A MODIFIED SBM-NDEA APPROACH FOR THE EFFICIENCY IMPROVEMENT IN BANK BRANCHES

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ABSTRACT

In this study an envelopment form of NDEA model is used for efficiency measurement of bank branches. So, a slack based NDEA model introduced by Tone and Tsutsui (SBM-NDEA) is nominated for its mathematical model. But according to the new categorization of the efficiency measurement factors introduced in this paper and also regarding some previous reviews on SBM-NDEA model, the model will be modified to include desired properties.

Keywords: Data envelopment analysis; network DEA; SBM-NDEA model; bank branches.

1. INTRODUCTION

Suppose that there exist \( j = 1, \ldots, J \) DMUs (or branches). Each DMU has \( k = 1, \ldots, K \) processes. Assume that \( N_k, M_k, \tilde{N}_k \) and \( \tilde{M}_k \) denote to the sets of main inputs, intermediate inputs, main outputs and intermediate outputs of process \( k \) respectively. Also suppose that the amount of \( n \)-th main inputs and \( m \)-th main outputs respectively and \( z_{kj} \) is the amount of intermediate factor \( q \) produced in process \( k \) and used in process \( h \) in DMU \( j \). According to these notations, Tone and Tsutsui’s model [1] is as below:

\[
\theta^*_o = \min \sum_{k=1}^{K} \theta_{k0} \left( 1 - \frac{1}{m} \sum_{n=1}^{n_k} \frac{x_{nj}}{y_{nj}} \right) \\
\text{s.t.:} \\
x_{nj} = \sum_j \lambda_{kj} y_{mj} + s_{nj}^+ - s_{nj}^- \\
\sum_j \lambda_{kj} = 1 \\
\sum_j \lambda_{kj} z_{qj} = \sum_j \lambda_{kj} z_{kj}^{(k,h)} \quad \forall (k, h)
\]

In further studies [2,3] Tone and Tsutsui s model and its definition of overall efficiency and process efficiency measures were reviewed. Fukuyama and Mirdehghan [2] and also Chen et al., [3] noted that overall efficiency cannot be regarded as the weighted average of process efficiencies as mentioned in Tone and Tsutsui [1].

2. PROPOSING APPROACH

In order to overcome the above shortfalls, the overall efficiency in the objective function will be modified. Moreover intermediate factors are considered in for their related process depending on the categories which will be introduced for them within a more detailed categorization which is suggested here. The modifications are briefly mentioned in the table.

3. CASE STUDY: BANK BRANCHES EVALUATION

In our proposed model all contributing factors in each process either main or intermediate factors are considered in the constraints. General and administrative expenses is an inseparable shared factor. The modification ensures that its changes in its contributing processes be identical.

Generally, in this new approach, our ultimate goal is to increase main outputs and reduction of main inputs totally in DMU not in processes individually. Therefore only the main inputs and outputs are appeared in the objective function. Meanwhile, intermediate factors can be increased, decreased or remain constant depending on their categorization:

1. In ordinary intermediate factors, the model itself recognizes that how should these factors be changed in line with the optimization of the overall efficiency. So their corresponding slack variables are considered to be free in sign (Such as daily cash flow in this study).
2. In some network structures, intermediate factors naturally cannot be decreased (increased) or we do not tend to decrease (increase) them. Such factors are called increasing (decreasing) intermediate factors. In this study, the attracted deposits are increasing intermediate factor. Their corresponding slacks are non-negative to insure that the targets are increased.
3. In this study, the commitment cost is a decreasing intermediate factor. So, its corresponding change amount in deposit attraction process and also in deposit allocation process is considered to be non-positive. This insures that the considered target for this factor is reduced.

4. CONCLUSIONS

According to the bank branches network structure defined in this paper, a more detailed categorization of factor types in a network structure was introduced and some modifications in SBM-NDEA model were represented. These modifications constitute some revisions in the overall efficiency measure and contribution of intermediate factors in constraints according to their categorization.
5. REFERENCES


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**Figure 1:** modifications in Tone and Tsutsui’s model