

## Determining the Competitiveness in Iran Banking Industry: Case study of private banks

Majid Aghaei\*  
Seyyed Jaber Hosseini Khalili‡

Mahdieh Rezagholizadeh†

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Iran's banking industry has faced a wide range of changes during recent years and its banks' performance has been affected by these changes. On the one hand, the entry of private banks to the industry has made various changes in the industry's concentration and the market share of banks, on the other hand, banking technologies and strengthened competitive environment have led banks to increase efficiency and improve their performance. Given the importance of competition and efficiency in different components of the economy, the present study aims to investigate the competitiveness of private banks over the period 2005 to 2017. For this purpose, according to Panzar-Rosse model in the framework of panel data models, required data are collected from all private banks, then the competitiveness of private banks is calculated using the Panzar-Rosse model. According to the results, markets of Iran's private banks are involved in monopolistic competition during the underlying time period.

**Keywords:** Private Banks, Panzar, Rosse Model, Panel Data

**JEL Classification:** C23, G21

### 1 Introduction

The essential function of the financial sector (money and capital markets) as a superstructure of the economy is its consistency with the real sector as a prerequisite for achieving economic sustainability; in that, most economists agree on the critical role of the financial industry in the development of the real sector. The correct and perfect functioning of financial markets in the economy accompanies optimizing the financial resource flows, collecting resources, and providing investment needs. More specifically, managing resources and allocating them to different parts of the economy are considered main activities in the banks (Sami, 2009). So, the significant parts of funds are provided through bank deposits in Iran.

\* University of Mazandaran; m.ghaei@umz.ac.ir (Corresponding Author)

† University of Mazandaran; m.Gholizadeh@umz.ac.ir

‡ Allameh Tabatabaei University; j\_hosseinkhalili@atu.ac.ir

The banking industry in Iran encountered fundamental changes after the Islamic revolution. In fact, at the beginning of the Islamic Republic of Iran, bank nationalization and a shift toward state-owned banks led to a banking system in which the government could quickly and widely interfere in its development and even its regulation. Then, the ratification and implementation of Islamic banking in 1982 viewed as a kind of Islamic banking, which was the most innovative movement in banking. In the following years, privatization and liberalization of economic concepts became prevalent by the introduction of reconstruction and economic reform programs in Iran's economy, and since then, the banking industry has been changing. The establishment of new private banks and privatization of some state-owned banks are examples of these continuous transformations and developments (Dehghan, 2011).

Although there have been successes in privatization, liberalization policies in Iran banking industry is not well-referred. Iran's banking has significant limitations for trading and pricing policies. It is more objective in the state-owned banks, and even private banks have been partly affected. It seems some of the deficiencies in Iran's banking system are due to a lack of synchronized sophistication of both privatization and liberalization policies. Some part of the failure of privatization policies and the lack of the banking system efficiency results from this mentioned inconsistency.

Competition has been suggested as one of the most important factors leading to efficiency in economic and promoting economical welfare level (Stigler, 2008). In Iran banking industry, policies on encouraging competition between banks to array driving forces of efficiency have always been considered, and the economic policymakers have emphasized on this issue. However, credit-constrained policies and supervisions have limited competition, so competition in the banking industry is affected by factors such as entry of private banks and credit institutions. Increased competition and efficiency in the banking market can increase the quality and variety of banking services and reduce transaction costs.

Given the role of banks in the economy, competitiveness or lack of competitiveness may indicate banks' ability to influence the economy. Identifying and explaining the competitive condition of the banking market can help policymakers and regulators to guide the banking system toward higher efficiency and being more competitive. Without the knowledge of banking network structure, following structural changes and incurring costs to advance the country's banking system towards more efficiency and competition may be ineffective and, therefore, not desirable. Given the role of

competition in increasing the efficiency of the banks, it is necessary to determine the degree of competition in the banking market and measuring the degree of bank competitiveness to provide appropriate policies and strategies by policymakers and regulators. In the respect of the main purpose of research, the present study is organized as follows. In the second section, the economic literature and previous studies are reviewed. Following the appropriate research model to analyzing has presented. After estimating the model, the results of the research are interpreted and analyzed.

## **2 Literature Review**

A wide range of businesses and households are linked to banks through deposit accounts, loans, and other related financial services, and hence, they are directly affected by pricing and other functions in banks. So it is likely any flaws, inefficiency, and non-competitive activities between banks lead to additional costs, compared to other industries in the economy. In particular, the competition between banks may increase economic growth and enhance social welfare by reducing the cost of banking services. Licensing private banks establishment to operate in Iran banking system in 2000 for increasing competitiveness and improving the bank services is one of the most important reforms that the Central Bank has done after the Islamic Revolution of Iran.

This plan is implemented after a long and arduous process. Following the fundamental reforms occurred in Iran's banking system, a basic question that can be addressed is the impact and success of these reforms. Before the reforms, the banking industry was composed of a few state-owned banks. State banks have always been facing poor efficiency and decreased quality of monetary and fiscal services due to many reasons such as involving in providing the massive amount of required financial resources by state agencies, operating in environments in which monetary policies are functions of government fiscal policies as well as the equilibrium of competition. By 2005 only four private banks were licensed to operate, and two other private banks were added in Iran banking system within this year. According to their proper performances and operations, these banks are rapidly developing and increasing their shares in Iran banking market, as private banks currently hold around 23% of total deposits (Tohidi et al. 2005).

After the entry of private banks, significant changes occurred in Iran banking system. Improving service quality, bridging the gap between the deposit interest rate and loan interest rate, and granted facilities are among the main reasons for these changes. Before the entry of private banks, the gap has always been higher than 10%, which is less than 5% in developed countries.

The reduced concentration in Iran banking system due to the entry of private banks is among the other significant reasons why many researchers are optimistic about increasing competition. The traditional theory of Mason (1939) & Bin (1951) Structure Conduct Performance predicts that when there are more agencies or the market is less concentrated, market would be more competitive. However, either these cases can not be definite reasons for increased competition. Bridging the gap between deposits and loans interest rates can result from short-term economic cycles or even increased efficiency. Concentration merely does not indicate non-competitive behavior. While some empirical studies show a direct correlation between concentration and market power in the banking industry, some others do not support this relationship, and this causes an uncertainty in the overall strength of the mentioned relationship. For example, in the wake of the banking system reforms in the European Union in 1990, the number of banks in Italy decreased by 20%, but contrary to the prediction of Structure Conduct Performance hypothesis, bank competitiveness has significantly improved<sup>1</sup>. Newer methods to analyze competitive conditions, known as the profit margin test, are based on microeconomic foundations and estimates of the gap between marginal cost and price to measure the degree of monopoly. This technique is currently considered the dominant methodology for measuring the degree of monopoly in the economic literature due to its various advantages. According to Lerner index<sup>2</sup>, competitive conditions in the Iran banking industry have been getting worse by 2000 and after the entry of private banks the competition has been significantly improved.

Despite this improved competitive condition, there still exists a significant gap between the degree of competition in Iran and other developed countries. Different reasons may explain changes in competitive conditions, two of which are briefly described below. The increased marginal cost of the banking system is the main factor in increased competition after the entry of private banks. Before the arrival of private banks, state banks paid negligible interests on deposits. By introduction of private banks, competition on attracting deposits, which are the main source of banks to provide services, increased sharply; in turn, the interest rate paid to depositors improved. To attract the depositors, on the other hand, banks were compelled to use modern technologies (ATM, credit cards, etc.), implement electronic banking to make

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<sup>1</sup> Ibid

<sup>2</sup>This index is similar to an inverse elasticity of demand in which marginal cost is replaced by marginal revenue. In the long-run equilibrium, marginal cost coincides marginal revenue and hence, the Lerner index is an inverse elasticity of demand which is considered as a unique state.

it easy and timely for customers to access a variety of banking services and apply qualified and vigorous man forces, which in turn increased the costs of the banking system. Another factor that seems to be leading to increasing competition is the reduced price of monetary and fiscal services by banking system. The reason was that there was intense competition between banks, and many deposits rates have been collected by raising interest rates by banks, and because they could not spend them, they were forced to lower the rates. It is especially more pronounced in private banks since the central bank could let them adjust their maximum deposit rates to 3% above the rate set by state-owned banks (studies on the performance of private banks show that the number of their deposits in the understudied periods are, on average, 34 times per year). The interest rate of private bank loans that initially was about 30 percent has been gradually decreased to 22 percent (Dehghan, 2011). The gradual reduction of inflation and economic conditions accelerated the process.

In light of the preceding, although private banks are not now literally private, because they are obliged to respect government's decisions and they cannot exceed the regulations set to state banks, their positive impact of increased competition and enhanced banking services is quite evident. It seems elimination of unnecessary and cumbersome regulations, especially the increasing number of private banks and the entrance of foreign banks leads to further increase of competition and efficiency in the banking system.

### 3 Previous Literature

There are numerous studies on measuring the competitiveness in industries in both the empirical and theoretical areas in modern economic literature. In theory, the degree of competition or market power can be measured by higher price competition to the marginal cost ratio, while it will be difficult or impossible where detailed information on the costs and prices in the banking industry do not exist (Bikker et al, 2009). For this reason, two indirect approaches are used in the empirical area to measure competition in the industry.

In the first group, known as structural methods, the degree of the competition is assumed invisible, and industry structure and particularly the concentration degree of the industry are considered as the decisive variables of the competition level. In an empirical study, a positive and strong relationship between a high degree of concentration and profitability is viewed as a sign of imperfect competition in the industry. The Model of the structure-conduct-performance hypothesis is the core of this approach. The second

group, called as non-structural methods, is derived by market equilibrium conditions and earning maximization principle. Iwata (Iwata, 1974), the Bresnahan-Lau (Bresnahan, 1982, 1989 Lau, 1982), and Panzar- Rosse models (Panzar & Rosse, 1982, 1987) are the essential methods in this approach.

Panzar - Rosse model is a reduced-form of revenue model and is derived from the profit maximization hypothesis. The above approach works well with company-specific data about revenue and input prices and does not need price information and balanced outputs relating to a company or industry.

Molyneux (1994) made the Panzar-Rosse model a basis to examine the competitive conditions in the banking industry. It calculates H statistics of Britain, France, Germany, and Spain banking industry from 1986 to 1989 and shows that except Italy, whose monopoly hypothesis is not ignorable, there was a monopolistic competitive condition in the rest of the studied countries.

Bikker and Groeneveld (2000) collectively and individually studied the competitive structure in the EU banking industry using the Panzar-Rosse model. The results of their study indicate that there are varying monopolistic competition conditions in these countries. Klasens and Levine (2004) conduct a more comprehensive study of 50 developed and developing countries. They found that banking systems with fewer restrictions on entering and exiting banks, as well as more entries of foreign banks, are more competitive. They also indicate a negative correlation between H statistic and the degree of concentration in the banking industry.

Similar to the structure-conduct-performance model, Bikker and Bos (2008) used the Panzar- Rosse model for 46 countries from 1996 to 2005. According to their results, the hypothesis of the existence of monopoly is not rejected in the 11 states (H statistic was statistically less than zero) and with the exception of the 8 countries, having H-statistic statistically more significant than unity, 27 other countries have H-statistic between zero and unity, demonstrating the presence of monopoly competition. The results further indicate that the average value for the H statistic in 46 countries is 0.54, of which EU is 0.46, below the average, and emerging economic powers are 0.60, above the average.

Bikker and Haaf (2002) and Delis et al. (2008) extended the Panzar- Rosse model. Bikker and Haaf (2002) include time component to fit model and calculate statistic H. Assuming increased competition over time by adding exponential - nonlinear time component in log-linear Panzar - Rosse model, they calculate different H statistics for each year of the study period.

Bikker and Haaf (2002) studied competitive conditions in the 23 countries during the 1990s and achieved similar results (monopoly competition or varying degrees). They also show that competition in smaller banks operating in domestic markets is lower than larger banks operating in the international scopes. The overall results indicate that competition in the European industry is more intensive than in Japan and Canada. Matthews, Murinde, and Tianshu (2007) studied 12 large British banks during 1980-2004 based on Panzar - Rosse method and concluded that British banks are monopolistic competitive. Coccorese (2003) applies Panzar - Rosse index to assess competition in the banking industry in Italy in 1997-1999 on both federal and provincial levels of the four major regions of Italy economic and concludes Italian banks operate in a monopolistic competitive environment and there is a positive relationship between local economic performance and competitiveness of the banks.

Dehghan (2011), in a study titled "The structure and performance of Iran banking industry" investigates the competition in Iran's banking market and how profitability is affected by banks' internal efficiency and market structure. He applies the Panzar - Rosse model and the data of 15 banks during 2005-2009 to measure the competition. Considering the difference in the size of banks and relying on the Durbin-Watson statistic, he argues there are heteroscedasticity and autocorrelation in the model. Strong White covariance and the cross-section method are used in this study. Durbin-Watson test results cannot be used to detect autocorrelation. According to the estimation method in this study, H values are often obtained negative. The equilibrium is not capable of interpretation due to the lack of long-run equilibrium. He thus achieves H value to be 6.10 by restricting the period (2009-2005). Finally, by excluding private banks, model demonstrates that the competitiveness of state-owned banks has been increased. He argues that competitiveness of Iran's banking network is increased.

Prasad and Ghosh (2005) use the Panzar-Rosse method to assess the competitive conditions in the Indian banking industry from 1996 to 2004. They conclude that competition in the Indian banking industry has increased since the beginning of financial sector reform in 1992. Since then, Indian banks operate and earn under competitive and monopolistic competition conditions.

Ahmadian (2014) in a study titled "Assessing the dynamic of Iran's banking industry" using panel data, has estimated a log- linear model based on Panzar-Rosse method for the banking system due to long term disequilibrium in the banking system the banking network of the country was

modeled in two ways: statistic and dynamic. The statistic of H in the statistic model was 0.5 and in the dynamic model was 0.7, indicating moderate competition in the banking industry. The results of his studies suggest that private banks compared to state-owned banks and big banks compared to small banks are more competitive.

The following table provides a summary of the measures taken in assessing market structure using Panzar-Rosse model:

Table 1

*Application of Panzar –Rosse model in evaluating the degree of competition in the banking industry*

	Period	studied Countries	The results
Molyneux et al. (1994)	1989-1986	France, Italy, Spain, and the UK	Italy has a monopoly, France, Germany, Spain, and the United Kingdom have monopolistic competition
Molyneux et al. (1996)	1988-1985	Japan	Perfect Monopoly
Coccorese (1998)	1996-1988	Italy	Monopolistic Competition
Rime (1999)	1994-1987	Switzerland	Monopolistic Competition
Bikker and Groeneveld (2000)	1996-1989	15 countries of the European Union	Monopolistic Competition
DeBenedetti & Davis (2000)	1996-1992	France, Germany, and Italy	Monopolistic Competition - Major banks: Monopolistic Competition in 3 countries, small banks: Italy - monopolistic competition. Germany and France: monopoly
Bikker and Haaf (2002)	1998-1988	23 OECD member countries	Monopolistic Competition
Prasad and Ghosh (2005)	2004-1996	India	Monopolistic Competition
Matthews, Murinde, and Tianshu (2007)	2004-1980	UK	Monopolistic Competition
Baker & bass (2008)	200-1996	46 European countries	8 countries are monopolistic, and the rest is in a perfect monopoly
Abbasoglu, Aysan, and Gunes(2007)	2005-2001	Turkey	Monopolistic Competition
Al-Muharram, Matthews, and Khabari	2002-1993	Asian countries	Kuwait, Saudi Arabia, and the UAE Full-competitive, Bahrain, Qatar, and Oman-monopolistic competition
Dehghan (2011)	2005-2009	15 Banks of Iran	Monopolistic Competition
Berger & Hannan (1989)		Europe banking network	Perfect competition

Source: Bikker and Haaf (2002)



As can be seen, the limited studies that have been conducted to determine the Competitiveness of banks in Iran, the total number of banks in the country has been selected as the case study while in this study the level of competitiveness of private banks has been selected separately and due to the Panzar and Rosse model, so far no study has been done in this area.

### 4 Specification of Econometric Model

Based on previous studies, the following conceptual model is offered to analyze and study the factors affecting the competitiveness of banks<sup>1</sup>:

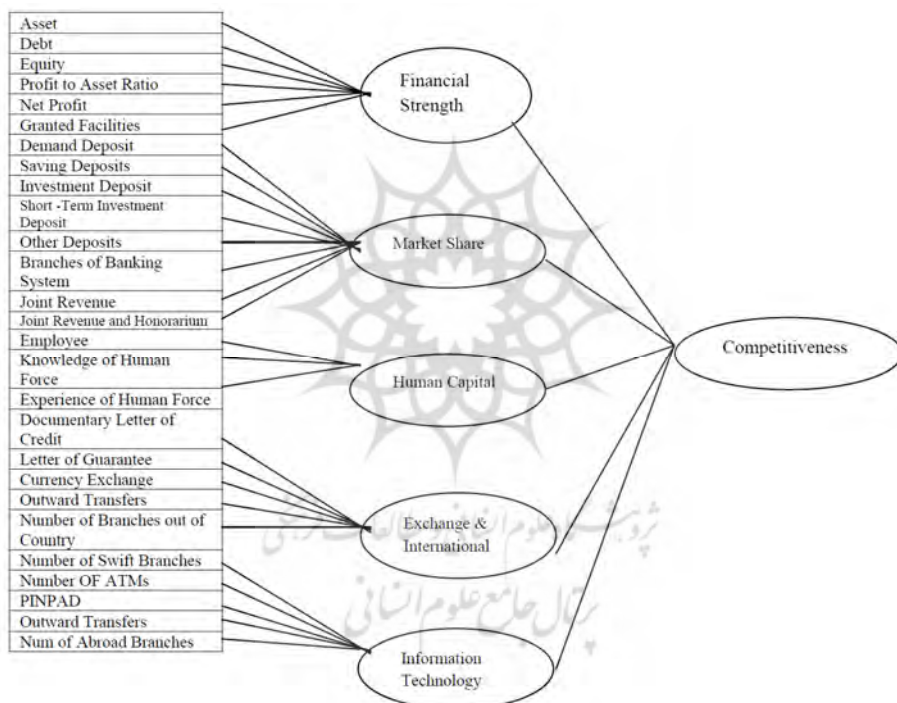


Figure 1. The theoretical model of the factors affecting the competitiveness of banks. Source: Safari and Ebrahimi (2012)

As shown in the above conceptual model, factors such as the bank's financial strength, market share, human capital, and international and exchange activities and information technology are among the factors that

<sup>1</sup> see Yeyati and Micco (2007), Safari & Ebrahimi (2012)

play a significant role in determining the competitiveness of banks. In this study, the Panzar - Rosse method is used to determine the competitiveness of private banks. Theoretically, the Panzar - Rosse model is derived from profit maximization conditions (equality of marginal cost and marginal revenue) as follows

$$\ln MC = \alpha_0 + \alpha_1 \ln Y + \sum_{k=1}^m \beta_k \ln w_k + \sum_{j=1}^p \gamma_j \ln T_j \quad (1)$$

$$\ln MR = \delta_0 + \delta_1 \ln Y + \sum_{j=1}^q \theta_j \ln Z_j \quad (2)$$

In the above equations, MR and MC are marginal revenue and marginal cost, respectively, and equilibrium conditions are obtained when these two are equal. By putting relations and displacement of its elements following equation is obtained:

$$\ln Y^* = (\alpha_0 - \delta_0 + \sum_{k=1}^m \beta_k \ln w_k + \sum_{j=1}^p \gamma_j \ln T_j - \sum_{j=1}^q \theta_j \ln Z_j) / (\delta_1 - \alpha_1) \quad (3)$$

On the other hand, price is considered as a function of equilibrium value in the logarithmic equation of inverse demand relationship as:

$$\ln P = \vartheta + \varphi \ln(\sum_i Y^*)$$

Since revenue is captured by price times equilibrium value, the structural form of the Panzar - Rosse model is derived from the combination of the two last equations. Thus the log of revenue is a function of input prices and some other exogenous variables<sup>1</sup>. Empirical works used a reduced form of revenue equation as follow:

$$\ln TR = \alpha + \beta_1 \ln w_1 + \beta_2 \ln w_2 + \beta_3 \ln w_3 + \sum \gamma_i \ln X_i \quad (4)$$

Where:

The dependent variable, log of corporation gross income and explanatory variables, include log of input prices (w) and control variables (x). Each coefficient of price logarithm of the above equation indicates gross income elasticity to the corresponding input prices. Their sum ( $\beta_1 + \beta_2 + \beta_3$ ) will be H index, representing the competition condition in the market (Shaffer, 2004). To assess the degree of competitiveness of private banks using this model, the revenue equation (4) must be estimated, and then using that equation, H statistic is measured. In most studies used the Panzar - Rosse method to evaluate the competitiveness of the entities, an equation similar to equation

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<sup>1</sup> Bikker and Bos, 2008

(4) has been applied, but the choice of explanatory variables and control variables can vary in different studies. In this study to examine the factors affecting the competitiveness of private banks empirical models and variables by Baker & Bos (2008) are applied as below:

$$\ln IR = \alpha + \delta_i + \beta_1 \ln FR + \beta_2 \ln PW + \beta_3 \ln CP + \sum \ln x_j + \zeta OR + \varepsilon \quad (5)$$

Where:

IR is the ratio of bank credit revenue, FR is the ratio of dividend costs to the total value (financing rate), PW is the price of workers to bank total assets ratio, CP is the cost of capital and other expenses to total fixed assets ratio,  $x_j$  is control and exogenous variables, OR is bank's other revenue (debit revenues) to credit revenue,  $\delta_i$  is fixed or random effects of the regression model,  $\varepsilon$  is error term. In this model, H statistics are calculated as follow:

$$H = \beta_1 + \beta_2 + \beta_3 \quad (6)$$

Using debit revenue to credit revenue (OR) as one of the explanatory variables is another point to specify the above model. This specification is based on Baker and Bos (2008), which is derived from the following equation:

$$\ln TR = \ln(IR + OI) \approx \ln IR + OI/IR \quad (7)$$

As you can see, the logarithm of total revenue ( $\ln TR$ ) with an approximate value is changed to a two-component logarithm of credit revenue ( $\ln IR$ ) and debit revenue to credit revenue ratio ( $OI/IR$ ) that is called OR in equation (5). Since credit revenues reflect the bank's core activities, thus it is preferred to include a log of credit revenue rather than the log of total revenue in equation (7). Despite having OR on the right side of equation (5), the coefficient of this variable shows the importance of debit revenue.

As mentioned above, to test H statistic, the existence of long-run equilibrium conditions in the market should be ensured. For this purpose, the following equation will be estimated as:

$$ROA = \alpha + \delta_i + \beta_1 \ln FR + \beta_2 \ln PW + \beta_3 \ln CP + \sum \gamma_j \ln x_j + \zeta OR + \varepsilon \quad (8)$$

The equilibrium statistic is calculated as follow:

$$H_e = \beta_1 + \beta_2 + \beta_3 \quad (9)$$

Finally, after the estimation based on the equation (5), H statistic of Iran private banking is calculated. The significance level of this statistic is

evaluated using the Wald test. Panzar-Rosse shows that when H statistic is negative ( $H \leq 0$ ), the market has a monopolistic structure. It includes a multilateral monopoly on the sale along with collusion in the market and may involve predicted changes of peers' performance in the short-run monopolistic market (Cournot equilibrium). In such cases, an increase in the price of inputs increases marginal cost and decreases bank equilibrium output and total income. Unity H statistic ( $H=1$ ) indicates perfect competition condition, and in this case, an increase in the bank input prices increases the average costs of the bank while the optimum production level is unchanged in each bank. It also includes operating in a naturally monopolistic manner in a completely conflicting market and operating in a state of maximizing the sale of the bank to achieve the breakeven point. Finally, ( $\alpha < H < 0$ ), indicates monopolistic competition.

The sample used in this study includes 5 private banks of Parsian, Eqtesad Novin, Pasargad, and Karafarin from 2005 to 2017. Required data is collected based on financial statements of the above banks and the Bankscope database as well as annual reports of the banking system (Central Bank, the Higher Institute of Banking and Monetary and Banking Research Institute) during the understudied period. Primary derived information relating samples are as follow, which are then converted to data used in the model:

Table 2

*General information required in Panzar & Rosse model*

<b>Balance sheet</b>			<b>Profit and Loss Statement</b>	
	Title	Symbol	Title	Symbol
1	Current Liabilities	CL	Credit Revenue	IR
2	Fixed assets	FA	Other income	OI
3	Total assets	TA	Total revenues	TR
4	Current deposits	CD	The cost of equity	IE
5	Total deposits	TD	personnel expenditure	PE
6	Total funds	TF	other expenditure	OE
7	Total Equity	TE	Pretax Profit	PTP

Source: Research Findings

Except for the credit revenue variable which is directly used in the Panzar-Rosse model, other variables are defined and calculated based on the variables mentioned above. The Panzar – Rosse model variables and long-run equilibrium test have been calculated as the following table:

Table 3  
*How to calculate the variables used in the Panzar-Rosse model & Equilibrium model*

Variable	Symbol	Definition
1 Credit revenue	IR	Direct
2 The adjusted rate of return on assets	ROA	$ROA = PTP / (TA-FA)$
3 Input price of funds (financing rate)	FR	$FR = IE / TF$
4 Input prices of workers	PW	$PW = PE / TA$
5 Capital input prices	CP	$CP = OE / FA$
6 Debit revenue ratios	OR	$OR = OI / IR$
7 The ratio of current deposits to total deposits	CT	$CT = CD / TD$
8 Ratio of total loans to total assets	LT	$LT = CL / TA$
9 The ratio of equity to total assets	ET	$ET = TE / TA$

Source: Research Findings

The adjusted rate of return on assets and credit revenue are dependent variables in the Panzar and Rosse model and equilibrium model. The price of funds, input price of capital, and input prices of workers are the main explanatory variables in the Panzar-Rosse model. Current deposits to total deposits ratio, total loans to total assets ratio and equity to total asset ratio are control variables that can vary from one study to another study. CT shows deposit compositions of banks. The higher CT, the cheaper financing for banks, but on the other hand, current deposits are not appropriate to create long-term credit assets with high efficiency due to lower persistence and higher volatility. Loan to asset ratio (LT) indicates the loan share of total assets of the bank and the profitability of each bank. Equity to total assets ratio (ET) reflects the bank's risk as capital is known as risk shield in banks.

## 4.1 Model Estimation

### 4.1.1 Panel Unit Root Test For Stationary of the Variables

Given that the time period used in this study is relatively large, and to ensure the accuracy of the obtained results reliability test is done. The panel unit root test is applied to examine the stationarity or non – stationarity of the variables based on Levin, Brittany, Bruno, Shin, Fischer and Hedri statistics. All variables used in this study are stationary with a difference in confidence level above 99 percent.

Table 4

*Measuring the stationarity and non-stationarity of variables*

regression	dCP		dIR		FR		ROA		PW	
	Statistic	P - value	Statistics	P - value	Statistics	P - value	Statistics	P - value	Statistics	P - value
Levine	-	.00	-	0.10	-	0.00	-	0.00	-	0.00
	5.32082	00	1.23608	82	7.84177	00	4.13575	00	2.99193	14
Britoung	-	.01	-	0.01	-	0.47	-	0.33	-	0.04
	2.31570	03	1.12277	31	0.06799	29	0.43785	07	1.66580	79
Boys & Shin	-	.01	-	0.03	-	0.00	-	0.01	-	0.00
	2.25113	22	0.41157	40	2.66836	38	2.21961	32	5.97089	00
Fisher (ADF)	17.2510	.00	22.3384	0.01	26.1617	0.00	23.8369	0.00	30.2970	0.00
Fisher (PP)	19.1725	.00	28.4239	0.00	38.4415	0.00	33.5639	0.00	28.4579	0.00

Source: Research Findings

Table 5

*Measuring the stationarity of variables*

regression	OR		CT		LT		ET		IR		CP	
	Statistics	P - value	Statistics	P - value	Statistics	P - value	Statistics	P - value	Statistics	P - value	Statistics	P - value
Levine	-	0.0	-	0.0	-	0.0	-	0.0	1.94	0.9	-	0.4
	67.5690	000	13.5541	000	7.18109	000	13.4285	000	074	739	0.13493	463
Britoung	-	0.1	-	0.0	-	0.0	-	0.4	2.44	0.9	0.67	0.7
	0.85792	955	1.52138	641	3.20087	007	0.13757	453	880	928	087	488
Boys & Shin	-	0.0	-	0.0	-	0.0	-	0.0	2.94	0.9	2.77	0.8
	16.6965	000	6.80270	000	4.26012	000	5.40366	000	812	826	604	364
Fisher ADF	33.6140	0.0002	46.8348	0.000	37.6128	0.000	42.1684	0.000	3.95644	0.9493	3.65153	0.7237
Fisher PP	16.6234	0.0831	25.1423	0.051	36.7282	0.001	42.0234	0.000	3.98765	0.4323	3.87654	0.6543

Source: Research Findings

### 4.1.2 Panel Cointegration Test

Dominant economic theories present a long-term relationship between the variables in level form. To ensure a long term relationship between the variables in the model, it is necessary for variables to be static and otherwise (non-static) to have an equal degree of integration. Thus, to infer the existence of a long-term relationship between variables, either their stationary or cointegration must be examined using different tests. In present study, the cointegration test of kao panel residuals has been used to confirm the results. Based on the results of the test, the panel cointegration relationship between the variables in two model is confirmed. Variables tend to have a long-term relationship that is evaluated in the next phase. The following table shows the estimated results of the regression.

Table 6  
*Co-Integration Test of Kao residuals*

Model	augumanted Dicky-Fuller test (ADF)	P- value
Equilibrium Model	-3.52147	.0058
Panzar model	-3.87657	.0041

\*Augmented Dicky Fuller statistic is based on the residual components in this test. *Source:* Research Findings

### 4.1.3 Estimation Results

In this section, we estimate the degree of competitiveness in private banks and interpret model results. One of the underlying assumptions in the Panzar - Rosse model is that banks are in long-run equilibrium. Schaefer showed that if there is no long-run equilibrium on the market, only if  $H \geq 0$ , a clear interpretation of the results is available, while if  $H < 0$ , a long-run equilibrium in the market is needed to interpret the results. Therefore, the first step to determine the degree of competitiveness is the long-run equilibrium test using equation 8. According to the results of F and Hausman tests, the fixed effects method is considered the best to estimate this model. The results are reported as follow:

Table 7

*Results of Testing Long-Run Equilibrium Conditions*

<b>Estimated using the fixed-effects model (the dependent variable ROA)</b>				
	Coefficients	Standard Deviation Error	T- Statistics	p- value
C	0.060075	0.005112	11.75168	0.0000
LFR	-0.007571	0.003837	-1.973160	0.0839
LPW	0.005381	0.005047	1.066094	0.3175
LCP	-0.002999	0.000216	-13.89159	0.0000
OR	-0.064083	0.015191	-4.218557	0.0029
LCT	0.000453	0.001748	0.258899	0.8023
LLT	0.001074	0.004498	0.238770	0.8173
LET	0.012970	0.008221	1.577581	0.1533
Fixed effects				
_PAR - C	-0.002432			
_EGH - C	0.005343			
_PAS - C	-0.021051			
_SAM - C	-0.002722			
_KAR - C	0.004079			
R <sup>2</sup>	0.935840			
justified R <sup>2</sup>	0.847620			
F Statistics	10.60801 (0.00000)			
Durbin-Watson statistic	2.098112			

Source: Research calculations

Total results of above equilibrium model indicate that:

- 1) Nearly 93% of the dependent variable is explained by independent variables
- 2) According to F statistic of the model, all estimated variables are highly statistically significant. Durbin-Watson statistic also indicates the absence of autocorrelation in the model.

After estimating the equilibrium relationship, equilibrium H value is obtained by the sum of coefficients of LFR, LPW, and LCP. According to the results presented in the above table, value of this statistic is -0.0052, used to determine the significance of the Wald test. Wald test results are presented in the following table:

Table 8

*Wald test to determine the significance of equilibrium H value*

Null hypothesis	Alternative hypothesis	H statistic	F test results		Chi-square results ( $\chi^2$ )	
			statistic	P-value	statistic	P-value
$H_e = 0$	$H_e \neq 0$	-0.0052	15.03664	.0012	45.10993	.0000

Source: Research Findings



As can be seen in the table above, equilibrium H statistic values are significantly different from zero due to the p-value of the Wald test indicating the absence of the long-run equilibrium during the understudied period. In this case if the equilibrium H value of Panzar - Rosse model is negative, market conditions can not be adequately recognized, and only if the given statistic is positive identifying whether the market is competitive or monopolistic will be possible.

After the equilibrium test, Panzar - Rosse model will be estimated to assess the competitiveness of private banks. The results of the Panzar - Rosse model in private banks is shown in the below table.

Table 9

*Panzar & Rosse model*

<b>Estimated using fixed effects model (the dependent variable LIR)</b>				
	Coefficients	standard deviation Error	Statistics t	p-value
C	0.0017	-4.952742	49.47267	-245.0254
LFR	0.0002	7.285987	0.052928	0.385630
LPW	0.0000	27.42574	0.014838	0.406943
LCP	0.0845	2.009219	0.075861	0.152421
OR	0.1041	-1.867075	0.010635	-0.019857
LCT	0.9096	-0.117700	0.105675	-0.012438
LLT	0.2625	1.218461	0.113339	0.138100
LET	0.0027	-4.531332	0.154561	-0.700369
		Fixed effects		
_PAR - C		0.936251		
_EGH - C		-1.036351		
_PAS - C		-0.165357		
_SAM - C		2.530969		
_KAR - C		-0.233139		
R <sup>2</sup>		0.985749		
justified R <sup>2</sup>		0.961319		
F Statistics		40.34943 (0.00000)		
Durbin-Watson statistic		1.640868		

Source: Research Findings

Table 10  
*Wald test to measure H statistic by Panzar and Rosse*

Null hypothesis	Alternative hypothesis	statistic H	F test results		Chi-square test results ( $\chi^2$ )	
			statistic	P - value	statistic	p-vaalue
$H_e = 0$	$H_e \neq 0$	-0.0052	15.03664	.0012	45.10993	.0000
$H_e = 0$	$H_e \neq 0$	0.944993	5.185879	.0337	15.55764	.0014

*Source:* Research Findings

According to the results obtained by Panzar & Rosse model, the H statistic is equal to 0.94. Based on the Wald test, this statistic is significantly different from zero. According to the obtained H statistics it can be said markets of private banks in Iran are monopolistic competitive during the case of study. Given that the value of this statistic is almost unity, the Wald test is done assuming that the value of this statistic is zero; the null hypothesis of unity H statistic is rejected at a 99% confidence level. Consequently, it is confirmed markets for private banks in Iran are in monopolistic competition conditions.

Among the presented control variables in this model only the ratio of equity to total assets and time trends are statistically significant and non-credit revenues ratio (OR) and the current deposits to total deposits ratio (CT) total loans to total assets ratio (LT) are not statistically significant and therefore any accurate conclusion is not possible and valid. OR coefficient is negative, reflecting the negative impact of non-credit revenues on credit revenues. The deposits rate coefficient is also positive, demonstrating the decisive role of demand deposits in private banks during the corresponding period, although they are not statistically significant.

The coefficient of loan residue rate is positive, reflecting the positive impact of loans on credit revenues. ET coefficient, equity to total assets, is negative and significant. Its negativity indicates the positive correlation between leverage ratio and revenue. In other words, the banks with a higher capability to create the debt have a higher income. The time trend is positive and significant, indicating that banks' revenue has increased over time.

## 5 Summary and Conclusions

One of the most significant reforms that Central Bank has done since the Islamic Revolution of Iran in the banking system is licensing the establishment of private banks in Iran banking system in 2000, meeting the aim of increasing competitiveness and improving the Bank services. Given that a competitive environment in the banking system can increase efficiency and facilitate

financial transactions, identifying the structure of the banking system can pave the way for the elimination of barriers and problems to create a competitive market and assist policymakers in monetary and financial policy conform to the country's economic goals. Since the development of private banks in the country was created to provide a competitive environment and increase the efficiency of the banking system, awareness of their competitiveness over an elapsed time can be useful to assess the efficiency of adopted policies and the implementation of appropriate monetary policies in the future. After the entry of private banks, significant changes occurred in Iran banking system that made many scholars and economic experts optimistic about changes in competitive conditions in Iran banking industry. Improving the quality of services, bridging the gap between the interest rate, loan rates and grant rates are among the main reasons for many of these expectations. In this study, using data collected annually from five private banks from 2005 to 2017 and relying on panel data model, a logarithmic model - based on linear Panzer & Rosse is estimated for private banks. Using the estimated model, the H statistic by Panzar & Rosse model (captured by estimating Panzer –Rosse coefficient) is calculated to assess the competitiveness of Bank market.

The assumption of long-run equilibrium conditions in Iran private banks is examined. Based on the obtained results, the conditions above are not established. Due to this result and negativity of H statistic, considering the competitiveness and noncompetitiveness of market situation is when possible that the H statistic by Panzar - Rosse model is positive. The obtained H statistic value in this study equals to 0.94, indicating that the market for private banks is monopolistic competitive during the under-investigated period. Given that the H-statistic is close to unity, the Wald test is applied to examine whether this statistic equals unity or not. The null hypothesis is rejected at a 99% confidence level. Therefore, it cannot be said private banking markets are perfectly competitive, though the competitiveness is high

According to the results obtained in this study, it can be said that competition policies among banks for provision of efficiency enhancing forces can be considered by the banking system policy maker. These include removing barriers to entry private sector to the country's banking network and providing facilities and encouraging the private sector to attend in the country's banking market. The government can also enhance the efficiency and competitiveness of these banks by highlighting the role of private banks and exiting state-owned banks from private sector possessive. However government interventions and restrictive credit policies and price controls have restricted competition environment, factors such as the entry of private

banks and the presence of credit institutions can affect the competitive environment in the banking industry and make the banking system more efficient.

## References

- Dehghan, M. A. (2011). *The Structure and Performance of the Banking Industry* (Economics Doctoral Thesis). Tarbiat Modarres University in Tehran.
- Safari, H. (2008). *Practices to Measure Competition in Corporate Level: Field of Study Industries Petrochemical Company Iran* (Ph.D. Thesis). University Tehran, With Guidance Dr. MR. Mehrgan.
- Tohidi, S. J., Toosi, M. R., Mazyaki, A., & Karimi, S. M. (2005). *Reporting the Performance of Iran Banking System in 2004*. First Edition, Tehran: Banking Institute
- Abbasoglu, O., Aysan, A. F., & Gunes, A. (2007). *Concentration, Competition, Efficiency and Profitability of the Turkish Banking Sector in the Post-Crisis Period* (MPRA Paper No. 5494).
- Al-Muharrami, S., Mathews, K., & Khabari, Y. (2006). *Market Structure and Competitive Conditions in the Arab GCC Banking System*, Cardiff Economic Working Papers, No. 2006/8.
- Baltagi, B. (2001). *Econometric Analysis of Panel Data*, John Wiley & Sons, Ltd, 2nd ed.
- Bikker, J. A., & Groeneveld, J. M. (2000). Competition and Concentration in the EU Banking Industry. *Kredit und Kapital*, No. 30, 62-98.
- Bikker, J. A., & Haaf, K. (2002). Competition, Concentration, and their Relationship: An Empirical Analysis of the Banking Industry. *Journal of Banking and Finance*, No. 26, 2191-2214.
- Bikker, J. A., Shaffer, S., & Spierdijk, L. (2009). *Assessing Competition with the Panzar-Rosse Model: The Role of Scale, Costs, and Equilibrium*, Presented at the 22nd Australasian Banking and Finance Conference, Sydney, Australia, December.
- Bikker, J. A., Spierdijk, L., & Finnie, P. (2007). *Misspecification of the Panzar-Rosse Model: Assessing Competition in the Banking Industry* (DNB Working Paper No.114).
- Bresnahan, T. (1982). The Oligopoly Solution Concept is Identified. *Economics Letters*, 1087-92.
- Claessens, S., & Laeven, L. (2004). What Drives Bank Competition? Some International Evidence. *Journal of Money, Credit and Banking*, No. 36, 563-584.1
- De Bandit, O., & Davis, E. P. (2000). Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU. *Journal of Banking and Finance*, No. 24, 1045-1066

- De Guevara Fernandez, J., Maudos, J., & Perez, F. (2005). Market Power in European Banking Sectors. *Journal of Financial Services Research*, Vol. 27, No. 2, 109-137.
- Harris, R., & Sollis, R. (2003). *Applied Time Series Modeling and Forecasting*, Wiley.
- Hempell, H. (2002). *Testing For Competition among German Banks*. Economic Research Centre of the Deutsche Bundesbank, Discussion Paper 04/02.
- Iwata, G. (1974). Measurement of Conjectural Variations in Oligopoly. *Econometrica*, No. 42, 947-966.
- Jeon, B. N., Olivero, M. P., Wu, J. (2010). Do Foreign Banks Increase Competition? Evidence from Emerging Asian and Latin American Banking Markets. *Journal of Banking & Finance*.
- Matthews, K., Murinde, V., & Zhao, T. (2007). Competitive Conditions among the Major British Banks. *Journal of Banking and Finance*, No. 31, 2025-2042.
- Mensi, S. (2009). Measurement of Competitiveness Degree in Tunisian Deposit Banks: An Application of the Panzar and Rosse Model. *Panoeconomicus*, No. 2, 189-207.
- Nathan, A., & Neave, E. (1989). Competition and Contestability in Canada's Financial System: Empirical Results. *Canadian Journal of Economics*, No. 22, 576-594.
- Panzar, J., & Rosse, J. (1987). Testing for Monopoly' Equilibrium. *Journal of Industrial Economics*, No. 35, 443-456.
- Panzar, J. C., & Rosse, J. N. (1982). *Structure, Conduct and Comparative Statistics*. Bell Laboratories Economic Discussion Paper.
- Rozas, L. G. (2007). Testing for Competition in the Spanish Banking Industry: The Panzar-Rosse Approach Revisited. *National Energy Commission*.
- Stigler, G. J. (2008). Competition, the New Palgrave Dictionary of Economics.

## Appendix

### Appendix 1. Evaluating descriptive statistics of variables

Table 1

*Descriptive statistics of the variables used in research*

	IR	ROA	FR	PW	CP	OR	CT	LT	ET
mean	15674.02	0.0296	0.1201	0.0081	0.0201	0.0267	0.0849	0.6352	0.1042
median	11571.00	0.0247	0.1231	0.0041	0.0000	0.0100	0.0796	0.6461	0.0732
maximum	52392.00	0.0666	0.1645	0.1507	0.1536	0.3025	0.3498	0.9317	0.7568
minimum	251.00	0.0084	0.0121	0.0022	0.0000	0.0000	0.0000	0.2405	0.0437
SD	13989.62	0.0148	0.0250	0.0221	0.0391	0.0509	0.0498	0.1108	0.1077
Skewness	0.9253	0.6207	-1.8838	6.1558	2.0698	3.9471	3.3906	-1.2975	5.0933
kurtosis	2.8997	2.3759	9.1880	40.002	6.2381	20.747	19.046	7.4926	31.283
Total	705331.0	1.3341	5.4087	0.3671	0.9060	1.2017	3.8204	28.587	4.6908
observations	45	45	45	45	45	45	45	45	45
Cross Sections	5	5	5	5	5	5	5	5	5

Source: Research Findings

All descriptive statistics of Panel model variables are shown in the above table. The first row indicates the mean of the used variables in the panel model. The next rows represent the median, maximum and minimum, standard deviation, skewness, and kurtosis of used observations in panel model.

### Appendix 2. F & Hausman Tests

To estimate the equilibrium and Panzar - Rosse models of private banks in Iran, it is necessary to determine the type of panel data estimation method. So, first, to determine the presence (or absence) of individual intercept for each bank,  $F$  statistic is used as follows. The null hypothesis states that  $Q$  is stable in all banks and OLS procedure can be used:

$$H_0 : \alpha_0 = \alpha_1 = \dots = \alpha_n = \alpha$$

$$H_1 : \alpha_i \neq \alpha_j$$

(10-1)

The results of the F test are shown in Table A:

Table A

*Test to select whether the panel or pool estimation*

Test	Equilibrium Model			Panzar & Rosse model		
	Statistics	Degrees of freedom	p-value	Statistics	Degrees of freedom	P-value
Cross sectional F-test	4.329772	(4,8)	0.0372	2.983814	(4,7)	0.0098
Cross sectional Chi square ( $x^2$ )	23.042340	4	0.0001	19.902308	4	0.0005

Source: Research calculations

Since  $F$  statistic and chi-square are statistically significant in both models at 99 percent of confidence,  $H_0$  hypothesis is rejected, and Panel data model is accepted. So, different intercepts must be considered in estimating both models.

After F test, the question is, what is the appropriate estimator to estimate the model? Which models of fixed-effects or random-effects can be expressed and investigated?

Hausman Test is used to determine whether the model can be estimated using fixed-effects or random effects. To apply the Hausman test, it is required to estimate the model using random effects, but given the fact that in this study, the number of cross-sections (the banks) is smaller than the number of the explanatory variables, the random effects cannot be used to estimate the model. Therefore, the fixed effects method is selected to estimate both models.