

## The Effect of Electronic Banking on Deposit Attraction and Market Concentration in Iran's Banking Industry

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### **Abstract**

Along with the development of electronic banking due to the rapid growth of information technology, many banking indices, including concentration, are affected. This influence is made among different variables, of which the amount of banks' deposits and the level of deposit attraction are the most important. This study the influence of electronic banking on concentration in Iran's banking industry, considering each bank's portion of total deposit. To do this, using the annual data of the years 2006 to 2016 and in panel data form, along with descriptive-statistical analysis, bank concentration was studied under the impression of E-banking development. Concentration is measured using the Herfindahl-Hirschman index based on the deposit portion. Results indicate that small banks' portion of deposits has flourished, and the concentration has decreased. The reason is that small banks use more electronic banking services than larger ones. Results also show a positive, logical relationship between each bank's portion of total deposits and the development of Electronic banking.

**Keywords:** Electronic Banking, Panel Data, Market Concentration, Bank Deposit.

**JEL Classification:** C87, L22, G21.

### **1. Introduction**

One important issue in the field of theoretical studies and economic administration is to recognize market structure and effective factors on

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it. The study of elements of markets structure-conduct-performance, the way these elements act with each other, causality direction and the effective factor on each element including diverse studies is branched in industrial economics. Market share is a structural variable for measuring the intensity of competition among producers which in industrial economics literature is impressed by performance and conductive factors.(Hannan, 1991)

In recent years, competition (results from gaining more share of market)- as the most important structural variable of market and its dependents- has been seriously regarded by competition and market adjustment regulatory entities in Iran such as Islamic Consultative Parliament, National Competition Centre, Competition Council and consumer support organizations.

Experimental studies show that as a structural variable, concentration is an important and effective factor on market share and can have a deep influence on the closeness of market competition. (Khodadad Kashi, 2000)

As with the global increasing growth of communication technology, electronic commerce and banking are quickly developing. Electronic banking includes factors that can affect the number, distribution manner and market power or concentration of the banking market. The way this factor affects concentration and as a result closeness of competition (from absolute monopoly to perfect competition) has rarely been a case of study in banking market. This article aims to evaluate the influence of electronic banking development on the concentration of Iran's banking industry, using theoretical basics and records of experimental studies.

Consequently, in order to recognize the structure and evolution of market, we have utilized a measuring approach of concentration, with the emphasis on banks' share of deposit calculating Herfindahl-Hirschman index and a regressive pattern for examining the effect of electronic banking on concentration. The article starts with required theoretical basics and brief experimental studies and subsequent to that, results gained from measuring concentration in Iran's banking industry and the influence of electronic banking on it, will be offered.

## **2. Theoretical Basics**

### **2.1 Market Structure and Concentration**

According to industrial economics literature, market elements consist of structure, conduct and performance. The way these three connect to and interact with each other has always been a case of debate among economists and different economic schools. Early discussions and studies about the relationship between market triple elements were first posed by Mason and his students who were founders of structuralism school. Mason and Bain emphasized on the importance of market structure by offering the concept of entrance obstacles and its impact on conduct and performance of firms. Structuralists believe that the causality direction is from structure towards conduct and then performance. Chicago school which culminated since 1950 with Stigler in Chicago University, and from 1970 onward with the efforts of famous economists like Stigler, Brozen, Mcgee, Demsetz and Posner, is in the opposite point in industrial economics field. Unlike structuralists, Chicago school believes in opposite direction for causality, namely from performance towards conduct and then structure. Market performance is reflected in price, efficiency, technical improvement, profitability rate, production level, sale, export and employment. Price, profitability rate and other aspects of market performance are specified under the impression of competitive conduct or cooperation among firms, and market structure. Concentration is one of the structural variables of market. (Barthwal, 2007)

The structure of market implies the way industries are organized in the? Market and can affect the equilibrium price and quantity. Market structure is a concept which includes a wide range of conditions ruling the industry, from perfect competition to monopoly. In other words, market structure contains quiddity and domain. Quiddity determines the way firms are organized in market and domain is a range of circumstances from perfect competition to monopoly. Concentration, product individuality and entrance conditions are some essential factors for market structure. According to experimental studies on market structure, concentration is the most determinant and recognized factor. (Donsimoni, Geroski, and Jacquemin, 1984)

Concentration means the way firms' share in a special industry is distributed. To measure concentration in a definite industry two

important issues must be considered: number of firms in the industry and their relative size. The more firms in an industry, the less is the concentration and vice versa, the more difference in relative size of firms in an industry, the more is the concentration. In other words, concentration has a reverse relationship with the number of firms in an industry, and a positive relationship with the gap in the relative size of firms. Mathematically it can be shown as:

$$C = f(n, G)$$
$$\frac{\sigma C}{\sigma G} > 0, \quad \frac{\sigma C}{\sigma n} < 0$$

Where G is the gap in relative size of firms, n is the number of firms and C is concentration. As well as direct effect, number of firms can also have an indirect effect on concentration, that is if a new firm is large enough in comparison with other firms, its entrance to market will increase, instead of decreasing the concentration (Khodadad Kashi, 2000).

### 2.1.1 Indices for Evaluating Concentration

There are many theories and methods for studying structure and competitive status of a market. These methods are divided in two structural and non-structural categories. Structural methods consider extreme concentration as a forcible factor in appearance of collusion and firm performance, while the second claims that better efficiency and performance can lead to monopolistic behaviour and consequently monopolistic structure. The main characteristic of structural method is to examine structure based on concentration ratio. According to some theoretical studies, market concentration is measurable by different indices like firms' concentration ratio, Herfindahl-Hirschman index, reverse of firms' number in an industry, Hannah-kay index, Entropy index, logarithm variance, n-firm concentration ratio etc. Theoretically Herfindahl-Hirschman index is stronger and more reliable than the others and is also used the most for calculating concentration this index is also used in this essay

Structural indices are classified into two divisions of partial and absolute. Their main difference is that partial indices do not mind the influence of firms' number, although they can be treated as proper indices for examining concentration. Some important partial indices

are: Gini coefficient, Linda index, adjusted concentration ratio and dispersion measure (Bikker and Haaf, 2002). In table 1 some indices for measuring concentration are given.

**Table 1: Indices for Measuring Concentration**

Kind of index	Formula ( $S_i$ :share of bank $i$ th , $n$ : number of firms)	qualification
<b>Absolut indices of concentration</b>		
n-firm concentration ratio	$CR_n = \sum_{i=1}^n S_i$	Considering large firms
Herfindahl-Hirschman index	$HHI = \sum_{i=1}^n S_i^2$	Considering all firms (Gives more weight to large firms)
Hannah-kay index	$R = \sum_{i=1}^n S_i^a$	Emphasis on large firms effect (Researcher decides $a$ value)
Entropy index	$E = \sum_{i=1}^n S_i \ln \frac{1}{S_i}$	Considering all firms (Gives less weight to large firms)
Hall-Tideman index	$HTI = 1 / ( 2 \sum_{i=1}^n i S_i - 1)$	Firms rank from highest downward ( share of each bank is considered equal to its rank)
Rosenbluth index	$HTI = 1 / ( 2 \sum_{i=1}^n i S_i - 1/2)$	Firms rank from last upward ( share of each bank is considered equal to its rank)
Horvath index (the comprehensive concentration index)	$CCI = S_i + \sum_{i=2}^n S_i^2 (1 + (1 - S_i))$	Declaring partial dispersion and absolute size (Fit for cartel markets)
<b>Partial Concentration Indices</b>		
Rothschild index	$R = \frac{E_T}{E_F}$	The closer to zero, the more competition and the closer to one, the more monopoly ( $E_T$ : Elasticity of demand for the total market , $E_F$ : Elasticity of demand for firm)
Elasticity Index	$n-1 = - \frac{e_{ii}}{e_{ji}}$	Increase of this relation means fewer firms in market and decrease equals to more firms in market $e_{ii}$ :Elasticity of demand, $e_{ji}$ :cross-Elasticity of demand)
Joe s.Bain index	$r = \frac{R-C-D-I}{I}$	using interest of active firms in stock market to calculate monopolistic power (R:total sales, C:Current cost, D: Depreciation, I:investment)
Lerner index	$L = \frac{P-MC}{P}$	The more difference between $p$ and $MC$ , the more monopolistic power (P: price, MC: marginal cost)

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Kind of index	Formula ( $S_i$ :share of bank $i$ th , $n$ : number of firms)	qualification
The adjusted concentration relation index	$C_{An} = \frac{Q_n - C_n X}{Q + M - X}$	Due to foreign competition concentration is adjusted
Linda index	$L_n = \frac{1}{n(n-1)} \sum_{i=1}^n \frac{n-i}{i} \cdot \frac{CR_i}{CR_n - CR_i}$	This index is based on n-firm concentration ratio ( CR is representative of n-firm concentration ratio)
Gini coefficient	$G = 1 - 2 \int_0^1 F(X) d_x$	Measured by the Lorenz curve (With more inequality in firms size, the Gini coefficient is closer to 1 and With more equality in firms size, the Gini coefficient is closer to 0)
Dispersion index	$D = n \cdot \sqrt{\frac{1}{n} \cdot \sum_{i=1}^n (S_i - \frac{1}{n})^2}$	This coefficient varies between zero and $\sqrt{n} - 1$ . The less coefficient, the less inequality in market share distribution and it means less concentration.
Logarithm Variance	$V = \frac{1}{n} \cdot \sum_{i=1}^n (\log S_i)^2 - \frac{1}{n^2} \cdot (\sum_{i=1}^n \log S_i)^2$	-Considering all firms -If logarithm variance of firm size is zero, it shows that all firms are equal in size and market moves towards competitiveness

Source: Research Findings.

Among all, Herfindahl-Hirschman has had a remarkable success in economic studies. This index formulates as the sum of squared market share of each firm (Khodadad Kashi, 2010). It is as below:

$$HHI = \sum_{i=1}^n \left(\frac{X_i}{X}\right)^2$$

Or

$$HHI = \sum_{i=1}^n S_i^2$$

where  $S_i$  is market share of firm number  $i$  and  $n$  is number of firms in the industry.

This index is very useful in antimonopoly policy and begetting competition. In case firm share is multiplied by 100, the numerical extent of the index alters between zero and ten thousand. Where zero stands for perfect competition and 10000 stands for monopoly. The way this index determines whether an industry is competitive or not, is as below.

A market with  $HHI < 100$ , is competitive. Market with  $100 <$

$HHI < 1000$ , is called languid oligopoly and markets with  $HHI > 1000$ , are hard oligopoly and monopoly (Jaafari, Danesh and colleagues).

### **2.2 Concentration in Banking Industry**

A situation in which banking industry is handled by a few large and pioneer banks, is called concentrated bank supplies. Namely bank concentration reflects number of banks in a market and the way they are allocated. In order to look into bank concentration, first the market or industry area (e.g. governmental versus non-governmental or credential) and then objected variable (deposit, credits, property etc.) should be determined. Among all, the deposit ratio of each bank is a good variable to admeasure size of banks in an industry. So in the current essay, this is the way to evaluate bank concentration.

### **2.3 Electronic Banking and Its Services**

One of the most important phenomena resulted from information revolution, is the evolution of trade mechanisms and replacement of traditional methods by electronic commerce. Since money and banking have an important role in business, electronic banking is one the most essential bases and fields of electronic commerce as well as of commercial services. In 1994 when the internet showed its commercial capabilities besides its scientific applications in developed countries, banks and commercial organizations were the first to seriously endeavour to utilize this trend. The result is today's electronic banking infrastructure. It was soon discovered that internet has lots of opportunities for banking and economic activities. Today, electronic banking is known as a very sophisticated issue in the world and its adjustment to commercial and economic policies of different countries requires accurate investigation and planning (Shah and Clarke, 2009).

- There are many descriptions of E-banking given by banking experts and specialists of which some of the most important ones are mentioned below.
- E-banking is the act of providing facilities for personnel in order to increase their agility and efficiency in providing bank services at department, inter-departmental and inter-bank

processes worldwide. It is also to provide software and hardware comforts to customers so that they become able to do their bank operations safely and convenient at any time of day or night.

- E-banking is to utilize advanced, net based or dispatch based hardware and software technologies in order to communicate financial data and sources, needless to physical attendance of customer in the bank.
- The employment of information technology and communicational grounds (dispatch) in giving banking services and products to customers so that banking operations could be done 24 hours a day needless to customers' physical attendance.
- Employment of core banking, hardware and software systems at any time and any place.

In this paper, some E-banking services in the form of electronic payment tools, is used as the index (representative) for development of E-banking. These services include ATM (Automatic Teller Machine), POS (Point of Sale) and Pin pad.

#### **2.4 Electronic banking and Concentration in Banking Industry**

As we've already discussed, concentration is affected by relative size of firms' share in a market or industry and as a representative variable, banks' deposit share show the concentration degree of the market. So E-banking could impress banks' share and more precisely impress their deposit share from banking market and finally market concentration through offering better customer services. We are going to make practical experiment of this issue and evaluate the quality and quantity of the impression.

### **3. Research History**

History of researches done about the issue being discussed shows that the effect of E-banking on concentration in banking industry has rarely been in a case of concern among researchers. In opposite, there are many studies about structure of banking industry and respective topics a summary of which will be showed in Table 2.

Table 2: Experimental Studies

Authors/source	Period/Country	Index(s)	Result
Ali Zarif Honavar (2014) (In Persian)	2007-2013/Iran banking industry	- Rosenbluth index - Entropy index - Hall Tideman index - n firm concentration ratio - Herfindahl Hirschman index - comprehensive concentration index - Ponzar and Rosse	Although a concentrated banking industry in Iran, the trend has been decreasing. Also with evaluating <i>H</i> statistic it was revealed that Iran has a monopole banking industry.
Datta et al. (2013)	1987-2009 /36 banks of US banking industry	- Lerner index - 4 firm concentration ratio	LerLerner index came 0.08 which indicates a decentralized situation for large banks and the next index came 7.05 percent which evidences decentralized and nearly competitive situation.
Bramr et al. (2013)	2003-2009 /Banking industry of 12 European countries	-Herfindahl Hirschman index - 5 firm concentration ratio - Lerner index - Ponzar and Rosse	Concentration in all 12 banking industries had been in high level and has abated to its minimum during 2007 and 2008. The industry in Greece, Italy and Portugal faces highest concentration,
Milejkwich et al. (2013)	Serbia's banking industry	- n firm concentration ratio - Gini coefficient - Herfindahl Hirschman index	Experimental results of the essay contain concentrated capital, fund, loan, deposit, interest income and pre tax benefit. This analysis is in comparison with central, eastern and southern European countries.
Khodadad Khashi and Jafari (2012)	2001-2006 /Iran's banking industry	- Herfindahl Hirschman index	During 2001 to 2011 structural indices of Iran banking such as concentration and entrance barriers were subjects of changes towards competitiveness.
Najarzadeh, Ezzati and Mirzanejad (2012)	1997-2009 /18 banks of Iran banking industry	- Ponzar and Rosse	Results show that banking market of Iran is closer to monopolistic competition rather than perfect competition or perfect monopoly. Another result is that by non-governmental banks entering to country's banking system competitiveness has increased in banking market.

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Authors/source	Period/Country	Index(s)	Result
Massit (2012)	Turkey's banking industry	- n firm concentration ratio - Herfindahl Hirschman index	He found that there is monopolistic competition in Turkey's banking and it has abated in related periods.
Laptacrow (2012)	Bulgaria's banking industry	- Herfindahl Hirschman index - Entropy index	It studies loan market concentration in Bulgaria. The goal is to find factors to explain bank loan concentration in Bulgaria. Using a panel pattern showed that cash impresses portfolio level of loan and cash flow.
Dehghan (2001)	2001-2009 /15 banks of Iran's banking industry	- Ponzar and Rosse	Impression of structure and performance of banking market on profitability was studied. He argued that competitiveness of banking system has increased.
Sharma and Pal (2010)	India's banking industry	-n firm concentration ratio -Herfindahl Hirschman index - Entropy index - Gini coefficient	Concentration in India's banking market is considered. Here findings reflect more competition in India.
Bangman et al. (2010)	1998-2008/ Asia and Latin America banking	indices concentration and Ponzar and Rosse	Studied the effect of foreign banks participation on competitive banking structure. Outcome was that more entrance of foreign banks makes the host banking system more competitive.
Pejouyan and Shafiee (2008)	1996-1999/17 governmental and non-governmental banks of Iran banking industry	U Davis	Studying showed that the amount of this index has had diminution in recent years. It means that increase in number of non-governmental banks has led the industry towards competitiveness.
Hosseini and Ghandinejad (2007)	1996-2005/ 10 banks of Iran's baking industry	-10 firm concentration ratio -Herfindahl Hirschman index	Mellat, Melli, Saderat and Tejarat Banks own 70 percent of market share. Also with movement from small towards large banks enhances monopole power.
Abbas Eghloo, Ison and Gunesh (2007)	2001-2005/ 27 active banks in Turkey's banking industry	Ponzar and Rosse	According to results competitiveness has reduced until 2004 but enhanced since 2005. Also the amount between 0 and 1 in <i>H</i> statistic shows monopole structure of Turkey's banking.

Authors/source	Period/Country	Index(s)	Result
Bikker and Haaf (2007)	1986-2005/ Banking market of 101 selected countries round the world	Ponzar and Rosse	They ascertained that improper chose of dependent variable causes systematic digression in results and bias in calculated $H$ statistic towards 1. Measuring competitiveness level among studied countries banks they showed that 28 cases which already used Panzar-Rosse method suffer this error.
Al-Muharrami, Matthews, Khabari (2006)	1993-2003/ Banking industry of 6 members of gulf cooperation council	Ponzar and Rosse	Banks of Kuwait, KSA and UAE were in perfect competition and in Bahrain, Qatar and Oman the situation was monopolistic competition.
Bikker and Haaf (2002)	Netherland's banking industry during 2001	Indices concentration	They evaluated banking indices in Netherland and came to the result that using different indices about a definite market will not lead to definite conclusions and U and House index are closer to reality.
Bikker and Hoff (2000); Baker and Groeneveld (2000) In a similar study	1989-1996 Selected European and non-European banks	- n firm concentration ratio -Herfindahl Hirschman index - Ponzar and Rosse	Banking market in industrial countries often has a monopole structure and only in some cases perfect competition cannot be denied. Competitiveness of large banks is more than small ones and also a negative relationship has been seen between competitiveness level and concentration.
Hampell (1998)	1993-1998 Germany's banking	Ponzar and Rosse	He approved that because of operational differences between commercial and cooperative and also credential banks, there is a meaningful contrast in the structures of these banks in terms of competition.

Source: Research Findings.

In these studies different indices have been used some most useful of which are Herfindahl-Hirschman index, n-firm concentration ratio and Panzar-Rosse index. Here we have used Herfindahl-Hirschman index to assess concentration in Iran's banking industry.

#### 4. Assessing the Effect of Electronic Banking on Concentration in Iran's Banking Industry

The common method of studying the influence of E-banking development was to pass the below steps which is called direct way:

- Measuring concentration procedure in Iran's banking industry
- Inspecting E-banking development procedure
- Estimating influence of E-banking development on concentration in banking industry

But because of limitation of data (including time shortage) indirect method is used as below:

- Measuring concentration procedure in Iran's banking industry
- Estimating impact of E-banking development on banks' deposit share
- Assessing the relationship between E-banking development rate and changes in banks share from deposits

Sample banks used in this essay are: Melli, Eghtesad Novin, Parsian, Pasargad, Post Bank, Tejarat, Tosee Saderat, Refah, Saman, Sepah, Sarmayeh, Sina, Saderat, Sanaat va Maadan, Karafarin, Keshavarzi, Maskan, Mellat, Ansar, Tosee va Taavon, Day and Shahr which their information was available.

As mentioned before, the total deposit of these banks consists 91 percent of total banking deposit, according to Central Bank's website.

##### 4.1 Measuring Concentration Procedure in Iran's Banking Industry

Iran's banking industry concentration has been calculated from 2006 to 2016 in Table 3:

**Table 3: Concentration (Herfindahl-Hirschman Index)**

year	Iranian banking concentration based on Herfindahl-Hirschman index (on the view of deposit)
2006	1165,554257
2007	1125,292737
2008	1064,325668
2009	1070,933304
2010	980,9168384
2011	982,5961591
2012	945,506448

year	Iranian banking concentration based on Herfindahl-Hirschman index (on the view of deposit)
2013	871,907185
2014	843,9944661
2015	901,3219896
2016	857,4349376

Source: Research Findings.

As can be seen, the rate of concentration in Iran's banking industry has been descending and market structure is changing towards more competitiveness.

As noted in "Research history" section, Herfindahl-Hirschman index is used in many studies related to concentration measurement. It offers more reliable results as well as being adequate for this article's needs.

Nevertheless measuring some other indices also show that the changing direction of concentration has been is the same according those indices and Iran's banking market moves towards competitiveness. Results for all indices demonstrate a unique point. (What does it mean?), and partial indices are better to be used for measuring inequality not concentration (Kashi, 2010). The result is shown in Table 4:

Table 4: Concentration

year	n-firm concentration ratio	Hannah-kay index	Entropy index	Hall-Tideman index	Rosenbluth
2006	0,567366	0,015909	2,384663	0,109857	0,104137
2007	0,575676	0,015604	2,419138	0,107985	0,102453
2008	0,562361	0,014052	2,455599	0,103708	0,098595
2009	0,57764	0,014363	2,469255	0,10459	0,099392
2010	0,535622	0,012795	2,567627	0,096623	0,092171
2011	0,547288	0,012525	2,576781	0,096323	0,091898
2012	0,536566	0,012131	2,621202	0,091166	0,087192
2013	0,510836	0,010069	2,66964	0,085768	0,082241
2014	0,50456	0,009385	2,694831	0,083755	0,080388
2015	0,510251	0,011116	2,644459	0,079551	0,076508
2016	0,489781	0,009798	2,671773	0,076364	0,073556

Source: Research Findings.

## 4.2 Estimating the Impact of E-banking Development on Banks' Deposit Share

Steps for estimating impact of E-banking development on deposits share are as below:

- Introducing model and variables  
Checking stationary of variables (unit root test)
- Checking whether the pattern is *panel* or *pool* (F-Limer test)
- Checking whether fix or random effect estimation method should be used (Husman test)
- Estimating the model

### 4.2.1 Introducing Model and Variables

Three electronic banking tools are considered for assessing E-banking influence on banks' deposit share. They are, ATM (Automated Teller Machine), POS (Point of Sale) and PINPAD. We also use "number of branches" and "interest rate" as control variables. NB and RI stand for number of branches and interest rate respectively. Equation 1 shows the regression model:

$$D_t^i = \alpha_0 + \alpha_1 ATM_t^i + \alpha_2 PINPAD_t^i + \alpha_3 POS_t^i + \alpha_4 NB_t^i + \alpha_5 RI + \varepsilon_t^i \quad (1)$$

Since Herfindahl-Hirschman index discusses banks' relative size while looking at concentration, and on the other hand all sample banks have started developing electronic banking, it is necessary to enter variables in proportional forms (in competitive mode). Namely:

$$\frac{d_t^i}{D_t^i} = \alpha_0 + \alpha_1 \frac{ATM_t^i}{ATM_t^T} + \alpha_2 \frac{PINPAD_t^i}{PINPAD_t^T} + \alpha_3 \frac{POS_t^i}{POS_t^T} + \alpha_4 \frac{NB_t^i}{NB_t^T} + \alpha_5 RI_t^i + \varepsilon_t^i \quad (2)$$

$\frac{d_t^i}{D_t^i}$ : ratio of bank *i*th deposit to all banks deposits in year *t*.

$\frac{ATM_t^i}{ATM_t^T}$ : ratio of bank *i*th ATMs number to all ATMs in year *t*.

$\frac{PINPAD_t^i}{PINPAD_t^T}$ : ratio of bank *i*th PINPADs number to all PINPADs in year *t*.

$\frac{POS_t^i}{POS_t^T}$ : ratio of bank *i*th POS sets number to all POS sets in year *t*.

$\frac{NB_t^i}{NB_t^T}$ : ratio of branches number of bank *i*th to all bank branches in year *t*.

$RI_t^i$ : Determined interest rate (governmental and non-governmental banks) for each bank in year  $t$ .

#### 4.2.1.1 Checking the Stationarity of Variables

The regression model is estimated using Eviews software during 2006 to 2016. Unit root test and summary pattern is used for this purpose. Summary pattern is used because it is public and includes other types of stationary tests. In order to report the stationarity of variables in summary pattern, Levin, Lin and Chut methods are highly noted. Table number 5 shows the results of unit root test of variables: Deposit share ratio, Pin pad ratio, Departments number ratio, ATM ratio, POS ratio and interest rate. Existence of unit root is denied for all variables so their stationarity is approved.

**Table 5: Checking Stationary of Variables**

variable	probe	statistic	method
ATM ratio	0.0000	-7.91584	Levin, Lin & Chut
PINPAD ratio	0.0000	-13.1597	Levin, Lin & Chut
POS ratio	0.0000	-8.25246	Levin, Lin & Chut
Departments number ratio	0.0009	-3.11612	Levin, Lin & Chut
Interest rate	0.0002	-3.56566	Levin, Lin & Chut
Deposit share ratio	0.0085	-2.38645	Levin, Lin & Chut

Source: Research Findings.

#### 4.2.2 F-Leamer and Husman Test

It is necessary to check whether the pattern is *pool* or *panel* and whether the estimation should use fixed or random effects prior to estimation. F-Leamer test is used for determining the type of pattern and Husman test is used to examine whether the estimation should use fixed or random effects prior to estimation. F-Leamer and Husman tests were applied on regression model using variables such as Pin pad ratio, ATM ratio, POS ratio, Departments number ratio and interest rate. Results are given in table number 6. According to value probe in F-Leamer test, the  $H_0$  hypothesis was rejected and panel pattern approved. Also with due attention to value probe in Husman test,  $H_0$  was rejected and fixed effects regression should be used.

**Table 6: Results of F-Leamer and Husman Tests**

test	probe	statistic	d.f.	Description
F-Leamer test	0.0000	52.069836	(20,138)	rejected $H_0$ (Approval of <i>panel</i> pattern and rejection of Pool'S)
Husman test	0.0000	27.338056	5	rejected $H_0$ (Approval of <i>fixed effects</i> pattern and rejection of <i>random effects</i> pattern)

Source: Research Findings.

#### 4.2.3 Model Estimation

Since stationarity of variables is approved and it is also found that the regression model should be estimated for panel data with fix effects method, we estimated the pattern in different models. The best results were achieved along with AR (1) variable and eliminated interest rate variable. It means that probe values have been significantly different from zero and ATM ratio variable can be seen as an effective variable on deposit, regarding p-value with 10 percent error probability.

Durbin Watson statistics is estimated 0.9748 According to which we can say that the pattern suffers auto correlation. So we inserted AR(1) model into it, which changed Durbin Watson statistics to 2.1442 and consequently auto correlation disappeared. In other words, error terms of periods  $t$  and  $t-1$  are independent of each other. R-squared ( $R^2$ ) was also estimated as (0.9874) which means that independent variables explain deposit changes up to ninety eight percent.

Interest rate variable with auto correlation with other variables was eliminated since in spite of AR (1), it affected significance of other variables or in other words made regression unreliable. Results are shown in table number 7:

**Table 7: Estimation**

variable	coefficient	t- statistic	probe
ATM ratio	0.079602	1.640963	0.1031
Pin pad ratio	0.133300	3.270582	0.0014
POS ratio	0.061316	2.485693	0.0141
Departments number ratio	0.282603	2.422503	0.0167
AR(1)	0.551092	9.454105	0.0000

Source: Research Findings.

Results of the regression estimation are shown in Equation 3:

$$D_t^i = \alpha_0 - \alpha_1(ATM_t^i) + \alpha_2(PINPAD_t^i) + \alpha_3(POS_t^i) + \alpha_4(NB_t^i) + \varepsilon_t^i \quad (3)$$

$$D_t^i = 0.023 + 0.079*(ATM_t^i) + 0.133*(PINPAD_t^i) + 0.061*(POS_t^i) + 0.282*(NB_t^i) + \varepsilon_t^i$$

In fore coming model the fixed coefficient namely  $a_0$  became 0.023. The coefficients for ATM ratio is ( $a_1$ ), ( $a_2$ ) for PINPAD ratio and ( $a_3$ ) for POS ratio, which shows the effect of E-banking variables. We can see that  $a_1$ ,  $a_2$  and  $a_3$  are positive, which means by increasing POS, Pin pad and ATM ratios, their share of bank deposits will increase. It should be mentioned that increase of bank branches leads to the increase in share of banks' deposit. Since usage of E-banking has been in a growing trend, what determines banks' shares comparing to each other, is the rate of E-banking use which will be processed in the next section.

#### 4.3 Inspecting Relationship between the Rate of E-banking Development and Changes in Banks' Share of Deposits

We attained an average of each banks' deposit to all banks deposits ratio in year  $t$  ( $\frac{d_t^i}{D^T}$ ,  $t = \text{year}$ ,  $d^i = \text{bank } i\text{th deposit}$ ,  $D^T = \text{all banks deposit}$ ), during 2006 to 2016. The highest values of ratios during the mentioned period go respectively to the banks as below:

1. Melli 2. Mellat 3. Saderat 4. Tejarat 5. Parsian 6. Sepah 7. Maskan 8. Keshavarzi 9. Pasargad 10. Eghted-e Novin 11. Refah 12. Saman 13. Sina 14. Ansar 15. Karafarin 16. Shahr 17. Sarmayeh 18. Sanaat o maadan 19. Toseeh Saderat 20. Post Bank 21. Day 22. Tosee Taavon.

Now we need to divide banks into 3 groups, namely large, medium and small. The banks are divided by the following basis: banks with more than 10% share in market are called large banks, 1% to 10% share are medium banks and under 1% share are small banks. According to this division, Melli, Mellat, Saderat and Tejarat are large banks while Parsian, Sepah, Maskan, Keshavarzi, Pasargad, Eghtesad-e Novin, Refah, Saman, Sina, Ansar and Karafarin are medium banks and the rest are small ones.

As noted before, the main goal of this paper is to study the effects of E-banking on concentration in Iran's banking industry which is accomplished by indirect method. At the first step, concentration (transition trend of market structure) was evaluated. Then the effect of E-banking on banks' share of deposits was studied and the effect approved to be positive. Since all banks have embarked on using E-banking, according to theoretical principles it is intensity of E-banking usage which determines their deposit share (shrink of gap). Whereas concentration has diminished according to deposit share, it must be deliberated that whether E-banking development has been contributed or not. For this, we must answer the following questions: have small and medium banks share of deposit increased? Have they accelerated using E-banking?

In other words if it becomes clear that concentration has diminished because deduction of differences among deposits shares (as a result of increase in small and medium banks' shares) and on the other hand small and medium banks have increased using E-banking, it can be presumed that E-banking development has led to concentration decrease in Iran's banking industry. The mathematical explanation is as below:

Due to the definition of concentration, we have Equation 4:

$$C_{D_t} = f(n_t, G_{D_t}) \quad (4)$$

$$\frac{\sigma C_{D_t}}{\sigma G_{D_t}} > 0, \quad \frac{\sigma C_{D_t}}{\sigma n_t} < 0$$

$C_{D_t}$ : banking concentration based deposit variable in the year t.

$n_t$ : number of banks in the year t.

$G_{D_t}$ : index of banks' share distribution in the year t.

From survey result we found that the amount of E-banking usage effects on deposit share amount. In other words deposit share distribution index depends on intensity of E-banking use.

This is observable through Equation 5:

$$G_{D_t} = g(G_{EB_{ti}}), \quad \frac{\sigma G_{D_t}}{\sigma G_{EB_{ti}}} > 0, \quad i: S, M, L \quad (5)$$

$$G_{D_t} = g(G_{POS_{ti}}, G_{PINPAD_{ti}}, G_{ATM_{ti}})$$

S: group of small banks.

M: group of medium banks.

L: group of large banks.

$G_{EB_t}$ : Distribution of E-banking Shares of banks in year t.

From Equations 4 and 5, relation 6 is gained:

$$C_{D_t} = f(n_t, g(G_{EB_{ti}})) = f(n_t, g(G_{POS_{ti}}, G_{PINPAD_{ti}}, G_{ATM_{ti}})) \quad (6)$$

and somehow Equation 7:

$$C_{D_t} = Z(n_t, G_{POS_{ti}}, G_{PINPAD_{ti}}, G_{ATM_{ti}}) \quad (7)$$

where  $\frac{\sigma_{C_{D_t}}}{\sigma_{G_{POS_{ti}}}}, \frac{\sigma_{C_{D_t}}}{\sigma_{G_{PINPAD_{ti}}}}, \frac{\sigma_{C_{D_t}}}{\sigma_{G_{ATM_{ti}}}} > 0$ .

According to above statements, results are summarised in Table 8:

**Table 8: Banks Average Growth**

<b>Banks Classification (in Terms of Deposit)</b>	<b>Average Annual ATM Growth (Percent)</b>	<b>Average Annual POS Growth (Percent)</b>	<b>Average Annual PINPAD Growth (Percent)</b>	<b>Average Annual Deposit Growth (Percent)</b>
Large banks	19.8480	71.2275	16.6140	20.7421
Medium banks	27.5243	79.6264	19.7712	25.4309
Small banks	40.8008	92.1323	32.9950	58.7518

**Source:** Research Findings.

It is observed that since small bank have augmented using E-banking in comparison with medium and large bank (and also medium in comparison with large ones) their share of deposit have grown up, and deposits gaps totally shrunk. This one has caused concentration decrease.

## 5. Conclusion

The results show that concentration has been decreasing during recent years in Iran's banking industry. The reasons of this say that the gaps between banks' share of deposit have shrunk due to growth of small banks' share. On the other hand model assessment showed that there is a positive relationship between use of E-banking and each bank's share from total deposit. Results also show that small banks have had quicker bounces towards electronic banking and it has led to

enlargement of their deposit share and eventually decrease of concentration. Finally it is concluded that E-banking development has resulted in lower market concentration.

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