. The adoption of a flexible revenue function of translog form allows taking into account the significant changes in the level of production and production factors from one bank to another, which will be reflected in the calculation of competition level in the Arab banking sectors.

The most common flexible form, which we retain thereafter, is the translog function proposed by Christensen et al. (1971). The translog revenue function is a second order logarithmic approximation of the true revenue function. We can write the revenue function as follows:

$$LnREV_{it} = \alpha_0 + \sum_i \alpha_i \cdot \ln y_{it} + \sum_j \beta_j \cdot \ln w_{jt} + 1/2 \sum_i \sum_k \theta_{ik} \ln y_{it} \ln y_{kt}$$
$$+ 1/2 \sum_j \sum_h \psi_{jh} \cdot \ln w_{jt} \ln w_{ht} + \sum_i \sum_j \eta_{ij} \ln y_{it} \ln w_{jt} + \sum_{i=1}^{n} Z_{it} + \mu_i + \nu_{it} \quad (1)$$

where *REV* represents total revenue, w the vector of input prices, y the vector of outputs, Z is a vector of control variables that reflect the production mix of each bank, its financing structure, and its technology of production.

For function (1) to be a profit function, it has to be concave, homogeneous of degree 1 and that $\psi_{jh} = \psi_{hj}$. The homogeneity of degree 1 relative to price is induced by the conditions $\beta_j = 1, \sum_j \psi_{jh} = \sum_i \eta_{ij} = 0$. We make sure that this characteristic is imposed before estimating the revenue function. Once the parameters of the revenue function are estimated, the concavity characteristic is verified if the matrix of coefficients ψ_{jh} is negative semi-definite and if the elasticity of revenue relative to prices of production factors is non-negative (characteristic of monotony). We also test the scaling of the technology of production to verify if the prices of production factors and the level of production are independent, i.e. if the parameters of the cross terms of these variables are equal to zero. It is therefore to impose that the parameters relevant to the cross production between factor prices and quantity produced are jointly equal to zero: $\eta_{ij} = 0, \forall i$

According to Shephard (1970) lemma, we can derive equation (2) relative to prices of production factors to obtain the H-Statistic that measures the level of banking competition:

$$H = \sum_j \frac{\partial \ln RT}{\partial w_j} = \sum_j \left(\beta_j + \sum_j \psi_{jh} \cdot \ln w_h + \sum_i \eta_{ij} \cdot \ln y^i \right) \quad (2)$$

The superiority of the translog function relative to Cobb-Douglas and CES traditional forms lies in the fact that the separability is not a priori postulated, but tested. Moreover, the translog function does not constraint the partial elasticities of substitution proposed by Allen-Uzawa to be unit or constant, but allows them to vary from period to period, with the production mix, and with inputs.

4. Data and Descriptive Statistics

The calculation of competition level faces a difficulty represented by the lack of a consensual definition of banking inputs and outputs. This is in fact a subject of recurring debate and one of itsmain issues is the role of bank deposits.

Are bank deposits an input as considered by the intermediation approach, or an output as suggested by the production approach? In the production approach, the bank is seen as a firm that utilises different production factors to produce saving and lending services. Therefore, interest charges are excluded from our analysis and only operating costs (i.e. staff expenses and general expenses) are taken into account. In the intermediation approach, defended by Sealey and Lindley (1977), deposits are considered as a production factor utilised with other factors to produce loans. Total banking costs are then given by the sum of operating costs and interest paid on deposits. This definition of banking activity is incompatible with the production approach, where deposits cannot be considered as output because they generate more costs than revenues.

The dilemma between these 2 approaches of banking activity has prompted some authors, notably Nathan and Neave (1992), to adopt a hybrid approach considering deposits and credits as outputs without excluding financial costs from the production costs (i.e. financial costs should be considered as input). It seems more reasonable to see a bank as producing financial services. To do so, it utilises human capital and physical capital and consumes goods and services. Banks have, moreover, the particularity of producing a part of their financial resources. The collection of deposits costs the bank a credit rate, but it saves it the cost of resources should have otherwise been paid on the monetary or the financial markets. When such a view is taken, the controversy about bank deposits would be eliminated.

Our analysis of banking production technology, leads us to consider 3 outputs and 3 inputs. The outputs are: (1) total earning assets (*TEA*), (2) deposits (*DEP*), and (3) off-balance sheet activities (*OBS*). These activities are realised based on the following 3 inputs: staff expenses (*PEX*), general expenses (*GEX*), and financial costs (*FEX*). These factors consist in fact the largest part of banking expenditures and present the advantage of being equally measurable in quantities (borrowed amount, number of employees, and amount of fixed assets or number of branches), which allows us calculating factors‘ unit price. We also consider the price of the 3 production factors: (1) the price of human capitalmeasured by the average salary per bank, (2) the price of physical capital measured by dividing all expenditures associated with the use of bank equipments by the amount of fixed assets, and (3) the price of financial resources measured by dividing financial charges to creditor accounts. Finally, we add three control variables: (1) equity-to-asset ratio (*CAP*), (2) provisions for banking risks-to-total assets (*RISK*), and (3) log of total assets to represent the size of the bank *(LnASS*).

The sample chosen to test the flexible form of revenue function consists of 11 Arab banking systems: Lebanon (38 banks), Saudi Arabia (9 banks), Qatar (4 banks), Kuwait (6 banks), Jordan (8 banks), UAE (14 banks), Tunisia (8 banks), Bahrain (12 banks), Oman (5 banks), Morocco (7 banks), and Egypt (20 banks). Bank data are extracted from the international banking database Bankscope BVD-IBCA, which provides individual time series (i.e. per bank) of annual financial statements (balance sheet and income statement). The study covers the period 2000-2010 (i.e. 11 years). Tables 1 and 2 present the descriptive statistics for the value of outputs, prices of inputs, and the other variables.

As indicated by Tables 1 and 2, the dispersion of data is relatively constant over the studied period, shown by the coefficient of variation, albeit slight decrease. Besides, this dispersion is relatively homogeneous among different variables. The coefficients of variations are contained in rather narrow intervals: [1.01; 1.48] for Lebanon, [0.43; 0.80] for Kuwait, [0.62; 1.33] for Qatar, [0.69; 1.27] for Bahrain, [0.33; 0.81] for Oman, [0.51; 1.00] for Saudi Arabia, [1.07; 3.36] for Egypt, [0.42, 0.89] for Tunisia, [1.58; 2.55] for Jordan, and [0.87; 1.58] for UAE.

Table 1: Descriptive statistics of banking inputs and outputs ($ millions)

		Earning Assets		Deposits		Off Balance Sheet		Operating Cost		Interest Expenses		Staff Expenses	
		2000	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**
LEB	Max	138.2	230.3	125.9	196.4	24.4	44.2	0.9	1.3	10.3	10.2	1.3	1.4
	Min	0.6	2.8	0.3	0.5	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	Mean	31.0	49.5	27.5	43.4	3.9	6.8	0.3	0.3	2.0	1.9	0.4	0.4
	σ	38.0	50.7	34.4	45.2	5.6	10.0	0.3	0.3	2.6	2.2	0.4	0.4
	σ / *m*	1.23	1.02	1.25	1.04	1.43	1.48	1.06	0.97	1.30	1.15	1.01	0.81
KUW	Max	12,797.5	18,117.7	7,384.7	11,080.4	2,920.5	5,296.9	57.0	130.6	514.5	258.6	68.0	116.7
	Min	2,633.6	5,635.6	1,666.3	3,270.8	451.8	582.3	6.3	42.1	114.0	93.7	13.4	24.4
	Mean	4,899.0	8,114.6	3,094.1	5,032.5	938.1	1,977.4	26.0	64.9	204.5	140.7	26.1	46.5
	σ	3,928.6	4,957.3	2,148.7	3,002.3	977.1	1,671.0	20.3	33.7	153.3	60.6	20.9	34.8
	σ / *m*	0.80	0.61	0.69	0.60	1.04	0.85	0.78	0.52	0.75	0.43	0.80	0.75
QAT	Max	4,165.7	10,003.4	2,102.6	8,727.3	6,577.6	7,858.5	12.5	52.1	198.5	138.7	37.6	50.6
	Min	343.5	1,132.5	314.4	910.4	131.1	588.1	3.2	3.2	13.6	11.3	4.0	8.2
	Mean	1,466.9	4,346.3	890.3	3,662.2	1,797.1	2,751.1	7.2	29.4	66.6	53.2	14.9	27.0
	σ	1,807.7	3,891.9	821.1	3,459.5	3,188.5	3,428.4	4.4	20.1	88.3	57.8	15.4	17.6
	σ / *m*	1.23	0.90	0.92	0.94	1.77	1.25	0.62	0.68	1.33	1.09	1.03	0.65
BAH	Max	18,238.0	18,735.9	16,100.0	15,198.2	26,040.0	4,480.0	96.0	54.0	864.0	360.0	231.0	121.0
	Min	305.6	338.3	239.9	248.1	254.5	65.6	2.1	3.2	9.0	4.0	2.1	3.7
	Mean	8,037.8	8,027.8	7,171.0	6,371.2	9,565.5	1,555.5	36.8	27.8	361.8	143.9	87.5	54.2
	σ	8,256.8	7,088.0	7,268.8	5,547.9	12,798.9	1,645.6	46.0	19.2	399.9	146.3	111.4	42.9
	σ / *m*	1.03	0.88	1.01	0.87	1.34	1.06	1.25	0.69	1.11	1.02	1.27	0.79
OMA	Max	758.4	4,636.9	706.6	3,474.9	386.2	1,123.3	20.5	84.8	24.4	76.7	15.6	67.1
	Min	254.6	1,029.4	206.8	780.5	154.5	20.8	1.3	17.9	8.3	9.4	7.3	16.6
	Mean	545.0	2,113.4	490.1	1,663.4	276.0	633.9	11.1	43.4	16.1	34.6	10.7	31.5
	σ	210.0	1,442.4	218.4	1,048.7	91.2	481.9	8.7	27.0	6.2	27.9	3.5	20.8
	σ / *m*	0.39	0.68	0.45	0.63	0.33	0.76	0.79	0.62	0.39	0.81	0.33	0.66
SAU	Max	16,518.8	32,343.5	16,037.7	30,100.5	26,208.1	6,667.9	171.0	427.9	584.1	503.4	216.6	287.1
	Min	903.5	2,637.9	898.2	2,397.5	68.7	285.4	8.9	77.3	16.5	34.6	13.7	32.7
	Mean	7,977.2	16,616.2	7,534.7	15,273.3	8,823.6	3,415.2	69.2	190.0	302.9	195.3	91.7	153.8
	σ	4,816.0	8,504.2	4,571.1	7,855.5	8,835.9	2,149.0	48.7	126.2	175.7	136.1	59.3	77.0
	σ / *m*	0.60	0.51	0.61	0.51	1.00	0.63	0.70	0.66	0.58	0.70	0.65	0.50

Notes: LEB: Lebanon, KUW: Kuwait, QAT: Qatar, BAH: Bahrain, OMA: Oman, and SAU: Saudi Arabia.

Table 2: Descriptive statistics of used inputs and outputs ($ millions)

		Earning Assets		Deposits		Off Balance Sheet		Operating Cost		Interest Expenses		Staff Expenses	
		2000	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**	**2000**	**2010**
EGY	Max	11,840.1	20,317.2	10,327.7	18,531.1	7,309.7	14,095.7	705.0	78.6	862.1	1,011.3	490.0	274.8
	Min	191.3	316.7	133.2	285.1	32.0	30.3	1.1	3.7	9.0	16.3	2.5	4.6
	Mean	2,296.5	3,345.6	2,060.0	3,282.3	721.2	1,056.8	46.4	19.9	146.3	162.4	55.4	57.5
	σ	3,467.4	4,756.4	3,137.5	4,735.1	1,605.7	3,089.8	155.8	21.3	253.6	261.7	111.0	81.1
	σ / *m*	1.51	1.42	1.52	1.44	2.23	2.92	3.36	1.07	1.73	1.61	2.01	1.41
TUN	Max	2,449.8	3,274.2	1,557.9	1,724.4	1,843.2	2,364.8	127.6	106.8	30.2	65.2	30.9	36.3
	Min	498.2	872.9	0.2	63.6	433.4	672.4	23.0	5.8	10.2	2.3	3.9	1.1
	Mean	1,027.4	2,077.9	582.9	852.6	864.4	1,608.7	49.0	52.9	17.4	29.3	18.1	18.7
	σ	654.6	907.2	516.2	528.0	511.4	669.8	35.3	32.1	8.5	20.4	8.9	11.5
	σ / *m*	0.64	0.44	0.89	0.62	0.59	0.42	0.72	0.61	0.49	0.70	0.49	0.62
MOR	Max	4,833.4	10,840.2	4,626.1	11,287.2	2,643.2	3,384.0	125.1	392.0	190.5	324.7	76.7	162.6
	Min	926.0	2,099.4	823.0	2,360.6	300.3	371.1	24.9	69.1	36.8	32.4	21.4	44.0
	Mean	2,252.3	6,176.4	2,177.5	6,454.1	828.3	1,217.7	49.5	151.4	87.4	149.1	35.4	86.4
	σ	1,531.1	3,623.0	1,573.4	3,729.1	818.7	994.1	35.3	115.7	57.4	124.2	20.8	49.3
	σ / *m*	0.68	0.59	0.72	0.58	0.99	0.82	0.71	0.76	0.66	0.83	0.59	0.57
JOR	Max	6,146.0	26,600.9	1,180.5	21,237.6	7,917.6	9,189.7	92.4	244.5	475.3	505.1	107.1	269.9
	Min	0.8	139.0	20.3	138.7	59.5	40.0	0.1	7.3	7.8	7.1	1.3	4.6
	Mean	840.2	4,526.6	180.7	3,665.0	1,150.8	1,549.0	14.8	50.5	88.9	79.5	18.1	49.2
	σ	2,144.5	8,972.6	404.3	7,148.0	2,735.5	3,121.0	31.4	80.0	158.4	172.3	36.1	89.7
	σ / *m*	2.55	1.98	2.24	1.95	2.38	2.01	2.12	1.58	1.78	2.17	1.99	1.82
UAE	Max	7,177.0	14,727.1	5,796.6	12,574.3	5,788.9	12,604.0	67.3	75.5	279.2	257.8	67.3	94.3
	Min	107.2	623.3	74.6	487.2	55.7	319.6	0.9	3.6	2.9	5.9	1.3	7.2
	Mean	1,845.2	4,785.6	1,405.7	3,940.6	1,176.6	2,409.4	21.7	27.5	54.3	62.8	18.7	36.9
	σ	2,297.8	4,858.1	1,855.9	4,093.4	1,860.1	3,244.4	23.7	26.8	79.5	75.4	20.6	32.0
	σ / *m*	1.25	1.02	1.32	1.04	1.58	1.35	1.09	0.97	1.46	1.20	1.10	0.87

Notes: EGY: Egypt, TUN: Tunisia, MOR: Morocco, JOR: Jordan, and UAE: United Arab Emirates.

5. Results

To estimate the revenue function, we use a panel data set of Arab banks and proceed in 3 types of estimations. Firstly, we assumed that the constant is common for all banks in the sample, and thus, the OLS estimation was implemented. Then, we estimate a Fixed Effects model where the differences among banks could be explained by different constants. Finally, we estimate a Random Effects model which induces the specific effect in the error term. Fisher test allows discriminating between the first and the second models, whereas Hausman test permits choosing between the Fixed Effects model and the Random Effects model.

The results of Fisher test suggests rejecting the assumption that the banks in our sample are of homogenous behaviour, and leads us to favour the individual Fixed Effects model. Additionally, the results of Hausman test lead us not to accept the absence of correlation of individual fixed effects with the explanatory variables. This result underlines the importance of non-observable individual effects correlated with the variables of the model and suggests then not adopting the Random Effects model.

The results of the estimation of the revenue function are presented in Table 3. The value of the Durbin-Watson test suggests rejecting the hypothesis of autocorrelated errors. Finally, the coefficient of determination is very high, implying an excellent explanatory power of the model.

Table 3: Estimated Parameters of the Translogarithmic revenue function – Method SUR

Variables	Coefficients	t-student
C	4.251	2.83 *
$\ln y_1$	-1.431	-1.69 ***
$\ln y_2$	0.786	2.28 **
$\ln y_3$	-0.123	-0.46
$\ln y_1 \ln y_1$	0.367	5.26 *
$\ln y_1 \ln y_2$	0.319	9.02 *
$\ln y_1 \ln y_3$	0.532	10.06 *
$\ln y_2 \ln y_2$	0.740	3.07 *
$\ln y_2 \ln y_3$	-0.081	-1.16
$\ln y_3 \ln y_3$	-0.562	-3.79 *
$\ln p_1$	0.0001	0.05
$\ln p_2$	-0.125	-1.86 ***
$\ln p_3$	-0.023	-1.99 **
$\ln p_1 \ln p_1$	-0.030	-6.03 *
$\ln p_1 \ln p_2$	-0.042	-11.61 *
$\ln p_1 \ln p_3$	0.064	16.26 *
$\ln p_2 \ln p_2$	0.067	9.51 *
$\ln p_2 \ln p_3$	0.001	0.37
$\ln p_3 \ln p_3$	-0.019	-4.27 *
$\ln y_1 \ln p_1$	0.021	1.27
$\ln y_1 \ln p_2$	-0.047	-3.26 *
$\ln y_1 \ln p_3$	0.011	0.91
$\ln y_2 \ln p_1$	0.053	3.54 *
$\ln y_2 \ln p_2$	0.006	0.48

Table 3: Estimated Parameters of the Translogarithmic revenue function – Method SUR - continued

$\ln y_2 \ln p_3$	-0.039	-3.18 *
$\ln y_3 \ln p_1$	0.002	0.94
$\ln y_3 \ln p_2$	0.0001	-0.05
$\ln y_3 \ln p_3$	-0.015	-4.76 *
$\ln ASS$	0.437	8.65 *
$\ln CAP$	0.159	3.89 *
$\ln RISK$	-0.845	-1.87 ***
R^2	0.92	
$D.W$	2.18	

Notes: number of observations = 463. * Significantly different from zero at the 1% level. ** Significantly different from zero at the 5% level. *** Significantly different from zero at the 10% level.

The results presented in Table 4 show, on average, a value of H-Statistic less than unity, regardless of considered country. Therefore, the hypotheses of monopoly and of perfect competition in long-term equilibrium are rejected. Our results are consistent with the oligopoly hypothesis with conjectural variations and of monopolistic competition which combines elements of monopoly and perfect competition. The only apparent exception is Tunisia where the value of H-statistic is negative, which prevents rejecting the hypothesis of monopoly or of perfect competition over the period 2000-2010. This result could be explained by the fact that the Tunisian banking sector has not exited yet the liberalisation process that is translated into fluctuations in the competition conditions. Another explanation of this result is that it could be due to the inefficiency of Tunisian banks, where they are unable to totally exploit economies of scale and scope, which allow them minimising their average cost.

Regarding individual results, i.e. per country, we find that Lebanon, Bahrain, Saudi Arabia, and UAE recorded an H-statistic higher than the other countries. This result suggests that the competitive behaviour of banks in these countries is higher than other ones. Besides, the evolution of H-statistic indicates no significant strengthening of competition following the liberalisation process, except in Lebanon, Bahrain, Saudi Arabia and UAE. The H-statistic is an increasing function of competition level under the hypothesis of unchanged demand elasticity, and marks a slight downward trend in some countries as shown by the results in Table 4.

Overall, our application of Panzar-Rosse measure does not confirm the structure-conduct-performance paradigm, and high concentrations observed in the majority of Arab banking sectors have not provided Arab banks with a significant market power. On one hand, the positive values of H- statistic observed during the 2000-2010 period indicates that the process of liberalisation and deregulation prevented banks from establishing or maintaining a monopoly power. On the other hand, the evolution of H-statistic indicates no increase in competition, which is an increasing function of the competition level under the hypothesis of unchanged demand elasticity, shown by a slight declining tendency in some countries.

6. Conclusion

Panzar and Rosse have developed a statistic measuring the sum of elasticities of total revenue relative to factor prices. This statistic, called H, is estimated through a reduced form equation, allows determining the type of the competitive equilibrium on a given market. The Panzar-Rosse model allows overcoming the inherent difficulties in testing the structure-conduct-performance hypothesis. Nevertheless, the reduced form approach results in a significant reduction in the informative content of the competition indicator. The statistic allows excluding the cases of monopoly and perfect competition, but does not give practically any information about the case of oligopoly. To overcome

this problem of the Panzar-Rosse model, we chose to estimate a translog revenue function characterised by high flexibility compared to the equation of reduced form

Table 4: Evolution of average degree of competition of Arab banks over the period 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
LEB	0.86	0.87	0.87	0.88	0.86	0.89	0.87	0.87	0.91	0.88	0.89	0.89
KUW	0.57	0.60	0.58	0.61	0.61	0.63	0.58	0.52	0.54	0.61	0.60	0.59
QAT	0.54	0.45	0.47	0.53	0.51	0.54	0.56	0.57	0.57	0.55	0.56	0.53
BAH	0.61	0.62	0.63	0.66	0.65	0.63	0.7	0.64	0.63	0.65	0.67	0.64
OMA	0.24	0.24	0.25	0.26	0.26	0.31	0.28	0.32	0.31	0.24	0.24	0.27
SAU	0.65	0.64	0.65	0.66	0.67	0.67	0.67	0.67	0.67	0.65	0.64	0.66
EGY	0.68	0.62	0.59	0.62	0.616	0.76	0.65	0.66	0.69	0.68	0.62	0.65
TUN	-0.86	-0.89	-0.17	-0.09	0.21	0.28	0.38	0.35	0.38	0.11	0.18	-0.01
MOR	0.26	0.25	0.26	0.26	0.26	0.33	0.26	0.33	0.33	0.27	0.29	0.29
JOR	0.28	0.2	0.38	0.35	0.35	0.44	0.35	0.28	0.44	0.24	0.34	0.34
UAE	0.58	0.52	0.59	0.62	0.61	0.76	0.68	0.66	0.69	0.71	0.69	0.65

Notes: LEB: Lebanon, KUW: Kuwait, QAT: Qatar, BAH: Bahrain, OMA: Oman, SAU: Saudi Arabia, EGY: Egypt, TUN: Tunisia, MOR: Morocco, JOR: Jordan, and UAE: United Arab Emirates.

The empirical results show that, in most of Arab countries, the H-statistic is between zero and unity, and significantly different from both bounds. The hypotheses of perfect competition and monopoly can be rejected in favor of oligopoly or monopolistic competition. While these results produce interesting results, they must be interpreted with caution for several reasons. Firstly, the H- statistic is based on the hypothesis that markets are in equilibrium. Secondly, the conditions for exercising banking activities (e.g. regulations) differ from one country to another, which could complicate the comparisons among countries. Thirdly, researchers do not agree on a reliable way to establish a link between the values of H-statistics and specific conclusions regarding the competitive behaviour of banks, especially for values between zero and one.

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