

Efficiency of Banks in Iran: Semi-Parametric Approach

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ABSTRACT

Objective of the present survey is to measure and compare efficiency of ten commercial and specialized banks in Iran and introducing the efficient banks in various years as well as studying why these banks are efficient or inefficient and then evaluating the impact of environmental variables such as unemployment rate, inflation rate and gross domestic product (by fixed price) on efficiency level of banks during the period 2005-2009. Results demonstrate a reverse significant relationship among unemployment rate and inflation rate and direct significant relationship of gross domestic product on banks' efficiency.

KEYWORDS: Bank Efficiency, Semi-Parametric model, Macroeconomic variables **JEL Classification: C14, G21, P34**

1. INTRODUCTION

Human beings have encountered with limitation of resources and production possibilities in all centuries and demand for products and services has had an ascending trend by enhancement of individuals' expectations from economic welfare and is increasing unlimitedly. In the modern world in which customers have different tastes those institutions could continue their activities which emphasize access to maximum efficiency with the existing possibilities. Managers of modern organizations are faced with an environment that is totally different from the past. Change is the major index of such environment. Conditions are changed continuously in such environment and managers are faced with new challenges every day. Managers are obliged to enhance flexibility power in order to increase their efficiency and productivity and survive their organizations. Banks as important firms are not excluded too. Bank managers always want to know how the performance of the group under their supervision is; how they could measure it and which factors improve performance of this group. Therefore, performance assessment of each firm is one of the most major issues of management. One of the most effective models that has been used for performance assessment of organizations during the two recent decades is data envelopment analysis (DEA) technique which evaluates relative efficiency of homogenous firms using ratio of weight sum of the firm outputs to weight sum of its inputs.

Model representation and research methodology

Measuring efficiency based on output maximization means that the industry under study is faced with conditions under which it tries to increase outputs by fixing production factors. Efficiency of ten commercial and specialized banks in Iran are studied in this survey assuming that banks have fixed inputs and could not decrease their booths and personnel (who are formal employees). Thus they prefer to remain fixed given to their investment on inputs. Technical efficiency has been measured based on output maximization given to the above issues. Efficiency based on input-oriented and output-oriented methods is measured through two assumptions of constant return scale (CRS) or variable return scale (VRS). Banker, Charnes and Cooper (1984) generalized CCR model so that it contains variable return scale. Using the assumption of constant return scale would disrupt calculated amounts for technical efficiency (by containing scale efficiency) when all firms don't act at optimal scale. Using variable return scale and efficiency resulting from management. This is conducted in formulation of Dual problem in linear programming by assuming constant return scale.

NT $\lambda_{=1}$

MAX β

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$$\begin{array}{l} -\beta \ Y + Y \ \lambda \geq 0 \\ X + X \ \lambda \geq 0 \\ \text{NI} \ \lambda \ = 1 \\ \lambda \geq 0 \end{array}$$

Where $1 \le \beta \le \infty$ and β_i is relative increase in the product amount of ith firm by assuming production factors are fixed.

 $1/\beta$ shows technical efficiency level and is between zero and one. Y is K*1 vector of the model's outputs. X is K*1 vector of the model's inputs. λ is N*1 vector including constants that show weights of the reference set. λ NT (convexity constraint) is added to conduct calculations by assuming variable return to scale. Model variables are composed of two groups: the first vector (X) is inputs that include number of branches and personnel and the second vector (Y) is outputs that include deposits, facilities and annual profit. In the second phase macro-economy variables include inflation rate, unemployment rate and GDP amount. This is continuation of the first phase and the obtained technical efficiency is inserted in the model as dependent variable for each bank. Then the above environmental variables are inserted in the model as independent variables.

Model estimation and analysis

Growth level of output variables could be observed in table (1) in the period under study after studying such variables in data envelopment analysis model. Statistics show considerable growth of banks in this period.

Title	Melli	Melat	Tejarat	Sepah	Saderat	Refah	Tuse-e Saderat	Industry and mine	Keshavarzi	Maskan
Deposits growth	94%	145%	158%	87%	137%	84%	84%	235%	107%	136%
Growth of the granted facilities	123%	148%	143%	179%	126%	86%	567%	332%	138%	242%
Profit growth	540%	116%	39%	-7%	224%	-63%	222%	206%	152%	394%

Table 1- growth level of output variables

Source: research findings

Ten commercial and specialized banks during the period 2005-2007 were studied in this survey in two phases. First, technical efficiency of each bank was measured and its factors were examined. Then a model was estimated in the next phase based on panel data that illustrated relationship among economic variables and technical efficiency.

After measuring technical efficiency among fifty observations seven banks were efficient in different years. These banks succeeded to reach efficiency boundary due to high deposits' residue, offering facilities and reduction of overdue claims. List of efficient banks in this period is observed in table (2).

Year	2005	2006	2007	2008	2009		
	Tuse-e Saderat	Tuse-e Saderat	Tuse-e Saderat	Tuse-e Saderat	Maskan		
Name of the	Industry and mine						
bank				Tejarat	Saderat		
					Melat		
					Melli		
Source: research findings							

Table 2- list of efficient banks

Source: research findings

- Among the banks under study only Tuse'e Saderat Bank has increasing return to scale.
- Dispersion of banks' technical efficiency could be observed in diagram (1).



Diagram 1- dispersion of banks' efficiency and distance to the efficiency boundary

Source: research findings

Selecting a bank as the reference bank in comparison with other banks is due to high efficiency. In other words performance of one or more firms is modeled for other firms due to higher efficiency in measuring technical efficiency through DEA method. Number of times that banks have been selected as reference banks in various years is shown in diagram (3).

Diagram 3- Number of times banks have been selected as reference banks during the whole neriod

	period								
Bank	Industry and mine	Tuse'e Saderat	Saderat	Tejarat	Mellat	Melli	Maskan		
2008	12	1		6					
2009	1		10		29	18	24		
1 6 1									

Source: research findings

Introducing econometrics model

This phase is continuation of the first phase and the obtained technical efficiency in the first phase for each bank is inserted in the model as dependent variable. Then environmental variables such as inflation rate, unemployment rate and GDP amount are inserted in the model as independent variables. After estimating the model through panel data the following model is exploited: Efficiency= 0.94 +6.08E-06 GDP- 0.227 Unemployment - 0.038 Inflation

The obtained model induces that the highest negative impact on technical efficiency of banks is related to inflation rate and unemployment rate that are indexes of economic stagnation. If they are increased, technical efficiency of banks is decreased.

Analysis of the model's findings

Model estimation has been conducted through panel data method according to table (4) and independent variables are illustrated in variable column where gross domestic product (GDP), unemployment rate and inflation rate could be observed.

Table 4- results of model estimation							
Variable	Coefficient	Std. Error	t-Statistic	Prob			
GDP	6.08E-06	1.22E-06	4.993975	0.0000			
Unemployment	-0.227152	0.070861	-3.205589	0.0028			
Inflation	-0.038224	0.013163	-2.903835	0.0063			
С	0.943138	0.572732	1.646735	0.1083			

Source: research findings

Coefficients have been estimated in coefficient column. Whatever this coefficient is closer to zero it shows irrelevancy of coefficient and its weak impact on dependent variable of the model. Coefficient 6.08E-06has been obtained in the model for GDP and indicates that banks' efficiency is enhanced by increasing of GDP. In other words, by one unit increase in GDP technical efficiency affected by this variable is increased equal to 6.08E-06 units.

Increased efficiency of banks due to increased gross domestic product is interpreted in the way that gross domestic product growth means increased growth, consumption, investment, creating valueadded and totally increased economic activity in different sectors and it could have a positive impact in competitiveness capability and increased efficiency. Under such conditions demand for receiving facilities from banks by manufacturers and traders is increased. To put it differently, increasing of the above factors that is led to gross domestic product growth increases investment demand. As banks supply such capital granting facilities in the form of different contracts is increased. Given to the market status under economic prosperity conditions manufacturers offer their products to the market and sell them. Thus manufacturers and traders who embark upon exports and imports would be able to pay back installments of facilities they have received. This means timely return of bank resources along with its profit. The above issues are true about deposits too. If gross domestic product is increased, saving of the society would be increased due to income increase. In fact circular flow of gross domestic product and saving is completed that increasing of one increases the other.

When saving is increased it means increasing of bank's resources that are in the form of deposit such as term deposits, loan saving and current accounts. Increasing of bank resources because of customers' deposit from one side and repayment of principal and interest that are paid to investors in the form of facilities from the other side reinforce bank outputs. Increased gross domestic product means moving of the economy from stagnation towards economic prosperity. Economic prosperity is one of the major reasons to increase banks' efficiency. Increased economic prosperity means increased export and import indexes and international trade of countries. Any exporter or importer who conducts business in the current world exchanges commercial papers through banks to accelerate and increase coefficient of safety. Banks receive commission in lieu of such services they offer to customers. Increased commercial trade means increased commission of bank services received from customers by banks. Therefore, one ofthe profitability resources of banks is reinforced. The above-mentioned issues reveal increased gross domestic product that is led to economic prosperity is in the interests of banks and enhances banks' efficiency.

Coefficient of unemployment rate is equal to -0.227 which means reverse impact of unemployment rate on technical efficiency of banks, that is technical efficiency of banks is decreased by increasing of unemployment rate, i.e. intensification of economic stagnation. At the same time, decreasing of banks' technical efficiency as dependent variable is equal to 0.227 units in lieu of one unit increase in unemployment rate. Increasing of unemployment rate is the result of stagnation dominance in the economy and reverse of the previous state is occurred. Thus manufacturers and traders who have received facilities from banks are not able to pay back loan installments, so banks' overdue claims are increased. Unlike the previous state when there is economic stagnation one of the parameters that is increased is unemployment rate which is occurred due to decreased capacity or closing down of service-productive and commercial firms. When a firm is established with any nature it often enjoys banks' facilities in the form of developmental or complementary plans and the borrowed resources are returned after exploiting the economic unit based on bank's agreement with the applicant. Now if there is economic stagnation in the market at this time with consequences including decreased demand for products and services, tax pressures, increased inventory for manufacturing units, increased vulnerability, decreased profitability and increased worker adjustments returning loan installments is encountered with problem and capability of firms is decreased to return bank resources. Banks' profitability in this state is endangered in addition to the point that their principle is not returned completely by customers. On the other side, economic stagnation decreases activities in commercial affairs. Also international transactions in the form of export and import would be decreased considerably. The bank would suffer a loss in this state. When there is increased unemployment rate as the result of economic stagnation banks' overdue claims are increasing in addition that their profitability is reduced. Overdue claims means confinement of bank resources and limitation in applying such resources in cash flows. Claims increase in economy that is one of the consequences of economic stagnation would be led to decreasing of banks' efficiency as well as decreased profit and real value of money because of inflation besides that facilities are not paid back. This enhances opportunity cost of such resources. Above issues indicate decreased production, increased unemployment, decreased efficiency and operational power of banks and reinforcing durability of stagnation in economy. Claims increase in banks has a lot of disadvantages and excessive increasing of it would lock the economy and enhance the risk of granting facilities for banks. This causes more strictness of banks in granting facilities in the form of various contracts to their customers. Therefore overdue claims are one of the important and effective factors on banks' efficiency changes that is affected by environmental changes too.

Coefficient -0.038 for inflation rate indicates that technical efficiency is decreased 0.038 units by increasing of one unit of inflation rate. If inflation rate is high, the borrower is winner and the lender is loser. It means that real value of money is permanently reduced. Inflation rate is permanently calculated and announced by the Central Bank in monthly, seasonal and annual form and is the basis of calculations in different economic sectors including banks.

High inflation rate means losing value for money. So whatever the inflation rate is higher, real value of deposits that people have deposited with banks for investment is decreased. Such decreased value for depositors and their original owners is compensated by allocating different profit rates based

on deposit type but it is not compensated for the bank, because always a percentage of bank resources could not be operated because of several reasons such as legal storage in the Central Bank, precautionary storage of overdue claims and inter-bank accounts, thus they would have decrease in value. The more the inflation rate is, the more the loss of deposits' real value for the bank would be and this is resulted in decreased profitability of banks. Increasing of inflation rate would create problems for banking system. The above issues confirm that banks' efficiency is decreased by increased inflation rate.

In the next column of software output in table (4) *Std. Error* means standard error of estimators (SE) that it's square is VAR. Because variance has been dispersion standard and reliability in estimators whatever this amount is higher reliability to it is lower. According to definition and given to the obtained coefficients for independent variables these coefficients have a high reliability. In other words, they are highly related to the model. The obtained coefficients for all variables are very small in terms of amount and it is possible to rely on the obtained results, so they confirm expressions obtained in previous sections from these variables.

Absolute value of coefficients in t-statistic column that shows H0=0 is larger than 2, so it indicates that its coefficients have much relation with the model. In this section impact of all independent variables on efficiency is confirmed.

Column Prob shows percentage of probability of type I error and it shows the possibility that obtained coefficients are irrelevant and we perceive them as effective and relevant. As it is observed, Prob=0 was obtained for all variables in this column which means lack of any type I error and illustrates high significance of model variables. Results of this column in studies and econometrics models are very important. This column with an amount less than 5% means there is no type I error in calculations. Amount Prob=0 indicates high precision of estimation. Indeed results of this column persuade the researcher about research results more than ever.

The above-mentioned analyses are related only to each variable. In addition to considering each variable, the researcher should consider suitable goodness of model for more confidence about research results. Table 4-10 shows variables which determine suitable goodness of the model.

R.squared	0.421566	Mean dependent var	2.453642
Adjusted R.squared	0.373363	S.D.dependent var	1.151182
S.E.of regression	1.054093	Sum squared resid	40.00000
Durbin.Watson stat	1.935484	F-statistic	8.745659
		Prob(F-statistic)	0.000173

 Table 5- results of model estimation

Source: research findings

R squared or R^2 is equal to 0.42. It is clear that whatever $\sum E^2$ is lower, in other words if error term of the model is smaller, R^2 is larger and goodness of the model is better. But low amount of R^2 in this model doesn't indicate unsuitable goodness rather it is because of low range of efficiency changes in distance 0 and 1. Thus, low R^2 in this section due to low range of efficiency changes doesn't create any problem in the model (Mohammadi et al, 1994).

Standard error of regression shows closeness to regression line and whatever it is lower it shows suitable goodness of model and its closeness to regression line. In this state it is an acceptable amount of suitable goodness that is equal to 1.05 and indicates closeness of the estimated model to regression line.

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