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Does ownership moderate the effects of size on pension funds' efficiency and investment performance?

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Abstract

This study aims to explore the effect of specific characteristics of pension funds: size, efficiency, and ownership on pension fund performance. Specifically, it aims to obtain empirical evidence of whether pension fund ownership moderates the effect of size and efficiency on pension fund performance. We use annual financial statements obtained from the Indonesian Pension Fund Association (ADPI) for the period 2013-2017. The sampling technique generates the final sample of 167 pension funds and number of observations 835 firm-year. Using panel regression, we find that pension fund size has no significant positive effect on pension funds efficiency and investment performance. In addition, ownership does not moderate the effect of pension fund size on the efficiency and investment performance of pension funds. We suggest that large pension funds do not necessarily generate revenues higher than investment costs. Hence, our results inform the Financial Service Authority (FSA) to encourage pension funds to utilize their large size to generate higher revenues and exhibit more positive performance.

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh karakteristik tertentu dari dana pensiun: ukuran, efisiensi, dan kepemilikan terhadap kinerja dana pensiun. Secara khusus, ini bertujuan untuk mendapatkan bukti empiris apakah kepemilikan dana pensiun memoderasi pengaruh ukuran dan efisiensi terhadap kinerja dana pensiun. Kami menggunakan laporan keuangan tahunan yang diperoleh dari Asosiasi Dana Pensiun Indonesia (ADPI) untuk periode 2013-2017. Teknik pengambilan sampel menghasilkan sampel akhir 167 dana pensiun dan jumlah observasi 835 firm-year. Dengan menggunakan regresi panel, kami menemukan bahwa ukuran dana pensiun tidak berpengaruh positif signifikan terhadap efisiensi dana pensiun dan kinerja investasi. Selain itu, kepemilikan tidak memoderasi pengaruh ukuran dana pensiun terhadap efisiensi dan kinerja investasi dana pensiun. Kami menyarankan bahwa dana pensiun yang besar belum tentu menghasilkan pendapatan yang lebih tinggi dari biaya investasi. Karenanya, hasil kami menginformasikan Otoritas Jasa Keuangan (OJK) untuk mendorong dana pensiun memanfaatkan ukurannya yang besar untuk menghasilkan pendapatan yang lebih tinggi dan menunjukkan kinerja yang lebih positif.

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1. Introduction

Pension funds are non-bank financial institutions that develop rapidly due to increased public awareness about preparing pension age financially. From the macroeconomic perspective, the development of pension funds potentially increases gross domestic products and is an alternative financing source for various governmental programs, such as infrastructure projects.

The Indonesian pension system consists of three pillars, namely compulsory pension funds (Social Security Administration Agency - *BPJS* or *Badan Penyelenggara Jaminan Sosial*), regulated voluntary pension funds (employer's pension funds/*DPKK* and financial institution pension funds/*DPLK*), and individual pension funds, such as savings, investments, and insurance. Employers administer *DPPK* while financial institutions, such as banks or life insurance firms, offer *DPLK* pension funds.

An interesting *DPPK*-related phenomenon indicates the inverse relationship between the number of pension funds and investment returns based on pension funds' size. In particular, there were 163 small pension funds in 2017 (the Indonesian Financial Service Authority/*FSA* or *Otoritas Jasa Keuangan/OJK* classifies Indonesian pension funds into four groups based on total assets that range from less than 100 billion Rupiah to more than one trillion Rupiah. Large pension funds are classified into group I and II and have total assets of at least 500 billion Rupiah. Meanwhile, small pension funds are classified into group III and IV with total assets less than 500 billion Rupiah), more than twice than the large pension funds (73 entities). However, these 73 large pension funds generated a similar amount of funds (234.83 trillion Rupiah) with that of 163 small pension funds (239.23 trillion Rupiah) with the investment returns of 16 percent higher than that of small pension funds.

Galagedera & Watson (2015) observe that pension funds' size is positively correlated with investment performance. Similarly, Andonov,

Eichholtz, & Kok (2014) document that large pension funds tend to invest internally, incur lower investment costs, and generate higher net profits. Meanwhile, small pension funds invest externally through external investment intermediaries that increase investment costs and reduce investment returns. Besides investment costs, large pension funds' investment portfolios are dominated by risky assets that incur higher risk management costs (Bikker, 2015).

The ownership of the Indonesian pension fund industry is generally classified into governmental and private ownership. Private firms (as employers), groups, or individuals with stable fund sources sponsor private pension programs because of long-term contracts and relatively predictable risk probability. Meanwhile, in this respect, the public pension funds refer to those of state-owned enterprises (SOEs). Further, Woidtke (2002) reveals the relationship between institutional ownership and public and private pension funds' share ownership of firms. Mohan & Zhang (2014) confirm the results by demonstrating that pension fund ownership affects returns. In particular, different from private pension funds, public pension funds tend to take higher risks and generate lower returns. These findings are in line with another study that indicates the effect of ownership type in the banking industry (Atahau, 2016).

Currently, the regulations on the Indonesian pension fund industry is uniform (one size fits all). The government does not treat pension funds differently based on pension funds' specific characteristics such as size and ownership. In fact, the implementation of regulations has different effects on pension funds with different characteristics. The regulations of financing affect financing costs, primarily through the choices of investment strategies (Boon, Brière, & Rigot, 2018). Giannetti & Laeven (2009) highlight that firms will perform better if they manage large private pension funds, but not for those that manage small pension funds that are related to financial institutions and industry groups.

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Numerous scholars have investigated pension funds, such as Jackowicz & Kowalewski (2012), Handoko (2015), Jackwerth & Slavutskaya (2016), and Sonza & Granzotto (2018). However, these studies tend to focus on pension funds' performance and overlook investment efficiency. Meanwhile, Paradi & Zhu (2013), Hosseinzadeh et al. (2016), Sparta (2017), Anwar (2019), and Fang et al. (2019) who examine efficiency tend to focus on the efficiency and performance of non-pension funds, such as firms and banks. Different from these previous studies, we analyze the effects of pension funds' size on efficiency and performance with ownership as the moderating variable. Besides, this study also adds the ownership variable because we predict that private ownership is more likely to increase pension funds' efficiency and investment performance than public pension funds due to differences in governance and organizational culture. This study seeks to inform policymakers in creating policies related to the pension fund industry and offering references for academicians in future studies.

2. Hypotheses Development

Total assets determine pension funds' size (Bikker, 2015). Pension funds with higher total assets tend to commit large-scale investments that will affect investment costs (costs incurred during investment activities). Suboptimal and excessive investment costs will lead to inefficiency. Conversely, much smaller investment costs inhibit pension funds to achieve their optimal capacity (Sharasanti & Prayitno, 2017).

Andonov et al. (2014) demonstrate that pension funds' size positively affects investment efficiency. Large pension funds tend to invest internally without relying on investment managers as the intermediaries. Hence, they arguably incur lower investment costs and generate higher net profits. Meanwhile, small pension funds invest externally through investment managers as the intermediaries that increase investment costs and reduce invest-

ment returns. These explanations indicate that larger pension funds tend to invest in large amounts that generate investment revenues that are higher than investment costs. Thus, lower investment efficiency ratios indicate that pension funds invest more efficiently. Based on these arguments, we propose the following first hypothesis:

H_1 : pension funds' size positively affects investment efficiency.

Large pension funds tend to have higher total net assets or more than IDR 500 billion. Galagedera & Watson (2015) emphasize that pension funds' size is positively associated with investment performance. Larger pension funds have better abilities to utilize existing funds to generate net assets because larger investments likely generate higher returns. Besides, Rosananda & Hadi (2018) demonstrate that larger pension funds' size increases investors' confidence in the ability of pension funds to offer higher returns. In a similar vein, Giannetti & Laeven (2009) and Andonov et al. (2014) empirically show that large pension funds exhibit better investment performance than small ones. Based on these arguments, the following is our second hypothesis:

H_2 : pension funds' size positively affects investment performance.

Mohan & Zhang (2014) find that ownership strengthens the effect of size on pension funds' investment efficiency. Larger pension funds tend to be more efficient. In this respect, private pension funds exhibit better governance and lower agency problems than public ones. Besides, the ownership of private pension funds affects returns. Different from private pension programs, public pension funds tend to take higher risks but can only generate lower returns due to inefficiency. Meanwhile, private pension funds are more efficient because they tend to invest more internally and consequently generate higher returns revenues, incur lower investment costs, and increase their investment re-

turns. Based on these arguments, we propose the following third hypothesis:

H_3 : ownership strengthens the positive effect of size on pension funds' investment efficiency.

Ownership affects pension funds' investment performance. This argument is supported by Giannetti & Laeven (2009) who document that ownership moderates the effect of size on pension funds' investment performance. Large private pension funds likely have higher investment performance. These pension funds are better able to manage their funds to have higher net assets and generate higher investment returns. Thus, these pension funds exhibit better performance. Based on these arguments, we propose the following fourth hypothesis:

H_4 : ownership strengthens the positive effect of size on pension funds' investment performance.

3. Method, Data, and Analysis

This study uses the quantitative data from the annual reports of the member pension funds of the

Association of Indonesian Pension Funds (*ADPI – Asosiasi Dana Pension Indonesia*) in 2013-2017 with the population of all pension funds that are registered at the 2017 Indonesian Pension Fund book. We generate the sample with the purposive sampling technique by using a single sampling criterion (member pension funds of *ADPI*). The sampling technique generates the final sample of 167 pension funds.

Table 1. The sample selection process based on the criterion

Criterion	Number of Pension Funds
The number of pension funds based on the 2017 Indonesian Pension Funds Statistics (population)	236
The number of pension funds not registered at the Association of Indonesian Pension Funds in 2013-2017.	69
Number of the final sample	167
Observation years	5
Number of observations	835

Table 2. Operational definition and measurement of research variables

Variable	Proxy	Indicators	Scale
Dependent			
Pension Funds' Investment Efficiency	<i>INVEFF</i>	$\frac{\text{Investment Costs}}{\text{Investment Revenues}}$	Ratio
Pension Funds' Investment Performance	<i>ROI</i>	$\frac{\text{After – tax Net Income}}{\text{Total Investments}}$	Ratio
Independent			
Pension Funds' Size	<i>SIZE</i>	ln (Total Assets)	Ratio
Moderating			
Pension Funds' Ownership	<i>OWN</i>	1 = private pension fund, 0= public pension fund	Dummy
Control			
Pension Funds' Age	<i>AGE</i>	Observation year – establishment year	Ratio
Interest Rate	<i>IR</i>	<i>BI</i> rate	Ratio
Pension Fund Type	<i>TYPE</i>	1 = defined benefit plan, 0 = defined contribution plan	Dummy
Macroeconomic condition	<i>GDP</i>	ln(Gross Domestic Product)	Ratio

Operational definition and variable measurement

Table 2 explains the definition and measurement of size, ownership, investment efficiency, and investment performance.

The dependent variables of this study are pension funds' investment efficiency and performance. While the independent variable is pension funds' size, and the moderating variable is pension funds' ownership. This study uses the unbalanced panel data regression because we combine the time series and cross-section data, and several pension funds do not have complete data for the whole observation years. We use STATA 14 statistical software to analyze the data. This study uses Eq. (1) and (2) to test the hypotheses.

$$INVEFF_{it} = a + \beta_1 SIZE_{it} + \beta_2 OWN_{it} + \beta_3 SIZE * OWN_{it} + \beta_4 \sum Kontrol_{it} + e_{it} \quad (1)$$

$$ROI_{it} = a + \beta_1 SIZE_{it} + \beta_2 OWN_{it} + \beta_3 SIZE * OWN_{it} + \beta_4 \sum Kontrol_{it} + e_{it} \quad (2)$$

where, *INVEFF* = pension funds' investment efficiency; *ROI* = pension funds' profitability; *SIZE* = pension funds' size moderating; *OWN* = pension funds' ownership; α = constant; $\beta_1, \beta_2, \beta_3, \beta_4$ = the regression coefficients of the independent variables; *Kontrol* = variabel kontrol *AGE, IR, TYPE, GDP*; *i* = the cross section data of the pension fund sample; *t* = the time-series data of 2013-2017; e_{it} = error at *t* for the cross-section unit

The test of the panel data regression model

The panel data regression model consists of the common-effect model (CEM), fixed-effect model (FEM), and random-effect model (REM). We select the panel data regression model based on Gujarati & Porter (2009). The Chow test selects between the pooled least square (PLS) and FEM methods in the

panel data modeling. If probability > F is lower than the significance value, then the FEM model is better than PLS. We run the Breusch-Pagan Lagrange Multiplier (BGLM) test if the Chow test indicates that the PLS method is the appropriate one. This study then compares between PLS and REM. If the probability > $\chi^2_{0.05}$, then REM is more appropriate than PLS. Further, we run the Hausman test if the Chow test finds that FEM is the best model. The test compares FEM and REM. If the probability > $\chi^2_{0.05}$, then FEM is better than REM. However, if REM is more appropriate, then the heteroskedasticity and autocorrelation tests are no longer necessary.

4. Results

Descriptive statistics

Table 3 below demonstrates the descriptive statistics of the research variables. The mean value of investment efficiency (*INVEFF*) is 4.5 percent, while the minimum value of this variable is -1.86 percent (*Muhammadiyah Pension Fund - 2017*). The negative value indicates that the pension fund's investment revenues are negative because the market values of its investment instruments are lower than the book values. Meanwhile, the maximum value of *INVEFF* is 276 percent (*Mitra Krakatau Pension Fund - 2016*) likely because of the relatively lower investment revenues relative to investment costs. It is worth noting that lower *INVEFF* values indicate that pension funds exhibit greater investment efficiency.

The mean value of *ROI* as the measure of investment performance is 12.24 percent, while the minimum value of this variable is -145.5 percent (*Indonesian Islamic University Pension Fund - 2015*). The negative *ROI* value is likely affected by losses due to the decreasing market values of market-based investment instruments such as stocks and stock-based mutual funds. Meanwhile, the maximum value of *ROI* (1058.5 percent) belongs to the *Pendidikan Cendekia Utama - 2014*.

Table 3. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>INVEFF</i>	472	0.0456	0.1649	-0.0186	2.76
<i>ROI</i>	472	0.1224	0.5287	-1.455	10.585
<i>SIZE</i>	472	26.647	1.5848	22.2828	30.5987
<i>OWN</i>	835	0.1437	0.3510	0	1
<i>AGE</i>	835	42.269	23.628	5	158
<i>IR</i>	835	0.0638	0.0112	0.0456	0.0753
<i>TYPE</i>	835	0.7964	0.4029	0	1
<i>GDP</i>	835	36.734	0.0688	36.6375	36.8325

Notes: *INVEFF*= pension funds' investment efficiency is the ratio of investment cost to investment revenues; *ROI*= pension funds' investment performance is the ratio of after-tax net income to total investments; *SIZE*= pension funds' size is $\ln(\text{total assets})$; *OWN*= pension funds' ownership is the dummy variable for 1= private pension fund, 0= public pension fund; *AGE*= pension funds' age is observation year – establishment year; *IR*= interest rate (BI rate); *TYPE*= pension fund type is the dummy variable for 1 = defined benefit plan, 0 = defined contribution plan; *GDP*= macroeconomic condition is $\ln(\text{Gross Domestic Product})$

Tambi pension fund-2013 has the lowest total assets, with the total assets of IDR 4,756,693,614, while *Telkom* pension fund-2017 has the highest total assets with the value of IDR 19,447,263,296,357. These figures indicate vast total asset differences between the member pension funds of *ADPI*. The detailed descriptive statistics of the control variables can be seen in Table 3. This table suggests that due to our unbalanced panel data, we have only 472 observations for the *INVEFF*, *ROI*, and *SIZE* variables while we have 835 total observations.

The selection of the estimation model

Table 4 demonstrates that the PLS and *ROI* methods are the best estimation models for Eq. 1 (*INVEFF* as the dependent variable) and Eq. 2 (*ROI* as the dependent variable), respectively.

Table 4. The results of the test of panel data estimation model

Test	Prob.	Best Estimation Model
Model 1 (<i>INVEFF</i>)		
Chow test	0.3319	PLS
BGLM test	1.000	PLS
Model 2 (<i>ROI</i>)		
Chow test	0.0000	FEM
BGLM test	0.3835	PLS

Tests of classical assumptions

Because the best estimation methods for model 1 and model 2 are PLS and FEM, we need to run the tests of classical assumptions. Table 5 displays the results of the correlation test, while Table 6 illustrates the results of the classical assumption tests.

Table 5 indicates that all the correlation coefficients between independent variables are below 0.75, implying no serious multicollinearity problem. However, the VIF tests show that both models exhibit VIF mean values above 10, suggesting serious multicollinearity problems. Besides, other results also indicate heteroskedasticity and autocorrelation problems. Consequently, we include a robust standard error in each regression estimation.

Hypothesis testing

Table 7 demonstrates the results of the hypothesis testing with unbalanced panel data.

For model 1 with *INVEFF* as the dependent variable, Eq. (1) indicates that *SIZE* does not affect *INVEFF*. The finding indicates that pension funds' size does not increase their investment efficiency.

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Next, in equation 2 that involves *OWN* as the moderating variable (*MOD* as the product of *SIZE*OWN*), the result is qualitatively similar. *SIZE*, *OWN*, and *MOD* do not significantly affect *INVEFF*. Accordingly, ownership does not strengthen the positive effect of pension funds' size on their investment efficiency. Hence, the results suggest that H_1 and H_3 are not empirically supported.

Next, this study splits the sample into two subsamples based on *OWN* (equations 3 and 4) and *TYPE* (Eq. 5-8). The results are not significantly different from the full-sample analysis. Thus, both the full-sample and split-sample analysis result in no significant effect of *SIZE* on *INVEFF* and no moderating effect of *OWN*. In short, H_1 and H_3 are not empirically supported.

Lastly, R-squared values as the coefficient of determination in the full-sample analysis are only 1.05 percent and 1.45 percent. Meanwhile, in the split-sample analysis based on *OWN*, the values are 21.66 percent and 2.11 percent, whereas splitting the

sample based on *TYPE* results in R-squared values of 1.37 percent, 16.40 percent, 3.39 percent, and 4.71 percent. Equation 3 has the highest R-squared value of 21.66 percent. The findings suggest that the joint ability of the independent variables to explain the dependent variable is relatively low. In other words, other independent variables help to explain the dependent variable better. The results are also likely because of limited data availability (835 total observations and 472 full-sample observations).

For model 2, with *ROI* as the dependent variable, equation 1 shows that *SIZE* does not affect *ROI*. Thus, pension funds' size does not increase investment performance. Next, in equation 2 that involves *OWN* as the moderating variable (*MOD* as the product of *SIZE*OWN*), the result is qualitatively similar. *SIZE*, *OWN*, and *MOD* do not significantly affect *INVEFF*. Ownership does not strengthen the effect of size on pension funds' investment performance. Hence, both results indicate that H_2 and H_4 are not empirically supported.

Table 5. Correlation matrix

	<i>SIZE</i>	<i>OWN</i>	<i>AGE</i>	<i>IR</i>	<i>TYPE</i>	<i>GDP</i>
<i>SIZE</i>	1					
<i>OWN</i>	-0.1544	1				
<i>AGE</i>	-0.0758	-0.0476	1			
<i>IR</i>	-0.0356	0.0022	-0.0616	1		
<i>TYPE</i>	0.0029	-0.2559	0.1296	0.0046	1	
<i>GDP</i>	0.1017	0.0091	0.0714	-0.7255	-0.0053	1

Notes: *SIZE*= pension funds' size is $\ln(\text{total assets})$; *OWN*= pension funds' ownership is the dummy variable for 1= private pension fund, 0= public pension fund; *AGE*= pension funds' age is observation year – establishment year; *IR*= interest rate (BI rate); *TYPE*= pension fund type is the dummy variable for 1 = defined benefit plan, 0 = defined contribution plan; *GDP*= macroeconomic condition is $\ln(\text{Gross Domestic Product})$

Table 6. The results of the classical assumptions tests

Method	Model	Result	Conclusion
Variance Inflation Factor (VIF)	Model 1 (<i>INVEFF</i>)	Mean VIF = 1.42	Multicollinearity
	Model 2 (<i>ROI</i>)	Mean VIF = 164.23	Multicollinearity
Modified Wald test	Model 1 (<i>INVEFF</i>)	Prob > chi2 = 0.0000	Heteroskedasticity
	Model 2 (<i>ROI</i>)	Prob > chi2 = 0.0000	Heteroskedasticity
Wooldridge test	Model 1 (<i>INVEFF</i>)	Prob > F = 0.0000	Autocorrelation
	Model 2 (<i>ROI</i>)	Prob > F = 0.0000	Autocorrelation

Table 7. The results of regression analysis

Variable	Model 1: INVEFF							
	1	2	3	4	5	6	7	8
SIZE	0.0026	0.0006	0.0661	0.0003	0.0039	0.0016	0.0019	0.0001
OWN		-0.5352				-3.9879		-0.6111
MOD		0.0209				0.1586		0.0203
AGE	-0.0000	-0.0000	0.0028	-0.0001	-0.0002	-0.0003**	0.0009	0.0015
IR	1.8708	1.9532	-0.0964	2.8348	-1.8319	-0.5373	16.8015	16.7924
TYPE	-0.0280	-0.0193	0.1455	-0.0496				
GDP	0.1004	0.1062	-1.0134	0.3059	-0.2510	-0.1492	1.5694	1.5667
Constant	-3.7918	-3.9651	35.4167	-11.3143	9.2791	5.5259	-58.6269	-58.4775
Sample	Full	Full	OWN = 1	OWN = 0	TYPE = 1	TYPE = 1	TYPE = 0	TYPE = 0
n	167	167	24	143	133	133	34	34
Obs.	472	472	69	403	377	377	95	95
R-square	0.0105	0.0145	0.2166	0.02119	0.0137	0.1640	0.0339	0.0471
Dummy time effect	yes	yes	yes	yes	yes	yes	yes	yes
Model	PLS	PLS	PLS	PLS	PLS	PLS	PLS	PLS

Notes: SIZE= pension funds' size is ln(total assets); OWN= pension funds' ownership is the dummy variable for 1= private pension fund, 0= public pension fund; AGE= pension funds' age is observation year – establishment year; IR= interest rate (BI rate); TYPE= pension fund type is the dummy variable for 1 = defined benefit plan, 0 = defined contribution plan; GDP= macroeconomic condition is ln(Gross Domestic Product). *, **, and *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively

Table 8. The results of regression analysis (continued)

Variable	Model 2: ROI							
	1	2	3	4	5	6	7	8
SIZE	0.0027	0.0050	0.0022	0.0034	0.0660	0.0675	-0.0351	-0.0367
OWN	-0.0009	2.1730				3.8833		-0.5234
MOD		-0.0849				-0.1477		0.0174
AGE		0.0018	0.0003	0.0016	0.0016	0.0016	-0.0035	-0.0030
IR	3.4262	3.4220	1.7596	3.7498	3.5497	3.4042	-5.8957	-5.9046
TYPE	0.0756	0.0949	-0.0163	0.0941				
GDP	1.1360	1.1049	0.5170***	1.1828	1.0687	1.0829	-1.2670	-1.2692
Constant	-41.9378	-40.9396	-19.0866**	-43.7735	-41.3178	-41.8735	48.1230	48.2497
Sample	Full	Full	OWN = 1	OWN = 0	TYPE = 1	TYPE = 1	TYPE = 0	TYPE = 0
n	167	167	24	143	133	133	34	34
Obs.	472	472	69	403	377	377	95	95
R-squared	-	-	-	-	-	-	-	-
Dummy time effect	yes	yes	yes	yes	yes	yes	yes	yes
Model	Robust XTGLS	Robust XTGLS	Robust XTGLS	Robust XTGLS	Robust XTGLS	Robust XTGLS	XTGLS	XTGLS

Notes: SIZE= pension funds' size is ln(total assets); OWN= pension funds' ownership is the dummy variable for 1= private pension fund, 0= public pension fund; AGE= pension funds' age is observation year – establishment year; IR= interest rate (BI rate); TYPE= pension fund type is the dummy variable for 1 = defined benefit plan, 0 = defined contribution plan; GDP= macroeconomic condition is ln(Gross Domestic Product). *, **, and *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively

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Similar to model 1, we split the sample into two subsamples based on *OWN* (Eq. 3 and 4) and *TYPE* (Eq. 5-8). The results are not significantly different from the full-sample analysis. Both the full-sample and split-sample analysis result in no significant effect of *SIZE* on *ROI* and no moderating effect of *OWN*. Thus, H_2 and H_4 are not empirically supported.

Lastly, because the estimations use FEM, *OWN* as the moderating variable becomes omitted. Accordingly, we need to estimate the model with the Generalized Least Square (GLS) by adding the unit effect as the robust standard error of FEM. However, the estimation using the STATA command of `-xtgls-` does not produce R-squared values. McDowell & StataCorp (2020) explain that the R-squared values do not appear after we run the `-xlgls-` estimation for two reasons. First, the R-squared values of GLS do not necessarily fall between zero and one. Second, the R-squared values do not represent the percentage of the total variance of the dependent variable. Hence, deleting (adding) variables from (into) a model does not necessarily increase or reduce R-squared values.

5. Discussion

The effect of size on pension funds' investment efficiency

Based on model 1 of Table 7, in general, pension funds' size does not significantly affect pension funds' investment efficiency. These findings show that pension funds' size does not increase investment efficiency. Hence, hypothesis 1 that predicts that pension funds' size positively affects investment efficiency is not empirically supported.

Our results are not in line with Andonov et al. (2014) who document the positive impact of pension funds' size on investment efficiency. Larger pension funds' size will affect the investment efficiency ratio. In general, large pension funds tend to invest in large amounts internally (without inter-

mediaries). Consequently, they likely generate revenues higher than investment costs that will reduce their investment ratios, suggesting that their investments are more efficient. Besides, large pension funds enjoy the economics of scale and scope that suppress investment costs and eventually increase the efficiency of their investments. Meanwhile, this study indicates other factors that are more dominant in affecting pension funds' investment efficiency, as indicated by relatively low R-squared values. Also, the use of unbalanced data with a considerable number of observations with missing data potentially affects our results because the analysis with smaller samples produces different results.

The effect of size on pension funds' investment performance

Based on model 2 of Table 7, in general, pension funds' size does not significantly affect *ROI* in both full-sample or split-sample analysis. The results show that pension funds' size does not increase investment performance. Hence, it can be concluded that hypothesis 2 that predicts the positive effect of size on pension funds' investment performance is not empirically supported.

These findings are not consistent with Andonov et al. (2014) and Galagedera & Watson (2015) who observe that pension funds' size is positively associated with investment performance. Based on total assets, large pension funds tend to invest internally and consequently incur relatively lower costs because they can generate higher investment revenues. Besides, large pension funds tend to have more stable financial conditions that enable them to manage funds better to produce higher net assets, generate higher returns, and eventually increase their investment performance. Only large pension funds that can invest in several investment instruments that offer expected returns, such as Medium-Term Notes (MTN), Real Estate Investment Trust (REITs), and conventional and sharia-based bonds or *Sukuk*. Meanwhile, small pension

funds mainly invest in bank deposits that offer lower interest rates than other investment instruments.

In this study, our findings indicate other factors that are more dominant in explaining pension funds' investment performance, as indicated by relatively low R-squared values that affect estimation results.

The moderating effect of ownership on the relationship between size and pension funds' investment efficiency

Equations 2, 6, and 8 of model 1 in Table 7 imply that, in general, the moderating role of ownership on the relationship between pension funds' size and pension funds' investment efficiency is insignificant. The results indicate that hypothesis 3 that predicts that ownership strengthens the positive effect of size on pension funds' investment efficiency is not empirically supported.

Our results are not in line with Mohan & Zhang (2014) who demonstrate that ownership strengthens the effect of size on pension funds' investment efficiency, especially for private ones, because private pension funds have better governance and lower agency problems. Consequently, private pension funds likely generate higher returns than public ones. Besides, public pension funds tend to take higher risks, and consequently, they generate lower returns because they are less efficient.

Conversely, the findings support Akhigbe et al. (2017) who find that ownership type (private vs. public) does not moderate the effect of size on pension funds' investment efficiency likely because the pension fund industry is highly regulated. Consequently, pension funds, regardless of their owners, will arguably comply with existing regulations in managing funds. Meanwhile, the results do not empirically support the conjecture that private ownership will moderate (strengthen) the impact of size on investment efficiency because of better gover-

nance implementation. Because FSA strictly regulates and monitors pension funds' governance, pension funds, both private and public ones, are equally motivated to comply with FSA regulations. Consequently, ownership has a homogenous effect and does not moderate the relationship between size and investment efficiency.

The moderating effect of ownership on the relationship between size and pension funds' investment performance

Equations 2, 6, and 8 of model 2 in Table 7 suggest that, in general, the moderating role of ownership on the relationship between pension funds' size and pension funds' investment performance (*ROI*). The findings indicate that hypothesis 4 that predicts that ownership strengthens the positive effect of size on pension funds' investment performance is not empirically supported.

Pension funds with higher investment intensity require more assets to generate returns. Accordingly, the asset levels of private and public pension funds are not proportional to their returns and do not result in cost efficiency. These results support Broeders, van Oord, & Rijsbergen (2016) who reveal that private ownership does not affect investment performance. Persistently high investment costs and inefficiency can significantly affect investment performance by reducing investment returns and increasing the costs of pension provision. Based on sample data, the public and private share ownership of pension funds is not proportional to the returns, tends to exhibit decreasing investments in annual reports. Consequently, pension funds cannot generate stable net assets that affect their investment performance.

Robustness test

We check the robustness of our findings by running the linear interpolation to fill in the miss-

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ing values in the three main variables, namely *INVEFF*, *ROI*, *SIZE*, and rename the variables with *INVEFF2*, *ROI2*, *SIZE2*. Such interpolation seeks to generate more observations than our previous test on unbalanced panel data because several variables do not have complete data. Table 9 displays the results of the robustness tests.

Our robustness test shows that after the data interpolation, in equations 1, 2, and 4 of model 1 (*INVEFF2* as the dependent variable), *SIZE2* positively affects *INVEFF2*. The findings imply that larger pension funds exhibit greater investment efficiency. Meanwhile, the moderating role of ownership on the relationship between size and investment efficiency remains insignificant.

Meanwhile, the moderating role of ownership in the relationship between size and investment efficiency remains insignificant. Next, in general, the results of equations 1-4 in model 2 (*ROI2* as the de-

pendent variable) are consistent with pre-interpolation findings. Specifically, pension funds' size does not increase investment performance. Also, the moderating role of ownership is insignificant.

The results of our robustness tests demonstrate that data interpolation increases the number of observations and produces slightly different estimation results from previous ones (equations 1 and 2 of model 1). However, the results consistently indicate that hypotheses 1-4 are not empirically supported. Thus, pension funds' size does not increase investment efficiency and performance, and ownership does not moderate the effect of size on investment efficiency and performance.

The results also confirm the previous conjecture that other variables not analyzed in this study explain better investment efficiency and performance. Specifically, we conjecture that asset allocation in portfolios and the return of each asset in

Table 9. The results of the robustness tests

Variable	Model 1: <i>INVEFF2</i>				Model 2: <i>ROI2</i>			
	1	2	3	4	1	2	3	4
<i>SIZE2</i>	.0160**	.0136*	.0549	.0136*	-.1185	-.1326	.0014	-.1351
<i>OWN</i>		-.6770				-3.0359		
<i>MOD2</i>		.0269				.1079		
<i>AGE</i>	.0001	.0001	.0029	-.0000	-.0092	-.0091	-.0000	-.0099
<i>IR</i>	-1.2967	-1.2721	.9445	-1.7030	-3.3031	-3.4054	-.5906	-4.1212
<i>TYPE</i>	-.0628	-.0507	.1152	-.0989	.15659	.1396	.0334	.1664
<i>GDP</i>	.0267	.0293	-.5720	.1016	1.8911	1.9016	.1362	2.1341
Constant	-1.2263	-1.2742	19.4134	-3.8544	-65.6303	-65.5999	-4.9318	-74.0164
Sample	Full	Full	<i>OWN</i> = 1	<i>OWN</i> = 0	Full	Full	<i>OWN</i> = 1	<i>OWN</i> = 0
n	167	167	24	143	167	167	24	143
Obs.	659	659	88	571	659	659	88	571
<i>R-squared</i>	0.0194	0.0224	0.2817	0.0290	0.0337	0.0379	0.1795	0.0391
<i>Dummy time effect</i>	yes	yes	yes	yes	yes	yes	yes	yes
Model	REM	REM	REM	REM	REM	REM	REM	REM

Notes: *INVEFF*= pension funds' investment efficiency is the ratio of investment cost to investment revenues; *ROI*= pension funds' investment performance is the ratio of after-tax net income to total investments; *SIZE*= pension funds' size is $\ln(\text{total assets})$; *OWN*= pension funds' ownership is the dummy variable for 1= private pension fund, 0= public pension fund; *AGE*= pension funds' age is observation year – establishment year; *IR*= interest rate (BI rate); *TYPE*= pension fund type is the dummy variable for 1 = defined benefit plan, 0 = defined contribution plan; *GDP*= macroeconomic condition is $\ln(\text{Gross Domestic Product})$. *, **, and *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively

pension funds' investment portfolios affect the ratio between investment costs and revenues (a proxy of investment efficiency) and the ratio between investment returns and total investments (a proxy of investment performance) more significantly. The relatively low R-squared values indicate our conjecture. Besides, data interpolation increases the number of observations to 659. However, there are still observations with missing data because there are 835 total observations, resulting in unbalanced panel data.

6. Conclusion

Based on the analysis and discussion, we conclude that size does not significantly affect investment efficiency and performance. Besides, ownership does not moderate the relationship between size and investment efficiency and performance. Hence, all hypotheses are not empirically supported.

This study indicates that pension funds' size does not necessarily increase investment efficiency and performance. Besides, pension fund ownership (private vs. public) also does not significantly affect investment performance and efficiency. In particular, public or private ownership of pension funds does not strengthen or weaken the effect of pension funds' size on investment efficiency and performance, likely because the pension fund industry is highly regulated. Consequently, there are no significant differences in governance between public and private pension funds. In this respect, FSA, as the regulator, has issued several regulations to regulate pension funds' investment and governance and monitors the implementation carefully. This study

suggests that large pension funds do not necessarily generate revenues higher than investment costs. Hence, our results inform FSA to encourage pension funds to utilize their large size to generate higher revenues and exhibit more positive performance.

This study is subject to the following caveats that we hope in the future studies will address: (1) Our results have relatively low R-squared values. We then advise future studies to use other relevant independent variables, such as asset allocation and the return of each asset in pension funds' portfolios. For employer's pension funds, future studies can investigate the issue in the defined benefit plans by using actuarial liability to measure fund adequacy ratio (besides *ROI*). In this respect, pension funds may have higher *ROI* and fund adequacy ratios because they never increase pension benefits for passive participants and never increase basic pension income for active participants. (2) Several pension funds do not have complete annual reports that reduce the number of our sample and observations. In this respect, *ADPI* needs to review the data completeness of its members to facilitate a better understanding of the pension fund industry. (3) Future studies can use other proxies of the investment efficiency variable, such as using Data Envelopment Analysis (DEA). Also, they can measure the ownership variable by using more refined proxies such as the percentage of ownership of each pension fund. Besides, future studies can investigate pension funds' investment portfolios to provide a better understanding of the relationship between size and pension funds' investment efficiency and performance.

References

- Akhigbe, A., McNulty, J. E., & Stevenson, B. A. (2017). Does the form of ownership affect firm performance? Evidence from US bank profit efficiency before and during the financial crisis. *Quarterly Review of Economics and Finance*, 64, 120–129. <https://doi.org/10.1016/j.qref.2016.07.015>
- Andonov, A., Eichholtz, P., & Kok, N. (2014). Intermediated investment management in private markets: Evidence from pension fund investments in real estate. *Journal of Financial Markets*, 22, 73–103. <https://doi.org/10.1016/j.finmar.2014.11.002>

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- Anwar, M. (2019). Cost efficiency performance of Indonesian Banks over the recovery period: A stochastic frontier analysis. *Social Science Journal*, 56(3), 377–389. <https://doi.org/10.1016/j.soscij.2018.08.002>
- Atahau, A. D. R. (2016). Loan portfolio composition and performance of Indonesian Banks: does ownership matter?. *Jurnal Keuangan dan Perbankan*, 20(2). <https://doi.org/10.26905/jkdp.v20i2.361>
- Bikker, J. A. (2015). Is there an optimal pension fund size/ ? A scale-economy analysis of administrative costs. *The Journal of Risk and Insurance*, 84(2), 739-769. <https://doi.org/10.1111/jori.12103>
- Boon, L. N., Brière, M., & Rigot, S. (2018). Regulation and pension fund risk-taking. *Journal of International Money and Finance*, 84, 23–41. <https://doi.org/10.1016/j.jimonfin.2018.01.005>
- Broeders, D. W. G. A., van Oord, A., & Rijsbergen, D. R. (2016). Scale economies in pension fund investments: A dissection of investment costs across asset classes. *Journal of International Money and Finance*, 67, 147–171. <https://doi.org/10.1016/j.jimonfin.2016.04.003>
- Fang, J., Lau, C. K. M., Lu, Z., Tan, Y., & Zhang, H. (2019). Bank performance in China: A perspective from bank efficiency, risk-taking, and market competition. *Pacific-Basin Finance Journal*, 56, 290–309. <https://doi.org/10.1016/j.pacfin.2019.06.011>
- Galagedera, D. U. A., & Watson, J. (2015). Benchmarking superannuation funds based on relative performance. *Applied Economics*, 47(28), 2959–2973. <https://doi.org/10.1080/00036846.2015.1011315>
- Giannetti, M., & Laeven, L. (2009). Pension reform, ownership structure, and corporate governance: Evidence from Sweden. *The Review of Financial Studies*, 22(10), 4091–4127. <https://doi.org/10.1093/rfs/hhn091>
- Gujarati, N. D., & Porter, C. D. (2009). *Basic Econometrics* (Fifth Edit). The McGraw-Hill.
- Handoko, D. (2015). Effect of pension funds, asset size, and return on assets of investment portfolio pension fund. *Business and Entrepreneurial Review*, 14(2), 127–148. <https://doi.org/10.25105/ber.v14i2.1147>
- Hosseinzadeh, A., Smyth, R., Valadkhani, A., & Le, V. (2016). Analyzing the efficiency performance of major Australian mining companies using bootstrap data envelopment analysis. *Economic Modelling*, 57, 26–35. <https://doi.org/10.1016/j.econmod.2016.04.008>
- Jackowicz, K., & Kowalewski, O. (2012). Crisis, internal governance mechanisms, and pension fund performance: Evidence from Poland. *Emerging Markets Review*, 13(4), 493–515. <https://doi.org/10.1016/j.ememar.2012.07.006>
- Jackwerth, J. C., & Slavutskaya, A. (2016). The total benefit of alternative assets to pension fund portfolios. *Journal of Financial Markets*, 31, 25–42. <https://doi.org/10.1016/j.finmar.2016.06.002>
- McDowell, A., & StataCorp. (2020). *R-squared after xtgls*. Retrieved from: <https://www.stata.com/support/faqs/statistics/r-squared-after-xtgls/>
- Mohan, N., & Zhang, T. (2014). An analysis of risk-taking behavior for public defined benefit pension plans. *Journal of Banking and Finance*, 40(1), 403–419. <https://doi.org/10.1016/j.jbankfin.2013.12.011>
- Paradi, J. C., & Zhu, H. (2013). A survey on bank branch efficiency and performance research with data envelopment analysis. *Omega (United Kingdom)*, 41(1), 61–79. <https://doi.org/10.1016/j.omega.2011.08.010>
- Rosananda, T. L., & Hadi, S. (2018). Analisis portofolio optimal investasi dana pensiun di Indonesia. *Ilmu Ekonomi*, 2(3), 514–528.
- Sharasanti, D. A., & Prayitno, R. H. (2017). Analisis penilaian kinerja keuangan pada dana pensiun Universitas Surabaya. *Jurnal Bisnis Terapan*, 1(01), 1–12. <https://doi.org/https://doi.org/10.24123/jbt.v1i01.328>

- Sonza, I. B., & Granzotto, A. (2018). Are pension funds good monitors?. *RAUSP Management Journal*, 53(2), 190–201. <https://doi.org/10.1016/j.rauspm.2017.06.003>
- Sparta, S. (2017). Analisis pengaruh efisiensi dan kecukupan modal terhadap kinerja keuangan pada bank pembangunan daerah di Indonesia. *Jurnal Ekonomi dan Bisnis*, 20(1), 83–111. <https://doi.org/10.24914/jeb.v20i1.462>
- Woidtke, T. (2002). Agents watching agents?: Evidence from pension fund ownership and firm value. *Journal of Financial Economics*, 63(1), 99–131. [https://doi.org/10.1016/s0304-405x\(01\)00091-5](https://doi.org/10.1016/s0304-405x(01)00091-5)
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