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Market Structure in Iran's Banking Sector: An Application of Multilevel Models

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This paper analyzes Iran's banking market structure, using unbalanced panel data models during 1997-2009. To study the market structure, various measures of market concentration are examined theoretically and the *U* index of concentration is applied to Iran's banking system. The results show that, along with the commencement of privatization in Iran's banking sector (2001), U index of concentration has tended to decrease, indicating that competition in Iran's banking market has intensified. However, this may not happen until the strict regulations on private banks are relaxed.

Keywords: Market Structure, Cost Function, Banking Industry, Multi-level Models, Iran's Banking Sector.
JEL Classification: G21, L13.

1. Introduction

Banking is considered as one of the key industries in both developed and developing countries. This can be explained regarding the role of banks in producing value added – whether directly through getting involved in ventures or indirectly through providing monetary funds towards production as well as playing the role of intermediary in the coincidence of payment dues. In Iran's economy, specifically, as there are limitations in financing projects other than banking sector and as the banking sector is operating under strict governmental regulations,[1]

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1. That is because more than 75 percent of market share in Iran's banking industry is captured by governmental banks.

its function becomes more critical. Furthermore, privatization has been put on the top priorities since the amendment in Principle 44th of the Constitution was issued (2006).[1] Hence, ownership in banking sector is on way of transformation to be more privately owend. All these show the necessity of conducting a comprehensive study on banking industry structure and the performance of individual banks before going on with re-regulating this sector.[2]

Considering the importance of banking sector in Iran's economy, this paper is organized as follows: In section 2 it examines measures of concentration theoretically and then the evolution of banking industry in Iran's economy is discussed in section 3. In the 4th section, an empirical estimation of cost functions and measurement of U-Index in banking sector is conducted. Finally, in the 5th section, concluding remarks and policy implications are included.

2. Measures of Market Concentration

"Market Structure" shows how the industry in a specific market is organized (Stiglitz, 1993, P. 396), and is best shown through measuring market concentration. However, there are different viewpoints on how to measure market concentration. Concentration ratios are important as they capture structural characteristics of a market (Bikker and Haaf, 2003).

The concept of industrial concentration has been extensively argued in the economic literature. Despite many different approaches to its measurement, general agreement prevails about the constituting elements of concentration measures, *i.e.* the number of operating units (banks) and the distribution of bank sizes. In general, the concentration indices (CI) can be expressed in form of (1):

$$CI = \sum_{i=1}^{n} s_i w_i \tag{1}$$

Whereas s_i and w_i represent the market share of bank i and the associated weight; respectively, and n shows the number of banks in

1. According to Principle 44th of the Constitution, all key sectors were to operate under public ownership; however, the amendment allowed for third party access up to 80 percent, except for some limited number of sectors.

2. It is worth noting that banking sector in Iran experience one of the most severe governmental regulations on deposits' and loans' interest rates. On the other hand, banking industry has a dominant role in financing projects due to limitations of capital market.

the industry (Bikker and Haaf, 2003). However, as the weighting scheme of the indices determines its sensitivity towards changes at the tail-end of the firm size distribution, it is important to specify w_i accurately. In this respect, Marfels (1971) distinguishes four ways of weighing:

- Share of K dominant bank is weighted as unity and otherwise, zero ($i.e.\ w_i = 1 \text{ for } i \leq k \text{ and } w_i = 0 \text{ for } i \succ k$).
- Banks' market shares are used as their own weights $w_i = s_i$. So, the larger the markets share would mean the greater weights attached.
- Ranking banks in ascending or descending order and then using the rank of the individual banks as weights ($i.e.\ w_i = i$).
- Using the negative of each bank's market share logarithm as the weight ($\text{i.e.}\ w_i = -\log s_i$). In this regard, a smaller absolute weight is thus attached to larger market shares.

Considering (1) and what mentioned about the methods of weighting, there are different concentration indices represented in table (1).

Although mentioned indices may contain lots of information about the degree of competition in an industry (here banking), in many cases they bring about inaccurate results. That is mostly because of the exogenous nature of parameter a (the power of s_i). Clearly speaking, for the case of indices like *k Banks Ratio of Concentration, Rosenbluth, Hall-tideman* and *comprehensive index of industrial concentration*, the power of s_i ($i.e.\ a$) equals unity, in Herfindhal-Hirschman a equals 2, and in Hannah-Kay it is chosen by the researcher. It is obvious that the value of a determines the results considerably. To overcome this deficiency, Davies (1980) introduced U index in which is determined endogenously. He showed that previous concentration indices were likely to over/underestimate the concentration intensity due the exogenous nature of a. Therefore, in this paper, U concentration index is applied.

Table 1. Concentration Indices and Their Characteristics

	Index type	W_i weight	Typical features	range
CR_3 CR_4 CR_5	$CR_k = \sum_{i=1}^{k} s_i$	$W_i = 1 \quad for \quad i \geq k$ $W_i = 0 \quad for \quad i < k$	*Takes only large bank in to account. Arbitrary cut off*	$0 \leq CR_3 \leq 1$
	Herfindhal-Hirschman $HHI = \sum_{i=1}^{n} s_i^2$	$w_i = s_i$	*Considers all banks, sensitive to new entries*	$1/n \leq HHI \leq 1$
	Hall-Tideman $HTI = 1/(2\sum_{i=1}^{n} is_i - I)$	*Banks ranking from largest to smallest*	*Emphasizes on absolute number of banks*	$0 \leq HTI \leq 1$
	Rosenbluth $RI = 1/2(\sum_{i}^{n} is_i - 0.5)$	*Banks ranking from smallest to largest*	*Sensitive to changes in the size distribution of small banks*	$0 \leq RI \leq 1$
	comprehensive index of industrial concentration $CCI = s_i + \sum_{i=2}^{n} s_i^2 (I + (I - s_i))$	$w_i = 1 \quad for \quad s_1$ $w_i = \left(s_i + \left(s_i - s_i^2\right)\right) \quad for \quad i > 1$	*Addresses relative dispersion and absolute magnitude, suitable for cartel market*	$0 \leq CCI \leq 1$
	Hannah-Kay $HKI = \left(\sum_{i=1}^{n} s_i^{\alpha}\right)^{1/(1-\alpha)} \quad \alpha > 0, \alpha \neq 1$	$w_i = s_i^{a-1}$ *chosen by researcher a*	*Stress influence large banks*	$1/s_1 \leq HKI \leq n$
	Entropy $E = -\sum_{i=1}^{n} s_i \log_2 s_i$	*The market share of banks*	*Takes all banks*	$0 \leq E \leq \log n$
	U index $U_t = \left(\sum_{i=1} S_{it} (S_{it} n_t^{\frac{a-1}{a}})\right)^a$ *endogenous parameter a*	$w_i = s_i n^{(a-1)/a}$ *endogenous parameter: a*	*Emphasis on inequality distribution of banks and number of banks for $\alpha = 1$ equal to the HHI*	$1/n \leq U \leq \infty$

Source: Bikker & Haaf (2003)

3. Banking industry in Iran: structural changes and Performance Indices

3.1. Structural Changes in Banking Industry

The review of banking system evolution in Iran's economy indicates that this sector has passed 4 different stages as follows:

• **First stage: 1888-1949**

The commencement of banking in Iran goes back to 1888 when there were two foreign banks' branches established in Tehran. Then, in 1889 the Imperial bank of Iran was established through using the British grant of "Barron Jullio Roiter". Then, *Iran and Osmani Bank* was established. All these banks were founded under supervision of England and Russia. This was the case till the first national bank (*Meli bank*) was established in 1927. After about 20 years later, the first private bank with Iranian capital was established in 1949 (Ghandinejad, 2006).

• **Second stage:1950-78**

Since the establishment of the first private bank, some other banks with private, governmental and mixed ownership were established. Also in 1953, banking rules were revised. Gradually, the number of private banks enhanced considerably. The trend was such accelerating that till 1962, the number of banks reached 27 (10 governmental and 17 private). Meanwhile, the number of banking branches increased from 6980 to 8270.

• **Third stage:1979-1998**

After the Revolution of 1979 and therefore the incidence of various factors such as lapse of public confidence, considerable withdrawals, and increase in non-performing loans of banks, the operation of most private banks stopped in spite of Central Bank aids. In such circumstances, "the Bill for Nationalization of Banks, Credit and Insurance institutions" was passed by *Islamic Revolution Council of Iran* in the 1979, transferring the ownership of all private banks to Government. Thus, the number of banks was reduced from thirty six to nine. Then in 1983, the "Law for Non-Usury Banking Operation" was passed. From that time on, facilities are extended in the form of 14 Islamic contracts. Furthermore, interest rate is replaced by banking fees and assured fixed profit. (Mojtahed and Mehrabi, 2008). During this period, the governmental structure of banks and extensive intervention of government in banking operations allowed policy makers to take advantage of banks' monetary fund in favor of their macro/micro priorities.

• **Fourth stage: 1998-2009**

Governmental structure of the banking industry lasted till 1998. By this time, the "Law for Authorizing the Establishment of Private Banks" was passed. Therefore a number of monetary and financial

institutions began their operations, except for opening demand deposit accounts. Then, private banks were established and until 2009 ten private banks joined the banking industry. It is now expected that banking market in Iran is on way of getting more competitive (Ghandinejad, 2006).

3.2. Performance Indicators in Banking Industry

In table 2, there are some indicators comparing the performance of Iranian governmental banks with those of private banks, during 2003-2009.

Table 2. Performance Indicators in Iran's Banking System (2003-2009)

Index	Private banks	Governmental banks
ROA	2.86	1.42
ROE	45.73	21.42
C/R	36.66	73.43
NIM	3.34	4.04

There are four indices (1) Return on Assets (ROA), (2) Return on Equity (ROE), (3) The Ratio of Total Cost to Total Revenue (C/R), and (4) Net Interest Margin (NIM) presented in the table. The results show that:

- The ROA index, obtained through dividing total profit by total asset, shows that the private banks use assets in more efficient ways than governmental banks, hence gaining more profit. The average of this index was equal to1.42 and 2.86 percent for governmental and private banks, respectively.
- The "ROE" index is obtained from the ratio of net distributed profit to average total capital (Mojtahed and Mehrabi, 2008). The results show that the average return on equity during 2004-2009, in private banks (45.73percent) had been much better than governmental banks (21.42 percent).
- The ratio of cost to revenue (C/R) in governmental banks during 2003-2009 was higher than 60 percent and in some cases it reached above 90 percent. Totally, the average of the index during 2003-2009 among governmental banks was equal to 73.43 percent. While the average of C/R for private banks is lower and approached to 36.66 percent.

- Finally, the index of Net Profit Margins obtained from the ratio of received interest to total assets shows that the trend of changes in private banks' profitability was more stable than governmental banks (Mojtahed and Mehrabi, 2008). As, the average ratio in the private and governmental banks were 3.34 and 4.04 percent, respectively.

4. Empirical Analysis of Banking Industry Structure in Iran

As banking industry in Iran's economy reflects a special case of governmental monopoly, in which privatization is on way of getting done fast, it is worth measuring the corresponding effects of privatization on competition intensity in this industry. In this respect, several indices were introduced in section 2. As shown, in most cases the market share of banks (s_i) was weighted ignoring the industry characteristics. Putting the matter another way, it is likely that the predetermined nature of weighs brings about inaccuracy. This is the case that U index of concentration permits flexibility in weights. In fact, endogenity of weights minimizes the risk of likely over/underestimations.

Therefore, to evaluate banking structure in Iran's economy, U index of Concentration as Davies (1979) has shown, is expressed in the form of (2):

$$U_{it} = I_{it}^{*a} n_t^{-1} \tag{2}$$

Where $a \geq 0$ and I_{it} is some generally accepted measure of inequality, and n is the number of banks. As a is unknown, it is necessary to estimate a model of an inter-industry variance in price cost margins (π_{it}) as (3):

$$\pi_{it} = \frac{P_{it} - MC_{it}}{P_{it}} = \alpha U_{it}^{\beta} = \alpha[(1 + c_t{}^2)^a n_t^{-1}]_{it}^{\beta} \tag{3}$$

Where β is the coefficient of flexibility in industry's price cost margin. Moreover, inequality index of banks' marketing shares (I_{it}^{*}) in the model (like what Davis showed in his study) equals $1 + c^2$ in which c^2 is obtained from (4):

$$c^2 = \{(\sum_{j=1}^{n} S_j^2) - \overline{S}^2\} / \overline{S}^2 \tag{4}$$

To run the model, at first it is needed to take the logarithm of (3) and substitute c^2 by (4) to get (5):

$$\log \Pi_{it} = \log \alpha + \beta_1 \log \left(\frac{\sum_{i=1}^{n} S_{it}^2}{n_t \overline{S}_t^2} \right) + \beta_2 \log n_t + \upsilon_{it} \tag{5}$$

Considering $\beta_1 = \alpha\beta$, $\beta_2 = -\beta$, it is possible to compute a as $a = {-\beta_1}/{\beta_2}$. Then, it will be possible to calculated U index of Concentration as (6):

$$U = \left(\sum s_i (s_i n^{\frac{a-1}{a}}) \right)^a \tag{6}$$

The resulting index is due to two characteristics: first, parameter a is derived endogenously, considering the inter industry characteristics of banks; second, through using this index, it is possible to know the elasticity of banks' market share to any changes in the number of banks. To be more accurate, the elasticity can be derived as (7):

$$a = -\frac{\beta_2}{\beta_1} = \frac{\partial \log \left(\sum_{i=1}^{n} S_{it}^2 \Big/ n_t \overline{S}^2 \right)}{\partial \log n_t} = \frac{\partial \log(1 + c^2)}{\partial \log n_t} = \frac{\partial \log I_{it}^{*2}}{\partial \log n_t} \tag{7}$$

As it is necessary to have the estimation of a to calculate Concentration Index of U, firstly, it is needed to estimate the model of inter-industry variance in price cost margin to get a. However, the model cannot be estimated unless the estimation of marginal cost in banking industry is conducted.

In what follows, the estimation of marginal cost is performed and then we can go on setting up the model of inter-industry variance of price cost margin.

4.1. Marginal Cost, Methodology and the Results

4.1.1. Model Specifications

It is necessary to have the estimations of total cost to derive marginal cost. Therefore, the transcendental logarithm (transloge) function is used in this regard.

$$
\begin{aligned}
Ln(TC_{it}) &= \sum \gamma_i d_i + \gamma_{q1} \ln Q_{1it} + \gamma_{q2} \ln Q_{2it} b_K + \ln(P_{kit}) + b_L \ln(P_{Lit}) \\
&+ b_D \ln(P_{dit}) + \alpha_T T_t + \frac{1}{2}\alpha_{Q1}(\ln Q_{1it})^2 + \frac{1}{2}\alpha_{Q2}(\ln Q_{2it})^2 + \frac{1}{2}\alpha_{KK}(\ln P_{kit})^2 \\
&+ \frac{1}{2}\alpha_{LL}(\ln P_{Lit})^2 + \frac{1}{2}\alpha_{DD}(\ln P_{Dit})^2 + \frac{1}{2}\alpha_{TT}T^2 + \frac{1}{2}\alpha_{KL}\ln(P_{kit})\ln(P_{Lit}) \\
&+ \frac{1}{2}\alpha_{KD}\ln(P_{kit})\ln(P_{dit}) + \frac{1}{2}\alpha_{LD}\ln(P_{Lit})\ln(P_{dit}) + \alpha_{Q1K}\ln Q_{1it}\ln(P_{kit}) \\
&+ \alpha_{Q1L}\ln Q_{1it}\ln(P_{Lit}) + \alpha_{Q1D}\ln Q_{1it}\ln(P_{Dit}) + \alpha_{Q1T}\ln(Q_{it})T_{nt} \\
&+ \alpha_{Q2K}\ln Q_{2it}\ln(P_{kit}) + \alpha_{Q2L}\ln Q_{2it}\ln(P_{Lit}) + \alpha_{Q2D}\ln Q_{2it}\ln(P_{Dit}) \\
&+ \alpha_{Q2T}\ln(Q_{2it})T_{it} + \alpha_{Kt}\ln(P_{kit})T_t + \alpha_{Lt}\ln(P_{Lit})T_t + \alpha_{Dt}\ln(P_{dit})T_t + \varepsilon_{it}
\end{aligned}
\tag{8}
$$

Where the dependent variable is total cost (TC) and explanatory variables are banks' output (Q_1: Loans, Q_2: investment), interest expenses (P_d) which is the price of borrowed funds, the price of labor (P_L) obtained by the ratio of "personnel's cost" to "number of personnel", and the price of physical capital (P_k), that is obtained from the ratio of "operating cost plus depreciation cost" to "the value of fixed asset". Also there is a trend variable (t) capturing the effects of technical improvement.

Also in estimating the parameters, the regular restrictions of symmetry and linear homogeneity for input prices are imposed as (9):

The technique used to estimate the model is Stochastic Frontier Approach (SFA), because it is based on the optimization assumption. To be more accurate, through using SFA technique, the cost frontier is fitted as an envelop showing the minimum levels of cost feasible. Figure (2) compares a cost function fitted through using SFA technique with the other one fitted by ordinary method of tracing regression line between observations (*i.e.* OLS).

$$
\begin{aligned}
&\frac{\partial \ln C}{\partial \ln P_l}+\frac{\partial \ln C}{\partial \ln P_k}+\frac{\partial \ln C}{\partial \ln P_d}=1\\
&\frac{\partial^2 \ln C}{(\partial \ln P_l)^2}+\frac{\partial^2 \ln C}{\partial \ln P_l \partial \ln P_k}+\frac{\partial^2 \ln C}{\partial \ln P_l \partial \ln P_d}=0\\
&\frac{\partial^2 \ln C}{(\partial \ln P_k)^2}+\frac{\partial^2 \ln C}{\partial \ln P_k \partial \ln P_l}+\frac{\partial^2 \ln C}{\partial \ln P_k \partial \ln P_d}=0\\
&\frac{\partial^2 \ln C}{(\partial \ln P_d)^2}+\frac{\partial^2 \ln C}{\partial \ln P_d \partial \ln P_l}+\frac{\partial^2 \ln C}{\partial \ln P_d \partial \ln P_k}=0\\
&\frac{\partial^2 \ln C}{\partial t \partial \ln P_l}+\frac{\partial^2 \ln C}{\partial t \partial \ln P_k}+\frac{\partial^2 \ln C}{\partial t \partial \ln P_d}=0\\
&\frac{\partial^2 \ln C}{(\partial \ln q_1)(\partial \ln P_l)}+\frac{\partial^2 \ln C}{(\partial \ln q_1)(\partial \ln P_l)}+\frac{\partial^2 \ln C}{(\partial \ln q_1)(\partial \ln P_d)}=0\\
&\frac{\partial^2 \ln C}{(\partial \ln q_2)(\partial \ln P_l)}+\frac{\partial^2 \ln C}{(\partial \ln q_2)(\partial \ln P_l)}+\frac{\partial^2 \ln C}{(\partial \ln q_2)(\partial \ln P_d)}=0
\end{aligned}
\tag{9}
$$

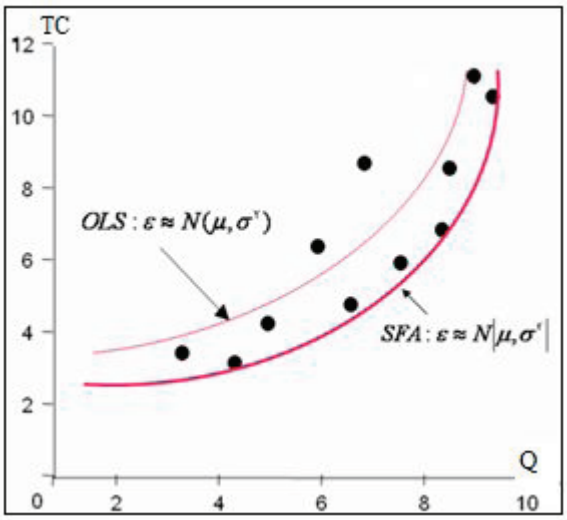

Figure 1. Cost Function Fitted by Two Different Techniques (SFA vs. LS)

As the figure shows frontier technique traces the lower frontier of cost function (TC); whereas, through using methods that fit regression line between observations, it is possible to have some observations below the cost function, which is not consistent with the presumptions

of a cost function. That's because, cost function is the locus of all cost minimizing choice of inputs subject to a given amount of output (Q).

To distinguish between SFA method with OLS, it is worth noting that unlike ordinary method of least square that assumes a normally distibuted error term ($\varepsilon_{it} \approx N(\mu,\sigma^2)$), in frontier technique there are two error components as v_i and u_i, where v_i is the "noise" component, mostly considered as a two-sided normally distributed variable, and u_i is the non-negative technical inefficiency component.

To apply SFA technique, it is needed to use Maximum Likelihood Estimator (MLE). Hence, the model is regressed using this estimator. Estimating total cost function, marginal cost can be finally derived from (9):

$$(9) \qquad \frac{TC}{Q} = AC, \quad \frac{\partial LnTC}{\partial LnQ} = \varepsilon = \frac{MC}{AC} \quad \Rightarrow MC = \varepsilon.AC$$

Therefore, marginal cost is obtained through multiplying average cost by the cost elasticity (ε).

Data used in the model consists of 11 Iranian governmental banks (1996 to 2009) and 6 private banks (2001-2009) reported by Central Bank of Islamic Republic of Iran. Deflating dataset for inflation effects, the variables are expressed in real term.

4.1.2. The Results

Before conducting estimations, it is necessary to verify the model stability. For this, it is needed to test for stationarity of variables and in case of non-stationarity of the same order, the existence of long run relationship must be tested to avoid spurious regression. Table (3).

Table 3. Testing Results for Panel Data Stationarity (Im, Pesaran, and Shin test)

Variables	Including Intercept		Including Intercept and Trend	
	t -statistic	P value	t -statistic	P value
Total Cost	-3.96	0.00	-	-
Investment Expenditures	0.72	0.772	-6.9	0.00
Loan	-3.42	0.01	-	-
Deposit Cost	-1.37	0.085	-3.2	0.007
Personnel's Cost	0.733	0.768	-16.7	0.00
Fixed Asset Cost	-4.14	0.00	-	-

The results show that the non-stationarity hypothesis of variables in 5 percent level of significance is rejected. Getting assured of stationarity of variable, there is no need to test for long-term stability and non-spurious regression.

However, as there are several types of panel data analytic models (including constant coefficients, fixed effects, and random effects models), it is first needed to specify the model that best fits. Therefore, the model of constant coefficients (pooled regression model)[1] is used as the baseline to be tested against fixed effect model.

Hence, we first test the group (bank) effects. We can perform this significance test with an F test to test the null hypothesis as (10):

$$
\begin{aligned}
&H_0 : \alpha_1 = \alpha_2 = ... = \alpha_n = \alpha \\
&H_1 : \alpha_1 \neq \alpha_2 \neq ... \neq \alpha_n \neq \alpha \\
&F_{groupeffect} = \frac{(R^2_{fem} - R^2_{pooled})/n-1}{(1-R^2_{fem})/(nT-n-k)}
\end{aligned} \tag{10}
$$

The results of the test showed The F-statistic of 17.73. Therefore, the model can be set up in a panel form. Estimation results are presented in table (4):

Using (10), marginal cost per each bank can be derived as (11):

$$
\begin{aligned}
MC &= \frac{TC}{Q} \times \frac{\partial LnTC}{\partial LnQ_1} \\
&= \frac{TC}{Q}(0.47 + 2 \times 0.13 \ln Q_1 - 0.13 \ln Q_2 \\
&\qquad - 0.18 \ln P_l + 0.2 \ln P_k + 0.18 \ln P_d - 0.009t)
\end{aligned} \tag{11}
$$

Estimating MC, it is possible to go on to the next stage which is the estimation of inter-industry variance in price cost margin model.

1. One type of panel model has constant coefficients, referring to both intercepts and slopes. In the event that there is neither significant bank nor significant temporal effects, we could pool all of the data and run an ordinary least squares regression model. Although most of the time there are either bank or temporal effects, there are occasions when neither of these are statistically significant. This model is sometimes called the pooled regression model.

Table 4. Estimation Results of Total Cost Function in Iran's Banking Industry

Variable	coefficients	P value
Intercept	0.0014	0.902
Loan (Lnq_1)	0.47	0.053
Investment (Lnq2)	0.32	0.001
Personnel's Cost per Capita (Lnp)	0.12	0.742
Fixed Asset Cost (Lnp_k)	0.205	0.542
Deposit Cost (LnP_d)	0.67	0.004
Trend (t)	-1.99	0.013
Lnq_1^2	0.13	0.064
$Lnpl^2$	0.32	0.026
$Lnpk^2$	0.077	0.02
$Lnpd^2$	-0.38	0.513
Lnq_2^2	0.21	0.00
t^2	-0.001	0.833
$(Lnq_2)(Lnq_1)$	-0.13	0.00
$(Lnq_1)(LnP_l)$	-0.18	0.049
$(Lnq_1)(LnP_k)$	0.2	0.004
$(Lnq_1)(LnP_d)$	0.18	0.04
$(Lnq_1)(t)$	-0.09	0.37
$(LnP_l)(LnP_k)$	-0.02	0.715
$(LnP_l)(LnP_d)$	0.07	0.24
$(LnP_l)(t)$	-0.02	0.82
$(LnP_k)(LnP_d)$	-0.1	0.07
$(LnP_k)(t)$	-0.02	0.018
$(LnP_d)(t)$	0.02	0.01
$(Lnq_۲)(LnP_l)$	0.08	0.254
$(Lnq_۲)(LnP_k)$	0.1	0.00
$(Lnq_۲)(LnP_d)$	0.06	0.002
$(Lnq_۲)(t)$	0.003	0.429
Log Likelihood		160.44

4.2. The Model of Inter-industry Variance in Price Cost Margins

To estimate the model of inter-industry variance in price cost margin, it is needed to have data on marginal cost, price, inequality index of banks' market share, and the number of banks per year. Marginal cost

was calculated as (11). However, for the case of *Price*, a weighted average of three types of loans' interest rate[1] is used as (12):

(12) Interest rate on loan = (the interest rate on Gharz-Alhasan*share of Gharz-Alhasan in total facilities) + (the average interest rate on facilities with fixed returns*share of such facilities in total) + (the average interest rate on facilities with variable returns*share of such facilities in total)

Finally, inequality index of banks' market share is calculated as $(1+c^2)$ as (3).

However, before conducting estimations, stationarity of variables must be tested. The results is presented in table (5).

Table 5. Testing Results for Panel Data Stationarity (Im, Pesaran, and Shin test)

variable	Level				First Difference			
	Including Intercept		Including Trend and Intercept		Including Intercept		Including Trend and Intercept	
	t-stat	Prob	t-stat	Prob	t-stat	Prob	t-stat	Prob
I	0.98	2.25	0.68	0.75	-2.06	0.019	-	-
$\frac{(P-MC)}{P}$	-0.95	0.17	1.142	0.873	-3.27	0.00	-	-
n	1.83	0.96	0.24	0.59	-1.73	0.04	-	-

According to the results, all three variables are I(1). In case of non-stationary variables, spurious regression is likely. Therefore, testing the null hypothesis of no co-integration in the panel data model, is required. Hence, Pedroni test (2004) is applied and the result is presented in table (6).

Table 6. The Results of Panel Co-integration test

	Stat.	Prob.
ADF panel	-3.81	0.0001
ADF^* groups	-2.64	0.0016

1. According to the Non-Usary Banking Law, facilities should be extended in three forms: 1- gharz-alhasan which is an interest free loan (just a 4 percent banking fee is charged); 2- loans with fixed interest rate; 3- loans with variable interest rate.

As the result shows, null hypothesis of no co-integration is rejected. Therefore, the model will not yield spurious regression. Now, it's essential to test for the redundancy of fix effects.
The resulting F-statistic (equal to 13.54) shows that the model should be set up in a panel form.

However, it is worth noting that price cost margin (market power) of banks in Iran is not just determined by the performance of banks. That's due to the special conditions under which Iranian banks are operating. More precisely, in Iran there are three types of banks: 1- governmental specialized banks (on which the most strict regulations are imposed); 2- governmental commercial banks that are operating under less strict regulations than the former but face with more constraints than private banks; 3- commercial private banks. This is the case that there are special discriminations offered on behalf of governmental banks (both commercial and specialized), of which private banks are deprived. In fact, performance of banks in Iran and specially their market power are highly influenced by the structure differences among banks. This is beyond what linear models do in justifying individual differences among banks. In other words, it is needed to enter the effect of structure differences to the model. As a result, multi-level/mixed effect models may better explain differences among banks, than ordinary linear models.

4.2.1. Model Specifications: Multilevel/Mixed Effects Model

Multilevel/ mixed effect models are a generalization of linear regression models in which random effects other than those associated with the overall error terms are included. In matrix notation, the model can be represented as (13):

$$
\begin{aligned}
& y_{ij} = \beta_{0j} + \beta_1 x_{ij} + e_{0ij} \\
& \beta_{0j} = \beta_0 + u_{0j}, \quad \beta_{1j} = \beta_1 + u_{1j} \\
& y_{ij} = \beta_0 + \beta_1 x_{ij} + u_{0j} + u_{1j} x_{ij} + e_{0ij} \\
& E(u_{0j}) = E(u_{1j}) = 0, \operatorname{var}(e_{0ij}) = \sigma^2_{e0} \\
& \operatorname{var}(u_{0j}) = \sigma^2_{u0}, \quad \operatorname{var}(u_{1j}) = \sigma^2_{u1}, \quad \operatorname{cov}(u_{0j}, u_{1j}) = \sigma_{u01}
\end{aligned}
\tag{13}
$$

Where random error component (e_{ij}) equals $u_{0j} + u_{1j}x_{ij} + e_{0ij}$. While in linear models, we have $u_{0j} + u_{1j}x_{ij} = 0$.

To regress (13), it is necessary to estimate $\beta_{ij}s$ and $\sigma^2_{e0}, \sigma^2_{u0}, \sigma^2_{u1}$ which are the variances of random parameters ($u_{1j}x_{ij}$).

To conduct estimations, we divide banks into three groups, assigning dummy variables 1 to 3 to each group as follows:

1. governmental specialized banks[1]
2. governmental commercial banks[2]
3. private commercial banks[3]

Also, to show what makes structural differences, the level of regulation is entered as a random coefficient which defines the differences among groups. See figure 2.

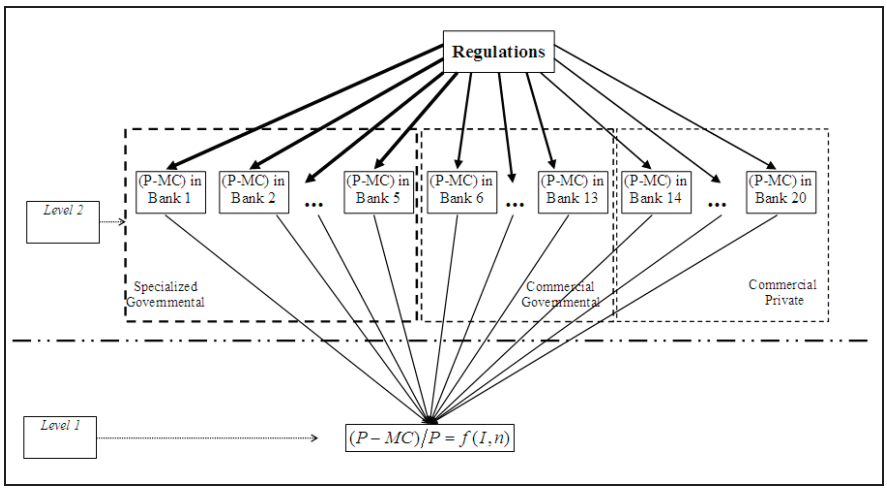

Figure 2. Effects of Banking Industry Structure on Banks' Performance

1. To the end of 2009, there were 4 banks in this group. These banks were allowed to operate and extend loans just in one predetermined field and mostly according to what government decides. The fields are agriculture, Industry and mining, export promotion, and housing. In 2010 another specialized bank entered the industry to offer interest free (Gharz-Alhasan) loans.
2. There are 8 banks in this group. These banks are allowed to operate in all fields but they have to extend a fraction of loans according to government's policies (Called Compulsory Facilities).
3. There are 8 private banks in the industry. To their loan extension policies, there are no such obligations imposed. But they have to conform to the interest rate ceilings like what the two formers do. Furthermore, there are some other limitations they face, which is not as tight as those of governmental banks.

As the figure shows in the first level, the price cost margin in bank *i* is just defined by the changes in *I* (inequality index of market share) and *n* (number of banks). But as *the level of regulations* (which varies among different bank groups), has indirect effect on prices and marginal costs of banks, it should also be included in the model. So, we consider direct effects (*I* and *n*) in the first level and *level of regulations* in the second level.
Therefore, the model can be defined as (14):

$$\log\left(\frac{P_{it}-MC_{it}}{P_{it}}\right)=\log\alpha+\delta_{1i}\log\left(I_{it}\right)+\delta_{2i}\log n_t + Z_{ijt}^{(1)}u_{it}^{(1)}+Z_{ijt}^{(2)}u_{ijt}^{(2)}+\mathrm{E}_{it}$$

(14) $\forall: i=1,...,17 \qquad j=1,...,3 \qquad t=1375,...,1387$

$$Z=\begin{bmatrix} z_1 & 0 \\ 0 & z_2 \end{bmatrix}$$

$$Var=\begin{bmatrix} U \\ E \end{bmatrix}=\begin{bmatrix} \Phi & 0 \\ 0 & \sigma_{\mathrm{E}}^2 I_n \end{bmatrix};\Phi=I_M\otimes\sum$$

As it is shown the model is set up in multilevel form through adding $Z_{ijt}^{(1)}u_{it}^{(1)}+Z_{ijt}^{(2)}u_{ijt}^{(2)}$, where $Z_{ij}^{(1)}$ is random coefficient matrix that is $n_{ij}\times q_1$ and contain first level random effect $u_i^{(1)}$ and $Z_{ij}^{(2)}$ is $n_{ij}\times q_2$ matrix and contain second level $u_{ij}^{(2)}$. It contains the implicit effects of regulations in different bank groups.
To conduct estimations of multilevel model, it should be noted that least square estimators are not suitable. Instead, Restricted (Residual) Maximum Likelihood (REML) estimator makes efficient results. So, estimations are conducted through using REML estimator in STATA10.

4.2.2. Estimation Results

Before going on to conduct estimations, it is necessary to test the validity of multi-level model vs. linear model as (15):

$$\begin{cases} H_0 : Z_{ijt}^{(2)} u_{ijt}^{(2)} = 0 \\ H_{a:} : Z_{ijt}^{(2)} u_{ijt}^{(2)} \neq 0 \end{cases}$$

$$LR = -2\{\ln L(H_0) - \ln L(H_a)\} \approx \chi^2_{\alpha, df_1 - df_2} \quad (15)$$

$$= 114.5, \quad \chi^2_{0.05,2} = 3.84$$

As the result shows null hypothesis of $Z_{ijt}^{(2)} u_{ijt}^{(2)} = 0$ is rejected, implying that multilevel model wins against linear model. Therefore, the model can be estimated in multilevel form. The results of estimations are presented in table 7.

Table 7. Inter-industry Variance of Price Cost Margin (Multilevel model)

Price Cost Margin (π)	**Coefficient**	***t***	$P > \|t\|$	**Confidence Interval (95 Percent)**
Inequality index of marketing share(I)	0.402	0.045	0.00	(0.312 – 0.492)
)n(number of banks	-0.241	0.103	0.02	(–0.444,–0.038)
Stochastic coefficients parameters	**coefficient**	**s.d**	**Confidence Interval (95 Percent)**	
standard deviation z_2 (variations due to structural changes)	0.436	0.221	(0.161 – 1.175)	
standard deviation z_1 (variations due to individual differences)	0.0879	0.037	(0.037 – 0.204)	
Standard deviation (total variations)	0.291	0.016	(0.261 – 0.325)	
REML			43.7	

Therefore, the elasticity of bank's market share to entry of new banks (a) is derived as follows:

$$a = \frac{\partial \log I_{it}}{\partial \log n_t} = -\frac{\beta_2}{\beta_1} = -(\frac{-0.24}{0.402})$$

$$= 0.597$$

Getting to know that $a = 0.597$, it is possible to compute U index of concentration. The result is presented in Figure (3).

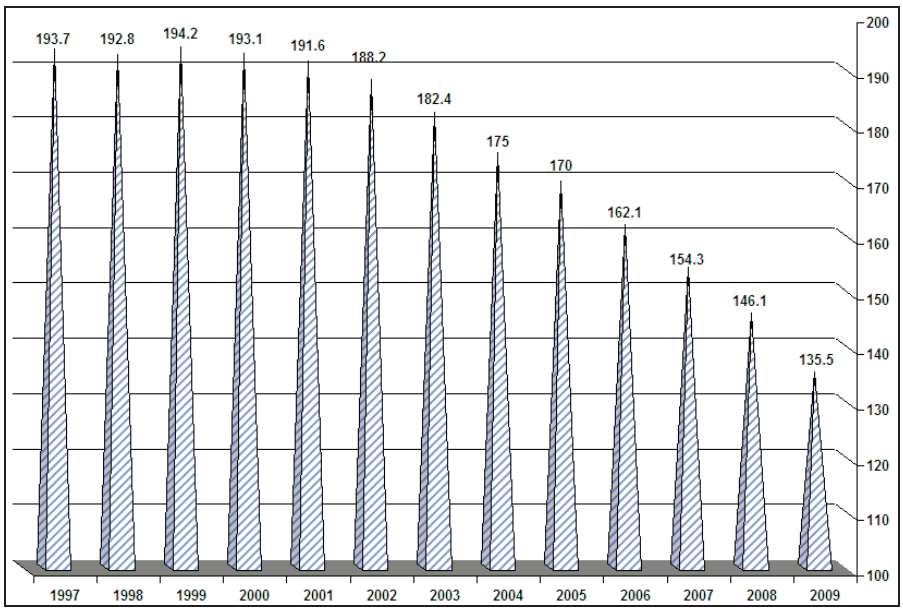

Figure 3. Trend of U Index in Iran's Banking Industry (1996-2009)

It should be noted that U index of concentration varies between $1/n$ and infinity, *i.e.* as the intensity of competition increases in an industry, the value of this index approaches $1/n$. As the resulted figures show, the value of index has been decreasing from 193.7 in 1997 to 135.5 in 2009, implying that competition intensity tends to increase in Iran's banking industry. However, it is still far from the ideal condition. Better saying, although half of the banks operating in Iran's banking industry are private, they just capture about one forth of the market shares of facilities. This is justified more exactly by the small value of a, meaning that the governmental banks' market share is not easily lost with new banks' entry. This is due to the governmental nature of ownership in key industries (as the major clients of such banks) in Iran. There is also another explanation as tight regulations (interest rate ceilings, limitations with new branches,…) that private banks are subject to. Such limitations are also the case for governmental banks; however, there are some exclusive grantings provided for governmental banks to compensate them and make them able to offer cheap loans. As a result governmental banks hold dominant position even in the case of

accelerating entrance of private banks. Putting the matter another way, if private banks were not subject to interest rate ceilings and were permitted to pay for deposits as much as they would afford, surely they could attract more share in deposit market and could lend more accordingly, to acquire greater share in loan market. This was what happened during 2003-2006, that tight interest rate ceilings were not still imposed. In such atmosphere, acceleration of new banks' entry or pushing the process of governmental banks' privatization (under the amendments in 44th principle of Constitution) may not yield expected results, unless regulations are revised.

5. Concluding Remarks

Banking industry in Iran's economy plays the key role in providing financial resources due to capital market deficiencies. Therefore, likely deficiencies in the structure and performance of this sector may bring about likely disturbances in other sectors. This implies the necessity of precise understanding of this sector while policy making.

In Iran, banking system consisted of 11 governmental and 10 non-governmental banks to the end of 2009. Comparative studies show more efficiency in the performance and much better financial indices in non-governmental banks in spite of limited share of non-governmental banks (almost a quarter in both loan and deposit marekt).[1] Other limitations constraining non-governmental banks can be classified as: higher costs of financing financial resources, restrictions with establishment of new branches, predetermined interest rates, lack of central bank's financial support (which is provided for governmental banks) as well as facing with similar required reserves.

We can classify the structural changes in Iran's banking sector in four stages. In the first and second stage private sector was permitted to enter while competitive atmosphere promoted in the sector. During this period 36 banks were established, 26 of which were private. The third stage started with the nationalization and merger of banks. At this stage, the number of banks in Iran's economy reduced to 9, after the law of banks nationalization was passed. Therefore, competition turned into the monopolistic condition. The forth stage initiated from

1. It is noteworthy that private bank's better performance compared with the governmental ones is to some extent justified by the absence of obligatory loans (imposed by government on governmental banks) in their optimization decisions.

the time "law for banking privatization" was passed (1998). At this stage, banking industry structure tended to get more competitive. This can be justified through investigating the changes in U index of concentration, which indicates intensifying competition. However, competitive condition may realize just in the case of re-regulation in banking system.

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