Efficiency of Banks in Iran: Semi-Parametric Approach

Ghodratollah Emamverdi¹ (Ph.D.), Barzan Ahmadi², Mona Moosapour³, Raheleh Hezbe Elahi⁴

¹Assistant Professor of Economics, Islamic Azad University, Central Tehran Branch
²M.A of Planning Economic Systems
³Student M.A. of Planning Economic Systems
⁴M.A Student of Planning Economic Systems

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 would give a very precise analysis by calculating technical efficiency in terms of efficiency amounts resulting from scale and efficiency resulting from management. This is conducted in formulation of Dual problem in linear programming by assuming constant return scale and adding limitation (convexity constraint) of calculations by assuming variable return scale.

*Corresponding Author: Ghodratollah Emamverdi Assistant Professor of Economics, Islamic Azad University, Central Tehran Branch, ghemamverdi@gmail.com
- $\beta Y + Y \lambda \geq 0$
- $X + X \lambda \geq 0$
- $N\beta \lambda_i = 1$
- $\lambda \geq 0$

Where $1 \leq \beta \leq \infty$ and $\beta_i$ is relative increase in the product amount of $i$th 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. $\lambda_i$ is $N*1$ vector including constants that show weights of the reference set. $\lambda_i$ 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.

<table>
<thead>
<tr>
<th>Title</th>
<th>Melli</th>
<th>Melat</th>
<th>Tejarat</th>
<th>Sepah</th>
<th>Saderat</th>
<th>Refah</th>
<th>Tuse-e Saderat</th>
<th>Industry and mine</th>
<th>Keshavarzi</th>
<th>Maskan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposits growth</td>
<td>94%</td>
<td>145%</td>
<td>158%</td>
<td>87%</td>
<td>137%</td>
<td>84%</td>
<td>84%</td>
<td>235%</td>
<td>107%</td>
<td>136%</td>
</tr>
<tr>
<td>Growth of the granted facilities</td>
<td>125%</td>
<td>148%</td>
<td>143%</td>
<td>179%</td>
<td>126%</td>
<td>86%</td>
<td>567%</td>
<td>332%</td>
<td>138%</td>
<td>242%</td>
</tr>
<tr>
<td>Profit growth</td>
<td>540%</td>
<td>116%</td>
<td>39%</td>
<td>-7%</td>
<td>224%</td>
<td>-63%</td>
<td>222%</td>
<td>206%</td>
<td>152%</td>
<td>394%</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tuse-e Saderat</td>
<td>Tuse-e Saderat</td>
<td>Tuse-e Saderat</td>
<td>Tuse-e Saderat</td>
<td>Maskan</td>
</tr>
<tr>
<td></td>
<td>Industry and mine</td>
<td>Industry and mine</td>
<td>Industry and mine</td>
<td>Industry and mine</td>
<td>Industry and mine</td>
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<td>------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>----</td>
<td>Tejarat</td>
<td>Saderat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>Tejarat</td>
<td></td>
<td>Melat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>Melli</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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).
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 period

<table>
<thead>
<tr>
<th>Bank</th>
<th>Industry and mine Tuse’e Saderat Saderat Tejarat Mellat Melli Maskan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>12 1 ----- 6 ----- ---- ---- ----</td>
</tr>
<tr>
<td>2009</td>
<td>1 ----- 10 ---- 29 18 24</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>6.08E-06</td>
<td>1.22E-06</td>
<td>4.993975</td>
<td>0.0000</td>
</tr>
<tr>
<td>Unemployment</td>
<td>-0.227152</td>
<td>0.070861</td>
<td>-3.205589</td>
<td>0.0028</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.038224</td>
<td>0.013163</td>
<td>-2.903835</td>
<td>0.0063</td>
</tr>
<tr>
<td>C</td>
<td>0.943138</td>
<td>0.572732</td>
<td>1.646735</td>
<td>0.1083</td>
</tr>
</tbody>
</table>

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-06 has 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 value-added 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 of the 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.

Table 5- results of model estimation

<table>
<thead>
<tr>
<th>R.squared</th>
<th>Mean dependent var</th>
<th>Durbin.Watson stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.421566</td>
<td>0.373363</td>
<td>1.935484</td>
</tr>
<tr>
<td>Adjusted R.squared</td>
<td>S.D.dependent var</td>
<td>Sum squared resid</td>
</tr>
<tr>
<td>0.373363</td>
<td>1.054093</td>
<td>1.151182</td>
</tr>
<tr>
<td>S.E.of regression</td>
<td>Prob(F-statistic)</td>
<td>8.745659</td>
</tr>
</tbody>
</table>

Source: research findings

R squared or R² 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, R² is larger and goodness of the model is better. But low amount of R² 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 R² 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.

REFERENCES

Abirshami, Hamid, Mehr Ara, Mohsen and Ajorlu, Maryam. (2009). "Studying Cost Efficiency in


Alirezaee, Mohammad Reza, Afsarian, Mohsen and Taslimi, Vahid.(2008). "Representing Rational
Strategies of Improving Performance of Bank Branches by Generalized Models of Data
Envelopment Analysis“. Economic Researches Quarterly, No.27.

through DEA method "M.A thesis of Allame Tabatabaee University.

Analysis”. IMF Working Paper,WP/05/49.


Hollo, Daniel and Nagy, Marton. (2004), "Bank Efficiency in Enlarged European Union".


Hauner, D and Peiris, SH. (2005), "Bank Efficiency and Competition in Low-Income Countries: The Case of Uganda". IMF Working Paper, African Department, WP/05/240.


http://www.agri-bank.com/Static/About/AtaGlance.asp.
http://www.bankmaskan.ir/homepage.aspx?TabId=5118&&Site=douran portal&Lang=fa-IR
Ranjbar, Homayoun, Sameti, Morteza, Aghaei, Kiumarth and Bajoghli, Shadi. (2007). "Estimation of Border Cost Function and Measuring Efficiency of Central Banks, case study of Iran and the selected countries".