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BANK INDUSTRY PRODUCTIVITY, IS SANCTIONS HAS BEEN CHANGED TO OPPORTUNITY?

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ABSTRACT

Start banking sanctions in the 2006, is should be noted that what is the sanctions effect on bank industry productivity in Iran? In the present study we analyze the bank industry for responding to this question, therefore we present a combinational method data envelopment analysis (DEA) method and Tornquist efficiency index which more over to measuring the total factor productivity efficacy's growth (TFP), will measure the performance changes and technological changes in the TFP growth through time and by presence of just one decision unit as the bank industry since 2004 till 2014. Finally the conclusion is that bank industry is not efficient in practice and sanction even led to more inefficiency and more productivity decreasing. Bank industry couldn't use from the sanctions opportunities.

JEL Classification: $H_{21}, C_{61}, C_{02}, C_{14}, C_{43}$

KEYWORDS: Productivity, Data Envelopment Analysis (DEA), Analytical Hierarchy Process, Iran's Bank Industry, Tornquist Index, Efficiency

INTRODUCTION

Banks also are considered as one of the most important economic institutions and strong foundations for financial system of each and every economy, especially in Iran with underdeveloped and shallow financial markets. Attracting peoples' dispersed deposits, banks could supply and mobilize financial sources of Iran's economic development. Should the banks be productivity in attracting, allocating and flowing people dispersed deposits, they could prepare the ground for economic growth; otherwise they not only could not provide for economic development, but also would create crisis. Start banking sanctions by the Treasury Department America, with the designation of Bank Sepah, in the 2006, issued a Security Council Resolution 1747 and a few months later by the Europe Union sanctions began. After Bank Sepah, Melli Bank and Saderat Bank were put on the list of sanctions. The most important part of banking sanctions against the central bank's sanctions, on 31 December 2011, sanctions against Iran's central bank began. Is should be noted that what is the sanctions effect on bank industry productivity in Iran?

Imposition of sanctions on the country's bank industry can be studied from two directions and can be calculated. Firstly, the direct effect of sanctions on the bank industry has caused to limit relationship with foreign banks and restrictions in relation to foreign companies and secondly, the indirect effect of sanctions on the bank industry is through pressure on macroeconomic variables and influence of these variables on bank industry. Variables such as imports, exports, exchange rate, inflation rate and the impact on GDP. Greater reliance on domestic bank increase the risk of the

bank industry in the country and Bank companies can overcome this problem by increasing the capacity of bank and risk transfer. Bank has a significant role in improving the economy's vigor and bank institutions to provide and ensure a large investment in the community and with their development, financial facilities in the economy is one of the growth and development factors of the entire country's economy. The bank industry is attracting deposit and then invests and facility them efficiently, which can provide a platform for economic growth. The point is that deposit and facility of bank companies cannot guide us to achieve the desired goals in the bank industry. So the question is always about the performance of the bank industry that to what extent of productivity does the bank industry work?

The bank industry can provide a suitable platform for growth and economic development by attracting received deposit and to unsheathe the monetary resources collected efficiently and to invest them. Development and efficient operation of bank coincide with the country's economic development and restoration of the country's economic situation, increasing exchanges, promoting the quality of life and developing investments helps to progress bank in the country and maintains the national wealth and create big savings.

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The first step to improve the productivity of the bank industry is to identify the current situation which is the aim of this study. So in this paper, we try to calculate the entire productivity of the bank industry before and after the sanctions and the reasons for being productivity or not, are obvious too. At the end of this study we can answer to questions such as whether the bank industry is productivity. Have we used sanctions as an opportunity? To calculate the efficiency is used the parametric techniques of data envelopment analysis (DEA) and productivity index of Tornquist. Therefore in this study, we examine the following hypotheses:

- Bank industry of the country is not productivity.
- Sanctions of bank industry are leading to increased productivity.

PRODUCTIVITY

The conceptualization and discussions on productivity with Title efficiency were systematically heralded by the studies conducted by Debro and Koopmans followed Farrell (1957). The practicality of them measurement of efficiency, based on the SFA approach, dates bank to 1997, and in the DEA linear programming method, to 1978. Efficiency, for Farrell. Is the extent of access an enterprise may have to the maximum production obtained via a combination of different inputs. Efficiency is achieved by the ratio between the current production, in an enterprise, and its potential capacity top the ratio between the current production, in an enterprise, and its potential capacity to produce. The ratio between the current output and potential output. Productivity & Efficiency is achieved through measuring the ratio of current output to standard output. (Abatahi & Kazemi, 1996), (Balk, 2001), (Alirezaee, 2003)

Though there exist many studies on banking in transition nations, such as Croatia (Kraft and Tirtiroglu, 1998); (Jemric and Vujcic, 2002), the Czech Republic (Matousek and Taci, 2002) (Weill, 2003), Hungary (Hasan and Marton, 2003), and Poland (Nikiel and Opiela, 2002); (Weill, 2003).

For example: Burger and Moormann (2008) discuss the difficulties in measuring productivity in banks and

criticize the inadequate usage of the CIR. In order to derive an approximation of a bank's productivity an adjusted CIR measure is proposed. The elimination of unwanted effects is conducted in a pragmatic way and is based on publicly available data. This approach is illustrated using large European stock exchange-listed banks as an example. Furthermore, new opportunities for measuring the banks' productivity are outlined on the basis of introducing efficiency measurements on a process level. However, these ratios can be interpreted more correctly as measuring the banks' efficiency target rather than directly measuring their productivity. Nonetheless, such measures of efficiency are the most commonly-examined indicators of productivity in banking.

Casu et al (2016) compares parametric and non-parametric estimates of productivity change in European banking between 1994 and 2000. Productivity growth has also been further decomposed into technological change, or change in best practice, and efficiency change. Both the parametric and non-parametric approaches consistently identify those systems that have benefited most (and least) from productivity change during the 1990's. The results also suggest that (where found) productivity growth has mainly been brought about by improvements in the performance of best practice banks and there does not appear to have been 'catch-up' by non best-practice institutions. Competing methodologies sometimes identify conflicting findings for the sources of productivity for individual years. However, the two approaches generally do not yield markedly different results in terms of identifying the broad trends in the level and sources of productivity growth in European banking during the 1990's.

According to Burger and Moormann (2008) , Concepts of efficiency relate to how well a bank employs its resources relative to the existing production possibilities frontier (or, in other words, relative to current 'best practice') – how an institution simultaneously minimizes costs and maximizes revenue, based on an existing level of production technology. The analysis of bank efficiency, therefore, relies on intra-sector comparisons, involves both technological and relative pricing aspects, and has partial indicator value for analyzing productivity performance. The concept of productivity, on the other hand, refers to the performance of the sector as a whole and effectively combines changes in efficiency and technological advances in an average measure. Figure 1 organizes aspects of efficiency measures in order to gain a perspective on banks' productivity.

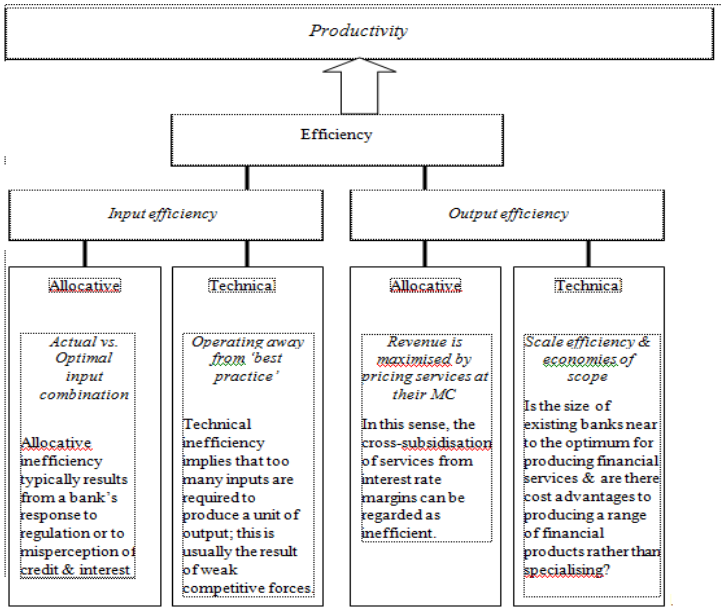

Figure 1: Organizes Aspects of Efficiency Measures

PRODUCTIVITY CALCULATION METHODS

Productivity is known as the combination of two elements: Efficiency and Effectiveness (Productivity=Efficiency + Effectiveness). Productivity growth calculation methods include methods of measuring productivity, using input – output, value added index, Kendrick index, Elementary index, Malmquist Index, Tornquist index.

TORNQUIST INDEX

Malmquist index cannot be used in the single-agent firm. So it is made a new index called Tornquist index with the help of Malmquist index to make it possible to calculate the efficiency of one single decision maker unit. Therefore, in this study we use Tornquist index which is designed by Malmquist index. The index is calculated as follows for a single decision maker unit.

- Total factor productivity Change Index (TFPCH)
- Technical change Index (ECHCH)
- Efficiency Change Index (EFFCH)
- Scale Efficiency change Index (SECH)
- Pure Efficiency change Index (PECH)

Which the index of efficiency changes is achieved by multiplying the index of scale efficiency and management efficiency and total factor productivity Change Index and is obtained by multiplying Technical change Index.

The Performance of computing productivity growth in the bank industry in country using Tornquist Index and DEA Method

Given the shortage of Statistics and information (Low duration), we examine the productivity growth assuming constant returns to consider the efficiency of the bank industry.

- First, we examine the outputs and inputs of bank industry for the model and given the outlook for the bank industry, we consider goals as output..
- Each year, we assume an equivalent to a firm then suppose we have j firms that each of which contains n input and m outputs. Matrix n*j of inputs is shown by X and matrix m*j of outputs by Y as well as input and output vectors Xi and Yi represent the i th firm. So, the output model of shaft and yield to the constant scale is considered as equation (1).

$$(EFF_p =) Maxz = \frac{U^T Y_p}{W^T Y_p}$$

$$S.T:$$

$$U^T Y_i - W^T X_i \le 0$$

$$W^T X_p = 1$$

$$W \ge \varepsilon, U \ge \varepsilon \qquad (1)$$

Where U and W are weighted vectors of input and output variables respectively. The proposed model for any firms that P = 1, 2... J once run-up to the efficiency of the p-th unit of the objective function value is obtained.

3. Using DEA model and partial capture of income and expenses are estimated elasticity's of input and output shaft. The affinity of input shaft according the formula of $ex_{ip}=\frac{r_{ip}x_{ip}}{\sum_i r_{ip}x_{ip}}, \sum_i ex_{ip}=1$ and the elasticity of output shaft using the formula of $ey_{ip}=\frac{q_{ip}y_{ip}}{\sum_i q_{ip}y_{ip}}, \sum_i ey_{ip}=1$ are measured.

- We assume the data of bank industry during j year include n input and m output. It is assumed that it contains the input vector $X^K=(x_1^k,x_2^k,...,x_n^k)$ and Output vector $Y^k=(y_1^k,y_2^k,...,y_m^k)$ in K-th year and comprises

The input vector $X^K=(x_1^k,x_2^k,...,x_n^k)$ and output vector $Y^{K+1}=(y_1^{k+1},y_2^{k+1},...,y_m^{k+1})$ in the K + 1 th year. Therefore, if the bank industry situation is considered as a firm each year and DEA model is considered with constant returns to scale and output shaft, the following input and output Tornquist index are used.

Tornquist of input shaft of $TQ_x=\prod_{i=1}^{n}(\frac{x_i^{k+1}}{x_i^k})^{ex_i}, \sum_i ex_i=1$: Where the geometric mean is $ex_i^{k+1}=\frac{r_i^{k+1}x_i}{\sum_i r_i^{k+1}x_{ii}}$, $ex_i^k=\frac{r_i^k x_i}{\sum_i r_i^k x_{ii}}$.

Tornquist of output shaft of $TQ_y=\prod_{i=1}^{m}(\frac{y_i^{k+1}}{y_i^k})^{ey_i}, \sum_i ey_i=1$: Where the geometric mean is $ey_i^{k+1}=\frac{q_i^{k+1}y_i}{\sum_i q_i^{k+1}y_{ii}}$, $ex_i^k=\frac{q_i^k y_i}{\sum_i q_i^k y_{ii}}$.

- Total factor productivity growth during the transition from year k to year k + 1, is obtained by the output shaft Tornquist division on the input shaft Tornquist according to equation (2).

$$TFPG_{k,k+1}=\frac{TQ_y}{TQ_x} \quad (2)$$

- Changes in efficiency during the transition from year k to year k+1 is obtained by efficiency division of year k+1 on the efficiency division of year k according (3).

$$EC_{k,k+1}=\frac{EFF_{k+1}}{EFF_k} \quad (3)$$

- Technology changes by dividing the total factor productivity growth on efficiency changes is obtained according to equation 4.

$$TC_{K,K+1} = \frac{TFPG_{K,K+1}}{EC_{K,K+1}} \tag{4}$$

Now, we will explain:

Inputs and Outputs of the Bank

The nature of the inputs and outputs of each economic unit including bank depends on how define expectations and economic unit. By changing our definition of the bank, the bank will also change the nature of the inputs and outputs.

In view of manufacturing and services to banks, banks are like service firms. Bank services are such as holding deposits and providing the output of the bank and bank capital facility, bank input.

In view of the interfaces to the bank, the bank is an intermediary firm. Bank input is amount of deposits, labor and capital, and bank outputs, and its granted facilities.

In view of the bank's risk management, all assets and liabilities of its collapsed banks in terms of risk sources and facilities provided is bank output and facilities investment bank, bank output (asayesh et al, 2015).

So Data and Statistics in this paper are:

Output Variable: deposits and facilities as output variables.

Input Variables: Human resources, fixed assets are costs of collecting deposit as inputs and inputs variables of industry. GDP growth used for the effect of sanctions

Performance Computing and Productivity Growth

Since the number of years is low, Performance in condition of variable returns has deviation. For this purpose, the result of the technical efficiency with assumptions of constant return (That is equal to administrative efficiency) is investigated by WIN4Deap Software. The Investigation is since 2003 to 2014 that 2005 and 2010 are the two most efficient years. Among these two years, 2010, 11 times And 2004, three times used for a total of reference. Therefore2010 is more efficient than 2005.

Now to study Total factor productivity growth elasticity's, it was calculated by the DEA model. We assume that n years of bank industry are existence. Consider a model with constant Scale. Suppose that the objective function row, in calculation model of efficiency for *p* year of the bank industry is according to equation (5):

$$EFF_p = \frac{\sum_j q_{jp} y_{jp}}{\sum_i r_{ip} x_{ip}} = \frac{TR_p}{TC_p} \tag{5}$$

Which EFF is *p* unit that shows the relationship between total costs and total income? Therefore we have equation (6):

$$(TR_p = EFF_p * (TC_p) \tag{6}$$

So the elasticity of i in total income is calculated according to equation below:

$$TR_p = EFF_p * \sum_i r_{ip} x_{ip}$$
$$\frac{\partial TR_p}{\partial x_{ip}} = EFF_p * r_{ip} \tag{7}$$
$$ex_{ip} = \frac{\partial TR_p}{\partial x_{ip}} * \frac{x_{ip}}{TR_p} = EFF_p * r_{ip} * \frac{x_{ip}}{EFF_p * \sum_i r_{ip} x_{ip}} = \frac{r_{ip} x_{ip}}{\sum_i r_{ip} x_{ip}}$$

$$ex_{ip} = \frac{r_{ip} x_{ip}}{\sum_i r_{ip} x_{ip}}, \sum_i ex_{ip} = 1$$

The elasticity of output j in total is according to (8):

$$(TR_p = EFF_p * (TC_p) \tag{8}$$

$$\sum_j q_{jp} y_{jp} = EFF_p * TC_p$$
$$\frac{\partial TC_p}{\partial y_{jp}} = \frac{q_{jp}}{EFF_p}$$

$$ey_{jp} = \frac{\partial TC_p}{\partial y_{jp}} * \frac{y_{jp}}{TC_p} = \frac{q_{jp}}{EFF_p} * \frac{y_{jp}}{(\frac{\sum_j q_{jp} y_{jp}}{EFF_p})} = \frac{q_{jp} y_{jp}}{\sum_i q_{jp} y_{jp}}$$

$$ey_{jp} = \frac{q_{jp} y_{jp}}{\sum_i q_{jp} y_{jp}}, \sum_j ey_{jp} = 1$$

The Tornquist indicators of output t and input shaft which reflects the change in output and calculate factors during the two years that the results show in Table 1.

Table 1: Tornquist Input and Output Indicators in 2003-2013

Year	Tornquist Output Shaft	Tornquist Input Shaft
2004	1.111	1.029
2005	1.081	1.009
2006	1.040	1.079
2007	1.040	1.039
2008	1.151	1.009
2009	1.081	1.049
2010	1.232	1.139
2011	1.101	1.019

Table 1 Continue……		
2012	1.040	1.079
2013	1.040	1.039
2014	1.030	1.169

Since the growth of total factor productivity by dividing the 2 Tornquist output based on the input shaft, Productivity growth numbers obtained in the table 2

Table 2: The Growth of Total Factor Productivity in 2003-2013

Year	Total Productivity Growth
2004	1.07972
2005	1.071071
2006	0.964205
2007	1.00129
2008	1.141141
2009	1.030268
2010	1.081959
2011	1.080394
2012	0.964205
2013	1.00129
2014	0.881394

Changes in performance efficiency are gained by dividing two of the DEA in a year .the result show in table 3.

Table 3: Changes in Performance Efficiency

Year	Efficiency Changes
2004	1.02897
2005	1.00899
2006	1.07892
2007	1.03896
2008	1.00899
2009	1.04895
2010	1.13886
2011	1.01898
2012	1.07892
2013	1.03896
2014	1.16883

By dividing the productivity growth on growth performance, obtained technology changes due to the table 4.

Table 4: Changes Caused by Technology in 2003-2013

Year	Technology Changes
2004	1.049322
2005	1.061528
2006	0.893676
2007	0.963742
2008	1.130974
2009	0.98219
2010	0.950037
2011	1.06027
2012	0.893676
2013	0.963742
2014	0.754082

By DEA and Tornquist indicators, the total factor productivity growth of the bank industry in 2003 to 2014, and

were divided to changes in technical efficiency and technological change. However it should be noted that TC>1, Then mentioned unit during a period (two years) have been technological advances and when TC <1 this is reversed. And EC>1, Then mentioned unit during a period (two years) has increased efficiency and whenever EC <1 efficiency decreased. Total factor productivity growth over a mean period (two years) and less, show negative total productivity growth.

According to Table 2, the highest TFP growth is in 2008. In the 2006and 2007 changes in performance, changes in technology and total factor productivity growth has been negative. Also sanctions despite the possibility of establishing private bank led to negative growth.

CONCLUSIONS

One of the popular indicators in calculation total factor productivity growth by using the techniques of non-parametric DEA is Malmquist productivity indicator. This indicator if the data contains a single decision-maker in each period, can calculate the TFP growth units under investigated and separate the results by changes in efficiency and technology. But in many situations there is only one unit under review that in this case the problem of calculating efficiency by Tornquist Productivity and non-parametric models DEA resolved.

Focus on inputs and outputs show that organizations are most efficient in 2010 and 2009. In other years, the bank industry to improve must increase and reduced. In general, the results show that in most years the cost of inputs, assets and surplus of deposit has been rejected While the aim of expanding regional and international cooperation (international scope) and expand bank coverage and competition (the firms) are not provided with good facilities.

Calculation of productivity growth in the bank industry shows that Efficiency change and technological change has been irregular process and has experienced negative growth during the period of sanctions.

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