Nexus Between Pension Fund Size, Design and Investment Strategy: A Review of Occupational Retirement Benefits Schemes in Kenya

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Abstract

The funding risk borne by sponsors of defined benefit pension funds and the residual risk borne by members of defined contribution pension funds have necessitated focus on the investment strategies employed by pension funds. We use secondary data from 206 pension funds in Kenya, to determine the nexus between the investment strategy, size and design. We then validate the results using focused group discussions with industry experts. Results from the regression models indicate that larger schemes adopted a riskier investment strategies compared to their smaller counterparts. However, the investment strategies are not informed by the fund designs. Trustees of retirement benefit schemes are therefore advised to focus their investment strategies to avoid exposing the residual claimants to excessive risk.

Keywords: investment strategy, pension scheme, risky assets, risk, return, defined benefit, defined contribution

1. Introduction

Pension funds are instrumental in providing retirement income to households, development funds to Governments and capital to the corporations. Consequently, they contribute to social-economic development, deepen financial markets and promote economic stability (EOCD, 2013a). These funds have consistently evolved from the Bismarck model developed in 1889 (Börsch-Supan and Wilke, 2003) to the global capitalistic organizations that they are today. OECD countries private pension assets totaled $38 trillion equivalent to 83% of gross domestic product in 2016 with United States accounting for 66% of these assets. Public Pension Reserve Funds (PPRFs) assets amounted to $5 trillion a 19% of gross domestic product in 2015 (OECD, 2017). According to RBA (2017) retirement benefits assets in Kenya amounted to Ksh 913 billion ($9.3 billion) as at 31 December 2016. The assets had crossed Ksh 1 trillion ($10 billion) mark by 31 December 2017 to total Ksh 1.08 trillion (RBA, 2018).

Typical investment strategy of pension funds cover decisions related to asset allocation, investment management and risk (Stanko, 2002) and determines the combination of investments that balance the overall risks and returns in addition to providing a plan for the prudent investment of the assets (Asebedo and Grable, 2004). Empirical studies have documented the strong relationship between the investment strategy and pension fund's financial performance. In particular, the asset allocation decision between equity and fixed income investments plays a greater role than the tactical movements of holdings within asset classes in shaping fund performance (Brinson, Hood and Beebower, 1986; Brinson, Singer and Beebower, 1991).

Given the importance of asset allocation decisions to performance, a number of studies have documented the positive influence of pension scheme size on the scheme's investment strategy. Gerber and Weber (2007) in study of Switzerland pension schemes noted that large schemes invested more in equities and real estate compared to small schemes. Chemla (2005) found that size influenced positively investment in private equity by pension schemes in the United States of America and Canada but had no influence in investment in venture capital. The study attributed the low investment in private equity by small pension schemes to illiquidity, complexity and costly nature of these investments. A recent study by Boon, Briere and Rigot (2017) investigated the influence pension scheme size had on allocation to risky assets in United States of America, Canada and Netherlands. The study found that an increase of $1 billion in pension scheme size resulted in a 0.2% increase in amounts invested in risky assets.

Design of the pension fund has implication on who bears the investment and longevity risks (Broadbent, Palumbo, and Woodman, 2006). In a pure defined benefit arrangement, sponsor or employer bears the risks as they promise the benefit (Broadbent *at el*., 2006). The risk to members of such schemes materializes if the sponsor becomes insolvent unless the pension promises are pre-funded (Franzen, 2010). In defined contribution designs members bear the investment risks since their contributions are invested and benefits determined by the amounts accrued in their accounts (Mowbray, 2009).

Investment objectives of define benefit and defined contribution funds differ and hence they pursue different investment strategies (OECD, 2006). Investment strategies of defined benefit funds are designed to ensure there are adequate assets to fully fund the benefit and ensure liquidity to meet regular pension payments. This is critical for the pension scheme sponsors since underfunding of benefits would call for additional contributions since they bear the investment and longevity risk (Alestalo& Puttonen, 2006). In contrast the investment strategies of defined contribution funds are crafted to earn adequate returns on savings to reach a reasonable income replacement ratio and maintain liquidity to pay benefits as they fall due (OECD, 2006).

In the 21st Century, global markets have experienced significant revolution and consequent development of non-traditional assets such as private equity, derivatives, property, infrastructure and hedge funds (OECD, 2013b). These assets have expanded the investment options available to pension funds but have inherent risks and returns. Thus the investment strategies of pension funds have evolved to accommodate these assets. This study seeks to determine the influence of the size of the fund and the design on investment strategies of pension schemes.

The studies reviewed assessed the influence of pension scheme size and design on a few asset classes. Gerber and Weber (2007) used equities and real estate, Chemla (2005) study was on private equity and venture capital and Boon, Briere and Rigot (2017) grouped the risky into; equities, risky fixed income and alternatives. The risky assets in this study combined quoted, unquoted and private equities and offshore investment, a better representation of investment strategy than previous studies. The studies reviewed on determinants of pension scheme investment strategy were carried out in mature pension markets of America (Chemla, 2005; Lucas & Zeldes, 2009), and Europe (Gerber& Weber, (2007) and Bikker, Broeders &Hollanders (2012)). The study sought to fill the regional gap by carrying out the study in emerging pension markets in and Kenya in particular.

2. Literature Review

2.1 Theoretical Review

Economic theory postulate that as organizations increase in size they achieve economies of scale which lead to lower unit costs as a result of greater utilization of capacities, ability to hire experienced and qualified staff or service providers and investment in innovation (Celli, 2013). However, as the size increases organizations may start experiencing diseconomies of scale.

A survey of large pension funds from thirty-five countries around the world carried out in 2015 by the Organization of Economic Cooperation and Development (OECD) found that large pension funds have the knowledge, expertise and resources to invest in alternative asset classes such as infrastructure projects. On the other hand, smaller and less experienced pension funds do not have a specific investment policy for investment in alternative assets (OECD, 2013a). According to the survey pension scheme size had an influence on the schemes' investment strategy.

The Harry Markowitz Modern Portfolio Theory identified the risk-return trade-off and advocates for diversification of assets in order to reduce portfolio risk (Markowitz, 1952). Pension funds thus diversify their portfolio in order to mitigate the volatility of their investment in equities and other assets (Chan-Lau, 2005).

2.2 Effect of Scheme Size on Investment Strategy

Chemla (2005) examined the determinants of investment in private equity and venture capital in pension funds in the United States of America and Canada with the asset value being the independent variable. Results showed that in the United States of America 68% of pension funds with asset in excess of $ 1 billion invested in private equity while only 12% of pension schemes with less than $ 1 billion invested in private equity. In Canada, 100% of pension scheme with asset in excess of $10 billion invested in private equity while only 12% of pension schemes with less than $ 1 billion invested in private equity. In the United States and Canada size did not significantly influence investment in venture capital. The study attributed the low investment in private equity by small pension schemes to illiquidity, complexity and costly nature of these investments.

Lahey, Akhigbe, Newman and Anenson (2012) examined the asset allocation to real estate and alternative investments by U.S. defined benefit funds. The study used data from Compustat database for the period 2002 to 2010

obtaining 9,899 samples. The main dependent variables were percentage invested in real estate and alternative investment on an annual basis with asset values being an independent variable. The logistic regression results showed a positive and statistically significant relationship between size measured by asset values and investment in alternative assets and real estate.

Aguirre and McFarland (2016) examined the asset allocation of a sample of 513 Fortune 1000 pension schemes at the end of 2015. They split their sample into three equal groups based on their total pension asset; small schemes with less than $480 million**,** medium schemes had between $480 million and $1.92 billion while large pension scheme had assets worth more than $1.92 billion. They found that large pension schemes invested more in risky assets at 54% compared to 52% for midsized and 48% for small pension schemes.

Gerber and Weber (2007) investigated the determinants of asset allocation for Swiss pension schemes using asset value as one of the independent variables and found a negative influence of smaller size of pension funds investment in equities and real estate. López-Villavicencio and Rigot (2013) examined the determinants of defined benefit pension schemes investing in private equity in United States of America and Canada. The study used pension scheme total assets as a measure of size. The study found that on average, pension schemes which made allocations to private equity were larger. However, they did not find the same size effect in regards to investment in equities contrary to findings of previous studies. Reid (2014) studied factors that influenced Dutch pension schemes' strategic risk exposure with the scheme asset values as the independent variable and found a positive relationship between pension scheme size and strategic risk exposure.

Boon, Briere and Rigot (2017) investigated the influence pension scheme size measured by asset market value on allocation to risky assets in United States of America, Canada and Netherlands. The dependent variables were the percentage of scheme value invested in risky assets grouped into; equities, risky fixed income and alternatives. The study found a statistically significant relationship between pension scheme size and investment in risky assets. An increase of $1 billion in pension scheme size resulted in a 0.2% increase in amounts invested in risky assets.

2.3 Effect of Scheme Design on Investment Strategy

Gerber and Weber (2007) investigated the influence of pension fund design on asset allocation for Swiss schemes and found no evidence that the design influenced asset allocation and more particularly to equity and real estate.

Bikker, Broeders and Hollanders (2012) investigated the impact of pension scheme design on asset allocation of Dutch pension funds. Strategic equity allocation was the study's dependent variable. The results indicated that scheme design did not influence strategic equity exposure. Reid (2014) extended the study by Bikker *et al.,* (2012) by investigating factors that influenced Dutch pension schemes' strategic risk exposure. Using annual financial data from 110 Dutch pension schemes for the period 2011 and 2012 and found evidence that defined benefit schemes had a higher strategic risk exposure compared to defined contribution and hybrid pension schemes.

Chemla (2005) studied the determinants of investment in private equity and venture capital in the United States of America and Canada. They sampled 1,000 pension plans in theUnited States out of which none of the 83 defined contribution schemes invested in private equity. In Canada they also found that of the 156 pension schemes, none of the 10 defined contribution schemes invested in private equity. The study results indicated that defined benefit pension schemes were more likely to invest in private equity than defined contribution schemes.

Sievänen, Rita and Scholtens (2013) carried out a survey of 250 pension planss in 15 European countries to determine the factors that influence pursuit of responsible investment. Scheme design was one of their independent variables and schemes were categories as defined benefit, defined contribution, hybrid or others. The study concluded that defined benefit schemes were more likely to engage in responsible investment compared to the other scheme designs.

Based on the theoretical and empirical review, the study's null hypotheses were that scheme size and design exert no influence on scheme's investment strategies.

3. Methodology

This study utilized explanatory research design to discern the nexus between investment strategies and size of the fund and design. Mixed research method was used to collect both quantitative and qualitative data. The qualitative data collected through focused group discussions was used to explain the findings from quantitative data. The study adopted a cross sectional research design and collected secondary data from pension schemes as at December 31, 2016. Pension scheme size was measure by fund value in Kenya Shillings (Ksh) as at December 31, 2016, investment strategies were represented by scheme's investment in risky assets (quoted, unquoted and private equity

and offshore investments) expressed as a percentage of the scheme's fund value. Schemes were categorized into one of the three following designs; defined benefits, defined contribution and hybrid (DB/DC) schemes.

The 442 segregated occupational retirement benefits schemes as per the Retirement Benefits Authority's 2015 industry performance report formed the population of the study (RBA, 2016). Using Yamane's (1967) formula a sample size of 210 pension schemes was arrived at (sample tolerance error 0.05).

Since audited financial reports for occupational pension funds in Kenya are not publicly available, a secondary data collection sheet was developed and used to collect data from the administrators of the sampled funds. The data included; Fund value and investments in risky assets as at 31 December 2016 and the design (determined as defined contribution, defined benefit or hybrid). The investment strategies were determined by calculating the percentage of risky assets on fund value. Completed data was received for 206 pension schemes.

Pearson correlation was used to analyze the relationship between the independent and dependent variables and regression analysis was used to test the hypotheses, establish direction and significant of the relationship between the size, design and the investment strategy. Focus Group Discussions were conducted with industry experts to validate the results.

The model was specified as;

$$Y= \beta0 + \beta1X1 + \beta2X2 +\varepsilon \quad \text{equation (i)}$$

$$Y= \beta0 + \beta1SS + \beta2SD +\varepsilon \quad \text{equation (ii)}$$

Where: Y = Investment Strategies (percentage invested in risky assets),

X1 = Scheme Size (SS), X2 = Scheme Design (SD), ε = Error term, β0= The Constant and β1, β2 = Slope of the regression equation

4. Results

4.1 General Results

4.1.1 Occupational Retirement Benefits Schemes Size

The 206 schemes had a total fund value of Ksh 361 billion ($ 3.6 billion) on December 31, 2016. This was about 40% of the value of all pension fund assets in Kenya at that date and about 60% of the pension fund assets held by the segregated funds from whom the sample was drawn.

The largest had a fund value of Ksh 26.5 billion ($ 265 million) while the smallest scheme had a value of Ksh 2.4 million ($ 24,000). The mean was Ksh 1.8 billion ($ 18 million). The DC schemes total fund value was Ksh 233 billion ($2.33 billion) representing 65% of the value of the sampled funds. The DB funds had a value of Ksh 109 billion ($1.1 billion) representing 30% of the value of the sampled funds while the hybrid funds had a value of Ksh 19 billion ($19 million) accounting for 5% of the aggregate value of the sampled schemes. The information is summarized in Table 1.

Table 1. Asset values of the sampled schemes Ksh ($ equivalent)

Design	**Value Ksh Billion ($ equivalent Billion)**	**Percentage of the Sample (value)**	**Percentage of the sample (frequency (n))**
Defined Contribution	233 (2.3)	65%	87% (179)
Defined Benefit	109 (1.1)	30%	12% (24)
Hybrid	19 (0.19)	5%	1% (3)
Total	361 (3.6)	100%	100% (206)

Using visual binning, the schemes were categorized into large, medium and small. Large schemes had asset over Ksh 2.3 billion ($ 23 million), medium schemes between Ksh 2.3 billion ($23 million) and Ksh 103 million ($1.03 million) while small schemes had assets below Ksh 103 million ($ 1.03 million).

4.1.2 Occupational Retirement Benefits Schemes Scheme Design

The predominant scheme design was defined contribution at 87% (n=179), followed by defined benefit at 12% (n=24) and hybrid schemes accounting for only 1% (n=3) of the total schemes in the sample.

4.1.3 Investment in Risky Assets

Table 2 presents a summary of the pension funds' investment in risky assets. An amount of Ksh 79.6 billion ($ 796 million) (22%) of the total assets had been invested in risky assets.

The DC, DB and hybrid schemes had invested 21%, 22% and 27% in risky assets respectively as shown in Table 2.

Table 2. Investments in risky assets per scheme design

Scheme Design	Fund Value Ksh ($ equivalent) in billion	Risk Assets Ksh ($equivalent) billion	% age in Risk Assets
DC	233 (2.33)	50.1 (0.5)	21%
DB	109 (1.1)	24.3 (0.24)	22%
DB/DC	19 (0.19)	5.2 (0.05)	27%
	361 (3.61)	**79.6 (0.796)**	**22%**

4.1.4 Schemes Investment in Risky Assets

The schemes' Ksh 79.6 billion ($ 0.796 billion) investment in risky assets of is further broken down as indicated in Table 3. Investment in quoted equities dominated the investment in risky assets at 90%. The results above confirm that occupational pension schemes in Kenya continue to invest predominantly in the traditional asset class of quoted equities. The schemes had invested 22% of their fund value in the four categories of risky assets compared to the RBA limit of a maximum of 100% as detailed in Table 3.

Table 3. Investment in various risky assets

Risky Assets	Ksh ($ Equivalent) Billion	% of Fund Value	RBA Maximum Limits
Quoted Equities	71.9 (0.719)	20%	70%
Unquoted Equities	3.5 (0.035)	1%	5%
Offshore Investments	3.6 (0.036)	1%	15%
Private Equity	0.6 (0.006)	0.2%	10%
Total	**79.6** (0.796)	**22%**	**100%**

Descriptive statistic of schemes' investments in risky assets based on size indicated that on average, large schemes invested 22% in risky assets, medium schemes 19% and small schemes 14%.

4.2 Results of Hypotheses Tests

4.2.1 Effect of Size of the Fund on Investment Strategies

Test of correlation between scheme size and percentage of the scheme's assets invested in risky assets disclosed size positively influenced investment in risky assets (r=.269) and was significant given ($p<0.001$). Further analysis indicated that size influenced investment in quoted equities (r=0.221 and p=0.001) and unquoted equities (r=0.176 and p=0.011). However, size did not influence investment in offshore investment (r=0.132 and p=0.058) and private equity (r=0.08 and p=0.252).

Simple regression results and consequent analysis of variances indicate that the regression equation fits the data and hence size is a good predictor of scheme's investment in risky assets - F statistic (df 1,204) is 15.937 ($p<0.01$) as indicated in Tables 4 and 5. Size of the scheme contributed to a variation of 7.2% in the scheme's investment in risky assets.

Table 4. Regression model of scheme size and investment in risky

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.269[a]	.072	.068	.09199

a. Predictors: (Constant), ln Size

Table 5. ANOVA results on the influence of scheme size on investment in risky assets

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.135	1	.135	15.937	.000[b]
	Residual	1.726	204	.008		
	Total	1.861	205			

a. Dependent Variable: %age Invested in Risky Assets C=(B/A)

b. Predictors: (Constant), ln_size

The results per Table 6 indicate that there is a positive (B coefficient =0.038) and significant relationship between pension scheme size and investment in risky assets (P<0.05).

Table 6. The influence of pension scheme size on investment in risky assets

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	-.137	.082		-1.666	.097
	ln_size	.038	.009	.269	3.992	.000

Dependent Variable: %age Invested in Risky Assets

One-way Analysis of Variance (ANOVA) was carried out to determine the robustness of the influence of pension scheme size on investment in risky assets. Visual binning was used to categorize pension schemes based on their sizes into large, medium and small schemes. The descriptive statistics are shown in Table 7. The large, medium and small schemes invested 22%, 19% and 14% in risky assets respectively.

Table 7. Descriptive statistics of one way ANOVA on the influence of scheme size on scheme's investment in risky assets

					95% Confidence Interval for Mean			
	N	**Mean**	**Std. Deviation**	**Std. Error**	**Lower Bound**	**Upper Bound**	**Minimum**	**Maximum**
Small	26	.1431	.11909	.02336	.0950	.1912	.00	.34
Medium	145	.1916	.08818	.00732	.1771	.2061	.00	.38
Large	35	.2194	.09378	.01585	.1872	.2516	.01	.50
Total	**206**	**.1902**	**.09528**	**.00664**	**.1771**	**.2033**	**.00**	**.50**

Dependent Variable: % age Invested in Risky Assets

The results as per Table 8 of one way ANOVA's F statistic (2, 203) =5.032, p<0.01. This implies that there is significant difference in the scheme's investment in risky assets based on their size.

Table 8. Results of one way ANOVA on the influence of scheme size on scheme's investment in risky assets

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	.088	2	.044	5.032	.007
Within Groups	1.773	203	.009		
Total	1.861	205			

Dependent Variable: %age Invested in Risky Assets

The multiple comparisons tests results per Table 9 indicate that the mean differences between small and medium sized schemes (p=0.041) and between small and large sized schemes (p=0.005) are statistically significant since the p

values are smaller than 0.05. The p value for the mean difference between medium and large schemes is 0.256 and hence not statistically significant since it is greater than 0.05. Based on the results of the Tukey HSD test, there is a marked difference in the actual investments in risky assets by small schemes compared to large and medium schemes. However, there is no difference in the investment in risky assets between large and medium schemes.

Table 9. Results of Tukey HSD test between scheme size and investment in risky assets

(I) Scheme	(J) Scheme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Small	Medium	-.04851*	.01991	.041	-.0955	-.0015
	Large	-.07635*	.02420	.005	-.1335	-.0192
Medium	Small	.04851*	.01991	.041	.0015	.0955
	Large	-.02784	.01760	.256	-.0694	.0137
Large	Small	.07635*	.02420	.005	.0192	.1335
	Medium	.02784	.01760	.256	-.0137	.0694

Dependent Variable: %age Invested in Risky Assets

*The mean difference is significant at the 0.05 level

According to leading fund managers in Kenya investment in risky assets is a factor of experience gained over time. Large schemes have been in operations for a longer period compared to small schemes. They have gained experience in investing in risky assets over the years and hence the higher investment in risky assets at 22% compared to 14% for small schemes. They also noted that small schemes lack the asset base to investment in unquoted equities, offshore investments and private equity that require substantial investments for a single transaction.

In conclusion, the study has found a positive and strong association between the fund size and investment in risky assets. Large retirement benefit schemes in the study invested 22% of their total assets in risky assets compared to 14% by small schemes. These results compare to those obtained by Gerber and Weber (2007) in Switzerland; De Drue and Bikker (2009) and Reid (2014) in the Netherlands; Lahey *at el*., (2012) in the US; Aguirre and McFarland (2016) who reviewed the same variables on 513 Fortune 1000 pension funds; Boon, Briere and Rigot (2017) who compared pension funds in United States of America, Canada and Netherlands. However, the percentage of assets invested in risky assets was higher for the earlier studies.

4.2.2 The Influence of Scheme's Design on Investment in Risky Assets

Independent sample t test was used to determine the influence of scheme design on scheme's investment in risky assets. The hybrid scheme design was not included since it had data for 3 schemes out of the sample of 206. Table 10 presents the descriptive statistics of the DB and DC schemes investment in risky assets. The DB schemes had a higher mean investment in risky asset of 19.9% compared to DC schemes of 18.7%.

Table 10. Descriptive statistics of the DB and DC schemes investment in risky assets

	Scheme design	N	Mean	Std. Deviation	Std. Error Mean
%age Invested in Risky Assets	DB	24	.1992	.12180	.02486
	DC	179	.1872	.09120	.00682

Dependent Variable: Percentage Invested in Risky Assets

The results of Independent Samples Test of scheme design's influence on investment in risky assets are presented in Table 11 which indicate a t of 0.578, with df =201, ($p>0.01$) hence there is no significant difference between the means of the DB and DC schemes. The conclusion is that scheme design does not influence investment in risky assets.

Table 11. Independent samples test of scheme design's influence on investment in risky assets

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
%age Invested Risky Assets	Equal invariances assumed	3.461	.064	.578	201	.564	.01196	.02070	-.02885	.05277
	Equal variances not assumed			.464	26.569	.646	.01196	.02578	-.04097	.06489

Dependent Variable: Percentage Invested in Risky Assets

Focus Group Discussion with industry experts in Kenya attributed the finding to the similarity in regulation of DB and DC schemes. Industry experts explained that DC schemes focus on short term returns and DB schemes need for liquidity to pay benefits makes their investment strategies not materially different and hence the results.

The results of the study compare with Gerber and Weber (2007) in Switzerland. However, the study results differ with the results by Chemla (2005) in USA and Canada; Sievänen *et al.* (2013) and Reid (2014) in the Netherlands who concluded that scheme design influences investment strategies.

5. Conclusions and Implications of the Study

Large pension schemes are better for policy makers, trustees and members due to their ability to investment more in risky assets and hence diversify their portfolios from fixed income securities. The fact that there was no difference in the investment strategies of DB and DC schemes should be of concern to policy makers, trustees and members given the different investment objectives of the two scheme designs. The Retirement Benefits Authority should promote policies that encourage the establishment of bigger schemes in Kenya. This will enable pension schemes to enjoy economies of scale to diversify their portfolio into risky assets and invest with longer time horizons. RBA should educate trustees and members of DC schemes of the investment and longevity risks they bear and the need for the investment strategies of these schemes to address these risks by diversifying their portfolios.

6. Limitations of the Study and Suggestions for Further Research

The study adopted a cross-sectional design. If data on previous years was available, a longitudinal study could have been considered. Longitudinal studies are recommended in future and a further review of the effect of design on investment strategies.

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