

ON THE SHIFT FROM DEFINED BENEFIT TO
DEFINED CONTRIBUTION PENSION PLANS

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I here by declare that this research project is my original work and has not been presented in any learning institution for academic award or otherwise.

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This research work has been submitted for examination with my approval as the university supervisor

Signature.....  22/11/2012

Prof. R. O. Simwa



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ACRONYM

DB	-	Defined Benefit
DC	-	Defined contribution
PV	-	Present Value
FV	-	Future Value
a_n^-	-	Present Value of an annuity
v	-	Discounting Factor
P. a	-	Per Annum

ABSTRACT

Traditional DB pension plans are gradually losing their dominance in Kenya like many other occupational pension systems of many countries. Over the past few decades there has been a gradual shift towards DC pensions and, in some countries, DC plans now account for the majority of invested assets in private sector occupational pension plans. The most frequently quoted reasons are: Cost control, in the sense that an employer's obligation to a DC plan can be predicted up front, based on the contribution formula used, easier administration for DC plans, and difficulty in communicating the benefits provided by a DB plan. While all these are legitimate reasons, they are all reasons from an employer's perspective. Traditionally, the employer makes all decisions concerning retirement benefit arrangements. The ultimate choice of benefits often reflects the interest of the employer, even though Employee Retirement Income Security Act and the Pension Benefits Acts stress that retirement plans are solely for the benefit of the employees.

DB and DC plans have significantly different characteristics with respect to their cost and the benefits offered to the employees. How well they succeed must be judged in the context of their cost effectiveness and the benefit they provide to the employee. In this paper, we intend to approach the subject from both the perspective of the employee and employer welfare. We shall focus on the cost involved in DB Plan and DC Plan. We will then also compare the values of benefits they will provide to an employee.

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Chapter 1

1.0 INTRODUCTION

1.1 Background

Although employer pension programs vary in design they are usually classified into two broad types: defined contribution and defined benefit. Under a defined contribution (DC) plan each employee has an account into which the employer and, if it is a contributory plan, the employee make regular Contributions. Benefit levels depend on the total contributions and investment earnings of the accumulation in the account. Often the employee has some choice regarding the type of assets in which his accumulation is invested and can easily find out what its value is at any point in his working career. Defined contribution plans are in effect tax deferred savings accounts in trust for the employees, and are by definition fully funded.

In a defined benefit (DB) plan the employee's pension benefit entitlement is determined by a formula which takes into account years of service for the employer and, in most cases, wage or salary.

1.1 Objectives

DB and DC plans have significantly different characteristics with respect to their cost and the benefits offered to the employees. How well they succeed must be judged in the context of their cost effectiveness and the benefit they provide to the employee. In this paper, we intend to approach the subject from both the perspective of the employee and employer welfare. We shall focus on the cost involved in the arrangements as a percentage of the payroll. We will then also compare the values of benefits they will provide to an employee.

1.2 Research Hypothesis

Our research hypothesis is that DB plan is more cost effective and for a given level of contribution the DB Plan can yield better benefits than a DC Plan.

Chapter 2

2.0 LITRATURE REVIEW

2.1 Defined Contribution Plans

The DC arrangement is the conceptually simpler retirement plan. According to Scott(1999), The employer, and sometimes also the employee, make regular contributions into the employee's retirement account. The contributions are usually specified as a predetermined fraction of salary, although that fraction need not be constant over the course of a career.

Contributions from both parties are tax deductible, and investment income accrues tax free. Often the employee is given a choice as to how his account is to be invested. In principle, contributions may be Invested in any security, although In practice most plans limit investment options to various bond, stock and money market funds. At retirement, the employee either receives a lump sum or an annuity, the size of which depends upon the accumulated value of the funds in the retirement account. The investment risk and investment rewards are assumed by each individual/employee/retiree and not by the Sponsor/employer, and these risks may be substantial (Cannon Ian -2012) The employee thus bears all of the investment risk; the retirement account is by definition fully funded, and the firm has no obligation beyond making its periodic contributions.

Valuation of the DC plan is straightforward: simply measure the market value of the assets held in the retirement account. However, as a guide for personal financial planning, the DC plan sponsor often provides workers with the indicated size of a life annuity starting at retirement age that could be purchased now with the accumulation in their account under different scenarios. The actual size of the retirement annuity will of course, depend upon the realized investment performance of the retirement fund, the interest rate at retirement, and the ultimate wage path of the employee.

Examples of DC plans include United States Individual Retirement Accounts (IRAs) and 401(k) plans, the UK's personal pensions and proposed National Employment Savings Trust (NEST), Germany's Riester plans, Australia's Superannuation system and New Zealand's KiwiSaver scheme. Individual pension savings plans also exist in Austria, Czech Republic, Denmark, Greece, Finland, Ireland, Netherlands, Slovenia and Spain (Economic Policy Committee and the European Commission -2006)

2.2 Defined Benefit Plans

According to Scott (1999), a traditional defined benefit (DB) plan is a pension plan in which the benefit on retirement is determined by a set formula, rather than depending on investment returns. In the US the internal revenue code (1939) specifies a defined benefit plan to be any pension plan that is not a defined contribution plan (see above) where a defined contribution plan is any plan with individual accounts. These retirement plans are sponsored by the employers. For each year of service, the employer promises to provide a definite benefit to the employee, which commences upon the employee's retirement, and continues as long as he/she lives. The plan usually also provides some ancillary benefits such as early retirement subsidies, death, disability, and termination benefits. It may also provide cost of living increases for benefits after retirement. There are different types of DBs. However, the benefits are all designed to reflect the economic environment at the retirement age. The amount of retirement benefits is intended to replace a certain percentage of earnings immediately before retirement. The three major types of DB plans are:

2.2.1 Flat Dollar Plans

These plans provide a fixed amount of retirement benefits for each year of service. The benefit rate reflects the current economic situation only (Micheal – 2009). Thus, nominally, the benefit is not tied to the situation at retirement. However, through union negotiations or otherwise, the benefit rates are continually updated to the new economic situations. Consequently, the final retirement benefits are related to the situation at retirement.

2.2.2 Career Average Pay Plans

These plans provide retirement benefits each year based on the pay for that year (Micheal – 2009). Again, nominally these plans do not fully reflect the economic situation at retirement. However these plans usually get career average updates at regular intervals. At each update, benefits for all past service are increased to reflect pay close to the date of the update. However, if the career average pay plan is never updated, the retirement benefits provided by the plan will be inadequate.

2.2.3 Final Average Pay Plan

The majority of non-union plans are final average pay plans. Each year the participant earns retirement benefits which reflect pay close to the retirement date (Micheal – 2009). The retirement benefits provided by such plans are explicitly tied to the economic conditions at the retirement age, unlike the implicit schemes of the other types of DB plans.

Consider an hypothetical employee who starts working at age 25 with an initial pay of \$40,000. The DB pension plan provides a benefit of 1.5% of final pay for each year of service. Normal retirement age is 65. If the employee stays with the same employer throughout entire career and his/her pay increase at 5.5 % each year, the pay increases from \$40,000 at age 25 to \$323,000 before retirement, and the retirement benefit accumulates to \$194,000 at retirement.

Chapter 3

3.0 METHODOLOGY, APPLICATION AND RESULTS

3.1 Model Assumption

Our model is based on a hypothetical newly-hired female aged 30 on the starting date of her employment with an initial pay of \$1,5400. She continues working until age 60.

Thus, the length of the career is 30 years.

We make the following assumptions;

- She dies at the age of 80 years
- She never marries
- Her salary increases at the rate of 4% p.a
- We define investment returns to be 8% net of fees.
- We shall use the final average pay plan as the representative of DB plans providing a benefit of 1.5% of final pay for each year of service.
- The DC Plan provides a lump sum benefit which our employee splits to equal 30 annual amounts.

By their final year of work, her salary has reached \$50,000, having grown by about 4% percent each year as shown below.

$$FV = (1 + i)^n * PV$$

Where:

- FV = Future Value (Final salary after 30 years)
- PV = Present Value (Starting Salary)
- i = Rate of salary increase
- n = number of periods (30 years)

Next, we define a target retirement benefit that, combined with Social Security benefits, will allow her to achieve generally accepted standards of retirement adequacy. The plan provides a benefit in retirement equal to \$26,684 per year or \$2,224 per month. A cost of living adjustment is provided to ensure the benefit maintains its purchasing power during retirement. Thus, the nurse will receive a benefit equal to 53% of her final year's salary that adjusts with inflation, which we estimate at 2.8% per year. With this benefit and Social Security benefits, each nurse can expect to receive roughly 83% of her pre-retirement income – a level of retirement income that can be considered adequate, but not extravagant.

3.2 Modeling the cost of DB Plan and DC Plan

3.2.1 A model of DB Plans

Then, on the basis of all these inputs, we calculate the contribution that will be required to fund our target retirement benefit through the DB plan over the course of her career. We calculate as shown below the amount required at age 60 that would be required to be set aside for the our employee, to provide a modest retirement benefit of about \$2,224 per month cost to fund the target retirement benefit under the DB Plan is about \$272,000.

$$a_{n-1} = (1 - v^n) / i$$

There fore,

$$PV_{\text{Ordinary Annuity}} = C * \left[\frac{1 - (1 + i)^{-n}}{i} \right]$$

Where;

$$C = \$2,224$$

$$i = 1.08^{1/12} - 1 = 0.00643403$$

$$n = 12 \times 20$$

We express this amount as a level percent of payroll over a career (Appendix I). We get it is 10 % of payroll each year as shown figure 1.

3.2.2 A model of DC Plans

Modeling the cost of the target retirement benefit in the DC plan requires some adjustments based on what we know about how DC plans differ from DB plans.

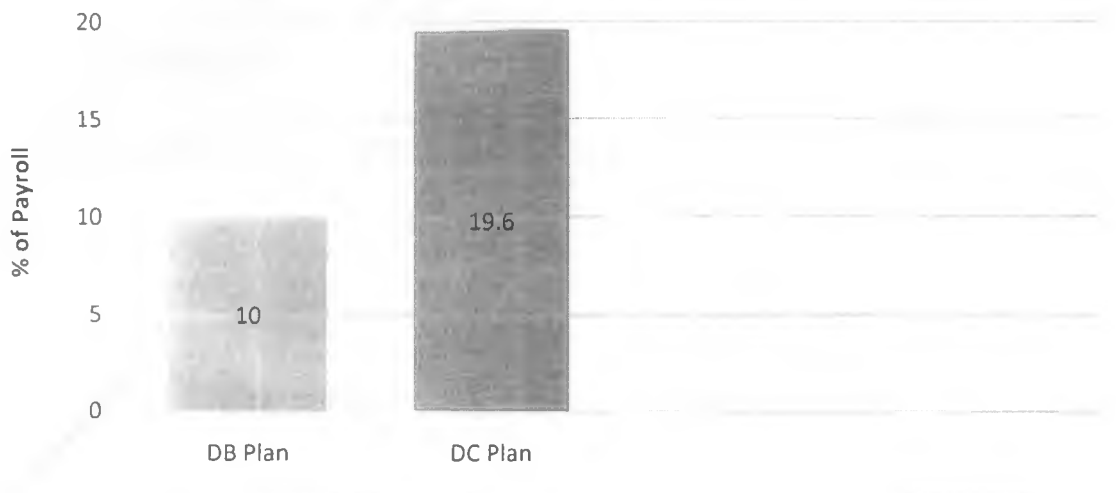
First, because employees are not provided with an annuity benefit at retirement under the DC plan, we determine the size of the lump sum amount that an individual would need to accumulate by their retirement date in order to fund a retirement benefit equivalent to that provided by the DB plan (including inflation adjustments).

We calculate as shown below the amount required at age 60 that would be required to be set aside for our employee to provide a modest retirement benefit of about \$2,224 per month cost to fund the target retirement benefit under the DC Plan is about \$534,000

Monthly retirement benefit x 12 x20

We then calculate the contribution that will be required to fund this benefit through the DC plan over the course of a career, and express this as a level percent of payroll (Appendix I). We find that the cost to fund the target retirement Benefit, smoothed over a career, comes to 19.6% of payroll each year as shown figure 1.

Figure 1 Showing Amount Required at Age 60 to be set aside for our employee for each type of Plan to provide a benefit of \$ 2,200 per month; as a % of Payroll



From figure 1 we found that to achieve roughly the same target retirement benefit that will replace 53% of final salary, the DB plan will require contributions equal to 10% of payroll, whereas the DC plan will require contributions to be almost twice as high - 19.6% of payroll

3.3 A Comparison of DB and DC plans Benefits

Let us now compare the values of yearly benefits provided by the DB and the DC plans for the same sample employee. A DB plan which provides 1.5% final pay for each year of service is compared to a DC plans which provide annual contribution rates of 10% and 19.6% respectively. We use investment returns of 8% p.a and 12% p.a.

The Value of benefit under DC Plan is calculated as follows and is shown in Appendix II;

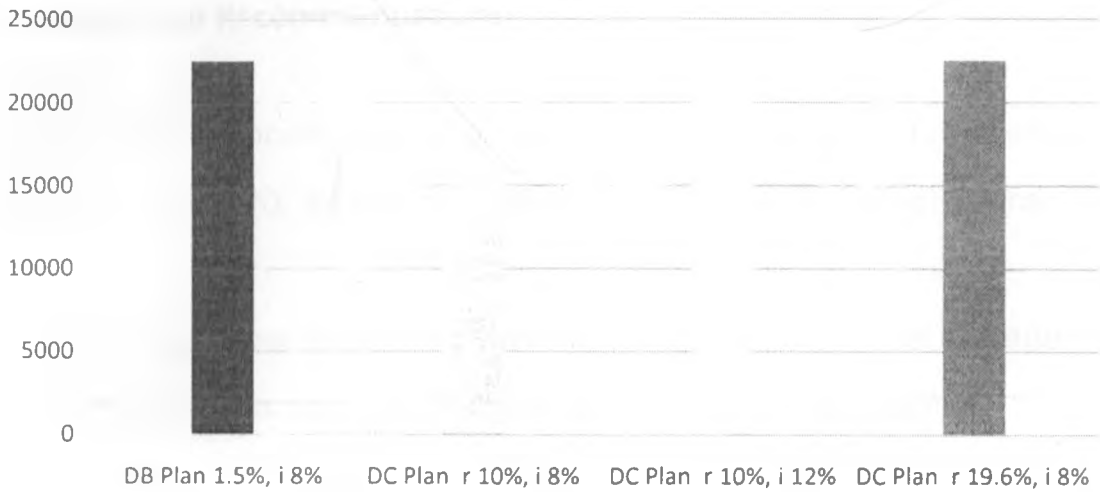
$$\sum_{n=0}^{30} 1,540(1.04)^n(r/100)(1+i/100)^{30-n}$$

Where; r is the contribution rate at 10% and 19.6%

i is the investment returns rate of 8% p.a and 12% p.a

We find that at retirement the amount of benefit under DC plan which provide annual contribution rates of 10% and 19.6% is approximately \$273,000 and \$535,200 respectively which translate to a yearly benefit of \$ 13,650 and \$ 26,760 respectively as shown in figure 2.

**Figure 2 Showing Yearly Values of benefits;
DB Plan Vs DC Plan**



Form figure 2 we find that for our employee to receive the same yearly benefit as in DB Plan the DC Plan will have a high contribution rate of 19.6% when the investment return is 8% or offer a contribution rate of 10% when the investment return is 12%.

Chapter 4

Conclusion and Recommendations

In our analysis on the cost to provide our employee with a target monthly benefit of \$2,200, we find that DB plans are more cost-effective than DC plans.

Our findings show that a DB plan can provide the same level of retirement income for our employee at almost half the cost of a DC plan.

We also found that for a DC Plan to provide the same benefit as a DB Plan it has to offer a high contribution rate or ensure its investment returns are high.

Hence, the shift from DB plans to DC Plans would not be beneficial to our employee and her employer as the former is more cost effective and can yield better returns.

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Appendix I

Period end	salary	DB 1.5% Final Pay	Contribution r 10%	Benefit i 8%	Contribution r 19.6%	Benefit i 8%
1	16016	240.24	1601.6	14922.54748	3139.136	29248.1931
2	16656.64	499.6992	1665.664	14369.86053	3264.70144	28164.9266
3	17322.91	779.530752	1732.29056	13837.64348	3395.289498	27121.7812
4	18015.82	1080.949309	1801.582182	13325.13816	3531.101078	26117.2708
5	18736.45	1405.234102	1873.64547	12831.61453	3672.345121	25149.9645
6	19485.91	1753.73216	1948.591288	12356.36954	3819.238925	24218.4843
7	20265.35	2127.861687	2026.53494	11898.72623	3972.008482	23321.5034
8	21075.96	2529.115605	2107.596338	11458.03266	4130.888822	22457.744
9	21919	2959.065258	2191.900191	11033.66108	4296.124375	21625.9757
10	22795.76	3419.364298	2279.576199	10625.00697	4467.96935	20825.0137
11	23707.59	3911.752757	2370.759247	10231.48819	4646.688124	20053.7169
12	24655.9	4438.06131	2465.589617	9852.544185	4832.555649	19310.9866
13	25642.13	5000.215742	2564.213201	9487.635141	5025.857874	18595.7649
14	26667.82	5600.241632	2666.781729	9136.241247	5226.892189	17907.0328
15	27734.53	6240.269247	2773.452998	8797.861941	5435.967877	17243.8094
16	28843.91	6922.538684	2884.391118	8472.015203	5653.406592	16605.1498
17	29997.67	7649.405246	2999.766763	8158.236862	5879.542856	15990.1442
18	31197.57	8423.345071	3119.757434	7856.079941	6114.72457	15397.9167
19	32445.48	9246.961033	3244.547731	7565.114017	6359.313553	14827.6235
20	33743.3	10122.98892	3374.32964	7284.924609	6613.686095	14278.4522
21	35093.03	11054.3039	3509.302826	7015.112587	6878.233539	13749.6207
22	36496.75	12043.9273	3649.674939	6755.293602	7153.36288	13240.3755
23	37956.62	13095.03368	3795.661936	6505.097543	7439.497395	12749.9912
24	39474.88	14210.95829	3947.488414	6264.168004	7737.077291	12277.7693
25	41053.88	15395.20481	4105.38795	6032.161782	8046.560383	11823.0371
26	42696.03	16651.45353	4269.603469	5808.748382	8368.422798	11385.1468
27	44403.88	17983.56981	4440.387607	5593.609554	8703.15971	10963.4747
28	46180.03	19395.61307	4618.003112	5386.438829	9051.286099	10557.4201
29	48027.23	20891.84608	4802.723236	5186.941095	9413.337543	10166.4045
30	49948.32	22476.74474	4994.832165	4994.832165	9789.871044	9789.87104

Appendix II

Period end	salary	Contribution r 10%	Benefit i 8%	Benefit i 12%	Contribution r 19.6%	Benefit i 8%
1	16016	1601.6	14922.54748	42842.68863	3139.136	29248.15
2	16656.64	1665.664	14369.86053	39782.49659	3264.70144	28164.91
3	17322.91	1732.29056	13837.64348	36940.88969	3395.289498	27121.78
4	18015.82	1801.582182	13325.13816	34302.25471	3531.101078	26117.21
5	18736.45	1873.64547	12831.61453	31852.09366	3672.345121	25149.91
6	19485.91	1948.591288	12356.36954	29576.94411	3819.238925	24218.44
7	20265.35	2026.53494	11898.72623	27464.30525	3972.008482	23321.51
8	21075.96	2107.596338	11458.03266	25502.56916	4130.888822	22457.11
9	21919	2191.900191	11033.66108	23680.95708	4296.124375	21625.91
10	22795.76	2279.576199	10625.00697	21989.46014	4467.96935	20825.01
11	23707.59	2370.759247	10231.48819	20418.78442	4646.688124	20053.71
12	24655.9	2465.589617	9852.544185	18960.29982	4832.555649	19310.91
13	25642.13	2564.213201	9487.635141	17605.99269	5025.857874	18595.71
14	26667.82	2666.781729	9136.241247	16348.42178	5226.892189	17907.01
15	27734.53	2773.452998	8797.861941	15180.67737	5435.967877	17243.81
16	28843.91	2884.391118	8472.015203	14096.34327	5653.406592	16605.11
17	29997.67	2999.766763	8158.236862	13089.46161	5879.542856	15990.11
18	31197.57	3119.757434	7856.079941	12154.50006	6114.72457	15397.81
19	32445.48	3244.547731	7565.114017	11286.32149	6359.313553	14827.61
20	33743.3	3374.32964	7284.924609	10480.15567	6613.686095	14278.41
21	35093.03	3509.302826	7015.112587	9731.57312	6878.233539	13749.61
22	36496.75	3649.674939	6755.293602	9036.460754	7153.36288	13240.31
23	37956.62	3795.661936	6505.097543	8390.999272	7439.497395	12749.81
24	39474.88	3947.488414	6264.168004	7791.642181	7737.077291	12277.11
25	41053.88	4105.38795	6032.161782	7235.096311	8046.560383	11823.01
26	42696.03	4269.603469	5808.748382	6718.303717	8368.422798	11385.11
27	44403.88	4440.387607	5593.609554	6238.42488	8703.15971	10963.11
28	46180.03	4618.003112	5386.438829	5792.823103	9051.286099	10557.11
29	48027.23	4802.723236	5186.941095	5379.050024	9413.337543	10166.11
30	49948.32	4994.832165	4994.832165	4994.832165	9789.871044	9789.81

