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Bank branches efficiency evaluation: The three -stage bootstrap DEA approach

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EXTENDED ABSTRACT

INTRODUCTION

Considering that the existence of a performance appraisal system in different dimensions of organizations and in decision-making units in general, is very important and the lack of a proper performance appraisal system to evaluate the performance of decision-making units in the use of available resources and facilities will have negative consequences for them, it is necessary for different organizations to develop an efficient evaluation system in order to evaluate and improve their performance. Also, considering that in general, efficiency is a criterion for evaluating the performance of a decision-making unit and generally expresses how a decision-making unit uses the resources at its disposal to produce the highest level of output, the performance of different decision-making units can be evaluated by calculating theirefficiency. Therefore, considering the vital role of banking system in the economic development of ourcountry and the effect ofbanks' branches performance on the overall performance of banks, in this study, considering the nature of banks' branches perfomance, the operational process in the investigated branches have been divided to three stages.Then the performance of each branch has been evaluated based oni these three stages. The first part of bank branches work process is related to how they use resources such as manpower, equipment and space of the branch to collect deposits, and the efficiency calculated at this stage is called operational

efficiency. In the second part, their performance in converting the collected deposits into bank facilities has been evaluated, and the performance calculated in this section has been named as accreditation efficiency. In the third part, the efficiency related to how theymake profit from the granted facilities is calculated, which is named as the profitability efficiency.

Because banks' products and their branches include multiple inputs and outputs, many studies on bank performance have used data envelopment analysis to evaluate the performance of these units (Kong et al., 2017). The main application of data envelopment analysis method is based on its ability to identify inefficient units.This enables the bank management to take action to eliminate inefficiency by reallocating resources at its disposal. But there is one major drawback to this method, and that is full-performance units that are actually on the performance frontier are only more efficient than the other units present in the sample under study. In other words, there may be branches outside the sample under study that perform better than branches on the performance frontier and are able to produce a certain level of output using less input. This structural flaw may lead to bias in the results of data envelopment analysis method (Aggelopoulos & Georgopoulos., 2017). In this research, an attempt has been made to eliminate this shortcoming by using bootstrap method and to correct the bias of the results obtained by applying envelope analysis method, which has been used to calculate the efficiency of bank branches in this research.

The results of this study shows that the average efficiency of the studied branches in stage one is more than stages two and three and the lowest level of efficiency is related to profitability efficiency. Also, none of the studied branches have been able to have full performance in all three stages. It is necessary to differentiate between the performance of branches that are on the edge of efficiency in terms of standard data envelopment analysis method, but their levels of performance are different.

METHODOLOGY

In this study, a slack-based measure model, which is one of the main models of data envelopment analysis method, has been used to calculate the efficiency of the studied bank branches. This also has the ability to consider the negative impact of adverse inputs and outputs. . This model is one of the data envelopment analysis models that uses auxiliary variables (surplus inputs and lack of outputs) and provides a scalar size for performance score.

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Also, because the working process of bank branches include different sub-processes, it is necessary to separate the operational process of branches into several stages and evaluate the efficiency of each stage and the overall efficiency of the branches. Therefore, in this research, branch operations have been divided into three levels, under the headings of "operational efficiency", "accreditation efficiency" and "profitability efficiency". In the first stage, the ability of the studied branches to attract deposits using the resources at their disposal has been measured; Therefore, variables "personnel and administrative costs", "depreciation costs" and "rent costs" of the branches are considered as input in the first stage and variable "volume of deposits" as output. In the second stage, the performance of the studied branches in terms of accreditation is evaluated, in which variable "Volume of deposits" as input and variables "Deferred loans" and "Non-deferred loans" as output are used. In the third stage, in order to evaluate the profitability of the studied branches, in addition to output variables of the second stage, variable "Volume of guarantees" is used as an input variable and variables "Profit and obligation of facilities" and "Fee of guarantees"are used as output variable. A noteworthy point in the development of the three-stage model is that in the process of determining appropriate inputs and outputs to calculate efficiency and applying the optimization modelfor calculating efficiency, considering the negative impact of undesirable variables such as "deferred loans" on a branch performance is really vital. It is obvious that not separating favorable variables from unfavorable ones will cause an increase in the production of desirable outputs and the efficiency of the studied branches will be calculated more than the actual value. Therefore, in this research, a measurement model based on auxiliary variables has been used to calculate the efficiency.It has been optimized to consider the negative impact of undesirable input and output variables. Finally, after calculating the efficiency of branches in each stage, the overall efficiency of each branch is calculated using simultaneous optimization method. But a more important flaw in standard envelopment analysis method is how to determine the efficiency boundary . As a limited sample of a large community is selected and the performance boundary is determined according to this sample, there might be a branch outside the sample that has more output with the same number of inputs as branches on the performance boundary, and this calls into question the validity of the performance boundary determined by standard envelopment analysis method. Therefore, in this research, to solve these problems, using Bootstrap method and SW algorithm, 2000 simulated branches have been generated for each

main branch, and by comparing the average experimental distribution of the simulated branches with the main branch, The amount of skewness of results obtained from the standard model is calculated.

FINDINGS

The results of this study show that at the third stage ("profitability efficiency"), due to large volume of non-performing loans (which are considered as undesirable inputs) or due to low volume of interest received on facilities and/ Or for both reasons, the efficiency of branches under review is lower than the other two stages. Also, none of the studied branches have been able to be efficient in all three stages. Furthermore, by comparing overall efficiency scores and modified overall efficiency scores, it can be seen that by modifying overall performance scores obtained from data envelopment analysis method, the overall efficiency of all branches is examined at a lower level. It should be noted that efficient branches are those whose efficiency is equal to one in terms of standard data envelopment analysis method, and if a branch with the highest modified efficiency is considered as an efficient branch, it means that bootstrap method is accepted as a method for ranking branches in terms of performance, while bootstrap method is not a valid method for ranking and only corrects the bias of standard data envelopment analysis method results.

The results also showed that the efficiency of two or more branches in terms of standard data envelopment analysis method may be equal to one and these branches are on the edge of efficiency but their levels of performance are different. This indicates that bootstrap method, is both able to correct the bias of standard envelopment analysis method results, and differentiate between the performance of branches that are on the edge of efficiency in terms of standard data envelopment analysis method but have different levels of performance.

CONCLUSION

According to the results of this study, none of the studied branches have been able to be efficient in all three levels and the lowest level of efficiency, among the three levels, is related to profitability efficiency. One of the policy recommendations to increase the efficiency of branches is that due to low efficiency scores in the third level (profitability efficiency), banks need to strengthen the credit and accreditation system of customers. This has a direct

impact on reducing the volume of overdue loans. It should be noted that high volume of overdue loans, as an unfavorable output, reduces both efficiency scores in the second level (credit efficiency) compared to the first level and the desired output in the third level by reducing interest received fromloans. , however unfavorable inflows (deferred loans) increase. Since the results of standard envelopment analysis method is skewed due to studying a limited sample and insufficient knowledge of the statistical community features, in this study we tried to use bootstrap method to approximately modify the skewed results of standard cover method. The results of this study show that bootstrap method, is both able to correct skew and differentiate between the performance ofefficient branches (in terms of standard data envelopment analysis method), which have different levels of performance. Therefore, the second policy recommendation to banks is to use the method used in this study to evaluate the performance of their branches.Finally, for future studies, it is suggested to use the dual bootstrap method to correct the skew and study the effects of various factors on the efficiency of bank branches.

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