ILO/TF/Ghana/R.17

Ghana

Report to the Government

Peer review of the fifth triennial actuarial valuation of the Social Security and National Insurance Trust as at 31 December 2005

International Financial and Actuarial Service
Social Security Department
International Labour Office, Geneva
January 2008

Copyright © International Labour Organization 2008
First published 2008

Publications of the International Labour Office enjoy copyright under Protocol 2 of the Universal Copyright Convention. Nevertheless, short excerpts from them may be reproduced without authorization, on condition that the source is indicated. For rights of reproduction or translation, application should be made to ILO Publications (Rights and Permissions), International Labour Office, CH-1211 Geneva 22, Switzerland, or by email: pubdroit@ilo.org. The International Labour Office welcomes such applications.

Libraries, institutions and other users registered with reproduction rights organizations may make copies in accordance with the licences issued to them for this purpose. Visit www.ifrro.org to find the reproduction rights organization in your country.

Ghana. Report to the Government. Peer review of the fifth triennial actuarial valuation of the Social Security and National Insurance Trust as at 31 December 2005 /
International Labour Office, Social Security Department – Geneva: ILO, 2008
x, 33 p.

ISBN: 978-92-2-121196-9 (print) & 978-92-2-121197-6 (web pdf)

International Labour Office; Social Security Dept

Social security / actuarial valuation / Ghana

02.03.1

ILO Cataloguing in Publication Data

The designations employed in ILO publications, which are in conformity with United Nations practice, and the presentation of material therein do not imply the expression of any opinion whatsoever on the part of the International Labour Office concerning the legal status of any country, area or territory or of its authorities, or concerning the delimitation of its frontiers.

The responsibility for opinions expressed in signed articles, studies and other contributions rests solely with their authors, and publication does not constitute an endorsement by the International Labour Office of the opinions expressed in them.

Reference to names of firms and commercial products and processes does not imply their endorsement by the International Labour Office, and any failure to mention a particular firm, commercial product or process is not a sign of disapproval.

ILO publications and electronic products can be obtained through major booksellers or ILO local offices in many countries, or direct from ILO Publications, International Labour Office, CH-1211 Geneva 22, Switzerland. Catalogues or lists of new publications are available free of charge from the above address, or by email: pubvente@ilo.org

Visit our website: www.ilo.org/publns

Printed in Switzerland

Contents

Foreword

This report has been prepared as an output of the trust-in-fund actuarial project between the Social Security and National Insurance Trust of Ghana (SSNIT) and the International Labour Office (ILO) to peer review the internal actuarial review of the Social Security and National Insurance Trust of Ghana (GHA/07/01/GHA).

With the passing of the Social Security Law in 1991, the provident fund administered by the SSNIT was converted into a National Pension Scheme open to all workers and providing partial replacement income as a result of old age, invalidity or loss of life (survivors). The ILO's Social Security Department has been collaborating closely with the Actuarial Services of the SSNIT for several years, providing technical support, guidance and training. An actuarial valuation has been undertaken by the internal services of the SSNIT in 2007, and there is a legal requirement that an external and independent body should formally review and audit the valuation. The assistance of ILO's Financial and Actuarial Service has been requested in this connection.

The objective is to support the financial governance of the social security system of Ghana by way of auditing the internal actuarial review of the SSNIT.

Acknowledgements

The Director General of the ILO entrusted the International Financial and Actuarial Service (ILO/FACTS) of the Social Security Department (SEC/SOC) to complete this mandate. W.R. McGillivray, FSA, undertook this peer review. He went on mission to Ghana from 5-10 August 2007. He worked under the supervision of Ms. Anne Drouin, Coordinator ILO/FACTS. Mr. Florian Léger, ILO/FACTS Actuary, provided support.

The Director-General of the ILO would like to express his appreciation to Mr. Kwasi Osei, Director General of the Social Security and National Insurance Trust (SSNIT), to Mr. Ben Assumang, Head of SSNIT's Actuarial Department and to all the staff of the Actuarial Department.

Executive summary

1. Introduction

This peer review of *The Fifth Triennial Actuarial Valuation of the Social Security and National Insurance Trust* of Ghana (2005 AR) was undertaken by the International Financial and Actuarial Service of the Social Security Department, International Labour Office at the request of the Executive Management of the Social Security and National Insurance Trust (SSNIT).

The peer review contains observations on the following matters:

- Is the professional experience of the Actuarial Department who worked on the 2005 AR adequate for carrying out the work required?
- Has the work been completed in compliance with the relevant statutory requirements and professional standards of practice?
- Did the Actuarial Department have access to the information required to perform the valuation, and were relevant tests and analysis on the data completed as might be expected?
- Were the actuarial methods and assumptions used in preparing the 2005 AR reasonable?
- Does the 2005 AR fairly communicate the results of the work performed?

The peer review contains recommendations with respect to future actuarial reports on the SSNIT prepared by the Actuarial Department of the SSNIT.

The peer review is based on the 2005 AR dated 24 September 2007. The 2005 AR was prepared as of 31 December 2005, and projections in the Report cover the period 2005 to 2055. The results of an actuarial valuation are estimates, not predictions. They present the outcomes if all of the assumptions were to come true in the future. The parameters involved cannot be predicted with confidence over a long projection period, and presenting results to two decimal points can give a false impression of precision. The estimates provide guidance for financing the SSNIT scheme and for planning and management tasks. The 2005 AR states: "It is concluded from the study that the financial position of SSNIT is sound for the next 45 years, up to 2049 when the end of year [reserve] fund turns negative."

2. Statutory requirements and professional experience

There is no requirement for periodic actuarial reviews in the legislation establishing the SSNIT, nor is the system which is to be applied to finance benefits and administration expenses set out in the legislation. It is not clear to whom the Actuarial Department of the SSNIT submits its triennial actuarial reviews – to the management or to the Board of the SSNIT. In order to maintain the professional independence of members of the Department, the actuarial reviews should be submitted to the Board.

The peer review was undertaken taking into account the International Actuarial Association *Guidelines of Actuarial Practice for Social Security Programs*, and the Social

Security Department of the ILO *Internal guidelines for the actuarial analysis of a national social security pension scheme*.

The Actuarial Department of the SSNIT is staffed by persons with actuarial training. They have applied the ILO projection programme to conduct the actuarial valuation.

It would be useful for the SSNIT Actuarial Department and the Financial, Actuarial and Statistical Branch of the ILO Social Security Department to agree on the basic assumptions before a valuation is undertaken. The final actuarial report would then be peer reviewed.

3. Data

The actuarial valuation had access to SSNIT data in monthly Operations Reports (OR) and reports produced by the Information Technology (IT) unit. These reports show quite different data, and the differences cannot be entirely explained by the different origins and uses of the reports. Inevitably there will be discrepancies, however it is not possible to reconcile the data from these two sources. The plea in the 2005 AR that "The Scheme has been in existence for more than ten years, and it is imperative that efforts are made to improve the quality of the data on members" should be heeded.

One cannot have confidence in an actuarial valuation which is based on unreliable or incomplete data on the insured persons and pensioners of a scheme. Data for the triennial actuarial valuations is equally as important as financial data for annual reports, and the same attention and effort devoted to producing data for annual reports should be made to produce data for actuarial valuations. Attaching an actuary to the IT unit could lead to better statistical data.

Tables showing extracts of all the items of data on the current status of the scheme and on which the assumptions are based should appear in annexes to the actuarial report. Summaries of SSNIT Annual Financial Statements for the period covered by the valuation should be annexed to the 2005 AR.

Since 1 January 2004, the SSNIT has been the agent for collection of contributions to the National Health Insurance Scheme (NHIS). Of the 17.5 per cent of insured earnings collected by the SSNIT, 2.5 per cent of insured earnings are transferred to the National Health Insurance Fund. Since the SSNIT is solely the contribution collection agent for the NHIS, health insurance benefits are not SSNIT benefits. The 2005 AR includes the NHIS contributions as income and treats them as benefit expenditures which complicates analysis of the financing of benefits provided by the SSNIT.

4. Methodology

The 2005 AR applied an ILO projection model of the SSNIT scheme which projects the annual number of insured persons and beneficiaries, the annual contribution and investment income and benefit and administration outgo, and the reserve fund at the end of each year. The model projects expected experience in future years based on demographic and economic assumptions. The 50 year projection period (2005 to 2055) is appropriate for a scheme such as the SSNIT which has been operating in a volatile economic environment.

5. Assumptions

The model requires input assumptions about future economic and demographic experience and future costs of operation of the SSNIT. The principal assumptions are noted in table 1.

The 2005 AR is silent on assumptions regarding the age distribution of new entrants, inactive insured persons, retirement rates, salary scales and the accrual of benefit rights.

It is not clear that the assumed **fertility** and **mortality rates** are consistent with the **growth of the insured population** (and the growth of the population of Ghana).

The SSNIT transfers to the NHIS 2.5 percentage points of contribution income. Since this portion of contribution income is not available to the SSNIT to offset expenses incurred by the SSNIT, it should be excluded from the calculation of **administration expense ratios**. This results in a 17 per cent increase in the expense ratios which are calculated on the entire contribution income. While the cost of collecting the NHIS contributions and remitting them to the NHIS should be minimal, it could be recovered from the NHIS by the SSNIT.

The **acquisition of fixed assets** is assumed to be 4.7 per cent of contribution income throughout the entire projection period. It is unlikely that the same level of acquisition of fixed assets will be required throughout the projection period. In a scheme such as the SSNIT which has a relatively small number of insured persons, the plant and equipment required to operate the scheme is sufficient to operate a scheme with a much larger number of insured persons.

For the actuarial valuation, administration and acquisition of fixed assets expenses can be combined. They can be regarded as a fixed cost plus a variable cost which depends on the number of insured persons and beneficiaries. This would result in total expenses in respect of the administration of the scheme being 26.7 per cent of contribution income in 2006, decreasing to 17.2 per cent of contribution income from 2025 on.

Presumably, in the Annual Accounts investment income is stated net of transaction costs, and the staff, management and other costs of dealing with investments are included in the scheme's administration expenses. The cost of investment and other operations of the scheme could be separated, and investment expenses could be deducted from (gross) investment income to give net investment income, thereby reducing (and better reflecting) the cost of administering the scheme.

Table 1. Principal assumptions

Parameter (annual rates)	In 2006	Later year
Total fertility rates	3.63/m	2.10/m from 2030 on
Mortality rates	gradually improving mortality	-
Net migration rates	-2 %	-1 % from 2026 on
Insured population growth	3.1 % annually until 2015	decreasing to 1.2 % ann. over 2045-55
Unemployment rates	12.3 % throughout	-
Administration expenses	22.0 %	12.5 % from 2025 on
Acquisition of fixed assets	4.7 % throughout	-
Real interest rate	2 % throughout	-
Price inflation	10–11 % until 2020	decreasing to 5 % in 2055
Real GDP growth rates	5.8 % rising to 6.3 % in 2009	decreasing to 4.23 % in 2055
Real wage growth rates	2.5-3.3 % throughout	-
Density of contributions	10.3 months/year throughout	-
Contributions compliance	90 % are paid throughout	-

It is assumed that real **GDP growth** increases to 6.3 per cent in 2009 and decreases gradually to the 2005 level in 2021 and thereafter to 4.2 per cent in 2055. The real GDP growth rate does not fall to the 2000 to 2005 average (4.9 per cent) until 2039. While there has been an upward trend in real GDP growth, it is optimistic to assume that this will continue unbroken, and that annual real GDP growth will consistently remain at relatively high levels until 2055.

Real wage growth is equal to productivity growth which is derived from GDP and employment growth. As a result of the real GDP growth assumption, throughout the entire projection period, the assumed rate of real wage growth exceeds the assumed real rate of return on investments. Normally, aside from exceptional years or even several years in a row, over a long period the real rate of increase in wages would be assumed to be lower than the real rate of return on investments. The GDP growth assumption has significant implications for the actuarial projections.

Actuaries need to measure the capacity of assets to generate income on a long-term basis. The traditional actuarial formulas for measuring rates of return and the system used by the SSNIT Finance Department should both be taken into account. Over long periods, both approaches should result in more or less equivalent rates of return.

The **contributions compliance** assumption results in the 15 per cent of insured earnings contribution in respect of SSNIT benefits being reduced to an effective contribution rate of 13.5 per cent. The basis of this compliance assumption is not stated in the 2005 AR. Clearly, improving compliance would have a significant effect on the contribution income of the SSNIT.

6. Analysis of results

Analysis of the results of the actuarial valuation of the SSNIT scheme is distorted since in the 2005 AR NHIS contributions are included in contribution income and their transfer is treated as an expense of the scheme.

On the basis of the current 17.5 per cent contribution rate, the **cash flow projections** show that expenditures on benefits (including NHIS transfers) and on administration will exceed contribution and investment income after 2040, and the reserve will be negative by 2050.

Under the **pay-as-you-go (PAYG)** financial system, each year benefit and administration expenditures are paid from the contribution income of the scheme in the year. The PAYG contribution rate (excluding NHIS transfers) rises from 11.2 per cent in 2006 to 15.7 per cent in 2055. This should be compared to the effective contribution rate for SSNIT benefits, 13.5 per cent of insured earnings. The effective contribution rate will be lower than the PAYG rate from 2037 on.

The financial system for SSNIT benefits is not defined in the legislation. It would be desirable if the legislation set out the partially funded financial system the SSNIT is to follow. The 2005 AR states that the SSNIT applies the **scaled premium financial system**. Under this system, the contribution rate must be increased before the difference between contribution and investment income and the benefit and administration expenses becomes negative. This occurs in 2044.

The **reserve (funding) ratio** is the ratio of reserve fund at the end of the year divided by the benefit and administration expenditures in the year. The ratio indicates the number of years of outgo at the current annual level of benefit payments and administration expenses which could be paid by the reserve fund. The reserve ratios (excluding NHIS transfers) fall from 6.5 in 2006 to 0.9 in 2045 and 0 around 2050.

The **general average premium (GAP)** is the long-term level contribution rate required to finance a scheme. It is a theoretical constant rate which could be applied indefinitely. The GAP financial system is rarely applied in practice. It is used to compare the costs of different benefit packages or the effect of alternative assumptions. The 20.68 per cent GAP contribution rate in the 2005 AR cannot be correct since the GAP cannot exceed the highest PAYG contribution rate during the period. It is estimated that the GAP contribution rate (excluding NHIS transfers) is approximately 14.8 per cent. This should be compared to the effective contribution rate for SSNIT benefits, 13.5 per cent, and the highest PAYG contribution rate, 15.7 per cent.

The 2005 AR presents an estimate of the **unfunded liabilities** of the SSNIT scheme. This conforms to International Accounting Standard (IAS) 26 *Accounting and Reporting by Retirement Benefit Plans*. Unlike occupational pension plans, a public social security scheme is established by statute, it is not subject to early termination and it will have continuous new entrants. Social security schemes such as the SSNIT do not fall within the definition of retirement benefit plans in IAS 26, nor is the actuarial methodology prescribed in IAS 26 appropriate for public social security pension schemes.

Sensitivity tests are used to illustrate the effects of alternative assumptions. The 2005 AR includes sensitivity tests at real rates of return of 0 and 4 per cent. It would be useful to present the results of sensitivity tests of other alternative assumptions, for example real wage growth.

The results of the 2005 actuarial review should be compared to those in previous actuarial reviews, and the reasons for changes in the results should be identified. This is complicated by how the collection and transfer of contributions to the NHIS are treated in the 2005 AR, and since the 2005 AR revises many of the assumptions made in the 2002 AR.

There are so many changes in the assumptions (for which few reasons are mentioned in the 2005 AR) that it is impossible to isolate and estimate the effect of any specific change. While, over a three year period there may be trends and new information which merit changes in some assumptions, it is unusual for so many assumptions to be revised.

7. Communication of results

The 2005 AR is an informative document. It includes much detail, an Executive Summary and useful tables and charts. As noted in the peer review there are elements of an actuarial valuation which are missing from the text.

These omissions will not be of concern to general readers, but will be missed by technical readers (actuaries, economists, demographers, policy analysts, etc). For future triennial actuarial reviews, it could be useful to produce two reports, one for technical readers would be a more complete volume than the present report, and the other for general readers would be a much shorter summary. The short report could be published separately or annexed to a SSNIT Annual Report.

1. Introduction

This report presents the results of a peer review of *The Fifth Triennial Actuarial Valuation of the Social Security and National Insurance Trust* of Ghana (2005 AR) which was undertaken by the Actuarial Department of the Social Security and National Insurance Trust (SSNIT).[1] A peer review by the International Financial and Actuarial Service of the Social Security Department, International Labour Office was requested by the Executive Management of the SSNIT.

The peer review contains observations on the following matters:

- Is the professional experience of the Actuarial Department who worked on the 2005 AR adequate for carrying out the work required?
- Has the work been completed in compliance with the relevant statutory requirements and professional standards of practice?
- Did the Actuarial Department have access to the information required to perform the valuation, and were relevant tests and analysis on the data completed as might be expected?
- Were the actuarial methods and assumptions used in preparing the 2005 AR reasonable?
- Does the 2005 AR fairly communicate the results of the work performed?

The peer review focuses principally on tabular data contained in the 2005 AR and not on the text. It includes recommendations for future actuarial reports of the SSNIT.

A peer review of an actuarial report is normally conducted on the basis of material in the report. Necessary material which is missing from the 2005 AR is annexed to this peer review. Data which is included in the 2005 AR in the form of charts should also be annexed to the Report.

The peer review does not comment on the current SSNIT plan design, administration or investment arrangements, except in so far as these have an impact on the actuarial review.

The SSNIT operates a social insurance programme which provides pensions and lump sum benefits principally on retirement, death or disability of participants. Appendix A of the 2005 AR provides a summary description of the SSNIT scheme.

This review by the International Financial and Actuarial Service of the International Labour Office Social Security Department focuses on the most important issues, notably, the data used, methodology and key actuarial assumptions as set out the 2005 AR.

Recent triennial actuarial reviews of the SSNIT have been undertaken as of 31 December: 2002 by the ILO and the United Kingdom Government Actuary, and 1999 by the United Kingdom Government Actuary.

The 2005 AR includes the following principal results:

[1] Report dated 24 September 2007.

- Projections to 2055 of numbers of insured persons and beneficiaries (Tables 10, 12 and 13), and amounts of contributions and benefits (Tables 15, 16 and 17).

- Projected cash flows and reserves to 2055 at the current contribution rate (Table 14).

- Projected total (benefits plus administration) pay-as-you-go (PAYG) contribution rates.

- Sensitivity tests illustrating the results which would be obtained under alternative investment rate of return assumptions.

The 2005 AR contains recommendations (Section 8), and in the Executive Summary states "It is concluded from the study that the financial position of SSNIT is sound for the next 45 years, up to 2049 when the end of year [reserve] fund turns negative."

It must be emphasized that the results of an actuarial valuation are not predictions. They present the outcomes if all of the assumptions were to come true in the future. The parameters involved (e.g., fertility rates, net migration rates, mortality rates, disability incidence rates, rates of labour force participation, retirement rates, rates of price increase, real rates of wage increase, real rates of return on investments) cannot be predicted with confidence over a long projection period. Presenting results to two decimal points can give a false impression of precision; ratios and percentages should normally be shown to only one decimal point.

The estimates provide guidance for financing the SSNIT scheme and for planning and management tasks. Sensitivity tests give indications of the range of possible actual outcomes.

With respect to financing a scheme, what is of particular interest is changes in the results of the current valuation compared to the previous valuation, and the reason(s) for the changes.

Sections 2 and 3 of this report deal with statutory requirements and professional standards of practice and data for the review. The actuarial methodology and assumptions are considered in Sections 4 and 5. Section 6 includes comments on the analysis of the results of the actuarial projections, and Section 7 deals with communication of results of the actuarial review.

2. Statutory requirements and professional experience

There is no requirement for periodic actuarial reviews in the legislation establishing the SSNIT (Social Security Law, 1991 – PNL 247). It is to the credit of the SSNIT that it has commissioned triennial actuarial reviews since the inception of the scheme.

In the absence of a statutory requirement, it is not clear to whom the Actuarial Department of the SSNIT submits its triennial actuarial reviews – to the management or to the Board of the SSNIT. In order to maintain the professional independence of members of the Department, the actuarial reviews should be submitted to the Board.

The International Actuarial Association has promulgated *Guidelines of Actuarial Practice for Social Security Programs*. They cover scientific rigour, objectivity and the transparency, explicitness, simplicity and consistency of information provided in the actuarial report. The IAA Guidelines provide guidance specific to social security programmes, and they have been taken into account in the review of the 2005 AR.

The AR has also been reviewed taking into account the *Internal guidelines for the actuarial analysis of a national social security pension* scheme published by the Social Security Department of the ILO (ISBN 92-2-111314-0).[2] The Guidelines summarize what the Department considers to be standard practice for actuarial analysis of social security pension schemes. They are meant to serve as checklists for staff members of the Department, as guidance for external collaborators and as information for client institutions and governments.

The Actuarial Department of the SSNIT is staffed by persons with actuarial training. They have applied the ILO projection programme to conduct the actuarial valuation.

The preliminary peer review identified certain necessary changes to the original actuarial report. Observations in this peer review (notably those concerning the assumptions) are provided for consideration in subsequent actuarial valuations.

It would be useful for the SSNIT Actuarial Department and the Financial, Actuarial and Statistical Branch of the ILO Social Security Department (SECSOC/FACTS) to agree on the basic assumptions before the valuation is undertaken. Then SECSOC/FACTS could review the draft valuation report and identify any errors or discrepancies which must be rectified. The final actuarial report would then be peer reviewed.

On 30 August 2007, the peer reviewer submitted the following statement to the SSNIT:

> "Pending the Statement of Actuarial Opinion on the Fifth Triennial Actuarial Valuation of the Social Security and National Insurance Trust (SSNIT) by the Social Security Department of the ILO, based on the available data and the Report prepared by the Actuarial Department of the SSNIT, the Peer Reviewer retained by the ILO is of the opinion that the valuation has been conducted in a manner consistent with accepted actuarial practice. Under the statutory provisions pertaining at 31 December 2005, the Report indicates that the SSNIT is in a sound financial position."

[2] See http://www3.ilo.org/public/english/protection/secsoc/publ/publ.php?idpubl=531&c_year=1998&c_region=All&c_tdoc=All

3. Data

For an actuarial review of the SSNIT, the data required normally include:

Data on current and past status
- Covered population (by age/sex)
- Contributory earnings of contributors (by age/sex)
- Contributions paid
- Benefit expenditures (by type/number/amount paid)
- Administration expenses
- Assets (reserve fund)
- Investment returns

Data for assumptions
- Demographic data
  - Mortality rates/future mortality improvement
  - Fertility rates
  - Migration rates
  - Retirement rates
  - Disability rates/recovery rates
- Economic data
  - Labour force participation rates
  - Earnings statistics
  - Wage/price inflation
  - Investment policy and performance
  - National economic data

Historical data and various projections of possible future experience are used to develop assumptions for the projections.

Tables showing extracts of all the items of data on the current status of the scheme and on which the assumptions are based should appear in annexes to an actuarial report.

From Section 4.1 of the 2005 AR, the main external sources of the data used for the valuation were the Ghana Statistical Service, the Bank of Ghana and University of Ghana Institute for Social Statistical and Economic Research (ISSER).

Internally, the actuarial valuation had access to statistical data in monthly Operations Reports (OR) and reports produced by the SSNIT Information Technology (IT) unit. These reports show quite different data, and the differences cannot be entirely explained by the different origins and uses of the reports. Inevitably there will be discrepancies due, for example, to multiple social security numbers for a single person and contributions which cannot be allocated to an insured person (although no suspense account for unallocated contributions appears in the SSNIT Annual Reports), however it is not possible to reconcile the data from the two sources due to these (or other) reasons.

The 2005 AR states in Section 8.2 that "The Scheme has been in existence for more than ten years, and it is imperative that efforts are made to improve the quality of the data on members."

The importance of this statement cannot be overemphasized. One cannot have confidence in an actuarial valuation which is based on unreliable or incomplete data on the insured persons and pensioners of a scheme. From the perspective of a social security scheme, data for the triennial actuarial valuations is equally as important as financial data for annual

reports, and the same attention and effort devoted to producing data for annual reports should be made to produce data for actuarial valuations. Attaching an actuary to the IT unit could lead to better statistical data.

Annual Financial Statements

The Actuarial Department had access to audited SSNIT Annual Financial Statements. Summaries of these Statements for the period covered by the valuation (which should be annexed to the 2005 AR) are in Annexes A and B of this peer review.

Since 1 January 2004, the SSNIT has been the agent for collection of contributions to the National Health Insurance Scheme (NHIS). Of the 17.5 per cent of insured earnings collected by the SSNIT, 2.5 per cent of insured earnings is transferred to the National Health Insurance Fund. Since the SSNIT is solely the contribution collection agent for the NHIS, health insurance benefits are not SSNIT benefits.

Consequently, for actuarial valuations of the SSNIT, NHIS contributions should be excluded from SSNIT contribution income and the transfer of these contributions should be excluded from SSNIT expenditures. The implications of this treatment of NHIS contributions are:

- In the 2005 AR, both projected contribution income and benefit expenditures of the SSNIT would be reduced by the amount the NHIS contributions. This will not affect the SSNIT surplus on operations.

- The administration expense ratio of the SSNIT would be increased by approximately 17 per cent since it would be based on lower contribution income. This increase would normally be offset to some extent by a negotiated agency fee which the SSNIT could charge the NHIS scheme for collection and remitting NHIS contributions.

Data on the initial insured population

According to the 2005 SSNIT Annual Report (page 12) the active contributing population has been redefined to include only members who had made at least one month's contribution in the last 12 months. At 31 December 2005 the Report notes that under this definition there were 898,368 active contributors.

This is the total contributing population which was used as the initial population for the 2005 AR. It is understood that the IT unit provided data on 718,162 members (205,424 females and 512,738 males). Data on these members was upgraded to 897,312 members assuming that the additional members had the same characteristics as those for whom data was available. [3]

Annex A of the 2005 AR shows input for the valuation – contributors in 2005 and their average monthly earnings (by sex and age). Over 2000 to 2005 the weighted average number of months during which contributors paid contributions to the SSNIT was 10.4 months. Combining these factors produces table 2.

[3] Annex A of the 2005 AR shows a total insured population of 898,366.

Table 2. Number and earnings of contributors at valuation date

	Males	Females	Total
Contributors in 2005	641,395	256,971	898,366
Average monthly earnings	1,178,730	1,125,203	-
Average months of contribution	10.4	10.4	-
Contributions at 17.5 per cent (¢ million)	1,381,269	528,267	1,909,536

The estimate of total contributions (¢1,909,536 million) is consistent with the 2005 Annual Report contributions received (¢1,905,767 million on a cash basis) in Annex A of this peer review.

From Annex A of the 2005 AR, the initial insured population (at 31 December 2005) is distributed by age group as shown in Table 3.

Table 3. Initial insured population by age group

Age	Males	%	Females	%
15-19	821	0.1	435	0.2
20-24	28,695	4.5	16,221	6.3
25-29	86,402	13.5	46,596	18.1
30-34	114,274	17.8	41,309	16.1
35-39	94,759	14.8	29,076	11.3
40-44	92,862	14.5	34,823	13.6
45-49	85,330	13.3	38,579	15.0
50-54	78,003	12.2	30,867	12.0
55-59	53,425	8.3	17,106	6.7
60	6,824	1.1	1,959	0.8
Total	641,395	-	256,971	-

Data on pensioners

Data on the number and amount of pensions in payment at a particular date are normally more reliable than data on contributors.

The SSNIT 2005 Annual Report contains little financial information on the benefits which were paid. Annexes G and H of the 2005 AR show the number and average monthly amounts of old-age and invalidity pensions by sex and age in payment at 31 December 2005. These can be reconciled to the 2005 SSNIT Annual Report and Table 4 presents the data.

Table 4. Number and amount of benefits (amounts in ¢ millions)

	Number			Estimated annual amount		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**
Old-age (Annex G)	58,963	7,799	66,762	300,003	41,544	341,547
Invalidity (Annex H)	627	127	754	3,163	628	3,791
Total pensions	-	-	67,516	-	-	345,338
25% lump sum (from OR)	-	-	-	-	-	118,153
PF lump sum (from OR)	-	-	-	-	-	29,789
Total	-	-	-	-	-	493,280
2005 SSNIT Annual Report						
Page 16	-	-	68,925	-	-	-
Financial Statement Note 11	-	-	-	-	-	496,991

Note: OR = Operational Reports.

The initial age distribution of 66,849 old-age pensioners at 31 December 2005 is as presented in Table 5.

Table 5. Initial old-age pensioners by age group

Age group	**Males**	**Females**
50-54	413	0
55-59	10,143	1,007
60-64	21,625	3,271
65-69	15,561	2,425
70-74	8,646	900
75-79	2,171	160
80+	492	35
Total	59,051	7,798

4. Methodology

The results presented in the 2005 AR are based on an ILO model of the SSNIT's operations, which projects the annual number of members and beneficiaries, the annual contribution and investment income and benefit and administration outgo, and the reserve fund at the end of each year.

The model starts with statistics by age and sex as of 31 December 2005 on (a) insured persons and their earnings, and (b) pensioners and the amounts of their pensions. Throughout the projection period, the model projects:

- the number and characteristics (e.g. age, sex) of insured persons, pensioners and other beneficiaries;
- the amount of contributions paid and benefits received, and
- projections of contribution income and benefit outgo are combined with projections of investment income and administration expenses to produce the amounts in the reserve fund.

The model projects expected experience in future years based on demographic and economic assumptions. These assumptions include demographic parameters such as fertility, mortality and migration, and economic parameters such as GDP and labour force growth, labour force participation rates, price inflation, wage escalation and investment returns.

The 50 year projection period is appropriate for a scheme such as the SSNIT which has been operating in a volatile economic environment. Elsewhere, in more stable situations, actuarial valuations of partially funded public pension schemes are made over longer projection periods (e.g. 75 years for the Canada Pension Plan and the OASDI system in the United States, 95 years in Japan).

Since the length of the projection period and the number of assumptions required mean that actual future experience will not develop precisely in accordance with the assumptions, sensitivity tests are performed using alternative assumptions.

5. Assumptions

The following text concerning actuarial assumptions is adapted from the *Review of the Twenty-First Actuarial Report on the Canada Pension Plan* conducted by the CPP Actuarial Review Panel.

The triennial actuarial review requires the actuary look to back in time, to review the operations of the programme and also look forward, to make an estimate of its future operations. For the forward-looking part of the process, the actuary builds a model that incorporates the details of the benefit, contribution and investment elements of the scheme and reflects the expected behaviour of the factors that determine the year-by-year development of the benefit costs and the contribution and investment income. The assumptions incorporated into the model for a particular actuarial review reflect the actuary's judgment, based on his/her interpretation of past experience and the available evidence about the likely course of future experience.

The nature of the actuarial process is to make projections (not predictions) about the future based on the evidence available and then to review them periodically. Where appropriate, the actuary makes "mid-course corrections" in the assumptions as the emerging experience of the plan deviates from the previous assumptions and the expectations for likely future experience change. In assessing whether to change an assumption and if so, by how much, the actuary must weigh

- long- and short-term historical data and recent experience data;
- recent amendments to the scheme;
- government policies (e.g. on inflation and migration), investment policy, administration policies;
- academic research, and
- other external sources of relevant information.

The assumptions are intended to apply over the long-term future, so the actuary will normally give substantial weight to long-term historical data. However, where the actuary judges that more recent data for a particular assumption indicate a shift or a trend that is likely to continue for the long-term future, the actuary will recognize that shift or trend in the assumption.

For some assumptions used in the model, the actuary may adopt an approach that actuaries describe as "select and ultimate". Under this approach, the particular assumption gradually changes over a period of years (the "select period") from one that initially is very close to actual recent experience to one that reflects the actuary's best estimate of the long-term future (the "ultimate" assumption). The length of the select period can be different for different assumptions. The choice is based on the actuary's judgment and depends partly on the nature of the parameter involved and partly on how significantly the ultimate assumption differs from recent experience.

The results of the actuarial process at any given time do not yield a "right" answer but should lie somewhere within a range that can be regarded as "reasonable". Actuarial reviews focus on several key assumptions where the assumptions are "best-estimates", i.e. in the judgment of the actuary, the assumptions were such that adverse or favourable deviations of actual future experience from each of the assumptions are about equally likely.

The major actuarial assumptions can be divided into two groups:

- demographic assumptions that deal with changes in the covered population (fertility, migration and mortality rates) and events (death, disability, retirement) that result in the starting or stopping of benefit payments or contributions, and

- economic assumptions that deal with employment, wages, prices and returns on investment.

Demographic assumptions

The ILO population projection model requires assumptions about future fertility, mortality and migration.

Fertility

Table 5 of the 2005 AR report shows the assumed total fertility rates. These rates are lower than those in the UN medium variant projection until 2015-2020, higher until 2030, and both assume a total fertility replacement rate (2.1 per cent) from 2030 onwards.

Mortality

Over the projection period, improvements in mortality are assumed. The (complete) expectations of life from the mortality table assumed in the 2005 AR are slightly lower than those in the UN medium variant projections as shown in Table 6.

Table 6. Expectation of life at birth

Year		2005	2050
2005 AR	Males	55.5	70.6
	Females	58.0	73.5
UN (med)		**2000-2005**	**2045-2050**
	Males	56.0	71.1
	Females	58.5	74.0

The expectation of life assumed in the 2005 AR report reaches the 2045-2050 level in the UN medium variant projection in 2055.

Expectations of life at retirement age (60) are also important and they are presented in Table 7.

Table 7. Expectation of life at age 60

Year		2005	2050
2005 AR	Males	14.4	18.1
	Females	15.9	20.3
UN (med)		**2000-2005**	**2045-2050**
	Males	16.4	19.8
	Females	17.8	21.7

The initial mortality table which was applied in 2005 for the 2005 AR (which should be annexed to the 2005 AR) is in Annex C of this peer review.

It is of interest to compare the mortality rates applied to the SSNIT actuarial valuation to other tables. For example, English Life Table No. 13 which takes into account mortality in the United Kingdom during 1970-72 has higher expectations of life at age 0, but at age 60

the ELT expectations of life are 15.4 years for males and 20.0 years for females. Life expectancy at birth is very much affected by neonatal and early childhood mortality.

It is noteworthy that members of the SSNIT will have more favourable mortality than the general population as a result of higher levels of education, better sanitary facilities, access to medical care and other factors.

Migration

From Table 5 of the 2005 AR, net migration is assumed to be -2 per cent until 2025 and -1 per cent thereafter. Reducing the total population by the assumed number of migrants (including their families) may underestimate the effect of out-migration on the SSNIT since workers who migrate probably include many skilled workers who would be covered by the SSNIT. It may be desirable to treat migrants in the same manner as persons who are unemployed, i.e. reduce the projected labour force by the number of migrants who might otherwise be in the labour force.

Population of Ghana

Over the years 2000 to 2050, the UN medium variant and the 2005 AR estimates of population growth are 1.39 per cent and 1.46 per cent per year respectively. The 2005 AR assumed population growth rate is in the order of 1.80 per cent annually until 2020 and thereafter decreases to 0.81 per cent from 2050 to 2055. Table 8 summarizes the data.

Table 8. Total population of Ghana at different dates.

Population of Ghana	2005	2050	2055	Increase per annum (%)	
				to 2050	to 2055
Ghana Statistics Service	21,243,308	-	-	-	-
UN (medium variant)	21,555,000	40,056,000	-	1.39	-
2005 AR (Table 6)	22,535,000	43,270,028	45,041,801	1.46	1.39

Growth of insured population/unemployment

The insured population is projected by applying labour force participation rates to the population of Ghana, allowing for unemployment and taking into account the portion of the active labour force which is covered by the SSNIT.

The assumed **labour force participation rates** for persons aged 15 to 59 are indicated in Table 9.

Table 9. Total labor force participation rate

Age	15	20	25	30	35	40	45	50	55
Males (%)	40	70	85	93	94	94	94	93	91
Females (%)	40	70	82	87	88	89	88	85	82

These participation rates are slightly lower than those in the ILO LABORSTA Economically Active Population Estimates and Projections for 2005 (see http://laborsta.ilo.org/).

An economic assumption, **unemployment**, is assumed to be 12.3 per cent of the labour force throughout the projection period.

Applying the projected labour force participation and unemployment rates to the Ghana population aged 15 to 59 and relating the result to the number of persons covered by the SSNIT at 31 December 2005 produces the projected insured population shown in Table 10 of the 2005 AR.[4]

Table 10. Projected SSNIT insured population

Year	2005	2015	2025	2035	2045	2055
Male	640,576	871,641	1,139,856	1,415,902	1,661,383	1,866,121
Female	256,736	344,999	445,716	552,706	644,190	724,592
Total	897,312	1,216,640	1,585,572	1,968,608	2,305,573	2,590,713

From 2005 to 2015 the annual growth rate of the insured population is 3.1 per cent. Thereafter it reduces to 1.2 per cent from 2045 to 2055. Over the entire period the annual growth rate of the insured population is 2.1 per cent.

This is greater than the projected Ghana overall population growth rate (1.4 per cent). This is due to the growth of the population aged 15-59 as a proportion of the total population, and the higher labour force participation rates at the upper ages. It is implicitly assumed that the economy of Ghana will grow to support this increased number of persons projected to be covered by the SSNIT.

The report is silent on the assumed age distribution of **new entrants** and the treatment of **inactive insured persons**.

Morbidity (incidence of invalidity)

The incidence of invalidity claims depends on the definition of incapacity and the application of the definition. Future invalidity claims are projected using a table of rates of entry into invalidity. Given the low incidence of invalidity and the limited invalidity experience of the SSNIT (at 31 December 2005 there were 754 invalidity claims of which 71 were new cases in 2005), it is not possible to prepare (or to adapt another table) to produce a reliable table of rates of entry into invalidity for the SSNIT.

Future projections of numbers and average amounts of new invalidity claims could be made by developing formulas to estimate them as proportions of new retirement pensioners and pension amounts.

Retirement rates

The 2005 AR is silent on retirement rates (the proportion of insured persons at specific ages retiring in any year). Subject to conditions, insured persons can retire early from age 50. From Table 11, in 2005 there were 7,245 new retirement pensions and 71 new invalidity pensions. The total is consistent with the 2005 SSNIT Annual Report (page 16) total of 7528 new pensions. The distribution of their retirement ages is shown in Table 11.

[4] In Table 10 of the 2005 AR the fifth column is not the rate of annual increase.

Table 11. Distribution of new old-age pensions in 2005

Age	Males (%)	Females (%)
50-54	2.1	-
55-59	31.2	32.8
60	10.7	14.0
61	21.8	30.3
62+	34.2	22.9

Lump sums

Based on the experience of the SSNIT, all persons who become eligible for lump sum benefits are assumed to opt for lump sums. In the case of a deceased insured person or pensioner who does not leave a spouse or child survivor, the lump sum is payable to a nominated beneficiary. The lump sum is the present value of 25 per cent of the pension payable for 12 years (or up to age 72 if less). The discount rate which is applied is 10 per cent per annum of the annual pension or 0.083 per cent per month of the monthly pension which is commuted. The latter monthly rate produces a slightly higher discount rate than 10 per cent on an annual basis.

The SSNIT benefit accrual rates (2 per cent per year for the first 20 years and 1.5 per cent per year thereafter) produce pensions after 30 years of contributions with a replacement rate of 55 per cent of the highest three years' earnings. This replacement rate exceeds ILO standards, and would be a reasonable inflation adjusted retirement income. As the 2005 AR notes, commutation of 25 per cent of the pension reduces the earnings which are replaced by 25 per cent. Commuting 25 per cent of the pension results in an earnings replacement rate of 41 per cent after 30 years of contributions. Commutation thus leads to complaints that retirement pensions are inadequate.

Economic assumptions

Key assumptions for the financial projections are future rates of price inflation, wage inflation and rates of return on investments. They can be found in the Appendix C of the 2005 AR.

Real GDP growth

To make these assumptions, estimates of future GDP growth and growth in employment must be made. The 2000-2005 rates of GDP growth at constant prices shown in Table 12 are from IMF data (see http://www.imf.org/external/pubs/ft/weo/).

Table 12. GDP growth

Year	Real GDP growth (%)	Employment growth (%)	Productivity growth (%)
		History	
2000	3.7	-	-
2001	4.2	-	-
2002	4.5	-	-
2003	5.2	-	-
2004	5.8	-	-
2005	5.8	-	-
		Assumptions	
2010	6.3	3.1	3.2
2015	6.1	2.7	3.3
2020	5.8	2.6	3.2
2025	5.6	2.5	3.1
2030	5.3	2.3	3.0
2035	5.1	2.1	3.0
2040	4.8	1.7	3.1
2045	4.7	1.4	3.2
2050	4.5	1.1	3.3
2055	4.2	0.9	3.3

It is assumed that real GDP growth increases to 6.3 per cent in 2009 and decreases gradually to the 2005 level in 2021 and thereafter to 4.2 per cent in 2055. The real GDP growth rate does not fall to the 2000 to 2005 average (4.9 per cent) until 2039.

While there has been an upward trend in real GDP growth, it is optimistic to assume that this will continue unbroken to 2010, and that annual real GDP growth will consistently remain at relatively high levels until 2055, the end of the projection period.

There will be unpredictable deviations from the smooth progression of GDP growth which has been assumed. It is necessary to take into account years when real GDP growth will be below the assumed rate. Since the assumed rates of real GDP growth are high, these deviations are unlikely to be entirely compensated by years when real GDP growth exceeds the assumed rates. This can be taken into account by assuming lower real GDP growth rates throughout the projection period. In this regard, see the section below on assumed wage inflation.

Employment growth is reproduced from the demographic assumptions. The annual real rate of productivity growth is derived from real GDP and employment growth, where:

real productivity growth = [(1 + real GDP growth) / (1 + employment growth)] – 1.

Price inflation

The rates of annual average price inflation (national combined data) and nominal and real rates of wage inflation from 2000 (see 2005 AR Chart 7) are presented in Table 13.

Table 13. Nominal and real rates of wage inflation

Year	Average earnings increase		
	Inflation (%)	Nominal (%)	Real (%)
2000	25.2	7.9	-17.3
2001	32.9	47.5	14.6
2002	14.8	24.3	9.5
2003	26.7	42.0	15.3
2004	12.6	19.7	7.1
2005	14.5	18.5	4.0

The rates of price inflation are based on Ghana Statistical Service data reported by the Bank of Ghana and the International Labour Office LABORSTA. There are small, but insignificant, differences in the reported rates.

Taking into account the current macroeconomic environment, it is assumed that annual inflation will vary from 11.4 to 10 per cent in 2019 and thereafter decrease to 5.0 per cent at the end of the projection period.

Interest rate

The rates of return on investments earned since 2001 are provided in Table 14.

Table 14. Rates of return on investments

Year	SSNIT 2005 Annual Report Table 11			Calculated using $2I/(A+B-I)$		
	Nominal (%)	Inflation (%)	Real (%)	Nominal (%)	Inflation (%)	Real (%)
2001	26.2	32.9	-5.1	12.0	32.9	-20.9
2002	22.7	14.8	6.9	12.6	14.8	-2.2
2003	45.1	26.7	14.5	14.5	26.7	-12.2
2004	34.4	12.7	19.2	11.5	12.6	-1.1
2005	5.4	15.1	-8.4	8.8	14.5	-5.7

The high returns noted in the SSNIT 2005 Annual Report take into account unrealized investment income (net unrealized capital gains). The calculated rates of return are based on the ratio of investment income received *(I)* to the average of SSNIT assets at the beginning of the year *(A)* and the end of the year *(B)*.

According to the 2005 Annual Report, the average real return over the five years is 4.9 per cent and over the three years ending in 2005 it is 7.7 per cent. The calculated real returns have been negative over these periods.

In accordance with the 2005-2009 Strategic Plan of the SSNIT, it was assumed that the real rate of return on investments would be 2 per cent throughout the projection period.

This is a reasonable long-term assumption, although in view of recent experience it might be prudent to gradually increase the assumed real rate of return to 2 per cent over a period.

Quoted SSNIT assets are valued at the mid-market price at the end of the fiscal year. Unquoted investments have generally been valued at cost with a provision in case of permanent impairment of an asset(s). Property investments are valued at periodically determined market values. Net changes in the values of assets during an accounting period are reported in the Fund Account as "Movement in net assets". Investment income is shown as actual investment income received.

Accounting standards now require assets to be "marked to market". As a consequence, greater volatility can be expected in the statement of operations. Carrying assets at their market values facilitates the monitoring of investment performance by comparing yields with recognized indices (benchmarks).

What actuaries need to measure is the capacity of assets to generate income on a long-term basis. The traditional formula for the rate of return on investments is 2I/(A+B-I) where I is the actual (realized) investment income and A and B are the initial and ending asset values.

The question is whether unrealized capital gains (losses) should be included in the value of I in the formula? Recognizing only realized gains and losses, may not reveal the true picture of the assets. Nor does this approach protect the fund from undesirable actions, for example, decisions to sell certain assets can be influenced by short-term considerations in order to show a higher yield in a particular year.

In setting the assumed rate of return assumption, actuaries should consider both measures of the rate of return on investments. Over long periods, both approaches should result in more or less equivalent rates of return.

Wage inflation

Average earnings increases show great volatility. (See the preceding price inflation table.) The average of average annual real rates of increase in wages over 2000 to 2005 is 5.5 per cent. Wage growth is assumed to be equal to productivity growth (Section 4.2.1 of the 2005 AR), Productivity growth is derived from GDP and employment growth.

As a result of these assumptions, throughout the projection period, the assumed rate of real wage growth exceeds the assumed real rate of return on investments, as shown in Table 15.

Table 15. Real interest rate and wage growth

Year	Real interest rate (%)	Real wage growth (%)
2010	2.00	3.15
2015	2.00	3.26
2020	2.00	3.19
2025	2.00	3.05
2030	2.00	2.97
2035	2.00	2.96
2040	2.00	3.06
2045	2.00	3.24
2050	2.00	3.31
2055	2.00	3.26

While annual real wage inflation may exceed real investment returns from time to time or over a period, this situation is unlikely to pertain over a 50 year projection period.

Applying this real wage growth assumption means that:

- projected contributions will be higher than those likely to be received;
- projected initial pensions and the 25 per cent lump sum benefits which are based on the highest three years' average earnings will be higher than the amounts likely to be paid;
- since pensions in payment are adjusted according to wage inflation, the projected adjustments will be higher than the actual adjustments which are likely to be made.

Normally, except for exceptional years or even several years in a row, over a long projection period, the real rate of increase in wages would be assumed generally to be lower than the real rate of return on investments.

This would require reexamination the assumed rate of productivity growth and the real GDP and employment growth assumptions from which productivity growth is derived. The employment growth assumption is derived from the basic demographic assumptions, and over a long projection period demographic assumptions are more reliable than real GDP growth assumptions. It has been noted above that the assumed real GDP growth rates could be reduced to reflect better the volatility and uncertainty of these rates.

To illustrate (only), if the assumed real GDP growth rates were reduced by a constant 1.5 per cent. the following data from table 16 would apply.

Table 16. Real GDP growth rates reduced by 1.5 per cent

Year	Real GDP growth		Employment growth (%)	Productivity growth (%)
	Original (%)	Less 1.5 % (%)		
2010	6.3	4.8	3.1	1.7
2015	6.1	4.6	2.7	1.8
2020	5.8	4.4	2.6	1.8
2025	5.6	4.1	2.5	1.6
2030	5.3	3.9	2.3	1.5
2035	5.1	3.6	2.1	1.5
2040	4.8	3.4	1.7	1.6
2045	4.7	3.2	1.4	1.8
2050	4.5	3.0	1.1	1.9
2055	4.2	2.8	0.9	1.8

With a 1.5 per cent reduction in the assumed real GDP growth, productivity growth (i.e. the real wage growth assumption) is always less than the 2 per cent assumed real rate of return on investments. Alternative adjustments to the original assumed real GDP growth rates could be made.

Salary scale

The salary scale refers to the increase of an insured person's salary over time ignoring increases which are attributable to wage inflation. The 2005 AR is silent on the salary scale which has been assumed.

By discounting projected salaries by sex, age and projection year back to the initial projection year at the rate of wage inflation, a salary scale which is consistent with those normally found is produced. Ignoring wage inflation, the salary of a new entrant at age 20 increases 4.6 times by age 60.

Density of contributions

The density of contributions refers to the average number of contributions made in a period compared to the maximum number of contributions which could have been made in the period. Annexes D and E of the 2005 AR show 2005 contribution data for 718,060 contributors. From this, the density of contributions in 2005 can be calculated. The assumed density of contributions (which is not set out in the 2005 AR) for both males and females is the average density over 2000 to 2005 which is consistent with the 2005 experience and presented in Table 17.

Table 17. Density at central age of age group

Age group	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Density (2005) (%)	64	80	86	89	91	93	89	89
Assumed density (%)	61	77	85	89	91	92	93	93

The weighted average of the assumed densities of contributions is 0.86, i.e. 10.3 months per year.

To take into account failure to collect contributions, a compliance assumption is introduced, and it is assumed that 90 per cent of the contributions which are due will be paid. In effect, the compliance assumption reduces the total contribution rate from 17.5 to 15.75 per cent and the 15 per cent which is for the SSNIT to 13.5 per cent. Alternatively, the compliance assumption can be regarded as reducing the overall density of contributions to 77 per cent. The basis for the compliance assumption is not stated in the 2005 AR. Clearly, improving compliance would have a significant effect on the contribution income of the SSNIT.

The compliance assumption does not affect the accrual of benefit rights by insured persons. Non-compliance is a failure of employer-contributors and the enforcement of contribution collections by the SSNIT, hence insured persons accrue benefit rights when their contributions are uncollected through no fault of their own.

Accrual of benefit rights

Annex F of the 2005 AR shows average pension rights at retirement for retired persons aged 50 and over. Age is presumably age last birthday at 31 December 2005. The pension rights earned appear to give the percentage of the average number of months of contributions paid divided by 534 months (the total number of months between age 15 and age 60 assuming retirement in the middle of the final year).

At age 61 the number of years contributed is 29. Above this age, the number of years contributed generally decreases, since these persons had fewer years during which to contribute. Below age 61, the number of years contributed also decreases since these

retired persons still had years to contribute before reaching age 60. As the SSNIT scheme matures, persons who retire will have steadily increasing periods of contributory service and hence increasing pension rights at the time of retirement.

Insured persons who do not complete the 20 years of contributions minimum qualifying period receive a lump sum equal to the return of their contributions plus interest (PF lump sum).

The 2005 AR does not indicate the average accrued benefit rights of the initial insured population by sex and age.

Administration expenses/Acquisition of fixed assets

From SSNIT Annual Reports, general and administration expenses from 2002 to 2005 are set out in the following table 18.

The administration expense ratio is best expressed as a percentage of contribution income. The SSNIT transfers to the NHIS 2.5 percentage points of contribution income. Since this portion of contribution income is not available to the SSNIT to offset expenses incurred by the SSNIT, it should be excluded from the calculation of administration expense ratios. This results in a 17 per cent increase in the expense ratios calculated on the entire contribution income.

Table 18. General and administration expenses (amounts in ¢ millions)

Year	2002	2003	2004	2005
Contribution income	1,001,718	1,340,220	1,632,531	1,905,767
Transfer to NHIS	-	-	233,219	272,252
General administrative expenses	223,817	266,505	369,163	401,033
Ratio to contributions (%)	22	20	23	21
Ratio excluding NHIS transfer (%)	-	-	26	25

From Table 18 of the 2005 AR, administration expenses are assumed to decrease from 22 per cent of contribution income in 2006 to 12.5 per cent in 2025 and thereafter.

From 2005 AR tables 14 and 16, acquisition of fixed assets is assumed to be 4.7 per cent of contribution income throughout the projection period. According to the 2005 Annual Report, these fixed assets consist of property, plant and equipment (land and buildings, furniture and equipment, motor vehicles) required for the operations of the scheme.

For the actuarial valuation, these two expenses can be combined. They can be regarded as a fixed cost (acquisition of fixed assets plus other fixed costs) plus a variable cost which depends on the number of insured persons and beneficiaries (administration expenses in the 2005 AR). This would result in total expenses in respect of the administration of the scheme being 26.7 per cent of contribution income in 2006, decreasing to 17.2 per cent of contribution income from 2025 on.

It is unlikely that the same level of acquisition of fixed assets will be required throughout the projection period. In a scheme such as the SSNIT which has a relatively small number of insured persons, the plant and equipment required to operate the scheme is sufficient to operate a scheme with a much larger number of insured persons.

While the cost of collecting the NHIS contributions and remitting them to the NHIS should be minimal, it could be recovered from the NHIS by the SSNIT.

Presumably, in the Annual Accounts investment income is stated net of transaction costs, and the staff, management and other costs of dealing with investments are included in the scheme's administration expenses. The cost of investment and other operations of the scheme could be separated, and investment expenses could be deducted from (gross) investment income to give net investment income, thereby reducing (and better reflecting) the cost of administrative operations.

6. Analysis of results

The principal outputs from the model are:

- projected demographic and financial results, including cash flows and the accumulated reserve fund;
- projections of the
  - pay-as-you-go contribution rates, and
  - reserve ratios;
- calculations of the contribution rate under alternative financial systems.

Analysis of the results of the actuarial valuation of the SSNIT scheme is distorted since in the 2005 AR NHIS contributions are included in contribution income and their transfer is treated as an expense of the scheme.

Cash flow projections

Table 14 shows cash flow and year-end reserve projections. On the basis of the current 17.5 per cent contribution rate, the projections show that expenditures on benefits (including NHIS transfers) and on administration will exceed contribution and investment income after 2040, and the reserve will be negative by 2050.

Pay-as-you-go (PAYG) contribution rate

Under the PAYG financial system, each year benefit and administration expenditures are paid from the contribution income of the scheme in the year.

Table 16 of the 2005 AR shows the PAYG contribution rate as a percentage of insured earnings for SSNIT benefits and the transfer of contributions to the NHIS. Based on the 2005 AR Tables 14, 15, 16 and 17, the contribution rate which would be required each year under the PAYG financial system for SSNIT benefits excluding the NHIS transfer is also shown in Table 19.

Table 19. PAYG contribution rates

Year	PAYG (including NHIS) (%)	PAYG (excluding NHIS) (%)
2006	13.4	11.2
2015	14.2	11.9
2025	14.2	11.9
2035	15.4	13.2
2045	17.6	15.3
2055	17.9	15.7

The SSNIT contribution rate is 17.5 per cent of which 2.5 per cent is transferred to the NHIS scheme. It is assumed that 90 per cent of contributions are collected, consequently the effective contribution rates are 15.75 per cent in total and 13.5 per cent for SSNIT

benefits and administration expenses. It is these effective contribution rates which should be compared to the PAYG rates in the table.

In Table 14, the "Surplus for Reserve" is the difference between contribution income and benefit and administration expenditures. When this becomes negative, it simply indicates that the PAYG contribution rate is higher than the actual effective contribution rate. This occurs in 2037.

Scaled premium

The financial system for SSNIT benefits is not defined in the legislation. It would be desirable if the legislation set out the partially funded financial system the SSNIT is to follow. An actuarial review would then determine whether the prescribed system was being followed. In the event it was not, the SSNIT would have to increase the contribution rate or reduce benefits.

In Section 2 of the 2005 AR it is noted that the SSNIT scheme applies the scaled premium financial system. Under this financial system the accumulated reserve is not used to pay benefit and administration expenses. Contribution rates are increased periodically so that annual contribution and investment income are at least equal to benefit and administration expenditures.

Under the scaled premium financial system, the contribution rate must be increased before the difference between contribution and investment income and the benefit and administration expenses becomes negative. From page 22 of the 2005 AR, this occurs in 2044.

On the basis of the assumptions and projections in the 2005 AR, under the scaled premium system of finance, in order to sustain the benefits currently provided by the SSNIT it will be necessary to increase the contribution rate at the latest by 2044.

Reserve (funding) ratio

The reserve (funding) ratio is the ratio of reserve fund at the end of the year divided by the benefit and administration expenditures in the year. The reserve ratio indicates the number of years of outgo at the current annual level of benefit payments and administration expenses which could be paid by the reserve fund alone. A financial system based on the reserve ratio sets out a reserve ratio which must be maintained.[5]

The current and projected reserve ratios below for the SSNIT (including NHIS contributions and transfers) are from Table 14 of the 2005 AR. The ratios if the NHIS is excluded have been calculated.

[5] For example, as in Canada and the United States.

Table 20. Reserve (funding) ratios

Year	SSNIT (including NHIS)	SSNIT (excluding NHIS)
2006	5.6	6.8
2015	4.1	4.9
2025	3.2	3.7
2035	2.2	2.6
2045	0.8	0.9

In both cases, the reserve ratio falls to zero around 2050 as shown in Table 20. Unless the contribution rate is increased before then, benefits under the existing scheme cannot be paid thereafter by the SSNIT.

General average premium (GAP)

Under this financial system a theoretical constant contribution rate which could be applied indefinitely is calculated by equating the present value of contributions for existing and future insured persons plus the amount of the current reserve to the present value of future benefits for existing and future insured persons and administration expenses. The GAP financial system indicates the long-term level contribution rate cost of a scheme. It is rarely applied in practice, and is used to compare the costs of different benefit packages or the effect of alternative assumptions.

In Section 7 of the 2005 AR, a GAP contribution rate of 20.8 per cent has been calculated for the 50 year projection period (20.68 per cent in Appendix F). However, the GAP cannot exceed the highest PAYG contribution rate over the period. It is estimated that the GAP contribution rate (excluding NHIS contributions and transfers) is approximately 14.8 per cent. This should be compared to the actual effective contribution rate for SSNIT benefits, 13.5 per cent, and the highest PAYG contribution rate 15.7 per cent (see above).

Unfunded liabilities

Section 6 of the 2005 AR presents an estimate of the unfunded liabilities of the SSNIT scheme.

International Accounting Standard (IAS) 26 *Accounting and Reporting by Retirement Benefit Plans* applies to the financial statements of retirement benefit plans which are defined to be arrangements whereby an entity provides benefits for employees on or after termination of service. Among the alternative requirements is that financial statements show net assets available for benefits including either a note disclosing the actuarial present value of promised retirement benefits, or a reference to this information in an accompanying actuarial report. If an actuarial valuation has not been prepared at the date of the financial statements, the most recent valuation is used as a base and the date of the valuation disclosed. An accrued benefit actuarial cost method is to be used for the actuarial valuation.[6]

Unlike employer (or other entity) sponsored occupational pension schemes, a public social security pension scheme is established by statute and is not subject to early termination. A

[6] See IASB Technical Summary at http://www.iasb.org/NR/rdonlyres/EBFAD1C0-13A6-43B7-A109-83BA2D4B6380/0/IAS26.pdf

public social security scheme can also anticipate continuous new entrants. Hence, social security schemes such as the SSNIT do not fall within the definition of retirement benefit plans in IAS 26. In addition, the actuarial methodology prescribed in IAS 26 is inappropriate for public social security pension schemes.

Triennial actuarial valuations of social security schemes are necessary, but accounting standard IAS 26 is inapplicable to public social security schemes.

Sensitivity tests

The ILO model produces a single set of projected results for each year. Sensitivity tests are used to illustrate the effects of alternative assumptions. The 2005 AR main real rate of return on investments assumption is 2 per cent throughout the projection period, and this assumption has been the basis of observations in this peer review. The Report includes sensitivity tests at real rates of return of 0 and 4 per cent. It would be useful to present the results of sensitivity tests of other alternative assumptions, for example real wage growth.

The sensitivity test at a 0 per cent real rate of return is useful. It is a "worst case" scenario since it projects the development of the scheme under the unlikely assumption that the real rate of return is zero throughout the entire projection period.

Comparison of the 2005 AR with the 31 December 2002 Actuarial Report (2002 AR)

Results of the 2005 actuarial review should be compared to those in previous actuarial reviews, and the reasons for changes in the results should be identified. This is complicated by how the collection and transfer of contributions to the NHIS are treated in the 2005 AR, and especially since the 2005 AR revises many of the assumptions made in the 2002 AR. The restatement of the number of insured persons means that monetary amounts in the two valuations are not comparable (see Section 3 of this report).

In both actuarial reports, the main assumed real rate of return is 2 per cent. Both actuarial valuations assume that administration expenses will decrease from 22 per cent of contribution income to 12.5 per cent in 2025 and thereafter. Acquisition of fixed assets is assumed to be a constant 4.7 per cent of contribution income in the 2005 AR. In the 2002 AR this expense is assumed to be 1.16 per cent of contribution income in 2006 and thereafter.

The following table 21 shows that in the 2005 AR the PAYG contribution rates are lower than those in the 2002 AR, while the reserve (funding) ratios are much lower. In this table the 2.5 per cent NHIS contribution in the 2005 AR is taken into account as income and as a benefit expenditure of the SSNIT. The data from the 2002 AR comes from tables 16, 18 and 19 in the Report.

Table 21. Comparison of results in 2002 and 2005 AR (including NHIS transfers)

Year	PAYG rates		Reserve ratios	
	2005 AR (%)	2002 AR (%)	2005 AR	2002 AR
2003	-	10.8	-	6.8
2006	13.4	-	5.6	-
2015	14.2	14.5	4.1	6.3
2025	14.2	15.7	3.2	5.6
2035	15.4	17.4	2.2	4.6
2045	17.6	20.7	0.8	2.5
2055	17.9	-	-	-

Demographic assumptions

The following table 22 compares demographic assumptions in the two actuarial reports. In both reports, net migration is assumed to be -2 per cent of the population until 2020 (2015 in the 2002 AR) and -1 per cent thereafter.

Table 22. Comparison of demographic assumptions in 2002 and 2005 AR

Year	Total fertility rate		Crude death rate	
	2002 AR	2005 AR	2002 AR	2005 AR
2010	3.26	3.37	0.96	1.09
2015	2.78	3.05	0.84	0.99
2025	2.18	2.42	0.71	0.80
2035	2.10	2.10	0.70	0.72
2045	2.10	2.10	0.76	0.72

It is not known why only three years after the 2002 AR, in the 2005 AR the total fertility rate assumption was increased by over 10 per cent in the years before 2030 after which it becomes constant in both actuarial reports at 2.1 births per female.

The crude death rate depends on the age distribution of the population (which in turn depends on the fertility rate). Since the same initial mortality table and projected mortality improvements were applied in both valuations, the substantial increases in the crude death rate until 2025 are unusual.

The interaction of these (and other) factors results in an estimated insured population in 2050 of 2,648,406 in the 2002 AR and 2,452,031 in the 2005 AR. In 2050, the estimated numbers of old-age pensioners are significantly different; 914,590 in the 2002 AR and 690,771 in the 2005 AR. (See tables 10 and 12 in the actuarial reports.) This reduction in the old-age pensioner population by one-quarter cannot be adequately explained by the initial insured population or the demographic assumptions.

Economic assumptions

The following table 23 shows the significant differences between the economic assumptions in the 2002 AR and 2005 AR.

The 2002 AR assumes a more rapid decrease in the rate of price inflation. Real GDP growth in the 2005 AR is assumed to increase and after 2020 is around 1 ½ times as great as in the 2002 AR. This leads to substantial increases in the 2005 AR real wage growth assumption. (See Section 5, Assumptions, for the implications of this assumed rate of real wage growth.)

Table 23. Comparison of economic assumptions in the 2002 and 2005 AR (rates are percentages)

Year	Real GDP growth		Price inflation		Real wage growth	
	2002 AR	2005 AR	2002 AR	2005 AR	2002 AR	2005 AR
2010	4.8	6.3	11	11	1.8	3.1
2015	4.3	6.1	8	10	1.6	3.3
2025	3.6	5.6	5	9	1.3	3.1
2035	3.4	5.1	5	8	1.9	3.0
2045	3.1	4.7	5	6	2.3	3.2

There are so many changes in the assumptions (for which few reasons are mentioned in the 2005 AR) it is impossible to isolate and estimate the effect of any specific change. While, over a three year period, there may be trends and new information which merit changes in some assumptions, it is unusual for so many assumptions to be revised. In any event the justifications for changes in assumptions should be stated in the actuarial report.

7. Communication of results

The 2005 AR is a very informative document. It includes much detail, an Executive Summary and useful tables and charts. As noted in this peer review there are elements of an actuarial valuation which are missing from the text.

These omissions will not be of concern to general readers, but will be missed by technical readers (actuaries, economists, demographers, policy analysts, etc). The Report thus falls between the expectations and requirements of these two groups of readers.

For future triennial actuarial reviews, it would be useful to produce two reports, one for technical readers would be a more complete volume than the present report, and the other for general readers would be a much shorter summary. The short report could be published separately or annexed to a SSNIT Annual Report.

The full report would contain details of the SSNIT scheme provisions, and the data, methodology and assumptions used for the actuarial valuation, including complete data for each data series, full explanations (not just descriptions) of all assumptions and identification of changes in data sources, methods and assumptions since the preceding valuation, and the effect of the changes on the valuation results.

The short report would contain the results of the actuarial review including sensitivity tests, reconciliations and a summary of the SSNIT scheme provisions, and data, methodology and assumptions.

Both reports must emphasize that the results of the actuarial review's projections are not predictions. They present the outcomes if all of the assumptions were to come true in the future. It is important that the uncertainty inevitably involved in the estimates be understood.

Annex A

Fund Account at 31 December 2005 (cedis million)
(SSNIT Annual Reports)

	2003	2004	2005
Income			
Contributions received	1,340,220	1,632,531	1,905,767
Investment income	680,479	817,443	765,619
Other income	20,516	41,850	12,119
Total income	2,041,215	2,491,824	2,683,505
Expenditure			
Benefits paid			
Old-age and invalidity	232,418	359,482	496,991
Death and survivors	57,456	87,869	133,249
Provident Fund lump sum	12,180	-	-
Sub-total benefits	302,054	447,351	630,240
General and administrative expenses	266,505	369,163	401,033
Total expenditures	568,559	816,514	1,031,273
Surplus of income over expenditure	1,472,656	1,675,310	1,652,232
Transfer to NHIS Scheme	-	-233,219	-272,252
Net change in value of investments	872,206	1,123,119	-868,032
Net current year movement	**2,344,862**	**2,565,210**	**511,948**
Net assets at 1 January	3,870,010	6,214,872	8,780,082
Net current year movement	2,344,862	2,565,210	511,948
Net assets at 31 December	**6,214,872**	**8,780,082**	**9,292,030**

Annex B

Net Assets Statement at 31 December 2005 (cedis million)
(SSNIT Annual Reports)

	2003	2004	2005
Long term investments			
Equities	1,722,275	3,233,193	2,825,402
Corporate loans	278,798	565,602	980,741
Bonds (Government, HFC)	203,893	154,983	171,682
Sub-total	2,204,966	3,953,778	3,977,825
Student loans	803,903	941,800	1,147,780
Property	296,551	282,407	279,078
Real estate under construction	508,224	621,204	706,372
Sub-total	804,775	903,611	985,450
Associated units	35,212	47,193	92,768
Sub-total long term investments	**3,848,856**	**5,846,382**	**6,203,823**
Property, plant and equipment	78,923	96,898	85,650
Sub-total	3,850,859	5,848,386	6,205,828
Current assets			
Stock	4,003	4,940	5,956
Debtors	123,732	138,173	190,898
	127,735	143,113	196,854
Short term investments			
Term deposits/Treasury bills	1,802,665	2,544,258	2,878,004
Other	547,322	409,053	227,374
Sub-total short term investments	**2,349,987**	**2,953,311**	**3,105,378**
Cash and bank balances	15,609	7,127	55,922
Sub-total current assets	2,493,331	3,103,551	3,358,154
Total assets	**6,421,110**	**9,046,831**	**9,647,627**
Current liabilities	**206,238**	**266,749**	**355,597**
Total assets less current liabilities	**6,214,872**	**8,780,082**	**9,292,030**

Annex C

2005 Actuarial Valuation Mortality Table
(Table applied in 2005)

	Probability of death (per 1000)			Probability of death (per 1000)	
Age	**Males**	**Females**	**Age**	**Males**	**Females**
0	91.375	79.594	50	13.865	10.647
1	19.655	20.986	51	14.900	11.436
2	10.095	11.128	52	16.035	12.305
3	6.415	7.143	53	17.260	13.254
4	4.545	5.060	54	18.580	14.292
5	3.460	3.815	55	20.015	15.421
6	2.770	3.009	56	21.560	16.659
7	2.310	2.461	57	23.230	18.008
8	2.005	2.082	58	25.030	19.476
9	1.810	1.823	59	26.970	21.064
10	1.700	1.654	60	29.070	22.802
11	1.660	1.564	61	31.325	24.680
12	1.690	1.545	62	33.755	26.727
13	1.780	1.594	63	36.370	28.945
14	1.905	1.694	64	39.180	31.342
15	2.070	1.843	65	42.210	33.940
16	2.265	2.032	66	45.455	36.757
17	2.470	2.242	67	48.945	39.804
18	2.680	2.471	68	52.690	43.091
19	2.895	2.700	69	56.705	46.648
20	3.100	2.929	70	61.015	50.484
21	3.290	3.158	71	65.620	54.621
22	3.475	3.367	72	70.555	59.087
23	3.640	3.557	73	75.830	63.884
24	3.795	3.736	74	81.465	69.060
25	3.940	3.886	75	87.480	74.617
26	4.085	4.035	76	93.905	80.583
27	4.215	4.155	77	100.735	86.980
28	4.345	4.265	78	108.015	93.846
29	4.485	4.374	79	115.750	101.183
30	4.630	4.474	80	123.960	109.039
31	4.780	4.564	81	132.670	117.416
32	4.945	4.664	82	141.890	126.352
33	5.130	4.764	83	151.645	135.869
34	5.335	4.884	84	161.940	145.977
35	5.560	5.004	85	172.790	156.704
36	5.815	5.144	86	184.210	168.072
37	6.095	5.304	87	196.200	180.080
38	6.410	5.484	88	208.780	192.749
39	6.760	5.694	89	221.945	206.088
40	7.150	5.934	90	235.685	220.097
41	7.580	6.203	91	250.005	234.778
42	8.050	6.513	92	264.895	250.128
43	8.575	6.853	93	280.345	266.130
44	9.145	7.242	94	296.325	282.772
45	9.775	7.671	95	312.825	300.034
46	10.455	8.151	96	329.815	317.877
47	11.205	8.690	97	347.260	336.272
48	12.020	9.279	98	365.125	355.176
49	12.900	9.928	99	1000.000	1000.000