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Actuarial perspectives on pension reform: a closer look at Nigeria's individual accounts system

Abstract

Many countries, especially in the developing economies, have adopted the Chilean model of pension reform even under very dissimilar situations. In many of these countries the rate of contribution and the charges imposed by the pension fund administrators and pension fund custodians endanger the success of the reform. This study examines the effect of administration charges on the fund accumulation and the ultimate pension expectations of the contributors.

Keywords: defined contribution, Nigerian pension system, administration charges, annuity, programmed withdrawal.

Introduction

Two major events appeared to have shaped the interest shown by various governments in pension reform around the world. The first is the trailblazing decision by the Chilean government, in 1981, to switch from defined benefit scheme to defined contribution pension scheme while the second is the apparent tacit endorsement of the Chilean model by the World Bank (1994) with the publication of the classic 'Averting Old Age Crisis'. Since then many other countries have adopted the Chilean model even under very dissimilar circumstances (see Casey and Dostal, 2008).

Nigeria joined the race for pension reform in 2004 by moving from defined benefit pension scheme to defined contribution system. The rate of contribution stipulated by the government was 7.5% of annual salary for each employee and an equal contribution by the employer. The new scheme may have commenced with a problem at inception as, to the best of our knowledge, no actuarial valuation was conducted to arrive at these rates. If there was any actuarial input in the process leading to the introduction of the reform, it was only at a later stage when the ILO was consulted about the calculation of the pension entitlement of those who would not transfer to the new scheme (Casey and Dostal, 2008).

In developing economies, often characterized by unusually high inflation and restriction of investment channels, it may be difficult, given the stipulated rate of contribution, to have the replacement ratios at retirement under the new system to be anywhere comparable to the figure under the old system. Ibiwoye (2008) examined this problem for the public service sector. Then, however, the infrastructures were just being put in place. Important organs, like the Pension Fund Administrators (PFAs) and Pension Fund Custodians (PFCs), were just being licensed by the Pension Commission (Pencom) and the latter had not come to a decision about the ceiling for administration charges that the PFAs and PFCs would be allowed to deduct. Since then Stewart and Yermo (2009) have ascertained that the problem of suitable investment outlets remains a crucial policy-making dilemma. That may explain why Dorstal (2010) insists that analysis must now turn to PFAs and the management fees that they charge. This is an urgent task for developing economies, as it appears that many of the reforms in these areas fail to take into consideration the effect of the administration charges on the growth of the pension fund. Although they may appear insignificant on face value, the cumulative effects of the charges, as structured at present, may grow out of proportion and may put the fund in jeopardy. Even the much acclaimed Chilean model was not immune from this danger as the concern by the Chilean President about insufficient contributions, accumulations and commissions, and lack of financial knowledge on the part of the Chilean people (PRC, 2006) had revealed. Zychowicz and Zarb (2003) also cautioned that, in spite of the benefits of the Chilean model, the administrative costs associated with the scheme are high.

In this study, we first develop an actuarial model which incorporates the various charges by the PFAs and PFCs for accumulating the contributions. The annual rate of increase in an employee's wage, inflation, projected rate of return on investment of the fund, the contribution rate, and cost of annuities required to ultimately purchase the pension in a defined contribution scheme, are also considered. We then examine the effect of the administration charges on the fund. Finally, the study examines the prospect of an employee benefiting from the provision of a lump sum withdrawal from the fund at retirement, akin to the gratuity benefit under the old scheme.

The paper is organized as follows. Section 1 looks at the contextual setting. In Section 2, the relevant literature is reviewed. Section 3 deals with model development. The application of the model to the Nigerian pension system is presented in Section 4 while discussion of the result is in Section 5. The last section concludes.

1. Contextual setting

Up till June 2004, Nigeria operated a fragmented pension system. In the public service, non-contributory defined benefit retirement scheme was the practice while an assortment of diverse schemes was witnessed in the private sector. The public service comprises the federal government ministries, federal government agencies, state government service and local government service. The public service pension scheme was of the "pay-as-you-go" type and was generally unfunded, except for the government agencies that are, generally, referred to as parastatals. The parastatal scheme was partially and irregularly funded in the form of annual subventions by the government. The benefits provided, which were uniform in both cases, were of two types: gratuity, consisting of lump sum payments; and pensions. Both benefits were expressed as functions of the final wage of the employee and the number of years of service rendered up to the time of retirement.

To qualify for gratuity, an employee was required to have attained, at least, the age of 45 years and to have put in a minimum number of 5 years of service, while to qualify for pension, an employee, in addition to the age requirement, also needed to have put in a minimum number of 10 years of service. Employees, who satisfied the years of service requirement, but not the age requirement, qualify to receive immediate gratuity but could only draw pension after attaining the age of 45 years.

In the case of the private sector, some schemes were funded, some were unfunded, some were contributory while others were not. The establishment of retirement schemes was not compulsory but depended on the agreement between the employees' unions and the employers. Although the scheme rules used the public service rules as a benchmark, they were defined by the individual organizations.

The problems encountered, particularly, under the old public service scheme were legion and are well documented (see Ahmad, 2008). The coverage of the private sector schemes was also felt to be very limited. In 2004, government decisively harmonized all the schemes into a defined contribution pension scheme by the enactment of the Pension Reform Act 2004, otherwise called PRA 2004. The Act makes it compulsory for all organizations, whether private or public, that employ five or more persons, to subscribe to the scheme.

The Act provides for minimum contribution rates of 7.5% of wage by the employee and employer respectively. The contributions are to be made into dedicated individual accounts, called Retirement Savings Account (RSA), to be opened and maintained for each employee by public liability companies, called Pension Fund Administrators (PFAs) specially, licensed for that purpose. The investment of the fund is also done by other independent licensed public liability companies, called Pension Fund Custodians (PFCs). The employee can only have access to the fund upon retirement at a minimum age of 50 years, at which point he could purchase a life annuity policy from an insurance company or *"programmed withdrawals"*, administered by the PFAs. For the supervision, control and provision of guidelines on the operations of the new system, a government agency, named the National Pensions Commission (Pencom), was set up with the necessary statutory powers.

2. Related literature

Although it is generally assumed that little actuarial input is required in the operation of a defined contribution pension scheme, Daykin (2002) has identified certain areas where actuarial involvement is an imperative. They include scheme design, projections for individuals, expenses, guarantees, investment management, performance management, annuities, programmed withdrawal, life and disability cover and regulation. These can be classified into three main groups. The first six areas are concerned with accumulation, the next three deals with decumulation or payout phase and the last with regulation.

Models that have dwelt on the accumulation phase are the most common. They include Mariani *et al*. (2007), a simulation model on the Italian pension funds based on finite difference equations, Holzman (1997), an econometric model testing the conjectured reform effects on Chile's financial market development and its impact on total factor productivity, and Wang *et al*. (2009) on the implicit pension debt of China. Cobb-Douglas production function (Chlon, 2002; Bosworth and Burtless, 2002; Davis and Hu, 2004) and regression (Bateman and Mitchell 2003; Stanko, 2003, 2003b; Aguila et al. 2008) are some of the other standard models that have been employed in evaluating the performance of pension funds. Putelberger's (2000) model for the initial capital under a new pension scheme was based on stationary population theory. The aforementioned models and many others in the literature (McCarthy and Zheng, 1996; Holzmann et al., 2001; Mitchell, 2001; Berkel and Borsch-Supan, 2003; Blake and Mayhew, 2006) deal with the defined benefit system, where management charge is rarely a major concern to the individual contributor, as the investment risk is usually borne by the sponsor.

The model proposed by Wills and Ross (2002) for personal retirement savings decisions is an iconic model, which may not be suitable for capturing the complexities of a dynamic system, like a pension scheme. To quantitatively analyze policy implications of pension reforms, a mathematical model is necessary (McCarthy & Zheng, 1996).

Since administrative charges mainly impact on the final amount available to be paid out to the individual retiree at retirement, we group this important item under the decumulation phase. With respect to the decumulation phase, Ginn (2004), Queisser and Whitehouse (2006) and Jousten (2007) revisited the long-time confusion of policy makers between actuarial fairness and actuarial neutrality in the analysis of pension systems. Although they recognized that most retirement income systems have several components, Queisser and Whitehouse (2006) ignored any adjustment for actuarial fairness and concentrated on the actuarial neutrality in their model. Ginn (2004) and Jousten (2007) only discussed the concepts without building any model.

Concerning the mode of collecting retirement entitlement, Daykin (2004) dwelt extensively on the annuitisation, income drawdown and other pay-out methods of the decumulation phase. With a simple illustration, he pointed out that draw down arrangements, relative to annuitisation, suffers from mortality drag and suggested an increasing annuity plan as an option. Another model, in this regard, is that of Reyes and Pino (2005). Using probit regression, they forecast the individual pension payouts for members of each retirement cohort between 2005 and 2025. They then compared the distribution of this retirement income to the corresponding active life income distribution for each cohort and found that, in general, the distribution of retirement income is much more unequal than the distribution of active life income for the same cohort. Tapia & Yermo (2008) use the simple ratio of annual fees divided by total asset under management to compare the cost of fund management. None of these decumulation based studies constructed a customized model to examine the effect of the administration charges.

On the specific subject of administration charge, Fox and Palmer (2000) emphasized that privately managed financial account systems are growing and some of the emerging issues in this regard include how to hold down the administrative costs of privately managed financial account systems, how to assign risks *ex ante* or what low-income countries should do. Our paper, which addresses the concern of low income countries, where the effect of inflation and other unfavourable econometric indicators make the models for developed economies unsuitable, is a response to this clarion call. The study uses Nigeria, a leading economy in the African subregion, as a case study in the hope that the results for Nigeria can serve as a lesson for many emerging economies.

One of the earliest studies to explicitly model administration charges was Diamond (2000). He constructed a continuous time model in which one administration charge is structured as a front load, proportional to contribution and the other as a fixed rate deductible from investment return. Whitehouse (2000) modified Diamond's (2000) model in another continuous time study, using four equations that produce lifetime pension contributions, plus the investment they earn. Four different types of charges are deductible in Whitehouse's (2000) model. They are a fixed up-front fee, a levy on contributions, annual charge on the assets of the fund and an exit charge as a proportion of the accumulated balance. The model we have constructed in this study recognizes that administration charges are, in practice, deducted monthly. It, therefore, differs significantly from the earlier models because it is constructed on discrete time basis, akin to how the charges are deducted in practice.

3. Model formulation

3.1. Specification of parameters. We define the following notations used in the analysis:

P is the wage of the contributor at entry into the programme;

r is the retirement age;

i is the long-term effective rate of return p.a on the invested contributions;

s is the rate of wage increase p.a;

n is a number of years of contribution to retirement;

F_n is the accumulated fund in year n net of all administration charges;

F_n^* is the accumulated fund in year n free of administration charges;

g is the contribution rate into the fund as a proportion of the annual wage, $0 \le g \le 1$;

$T(r, n)$ is an annual pension purchased at retirement age r by fund F_n;

C is an annual flat administration charge per contributor;

σ is an annual administration charge as a proportion of contribution, $0 \le \sigma \le 1$;

m is an administration charge per annum as a proportion of fund, $0 \le m \le 1$;

E_r is age r single premium rate per N1,000 annuity p.a. This is the insurance company's rate;

K_t is the total contribution in year t, $t = 1, 2, \ldots, n$;

L_t is the total administration charge in year t, $t = 1, 2, \ldots, n$;

R_t is an administration charge ratio in year t expressed as a proportion of total contribution in year t, $t = 1, 2, \ldots, n$;

H_n is a cost ratio defined as the proportion of the accumulated fund up to year n taken up by the administration charges;

$M(r, n)$ is an annual pension purchased at age r by the accumulated fund F_n expressed as a proportion of final wage at age r.

$M^*(r, n)$ is maximum value of $M(r, n)$ which is attained only when there are no administration charges imposed.

We seek to develop expressions for F_n, F_n^*, K_t, L_t, R_t, $T(r, n)$, H_n, $M(r, n)$ and $M^*(r, n)$. We assume that administration charges can be a combination of C, σ and m only. We assume also that wage increases take place on 1st January of each Calendar year and that the contributor enters the scheme at the beginning of a Calendar year. Contributions are made at the end of every month. The administration charge (m), based on fund, is deducted at the end of the year, while the other two charges are deducted monthly.

3.2. Model development. The gross monthly contribution in the t^{th} year is:

$$g\frac{P}{12}(1+s)^{t-1}. \tag{1a}$$

The accumulation in that year of the net t^{th} year monthly contributions of $(1-\sigma)g\frac{P}{12}(1+s)^{t-1}-\frac{C}{12}$ is given by

$$\left((1-\sigma)gP(1+s)^{t-1}-C\right)S\frac{(12)}{1};\ t=1,\ldots,n, \tag{1b}$$

where $S\frac{(12)}{1}=\frac{i}{i^{(12)}}$ and $i^{(12)}$ is the nominal rate of interest convertible monthly, i.e. $(1+i)^{1/12}-\left[1+\frac{i^{(12)}}{12}\right]$.

If we let ${}_tF_n$ represent the accumulated fund in year n due to the net contributions in year t after having deducted all the applicable administration charges, then

$${}_tF_n=\left[(1-\sigma)gP(1+s)^{t-1}-C\right]\times$$

$$\times S\frac{(12)}{1}(1-m)^{n-t+1}(1+i)^{n-t}. \tag{2}$$

Then, $F_n=\sum_{t=1}^{n}{}_tF_n$ (3)

i.e. $F_n=\sum_{t=0}^{n-t}\left[(1-\sigma)gP(1+s)^t-C\right]\times$

$$\times S\frac{(12)}{1}(1-m)^{n-t}(1+i)^{n-t-1}= \tag{4}$$

$$=(1-\sigma)gPS\frac{(12)}{1}\sum_{t=0}^{n-1}(1+s)^t(1-m)^{n-t}(1+i)^{n-t-1}-$$

$$-CS\frac{(12)}{1}\sum_{t=0}^{n-1}(1-m)^{n-1}(1+i)^{n-t-1}. \tag{5}$$

Let $(1+j)(1+s)=(1+i)$ so that $j=\frac{i-s}{1+s}$.

Then,

$$F_n=(1-\sigma)gPS\frac{(12)}{1}(1+i)^{-1}\times$$

$$\times\sum_{t=0}^{n-1}(1+s)^t(1-m)^{n-t}(1+j)^{n-1}(1+s)^{n-t}-$$

$$-CS\frac{(12)}{1}\sum_{t=0}^{n-1}(1-m)^{n-t}(1+i)^{n-t-1}; \tag{6}$$

$$F_n=(1-\sigma)gPS\frac{(12)}{1}(1+i)^{-1}(1+s)^n\times$$

$$\times\sum_{t=0}^{n-i}(1+j)^{n-t}(1-m)^{n-t}-$$

$$-CS\frac{(12)}{1}(1+i)\sum_{t=0}^{n-1}(1-m)^{n-t}(1+i)^{n-t}. \tag{7}$$

Let $(1+w)=(1+j)(1-m)$ and

$$(1+\lambda)=(1-m)(1+i). \tag{8}$$

Then,

$$F_n=(1-\sigma)gPa\frac{(12)}{1}(1+s)^n\sum_{1=0}^{n-1}(1+w)^{n-t}-$$

$$-Ca\frac{(12)}{1}(1+i)^{-1}\sum_{t=0}^{n-1}(1+\lambda)^{n-t}, \tag{9}$$

where $a\frac{(12)}{1}=(1+i)^{-1}S\frac{(12)}{1}$.

$$\therefore\quad F_n=(1-\sigma)gPa\frac{(12)}{1}(1+s)^n\ddot{S}\frac{w}{n}-$$

$$-Ca\frac{(12)}{1}\ddot{S}\frac{\lambda}{n}, \tag{10}$$

where $\ddot{S}\frac{w}{n}=\left\{(1+w)^n-1\right\}\frac{(1+w)}{w}$ i.e. accumulated annuity due of 1 p.a for n years at rate of interest w and $\ddot{S}\frac{\lambda}{n}=\left\{(1+\lambda)^n-1\right\}\frac{(1+\lambda)}{\lambda}$.

F_n represents the total accumulated fund available to purchase either a life annuity or programmed withdrawal after m years' contributions.

If no administration charges are imposed, then $m = 0$, $c = 0$ and $\sigma = 0$.

We then have $w = j$ and $\lambda = i$, then from equation (10)

F_n^* (i.e. accumulated fund free of charges) becomes

$$F_n^* = gP\, a\frac{(12)}{1}(1+s)^n \ddot{S}_n^j . \tag{11}$$

3.3. Accumulated administration charge/cost ratio (H_n). In order to determine the effect of administration charges on the final fund we compute the proportion of the final fund with administration charges to the final fund free of charges as:

$$\frac{F_n}{F_n^\bullet} = \frac{(1-\sigma)gP\, a\frac{(12)}{1}(1+s)^n \ddot{S}\frac{w}{n} - Ca\frac{(12)}{1}\frac{\ddot{S}\lambda}{n}}{gPa\frac{(12)}{1}(1+s)^n \ddot{S}\frac{j}{n}}, \tag{12}$$

$$\frac{F_n}{F_n^\bullet} = (1-\sigma)\frac{\frac{\ddot{S}w}{n}}{\frac{\ddot{S}j}{n}} - \frac{C\ddot{S}\frac{\lambda}{n}}{gP(1+s)^n \ddot{S}\frac{j}{n}}, \tag{13}$$

$gP(1+s)^{n-1}$ is the final year contribution.

The cost ratio of the fund at retirement which is the proportion of the accumulated fund at retirement taken by administration charges is therefore

$$H_n = 1 - \frac{F_n}{F_n^\bullet}. \tag{14}$$

3.4. Determination of the administration charge ratio (R_t), t = 1, 2,…, n. We now develop the expression for the accumulated administration charges in year t as a proportion of the accumulated contributions in year t.

Total accumulated contribution in year $t = K_t = gP(1+s)^{t-1} S\frac{(12)}{1}$. (15)

The accumulated administration charge in year n proportional to contributions, σ can be expressed as

$$\sigma gP(1+s)^{t-1} S\frac{(12)}{1}. \tag{16}$$

The accumulated flat administration charge in year t is $CS\frac{(12)}{1}$. (17)

The accumulated administration charge proportional to fund m in year t can then be given as

$$m\left[F_{t-1}(1+i) + gP(1+s)^{t-1} S\frac{(12)}{1} - CS\frac{(12)}{1} - \right.$$
$$\left. - \sigma gP(1+s)^{t-1} S\frac{(12)}{1}\right]. \tag{18}$$

Then L_t = (16) + (17) + (18) =

$$= m\left[F_{t-1}(1+i) + gP(1+s)^{t-1} S\frac{(12)}{1}\right] +$$
$$+ (1-m)S\frac{(12)}{1}\left(\sigma gP(1+s)^{t-1} + C\right). \tag{19}$$

R_t = Total administration charge in year t / Total constribution in year t. (20)

$$\frac{L_t}{K_t} = \frac{m\left[F_{t-1}(1+i) + gP(1+s)^{t-1} S\frac{(12)}{1}\right]}{gP(1+s)^{t-1} S\frac{(12)}{1}} +$$
$$+ \frac{(1-m)S\frac{(12)}{1}\left(\sigma gP(1+s)^{t-1} + C\right)}{gP(1+s)^{t-1} S\frac{(12)}{1}}. \tag{21a}$$

If we apply equation (10) to F_{n-1}, (21a) reduces to

$$R_t = m(1-\sigma)S\frac{w}{n} + \sigma + \frac{C\left(1 - mS\frac{\lambda}{t}\right)}{gP(1+s)^{t-1}}. \tag{21b}$$

3.5. Determination of annual pensions. Now given E_r and F_n, we obtain $T(r,n)$

as $T(r,n) = \frac{100F_n}{E_r}$. (22)

We can express the annual pension purchased at age r after n years' contributions as a proportion of the final wage as follows:

$$M(r,n) = \frac{Annual\ pension}{Final\ wage} = \frac{T(r,n)}{P(1+s)^{n-1}}, \tag{23}$$

$$M(r,n) = \frac{1000F_n}{E_r P(1+s)^{n-1}}, \tag{24}$$

$$M(r,n) = \frac{1000\left((1-\sigma)gP(1+s)^n a\frac{(12)}{1}\ddot{S}\frac{w}{n} - C\,a\frac{(12)}{1}\ddot{S}\frac{\lambda}{n}\right)}{P(1+s)^{n-1}E_r}, \tag{25}$$

$$M(r,n) = \frac{1000(1-\sigma)(1+s)g\; a\frac{(12)}{1}\ddot{S}\frac{w}{n}}{E_r} -$$
$$- \frac{1000C\, a\frac{(12)}{1}\ddot{S}\frac{\lambda}{n}}{P(1+s)^{n-1}E_r}. \tag{26}$$

The maximum value of $M(r,n)$ is obtained when $m = C = \sigma = 0$, then $w = j$ and $\lambda = i$.

From (26) we then have

$$M^*(r,n) = \frac{1000g\ a\dfrac{(12)}{1}(1+s)\ddot{S}\dfrac{j}{n}}{E_r}. \qquad (27)$$

Equation 26 shows that $M(r, n)$ is largely independent of the annual wages. It is, however, dependent on the contribution rate, the annuity premium rate E_r, the number of years of contribution n, the margin between the interest rate and rate of wage increase, and the administration charges. Results for various values of $M(r, n)$ at age of 55 are shown in figure 1.

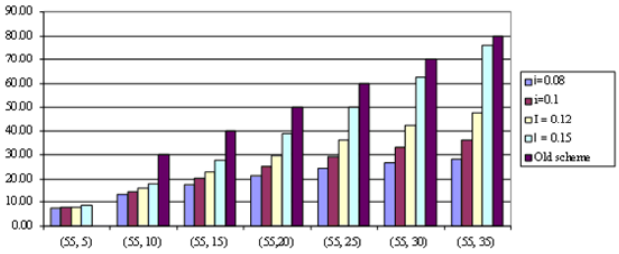

Fig. 1. Values of $M(r, n)$ for retirement age of 55 at different interest rates

4. Application of the model to the Nigerian pension system

At the inception of the new scheme, there were three categories of employees affected by the change. The first are those employees who, as at the commencement of the new scheme in the year 2004, had not more than 3 years to their retirements. The transitional arrangement allowed them to remain in the old scheme and receive their retirement benefits in accordance with the rules guiding the old scheme.

Next are the employees who were members of the old scheme as at the commencement of the new scheme but have more than 3 years to their retirements. For this group, the transitional arrangement provide for the determination of their accrued benefits through the process of actuarial valuation. These accrued benefits were recognized by the issuance to the employees of the Federal Government Bonds which are redeemable and to be paid into their PSA accounts upon their retirements to form part of their fund for their retirement benefits. Their subsequent contributions into the new scheme would also form a part of their fund at retirement. Finally, we have the employees who started with the new scheme on a completely new slate, and therefore, depend entirely on only the new scheme for their future benefits. Our concern will be with this last category of employees, as this is the group that would experience the full impact of the new scheme and, therefore, will ultimately determine the efficiency, or otherwise, of the new scheme in terms of the efficiency and adequacy of the retirement benefits.

4.1. Parameters of the model. The following parameters of the model are discussed:

Retirement age. The PRA 2004 has stipulated the earliest age for commencement of pensions at 50 years. The normal retirement age in government and many private institutions is 60 years. A few private institutions maintain the retirement age of 55 years whilst academic staff of universities and judicial officers are allowed to stay on until age of 65. Contributors can therefore commence their pensions at any age from 50 years. We shall investigate the effect on the pensions, of retiring at ages of 50, 55, 60 and 65.

Rate of wage increase and rate of interest (s and i). Government's monetary policies are geared principally towards maintaining low levels of inflation. Currently inflation rates hover between 12% and 14% p.a. This study uses the projected inflation rate as a benchmark for projecting both the rate of wage increase s and the rate of interest i. We project that the country should be able to maintain an average long-term inflation rate of 8% p.a. For real wages to be maintained, we project the wages to increase at an average margin of 2 percentage points above the inflation rate and the interest rate at 4 percentage points above the inflation rate. Hence, we fix the values of s and i at 10% and 12% respectively. It is important to note that, rather than the absolute values of the interest and wage increase rates, it is the margin between the two parameters that determines the principal effects on the fund. In order to underscore the effects of the interest rates on the fund and also to accommodate both optimistic and pessimistic scenarios we apply margins of -2%, 0%, and 5% points, which translate to interest rates of 8%, 10% and 15% respectively.

Administration charges on the fund (m, c, σ). One of the statutory responsibilities of the PENCOM is the prescription of ceilings for administration charges to be deducted by the PFAs and the PFCs. They are presumably amenable to reviews in the future. At present, the combined ceiling, prescribed by PENCOM, is a monthly flat deduction of N100 per month per contributor and 3% of fund per annum. Thus, c = Naira 1,200, m =.03 and σ = 0.

Life annuity premium rate (E_r). The PRA 2004 prescribes a life annuity guaranteed for 10 years. No pension increase to take care of inflation is suggested. We have, therefore, adopted the 10 year guaranteed fixed amount life annuity. For the applicable single premium rates, we have adopted the

rates in table 4, which are fair representations of the annuity rates currently available in the Nigerian annuity market.

Contribution rate (g). The PRA 2004 prescribes a minimum annual contribution rate of 15% of wages, shared equally between the employer and the employee. Therefore, $g = .15$.

5. Discussion of results

We apply the model to the case of an employee who enters the scheme on an annual wage of Naira 400,000. The total initial contribution by him and his employer is Naira 60,000, which increases at the rate of 10% per annum, the same rate at which his annual wage increases. The assumed interest rate is 12% p.a.

Table 1. Projected funds (with and without charges) proportions of fund claimed by administration charges projected annual pensions and projected final wages (1 = 0.12, P = 400,000)

No of YRS of contribotions	Fund after charges	Fund without charges	Charges as proportions of fund	Annual pensions at age of 50	Annual pensions at age of 55	Annual pensions at age of 60	Annual pensions at of age 65	Final wage
n	F_n	F_n^*	$H_n=1-F_n/F_n^*$	T(50, n)	T(55, n)	T(60, n)	T(65, n)	
5	430751.32	480,034.77	0.10	43,508.13	44,820.67	47,307.24	49,789.15	585,540.00
10	1,350,070.97	1,619,086.07	0.17	136,364.19	140,478.01	148,271.46	156,050.33	943,179.08
15	3,172,048.97	4,096,469.42	0.23	320,393.45	330,059.05	348,370.08	366,646.86	1,518,999.33
20	6,623,038.47	9,228,127.85	0.28	668,961.35	689,142.50	727,374.80	765,535.55	2,446,363.62
25	12,962,819.71	19,492548.23	0.33	1,309,312.25	1,348,811.43	1,423,640.88	1,498,330.32	3,939,893.07
30	24,356,457.38	39,553,565.79	0.38	2,462,128.94	2,534,345.83	2,674,946.44	2,815,283.96	6,345,237.19
35	44,496,896.08	78,083,217.44	0.43	4,494,418.06	4,630,005.16	4,886,868.90	5,143,252.00	10,219,067.94

Table 1 summarizes the pattern of growth of an individual's fund and the proportion of the fund that goes into administration charges, if that individual contributes for a total number of n years up to retirement. The pension expectations are also provided, given that individual's age at retirement. It is particularly worth noting the rate at which the fund is depleted by administration charges from 10% at $n = 5$ years to 43% at $n = 35$ years. It is very clear therefore that the current rates of administration charges, if sustained into the future, will have a debilitating effect on an individual's pensions.

Table 2. Administration charges as proportion of annual contributions

t	i = 0.08	i = 0.1	i = 0.12	i = 0.15
1	0.05	0.05	0.05	0.05
5	0.15	0.16	0.17	0.16
10	0.26	0.28	0.3	0.35
15	0.34	0.39	0.44	0.53
20	0.41	0.48	0.56	0.73
25	0.46	0.56	0.68	0.95
30	0.5	0.62	0.79	1.18
35	0.53	0.68	0.9	1.43

Table 2 goes further to investigate the effect of the t^{th} year administration charges on the t^{th} year contribution at different rates of return on investment. The administration charges are expressed here as proportions of the t^{th} year annual contribution. As the rate of return on investment increases, the expense ratio increases. For instance, at $t = 35$, it increases from 53% of the contribution with $i = 8\%$ to 143% when $i = 15\%$, meaning that the year's contribution is not even enough to accommodate the charges and the fund has to be dipped into. These figures are general for all sizes of wages. It also indicates that most of the contributions at the advanced years go into servicing the administration charges with little or no benefits left for the contributor. The reason for this apparently unfair depletion of the contributor's fund is the administration charge, expressed as a percentage of the fund, which grows as the fund grows.

Table 3. Accumulated cost ratios at different rates of interest (H_n)

n	i = 0.08	i = 0.1	i = 0.12	i = 0.15
	Margin = -0.02	Margin = 0	Margin = 0.02	Margin = 0.05
5	0.1	0.1	0.1	0.1
10	0.16	0.16	0.17	0.17
15	0.21	0.22	0.23	0.24
20	0.26	0.27	0.28	0.30
25	0.30	0.32	0.33	0.36
30	0.33	0.36	0.38	0.42
35	0.36	0.40	0.43	0.48

Table 3 shows the total portion of the final fund taken up by administration charges at different rates of interest and number of years' contribution to retirement n. It shows that, as the rate of interest increases, this ratio also increases. Or, put differently, as the margin between the interest rate and rate of wage increase widens, the ratio also widens.

Table 4A. Values of M for retirement age of 50 at different interest rates

(r, n)	i = 0.08	i = 0.1	i = 0.12	i = 0.15	Old scheme
(50, 5)	6.81	7.11	7.43	7.93	
(50,10)	12.18	13.26	14.46	16.49	30.00
(50,15)	16.42	18.57	21.09	25.69	40.00
(50,20)	19.76	23.14	27.35	35.59	50.00
(50, 25)	22.39	27.7	33.23	46.21	60.00
(50,30)	24.45	30.46	38.77	57.61*	70.00
(50,35)	26.07	33.37	43.98	69.54*	80.00

Table 4B. Values of M for retirement age of 55 at different interest rates

(r, n)	i = 0.08	i = 0.1	i = 0.12	i = 0.15	Old scheme
(55, 5)	7.01	7.33	7.65	8.17	
(55, 10)	12.55	13.66	14.89	16.98	30.00
(55, 15)	16.92	19.14	21.73	26.47	40.00
(55, 20)	20.36	23.85	28.17	36.66	50.00
(55, 25)	23.05	27.91	34.23	47.6	60.00
(55,30)	25.19	31.41	39.94	59.35*	70.00
(55,35)	26.86	34.41	45.31	71.95	80.00

Table 4C. Values of M for retirement age of 60 at different interest rates

(r, n)	i = 0.08	i = 0.1	i = 0.12	i = 0.15	Old scheme
(60, 5)	7.40	7.73	8.08	8.62	
(60, 10)	13.25	14.42	15.72	17.92	30.00
(60, 15)	17.86	20.19	22.93	27.94	40.00
(60, 20)	21.49	25.16	29.73	38.69	50.00
(60, 25)	24.34	29.44	36.13	50.25*	60.00
(60, 30)	26.59	33.12	42.16	62.64*	70.00
(60, 35)	28.35	36.28	47.82	75.94*	80.00

Table 4D. Values of M for retirement age of 65 at different interest rates

(r, n)	i = 0.08	i = 0.1	i = 0.12	i = 0.15	Old scheme
(65, 5)	7.79	8.14	8.50	9.07	
(65, 10)	13.94	15.17	16.55	18.87	30.00
(65, 15)	18.80	21.25	24.14	29.40	40.00
(65,20)	22.62	26.48	31.29	40.72	50.00
(65, 25)	25.62	30.98	38.03	52.88*	60.00
(65, 30)	27.98	34.85	44.37	65.93*	70.00
(65, 35)	29.84	38.18	50.33*	79.93*	80.00

Table 5. Single premium rates per 1,000 annual pension

Retirement	
Age	Rate
50	9,900.48
55	9,610.55
60	9,105.40
65	8,651.51

The pension expectations of the contributors as percentages $M(r,n)$ of the final wages, in what are commonly termed replacement ratios, are shown in Tables 4A - 4D. It is clear that these values are affected by the rate of return on investment, the number of contributions made before retirement and the age at retirement. Already, the effect of the administration charges follows from the discussions on Tables 1 and 2. The rate of premium on the annuity charged by the insurance companies is also a very critical contributor to the value of $M(r,n)$. If we adopt $i = 8\%$ and $i = 15\%$ as most pessimistic and most optimistic rates of return respectively, we can conclude that, for a contributor, $M(r,n)$ would most likely lie between the values corresponding to these two rates. For instance, a contributor who retires at the age of 55 years after having contributed for 20 years, can look forward to a pension between 20.36% and 50% of his final wage.

A very serious observation is that, except for contributors who have contributed for between 25 years and 35 years and except the rate of return on investment is high, most contributors would not make a pension of 38.69% of their final wages. The cases where pensions are, at least 50%, of final wages are shown in asterisk in the tables. It can also be observed that, across board, the pensions under the old scheme are far superior to those under the new scheme, including having features that were more pensioner-friendly. Another critical deduction that can be made here is that almost all contributors would be able to draw any lump sum (gratuity) from their fund, as the Act stipulates that after such a withdrawal, the fund should be able to sustain a pension of at least $M(r, n) = 50\%$.

Conclusion

Besides the contributor's age at retirement and the number of years during which the individual has contributed to the fund, this study has identified two major factors that can have profound effects on the growth of the RSA and the pension benefits ultimately derivable from the fund at retirement. These are the administrative charges, the rate of wage increase and the rate of return achieved and declared on the investment of the fund.

In order, therefore, to protect the contributors and ensure a fair and meaningful pension for them, government should take steps to control and reduce administration cost through collaborative efforts between it and the service providers. This is specifically because, basing the administration cost on the amount in the fund would continue to put the contributors at a great disadvantage as the fund grows. An alternative approach could be to base the application of charges on the annual contributions, rather than on the fund.

However, looked at holistically, it can be appreciated that governments' liability will be enormous, unless certain controls are put in place. Administrative cost had been identified as one area of great concern which prevented pensioners from enjoying the benefit of the high investment returns achieved on the funds in the Chilean System. Our analysis, based on the cost ceiling imposed by PENCOM, shows that administrative charge, pegged at 3% of fund, was responsible for the high cost ratios that emerged. It should be recognized, however that this charge is determined by administrative fiat the appropriateness of which has not yet been borne – out through the empirical experience of the operators. Detail analysis would need to be conducted to arrive at a fair and reasonable rate.

Realizing that most of the contributors are not very knowledgeable concerning investment matters, government should take up the responsibility of monitoring the returns on investment released to the contributors. A cue can be taken from the Chilean experience. Whilst one could reasonably expect that competition among the PFAs, in a bid to claim a larger share of the market, would be enough to ensure good returns to the contributors, the possibility of the formation of an oligopoly by the few PFAs cannot be totally written off.

At the payout phase, it is important that the regulator monitor the interest rates and expense charges used in determining annuity rates and the rates for the programmed withdrawals. Special consideration should also be given to the contributors in the low-income bracket because of their expected lower than average life expectancy and the heavy impact of administrative charges on their pensions.

In the short term, the appropriateness of the annuitant mortality tables in use should be investigated as this has significant impact on the pension rates. In the medium to long-term, steps should be taken through the collaborative efforts of government, the service providers and the actuarial profession, to institute continuous annuitant mortality investigations reflecting the Nigerian experience most preferably on cohort basis.

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