

Economic efficiency of selected socially responsible enterprises – DEA results

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The article presents research results on efficiency measurements of selected enterprises listed on the WSE and included in the RESPECT Index. The analysis was conducted with the use of DEA. The source of data was EMIS database.

Key words: RESPECT Index, DEA method, Efficiency.

Introduction. Efficiency is usually defined as a ratio of output to input. More output per unit of input means greater efficiency. In economic theories and business practice there exist different measures of efficiency. The most popular are quantitative methods, both parametric (based on econometric models) and non-parametric (based on linear programming). These methods allow the recognition and control the economic situation of an enterprise. They also provide important information, useful to its owners, shareholders or investors in their decision-making process. This article presents the research results of the economic efficiency analysis of selected Polish socially responsible enterprises. The use of Data Envelopment Analysis (DEA) was necessary to define such a research objective. This is a method which uses linear programming techniques to build a non-parametric efficiency frontier of a data sample. DEA assumes that there is a frontier technology, which can be constructed using suitable combinations of inputs and outputs (Silva et al. 2017). The basic CCR-DEA input oriented model was applied in the current paper.

Respect index. Socially responsible enterprises were, in the current study, represented by Polish enterprises listed on the Warsaw Stock Exchange (WSE) and were included in the Respect Index. They were selected based on three steps of verification carried out by WSE and the Association of Listed Companies as well as through an audit performed by the project partner Deloitte. Eight editions of the survey have been completed to date with 16 to 24 companies being included in the index portfolio at each time. On the 16th of December 2015, the WSE published the latest composition of the index, which included 23 companies (https://www.gpw.pl/RESPECT_Index). The companies grouped in the index represented the following sectors of business activity: power engineering, raw material, petrochemical, electromechanical, construction, stock market, telecommunication, and insurance.

Data and Method. One of the assumptions of DEA is that the decision-making units (DMU) being compared should be homogeneous (Guzik 2009). This is why objects for the analysis were selected from only one sector namely, banking. The source of data was Emerging Market Information Service (EMIS) database. The latest available data (2015) was applied for the analysis. The banking sector was

represented by: Bank BPH S.A. (BPH), Bank Ochrony Środowiska S.A. (BOS), Bank Zachodni WBK S.A. (BZW), Bank Handlowy in Warsaw S.A. (BHW), ING Bank Śląski S.A. (ING), and Bank Millennium S.A. (MIL). While the total number of employees (in persons) was considered as the input, company's liabilities (in thousand zł) served as the output. The efficiency score took the values from 0 to 1. The higher the value, the better position of the object.

Results. Results were obtained with the use of MaxDEA software (Table 1).

Table 1. CCR input oriented model results

| No | DM U | Score | Benchmark (Lambda) | Times as a benchmark for another DMU | Proportionate Movement (Input {I}) | Slack Movement (Input {I}) | Projection (Input {I}) | Proportionate Movement (Output {O}) | Slack Movement (Output {O}) | Projection (Output {O}) |
|----|------|----------|--------------------|--------------------------------------|------------------------------------|----------------------------|------------------------|-------------------------------------|-----------------------------|-------------------------|
| 1 | BPH | 0.403447 | BOS(1,401461) | 0 | -3153,975853 | 0 | 2133,024147 | 0 | 0 | 27262930 |
| 2 | BOS | 1 | BOS(1,000000) | 5 | 0 | 0 | 1522 | 0 | 0 | 19453216 |
| 3 | BZW | 0.818244 | BOS(6,124467) | 0 | -2070,561964 | 0 | 9321,438036 | 0 | 0 | 119140570 |
| 4 | BHW | 0.817583 | BOS(2,192755) | 0 | -744,626941 | 0 | 3337,373059 | 0 | 0 | 42656136 |
| 5 | ING | 0.994314 | BOS(5,048656) | 0 | -43,94523 | 0 | 7684,05477 | 0 | 0 | 98212600 |
| 6 | MIL | 0.825348 | BOS(3,073635) | 0 | -989,927104 | 0 | 4678,072896 | 0 | 0 | 59792091 |

BOS Bank was, from among the examined enterprises, the only fully effective in the sense of Farrell's (Guzik 2009). It became the benchmark for the other five banks. The least effective bank was BPH. It's efficiency was only 40.34% of its possible efficiency, if it had used BOS technology. ING was also high in the ranking, taking 2nd position. MIL, BZW and BPH achieved comparable results regarding their efficiency, namely 0.8253; 0.8182 and 0.8176 respectively. The optimal technology for BPH bank was defined as: 140.15% of BOS technology (Table 2).

Table 2. Optimal technology for BPH bank

| Benchmark (BOS) Lambda | 1,401461 × | BPH (optimal technology) | BPH (actual technology) |
|------------------------|---------------|-----------------------------|----------------------------|
| Employment | 1522 | 2133 | 5287 |
| Total liabilities | 1468556 | 4076954 | 4076954 |

BPH Bank used too many employees to achieve its result. The level of employment at BPH was 2.47 times higher than its optimal technology (2,133 employees).

Conclusions. The applied DEA method allowed us to evaluate the efficiency of six banks. We distinguished efficient and non-efficient objects as well as identified the optimal technology for non-efficient objects. Among the examined enterprises, BOS Bank was the only fully efficient one and thus became a benchmark for the rest banks. The information provided by DEA might be very important from the point of view of top management, shareholders or investors of business entities. It can be used in many areas of business activity, not only in profit making companies but also in non-profit organizations.

Bibliography

1. Guzik B. (2009). Podstawy analityczne modelu CCR-DEA. „Badania Operacyjne i Decyzje”, 1, 55–75.; 2. https://www.gpw.pl/RESPECT_Index.; 3. Silva T.C., Tabak B.M., Cajueiro D.O., Dias M.V.B. (2017) A comparison of DEA and SFA using micro- and macro-level perspectives: Efficiency of Chinese local banks. „Physica” A, 216–223.