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Competition In Iran's Banking Sector: Panzar-Rosse Approach

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Abstract

The Iranian banking sector has undergone huge and substantial reform in the last decade; privatization, establishment of private banks and development of modern technologies (IT). This paper investigates the competitive condition of the Iranian banking industry over the period 2005-2010 using the H-statistic proposed by Panzar and Rosse. The properties of this non-structural methodology make it an excellent framework for assessing the degree of competition in the banking industry. To calculate H statistics, a reduced form of revenue equation was estimated. The calculated H statistics for the whole sample period was 0.7101.The extent of H statistics and the result of wald test indicate that the structure of Iranian Banking sector is neither monopoly nor competition. Our findings were in favor of monopolistic competition.

Keywords: Competition, Iranian Banking Industry, Market Structure, Panzar-Rosse.

JEL Classification;

1. Introduction

Banks play a pivotal role in the provision of credit, the payment system, the transmission of monetary policy and maintaining financial stability. The vital role of banks in the economy makes the issue of banking competition extremely important (Spierdijk, Bikker & Shafer, 2009). The degree of competition in the banking sector has been at the frontier of research for the past two decades. Knowledge of the market structure is of particular importance to academics and policy makers as well as practitioners (Zulkhabiri & Sufian, 2007). Many recent studies have confirmed a strong empirical association between banking structure and economic growth, both

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within the US (Collender & Shaffer, 2002) and abroad (Levine, Loayza & Beck, 2000; Rajan & Zingales, 1998).

Also, the Iranian banking sector has undergone huge and substantial reform in the last decade in case of the privatization, establishment of private banks and expansion of new technologies.

In this study, we try to answer the question of how have the competitive conditions in the Iranian banking industry changed the overall banking and regulations in the last decade particularly after the dramatic changes. Moreover the paper provides empirical evidence on the level and evolution of competition in the Iranian banking industry.

We utilize the Panzar-Rosse methodology in order to measure the degree of competition in the banking sector. The Panzar-Rosse model uses data for individual banks, which tend to be available in sample quantities, allowing fairly precise estimations of competition (Bikker & Haaf, 2002). The aim of the paper is to examine the degree of competition within the Iranian banking industry during the period of 2005–2010.

2. Literature review

The literature on the measurement of competition can be divided into two major streams: structural and non-structural approaches. The structural approach to the measurement of competition embraces the Structure-Conduct-Performance paradigm (SCP) and the efficiency hypothesis, (Stavareks & Repkova, 2011), Conventional views on the relation between competition and market structure such as the structure-conduct-performance paradigm (Bain, 1951) would suggest that more concentrated markets tend to be more collusive. However, this view was questioned by the contestability theory (Baumol, 1982) and the efficiency hypothesis by Demsetz (1974). While the contestability theory argues that the threat of entry alone can lead to competitive conduct independent of the number of firms actually acting in the market given free market entry and exit, in the efficiency hypothesis concentration may result from the strategic decision of the more efficient firms to increase market share rather than to exploit their efficiency advantages at the original market share and price level (Hampell, 2002). Moreover, both approaches focus on the most frequently applied measures of concentrations, k-bank concentration ratio (CR_k) and Herfindahl- Herschman Index (HHI).

Concentration ratio (CR) shows the degree to which an industry is dominated by a small number of large firms or made up of many small banks. Higher CR reflects a more concentrated market .Summing only over the market shares of the k largest banks in the market, it takes the form: ($CR = \sum_{i=1}^{k} s_i$) (Bikker & Haaf, 2002). The Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in a market,

and then resulting number: ($HHI = \sum_{i=1}^{k} s_i^{\,2}$). The empirical banking literature has shown that concentration is generally a poor measure of competition (Shafer, 1993, 2002; Shafer & DiSalvo, 1994; Claessens & Laeven, 2004). Some of these studies find conduct that is much more competitive than the market structure would suggest, while others find much more market power than the market structure would suggest. Since the mismatch can run in either direction, concentration is an extremely unreliable measure of performance. (Bikker, Shafer & Sperdijk, 2009).

The shortcomings of the SCP and ESH approaches are addressed by the new empirical industrial organization (NEIO), which assesses the strength of market power by examining deviations between observed and marginal cost pricing, without explicitly using any market structure indictor (Matthews et al., 2006) . Non-structural models, namely the Iwata model (Iwata, 1974), the Bresnahan model (Bresnahan, 1982; Lau, 1982) and Panzar-Rosse model (Panzar & Rosse, 1987), have been used in recent empirical studies.

Bersnahan's method uses historical data to estimate a market demand and coast equations indicating the bank's price setting equation and implicit mark up over marginal coasts. In turn, these estimates may be combined to yield a parameter λ whose value indicates the market's structure. If λ=0, perfect competition exists; if λ=1 a perfect cartel with substantial market power; intermediate indicates an oligopoly solution (Mkrtchyan, 2005).

The Panzar-Rosse (P-R) model is one of the non-structural methods to measuring competition in the banking industry. Seminal articles by Rosse, Panzar and Rosse (1982, 1987) provide a convincing and convenient framework for analyzing the banking industry structure. This approach estimates a reduced-form equation relating gross revenue to a vector of input prices and other control variables. The H statistic is the sum of the elasticities of the reduced form revenues with respect to factor prices.

The estimated value of the H statistic ranges between $-\infty < H \leq 1$. An H-statistic of one (H=1) is associated with perfect competition, under perfect competition an increase in input prices and thus in average costs should lead to a proportional price increase and (at the firm level)to a proportional rise in revenues. Under monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output and consequently reduce total revenues and the H statistic is negative or equal to zero. Finally, 0<H<1, is associated with monopolistic competition (Bikker, 2004).

Some authors claim that one of the advantages of the P-R model, as well as other non-structural models, is that there is no need to specify a relevant market, since the behavior of individual firms provides an indication of their market power (Gutiérrez, 2007).Other advantages of this method include, Requires only a few variables, Robust to the extent of market and Can be estimated by simple, single-equation, linear model (Shaffer, 2004).

Several studies have utilized the Panzar-Rosse method to measure the degree of competition in the banking sector. Gelos and Roldos (2002) to banks in emerging markets including Argentina, Brazil, Chile, Czech Republic, Hungary, Mexico, Poland and Turkey, Nathan and Neave (1989) applied this technique to Canadian banks, Claessens and Laeven (2004) to banks of industrialised and developing countries, De Bandt and Davis (2000) for France, German, Italy, Perera et al. for 4 South Asian countries (2006), Aktan and Massood (2010) for banking industry in Turkey, Hamza (2010) for Tunisian banking industry, all of these studies find that banking markets are best described as monopolisticaly competitive. This method applied to banking data from Japan by Molyneux et al. (1996) and the results imply there is a monopoly. Yuan (2006) applied this method for Chinese Banks, the result indicate there is nearly perfect competition situation. Because of its strong theoretical roots, this paper uses the Panzar-Rosse technique to examine Iranian banking.

3. Iranian Banking Industry

During the 2000-2010 period, the Iranian banking sector was undergoing intense transformation and development. The parliament passed the establishment of privet bank act in April 2000 and First privet bank was established in 2001. In 2010, The number of private banks have been increased to more than 12 banks.

After notification of the Policies of Principle 44 of constitution in 2006, the government attempted to privatize stated-owned banks, except 2 commercial bank (Melli Bank & Sepah bank) and four specialised banks. In 2008, Large state-owned shares of three banks entered in the stock exchange. Gradually, other banks including this law are scheduled for privatization.

The modernization of distribution channels and the implementation of new technologies have increased the availability of services and the effectiveness of banks' operation. Movement toward electronic banking leads to increase in using ATM, telephone bank, Internet banking among the banks' customers in Iran. For instance, number of ATM from 2289 in 2004 has been increased to 26626 in 2011 and number of card payment from 7,800,000 in 2004 has been increased to 174,000,000 in 2011.

In this study, concentration proxies for the market structure. Table 1 shows the evolution of market concentration (market structure) in terms of Deposit, Total asset and Loan for the period of this study. N-firm concentration ratio (n=4, 8, 10) and Herfindhal-Hirschman were used to calculate the degree of concentration in Iranian Banking Industry.

Table 1. Market Structure In Iranian Banking Industry in Terms of Deposit, Total Asset and Loan

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Deposit										
CR_4	0.73	0.73	0.72	0.67	0.61	0.57	0.57	0.56	0.57	0.58
CR_8	0.98	0.97	0.96	0.92	0.9	0.87	0.85	0.82	0.82	0.82
CR_{10}	1	0.99	0.98	0.97	0.95	0.93	0.91	0.91	0.91	0.9
HHI	1625	1605	1531	1385	1221	1117	1096	1047	1066	1061
Total asset										
CR_4	0.067	0.68	0.68	0.65	0.62	0.59	0.58	0.49	0.57	0.55
CR_8	0.97	0.96	0.94	0.93	0.9	0.88	0.85	0.81	0.83	0.82
CR_{10}	0.99	0.98	0.97	0.97	0.94	0.92	0.91	0.9	0.89	0.89
HHI	1471	1481	1440	1365	1229	1150	1096	1048	1042	1026
Loan										
CR_4	0.65	0.68	0.68	0.67	0.57	0.56	0.54	0.52	0.52	0.52
CR_8	0.97	0.97	0.96	0.92	0.89	0.87	0.84	0.83	0.82	0.81
CR_{10}	0.99	0.99	0.98	0.97	0.94	0.93	0.9	0.9	0.89	0.89
HHI	1413	1486	1483	1446	1123	1065	1037	1001	987	977

Source: Author's calculations based on bank statements provided to the CBI.

In general, the concentration ratio shows the declining trend from 2001 until the 2010, where the total deposits, total Asset and total loans have been taken as the measure of bank size. All indicators show a similar pattern.

Concentration ratio in deposit market implies a relatively 'somewhat concentrated market' with CR_4 recording 0.73% and HHI at 1625 in the 2001. However in 2010, concentration ratio went down with CR_4 recording 0.58% and HHI at 1068, as well as concentration ratio in the loan market shows similar trend with that in the deposit market with CR_8 recording 0.97% and HHI at 1413 in the 2001 while concentration ratio went down with CR_8 recording 0.81% and HHI at 977 in 2010. Also declining in concentration indicators until 2007 are more than years after 2007. In the last three years, concentration decreasing is softer and in some cases it has been increased.

4. Model Specification, Data

For the empirical analysis the data of 19 banks for the period of 2001-20010 would be used. We apply the Panzar-Rosse model to measure competition in the banking industry. Following Bikker and Haaf (2002), Claessens and Laeven (2004) and Shaffer (2004) are among many others in employing the Panzar and Rosse (1987) revenue test to banking. Their approach was to

measure the effect of factor prices on the observed equilibrium values of total revenue (TR). TR is the observed revenue and ***Pf***, ***Pl***, ***Pk*** are the price of inputs, ***ETA*** and ***TA*** are a set of bank-specific factors. The H-statistic is derived using the following specification of the reduced-form revenue equation for a panel data set:

$$\text{Ln}\left(\text{TR}_{it}\right)=\beta_{\circ}+\beta_1\text{Ln}\left(\text{Pf}_{it}\right)+\beta_2\text{Ln}\left(\text{Pl}_{it}\right)+\beta_3\text{Ln}\left(\text{Pk}_{it}\right)+\beta_4\text{Ln}\left(\text{ETA}_{it}\right)+\beta_5\text{Ln}\left(\text{TA}_{it}\right)+\text{ei}+\mu_{it} \quad (1)$$

A crucial difference among studies is the definition of the dependent variable applied in the estimation of H statistic. Bikker and Geroeneveld (2000), Deltuvaitė (2007) or Mkrtchyan (2005) used interest revenues. Alternatively, Hempell (2002), Bikker et al. (2009) or Aktan and Massood (2010) applied a total revenues or net revenues. Following Nathan and Neave, (1989); De Bandt and Davies (2000),In this study we utilize total revenues and define dependent variable (TR) as the ratio of total revenues to the total assets

Pl is the ratio of personnel expenses to the total assets, a proxy for cost of labour , ***Pk*** is the ratio of other operating expenditure (non-interest cost ie; taxes and amortization) to total assets, a proxy for cost of capital and ***Pf*** is the ratio interest expenses to total deposits, as a proxy of price of funds. The input prices are followed by a set of bank-specific factors. The bank-specific factors include the ratio of total equity to total assets (***ETA***) is included to control for differences in capital structure. Total assets (***AT***) controls the size of the bank and can be considered as a proxy for economies of scale (De Bandt & Davies, 2000; Shaffer, 2002; Zulkhabiri & Fadzlan, 2007).

The main indicator, H-statistic, is calculated as a sum of elasticities of revenue by price of input factor. $H=\beta_1+\beta_2+\beta_3$.

A critical feature of the H-statistic is that the tests must be undertaken on observations that are in a long-run equilibrium. This suggests that competitive capital markets will equalise risk-adjusted rates of return across banks such that, in equilibrium, rates of return should be uncorrelated with input prices. (Matthews et al., 2007) It should be noted that equilibrium does not mean that competitive conditions are not allowed to change during the sample period. It only implies that changes are to be taken as gradual (Shaffer, 1982; Claessens & Laeven, 2004). The previous studies (Molyneux et al., 1994; De Bandt & Davies, 2000; Yu Sun, 2011; Aktan & Massood, 2010), to test for equilibrium, one can calculate the H-statistic (E) using the rate of return, instead of total revenue, as the dependent variable in the regression equation. The largest body of the existing literature uses a regression that relates the return on assets (ROA)[1] with input prices.

1. The ROA ratio is calculated by comparing net income to total assets (Bikker, Shaffer & Spierdijk, 2009)

$$\text{Ln}\left(\text{ROA}_{it}\right)=\beta_{\circ}+\beta_1\text{Ln}\left(\text{Pf}_{it}\right)+\beta_2\text{Ln}\left(\text{Pl}_{it}\right)+\beta_3\text{Ln}\left(\text{Pk}_{it}\right)+\beta_4\text{Ln}\left(\text{ETA}_{it}\right)+\beta_5\text{Ln}\left(\text{TA}_{it}\right)+\text{ei}+\mu_i \quad (2)$$

E= $\beta_1+\beta_2+\beta_3$, E=0 indicates long-run equilibrium, while E < 0 reflects disequilibrium.

Table 2. Interpreting the Panzar-Rose *H*-Statistic

Parameter Region	**Competitive Environment Test**
$H \leq 0$	Monopoly or conjectural variations short run oligopoly
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition or natural monopoly in a perfectly contestable market or sales maximizing firm subject to a break even constraint
Parameter Region	**Market Equilibrium Test**
E=0	Equilibrium
E<0	Disequilibrium

Source: Panzar and Rosse (1982, 1987), Molyneux et al. (1994).

4.1. Empirical Analysis

The dataset used in the analysis covers all major Iranian banks for the period 2005–2010. These Data have been collected from the annual performance of Iranian banking reports. The dataset consists of 19 banks over 6 years.

To assess the degree of competition in the Iranian banking sector, We stemated the Equation (1) for examination the level of competition for Iranian banks. In order to exploit both the cross-sectional and the time-series dimensions has been used the panel dataset. Ultimatelty, to identify whether individual banks‘ features have a significant effect on the competition , a series of specification tests were run between pooled OLS, fixed effects and random effects. After testing [F_{Leamer} Test,(90,18)=3.9134, Prob=0.000] panel data method was chosen. Based on the Hausman test [Hausman Test (25.049994, Prob=0.0001)], the random effects model was rejected in favour of fixed effects. Results of a panel estimation on with fixed effects for Panzar-Rosse model is presented in Table 3.

Table 3. Competitive Conditions Test Results for Iranian Banks for 2005-2010 (The dependent variable (TR) is the ratio of total revenues to the total assets)

Variable	**Coefficients**	**t-statistic**	**prob**
Pf	-0.0925	-1.8879	0.0622
Pl	0.2671	4.3906	0.0000
Pk	0.5655	9.2018	0.0000
ETA	0.1661	5.0848	0.0000
TA	-0.1792	-3.4828	0.0008
R-squared	0.806		
D-W	2.154		
Prob	0.000000		
H=0.710*	The Wald test rejects H=0 at the 1% significance level The Wald test rejects H=1 at the 1% significance level		
F_{Leamer} Test & Hausman test			
F(90,18)	3.9134	Prob=0.000	
Hausman Test	25.049994	Prob=0.0001	

The dependent variable (TR) appears to be negatively related to the price of funds (Pf). By contrast, the price of labour (Pl) and the price of capital (Pk) are positively associated with the dependent variable. Moreover other than (Pf) all variables are significant at the 1% level. Also, a negative sign for (ETA) was expected to arise because lower capital ratios are supposed to lead to higher bank revenues. The coefficient of the (TA) variable is negative. Those larger banks seem to be less efficient compared to smaller banks. This also suggests that as a whole the Iranian banking faces diseconomies of scale.

The Wald test rejects the hypothesis of monopolistic market structure (H=0) at the 1% significance level. It also rejects the hypothesis of perfectly competitive market structure (H=1) at the 1% significance level. The estimation of H=0.7101 suggests monopolistically competitive banking industry in Iran.

Finally, we test for long-run equilibrium using *ROA* (ratio of net profit to total asset) as the dependent variable as discussed above. After testing [F_{Leamer} ,(90,18)=7,282920,Prob=0,000 & Hausman Test, 27.215156, prob=0.0001] fixed effects method was chosen. The results of this estimation are presented in Tables 4. The Wald test does not reject the null hypothesis E=0.(Existing long-run equilibrium over the period).

Table 4. Equilibrium Test Results for Iranian Banks for 2005-20010

(Dependent variable –ROA)

variable	Coefficients	t-statistic	Prob
Pf	-0.1841	-1.3516	0.1799
Pl	0.1996	1.0288	0.3063
Pk	0.2709	3.0678	0.0028
ETA	0.2332	2.2966	0.0240
TA	-0.2770	-2.6876	0.0086
R-squared	0.7560		
D-W	2.1994		
Prob	0.000000		
E-Statistic	The Wald test does not reject the null hypothesis E=0 at the conventional significance level.(F-statistic, P=0.3190)		
F_{Leamer} Test & Hausman test			
F_{Leamer} ,(90,18)	7,282920	Prob=0,000	
Hausman Test	27.215156	prob=0.0001	

Conclusion

In this paper, Applying structural model and the Panzar-Rosse method, we measured the extent of competition in Iranian banking, using n-firm concentration ratio and Herfinhal-Hirschman, Market concentration, as a proxy for market structure. We calculated CR and HHI for total deposit, Loan and total Asset, during 2001-2010. The results of estimation CR and HHI imply that the concentration indicators were reduced after structural changes in Iranian banking (for example; privatization, establishment of private banks and expansion new technologies). Also ,the evidences from concentration indicators suggest that the declining in concentration

indicators until 2007 are more than years after 2007. In the last three years, concentration decreasing is softer and in some cases it has increased.

To assess the degree of competition in Iranian banking industry, a modern empirical analysis based on the non-structural method developed by Panzar and Rosse (1987) was conducted. This method is also known as the H-statistic .We used annual panel data covering 19 banks over six years (2005-2010).A panel regression with fixed effects were used to calculate the Panzar-Rosse H statistic. The H statistic computed for the sample is 0.7101. The Wald test rejects the hypothesis for the market structure of monopoly or perfect competition at the 1% significance level leading us to this conclusion that total bank revenues appear to be earned in conditions of monopolistic competition during the sample periods.

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