DEMOGRAPHIC DYNAMICS AND SOCIAL INSURANCE SYSTEM IN MONGOLIA: THE NOTIONAL DEFINED CONTRIBUTION SCHEME

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Abstract

The purpose of this research is to evaluate the effectiveness and financial feasibility of the old age pension (Notional Defined Contribution) scheme in Mongolia in the context of its changing demographic dynamics by developing an Excel-based dynamic model. We find that the current scheme will experience considerable financial deficit due to its design flaws. The simulation results from two policy scenarios – increased national pension age and increased contributions rates – suggest that the financial deficit of the scheme will become worse. Given the results, a Funded Defined Contribution scheme is examined to establish an effective and sustainable pension system in Mongolia

Keywords: pension scheme, demographic dynamics, Notional Defined Contribution (NDC), Funded Defined Contribution

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1. Introduction

Recent demographic changes across the globe have had a significant effect on every aspect of our social and economic lives. Demographic effects such as human longevity may need to be considered as one of the key factors in determining social insurance and social welfare policies including retirement benefits, life insurance, long term care, government funding for age entitlement programmes and pension schemes in any country.

In line with the global trend, population ageing is inevitable in Mongolia. The number of individuals aged 60 or over was about 162,000 or 5.9% of the total population in 2009 (Mongolian Statistical Yearbook, 2009). This number is projected to reach 837,000 by 2050, representing 20.5% of the total population (United Nations, 2010). A demographic change of such magnitude is likely to impact negatively the financing of social security insurance provisions. In particular, the financial strength of a national pension insurance system and its capability to meet future liabilities will be directly affected by this demographic change, in addition to other factors.

In this research, we aim to examine how the current Mongolian social insurance system, in particular the Notional Defined Contribution (NDC) scheme will be affected by future demographic trends within the context of the expected future economic environment of Mongolia.

The paper is organised as follows. Section 2 reviews the related literature. Section 3 discusses the NDC scheme in Mongolia, develops an Excel-based model for the scheme and simulates the model in different scenarios. Section 4 presents the simulation results. Section 5 concludes the paper and provides policy recommendations. Section 6 has a short list of abbreviations used in the paper.

2. Literature Review

Demographic trends and their implications on defined contribution pension schemes have been widely studied and examined by academics and practitioners around the world.

In 2010, Revision of the World Population Prospects of the United Nations (United Nations, 2010), the future population of each country was projected to year 2100 by using a new, probabilistic method for projecting total fertility. This new method was developed in collaboration with the Probabilistic Projections Group of the Centre for Statistics and the Social Sciences (CSSS), University of Washington. Projected future demographic trend for Mongolia, as reported in the above mentioned UN study, is employed as an exogenous input in the model developed in our study.

Actuarial deterministic modelling of defined contribution pension funds is illustrated by Khorasanee (1998). In doing so, Khorasanee (1998) incorporates the following investment shocks into the model: (1) an instantaneous fall in the value of the fund assets and (2) a permanent, uniform reduction in the rate of earned interest. Gabay et. al., (2012) discusses the management of demographic risk faced by a defined contribution social pension scheme and solved the optimal stochastic control problem of a social planner who has to deliver not only a (lump sum) pension at the retirement date to all participants of all generations according to a same rule but also proportional to the contributions they paid during their work life, taking into account of future random contributions and satisfying a terminal solvency constraint. They suggest that collective participation in an intergeneration fund is better than individual investment, even when both individuals and the fund manager have the same investment opportunities.

Olshansky et. al., (2009), on the other hand, argue that actuaries and mathematical demographers involved in mortality forecasting have tended to be one-dimensional – i.e., they have consistently struggle with their vision of the future of mortality primarily because they have relied heavily on outdated trends in death statistics; completely ignored the underlying biological forces that influence and drive death rates; or maintain a biased view that assumes observed improvements in mortality will continue whereas observed declines in health and longevity will be resolved by medical technology and behaviour modification.

Pension politics of Denmark, Sweden and the Netherlands are investigated in Anderson (2004) which reports that since the governments and pension funds make pension promises decades in advance, the notion of "path-dependence" was inherent in pension development, and actors adapted their behaviour to the prevailing structure of pension provision. In these three countries, initial choices concerning the structure of basic and occupational pensions significantly shaped subsequent pension development.

The equity and efficiency benefits of the NDC schemes are explored by Whitehouse (2010). Auerbach and Lee (2006) stress the stability features of NDC systems by employing a stochastic macro model. One of their findings is that much of the volatility of such systems is due to economic uncertainty rather than demographic.

Peer reviewed literature specifically focusing on the review and the projection of the Mongolian pension system is quite limited. Patrick carried out series of works on the

evaluation and pension reform options for Mongolia (Patrick et. al., (2003); Patrick (2006)). The Asian Development Bank commissioned a project in 2008, titled "*Mongolia: Strengthening the Pension System"* (ADB, 2008) while the World Bank issued a report in 2008 on Pension Policy challenges and reform options (World Bank, 2008).

In the latter two studies, financial projections of the Mongolian pension system are made using the Pension Reform Options Simulation Toolkit (PROST). PROST is an Excel-based software developed by the World Bank and models pension contributions, entitlements, system revenues and system expenditures over a long time frame.

3. NDC Scheme in Mongolia

The Mongolian Government operates all pension schemes in Mongolia. Occupational savings schemes are offered by a small number of Mongolian private sector employers. The national pension system is Pension Insurance, a part of Social Insurance, established in accordance with the Law on Social Insurance of 1994 and the Law on Individual Pension Insurance Contribution Accounts of 1999.

In this study, the impact of future demographic trends on the NDC scheme in Mongolia is analysed by developing an Excel-based model, based on the NDC scheme design and available data constraints. By using a different modelling technique, authors hope that the study might provide an alternative outlook on pension issues and current reform options that are being considered.

3.1 Overview

Individual pension insurance contribution accounts were created for Mongolian citizens who were born on or after 01 January 1960. An individual, born on or after 01 January 1960, is registered as a member of the NDC scheme once he/she pays first pension contribution to the scheme and an individual account is opened on the name of a person. There are two types of decrements from the scheme: disability and death.

Initial balance of an account

Initial balance of an individual account (A) is determined as follows:

$$A = B \times C$$

where B is an appropriate pension insurance contribution amount and C is the total number of employment months. The appropriate pension insurance contribution amount (B) is determined as follows:

$$B = D \times E \times F$$

where D is the average monthly salary of an individual, E is the average growth of national average salary in last 5 years and F is the pension contribution rate.

Fund accumulation rate

Interest on individual accounts is calculated once a year, at the year end. The account balance at the beginning of the year and total pension contributions during the year are accumulated by an average growth rate of the national average salary in three preceding years. Currently, the contribution rate of employers is the same as that of employees and is defined at 7% of employees' monthly salary. However, a contribution ceiling exists for employees, which states that the employee's contribution shall not exceed 10 times of the 7% of the monthly minimum (national) salary. There is, on the other hand, no ceiling for employers' contribution. For example, in 2012 the monthly minimum salary was set to MNT 140,400; which means that the

maximum monthly pension contribution from an employee was to be MNT 98,280 (140,400x10x0.07).

Pension benefit

Monthly benefit of retirement pension (T) is calculated as follows:

$$T = \frac{X}{12 \times K}$$

where X is the balance of the account at the retirement and K is a life expectancy factor.

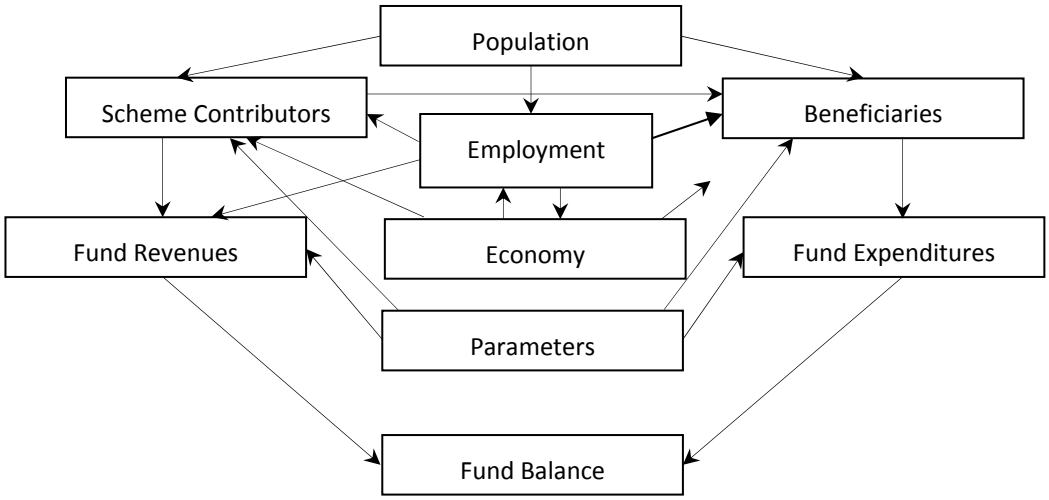
Minimum pension

For the NDC scheme, the minimum pension must not be less than 20% of the national average salary for those who have contributed for 15 years. For those who have contributed for longer periods, the minimum shall increase by 0.5% for each additional year.

3.2 Model Introduction

The model developed in this study integrates both the demographic and economic aspects in a single framework. The framework of the model is illustrated in Figure 1.

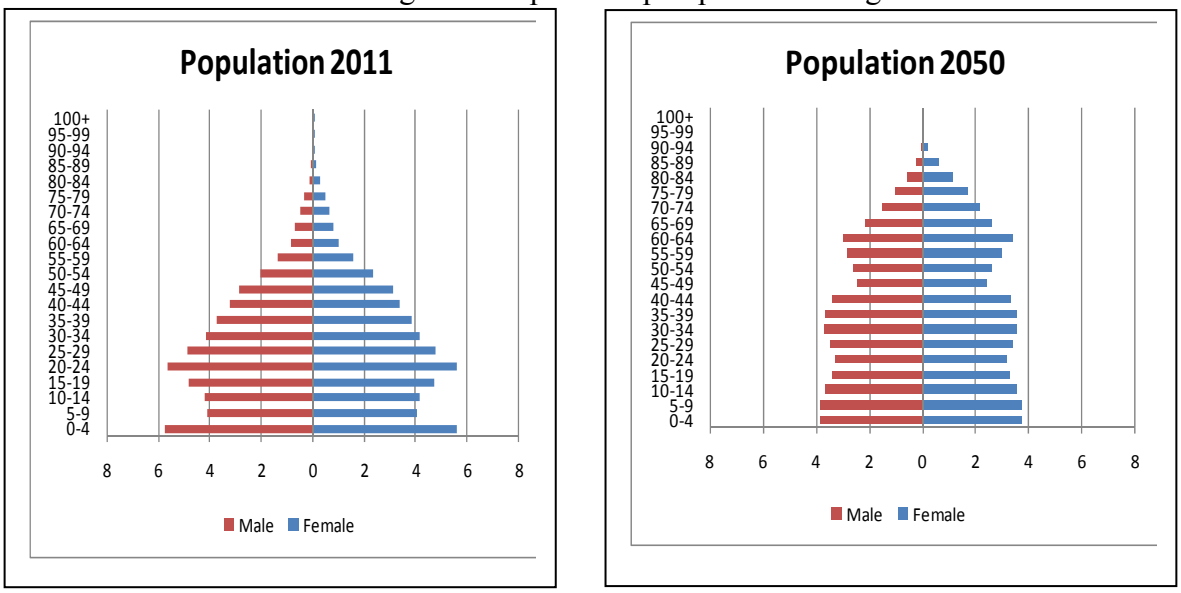
Figure 1. Model Framework



Population

Population dynamics will be the main factor in determining the number of potential contributors and beneficiaries from the NDC pension scheme in a given economic environment that determines the employment level. Medium fertility scenario of the UN population projections (United Nations, 2010) for Mongolia are used in simulating our model. According to this, the total population of Mongolia is projected to reach 4.1 million in 2050. The population pyramid in 2011 and its projected counterpart as of 2050 are illustrated below:

Figure 2. Population prospects in Mongolia



The UN projections for female and male population in Mongolia by five-year age group (2010 – 2050 period) and population estimates of those who were born on or after 01 January 1960 were given in Appendixes 1 and 2 respectively.

Economy

The national economy influences both revenues and expenditures of the pension fund. The scheme revenues will be indirectly affected through the scheme contributors: the number of employees as well as their salary levels. Since the minimum pension contribution in NDC scheme is linked to the national average salary level, the economy has a direct effect on determining the scheme expenditures. The economy also has an indirect effect on the scheme expenditures. The pension entitlement rights are contingent on employees' work conditions and environment during their employment which is closely related to economic sectors such as mining.

Parameters

The key parameters of the pension scheme that policymakers need to focus on are:

- The contribution rate of employers and employees;
- The retirement age;
- The expected subsidy by the Government to contribute to the target level of income replacement in retirement.

The model provides insights into the coherence and consistency of objectives, hypothesis and data. The model will enable the running of alternative scenarios based on policy propositions and provide an understanding of how different strategic choices and external conditions can impact the future development of the pension scheme.

3.3 Model Inputs and Assumptions

The main inputs and assumptions used in the model are summarized in the following table. For example, we assume that the unemployment rate stays at 10% of labour force throughout the simulation (or projection) period which is 2010-2050. We also assume that real GDP and real salary grow at 6% in light of growth accounting in economics which seems to be a reasonable assumption for a long term analysis. Below we will discuss the possibility of doing sensitivity analyses with rest to the values assumed for the inputs.

Table 1: Main inputs and assumptions

No	Inputs	Value	Remarks
1	Projection period	2010 – 2050	Input
2	Annual unemployment rate	10%	Assumption
3	Average employment start age	27	Assumption
4	Real GDP growth (annual)	6%	Assumption
5	Real rate of investment return (annual)	4%	Assumption
6	Minimum pension	20% of the national average salary	Current law
7	Pension income inequality	Lognormal distribution (standard deviation/mean = 0.786)	See below
8	Annual administrative expenses	2% of contributions	See below
9	Minimum salary	33% of the national average salary	See below
10	Number of decrements	63.8% of pensioners (a_1)	See below
11	Average accumulated fund per old age retiree	4.79 when NPA is 55, 5.50 when NPA is 60, and 6.28 when NPA is 65 times the average fund per active member	See below
12	Real salary growth (annual)	6%	See below

3.3.1 Pension income inequality

Household incomes within countries typically follow a skewed distribution with a long high tail. It is found that, on average, national income fits a lognormal distribution quite well (William (1993) and Aitchison and Brown (1969)). It can be shown that, if income is lognormally distributed, there is an one-to-one correspondence between the Gini coefficient and the ratio of standard deviation to mean (S/M). Qu and Barney (2002) illustrate a relationship between the S/M ratio and the Gini coefficient as follows:

S/M ratio	0.1	0.2	0.5	1	1.5	2	3	4	5
Gini	5.18%	10.90%	26.05%	44.29%	55.54%	62.70%	71.03%	75.72%	78.74%

According to the World Bank, the Gini coefficient in Mongolia was estimated to be 36.5% in 2008[2]. This implies that the S/M ratio is 0.786 in 2008, having applied interpolation. In our study, the initial pension benefit at the retirement age of a member, determined by accumulated pension fund before applying the minimum pension requirement, is assumed to follow a lognormal distribution and the S/M ratio in each projection year is constant and equal to 0.786.

3.3.2 Administrative expenses

According to the State Social Insurance General Office (SSIGO), social insurance contributions and SSIGO operational/administrative expenses in 2007 – 2010 were as follows:

[2] http://data.worldbank.org/indicator/SI.POV.GINI/

Social Insurance Contributions

MNT, million

Contributions	**2007**	**2008**	**2009**	**2010**
Retirement insurance fund	241,602	314,353	330,394	462,795
Benefit insurance fund	14,624	13,018	15,171	17,996
Health insurance fund	52,671	62,425	71,826	91,258
IAOD* insurance fund	10,435	20,297	23,877	31,557
Unemployment insurance fund	7,245	12,547	15,742	19,113
Total	326,576	422,640	457,009	622,719
SSIGO administrative cost	**5,736**	**8,605**	**9,277**	**9,649**

The following table illustrates amounts of annual allocated cost and the percentage of the cost in the contributions paid for retirement insurance in Mongolia between 2007 and 2010. The total administrative cost of the SSIGO was allocated among the different categories in proportion with the contributions paid.

Cost Allocation for Retirement Insurance

Year	**2007**	**2008**	**2009**	**2010**
Amount (*MNT, mln)*	4,244	6,400	6,707	7,171
Percentage	1.8%	2.0%	2.0%	1.5%

The average percentage of SSIGO administrative cost in contributions between 2007 and 2010 was 1.8%. In our study, the annual administrative cost of the NDC scheme is assumed to be 2% of the total annual contributions.

3.3.3 Minimum salary

The statistics of the national monthly average salary and the minimum salary in Mongolia in 2007 – 2011 were as follows:

MNT, nominal value

	2007	**2008**	**2009**	**2010**	**2011**
Average salary (AS)	173,000	274,200	300,500	326,800	427,000
Minimum salary (MS)	90,000	108,000	108,000	108,000	140,400
MS as percentage of AS	52%	39%	36%	33%	33%

In the simulations, the minimum salary is projected to stay at 33% of the national average salary in any given year.

3.3.4 Number of decrements

Two main categories of decrements from the NDC scheme are disablement and death before reaching the national pension age. The number of old age retirees and decrements from the pension schemes in Mongolia in 2008 – 2011 were provided by SSIGO as follows:

	2008	2009	2010	2011	Average
Old age retirement	11,519	11,540	12,536	11,790	
Disabled	8,175	6,006	6,152	5,375	
Bread winner loss	2,646	2,460	2,275	2,200	
Total decrements	10,821	8,466	8,427	7,575	
Decrements as % of new pensioners	93.9%	73.4%	67.2%	64.2%	**68.3%**

In the simulation, the number of decrements in any given year is assumed to be 68.3% of new retirees in the same year.

3.3.5 Average accumulated fund per retiree (MNT, million)

The following statistics of the NDC scheme were provided by the SSIGO:

Age group	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
Average contribution amount in 2011	68	177	325	362	369	365	395	412
Average NDC balance, 31 Dec 2010	337	362	1,088	2,045	3,297	5,109	9,312	8,925

Based on the above statistics, we estimate the average accumulated fund per old age member and the comparison to an average fund per active member are estimated as follows:

Ages	**55**	**60**	**65**	**All age**
Average NDC balance, 31 Dec 2010	12,609	14,464	16,525	2,632
Ratio to all age average	**4.79**	**5.50**	**6.28**	

These ratios are assumed to be the same in each projection year.

3.3.6 Salary projection

According to the National Statistical Office of Mongolia (NSO 2010), the national average monthly salary in 2010 was MNT 326.8 thousand. However, the average member of the NDC scheme earned MNT 198.1 thousand a month. This is due to discrepancy between earned salary and reported salary – companies and employees report less income than they actually earn. In this work, two cases are studied when projecting the cash flows: Case A – this discrepancy in reporting salaries remains until 2050 at the same level as it was in 2010; and Case B – there was no discrepancy between earned and reported salaries.

3.4 Modelling

Based on the NDC scheme design and available data constraints, the following model is developed when projecting cash flows of the NDC retirement benefit scheme. The NDC scheme is modelled at two phases: accumulation phase and payment phase. At the accumulation phase, first, the average fund balance per active member is projected in each projection year. Next, the average fund balance per member at the retirement age is estimated by using the ratios determined in Section 3.3.5. Then, the pension income inequality between the retirees at the retirement age is introduced using assumptions in Section 3.3.1. At the payment phase, the future pension benefits of the members are estimated using the current rules of the scheme as well as annuity type contracts.

3.4.1 Model

Projection years from 2010 to 2050 are indexed as $t = 0, 1, 2, \dots, 40$.

When a member leaves the scheme through decrement, it can be regarded that the accumulated fund for the member is transferred to the Decrements Fund (DF). Similarly, when a member retires, the accumulated fund for the member is transferred to the Pensioners Fund (PF). The total fund balance of active members at the end of year t, F_t is defined as follows:

$$F_{t+1} = (F_t + C_{t+1} - F_{t+1}^D - F_{t+1}^P)(1 + r_{t+1}^a) \qquad t = 0,1,2, \dots, 40 \qquad (1)$$

where C_t is the total pension contribution of the NDC scheme members in year t, r_t^a is the fund accumulation rate in year t, F_t^D is the total fund balance transferred to DF, and F_t^P is the total fund transferred to PF in year t.

The expression in Equation (1) can be written as:

$$\frac{F_{t+1}}{N_{t+1}} = \left(\frac{F_t}{N_t}\frac{N_t}{N_{t+1}} + \frac{C_{t+1}}{N_{t+1}^M}\frac{N_{t+1}^M}{N_{t+1}} - \frac{F_{t+1}^D}{N_{t+1}^D}\frac{N_{t+1}^D}{N_{t+1}^P}\frac{N_{t+1}^P}{N_{t+1}} - \frac{F_{t+1}^P}{N_{t+1}^P}\frac{N_{t+1}^P}{N_{t+1}} \right)(1 + r_{t+1}^a)$$

where N_t and N_t^M are the numbers of active members of the NDC scheme at the end of year t and at the middle of year t, respectively, and N_t^D and N_t^P are the numbers of new decrements and new pensioners from the NDC scheme in year t, respectively. Furthermore,

$$f_{t+1} = \left(\frac{N_t}{N_{t+1}} - a_1 \frac{N_{t+1}^P}{N_{t+1}} - a_2 \frac{N_{t+1}^P}{N_{t+1}} \right)(1 + r_{t+1}^a) f_t + c_t \frac{N_{t+1}^M}{N_{t+1}}(1 + r_{t+1}^a) \qquad (2)$$

where $f_t = F_t/N_t$ is the average fund balance per active member at the end of year t, $a_1 = N_t^D/N_t^P$ is the ratio of the number of decrements to the number of new old age pensioners in year t (assumed at 0.683 each year), $f_t^D = F_t^D/N_t^D = f_{t-1}$ is the average fund balance per decrement in year t (assumed to be the same as average fund balance per active member at the end of year t - i.e., 1) and $f_t^P = F_t^P/N_t^P = a_2\, f_{t-1}$ is the average pension benefit per new pensioner in year t. As explained in Section 3.3, a_2 was given as follows:

$$a_2 = \begin{Bmatrix} 4.79,\ if\ NPA\ is\ 55 \\ 5.50,\ if\ NPA\ is\ 60 \\ 6.28,\ if\ NPA\ is\ 65 \end{Bmatrix}$$

where NPA stands for National Pension Age.

The term $c_t = C_t/N_t^M$ is the average contribution per active member in year t which is given by

$$c_t = s_t\, r_t^c\, (1-u_t)(1-exp_t) \tag{3}$$

and

$$s_t = s_{t-1}\,(1+r_t^s) \tag{4}$$

where s_t is the average annual salary, r_t^c is the contribution rate for retirement pension, u_t is the annual unemployment rate, exp_t is the administrative expense rate, and r_t^s is the average real salary growth rate.

The average initial fund balance in year 2010, f_0, and the average annual salary in 2010, s_0 are given. Unemployment and administrative expenses are taken into account when estimating annual contributions in equation (3) and the rates are assumed at 10% and 2% respectively, as illustrated in 3.3.

Based on the assumptions described in Section 3.3.1, initial pension income for new old age retirees at the retirement age, I_t, without the minimum pension requirement, is assumed to follow a lognormal distribution, i.e.,

$$I_t \sim LogNormal(\alpha_t, \beta_t) \tag{5}$$

and

$$Mean[I_t] = \frac{f_t^P}{e_t^{NPA}} \qquad \text{and} \qquad st.dev[I_t] = 0.786\,Mean[I_t]$$

where e_t^{NPA} is the life expectancy of a member in year t who is at the NPA.

Then according to the current rule of the NDC scheme, monthly pension benefit of a member in year t who retired in year j, P_t^j, is determined as:

$$P_t^j = \max\left(I_t : 12, P_t^{min}\right) \tag{6}$$

where P_t^{min} is monthly minimum pension benefit in year t.

If annuity type contracts are used instead of the current rule, monthly pension benefit of a member who retired in year j would be determined as:

$$P^j = \frac{A_j}{a_{NPA}^{(12)}} \tag{7}$$

where A_j is the accumulated fund balance of a member in year j and $a_{NPA}^{(12)}$ is an annuity of one unit per year, payable 12 times a year, until death to a member currently at the NPA and are determined as follows:

$$A_j = e_j^{NPA}\, I_j,$$

$$a_{NPA}^{(12)} \approx a_{NPA} + \frac{11}{24}$$

where $a_{NPA} = \sum_{t=1}^{\infty} {}_t p_{NPA} v^t$ and ${}_t p_{NPA}$ is the probability that a life aged at NPA survives for at least another t years and v is the discount factor.

3.4.2 Scenarios

The parameter values that are used in projecting the financial performances of the NDC scheme are given in Table 2.

Table 2: Scenario parameters

Parameters	**Current value**	**Option**	
NPA	Female-55 Male-60	Female-60 Male-60	Female-65 Male-65
Contribution rate	14%	19%	
Minimum pension	20% of the national average salary	No minimum pension	
Fund accumulation	Average national salary increase in the last 3 years	Investment return	

Different scenarios are created using combinations of the above parameter values and the financial performances are projected in each scenario.

4. Results

Since the NDC scheme is a mandatory scheme, it is evaluated based on the Mongolian population projections to 2050 and not on the current member participations. There are differences in earned and reported salaries: according to the National Statistics Office of Mongolia (NSO, 2010), the national average monthly salary in 2010 was at MNT 327 thousand. However, the average reported monthly salary, estimated by using the pension contribution statistics provided by the SSIGO, was approximately 39% lower than the national average salary. Therefore, the NDC scheme is evaluated in both earned and reported salary cases.

The Organisation for Economic Cooperation and Development (OECD) defines an adequate retirement income as equating 70% of pre-retirement income. The replacement rate in this study is defined as the percentage of an average pension benefit in average pre-retirement salary. This replacement rate is used as the key criteria in determining the effectiveness of pension schemes. If we assume that incomes from other sources than employment would stay relatively stable before and after retirement, then an adequate level of the replacement rate used in this study would be lower than 70%.

4.1 Simulations

Based on the UN population projections for Mongolia (UN, 2010), retirement age population, born on or after 01 January 1960, is estimated. The summary of the projection is given in Table 3.

Table 3: Retirement age population projections*

Thousand people

Year	NPA: Female = 55, Male = 60			NPA = 65
	Female_55	Male_60	All	
2015	7	-	7	-
2020	84	5	89	-
2025	167	65	231	11
2030	254	124	378	130
2035	342	182	524	250
2040	436	238	673	365
2045	527	295	822	470
2050	589	350	939	576

* The number of retirement age population who will get a social welfare benefit are estimated and deducted

4.2 The NDC Scheme

There are two main reasons for the NDC scheme deficits: the minimum pension requirement and the scheme's "pay as you go" financing. The scheme deficit in a given year is defined as an additional funding that is required to meet the benefit payouts in the year in excess of

accumulated contributions until retirement from the retired members. Under the "pay as you go" system of financing a pension program, the benefit payouts for pensioners in a certain year are financed by the contributions collected from the active members in the same year. As a result, as is the case in Mongolia right now, there is no or limited opportunity of gaining investment return on the pension fund. The financial performances of the current NDC scheme are projected and summary results are illustrated in Table 4.

Table 4: The NDC Scheme Projection

Pension contribution rate – 14%
NPA_female - 55, NPA_male – 60
Reported salary

MNT millions, at 2010 price

Year	Total benefit payouts (with minimum pension)	R/Rate*	Min. pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment return	Deficit			
							Amount	% of GDP	Min. pension effect	Financing effect
2015	839	29%	80%	533	19%	410	429	0.00%	71%	29%
2020	14,410	30%	84%	8,525	19%	6,017	8,393	0.06%	70%	30%
2025	51,054	31%	84%	29,496	19%	19,608	31,446	0.16%	69%	31%
2030	108,658	30%	89%	55,307	18%	35,975	72,683	0.27%	73%	27%
2035	197,550	29%	92%	87,011	16%	56,336	141,214	0.40%	78%	22%
2040	334,716	29%	95%	127,705	14%	83,305	251,411	0.53%	82%	18%
2045	542,602	28%	96%	181,398	13%	120,241	422,362	0.67%	86%	14%
2050	826,661	28%	97%	247,181	13%	166,947	659,715	0.78%	88%	12%

**R/Rate – Replacement rate*

The model projects that the number of minimum pension receivers will increase from 80% in 2015 to 97% in 2050 while the replacement rate will decrease during the projection period from 19% to 13%, as in Table 4. The fund deficit will reach 0.78% of the GDP in 2050 to which the minimum pension requirement and financing effect will contribute 88% and 12%, respectively.

Similar projections that are carried out in scenarios based on different parameter values of contribution rates and the national pension ages are given in Appendices 3 and 4.

The following table illustrates the financial performances of the NDC scheme in different scenarios in year 2050.

Table 5: The NDC Scheme Projection in 2050

MNT millions, at 2010 price

Scenarios*	Salary**	Total benefit payouts (with minimum pension)	R/ Rate***	Min. pension receivers	Total benefit payouts (without minimum pension)	R/ Rate***	Contributors fund_no investment return	Deficit			
								Amount	% of GDP	Min. pension effect	Financing effect

S1	R	826,661	28%	97%	247,181	13%	166,947	659,715	0.78%	88%	12%
	E	862,145	31%	90%	397,219	21%	271,204	590,941	0.70%	79%	21%
S2	R	651,724	39%	79%	422,439	30%	243,138	408,585	0.48%	56%	44%
	E	801,100	52%	56%	667,059	48%	394,146	406,954	0.48%	33%	67%
S3	R	843,133	30%	94%	331,033	17%	225,180	617,953	0.73%	83%	17%
	E	917,237	36%	82%	534,529	28%	366,590	550,647	0.65%	70%	30%
S4	R	727,904	46%	66%	558,980	40%	327,399	400,505	0.47%	42%	58%
	E	977,698	67%	41%	892,262	65%	531,666	446,032	0.53%	19%	81%

**Scenarios:* *S1 - Contribution rate-14%, NPA_female -55, NPA_male-60;*
S2 - Contribution rate-14%, NPA_female -65, NPA_male-65;
S3 - Contribution rate-19%, NPA_female -55, NPA_male-60 and;
S4 - Contribution rate-19%, NPA_female -65, NPA_male-65

*Salary*** *R – Reported salary*
E – Earned salary

*R/Rate**** *Replacement rate*

It can be seen that the replacement rate is significantly improved in Scenario 4 where the contribution rate is 19% and the national retirement age is 65 for both female and male. However, 41% of all pensioners will still receive the minimum pension and the fund is considerably under-financed due to its "pay as you go" financing structure. The pension fund is accumulated by a notional rate (an average increase of the national salary in last 3 years) and the fund balance is a notional account only. As a result, no investment is made and the fund is financed on a pay-as-you-go basis - i.e., the benefit payouts for pensioners in any given year are financed by the contributions collected from the active members in the same year.

The minimum pension is the second main reason for the fund's financial deficit. The effect is magnified due to the differences between earned and reported salary. The minimum pension is linked to the national average salary which currently is much higher than the average reported salary. As a result, most of the pensioners are expected to receive the minimum pension. For example, in the current design (Scenario 1), it is estimated that approximately 80% of the pensioners will receive the minimum pension in 2015 (Table 4) and it will increase to 97% in 2050 (Table 5). The minimum pension is estimated to contribute 88% of the scheme deficit in 2050 (Scenario 1, Table 5).

Due to design characteristics or flaws of the scheme, the current NDC scheme will result in considerable financial deficit in the future. Changes in the scheme parameters or improvements such as increased NPA and/or increased contribution rates will increase the replacement rate but will worsen the financial deficit. In other words, sustainable financial feasibility will be the main concern. It is concluded that changes in the main parameters in the current NDC scheme will not offer a good pension program – a pension program that is effective (a reasonable replacement rate) and financially feasible (self sustainable).

4.3 Funded Scheme

In the next stage, a scheme where the individual fund is accumulated by real investment return in the accumulation phase and the pension benefits are determined by simple annuity products

is studied. The average real rate of investment return is assumed to be 4% annually both at accumulation and payment phases. The scheme is assumed as fully funded and there is no minimum pension requirement. Different NPA scenarios in different contribution rates are projected. For example, the following table illustrates the summary results of the scheme performances when the contribution rate is 14% and earned salary is taken.

Table 6: Funded Defined Contribution Scheme

Pension contribution – 14%; Earned salary

MNT million, at 2010 price

Year	NPA_female = 55 NPA_male = 60		NPA_female = 60 NPA_male = 60		NPA_female = 65 NPA_male = 65	
	Pension payment	Replacement Rate	Pension payment	Replacement Rate	Pension payment	Replacement Rate
2015	1,155	40%				
2020	19,248	44%	4,115	57%		
2025	67,407	46%	55,617	55%	10,287	127%
2030	129,781	43%	122,401	51%	131,475	108%
2035	209,534	40%	207,829	47%	273,552	94%
2040	315,642	37%	317,122	43%	444,402	84%
2045	459,168	34%	468,088	40%	656,534	78%
2050	637,605	34%	675,878	39%	947,382	71%

Some results of funded defined contribution scheme in different scenarios are given in Appendix 5.

The following table illustrates the Funded Defined Contribution scheme performances in different scenarios in year 2050.

Table 7: Funded Defined Contribution (DC) Scheme Projection in 2050

Scenarios	Salary*	Pension payment (*MNT million, at 2010 price*)	Replacement rate
Contribution rate-14%, NPA_female -55, NPA_male-60	R	395,088	21%
	E	637,605	34%
Contribution rate-14%, NPA_female -60, NPA_male-60	R	417,623	24%
	E	675,878	39%
Contribution rate-14%, NPA_female -65, NPA_male-65	R	591,617	42%
	E	947,382	71%
Contribution rate-19%, NPA_female -55, NPA_male-60	R	530,743	28%
	E	860,874	46%
Contribution rate-19%, NPA_female -60, NPA_male-60	R	562,088	32%
	E	913,742	53%
Contribution rate-19%, NPA_female -65, NPA_male-65	R	790,726	57%
	E	1,272,139	94%

**R – Reported salary, E – Earned salary*

It can be seen from Tables 5 and 7 that the scheme replacement rates improved noticeably in Funded DC scheme compared to that in the current NDC scheme. The main reason is due to the differences in estimated monthly pension benefit payments in the two schemes. In the

current NDC scheme, the monthly pension benefit formula does not incorporate any interest gains while in the Funded DC scheme annuities are expected to be used in determining the pension benefits. There is no fund deficit issue in the Funded DC scheme case.

4.4 Limitations and Improvements

The accuracy of the simulation results is dependent upon the accuracy and completeness of the underlying data and the inputs based on assumptions. We are unable to access to the detailed database of the NDC scheme in Mongolia and therefore the model uses many assumptions, where appropriate.

The model developed in this study could be improved and contribute further to the discussions of the current pension reform debate in Mongolia. For example, the credibility of the simulation results can be improved significantly by using a more detailed data. Sensitivity analyses can also be a useful tool in many ways – e.g., for testing the robustness of the model results and identifying model inputs that cause significant instability in the results etc. In this model, however, sensitivity analyses on macro economic variables are not carried out since the other inputs of the model are based on summary statistics and assumptions. As the underlying data becomes reliable and available, this type of analysis will be inevitable in the future research.

5. Conclusions and Recommendations

In this research, we have developed a model for the NDC in Mongolia and simulated it until 2050 in different policy scenarios by using available data and appropriate assumptions. Our findings are summarised in two folds.

5.1 The Current NDC Scheme

The following issues have been identified when examining the design of the current NDC scheme.

Notional accumulation rate and pay-as-you-go financing: The pension fund is accumulated by a notional rate (an average increase of the national salary in last 3 years) and the fund is financed on the pay-as-you-go basis. This is one of two main reasons that cause a financial deficit for the scheme as illustrated in Table 5.

The minimum pension: The minimum pension is the second main reason for the fund's financial deficit. For example, if the current NDC scheme continues without any changes (Scenario 1 in Table 5), the minimum pension will contribute 88% of the deficit by 2050.

Differences between earned and reported salary: The minimum pension is linked to the national average salary which currently is much higher than the average reported salary. As a result, most of the pensioners are expected to receive the minimum pension. For example, in the current design (Scenario 1), it is estimated that approximately 80% of the pensioners will receive the minimum pension in 2015 (Table 4) and it will increase to 97% in 2050 (Table 5).

Pension benefit calculation: Monthly pension benefit formula does not incorporate any interest accumulation so that it could damage the attractiveness of the scheme.

Large deficit of the scheme: Due to design characteristics or flaws of the scheme, the current NDC scheme will result in considerable financial deficit. Changes in the scheme parameters or improvements such as increased NPA and increased contribution rates will increase the replacement rate but will worsen the financial deficit. In other words, sustainable financial feasibility will be the main concern.

Changes of the main parameters in the current NDC scheme will not offer a good pension program – a pension program that is effective (a reasonable replacement rate) and financially feasible (self sustainable).

5.2 Recommendations

We conclude that the current NDC scheme needs to be developed into a Funded DC scheme to offer effective and financially sustainable pension benefits. We suggest the following actions to the decision makers as a start of the transformation process.

- Materialisation of the NDC fund - The notional balance of the NDC fund needs to be financed or "monetarized" for investment purposes.
- Investment of the fund assets - The fund assets need to be invested and the fund is accumulated by actual investment returns. Investment strategies and policies need to be carefully defined and managed by professional investment managers. At the beginning stage, more passive and secure investment approaches such as Government bonds and bank saving accounts may need to be adopted.
- No minimum pension - Any social welfare elements such as the minimum pension need to be removed from the old age pension scheme. The inequality issues can be tackled separately.
- Contribution rate - The minimum contribution rate could be set at 14% and additional contributions may be allowed at member's discretion.
- National pension age - The national pension age could be re-set at 60 years for both males and females.
- Pension payment - Annuities need to be introduced in providing pension benefits. The development of annuity markets as well as long term saving vehicles could play a crucial part in the development of effective social security system in Mongolia.

6. List of Abbreviations

NDC	Notional Defined Contribution
NPA	National Pension Age
NSO	National Statistical Office of Mongolia
SSIGO	State Social Insurance General Office
UN	United Nations

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Appendix 1: Mongolian Population Prospect, Female

World Population Prospects: The 2010 Revision

Female population by five-year age group, Mongolia, 2010-2100 (thousands)

Medium-fertility variant, 2011-2100

POP/DB/WPP/Rev.2010/04/F03B

United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

Reference date	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100+
2010	137.3	158.3	128.6	115.5	106.1	93.1	85.2	61.4	41.2	27.2	22.9	17.3	12.9	7.2	3.2	1.2	0.2	0.0
2015	118.2	135.1	156.0	126.7	113.8	104.3	91.0	82.6	58.7	38.7	24.8	19.7	13.6	8.8	3.9	1.2	0.3	0.0
2020	108.7	116.0	132.9	154.1	125.1	112.2	102.3	88.5	79.4	55.5	35.5	21.5	15.7	9.4	4.8	1.5	0.3	0.0
2025	144.2	106.6	113.9	131.1	152.4	123.5	110.3	99.8	85.5	75.5	51.4	31.2	17.5	11.1	5.3	1.9	0.4	0.0
2030	152.4	142.0	104.5	112.2	129.6	150.8	121.6	107.9	96.7	81.7	70.4	45.7	25.7	12.6	6.4	2.2	0.5	0.0
2035	151.6	150.2	139.9	102.9	110.9	128.2	148.7	119.2	104.8	92.9	76.6	63.2	38.1	18.9	7.5	2.7	0.6	0.1
2040	142.3	149.4	148.1	138.2	101.7	109.7	126.5	146.1	116.2	101.0	87.5	69.3	53.3	28.5	11.5	3.3	0.8	0.1
2045	132.8	140.2	147.3	146.5	136.9	100.5	108.3	124.4	142.7	112.3	95.7	79.8	59.1	40.5	17.8	5.3	1.0	0.1
2050	134.3	130.7	138.1	145.7	145.1	135.6	99.3	106.6	121.8	138.3	106.8	87.7	68.7	45.6	25.8	8.4	1.6	0.2
2055	144.6	132.4	128.9	136.7	144.5	143.9	134.2	97.9	104.5	118.3	132.0	98.5	76.2	53.7	29.7	12.6	2.7	0.3
2060	151.9	142.9	130.8	127.5	135.6	143.4	142.6	132.5	96.0	101.7	113.3	122.4	86.3	60.3	35.6	14.9	4.2	0.5
2065	150.8	150.4	141.5	129.6	126.6	134.6	142.2	140.9	130.2	93.7	97.7	105.5	108.0	69.0	40.7	18.3	5.1	0.8
2070	145.0	149.4	149.1	140.4	128.8	125.8	133.6	140.6	138.7	127.3	90.2	91.4	93.7	87.3	47.3	21.4	6.5	1.1
2075	141.1	143.9	148.3	148.2	139.7	128.0	124.9	132.2	138.6	135.8	122.9	84.7	81.6	76.5	60.7	25.5	7.8	1.4
2080	142.8	140.2	143.0	147.6	147.5	139.0	127.2	123.7	130.4	135.8	131.4	115.8	76.1	67.3	54.0	33.4	9.6	1.8
2085	148.0	142.1	139.5	142.4	147.0	146.9	138.2	126.1	122.2	128.0	131.7	124.2	104.7	63.3	48.2	30.4	13.1	2.3
2090	151.8	147.5	141.6	139.1	141.9	146.5	146.1	137.1	124.6	120.1	124.4	125.0	112.8	87.7	45.9	27.6	12.2	3.3
2095	151.7	151.5	147.2	141.3	138.8	141.5	145.8	145.1	135.6	122.6	116.9	118.4	114.1	95.3	64.4	26.8	11.4	3.4
2100	149.4	151.6	151.3	147.0	141.1	138.4	140.9	144.9	143.7	133.6	119.6	111.5	108.6	97.1	70.9	38.4	11.4	3.4

Female Population Prospect, born after 01 January 1960

thousands

Reference date	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100+
2010	137.3	158.3	128.6	115.5	106.1	93.1	85.2	6.1	-	-	-	-	-	-	-	-	-	-
2015	118.2	135.1	156.0	126.7	113.8	104.3	91.0	82.6	5.9	-	-	-	-	-	-	-	-	-
2020	108.7	116.0	132.9	154.1	125.1	112.2	102.3	88.5	79.4	5.5	-	-	-	-	-	-	-	-
2025	144.2	106.6	113.9	131.1	152.4	123.5	110.3	99.8	85.5	75.5	5.1	-	-	-	-	-	-	-
2030	152.4	142.0	104.5	112.2	129.6	150.8	121.6	107.9	96.7	81.7	70.4	4.6	-	-	-	-	-	-
2035	151.6	150.2	139.9	102.9	110.9	128.2	148.7	119.2	104.8	92.9	76.6	63.2	3.8	-	-	-	-	-
2040	142.3	149.4	148.1	138.2	101.7	109.7	126.5	146.1	116.2	101.0	87.5	69.3	53.3	2.8	-	-	-	-
2045	132.8	140.2	147.3	146.5	136.9	100.5	108.3	124.4	142.7	112.3	95.7	79.8	59.1	40.5	1.8	-	-	-
2050	134.3	130.7	138.1	145.7	145.1	135.6	99.3	106.6	121.8	138.3	106.8	87.7	68.7	45.6	25.8	0.8	-	-
2055	144.6	132.4	128.9	136.7	144.5	143.9	134.2	97.9	104.5	118.3	132.0	98.5	76.2	53.7	29.7	12.6	0.3	-
2060	151.9	142.9	130.8	127.5	135.6	143.4	142.6	132.5	96.0	101.7	113.3	122.4	86.3	60.3	35.6	14.9	4.2	0.0
2065	150.8	150.4	141.5	129.6	126.6	134.6	142.2	140.9	130.2	93.7	97.7	105.5	108.0	69.0	40.7	18.3	5.1	0.8
2070	145.0	149.4	149.1	140.4	128.8	125.8	133.6	140.6	138.7	127.3	90.2	91.4	93.7	87.3	47.3	21.4	6.5	1.1
2075	141.1	143.9	148.3	148.2	139.7	128.0	124.9	132.2	138.6	135.8	122.9	84.7	81.6	76.5	60.7	25.5	7.8	1.4
2080	142.8	140.2	143.0	147.6	147.5	139.0	127.2	123.7	130.4	135.8	131.4	115.8	76.1	67.3	54.0	33.4	9.6	1.8
2085	148.0	142.1	139.5	142.4	147.0	146.9	138.2	126.1	122.2	128.0	131.7	124.2	104.7	63.3	48.2	30.4	13.1	2.3
2090	151.8	147.5	141.6	139.1	141.9	146.5	146.1	137.1	124.6	120.1	124.4	125.0	112.8	87.7	45.9	27.6	12.2	3.3
2095	151.7	151.5	147.2	141.3	138.8	141.5	145.8	145.1	135.6	122.6	116.9	118.4	114.1	95.3	64.4	26.8	11.4	3.4
2100	149.4	151.6	151.3	147.0	141.1	138.4	140.9	144.9	143.7	133.6	119.6	111.5	108.6	97.1	70.9	38.4	11.4	3.4

Appendix 2: Mongolian Population Prospect, Male

World Population Prospects: The 2010 Revision

Male population by five-year age group, Mongolia, 2010-2100 (thousands)

Medium-fertility variant, 2011-2100

POP/DB/WPP/Rev.2010/04/F02B

United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

Reference date (	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100+
2010	140.1	159.7	131.3	114.2	103.6	88.6	78.8	53.5	36.2	22.9	19.1	13.7	8.5	4.0	1.6	0.4	0.1	0.0
2015	120.8	138.4	157.3	128.8	111.5	100.2	84.4	73.5	48.9	32.3	19.4	15.0	9.6	5.0	1.9	0.5	0.1	0.0
2020	111.4	119.3	136.4	154.8	126.2	108.4	96.0	79.3	67.7	43.8	27.5	15.3	10.6	5.8	2.4	0.6	0.1	0.0
2025	147.8	110.0	117.6	134.3	152.1	123.1	104.3	90.7	73.4	61.1	37.7	22.0	11.0	6.4	2.7	0.8	0.1	0.0
2030	156.3	146.3	108.5	115.9	132.2	148.9	119.1	99.1	84.6	66.7	53.0	30.4	15.9	6.7	3.1	0.9	0.2	0.0
2035	155.5	154.8	144.6	107.0	114.2	129.8	144.6	113.8	93.0	77.3	58.3	43.1	22.2	9.8	3.2	1.0	0.2	0.0
2040	146.2	154.1	153.2	143.0	105.6	112.3	126.5	138.9	107.4	85.6	68.1	47.9	31.9	14.0	4.8	1.1	0.2	0.0
2045	136.7	144.8	152.6	151.7	141.5	104.1	109.8	122.0	131.7	99.3	75.9	56.5	35.8	20.3	6.9	1.6	0.2	0.0
2050	138.5	135.4	143.5	151.2	150.3	139.7	101.9	106.2	116.1	122.6	88.8	63.6	42.9	23.2	10.2	2.4	0.3	0.0
2055	149.3	137.4	134.2	142.3	149.9	148.6	137.2	98.9	101.5	108.6	110.4	75.1	48.9	28.2	11.9	3.6	0.5	0.0
2060	156.9	148.3	136.3	133.2	141.2	148.4	146.2	133.6	94.9	95.4	98.4	94.2	58.4	32.7	14.8	4.3	0.8	0.1
2065	155.8	156.0	147.3	135.4	132.3	139.9	146.3	142.7	128.6	89.5	87.0	84.7	74.1	39.7	17.5	5.5	1.0	0.1
2070	149.8	154.9	155.1	146.4	134.5	131.2	138.0	143.0	137.7	121.8	82.1	75.5	67.5	51.3	21.7	6.7	1.3	0.1
2075	145.9	149.1	154.2	154.3	145.6	133.5	129.6	135.2	138.4	130.9	112.2	71.8	60.8	47.4	28.6	8.6	1.6	0.2
2080	147.6	145.3	148.4	153.5	153.6	144.7	132.0	127.1	131.1	132.0	121.2	98.8	58.3	43.2	26.9	11.5	2.1	0.2
2085	152.8	147.1	144.7	147.9	152.9	152.7	143.2	129.7	123.5	125.4	122.8	107.5	81.2	42.1	25.1	11.2	2.9	0.3
2090	156.7	152.4	146.6	144.3	147.3	152.0	151.2	140.8	126.3	118.5	117.2	109.5	89.1	59.4	25.0	10.7	2.9	0.4
2095	156.5	156.4	152.1	146.2	143.8	146.6	150.7	148.9	137.4	121.5	111.1	105.2	91.6	66.1	35.9	10.9	2.9	0.4
2100	154.1	156.3	156.1	151.8	145.9	143.2	145.5	148.6	145.5	132.4	114.3	100.3	88.7	68.8	40.6	16.1	3.1	0.5

Estimated Male Population Prospect, born after 01 January 1960

thous

Reference date (	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99	100+
2010	140.1	159.7	131.3	114.2	103.6	88.6	78.8	5.3	-	-	-	-	-	-	-	-	-	-
2015	120.8	138.4	157.3	128.8	111.5	100.2	84.4	73.5	4.9	-	-	-	-	-	-	-	-	-
2020	111.4	119.3	136.4	154.8	126.2	108.4	96.0	79.3	67.7	4.4	-	-	-	-	-	-	-	-
2025	147.8	110.0	117.6	134.3	152.1	123.1	104.3	90.7	73.4	61.1	3.8	-	-	-	-	-	-	-
2030	156.3	146.3	108.5	115.9	132.2	148.9	119.1	99.1	84.6	66.7	53.0	3.0	-	-	-	-	-	-
2035	155.5	154.8	144.6	107.0	114.2	129.8	144.6	113.8	93.0	77.3	58.3	43.1	2.2	-	-	-	-	-
2040	146.2	154.1	153.2	143.0	105.6	112.3	126.5	138.9	107.4	85.6	68.1	47.9	31.9	1.4	-	-	-	-
2045	136.7	144.8	152.6	151.7	141.5	104.1	109.8	122.0	131.7	99.3	75.9	56.5	35.8	20.3	0.7	-	-	-
2050	138.5	135.4	143.5	151.2	150.3	139.7	101.9	106.2	116.1	122.6	88.8	63.6	42.9	23.2	10.2	0.2	-	-
2055	149.3	137.4	134.2	142.3	149.9	148.6	137.2	98.9	101.5	108.6	110.4	75.1	48.9	28.2	11.9	3.6	0.1	-
2060	156.9	148.3	136.3	133.2	141.2	148.4	146.2	133.6	94.9	95.4	98.4	94.2	58.4	32.7	14.8	4.3	0.8	0.0
2065	155.8	156.0	147.3	135.4	132.3	139.9	146.3	142.7	128.6	89.5	87.0	84.7	74.1	39.7	17.5	5.5	1.0	0.1
2070	149.8	154.9	155.1	146.4	134.5	131.2	138.0	143.0	137.7	121.8	82.1	75.5	67.5	51.3	21.7	6.7	1.3	0.1
2075	145.9	149.1	154.2	154.3	145.6	133.5	129.6	135.2	138.4	130.9	112.2	71.8	60.8	47.4	28.6	8.6	1.6	0.2
2080	147.6	145.3	148.4	153.5	153.6	144.7	132.0	127.1	131.1	132.0	121.2	98.8	58.3	43.2	26.9	11.5	2.1	0.2
2085	152.8	147.1	144.7	147.9	152.9	152.7	143.2	129.7	123.5	125.4	122.8	107.5	81.2	42.1	25.1	11.2	2.9	0.3
2090	156.7	152.4	146.6	144.3	147.3	152.0	151.2	140.8	126.3	118.5	117.2	109.5	89.1	59.4	25.0	10.7	2.9	0.4
2095	156.5	156.4	152.1	146.2	143.8	146.6	150.7	148.9	137.4	121.5	111.1	105.2	91.6	66.1	35.9	10.9	2.9	0.4
2100	154.1	156.3	156.1	151.8	145.9	143.2	145.5	148.6	145.5	132.4	114.3	100.3	88.7	68.8	40.6	16.1	3.1	0.5

Appendix 3: The NDC Fund Deficiency_Case 1

Pension Contribution = 14%

NPA_female = 55, NPA_male = 60

Reported salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Financing effect
2015	839	29%	80%	533	19%	410	429	0.00%	71%	29%
2020	14,410	30%	84%	8,525	19%	6,017	8,393	0.06%	70%	30%
2025	51,054	31%	84%	29,496	19%	19,608	31,446	0.16%	69%	31%
2030	108,658	30%	89%	55,307	18%	35,975	72,683	0.27%	73%	27%
2035	197,550	29%	92%	87,011	16%	56,336	141,214	0.40%	78%	22%
2040	334,716	29%	95%	127,705	14%	83,305	251,411	0.53%	82%	18%
2045	542,602	28%	96%	181,398	13%	120,241	422,362	0.67%	86%	14%
2050	826,661	28%	97%	247,181	13%	166,947	659,715	0.78%	88%	12%

NPA_female = 55, NPA_male = 60

Earned salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Financing effect
2015	906	32%	70%	665	23%	523	383	0.00%	63%	37%
2020	15,865	34%	71%	11,462	26%	8,318	7,548	0.05%	58%	42%
2025	57,605	36%	70%	41,980	29%	28,865	28,739	0.15%	54%	46%
2030	120,812	35%	75%	81,782	27%	54,907	65,905	0.25%	59%	41%
2035	215,250	34%	81%	132,518	25%	88,127	127,123	0.36%	65%	35%
2040	357,875	33%	85%	199,025	23%	132,637	225,238	0.48%	71%	29%
2045	571,621	32%	88%	287,855	21%	193,798	377,824	0.60%	75%	25%
2050	862,145	31%	90%	397,219	21%	271,204	590,941	0.70%	79%	21%

NPA_female = 65, NPA_male = 65

Reported salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Financing effect
2015										
2020										
2025	5,180	64%	27%	4,962	61%	2,907	2,274	0.01%	10%	90%
2030	68,389	55%	39%	62,925	51%	35,322	33,067	0.12%	17%	83%
2035	150,232	49%	52%	129,528	43%	71,434	78,798	0.22%	26%	74%
2040	261,393	44%	63%	206,624	38%	114,198	147,195	0.31%	37%	63%
2045	417,254	42%	72%	298,752	34%	167,794	249,460	0.39%	48%	52%
2050	651,724	39%	79%	422,439	30%	243,138	408,585	0.48%	56%	44%

NPA_female = 65, NPA_male = 65

Earned salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Financing effect
2015										
2020										
2025	7,241	89%	13%	7,153	88%	4,349	2,892	0.01%	3%	97%
2030	95,039	78%	20%	92,671	77%	54,160	40,879	0.15%	6%	94%
2035	204,289	69%	29%	194,499	67%	111,718	92,570	0.26%	11%	89%
2040	344,517	62%	39%	316,388	59%	181,268	163,249	0.34%	17%	83%
2045	531,125	57%	49%	465,692	54%	269,399	261,726	0.41%	25%	75%
2050	801,100	52%	56%	667,059	48%	394,146	406,954	0.48%	33%	67%

*R/Rate - Replacement rate defined as a percentage of pension benefit in pre-retirement salary for an average new retiree in the year

Appendix 4: The NDC Fund Deficiency_Case 2

Pension Contribution = 19%

NPA_female = 55, NPA_male = 60

Reported salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Investment effect
2015	879	31%	75%	607	21%	473	406	0.00%	67%	33%
2020	15,170	32%	77%	10,172	23%	7,303	7,867	0.05%	64%	36%
2025	54,450	33%	76%	36,485	25%	24,771	29,680	0.15%	61%	39%
2030	114,803	33%	81%	70,118	23%	46,548	68,255	0.26%	65%	35%
2035	206,222	32%	86%	112,396	21%	74,126	132,096	0.37%	71%	29%
2040	345,779	31%	89%	167,520	19%	110,898	234,880	0.50%	76%	24%
2045	556,219	30%	92%	240,824	17%	161,345	394,874	0.62%	80%	20%
2050	843,133	30%	94%	331,033	17%	225,180	617,953	0.73%	83%	17%

NPA_female = 55, NPA_male = 60

Earned salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Investment effect
2015	983	34%	61%	789	28%	624	359	0.00%	54%	46%
2020	17,577	39%	61%	14,165	33%	10,432	7,146	0.05%	48%	52%
2025	65,293	42%	59%	53,431	37%	37,347	27,947	0.14%	42%	58%
2030	135,868	42%	64%	105,982	36%	72,235	63,633	0.24%	47%	53%
2035	238,471	40%	70%	173,980	34%	117,282	121,189	0.34%	53%	47%
2040	390,365	38%	75%	264,121	31%	177,937	212,428	0.45%	59%	41%
2045	614,764	36%	79%	385,140	29%	261,221	353,543	0.56%	65%	35%
2050	917,237	36%	82%	534,529	28%	366,590	550,647	0.65%	70%	30%

NPA_female = 65, NPA_male = 65

Reported salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Investment effect
2015										
2020										
2025	6,312	77%	18%	6,182	76%	3,726	2,586	0.01%	5%	95%
2030	82,914	68%	27%	79,534	65%	45,876	37,038	0.14%	9%	91%
2035	179,429	60%	38%	165,951	57%	93,986	85,443	0.24%	16%	84%
2040	305,415	54%	49%	267,994	50%	151,624	153,791	0.32%	24%	76%
2045	476,832	50%	58%	392,381	45%	224,568	252,264	0.40%	33%	67%
2050	727,904	46%	66%	558,980	40%	327,399	400,505	0.47%	42%	58%

NPA_female = 65, NPA_male = 65

Earned salary

Year	Total benefit payouts (with minimum pension)	R/Rate*	Minimum pension receivers	Total benefit payouts (without minimum pension)	R/Rate*	Contributors fund_no investment	Fund deficiency			
							Amount	% of GDP	Min.pension effect	Investment effect
2015										
2020										
2025	9,186	113%	7%	9,144	112%	5,680	3,506	0.02%	1%	99%
2030	121,069	100%	11%	119,870	100%	71,484	49,585	0.19%	2%	98%
2035	259,112	89%	18%	253,818	88%	148,670	110,441	0.31%	5%	95%
2040	433,118	81%	26%	416,908	79%	242,705	190,413	0.40%	9%	91%
2045	658,259	74%	34%	618,364	72%	362,664	295,594	0.47%	13%	87%
2050	977,698	67%	41%	892,262	65%	531,666	446,032	0.53%	19%	81%

*R/Rate - Replacement rate defined as a percentage of pension benefit in pre-retirement salary for an average new retiree in the year

Appendix 5: Fund Finance_Funded Defined Contribution Scheme

Pension Contribution = 14%

Reported salary

Year	NPA_female = 55, NPA_male = 60		NPA_female = 60, NPA_male = 60		NPA_female = 65, NPA_male = 65	
	Pension payment	R/Rate*	Pension payment	R/Rate*	Pension payment	R/Rate*
2015	916	32%				
2020	14,171	31%	2,917	40%		
2025	46,732	30%	37,807	36%	7,021	86%
2030	86,716	28%	80,704	32%	87,702	71%
2035	136,153	25%	133,760	29%	179,100	60%
2040	200,760	23%	200,463	26%	285,421	52%
2045	287,499	21%	291,936	24%	414,990	47%
2050	395,088	21%	417,623	24%	591,617	42%

Earned salary

Year	NPA_female = 55, NPA_male = 60		NPA_female = 60, NPA_male = 60		NPA_female = 65, NPA_male = 65	
	Pension payment	R/Rate*	Pension payment	R/Rate*	Pension payment	R/Rate*
2015	1,155	40%				
2020	19,248	44%	4,115	57%		
2025	67,407	46%	55,617	55%	10,287	127%
2030	129,781	43%	122,401	51%	131,475	108%
2035	209,534	40%	207,829	47%	273,552	94%
2040	315,642	37%	317,122	43%	444,402	84%
2045	459,168	34%	468,088	40%	656,534	78%
2050	637,605	34%	675,878	39%	947,382	71%

Pension Contribution = 19%

Reported salary

Year	NPA_female = 55, NPA_male = 60		NPA_female = 60, NPA_male = 60		NPA_female = 65, NPA_male = 65	
	Pension payment	R/Rate*	Pension payment	R/Rate*	Pension payment	R/Rate*
2015	1,049	37%				
2020	17,017	38%	3,589	49%		
2025	58,264	39%	47,751	47%	8,839	108%
2030	110,734	36%	103,955	43%	111,995	91%
2035	177,111	33%	175,071	39%	231,748	78%
2040	265,010	31%	265,756	36%	374,063	70%
2045	383,543	28%	390,517	33%	549,461	64%
2050	530,743	28%	562,088	32%	790,726	57%

Earned salary

Year	NPA_female = 55, NPA_male = 60		NPA_female = 60, NPA_male = 60		NPA_female = 65, NPA_male = 65	
	Pension payment	R/Rate*	Pension payment	R/Rate*	Pension payment	R/Rate*
2015	1,372	48%				
2020	23,930	56%	5,204	72%		
2025	86,347	60%	71,935	72%	13,330	164%
2030	169,272	58%	160,626	68%	171,174	141%
2035	276,758	54%	275,593	63%	359,874	124%
2040	420,988	50%	424,225	58%	588,938	112%
2045	617,072	46%	630,114	54%	875,751	104%
2050	860,874	46%	913,742	53%	1,272,139	94%

*R/Rate - Replacement rate defined as a percentage of pension benefit in pre-retirement salary for an average new retiree in the year