The Technical Efficiency of Pension Funds in Indonesia: Do Size and Ownership Make the Difference?

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ABSTRACT
This study investigates the technical and scale efficiency of Employer Pension Funds (DPPK). Involving data from 40 pension funds (280 observations), this study applied nonparametric DEA method and Kolmogorov-Smirnov test to measure and evaluate efficiency differences based on size and ownership. The study's findings show that large pension funds can do better in operational technical efficiency, but are only about the same level as small ones in investments technical efficiency. Large pension funds perform even lower than small pension funds, both in operational and investments scale efficiency. SOE pension funds are found to have higher technical efficiency but lower scale efficiency than Non-SOE pension funds. Diseconomies of scale as well as strict regulations and limited domestic capital market are believed to be the factors hindering large (SOE) pension funds to perform optimally. This study provides empirical evidence regarding differences in the level of technical and scale efficiency in operation and investment management between large pension funds (SOE) and small pension funds (Non-SOE). This study provides important information for management to improve the performance of pension funds.

Keywords: *DEA Analysis, Employer Pension Funds, Scale Efficiency, Technical Efficiency.*

1. INTRODUCTION

The economy of a nation benefits greatly from pension funds. At the macro level, pension funds can boost the economy's overall performance by directly increasing GDP (Davis & Hu, 2008) and spur the development of capital markets (Ashok & Spataro, 2016). At the micro level Pension funds function as old-age savings (Kadarisman & Wahyuni, 2010) as well as a strategy for balancing consumption throughout a person's life cycle (Barr & Diamond, 2006).

Studies on efficiency at the macro level analyse the efficiency of the pension system as a whole, including internal (i.e. efficiency of a particular scheme/pillar/group of pension funds) and external (i.e. external impact of the entire pension system on the economy, public finance, and labour market). Meanwhile, studies on micro-efficiency analyse the internal efficiency of a particular pension fund/group (Chybalski, 2015). This research examines the efficiency of pension funds from a micro perspective. Based on the size and type of sponsor/ownership, this study specifically analyses the technical and scale efficiency of the Indonesian Employer Pension Funds (Dana Pensiun Pemberi Kerja or DPPK) for the period of 2011–2017. Technical efficiency is a company's capacity to optimally transform inputs into outputs (Coelli, Rao, O'Donnel, & Battese, 2005). While scale efficiency is a component of technical efficiency related to the ability of a company to operate at its optimal scale (Avkiran, 2006).

Studies on technical efficiency is essential for assessing the Pension Fund's capacity to turn inputs in the form of contributions and assets into pension benefits as an output. An analysis of scale efficiency is needed to see whether the level of the technical capability of the pension funds is optimal for its size. The few studies on Indonesian pension fund efficiency, however, typically are focusing more on portfolio efficiency (Hasanudin, Wahyudi & Pangestuti, 2017) or efficiency determined by the fund adequacy ratio (Sunaryo, Santoni, Endri & Harahap, 2020) than they do on technical and scale efficiency. Accordingly, there is still room to investigate the technical and scale efficiency of the pension funds in Indonesia to advance the field of study and improve the pension fund's efficiency.

2. CONCEPTUAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

2.1. Pension Fund Efficiency and Measurement

Pension fund efficiency refers to its ability to provide maximum benefits based on certain contributions, or a certain amount of benefits from the minimum contributions for its participants (Chybalski, 2015). This study measures the efficiency of pension funds using the DEA method. DEA is a linear programming that identifies the inefficiency of a particular Decision-Making Unit (DMU) by comparing it with similar DMUs that are considered efficient (Coelli et al., 2005).

2.2. Hypothesis Development

2.2.1. Size and Efficiency

Technical efficiency refers to a company's capacity to combine inputs in such a way as to maximize output (i.e., return or income) while minimizing costs. Meanwhile, scale efficiency is a component of technical efficiency that reflects a company's ability to function at scale to its maximum potential. These technical capabilities may vary between pension funds based on the specific characteristics of each pension fund. For example, pension funds may differ in their level of efficiency because of their size. Due to the benefits of economies of scale, large pension funds are often considered to have a higher level of efficiency. Large pension funds with high-value asset, can spread costs across their fixed assets to reduce operational costs (Cummings, 2015), have bargaining power, and are more flexible in placing their investment assets (Dyck & Pomorsky, 2011).

Large pension funds, however, may encounter diseconomies of scale if the complexity of the structure and bureaucracy results in costs that are disproportionate to the scale as they grow in size (Galagedera & Watson, 2015). This study classifies the pension funds in Indonesia based on their net asset value into large and small categories. Large pension funds aside from having large assets are also sponsored by national banks and large companies that have typically sufficient skilled manpower available. Meanwhile, small pension funds are generally sponsored by small companies and social/school foundations with minimal availability of management staff and can only work part-time. The following hypotheses are put forward in light of the above-mentioned reasoning: *H1: There are differences in the technical efficiency levels in terms of operation and investment management between large and small employer pension funds. H2: There are differences in the scale efficiency levels in terms of operational and investment management between large and small employer pension funds.*

2.2.2. Ownership and Efficiency

Different ownership means different governance, which can result in different levels of efficiency. Research results in the pension fund industry provide mixed results. Barros and Garcia (2006) applied the DEA method to analyse the efficiency of pension fund management in Portugal from 1994 to 2003 and found that pension funds managed by private pensions companies had higher technical and scale efficiency than government pensions. Siddiqui (2021), who investigates pension funds in India between 2015 and 2019, discovered that government pension funds were more efficient than private pension funds. Based on ownerships, pension funds in Indonesia are categorized into pension funds of State-owned enterprises (SOE pension funds), which are held by government owned companies, and pension funds of non-state-owned enterprises (Non-SOE pension funds), which is organized by private/non-government companies. SOE pension funds are generally large in size, and held by national banks and national corporations. Whereas Non-SOE pension funds are generally held by small private companies and other school/social foundations. Therefore, the hypothesis is formulated as follows: *H3: There are differences in the technical efficiency levels in terms of operation and investment management between SOE pension funds and Non-SOE pension funds. H4: There are differences in the scale efficiency levels in terms of operation and investment management between SOE pension funds and Non-SOE pension funds.*

3. METHODOLOGY

3.1. Samples, Data Sources, and Variable Specification

The research samples include 40 pension funds (280 observations) that were actively operating from 2011 to 2017. The annual financial reports from 2011 to 2017 were obtained from the Association of Indonesian Pension Funds. To compare the efficiency level of the pension funds, the samples were divided into large and small pension funds based on the average net assets. Categorized as large are pension funds with a net asset equal to or above IDR 600 billion (18 pension funds). Meanwhile, pension funds with a net asset value of less than IDR 600 billion (22 pension funds) are categorized as small. Additionally, pension funds are divided based on the ownership, which are, State-Owned Enterprises (SOEs) holding 19 pension funds and Non-SOE (non-government institutions) consists of 21 pension funds.

DEA recognizes two categories of variables, namely input and output variables. The variables in this study were chosen based on the idea that operation management and investment management are the two main components of overall pension fund management (Galagedera, 2017). Operation management (Model A) includes activities such as collection of contributions and payment of pension benefits, bookkeeping, and other administrative activities. While investment management (Model B) includes portfolio management performed by investment managers. Based on this distinction, the input and output variables for Model A are the net asset value at the beginning of the period (x_1), total operating costs (x_2), and the net asset value at the end of the period (y). For model B, the input and output variables include the average investment value (x_1) and investment costs (x_2), and investment income (y).

3.2. Analysis Model

The main DEA model consists of Constant Return to Scale (CRS) (Charnes, Cooper, & Rhodes, 1978) and the Variable Returns to Scale (VRS) (Banker, Charnes, & Cooper, 1984). This study applies the input-oriented VRS model to the data to obtain efficiency scores. Following Coelli et al. (2005), the input-oriented VRS model is shown in Equation 1:

$$\text{Min}_{\theta,\lambda}\ \theta, \text{subject to: } -y_i + Y\lambda \geq 0, \theta x_i - X\lambda \geq 0, N1'\lambda = 1,\ \lambda \geq 0 \qquad (1)$$

Where θ is a scalar value between 1 and 0, representing technical efficiency. Λ is a constant representing the weight, xi and yi are input and output for -ith DMU (decision-making unit) while X and Y are inputs and outputs for all DMU. The highest value of θ obtained is the efficiency score for a certain DMU (company i) that fulfils $\theta \leq 1$. 1 is the optimal value that can be obtained, which indicates that the point is right on the frontier line so that the DMU is considered technically efficient according to the definition of Farrell (1957). All θ that fall short of 1 are regarded as inefficient. N1'λ = 1 is a convexity constraint, where N1 is a unitary Nx1 vector N represents DMUs.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Table 1. Descriptive Statistics (IDR. million)

	Ratnetas	Ratinv	Bop	Binv	Pendiv	
Large	4.120.636	3.969.434	20.485	19.070	394.122	Mean
	3.437.227	3.344.270	19.774	25.496	382.486	SD
	12.765.949	12.649.762	73.287	90.047	1.438.297	Max
	874.810	822.893	2.017	962	56.929	Min
Small	114.80	110.140	1.523	255	10.402	Mean
	88.445	85.827	1.354	360	9.033	SD
	334.301	312.266	5.713	1.510	30.978	Max
	13.549	12.978	369	14	-591	Min
SOE	3.429.679	3.284.023	20.042	16.258	338.580	Mean
	3.923.914	3.802.777	20.992	27.610	424.814	SD
	12.765.949	12.649.762	73.287	90.047	1.438.297	Max
	103.462	92.786	1.694	73	9.557	Min
Non-SOE	798.806	784.043	2.707	3.156	68.238	Mean
	1.446.350	1.435.106	3.630	5.902	126.715	SD
	4.840.794	4.811.625	12.851	21.095	433.335	Max
	13.549	12.978	369	14	-591	Min

Source: authors' elaboration. Note: Ratnetas = average net assets; Ratinv = average investment; Bop = operational costs; Binv = investment costs; Pendiv = investment income

Table 1 displays the descriptive statistics of Indonesian pension funds from 2011 to 2017. The gap in the average net asset value and investment between large (SOE) and small (Non-SOE) pension funds is quite large. Furthermore, the standard deviation of investment costs in each pension fund category is quite large and exceeds the mean value. These differences have certainly an impact on the level of operational and investment efficiency.

4.2. Pension Fund Efficiency Level Based on Size

Table 2 shows the average technical efficiency of operation management of large pension funds is higher (86 percent) than that of small ones (76.5 percent). The results of the Kolmogorov-Smirnov (K-S) test show a significant difference

between large and small pension funds regarding operational efficiency, i.e. large pension funds have higher level of operational efficiency than small pension funds (difference: 0.2972; p = 0.000 <0.05).

Technical efficiency relates to the ability to combine inputs in such a way as to produce maximum output at minimum cost (Avkiran, 2006). This result implies that in order to achieve operational efficiency level as higher as a large pension fund, a small pension fund must be able to combine its inputs (total operating costs and net assets at the beginning of the period) in such a way that it can minimize the total costs by 9.5 percent (the difference of 86 percent minus 76.5 percent). In this case, large pension funds may have benefited from their large number of assets and participants. For example, the use of information technology in operational activities (paying benefits, reporting, etc.) may lower the operational costs of pension funds with large number of participants compared to small pension funds. This result is in line with previous studies which found higher operational efficiency in pension funds with large asset due to economies of scale (Bikker & Dreu, 2009; Bikker, 2017).

Different results are shown in Table 2 regarding the technical efficiency of investment management. Descriptively, there is a difference in the average investment efficiency scores, where large pension funds have higher efficiency score (77.6 percent) than the small ones (71.5 percent). However, the K-S test shows that there is no significant difference between large and small pension funds (difference 0.1583; p = 0.061 > 0.05). The results do not support the hypothesis stating that there is a significant difference in the level of efficiency between large and small pension funds in their investment management. In terms of investment efficiency, large pension funds have not performed up to their best potential based on their size.

Table 2. Average Efficiency Scores of Pension Funds by Size

Year		2011	2012	2013	2014	2015	2016	2017	Mean
Average technical efficiency score (TE)									
Model A	Large	0.899	0.592	0.920	0.884	0.913	0.911	0.902	0.860
	Small	0.838	0.395	0.875	0.746	0.720	0.910	0.873	0.765
	K-S test	difference: 0.2972; significance: 0.000							
Model B	Large	0.816	0.813	0.783	0.792	0.641	0.835	0.750	0.776
	Small	0.674	0.735	0.624	0.803	0.617	0.785	0.769	0.715
	K-S test	difference: 0.1583; significance: 0.061							
The average score of scale efficiency (SE)									
Model A	Large	0.960	0.697	0.941	0.950	0.841	0.982	0.972	0.906
	Small	0.971	0.800	0.984	0.949	0.916	0.985	0.976	0.940
	K-S test	difference: 0.2066; significance: 0.005							
Model B	Large	0.762	0.879	0.097	0.833	0.327	0.813	0.788	0.642
	Small	0.877	0.945	0.319	0.947	0.431	0.964	0.943	0.775
	K-S test	difference: 0.4579; significance: 0.000							

Table 2 also presents the results of the scale efficiency (SE) analysis. As shown in Table 2, small pension funds have higher scale efficiency score than large pension funds both for operational management (94 percent vs 90.6 percent) and investment management (77.5 percent vs 64.2 percent). The results of the KS test show a significant difference between large and small pension funds in their level of operational scale efficiency (difference: 0.2066; p = 0.005 <0.05) and investment scale efficiency (difference: 0.4579; p = 0.000 <0.05). The results confirm the hypothesis that there are differences in the level of scale efficiency between large and small pension funds, both in operational and investment management. However, it is the small pension funds that have higher level of scale efficiency over the large ones.

These results imply that with the same input size, small pension funds can actually produce higher output than large pension funds. For example, in terms of operational management, with the same input size (total operating costs and net assets at the beginning of the period), a small pension fund can produce an average output (i.e net assets at the end of the period) of 94 percent, while a large pension fund only produces 90.6 percent . This has the implication that in order to achieve the same level of output as that of a small pension fund (i.e 94 percent), a larger pension fund must reduce its input size (total operating costs) by 3.4 percent (difference of 94 minus 90.6 percent). Likewise in the case of investment management, in order to achieve the same level of output as that of a small pension fund (i.e. 77.5 percent), a larger pension funds must reduce its input size (i.e total investment costs and average investment funds) by 13.3 percent (difference of 77.5 minus 64.2 percent). Based on these results it can be said that large pension funds were unable to perform optimally according to their scale.

A closer look at the results of the analysis of technical efficiency and scale efficiency based on size, it can be tell that large pension funds only excel in terms of operational technical efficiency. Meanwhile in terms of investment technical efficiency and scale efficiency, the large pension funds are less optimal compared to small ones. Previous studies have shown that diseconomies of scale can occur as the size of the pension fund increases (Bikker, 2017). This

can also the case for pension funds in Indonesia. In particular, however, for investment efficiency, factors such as limited domestic securities markets and strict investment regulations in Indonesia, may have contributed to preventing large pension funds from performing optimally (e.g. pension funds are not allowed to invest in foreign assets, etc.). Previous studies have shown that a tight regulatory environment (Robu & Sandu, 2011) and limited securities market liquidity (Bauer, Cremers, & Frehen, 2010) limit large pension funds to perform optimally.

4.3. Pension Fund Efficiency Level Based on Ownership

Table 3 displays the efficiency based on the pension fund ownership, i.e. SOE and Non-SOE pension funds. The average technical efficiency score of SOE pension funds is higher than that of Non-SOE pension funds in both operation management (84.6 vs. 778 percent) and investment management (84.4 vs. 65.3 percent). The KS test results revealed a significant difference between SOE and Non-SOE pension funds in terms of operational efficiency (difference: 0.1883; $p = 0.015 < 0.05$) and investment efficiency (difference 0.3391; $p = 0.000 < 0.05$). These results support the hypothesis that there are significant differences between SOE and Non-SOE pension funds in their operational and investment efficiency. The SOE pension funds are proven to have a significantly higher level of technical efficiency than Non-SOE pension funds, both in operation and investment management.

Table 3. Average Efficiency Scores Based on Ownership

Year		2011	2012	2013	2014	2015	2016	2017	Mean
Technical efficiency score									
Model A	SOE	0.926	0.577	0.915	0.838	0.882	0.900	0.885	0.846
	Non-SOE	0.814	0.408	0.879	0.788	0.748	0.920	0.889	0.778
K-S test	difference: 0.1883; significance: 0.015								
Model B	SOE	0.896	0.913	0.862	0.829	0.753	0.847	0.811	0.844
	Non-SOE	0.602	0.645	0.552	0.769	0.515	0.774	0.714	0.653
K-S test	difference: 0.3391; significance: 0.000								
Scale efficiency score									
Model A	SOE	0.768	0.674	0.938	0.932	0.804	0.975	0.963	0.891
	Non-SOE	0.981	0.821	0.987	0.965	0.950	0.991	0.984	0.954
K-S test	difference: 0.1811; significance: 0.021								
Model B	SOE	0.780	0.871	0.144	0.858	0.339	0.863	0.816	0.667
	Non-SOE	0.860	0.953	0.275	0.924	0.420	0.918	0.917	0.753
K-S test	difference: 0.3074; significance: 0.000								

These results mean that the production ability of SOE pension funds is higher than that of Non-SOE pension funds. The fact that the efficiency level of SOE pension funds is higher than that of Non-SOE pension funds, may relate to the special attributes of SOE pension funds. The SOE pension funds are typically sponsored by big government-owned companies and national banks, which have easy access to technology and the capacity to hire highly qualified personnel in pension funds management. Meanwhile, Non-SOE pension funds generally consist of small pension funds organized by social/school foundations and small non-government companies. These factors are considered to have played a role in the technical efficiency gap between SOE and Non-SOE pension funds. These results are similar to Siddiqui (2021), who found better performance in government owned pensions in India.

Table 3 also presents the results of the scale efficiency analysis of SOE and Non-SOE pension funds. The opposite results are seen in terms of scale efficiency, where Non-SOE pension funds scoring higher than SOE pension funds both in operational and investment efficiency. In terms of operational efficiency, the average efficiency score for Non-SOE pension funds reaches 94.5 percent, while SOE pension funds are only 89.1 percent. Likewise, in terms of investment efficiency, Non-SOE pension funds can achieve an average score of 75.3 percent, while SOE pension funds only reach 66.7 percent. The results of the K-S test showed that there were significant differences between SOE and Non-SOE pension funds both in operational efficiency (difference: 0.1811; $p = 0.021 < 0.05$) and investment efficiency (difference: 0.3074: $p = 0.000 < 0.05$).

Likewise, in terms of efficiency, the non-SOE pension investment scale can reach 75.3%, while SOE is 66.7%. The results of the Kolmogorov-Smirnov test showed that there were significant differences between SOE and Non-SOE pension funds in operational scale efficiency (difference: 0.1811; $p = 0.021 < 0.05$) and investment scale efficiency (difference: 0.3074: $p = 0.000 < 0.05$). Thus, the hypothesis is proven that there are significant differences between operational and investment scale efficiencies of SOE pension funds and Non-SOE pension funds. In this case, Non-SOE pension funds are proven to have a higher level of scale efficiency than SOE pension funds both in terms of operational and investment scale efficiency.

5. CONCLUSION

This study employs the nonparametric DEA method to examine the technical and scale efficiency of Indonesian Employer Pension Funds (DPPK) for the 2011-2017 period. The Kolmogorov-Smirnov test was carried out on DEA efficiency scores to see whether there was a difference in efficiency levels based on size and ownership. The results show that while large pension funds can outperform small pension funds in terms of operational management, they fall short in terms of investment management, i.e. they are only about the same level as small ones in investments technical efficiency. In terms of scale efficiency, large pension funds perform even lower than small pension funds, both in their operations and investments. SOE pension funds were found to have higher technical efficiency but lower scale efficiency than Non-SOE pension funds. It is believed that the incapacity of large pension funds and SOE pension funds to operate on an efficient scale is due to diseconomies of scale as well as environmental factors, a still-developing domestic capital market, and strict regulations.

Academically, this study broadens the understanding of pension fund efficiency from the perspectives of technical and scale efficiency. In the context of Indonesia, large pension funds do not perform differently in investment management than smaller pension funds, presumably due to strict regulatory framework and limited domestic securities market. Practically, this study provides important information for management to improve the performance of their pension funds. This study also has some limitations. First, this study did not identify the most optimal scale or size of pension funds. Second, this study does not investigate further the links between the non-optimal investment performance of large pension funds and the strict regulations and the domestic capital market. Future studies are expected to further examine these areas.

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