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Pension Investment Regulation in Nigeria: Opportunity Cost Assessment

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ABSTRACT
This study assessed the cost of missed opportunities for profitable equity trading and examined the extent to which current regulations on investment of pension funds in Nigeria affect pension fund values at retirement. The research made use of historical asset return distributions and assessed the effect of the restrictions on the provision of inflation-adjusted returns. Using mean-variance analysis, the study found that the current pension investment restriction policy in Nigeria results in failure to provide positive inflation-adjusted returns to retirees. The analysis also provided estimates of the costs of profitable opportunities foregone. The research recommended raising the current limits on equity investments to accommodate higher equity weighting in boom times, taking into consideration the age profile of plan participants in pension fund investment.

Keywords: Cost Assessment, Equity Investment Restriction, Pension Fund,

INTRODUCTION

1.0 Background to the Study

Pension funds are a special form of asset, in that they are invested and managed with the purpose of providing retirement income for retirees. Consequently, in order to mitigate the adverse impacts of excessive risk-taking by fund managers, governments usually attempt to protect pension funds (Davis and Hu, 2008). Among other controls and benchmarks, pension funds in Nigeria may be invested in various asset classes up to the following maximum limits as follows: Federal Government securities 80%; State Government securities 20%; Corporate bonds 35%; Money Market Instruments 35%; Ordinary shares 25%; Open and closed end funds 20% (National Pension Commission, 2012).

The main justification claimed for imposing restrictions is that they protect pension funds. However such protection may not be meaningful if the profitable opportunities lost by far outweigh the possible benefits of such protection. The European commission found that investment rules that are overly-restrictive and incompatible with modern portfolio management techniques tend to unnecessarily limit fund performance. Srinivas and Yermo (2000) provide cross- country evidence in support of this view. One shortcoming concerning Nigeria's pension fund asset allocation restrictions has to do with the cost of foregone opportunities. As mentioned previously, during the stock market boom in Nigeria prior to March 2008, the PFA's were restricted from maximizing gains once the 25% limit was reached. The cost of profitable opportunities foregone can sometimes be unacceptably high. For instance, Berstein & Chumacero (2003), found that the costs of investment limits in Chile may have been substantial.

Any shortfall in returns has very important consequences for the value of the pension. A one percent rise in annual return increases the pension value for a full 40-year lifetime of contributions by 20 or 30 per cent (Berstein and Chumacero, 2003). This is rather high and may, in the event of a shortfall, not be acceptable.

2.0 Review of Literature

Several studies have been carried out to investigate the effects of investment limits on pension funds. Davis (2002), Berstein & Chumacero (2003), and Anderson-Neita (2012) determined that investment restrictions have a negative impact on the performance of pension funds. Hu and Yermo (2007), Pfau (2010), (Basu, Byrnes, & Drew, 2009) are in agreement that reducing equity allocations as retirement approaches is counterproductive to the retirement savings goals of typical individual investors.

Some researchers adopted theoretical approaches by applying dynamic programming techniques. Haberman and Vigna (2002), Lei and Lei (2008), Ma (2008) and Milevsky (2007) provided an overview

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of the analytical relationship between the key risk variables that determine retirement income sustainability and provided a formula for calculating the probability of ruin in retirement.
Callil (2009), Chigodaev, Milevsky and Salisbury (2014) and Milevsky, Ho and Robinson (1997) investigated the risk of a retiree outliving his wealth (shortfall) with low risk, low return investments. They suggest that this risk is more serious than the risk of losing money on high risk investments, until quite late in life. Bengen (1994) established a range of stock and bond asset allocations that would be optimal for retirement portfolios. He found that stock allocations of lower than 50 percent were counterproductive, in that they lower the amount of accumulated wealth.
The lifetime ruin minimization (LRM) framework has been adopted or discussed in a number of papers. Examples within this literature include Milevsky and Robinson (2000), Albrecht and Maurer (2002), Young (2004), Moore and Young (2006) as well as Bayraktar and Young (2007).
Milevsky *et al*. (1997), Milevsky and Robinson (2000) and Milevsky and Robinson (2005), are instances where the probability of lifetime ruin is examined. Menoncin and Scaillet (2003), He and Liang (2013), Milevsky and Robinson (2005) and Moore &Young (2006) also help fill this void.
Achi and Okafor (2013) considered a stochastic control problem for the optimal management of a defined contribution pension fund model with solvency constraints. Adopting a dynamic programming approach, the authors attempted to maximize the utility function consequent upon the current level of fund wealth. They found that the wealth of the pension fund remains above a stipulated solvency level.

3.0 Methods

3.1 Theoretical Framework

This study is underpinned by the following theories: Lifecycle theory, Modern Portfolio Theory (MPT) and Actuarial theory of Pension funding.

3.1.1 Lifecycle Theory

The study is set within the context of the age-phasing or lifecycle theory. In this context, the assets of younger savers could be invested more aggressively for potentially higher returns while funds from older savers could be invested in low- or zero-risk assets as retirement approaches (Butt & Deng, 2010; Scheuenstuhl *et al*., 2010; MacDonald, Bianchi and Drew, 2012).

3.1.2 Modern Portfolio Theory and Asset Allocation

Modern portfolio theory provides the theoretical foundation to asset allocation decisions in finance. One of the key prescriptions of portfolio theory is that investors should hold well-diversified portfolios. Modern Portfolio Theory provides the platform that enabled this researcher to compare portfolios using means, variances and Sharpe ratios.

3.1.3 Actuarial Theory of Pension Funding

According to the American Academy of Actuaries (2004), the principal benefit under a pension plan is usually the deferred annuity for age-service retirement. For DB plans, actuarial cost methods are employed to obtain a stream of contributions and investment income to balance the benefit payments. In DC plans, the actuarial present value is simply the accumulation under interest of contributions made by or for participant, and the benefit is an annuity that can be purchased by such accumulation. As explained in Albrecht and Maurer (2001), the actuarial present value of the life annuity (PVA) is given in actuarial notation by:

$$\text{PVA(i)} = \sum_{t=0}^{w-x} R_{t\cdot t}p_x . v^t. \quad (2.1)$$

For equal pension payments per unit of time $R_t \equiv R$ and

$$\text{PVA(i)} = R.\ddot{a}_x, \quad (2.2)$$

$$\text{Where } \ddot{a}_{x\neg\atop :n} := \sum_{t=0}^{n-1} {}_tp_x \cdot v^t \quad (2.3)$$

The annuitization of the investment amount C provides an amount of *R*= *R*(i) given by

$$R = {}^{C}/_{\ddot{a}_x} \quad (2.4)$$

3.2 Methodology

This study compared investment returns of portfolios constrained within the 25% upper limit for equity investment with returns of less constrained theoretical portfolios that are permitted to have higher equity investment allocation of up to 55% in order to ascertain the costs of opportunities foregone. Mean-Variance Analysis was used to determine whether higher returns could be obtained by changing current permissible levels of equity investments. The investment performance of a basic

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group of portfolios (Group A) comprising six investment portfolios within the limits currently permitted by investment regulation on pension asset allocation in Nigeria was compared with the performance of a second group of portfolios (Group B) made up of twelve portfolios, each with increasingly higher equity allocations extending beyond the currently permissible investment allocation limits. These were analysed to examine the effects of shifting to a more liberalized regulatory regime. In the empirical analysis, each portfolio consisted of 3 asset classes- equities, bonds and money market instruments. It is assumed that pension assets are allocated to the three classes in varying proportions. With these specifications, the average returns for the period were calculated.

Mean returns and standard deviations of the two groups of portfolios were obtained and compared, along with the corresponding Sharpe ratios. The Sharpe ratio measures the extent to which extra returns compensate for additional risk. To estimate the cost of the restrictions, the study compared the fund values at retirement accumulated by the two groups of portfolios, the difference between the values being the cost of foregone opportunities.

3.3 Data and Data Collection

Data was collected from secondary sources, including Pencom, the Nigerian Stock Exchange and other stakeholders in the industry. Contributions amounting to 18 percent of annual salary are invested by the employee's PFA in an asset portfolio. The 90-day T-bill rate was used to calculate money market returns for 1985-2014. For computing the returns for stocks, the NSE index data for the period 1985-2014 was used. To compute returns from bonds, the data set uses the average coupon of listed government bonds for the period. Historical data for asset class returns would be used to generate investment returns for each asset class for the period of investment. The weights of individual asset classes, which depend on the allocation strategy, would be multiplied by their respective returns and then added up to generate the portfolio return for every period. Statistics of interest include mean, median, standard deviation and various percentiles and these will be calculated by the usual formulas.

4.1 Results

Using historical investment returns data on equities, bonds and treasury bills in Nigeria over the period 1985 to 2014 the table presenting the investment returns for the twelve portfolios over the 30-year period is generated.

Table 1A Summary of Investment returns statistics for the portfolios

Column1	P1	P2	P3	P4	P5	P6
Mean	0.107	0.1021	0.1331	0.1461	0.1591	0.1722
Std. dev.	0.0123	0.0226	0.0396	0.0577	0.076	0.0945
Risk Premium	-0.018	-0.005	0.008	0.0211	0.0341	0.0471
Sharpe ratio	-1.462	-0.2205	0.2029	0.3653	0.4482	0.4983

Table 1B Investment returns statistics

Column1	P7	P8	P9	P10	P11	P12
Mean	0.1795	0.1928	0.2059	0.2189	0.2319	0.2449
Stdev	0.1088	0.1273	0.1457	0.1642	0.1828	0.2014
Risk Premium	0.0545	0.0678	0.0808	0.0938	0.1068	0.1199
Sharpe ratio	0.5007	0.5323	0.5544	0.5712	0.5848	0.5953

Source: Author's computation (2016)

Table 1 summarizes investment returns for the twelve portfolios and shows a general increase in returns as equity investment increases. The mean return during the period ranged from 10.70% in portfolio 1 to 24.49% in portfolio 12 indicating higher returns with increasing equity content. Standard deviation is also higher as equity content increases, showing correspondingly higher risk levels for the associated higher returns. Sharpe ratios also follow the same trend, increasing from -1.4620 for the conservative P1 portfolio to 0.5953 for portfolio P12.

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Table 2 Descriptive statistics of Portfolio risk/return

	A	B
Mean Return	0.1396	0.176
Std. dev.	0.024371	0.04453
Risk Premium	0.0145	0.0509
Sharpe Ratio	0.596937	1.14299
End Fund Value	N20,732,325.77	N38,285,861.96

Source: Author's computation (2016)

Results clearly indicate that current investment restrictions may have compelled pension assets to be invested in a very conservative manner, resulting in opportunities foregone (as shown below) of up to 40% of total achievable potential.

Under the lifecycle strategy, both funds will converge at the end of 30 years (5 years to retirement) and will be conservatively invested in the same instruments for the same investment returns, during the period of convergence. At this time, the following state of affairs exists:

Fund Value for Group B portfolios (5 years to retirement)- ------34,285,861.96
Fund Value for Group A portfolios (5 years to retirement)---- ---20,782,325.77
Opportunity Cost 13,503,536.19

$\cong 40\%$

$\frac{A}{B}$= 0.606148557 = 60.62%

By constraining allowable investments in group A, investors can only take advantage of about 60% of available investment income, thus giving up about 40% of available opportunities. If a single worker is giving up about ₦13.5 million five years to retirement, then how much is being lost by the entire workforce? In particular, from Pencom data for q3 year 2014, the over 767,562 members currently aged 30 years and below, who are likely to suffer the full extent of the opportunities foregone (since they are expected to remain in the labor force for about another 30 years), could be giving up about N10.23 trillion. As stated above, Fund Value (5 years to retirement):

For Group A fund value is 20,782,325.77. In line with Lifecycle theory, this amount will be moved out of risky growth assets and invested very conservatively.

Investing this amount and accumulating it for a period of 5 years at ,say ,3% p.a. effective, the fund will accumulate to: $20,782,325.77(1.03)^5$=24,092,411.47

For Group B at 3% we have $34,285,861.96(1.03)^5$= 39,746,710.89

Difference in fund value= 39,746,710.89-24,092,411.47= ₦15,654,299.56

This amount represents the opportunity cost of equity investment restrictions (39.38%)

Taking into consideration the investment of new contributions during the 5-year period before retirement at the conservative rate of 3% p.a. effective, the fund values will accumulate to N29,132,746.56 for Group A portfolios and N44,787,045.98 for Group B.

B-A=15,654,299.42. This is the opportunity cost to a single worker at retirement date and amounts to 34.95% of the fund value at retirement. For those 30 years and below, this translates into N11.86 trillion.

A/B = 30,552,865.54/44,531,101.09 = 68.61%

Opportunity cost=31.39%

By moving out of risky growth assets at the appropriate time, the life cycle strategy would already have adequately taken care of the fears associated with investment in equities as the retirement date approaches. The extra opportunity cost of about 30 percent might therefore not be justifiable.

As stipulated in section 4 (1) of the Pension Reform Act 2004: A holder of a retirement savings account upon retirement or attaining the age of 50 years (whichever is later) shall utilize the balance standing to the credit of his retirement savings account for the following benefits:

(i) Programmed monthly or quarterly withdrawals calculated on the basis of an expected life span;
(ii) Annuity for life purchased from a life insurance company licensed by the National Insurance Commission with monthly or quarterly payments; and
(iii) A lump sum from the balance standing to the credit of his retirement savings account provided that the amount left after that lump sum withdrawal shall be insufficient to procure an annuity or fund

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programmed withdrawals that will produce an amount not less than 50 percent of his annual remuneration as at the date of his retirement.
In respect of programmed monthly or quarterly withdrawals calculated on the basis of an expected lifespan:
For an assumed lifespan of 100 years, the retiree is expected to live another 40 years. Therefore his programmed monthly withdrawals will be 40 x 12 = 480.
Hence, his monthly withdrawal for Group A will be (29,132,746.56 ÷ 480) = 60,693.222
For Group B, his monthly programmed withdrawal will be (44,787,045.98 ÷ 480) = 93,306.34579.
Thus under Group A, his monthly programmed withdrawal will be only about 63.021 percent of his programmed withdrawal under Group B.
His programmed quarterly withdrawals will be: 40 x 4 = 160
Programmed quarterly withdrawals for Group A will be (29,132,746.56 ÷ 160) = 182,079.666
Programmed quarterly withdrawals for Group B will be (44,787,045.98 ÷ 160) = 279,919.0374
If the total amount in his Retired Savings Account is invested in an annuity, then with $\omega = 100$ (implying a maturity time of 40 years since he is retiring at 60), there will be 480 monthly periods.
For Group A: 19,282,671.29 invested at 4% per annum convertible amount at age 60

$$R\ddot{a}_{\overline{\frac{0.04}{12}}} = 29{,}132{,}746.56 \qquad (4.1)$$

$$R\left[\frac{1-1.00333333^{-480}}{0.00333333}\right] = 19{,}282{,}671.29$$

$$R[239.2935033] = 19{,}282{,}671.29$$

$$R = \frac{19{,}282{,}671.29}{239.2935033} = 121{,}744.8287$$

For Group B:

$$R\ddot{a}_{\overline{\frac{0.04}{12}}} = 44{,}787{,}045.98$$

$$R[239.2935033] = 33{,}260{,}906.84$$

$$R = \frac{33{,}260{,}906.84}{239.2935033} = 187{,}163.652$$

Difference in monthly annuity $= 65{,}4188.82331$

$$\frac{A}{B} \rightarrow 65.047\% \cong 65\%$$

$\cong 58\%$ of what he could have been receiving under Group B strategy, implying an opportunity cost of 35%.
Under lump sum withdrawal, Group A accumulated to N29,132,746.56 while Group B accumulated to N44,787,045.98

$$25\%\ of\ A = 4{,}820{,}667.823$$

A.	RSA Balance	29,132,746.56
	Lump Sum Withdrawal	7,283,186.64
	Fund after 25% Withdrawal	21,849,559.92
B.	RSA Balance	44,787,045.98
	Lump Sum Withdrawal	11,196,761.5
	Fund after 25% Withdrawal	33,590,284.48

Deposit of 21,849,559.92 @ 4% per annum convertible monthly at age 60:
For 40-year maturity -> 480 periods

$$R\left[\frac{1-1.00333333^{-480}}{0.003333}\right] = 21{,}849{,}559.92$$

$$R[239.2935033] = 21{,}849{,}559.92$$

$$R = \frac{21{,}849{,}559.92}{239.2935033} = 91{,}308.6215$$

Deposit of 33,590,284.48 invested at 4% per annum, convertible monthly at age 60:
For 40-year maturity = 480 periods

$$R = \frac{33{,}590{,}284.48}{239.2935033} = 140{,}372.739$$

Lump Sum withdrawn under Group A about two-thirds the sum withdrawn under Group B. The

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difference can have quite a tangible effect on a retiree's lifestyle. Also, monthly annuity for A is only 65.05% of B's monthly annuity.

Fund A at retirement: 29,132,746.56

Final Salary per annum = 5,441,336

Final Salary per month = 453,446.6667

Fund Ratio = $\frac{29,132,746.56}{453,446.6667} = 64.247$ (4.2)

Replacement Rate = $\frac{Fund\ Ratio}{\ddot{a}_{60,t}} = \frac{64.247}{239.2935033} = 0.268487647\% = 26.85\%$ (4.3)

Fund B at retirement: 44,787,045.98

Fund Ratio = $\frac{44,787,045.98}{453,446.6667} = 98.77026179$ Replacement Rate = $0.412757807 = 41.28\%$

4.2 Inflation Analysis

Table 3 Inflation-adjusted returns

	P1	P2	P3	P4	P5	P6
Mean	**0.107**	**0.1201**	**0.1331**	**0.1461**	**0.1591**	**0.1722**
Stdev	**0.0123**	**0.0226**	**0.0396**	**0.0577**	**0.076**	**0.0945**
Inflation Rate	**0.1958**	**0.1958**	**0.1958**	**0.1958**	**0.1958**	**0.1958**
Real Return	**-0.0888**	**-0.0757**	**-0.0627**	**-0.0497**	**-0.0367**	**-0.0236**

	P7	P8	P9	P10	P11	P12
Mean	**0.1795**	**0.1928**	**0.2059**	**0.2189**	**0.2319**	**0.2449**
Stdev	**0.1088**	**0.1273**	**0.1457**	**0.1642**	**0.1828**	**0.2014**
Inflation Rate	**0.1958**	**0.1958**	**0.1958**	**0.1958**	**0.1958**	**0.1958**
Real Return	**-0.0163**	**-0.003**	**0.0101**	**0.0231**	**0.0361**	**0.0491**

Source: Author's computation (2016)

On an inflation–adjusted basis, portfolios P1, P2, P3, P4, P5 and P6 which are within current investment restrictions, individually fail to deliver positive investment returns. The results indicate increasing positive inflation-adjusted returns as equity investment increases. While portfolios 1-8 yield negative inflation-adjusted returns, portfolios 9 to 12 yield positive inflation-adjusted returns, ranging from about 1% to almost 5%.

4.3 Group Returns

Group A portfolios individually and collectively fail to deliver positive real returns, yielding an average real return of -5.62%. Group B portfolios, as a group, come close to, but also fail to provide positive average real returns (with-1.98%). However, individually, only portfolios P1- P8, with relatively lower equity content, fail to beat inflation. Portfolios P9, P10, P11, and P12 (with higher equity content) individually and collectively provide positive inflation-adjusted returns. This suggests a pressing need to review the current equity restrictions to provide the necessary latitude to take advantage of boom periods in the stock market. Beating inflation is a primary performance benchmark for pension funds, and the erosion of fund value violates the Equivalence Principle which is applied in actuarial studies and in determining insurance premiums. The equivalence principle requires that the benefits to retirees should not be less than the contributions plus investment returns. Even if the investments fail to add value to the contributions, they should, at worst, return to the retiree the present value of their contributions. Failing to beat inflation is a serious shortcoming for a pension fund, implying that the restrictions could be hampering or preventing Pension Funds in Nigeria from outperforming inflation.

Table 4. Risk/Return statistics of current and proposed strategies

	A	B
Mean real return	-0.056235	-0.019876667
StDev	0.024374249	0.044539246
Risk Premium	0.014533	0.050891333
Sharpe Ratio	0.596244019	1.142617746

Source: Author's Computation (2016)

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4.4 Group value-added

Whereas Strategy B adds N8.187m (about 42%) in real terms to total contributions, Strategy A, rather than add value to the contributions, erodes total contributions by N2.67m (almost 14%) in real terms over the 30 year period. For the more than 700,000 plan members aged 30 years or less, this translates to an erosion of pension contributions by more than N2.02 trillion.

Table 5 Value-added (inflation-adjusted)

	Group A	Group B
Fund value	N16,713,146.38	N27,572,690.19
Total Contribution	N19,385,444.61	N19,385,444.61
Value added	N(2,672,298.23)	N8,187,245.58
Value added %	-13.78	42.23

Source: Author's Computation (2016)

4.5 Comparing Groups A and B Portfolios

We set out to determine if there is a statistically significant difference in the mean returns of the two investment modes. The relevant hypothesis for this question would be:

H_0: $\mu_A - \mu_B = 0$ H_A: $\mu_A - \mu_B \neq 0$

The appropriate test for this hypothesis is the independent samples t-test.

Table 6 Independent t-test of mean returns between current investment mode and the proposed investment strategies

	Mean	Std. Deviation	t	df	Sig. (2-tailed)	Mean Difference
Group A	0.1396	0.04847	15.778	29	.000	0.13963
Group B	0.1745	0.09996	9.560	29	.000	0.17447

Source: The result of the test displayed in table 17 is based on the SPSS output.

With the P-value of .000 we reject the null hypothesis and conclude that there is a statistically significant difference in the means of the two groups.

5.0 Conclusion

The study estimated the cost of opportunities foregone as a result of the restrictions and indicated opportunity costs for different payout scenarios, ranging from about 20% to 40%. The research determined that pension equity investment restrictions in Nigeria reduce fund value at retirement. Investment returns generally increased as the degree of equity allocation increased. The analysis indicated higher mean returns for the liberalized group of portfolios (Group B) than for the currently restricted portfolio group (Group A) for the same level of risk.

Results presented under inflation analysis showed that individually portfolios within current investment limits, fail to deliver positive inflation-adjusted returns. Less restricted portfolios, on the other hand, come close to matching the long-term inflation rate.

5.2 Recommendations

This study recommends that the maximum limits allowed for investment in equities should be set high enough to accommodate the interests of younger workers who require higher equity weighting in their investment portfolios during the early periods of employment. This recommendation will also provide the latitude to enable PFAs earn positive inflation-adjusted returns.

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