JEAS | Journal of Economics and Administrative Sciences
E-ISSN: 2148-1792 P- ISSN: 1302-2024
Volume 4, No. 2 - July 2021
www.jeansweb.org

Capital market efficiency ranking by considering both financial and non-financial criteria in banks and financial institutions using data envelopment analysis

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ABSTRACT

One of the biggest risks for investors is allocating capital to corporate stocks and choosing a portfolio of stocks with two opposing goals, one is the profit goal that is desired and the other goal is risk. Therefore, the purpose of this study is to create an optimal portfolio of stocks that can lead investors to their two goals. By collecting data from financial and non-financial indicators for the units, the efficiency and ranking of these units were calculated by data envelopment analysis. During the years 2014 to 2018, respectively, ten, eleven, nine, eight and eight units were efficient. For each year, the ranking was calculated based on the AP model, and the optimal portfolio yield was compared with the trainer ratio each year. The efficiency obtained from data envelopment analysis(DEA) was higher than the

efficiency of the trainer ratio

Keywords: Optimal Stock Portfolio, Financial Index, Non-Financial Index, Trainer Ratio, Data Envelopment Analysis

Introduction

Investors in the stock market can invest in a way that brings them less risk and more returns, and reveals the true value of the stock of companies, so companies and institutions are actually ranked, which is the ranking itself. Classification is also a criterion for decision making and other analyzes. On the other hand, transparency in the Tehran Stock Exchange over the past few years has led to access to a large amount of specialized information, which on the one hand can be useful for financial experts and on the other hand its use for ordinary investors. it's not possible. This information includes a variety of financial and non-financial information that how to use and

analyze them in decisions is one of the challenges facing investors and analysts in these markets. By conducting this research, on the one hand, the various preferences of investors in decisions related to the selection of the optimal stock portfolio can be considered, and on the other hand, a comprehensive and optimal model of information analysis provided by companies can be provided.

Due to limited investment resources, if investors invest all resources in a particular asset, it increases the risk of losing resources, which is not desirable to them. So the main problem for investors is to determine the set of securities that leads to the maximization of wealth. This issue also leads to determining the optimal stock portfolio from a set of stock portfolios in order to create maximum benefits for shareholders and other stakeholders (Zhang & Nie, 2004).

In this regard, extensive efforts have recently been made to improve stock analysis and analysis methods, select the best analysis criteria, and select the best options for investing in financial markets. For example, the studies of Zhang and Nie (2004), Ben Abdulaziz et al. (2007), Dia (2009), Song (2014) and Kokadagli and Kaskin (2015) led to the use of new criteria and methods (such as quantitative methods, fuzzy theory). And innovative algorithms) that, along with previous methods, seek to meet the needs of investors and shareholders and maximize profits in financial markets.

Numerous studies such as Lai (1991), Huang (2006), Brendel (2006), Chen (2008), Edirisang and Zhang (2008), Bahata Charia (2010), Gupta (2010), Patari et al. (2012), Uston and Casimbeli (2012) and Woodside Orakhi et al. (2013) are examples of studies that over the years have provided a variety of models for optimal stock portfolio selection. In these studies, using financial information analysis and using various models such as meta-heuristic algorithms, neural networks, fuzzy theory and multi-criteria decision making techniques, the optimal stock portfolio model is presented. And in accordance with the aforementioned research, using various models and considering financial information, have provided optimal models for stock portfolio management.

In recent years, studies such as Yalama and Kaskan (2007), Copta et al. (2013), Nicomeram and Hemmati (2012) have also examined and analyzed the effects of using some non-financial information on the optimal portfolio of stocks. Numerous studies have shown that these indicators can affect the performance of companies as well as their returns. (Booth and Scholes (2004), Wang (2010), Demarjian et al. (2013), Andrew et al. (2013), Ghosh and San (2014)).

However, the presented studies pay less attention to evaluating the optimal combination of information analysis in order to form an efficient stock portfolio and do not provide a comprehensive model according to the different preferences of investors. In addition, most of these studies emphasize the presentation of the optimal stock portfolio model on the application of different decision models (meta-heuristic algorithms, neural networks, fuzzy theories and multi-criteria decision-making techniques) and most of them even have almost identical financial indicators and variables. Have used. Today, however, investors and analysts need indicators that are reliable to better understand the situation of companies, and in comparison with traditional accounting approaches, in addition to the usual accounting and financial criteria, important and basic non-financial criteria affect Include corporate trends as well.

The main issue of this research is to achieve the optimal model of information analysis in order to form an efficient portfolio in the stock market. In other words, this study seeks to properly answer this fundamental question: "Analysis of which set of models of transformation and development of financial institutions should be considered in order to create an optimal portfolio of shares among companies and financial institutions accepted in "Should the stock exchange be?" In this regard, in order to prioritize stock portfolios, the scientific technique of "data envelopment analysis" is used and compared with market returns.

Theoretical Framework

Market Efficiency

The concept of market efficiency with a better understanding of price formation in competitive markets, the random walk model came to be seen as a set of observations that can be consistent with the efficient markets hypothesis. The switch of emphasis began with observations such as that of Samuelson (1965), whose Proof That Properly Anticipated Prices Fluctuate Randomly began with the observation that “in competitive markets there is a buyer for every seller. If one could be sure

that a price would rise, it would have already risen." Samuelson asserted that "arguments like this are used to deduce that competitive prices must display price changes... that perform a random walk with no predictable bias." Samuelson explains that "we would expect people in the market place, in pursuit of avid and intelligent self-interest, to take account of those elements of future events that in a probability sense may be discerned to be casting their shadows before them." By presenting his proof in a general form, Samuelson added rigor to our notion of a well-functioning market. It is not clear to us whether these results ought to be seen as obvious or surprising, nor was it clear to Samuelson who wrote that "the theorem is so general that I must confess to having oscillated over the years in my own mind between regarding it as trivially obvious (and almost trivially vacuous) and regarding it as remarkably sweeping. Such perhaps is characteristic of basic results." Building on Samuelson's microeconomic approach, together with a taxonomy suggested by Harry Roberts (1967), Fama (1970) assembled a comprehensive review of the theory and evidence of market efficiency. Though his paper proceeds from theory to empirical work, he notes that most of the empirical work preceded development of the theory. The theory involves defining an efficient market as one in which trading on available information fails to provide an abnormal profit. A market can be deemed to be efficient, therefore, only if we posit a model for returns. From this point on, tests of market efficiency become joint tests of market behavior and models of asset pricing. We discuss this issue later. The weak form of the efficient market hypothesis claims that prices fully reflect the information implicit in the sequence of past prices. The semi-strong form of the hypothesis asserts that prices reflect all relevant information that is publicly available, while the strong form of market efficiency asserts information that is known to any participant is reflected in market prices. The literature begins, therefore, with studies of weak form market efficiency. Fama (1970) summarizes the early random walk literature, his own contributions and other studies of the information contained in the historical sequence of prices, and concludes that "the results are strongly in support" of the weak form of market efficiency. He then reviews a number of semi-strong and strong form tests, highlighting those that we cover in the next two sections, and concludes that "in short, the evidence in support of the efficient markets model is extensive, and (somewhat uniquely in economics) contradictory evidence is sparse." He concedes, however, that "much remains to be done", and indeed, Fama (1991) subsequently returned to the fray with a reinterpretation of the efficient markets hypothesis in the light of subsequent research.

Data envelopment analysis

Data envelopment analysis is a mathematical technique based on linear programming. In this method, using a set of several input and output variables, the efficiency of a group of units is determined. In data envelopment analysis, for a specific set of input and output variables, a specific score is assigned to each of the units under study. In this method, the efficient boundary is determined experimentally. Then, the units that are located on the efficient border are known as efficient units and the units that are not on the efficient border are known as inefficient units (Palveen, 1994).

The efficiency of a[1] decision-making unit (DMU) is the result of the ratio of the headquarters to the input of the unit. If a decision-making unit can produce fixed or greater headquarters with fixed inputs, more headquarters or less inputs, then the decision-making unit will have higher efficiency. If the decision-making units have only one input and one headquarters, the efficiency will be the ratio of the headquarters to the input. But if a decision-making unit has different inputs and headquarters, it is difficult and even impossible to find common weight for different headquarters and inputs. This is where data enveloping analysis technique should be used (Hee et al., 2019).

Research Background

Hee, Chen, and Hu (2019) examined the effect of managerial overconfidence on domestic financing and investment efficiency in China. Their results showed that domestic financing expands investment in business and reduces investment inefficiency, thus improving investment efficiency. They argue that in-house financing can create investment opportunities and reduce investment shortages, but may lead to over-investment, especially in companies with over-management

[1]- *Decision- Making Unit*

confidence. Also, the problem of over-investment due to managers' overconfidence is more in state-owned companies compared to non-governmental companies.

Siva and Prabhakar (2019) in an article entitled "Stock Market Performance Analysis in Emerging Markets: Evidence from BRICS" with the aim of examining the stock performance of BRICS markets.

This study uses variance ratio tests for linear dependencies and BDSL tests for nonlinear dependencies. In addition, the whole course is divided into sub-courses such as pre-crisis, crisis and post-crisis courses to understand the level of efficiency in different time periods. The results of variance ratio tests show that the Brazilian and Chinese markets are weakly efficient in all time periods, while Russia and South Africa have a weak form in full periods, crisis periods and post-crisis periods, but in previous periods. Not from the crisis. According to Indian stock markets, the markets have efficient weaknesses in the pre-crisis and crisis periods, while market inefficiencies are observed in the full and post-crisis periods. However, the results of the nonlinear test show that all BRICS markets reject the hypothesis of random gait due to nonlinear dependence in all study time periods.

Majid, Zhang and Omar (2018) examined the effect of investment efficiency on the cost of capital in Chinese companies. The results showed that the efficiency of investment is inversely related to the cost of capital. There is also a strong relationship between investment efficiency and the cost of capital for state-owned companies, while this relationship is not significant for state-owned companies. In addition, over-investment is significantly associated with the cost of capital.

Gariglia and Yang (2016) investigated the effect of financial constraints and agency costs on investment inefficiency in Chinese companies over a period of time (2010-2010). Evidence shows that companies with low cash flows tend to invest less due to financial constraints and companies with high free cash flows tend to invest more.

Li Yu[2] et al. (2015) concluded in their research that using data enveloping analysis technique is an effective and practical method to calculate portfolio efficiency. In addition, this technique can optimally evaluate the performance of the formed portfolio.

Lim et[3] al. (2014) also investigated the application of reciprocal efficiency measurement using data enveloping analysis technique to form portfolio. The results of this study indicate that the technique used leads to proper diversified portfolio using multiple evaluation criteria. They also practically tested the application of the technique in the Korean Stock Exchange. The results of this test showed that the use of this method resulted in higher returns than risks compared to similar portfolios during the 9 years studied.

Copta et al. (2013) in their research using financial and behavioral indicators, determined the optimal stock portfolio and were able to provide an optimal model for stock portfolio formation. In this study, AHP technique as a behavioral performance indicator and model. Fuzzy multi-criteria decision making was considered in order to calculate the financial quality index based on investors' preferences. Then, three optimal stock portfolio models were presented. The main goal of all three models was to maximize the financial goals of investors. The three models differed only in the behavioral goals expressed by investors. Finally, Copta et al. Demonstrated how to create an optimal stock portfolio that sets both financial and behavioral goals for shareholders. Also, the proposed model was evaluated based on real data and its efficiency was evaluated.

Research Methodology

The research method used in this research is survey method because it examines all financial companies and institutions and banks that are in the stock market. This research is applied in terms of purpose. Also, the data of this study were calculated by enveloping analysis of data. Finally, it should be noted that this research is descriptive and analytical in terms of research methodology.

[2]- *Liu et al.*
[3]- *Lim et al.*

Research Objectives

The main purpose of the research
Optimal portfolio of stocks using financial and non-financial indices

Research Sub-Objectives
Determine the efficiency of each bank and financial institution according to the criteria studied for the years 2014-2018
Ranking each of the efficient banks and financial institutions in terms of efficiency for the years between 2014 and 2018
Average efficiency of each bank and financial institution for the years between 2014 and 2018
Determining reference institutions and banks to make inefficient institutions and banks efficient

Research Questions

According to the title of the research in this research, the hypothesis is not formulated, but the objectives of the research become questions and the researcher tries to examine the efficiency of banks and financial institutions using data envelopment analysis in order to be able to answer the questions.

The main question of research
What is the optimal portfolio of stocks using financial and non-financial indicators?

Research Sub-Questions
What is the efficiency of each bank and financial institution according to the criteria studied for 2014-2018?
How is the ranking of each of the banks and financial institutions efficient for the years be 2014 and 2018 in terms of efficiency?
What is the average efficiency of each bank and financial institution between 2014 and 2018?
What are the banks and reference institutions for the efficient banks and financial institutions?

Research Variables

Table 1: Financial Criteria

Input/output	How to calculate	Indicators	Criteria
Output	Meek and Britta[4] (1974)	Inclusive Liquidity Index	New Ratios Liquidity
Input	Y.Tamen [5] (1974)	Cash Conversion Period Indicator	
Output	My Scarf and Cox's, (1985)[6]	Net Cash Residual Index	
Output	Extraction of financial statements	Gross sales profit	Profitability Ratios
Output	Extraction formal's facials	Net profit to sell	
Output	Net dividends divided by equity	Equity Returns	
Output	Total assets divided by equity	Return on assets	
Output	Sales divided by inventory of goods at the end of the period	Inventory circulation	Activity Ratio
Output	Sales divided by total liabilities	Total turnover of assets	
Input	Total debt divided by total asset	Debt Ratio	Leverage ratio
Output	Operating profit divided by interest expense	Interest Coverage Ratio	
Output	Hearts et al. (1997)[7]	Adjusted Economic Value Added	Economic
Output	Extraction of financial statements	Profit per share	Outlook Criteria
Output	Share price divided by profit	Price to earnings	
Output	Market value divided by total assets	Market value to office value	
Output	Extraction of financial statements	Earnings Growth Rate	Growth Criteria
Output	Extraction of financial statements	Profit growth rate per share	

[4] *Malik & Britta*
[5] *Guittman*
[6] *Schallman & Kaukse*
[7] *Beadle*

Table 2: Non-Financial Criteria

Input/output	How to calculate	Indicators	Criteria
Input	Extraction of financial statements	Operating cost to sell	Agency Theory
Input	Prayerand Agriculture (2009)	Q-Tobin ratio	
Output	Sale divided by total assets	Asset Circulation	
Input	Demergen et [8] al. (2012)	Risk	Management ability
Output	Demergen et al. (2012)	Management ability	
Output	Demergen et al. (2012)	Interaction between growth opportunity and free cash flow	
Output	Model Palic (1998, 2000) [9]	Palic Value Added Coefficient	Intellectual Capital

For data analysis, the linear programming model of output-driven BCC data envelops is used as BCC follows:

$$Min\ Z_0 = \sum_{i=1}^{m} v_i x_i + w$$

st:

$$\sum_{r=1}^{s} u_r y_r = 1$$

$$\sum_{i=1}^{m} v_i x_{ij} - \left|\sum_{r=1}^{s} u_r y_{rj} + w \geq 0 \quad (j = 1.2. \ldots . n)\right.$$

$$u_r, v_i \geq 0\ w: free\ of\ sign$$

Research Community

The study population of this study includes all banks, companies and financial institutions listed on the Tehran Stock Exchange. From this population, without sampling, the following companies have been selected as the study:

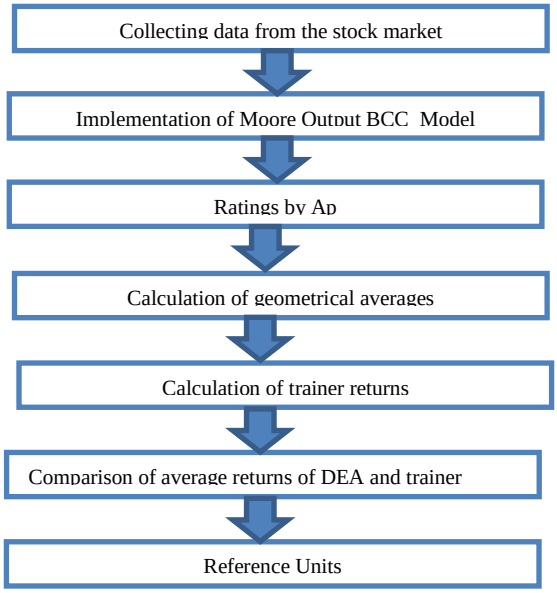
1- Companies whose financial period ends at the end of March of each year and have not changed the financial year in the research period.

2- Companies whose information is fully available for the period 1393 to 1397.

Due to the above limitations, 24 banks and financial institutions were selected and analyzed during 5 years of study (120 years - company).

Research Implementation Stages

The stages of the research methodology are as follows:



[8] *Demerjian*
[9] *Pulic*

Data Analysis

First, based on Moore's output model, sample members are identified as decision units, in other words, 24 decision units were identified. Then, the data required to calculate the research variables were collected through stock exchange databases for the research period and the research variables were calculated based on them.

Table 3. Name of decision-making units

Number	Unit Name	Number	Unit Name	Number	Unit Name	Number	Unit Name
1	Tejarat Bank	7	Pasargad Bank	13	Sina Bank	19	Industry & Mining Leasing
2	Taat Bank	8	Eghtesad Novin Bank	14	Iran Leasing	20	Ghadir Car Leasing
3	Iran Post Bank	9	Ghavamin Bank	15	Credit Development	21	Avien Investor
4	Parsian Bank	10	Saman Bank	16	Kar-afarin Bank	22	Noor Kosar Iran
5	Mellat Bank	11	Saderat Bank	17	Iran Etebar	23	Saipa Investment
6	Nations Credit Institution	12	Middle East Bank	18	Rayan Saipa	24	Dey Bank

Then, using the variables obtained from the output-driven BCC model was developed and tested by Lingo software.

Modeling was done for all 23 other decision making units. Then he enters the Lingo program. The results are presented in table -4 below.

Table 4. Efficiency of decision-making units based on output-driven BCC model

Number	BCC Performance 2014	BCC Performance 2015	BCC Performance 2016	BCC Performance 2017	BCC Performance 2018
1	1	1	1	1	1
2	0.809	0.192	0.808	0.046	0.05
3	0.817	0.961	0.367	0.283	0.431
4	1	1	1	0.352	1
5	1	1	1	1	1
6	0.843	1	0.628	1	0.793
7	1	1	1	1	1
8	1	1	1	1	0.384
9	0.67	0.638	0.361	0.243	0.301
10	0.346	0.03	0.655	0.408	0.464
11	0.627	1	1	1	1
12	0.351	1	0.789	1	1
13	1	0.475	1	0.447	1
14	1	0.768	1	0.51	1
15	0.770	0.03	0.97	0.007	0.013
16	0.592	0.464	0.534	0.404	0.217
17	0.773	0.52	0.48	0.45	0.432
18	1	0.550	0.944	0.004	0.029
19	0.274	1	0.771	0.199	0.215
20	1	1	0.05	0.439	0.707
21	0.249	0.15	0.85	0.136	0.128
22	0.223	0.864	0.153	0.274	0.467
23	0.267	0.32	1	0.2	0.3
24	1	1	0.831	1	0.233

According to table -4, in 2014, 10 units of decision making units are efficient in 2015, 11 units of decision making units are efficient in 2016, 9 units of decision making units are efficient in 2017, 8 units of decision making units are efficient and in 2018, 8 units of decision making units are efficient.

Ranking decision-making units based on Anderson Peterson's model

As specified from Table 4 above, the performance calculation is based on the output-driven BCC model. Ranking the efficiency of efficient units in table 5 to table 9 is based on Anderson-Peterson

model and presented below. In this study, the mean rating method was used. The average ratings of different years from table 5 to 9 are presented and the final ranking is provided based on it.

Table 5. Anderson-Peterson Results for 2014

Number	efficiency	Rating
1	1.71	4
4	1.83	2
5	1.59	7
7	1.89	1
8	1.45	10
13	1.72	3
14	1.70	5
18	1.46	9
20	1.55	8
24	1.62	6

According to table - 5 top four units in terms of efficiency in 2014, all are banks and none of the non-banking units are among the top four units. In total, out of 24units, 10 units are efficient, seven of which are banks, and the other three are related to other units.

Table 6. Anderson-Peterson Results for 2015

Number	efficiency	**Rating**
1	1.51	9
4	1.83	3
5	1.64	4
6	1.54	8
7	1.99	2
8	1.55	7
11	2.02	1
12	1.7	5
19	1.46	10
20	1.35	11
24	1.66	6

According to table – 6 seven units in terms of efficiency in 2015, all are banks and none of the non-banking units are among the top seven. In total, out of 24 units, there are eleven efficient units, eight of which are banks, and the other three are related to other units.

Table 7. Anderson-Peterson Results for 2016

Number	efficiency	**Rating**
1	1.91	2
4	1.64	4
5	1.94	1
7	1.89	3
8	1.11	7
11	1.07	8
13	1.02	9
14	1.17	5
23	1.16	6

According to table - 7, the top four units in terms of efficiency in 2016, all are banks and none of the non-banking units are among the top four. In total, out of 24units, nine units are efficient, seven of which are banks, and the other two are related to other units.

Table 8. Anderson-Peterson Results for 2017

Number	efficiency	**Rating**
1	1.93	2
5	2.24	1
6	1.49	7
7	1.81	4
8	1.47	8
11	1.92	3
12	1.66	5
24	1.56	6

According to table - 8 six units in terms of efficiency in 2017, all are banks and none of the non-banking units are among the top six. In total, out of 24units, eight units are efficient, seven of which are banks, and only one other unit is related to other units.

Table 9. Anderson-Peterson Results for 2018

Number	efficiency	**Rating**
1	1.82	5
5	2.01	1
7	1.42	7
11	1.91	2
12	1.83	4
14	1.88	3
15	1.26	8
19	1.56	6

According to table -9, the top two units in terms of efficiency in 2018 are Mellat and Saderat banks and the third best efficient unit is Iran leasing. In total, out of 24units, eight units are efficient, five of which are banks, and the other three are related to other units.

Geometric mean of units

Here, the geometric average of 16 units that have been efficient for at least once in five years has been calculated in order to rank the time series. Using the comparison of common weights to each input and output, the geometric mean of weights was calculated for five periods and the results were presented in table 10 below.

Table 10. Average geometric weight of units

Rating	Number	Decision-making unit name	Weight	Rating	Number	Decision-making unit name	Weight
1	5	Mellat Bank	0.849	9	13	Sina Bank	0.578
2	7	Pasargad Bank	0.82	10	6	Nations Credit Institution	0.56
3	1	Tejarat Bank	0.788	11	19	Industry & Mining Leasing	0.55
4	11	Saderat Bank	0.783	12	23	Saipa Investment	0.498
5	4	Parsian Bank	0.756	13	20	Ghadir Car Leasing	0.432
6	8	Eghtesad Novin Bank	0.744	14	15	Etebari Tousea	0.405
7	12	Middle East Bank	0.643	15	14	Iran Leasing	0.377
8	24	Dey Bank	0.625	16	18	Rayan Saipa	0.358

Table-10 results show that a total of 16 of 24 units have been able to be efficient at least once. The results show that during these five years, each unit has a totalrank. Mellat Bank has had the best performance (performance) in these five periods and Ryan Saipa has the weakest performance.

Trainer Ratio

Table 11. Trainer Test Results

Fiscal Year	Bcc	Market
2014	0.38	0.21
2015	0.39	0.25
2016	0.31	0.18
2017	0.29	0.17
2018	0.23	0.14

According to Table 11 in all the years 2014 to 2018, the rate of return obtained from data envelopment analysis is higher than the rate of return obtained from the trainer ratio

Conclusion of model implementation

The average efficiency of the optimal basket of data enveloping analysis was calculated for these five years and the average return of the optimal treynor basket was calculated and the results were presented in the table below.

Table 12. Comparison of average returns of DEA and treynor criteria

Stock basket	**return**
Bcc(DEA)	0.32
treynor	0.19

The results of table -12 above show that if the optimal portfolio is selected by data enveloping analysis, it will have more efficiency than the optimal portfolio selected from the treynor criteria.

Table-13 shows reference decision-making units

Table 13: Reference Decision-Making Units

Number	Status	Reference Set	Number	Status	Reference Set
1	Efficient	4	13	Efficient	6
2	Non-Efficient	14، 8	14	Efficient	13
3	Non-Efficient	6، 8	15	Non-Efficient	1
4	Efficient	13	16	Non-Efficient	14، 24
5	Efficient	7	17	Non-Efficient	14، 5
6	Efficient	7	18	Efficient	1
7	Efficient	1	19	Efficient	1
8	Efficient	11	20	Efficient	5
9	Non-Efficient	7	21	Non-Efficient	4
10	Non-Efficient	5، 4، 1	22	Non-Efficient	18، 19
11	Efficient	13	23	Efficient	7
12	Efficient	8	24	Efficient	4

The results in Table 13 above show that there are nine inefficient units that can emulate the reference units listed in the third column to become efficient units.

Discussion

According to the information obtained from the implementation of the model, the research questions will be answered below.

Question 1: What is the efficiency of each bank and financial institution according to the criteria studied for 2014-2018?

The model of this research is a model with sixteen output indicators and four input indicators from the researcher's point of view, and data enveloping analysis technique was used to evaluate the efficiency. The selected methods are multi-criteria methods that calculate both efficiency and efficiency and risk. The results concluded that as the trainer ratio increases, the DEA also increases, and on the contrary, there is a significant positive linear relationship between the two indicators.

Second question: What is the optimal portfolio of stocks using financial and non-financial indicators?

In each fiscal year, a number of units based on the sum of financial and non-financial indicators were determined as efficient units that these units will be the constituents of the optimal portfolio of stocks if the selection of the optimal portfolio is done only on the basis of either financial indicators or non-financial indicators, the composition of the optimal portfolio of stocks is different from when these two indicators simultaneously play a role in the selection of the optimal portfolio of stocks. . The results of this study are similar to the results of Hee et al., (2019).

Question 3: What is the average efficiency of each bank and financial institution between 2014 and12018?

Since efficiency calculation is not only for a period of time and includes five financial periods, therefore, using geometric average, the average efficiency of the units was determined and the most efficient unit was determined during these five years. It can be concluded that among banks and financial institutions and leasings, these banks are more efficient because they have higher geometrical averages and these geometric averages are calculated from the obtained efficiency.

Question 4: What is the ranking of each of the efficient banks and financial institutions in terms of efficiency?

After the efficiency of each unit was obtained, it was found that 16 units were efficient over five years. The ranking of units was presented based on the efficiency in tables 5 to 9, since the efficiency of the units is very close together in order to be able to rank them more accurately, the AP model was used, the results show that except one case in all other cases, each unit Decisions that are ranked between one and three efficiencies must be effective in the following year, except unit no. 13 which was ranked third in efficiency in 2014 and in the following year, 2015 was not among the eleven efficient units. The research results are identical to the research results of Copta et al. (2013), Li Yu et al. (2015) and Lim et al. (2014)[10][11]

Question 5: What are the banks and financial institutions for the efficient performance of banks and institutions?

Reference units are used to upgrade inefficient units to efficient units. Reference units are efficient units of these units and are able to act as a model for inefficient units that inefficient units by modeling these units to try to reach the efficiency boundary, table-13 shows efficient and reference units. The results of this study are similar to the results of Lyroudi. Et al. (2015).

Conclusion

In portfolio selection, using modeling with data enveloping analysis and using financial and non-financial criteria will have a better result for capital market decision makers. All Non-Efficient units can become an efficient unit by modelling the efficiency that are closest together. For example, the inefficient unit no. 2 can become an efficient unit by modeling the efficient unit no. 8 and 14.

Limitations of Research

The optimal portfolios that are suggested actually show the company's performance in the past year to the present day and do not represent the optimal stay in future times.

A large number of units are efficient, for example, in 2014, ten units are efficient. In 2015, there are eleven efficient units. The lack of two or three efficient units for decision making is one of the limitations of the research. It is not possible to compare the composition of the optimal portfolio of stocks when financial and non-financial indices are calculated separately with the time they are calculated together because the calculation of the efficiency for financial and non-financial indicators is not done separately. Researchers are suggested to use other methods and measurement criteria to reduce variables such as intellectual capital, representation theory and their analysis along with financial criteria information and compare the results with the results of this study.

The study of new accounting and financial information can also be considered in future researches.

[10] - *Liu et al.*

[11] - *Lim et al.*

Resources

[1]. Andreou, Panayiotis C. ; Ehrlich, Daphna; &Christodoulos Louca(2013). "Managerial Ability and Firm Performance: Evidence from the Global Financial Crisis. " Available online:http://www. efmaefm. org.

[2]. Bahata Charia C. (2010). "Managerial Ability and Firm Performance: Evidence from the Global Financial Crisis". Available at www. efm aefm. org.

[3]. Beadle, Yangyang; Podolski, Edward J. ; &MadhuVeeraraghavan (2015). "Does Managerial Ability Facilitate Corporate Innovative Success?". Journal of Empirical Finance, Forthcoming.

[4]. Ben AbdolAziz, M. M.; and S. M. H. Wallman. (2007), Unseen Wealth: Report of the Brookings Task Force on Understanding Intangibles Sources of Value. Washington, DC: The Brookings Institution Press.

[5]. Booth, T. and I. Schalze (2004). "Management Quality, Certification, and Initial Public Offerings". Journal of Financial Economics, Vol. 76, pp. 331-368.

[6]. Brendle, M. (2006). A Two Staged Goal Programming Model for Portfolio Selection. *Lecture Notes in Economics and mathematical Systems*, Vol. 432, PP: 286-299

[7]. Chen, H. H. (2008). "Stock Selection Using Data Envelopment Analysis. "Industrial Management & Data Systems. Vol. 108, No. 9: pp. 1255-1268.

[8]. Cupta, Sungmook; Oh, Kwang Wuk; & Joe Zhu (2013). "Use of DEA Cross-Efficiency Evaluation in Portfolio Selection: An Application to Korean Stock Market". European Journal of Operational Research, Vol. 236, Issue 1, PP. 361-368.

[9]. Demerjian, Peter; Lev, Baruch; Lewis, Melissa; & Sarah McVay. (2013). "Managerial Ability and Earnings Quality. " The Accounting Review. Vol. 88, No. 2: PP. 463-498.

[10]. Dia, M. (2009). A Portfolio Selection Methodology Based on Data Envelopment Analysis. INFOR. Vol. 47, No. 1, PP: 71-79

[11]. Fama, Eugene (1965). "The Behavior of Stock Market Prices", Journal of Business, 38, pp. 34-105.

[12]. Fama, Eugene (1970). "Efficient Capital Markets: A Review of Theory and Empirical Work", Journal of Finance, 25, pp. 383-417.

[13]. Fama, Eugene (1991). "Efficient Capital Markets II", Journal of Finance, 46, pp. 1575- 617.

[14]. Fama, Eugene (1998). "Market Efficiency, Long-Term Returns and Behavioral Finance", Journal of Financial Economics, 49, pp. 283-306.

[15]. Fama, Eugene, Lawrence Fisher, Michael Jensen and Richard Roll (1969). "The Adjustment of Stock Prices to New Information", International Economic Review, 10, pp. 1-21.

[16]. Fama, Eugene and Kenneth French (1988a). "Dividend Yields and Expected Stock Returns", Journal of Financial Economics, 22, pp. 3-25.

[17]. Fama, Eugene and Kenneth French (1988b). "Permanent and Temporary Components of Stock Prices", Journal of Political Economy, 96, pp. 246-273.

[18]. Fama, Eugene and Kenneth French (1992). "The Cross-Section of Expected Returns", Journal of Finance, 47, pp. 427-465.

[19]. Edirisinghe, N. C. P. &Zhang, X (2008). Portfolio Selection Under DEA-Based Relative Financial Strength Indicators: case of US Industries. *Journal of the Operational Research Society*. Vol. 59. PP: 842-856

[20]. Gopta, T.; (2010). "Dupes or Incompetents? An Examination of Management's Impact on Firm Distress. " The Journal of Risk Insurance, Vol. 79, No. 3: PP. 751-783.

[21]. Guittman, J.; (1974). "Using Data Envelopment Analysis to Select Efficient Market Cap Securities. " Journal of Business and Management, Vol. 7, No,2: pp. 31-42.

[22]. Guariglia, A., & Yang, J. (2016). A balancing act: Managing financial constraints and agency costs to minimize investment inefficiency in the Chinese market. Journal of Corporate Finance 36 (February), 111-130

[23]. Haung e (2006). "Economic Value Added for Performance Evalu ation: A Financial Engineering. " Systems Engineering Procedia, No. 5, pp. 379-387.

[24]. Hee, Y., Chen, C., & Hu, Y. (2019). Managerial overconfidence, internal financing, and investment efficiency: Evidence from China. Research in International Business and Finance, 47 (January), 501-510

[25]. Kocadagli, Ozan; &Ridvan Keskin (2015). A Novel Portfolio Selection Model Based on Fuzzy Goal Programming with different Important and Priorities. *Expert Systems with Applications*, Vol. 42, No. 20, PP: 6898-6912

[26]. Li, W.; liang, L.; Cook, W. D.; (1991). DEA models for Non-Homogeneous DMUs with Different Input Configurations. *European Journal of Operational Research*,

[27]. Lim, Sungmook; Oh, Kwang Wok &Joe Zhu (2014). Use of DEA Cross-Efficiency Evaluation in Portfolio Selection: An Application to Korean Stock Market. *European journal of operational Research*, Vol. 236, Issue. 1, PP: 361-368

[28]. Lyroudi, K.; McCarty D.; Lazaridis, J.; and T. Chatzigagios (2015). "An Empirical Investigation of Liquidity: The Case of UK Firms. "Presented at the Annual Financial Management Association Meeting in Orlando, October 1999.

[29]. Majeed, M. A., Zhang, X., & Umar, M. (2018). Impact of investment efficiency on cost of equity: evidence from China. *Journal of Asia Business Studies*, 12 (1), 44-59.

[30]. Malik, A; Britta, E; (1974). DEA Investment Strategy in the Brazilian Stock Market. *Economics Bulletin*, Vol. 13, No. 2, PP: 1-10

[31]. Patari, Eero; Leivo, Timo; &Samuli Honkapuro. (2012). Enhancement of Equity Portfolio Performance Using Data Envelopment Analysis. *European journal of operational Research*, No. 220, PP: 786-797

[32]. Pavleen, T. K (1998). "Managerial Ability Analyst Recommendations, and Price in formativeness". The 3rd International Conference of the Japanese Accounting Review in

[33]. Pulic, A. (1998). Intellectual capital–does it create or destroy value? Measuring business excellence.

[34]. Pulic, A. (2000). The principles of intellectual capital efficiency-A brief description. Croatian Intellectual Capital Center, Zagreb, 76.
[35]. Qosh, C. &C. Son (2014). On The Use of Multicriteria Decision Aid Methods to Portfolio Selection. *Multicriteria Analysis, Proceeding of the Xith International Conference on MCDM*, PP: 842-856
[36]. Schallman, G. E. , & D. S., Kaukse (1985). "Efficiency Measurement of the Greek Commercial Banks with the Use of Financial Ratios. " Management Accounting Research, Vol. 15, Issue 2: pp. 201–224.
[37]. Siva Kiran & Prabhakar Rao.R, 2019. "Analysis of Stock Market Efficiency in Emerging Markets: Evidence from BRICS," Romanian Economic Journal, Department of International Business and Economics from the Academy of Economic Studies Bucharest, vol. 22(72), pages 60-77, June.
[38]. Samuelson, Paul (1965). "Proof That Properly Anticipated Prices Fluctuate Randomly", Industrial Management Review, 6, pp. 41-49.
[39]. Song, George (2004). Financial Statement Analysis. 2nd Edition, Englewood Cliffs, N. J.: Prentice-Hall.
[40]. Uostaun, Stephen; Kasimbli, Randolph (2012). Fundamental of Corporate Finance. Tenth Edition, New York: Mc Graw-Hill.
[41]. Wang, B. (2010). Fundamental Information Analysis. *Journal of Accounting Research*. PP: 190-215
[42]. Woodsai Aurakhi, Peter; Lev, Baruch; & Sarah McVay. (2013). "Quantifying Managerial Ability: A New Measure and Validity Tests. " Management Science, Vol 58, No. 7: pp. 1229-1248.
[43]. Yamala, C.; Kauskan, D. K. (2007). Portfolio Selection Using the ADELAIS Multiobjective Linear Programming System. *computational Economics*, vol. 11, PP:189-204
[44]. Zhang ,R. ; &T. Nie. (2004). "Bank Failure Prediction Using DEA to Measure Management Quality. " Interfaces in Computer Science and Operations Research, Vol. 7: pp. 341–366. Downloaded from qfaj. ir at 18:54 +0430 on Friday August 10th 2018