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Confidentialité : ☐ NON ☑ OUI (Durée : ☐ 1 an ☑ 2 ans)

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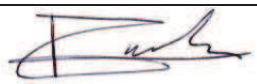

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Synthesis

Key Words
IFRS 4 - Insurance contracts, Phase I, Phase II, Exposure Draft, Provisions, Measurement model, Blocks vision, Cash flows, Fulfilment value, Discount rate, Best Estimate, Risk adjustment, Residual margin, Composite margin, Accounting, Statement of comprehensive income, Income Statement, P&L, Statement of financial position, Balance Sheet

> *"An **insurance contract** is a contract under which one party (the **insurer**) accepts **significant insurance risk** from another party (the **policyholder**) by agreeing to compensate the policyholder if a specified uncertain future event (the **insured event**) adversely affects the policyholder."*

This definition points out the main specificity of the insurance business which is that the insurer's service is subject to uncertainty and follows the premium payments from the policyholder.
It leads to the crucial interrogation of the insurance business:

> *Will the insurer be able to face his commitment?*

Thus, the asset and liability management is particularly important for an insurer.

On the 31^{st} March 2004, *International Financial Reporting Standard 4 - Insurance contracts* has been published. This is a temporary standard allowing the continuation of current practices such as US GAAP (the US Generally Accepted Accounting Principles) or Swiss GAAP (the Swiss statutory accounting regime).
The International Accounting Standard Board (IASB) and the Financial Accounting Standards Board (FASB) are commonly working on the second phase of the *IFRS 4 - Insurance contracts* project in order to improve consistency, comparability and efficiency of the financial reporting for insurance contracts.

On the 30^{th} July 2010, an *Exposure Draft - Insurance contracts* has been published as the result of discussions following the publication of *Preliminary Views on Insurance Contracts* in May 2007.

This second phase of *IFRS 4 - Insurance contracts* proposes a measurement model based on a four-block vision, which considers the insurance liability as the sum of:

1. The expected value of the future cash flows arising from the insurance contract
2. A discount rate adjusting these cash flows for the time value of money
3. An explicit risk adjustment reflecting the uncertainty about the amount and timing of those future cash flows
4. A residual margin eliminating any gain at inception of the contract

The final *IFRS 4 - Insurance contracts* standard is expected at the earliest in 2013 with first applications surely not required before January 2015.

To study the impacts of the second phase of *IFRS 4 - Insurance contracts* on the provisions calculation, on the data requirements and on the accounting, an analysis of two typical products of the Swiss insurance market has been conducted.
A traditional mixed endowment insurance and an old age annuity have been evaluated under both phases of the project.

The introduction of this new measurement model requires reflections about several concepts such as:

What are the cash flows linked to the insurance contract?

The IASB describes his first block as the explicit, unbiased and probability-weighted estimate of the future cash flows that will arise as the insurer fulfils the insurance contract. Before dealing with their estimation, the cash flows relevant for each contract have to be identified.

What is the appropriate discount rate reflecting the time value of money?

The proposals in the *Exposure Draft* do not prescribe a discount rate or a method to estimate it. Therefore, the insurer has to choose how to determine a rate that is consistent with observable current market prices and that excludes risks not relevant to the insurance contract liability.

How to determine the risk adjustment?

To cover the risk that the ultimate fulfilment cash flows exceed those expected, the IASB proposed to develop an explicit risk adjustment. Nevertheless, the board allows its determination either following a Cost of Capital approach, a confidence level (Value at Risk) approach or a conditional tail expectation (Tail Value at Risk) approach.

Should the residual margin be remeasured at each reporting period?

The idea in the *Exposure Draft* is to define the residual margin once at the inception of the insurance contract to ensure that the insurer does not realise any gain. However, the IASB may redefine this margin requiring its remeasurement each year.

How will the presentation of the insurance contract change?

The insurer has to adopt a brand new presentation of his statement of comprehensive income (Income Statement also known as Profit and Loss) and of the statement of financial position (Balance Sheet).

When should the insurance contract be recognised?

The first thought of the IASB was to recognise the insurance contract asset or liability as soon as the insurer becomes a party to the insurance contract, which is on the earlier of when he is bound by the terms of the contract or when he is first exposed to risk. Nevertheless, the board may finally consider that the insurance asset or liability should be recognised at the beginning of the coverage period. As the insurer can become a party to the contract before the start of the coverage period, this point requires discussions and clarifications.

Reflections and discussions on these questions will lead to a final standard improving insurers' provisioning and information about their financial position and performance on international markets.

Synthèse

Mots Clés
IFRS 4 - Contrats d'assurance, Phase I, Phase II, Exposé Sondage, Provisions, Modèle d'évaluation, Vision par blocs, Flux de trésorerie, Valeur de réalisation, Taux d'actualisation, Best Estimate, Ajustement pour risque, Marge résiduelle, Marge composite, Comptabilité, Compte de résultat, Bilan comptable

> *"Un* ***contrat d'assurance*** *est un contrat selon lequel une partie (l'****assureur****) accepte un* ***risque d'assurance significatif*** *d'une autre partie (le* ***titulaire de la police****) en convenant d'indemniser le titulaire de la police si un événement futur incertain spécifié (l'****événement assuré****) affecte de façon défavorable le titulaire de la police."*

Cette définition d'un contrat d'assurance met en avant la particularité du milieu assuranciel, à savoir son cycle de production inversé. En effet, les primes payées par l'assuré précèdent le service, soumis à incertitude, rendu par l'assureur.
Ceci mène à la principale interrogation du secteur des assurances :

> *L'assureur sera-t-il capable de faire face à ses engagements ?*

Le gestion actifs-passif des assurances est donc particulièrement importante.

Le 31 mai 2004, est paru *International Financial Reporting Standard 4 - Contrats d'assurance*. Ce texte est un standard temporaire autorisant les assureurs à continuer leurs pratiques comptables actuelles, telles que US GAAP (US Generally Accepted Accounting Principles) ou Swiss GAAP (le régime comptable statutaire en Suisse).
Le bureau des standards comptables internationaux (International Accounting Standard Board, IASB) et le comité des normes comptables et financières (Financial Accounting Standards Board, FASB) travaillent actuellement sur la seconde phase du projet *IFRS 4 - Contrats d'assurance* en vue d'améliorer l'efficacité et la comparabilité des normes comptables applicables aux contrats d'assurance.

Le 30 juillet 2010, un *Exposé Sondage - Contrats d'assurance* a été publié suite aux discussions concernant le texte *Avis préliminaire sur les contrats d'assurance* paru en mai 2007.

La seconde phase du projet *IFRS 4 - Contrats d'assurance* propose un modèle d'évaluation basé sur une vision par blocs qui considère la dette de l'assureur comme la somme de :

1. La valeur attendue des futurs flux de trésorerie dérivant du contrat d'assurance
2. Un taux d'actualisation ajustant ces flux futurs pour la valeur temps de l'argent
3. Un ajustement pour risque explicite refletant l'incertitude liée aux montants et à la date de ces flux futurs
4. Une marge résidiuelle éliminant tout gain à l'origine du contrat

La publication du standard final *IFRS 4 - Contrats d'assurance* est attendue au plus tôt en 2013, ce qui ne permettrait pas de premières applications avant janvier 2015.

Pour étudier l'impact de la seconde phase d'*IFRS 4 - Contrats d'assurance* sur le calcul des provisions et sur la présentation comptable des contrats d'assurance, une analyse de deux produits courants sur le marché assurantiel suisse a été menée.
Une assurance mixte traditionnelle et une rente viagère ont été évaluées suivant les exigences des deux phases du projet.

L'introduction du nouveau modèle d'évaluation par blocs nécessite notamment de s'interroger sur les differents point suivants :

Quels sont les flux de trésorerie liés au contrat d'assurance ?

L'IASB décrit le premier bloc de son modèle d'évaluation comme une estimation explicite, non biaisée et probabilisée des futurs flux de trésorerie liés à l'activité d'assurance. Avant même de s'intéresser à leur estimation, les flux futurs relatifs au contrat et pertinents pour l'étude du passif doivent être identifiés.

Quel taux d'atualisation reflète la valeur temps de l'argent ?

Les propositions faites dans l'*Éxposé Sondage* ne prescrivent pas de taux d'actualisation précis ou de méthode pour sa détermination. Chaque assureur se doit d'estimer un taux cohérent avec les informations disponibles sur les marchés financiers et excluant les risques non relatifs à l'opération d'assurance.

Comment déterminer l'ajustement pour risque ?

Pour couvrir le risque que les flux de trésorerie finaux soient supérieurs à ceux attendus, l'IASB propose de développer un ajustement pour risque explicite. Néanmoins, le choix de sa méthode de détermination revient à l'assureur qui peut opter pour une approche utilisant le Coût du Capital, la Value at Risk ou encore la Tail Value at Risk.

La marge résiduelle doit-elle être ré-évaluée à chaque période ?

L'*Éxposée Sondage* préconise de définir la marge résiduelle à la souscription du contrat de manière à annuler tout gain éventuel réalisé par l'assureur et de ne pas la recalculer. Néanmoins, l'IASB pourrait revenir sur cette description en recommandant la ré-évaluation de cette marge à chaque début de période.

Quelles seront les modifications comptables liées à ce nouveau standard ?

Lors de la mise en vigueur d'*IFRS 4 - Contrats d'assurance*, l'assureur devra adopter une nouvelle présentation comptable différant de la présentation actuelle aussi bien au point de vue du compte de résultat qu'au point de vue du bilan.

Quand le contrat doit il être reconnu ?

L'IASB a dans un premier lieu envisagé que la reconnaissance du contract devait avoir lieu aussitôt que l'assureur devient partie à l'opération d'assurance, c'est à dire dès qu'il est lié par les termes du contrat ou dès qu'il est exposé aux risques couverts par le contrat.
Néanmoins, cette description pourrait être modifiée et la reconaissance du contrat pourrait coïncider avec le début de la période de couverture. Sachant qu'il existe des situations dans lesquelles l'assureur est partie au contrat d'assurance avant que ne débute la période de couverture, ce point nécessite discussions et clarifications.

Le standard final résultera des reflections et des discussions concernant les questions prédédentes.

Contents

Introduction

> *"Insurance: An ingenious modern game of chance in which the player is permitted to enjoy the comfortable conviction that he is beating the man who keeps the table."*
> Bierce Ambrose G. *The Cynic's Word Book*. 1906. p197.

> *"What the insurance companies have done is to reverse the business so that the public at large insures the insurance companies."*
> Spence Gerry. *Humanscape: Environments for People*. 1987. p97.

The specificity of the insurance coverage is that the insurer's service is subject to uncertainty and follows the premium payments from the policyholder. It leads to the crucial interrogation of the insurance business:

> *Will the insurer be able to face his commitment ?*

Thus, the asset and liability management is particularly important for an insurer.

Considering the complaint of the investors community concerning the unclear and insufficiently detailed information about insurers' financial position and performance, the International Accounting Standards Committee (IASC) started a comprehensive insurance contracts project in 1975.

On the 1^{st} April 2001, the International Accounting Standards Board (IASB) succeeded to the committee on this project to improve the accounting for insurance contracts. Following an exposure draft published in July 2003, the 31^{st} March 2004 the IASB issued an International Financial Reporting Standard, *IFRS 4 - Insurance contracts*, to specify the financial reporting for insurance contracts. As this standard is the result of the first phase of the IASB's project, the insurance industry commonly refers to it as *IFRS 4 - Insurance contracts - Phase I* or as *IFRS 4 - Phase I*.

Since the application of this standard on the 1^{st} January 2005, any entity that issues insurance contracts should report under *IFRS 4 - Phase I* which allows the continuation of current accounting practices. Swiss companies usually either refer to US GAAP (the

US Generally Accepted Accounting Principles) or to Swiss GAAP (the Swiss statutory accounting regime).

In 2006, the Financial Accounting Standards Board (FASB) joined the project and is currently working together with the IASB in order to improve consistency, comparability and efficiency on global markets. The two boards are commonly working on the second phase of the project to develop an international guidance on accounting for insurance contracts which would provide relevant and sufficiently detailed information about insurers' financial position and performance.

On the 30^{th} of July 2010, an *Exposure Draft* to this second phase of *IFRS 4 - Insurance contracts* has been published as the result of discussions following the publication of the paper *Preliminary Views on Insurance Contracts* in May 2007.
The financial industry refers to this as *Exposure Draft*, as *IFRS 4 - Insurance contracts - Phase II* or simply as *IFRS 4 - Phase II*.

This second phase of *IFRS 4* proposes a measurement model based on a four-block vision, which considers the insurance liability as the sum of:

1. The expected value of the future cash flows arising from the insurance contract
2. A discount rate adjusting these cash flows for the time value of money
3. An explicit risk adjustment reflecting the uncertainty about the amount and timing of those future cash flows
4. A residual margin eliminating any gain at inception of the contract

This proposition of measurement model is the central element of the *IFRS 4 - Phase II*.
Until the 30 November 2010 the various readers and users have been able to comment this paper and to address their opinion to the two boards.
The IASB and the FASB have reviewed the feedbacks and are leading discussions about possible adjustments to the proposals in the *Exposure Draft*.

The modified standard was expected in the second half of 2011 with an introduction not required before 2013. Nevertheless, the market is today rather expecting another draft in 2012. Thus the final standard is expected at the earliest in 2013 and its first application would surely not be required before January 2015 or even later.

The future introduction of the new standard will lead to huge changes on financial markets. Insurers need to get prepared to these provisioning and accounting modifications. Therefore, they are currently studying the proposals in the *Exposure Draft* and the impacts that would result to this new regulation.

In this context, the purpose of this master report is the study of the new *IFRS 4 - Insurance contracts - Phase II* impacts on:

1. The provisions calculation
2. The data requirements
3. The statement of financial position:
   The Balance Sheet
4. The statement of comprehensive income:
   The Income Statement also called Profit and Loss (P&L)

To reach this goal, an impact analysis based on two typical products of the Swiss insurance market has been conducted. This work presents the changes in provisions modeling and in accounting for a traditional mixed endowment insurance and for an old age annuity.

The first part of this report will be dedicated to the presentation of the *IFRS 4 - Insurance contracts* project and to reflections about the new measurement model adopting the four-block vision.
The next parts will concern the application of the standards to the traditional mixed endowment and to the old age annuity in view to conclude with the study of the results.

Part I

PwC

Headquartered in London, PwC is an international firm delivering industry-specific auditing, tax and legal advice and business consultancy services. With more than 161'000 employees in 766 cities across 154 countries, it is the world's second-largest professional services firm and one of the "Big Four" accountancy firms.

History

In 1849, the accountant Samuel Lowell Price set up in business in London. In 1865, he joined forces into partnership with William Hopkins Holyland and Edwin Waterhouse, but quickly after Holyland chose to work alone and the firm changed name to *Price, Waterhouse & Co.* in 1874. The accounting firm developed itself and gained recognition to become the worldwide firm *Price Waterhouse* in 1982.

In 1854, William Cooper established his own practice in London and was joined by his three brothers seven years later to form *Cooper Brothers*.

In 1898, Robert H. Montgomery, William M. Lybrand, Adam A. Ross Jr. and his brother T. Edward Ross formed in the USA *Lybrand, Ross Brothers & Montgomery*.

In 1910, George McDonald started his accounting practice on St. James Street in Montreal, Québec. One year later, he was joined by his cousin George Currie and the name *McDonald, Currie & Co.* was officially adopted in 1920.

In 1957, the English firm *Cooper Brothers & Co.*, the Canadian firm *McDonald, Currie & Co.* and the American firm *Lybrand, Ross Brothers & Montgomery* merged to form the international firm *Coopers & Lybrand*.

Pricewaterhouse Coopers was formed in 1998 by the worldwide merger of the two large firms *Price Watherhouse* and *Coopers & Lybrand*. Since September 2010, the firm uses the shorter name *PwC*.

PwC Global

As a multicompetency firm, PwC provides assurance, tax and legal, and financial and business advisory services to large and smaller clients.
Therefore, the three main service lines of the company are:

- **Assurance**
  This auditing service represents the principal activity of the firm.
- **Tax and legal services**
  Among others, Pwc deals with international tax planning, local tax laws or human resource consulting.
- **Advisory**
  The company offers financial and business consulting services in specific areas such as accountancy and actuarial advisory.

Thanks to its corporate values, which are excellence, teamwork and leadership, PwC successfully managed to rank itself among the best.
Since 2002, the expression Big Four refers to the world largest accountancy and professional services firms: Deloitte, PwC, Ernst & Young and KPMG.
With a revenue of 26.6 billion of US Dollars in 2010, PwC is recognised as the second international auditor, as illustrated on the following table:

Table 1: Revenues of the Big Four Auditors for 2010

Big Four Auditors	**Revenue in billion of USD**	**Comparison with 2009**
Deloitte	26.578	+1.8%
PwC	26.569	+1.5%
Ernst & Young	21.300	+0.14%
KPMG	20.630	+2.6%

Source: PwC internal informations, September 2011.

This global revenue of 26.6 billion of USD has been generated as follows:

- 50%, about 13.3 billion, by the assurance practice
- 26.7%, about 7.1 billion, by the tax and legal consulting practice
- 23.3%, about 6.2 billion, by the advisory practice

PwC Switzerland

In Switzerland, PwC is the market leader measured by gross revenue with 704 million of CHF (corresponding to a net revenue of 614 million):

Table 2: Market position in Switzerland for 2010

Big Four Auditors	**Revenue in million of CHF**	**Comparison with 2009**
PwC	704	-1%
Ernst & Young	507.3	-1.1%
KPMG	435	-0.9%
Deloitte	222	+10%

Source: PwC internal informations, September 2011.

This Swiss revenue of 704 million of CHF has been generated as follows:

- 53.7%, about 378 million (354 million net), by the auditing
- 32.7%, about 230 million (180 million net), by the tax and legal consulting
- 13.6%, about 96 million (80 million net), by the business consulting

The firm employs 2'623 people of 58 nationalities across 15 offices, including Basel, Genève, Lausanne, Lugano and Zürich. They are distributed between the four lines of service:

- 1'246 employees in assurance
- 672 employees in tax and legal services
- 295 employees in advisory
- 410 employees in internal services

Part II

IFRS 4 - Insurance Contracts

The investors community is of the opinion that insurance accounting does not provide sufficiently detailed information about insurers' financial position and performance. Therefore, the IASB and the FASB are working since the 1^{st} April 2001 on a project to develop an international guidance on accounting for insurance contracts.

Following an exposure draft published on the 31^{st} July 2003, the 31^{st} March 2004 the IASB issued *IFRS 4 - Insurance contracts* to specify insurance contracts financial reporting. This standard is the result of the first phase of the IASB's project, therefore, we will refer to it as *IFRS 4 - Insurance contracts - Phase I* or *IFRS 4 - Phase I*.

Since its introduction the 1^{st} January of 2005, any entity that issues insurance contracts (described in the IFRS as an insurer) must report under *IFRS 4 - Phase I*. In particular, *IFRS 4 Phase I* allows the continuation of current accounting practice. Thus, Swiss companies usually either refer to US GAAP (US Generally Accepted Accounting Principles) or to Swiss GAAP (the Swiss statutory accounting regime).

In the meantime, the IASB and the FASB are working on the second phase of the model for insurance contracts, we will talk about *IFRS 4 - Insurance contracts - Phase II* or *IFRS 4 - Phase II*. On the 30^{th} of July 2010, an *Exposure Draft* to this second phase has been published as the result of discussions following the publication of the discussion paper *Preliminary Views on Insurance Contracts* in May 2007.

Proposals in the *Exposure Draft* aim to eliminate inconsistencies and weaknesses in existing practices by defining a comprehensive framework requiring insurers to provide relevant informations for economic decision making and by providing comparability across entities, jurisdictions and capital markets.

Until the 30^{th} November 2010 the various readers and users have been able to comment this paper. The two boards, IASB and FASB, have reviewed the feedbacks and are leading discussions about possible adjustments to the proposals in the *Exposure Draft*. The new modified standard was expected by the second half of 2011 and its introduction by 2013. However, currently, the observers are rather expecting another proposal in 2012 and therefore, the new insurance contracts standard is not expected to be effective before January 2015 at the earliest.

Following chapters are analysing *IFRS 4 - Insurance contracts - Phase I* and *Exposure Draft* proposals guidance that may still be different in the future final standard.

Chapter 1

Scope of *IFRS 4 - Insurance contracts*

IFRS 4 -Insurance contracts should be applied to any entity dealing with insurance or reinsurance contracts although it might not be legally or regulatory recognised as an insurance company.
Such entity shall apply *IFRS 4 - Insurance contracts* to:

- Issued insurance contracts
- Issued reinsurance contracts
- Held reinsurance contracts linked to an assuming insurance contract
- Issued financial instruments with a discretionary participation feature

In this context, the definitions of an insurance contract, a reinsurance contract and a discretionary participation feature need to be clarified.

1.1 Insurance contract

Under both *IFRS 4 - Insurance contracts - Phase I* and the *Exposure Draft* of *IFRS 4 - Phase II*, an insurance contract is defined as follows:

> *"An **insurance contract** is a contract under which one party (the **insurer**) accepts **significant insurance risk** from another party (the **policyholder**) by agreeing to compensate the policyholder if a specified **uncertain future event** (the **insured event**) adversely affects the policyholder."*
> IASB. *Exposure Draft - Insurance Contracts.* July 2010.[1]

This definition is based on the transfer of a significant insurance risk from the policyholder to the insurer.

[1] All quotes will refer to this source unless another one is notified.

Not only insurance companies but any entity dealing with insurance contracts is described in the standard as an insurer.
Under this definition, the essence of an insurance contract is uncertainty. Indeed, at the inception of an insurance contract, there must be an uncertainty on whether:

- An insured event will occur
- When the insured event will occur
- How much the insurer will need to pay if the insured event occurs

To clarify this idea, the standard gives the following definitions:

> *"An **insurance risk** is a risk, other than **financial risk**, transferred from the holder of a contract to the issuer."*

> *"A **financial risk** is the risk of a possible future change in one or more of a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract."*

> *"An insurance risk is **significant** if, and only if, an insured event could cause an insurer to pay significant additional benefits in any scenario, excluding scenarios that lack commercial substance (have no discernible effect on the economics of the transaction)."*

As mentioned earlier, the definition of an insurance contract remains the same from the first phase to the second phase of *IFRS 4*. Nevertheless, a clarification is done regarding the definition of a significant insurance risk:

- There must be a scenario in which the present value of net cash outflows can exceed the present value of the premiums
- The effect of the time value of money must be taken into account when determining the significance of benefits payable on an insured event

1.2 Reinsurance contract

Whatever the phase or the comments, everybody seems to agree on the following definition of a reinsurance contract:

> *"A **reinsurance contract** is an **insurance contract** issued by one insurer (the **reinsurer**) to compensate another insurer (the **cedant**) for losses on one or more contracts issued by the cedant."*

1.3 Discretionary participation feature

Proposals and comments under the second phase of *IFRS 4 -Insurance contracts* project retain the first phase definition and consider a discretionary participation feature as follows:

> *"A **discretionary participation feature** is a contractual right to receive, as a supplement to **guaranteed benefits**, additional benefits:*
>
> - *that are likely to be a significant portion of the total contractual benefits;*
> - *whose amount or timing is contractually at the discretion of the issuer; and*
> - *that are contractually based on:*
>   - *the performance of a specified pool of contracts or a specified type of contract;*
>   - *realised and/or unrealised investment returns on a specified pool of assets held by the issuer;or*
>   - *the profit or loss of the company, fund or other entity that issues the contract."*

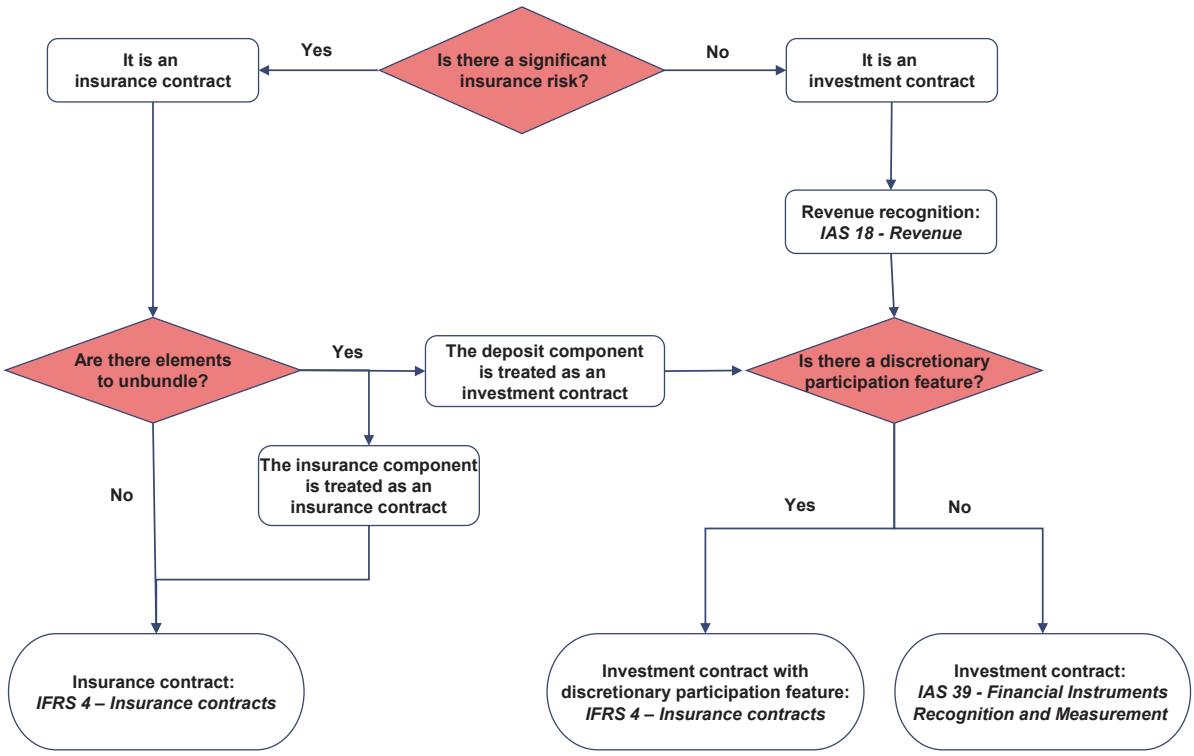
With the adding definition of guaranteed benefits:

> *"**Guaranteed benefits** are payments or other benefits to which a particular **policyholder** or investor has an unconditional right that is not subject to the contractual discretion of the issuer."*

This definition allows discretionary participation feature to be contained either in insurance contracts or in financial instruments. In each of these cases it will enter into the scope of *IFRS 4 -Insurance contracts*.

This description of *IFRS 4 - Insurance contracts* scope can be illustrated by the following classification tree:

Table 1.1: Classification tree



Chapter 2

Recognition of the contract

The concept of recognition refers to the integration in the Balance Sheet or in the Income Statement of some elements.

> *Under IFRS 4, what and when shall an insurer recognise his insurance contracts ?*

2.1 Elements to recognise

> *What shall an insurer recognise ?*

Depending on the situation, the insurer has the obligation to recognise either an insurance contract asset or an insurance contract liability which definitions are given by the standard:

> *"An **insurance contract asset** is an insurer's net remaining contractual rights less obligations under an insurance contract, if the rights exceed the obligations."*

> *"An **insurance contract liability** is an insurer's net remaining contractual obligations less rights under an insurance contract, if the obligations exceed the rights."*

2.2 Recognition period

> *When shall an insurer apply IFRS 4 -Insurance contracts to contracts in the scope ?*

To answer this question, the standard defines the recognition period of an insurance contract. This period is characterised by its date of beginning, we talk about recognition, and its date of end, we talk about derecognition.
These concepts are defined in the next two sections.

2.2.1 Recognition

An insurer shall recognise an insurance contract asset or an insurance contract liability as soon as he becomes a party to the insurance contract, which is on the earlier of the following two dates:

- When he is bound by the terms of the insurance contract:
  This is the date on which the contract is signed.
- When he is first exposed to risk under the contract:
  This is the date when he can no longer withdraw from its obligation to provide insurance coverage to the policyholder for insured events and no longer has the right to reassess the risk of the particular policyholder and, as a result, cannot set a price that fully reflect that risk.

Following responses to the publication of the exposure draft, the Board has reviewed this proposal for the final standard and may consider that insurance contract liabilities and assets should only be recognised when the coverage period begins.

> *"The **coverage period** is the period during which the insurer provides coverage for insured events."*

We have to be careful that an insurer can become a party to an insurance contract before the beginning of the coverage period. Therefore, in case the new definition would be adopted, further consideration would be necessary concerning contracts where insurance services are provided long before the coverage period starts, such as some annuities.

2.2.2 Derecognition

Following the proposals in the exposure draft,

> *"An insurer shall remove an insurance contract liability (or a part of an insurance contract liability) from its statement of financial position when, and only when, it is **extinguished** (ie when the obligation specified in the insurance contract is discharged or cancelled or expires). At that point, the insurer is no longer at risk and is therefore no longer required to transfer any economic resources to satisfy the insurance obligation."*

Chapter 3

Unbundling of the contract

In some cases, a contract can be seen as the combination of several components such as insurance or investment components. These ones can be within the scope of different standards and may, therefore, have to be separated for the reporting.
If a component is not closely related to the insurance coverage, the insurer shall account for it separately. This is called unbundling the component, which formal definition is given by the standard:

> *"To **unbundle** is to account for the components of a contract as if they were separated contracts, according to their nature."*

3.1 General description

In addition to their insurance component, insurance contracts can contain several other components such as investment, financial or service components. In such cases, where the insurance contract contains both an insurance component and a deposit component (including any embedded options), there are three cases in which the insurer can either be required, permitted or prohibited to unbundle those components:

1. If the insurer cannot measure the deposit component separately, means without considering the insurance component (ie the deposit component is closely related to the insurance coverage):
   Then unbundling is forbidden

2. If the insurer can measure the deposit component separately:

   - If the insurer's accounting policies require it to recognise all obligations and rights arising from the deposit component:
     Then unbundling is permitted but not required
   - If the insurer's accounting policies do not otherwise require it to recognise all obligations and rights arising from the deposit component:
     Then unbundling is required

Unbundling an insurance contract consists in applying:

- *IFRS 4 - Insurance contracts* to the insurance component
- *IAS 39 - Financial Instruments: Recognition and Measurement* to the investment component

3.2 Embedded derivatives

Some insurance contracts may be considered as the combination of both a host contract and an embedded derivative, which definition is given in *IAS 39 - Financial Instruments: Recognition and Measurement*:

> *"An **embedded derivative** is a component of a hybrid (combined) instrument that also includes a non-derivative host contract - with the effect that some of the cash flows of the combined instrument vary in a way similar to a stand-alone derivative."*
> IASB. *IAS 39 - Financial Instruments: Recognition and Measurement.* 1998.

Embedded derivatives are just a specific example of financial instrument described in the previous section. Therefore, an insurer may have to separate it from their host contract (the insurance contract under *IFRS 4*):

> *"An embedded derivative shall be separated from the host contract and accounted for as a derivative under IAS 39 if, and only if:*
>
> - *the economic characteristics and risks of the embedded derivative are not closely related to the economic characteristics and risks of the host contract;*
> - *a separate instrument with the same terms as the embedded derivative would meet the definition of a **derivative**; and*
> - *the hybrid (combined) instrument is not measured at **fair value** with changes in fair value recognised in profit or loss (ie a derivative that is embedded in a financial asset or financial liability at fair value through profit or loss is not separated)."*
>
> IASB. *IAS 39 - Financial Instruments: Recognition and Measurement.* 1998.

To fully understand this definition the concepts of derivative and fair value have to be specified:

> *"A **derivative** is a financial instrument or other contract within the scope of IAS 39 with all three of the following characteristics:*
>
> - *its value changes in response to the change in a specified interest rate, financial instrument price, commodity price, foreign exchange rate,*

index of prices or rates, credit rating or credit index, or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract (sometimes called the "underlying");

- *it requires no initial net investment or an initial net investment that is smaller than would be required for other types of contracts that would be expected to have a similar response to changes in market factors; and*
- *it is settled at a future date."*

IASB. *IAS 39 - Financial Instruments: Recognition and Measurement.* 1998.

In other words, derivatives are financial instruments that "derive" their future value from an underlying price or index, without or with a small initial investment.

*"The **fair value** is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction."*
IASB. *IAS 39 - Financial Instruments: Recognition and Measurement.* 1998.

To summarise, *IAS 39 - Financial Instruments: Recognition and Measurement* applies to embedded derivatives in an insurance contract unless the embedded derivatives is itself an insurance contract. Therefore, if the financial instrument is not closely related to the insurance coverage, it must be unbundled and accounted for at fair value on the Balance Sheet with changes recognised in the Income Statement according to *IAS 39*.

We can illustrate this situation with the example of a contract denominated in a foreign currency. Following previous considerations, an embedded foreign currency would be created, separated from the host contract and recorded separately at fair value unless the economic and risk characteristics of the two components are similar.

Chapter 4

Valuation of the contract

To permit access to a better information of the insurer financial position, the valuation of his contracts must reflect the amount, the timing and the uncertainty of all its future cash flows.
While the first phase of *IFRS 4 - Insurance Contracts* allows insurers to continue their current accounting practices (US GAAP or Swiss GAAP), the proposals in the *Exposure Draft* define a measurement model that an insurer shall apply to all insurance contracts in the scope. A modified approach for some short duration contracts is also described in the *Exposure Draft*.

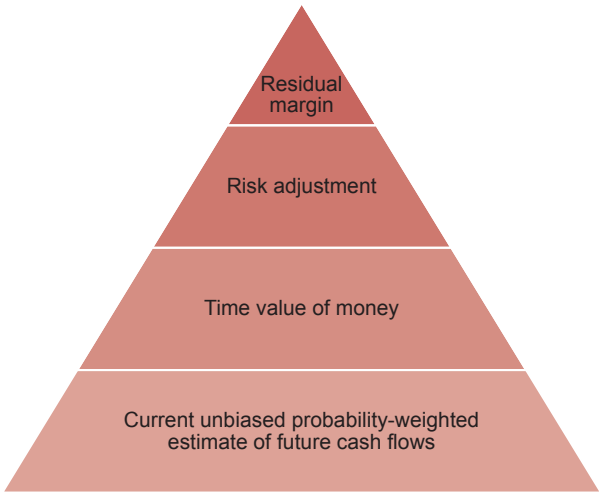
4.1 Measurement model

The measurement model is based on the principle that insurance contracts create a bundle of rights and obligations that work together to generate a package of cash inflows (premiums) and outflows (benefits, claims and costs). An insurer shall apply to that package of cash flows a measurement approach based on the following building blocks:

1. The expected value of the future cash flows arising from the insurance contract
2. A discount rate adjusting these cash flows for the time value of money
3. An explicit risk adjustment reflecting the uncertainty about the amount and timing of those future cash flows
4. A residual margin eliminating any gain at inception of the contract

This model is presented in a graphical way as follows:

Table 4.1: Measurement model proposed by IASB



The tree first blocks lead to the concept of fulfilment value. In fact, in the *Exposure Draft* proposals the comprehensive measurement model is described in a way that the insurer shall measure an insurance contract as the sum of:

1. The present value of the fulfilment cash flows
2. A residual margin that arises when the previous amount is negative to eliminate any gain at inception of the contract

Where the present value of the fulfilment cash flows is defined as the sum of three elements:

> *"The following building blocks constitute the* ***present value of the fulfilment cash flows****:*
>
> 1. *An explicit, unbiased and probability-weighted estimate (ie expected value) of the future cash outflows less the future cash inflows that will arise as the insurer fulfils the insurance contract;*
> 2. *A discount rate that adjusts those cash flows for the time value of money; and*
> 3. *An explicit estimate of the effects of uncertainty about the amount and timing of those future cash flows (risk adjustment)."*

This description is completed by the following definition:

> *"The **present value of the fulfilment cash flows** is the expected present value of the future cash outflows less future cash inflows that will arise as the insurer fulfils the insurance contract, adjusted for the effects of uncertainty about the amount and timing of those future cash flows."*

To summarise, the present value of the fulfilment cash flows is:

- A negative amount when:
  The expected present value of the future cash outflows plus the risk adjustment is less than the expected present value of the future cash inflows.
  In this situation, the insurer shall create a residual margin.

- A positive amount when:
  The expected present value of the future cash outflows plus the risk adjustment exceed the expected present value of the future cash inflows.
  In this situation, the insurer shall immediately recognise this positive amount as an expense in Profit and Loss.

This concept of fulfilment value succeed to the concept of exit value.
In the paper *Preliminary views on Insurance contracts* published in 2007, the IASB was describing his measurement model using the current exit value defined as:

> *"The **current exit value** is the amount the insurer would expect to pay at the reporting date to transfer its remaining contract rights and obligations immediately to another entity."*

This method would have been consistent with fair value accounting but has been rejected because of difficulties encountered in situations without observable values.
The current exit value has been replaced by the current fulfilment value in the *Exposure Draft*:

> *"The **current fulfilment value** is the expected present value of the cost of fulfilling the obligation to the policyholder over time."*

In the following sections, the four blocks of the IASB's measurement model will be analysed.

4.1.1 First block: The future cash flows

The cash flows arising from the insurance contract form the basis of the measurement model proposed by the IASB. Therefore, it is essential to estimate them to the best of our ability by showing as much and as relevant informations as possible. To achieve this purpose, the *Exposure Draft* proposes the following guidance:

> *"**Estimates of cash flows** for a portfolio of insurance contracts shall include all incremental cash inflows and cash outflows arising from that portfolio, and shall:*

- *be explicit:*
  separate from estimates of discount rates that adjust those cash flows for the time value of money and the risk adjustment that adjusts those cash flows for the effects of uncertainty about the amount and timing of those future cash flows
- *reflect the perspective of the entity but, for market variables, be consistent with observable market prices*
- *incorporate, in an unbiased way, all available information about the amount, timing and uncertainty of all cash flows that will arise as the insurer fulfils the insurance contract*
- *be current:*
  the estimates shall reflect all available information at the measurement date
- *include only those cash flows that arise from existing contracts:*
  cash inflows and cash outflows that arise within the boundary of those contracts."

One remaining question concerns the cash flows projection over the lifetime of the insurance contract:

> *How long should the insurer project the premium cash flows?*

Under the proposals in the *Exposure Draft*, the boundary of an insurance contract is the point at which an insurer either:

- is no longer required to provide coverage, or
- has the right or the practical ability to reassess the risk of the policyholder and, as a result, can set a price that fully reflects that risk.

As these cash flows are dispersed over the lifetime of the contract, they need to be discounted. This is part of the second block described in the next section.

4.1.2 Second block: The time value of money

The first proposal of the IASB and the FASB was to require a risk free rate plus a premium for illiquidity to adjust future cash flows for the time value of money and reflect the characteristics of the insurance contract liability. Nevertheless, following comments, the two boards have decided not to prescribe a discount rate or a precise method to estimate it but instead to provide guidance regarding matters to be considered in determining the appropriate rate:

> *"An insurer shall adjust the future cash flows for the time value of money, using* ***discount rates*** *that:*

- *are consistent with observable current market prices for instruments with cash flows whose characteristics reflect those of the insurance contract liability, in terms of, for example, timing, currency and liquidity*
- *exclude any factors that influence the observed rates but are not relevant to the insurance contract liability (eg risks not present in the liability but present in the instrument for which the market prices are observed).”*

Following this guidance, the discount rate should only reflect the effect of risks and uncertainties that are not reflected in other building blocks of the measurement model for insurance liability.
Furthermore, the discount rate should reflect the eventual link between assets and liabilities. This link exists for instance in case of profit sharing.
Both bottom-up and top-down approaches are allowed in the determination of this discount rate. Each insurer may decide to use the method he considers as the most appropriate depending on his risk characteristics:

- **The bottom-up approach**:
  The discount rate is deducted from a risk free rate by applying upward adjustments.
- **The top-down approach**:
  The discount rate is deducted from an asset-based rate by applying downward adjustments.
  In particular, the insurer should first determine an appropriate yield curve based on current market informations using his actual portfolio of assets as the reference portfolio. Then three kinds of adjustments have to be done to make the rate consistent with the characteristics of the liability:

  1. Adjustments for the difference between the timing of the asset portfolio (ie make the timing of cash flows consistent between assets and liabilities, make sure that the assets in the reference portfolio are matching with the duration of the liabilities)
  2. Adjustments for risks inherent in the assets not part of the liability
  3. Adjustments related to the difference in the liquidity characteristics between the assets and the liability

4.1.3 Third block: The risk adjustment

The purpose of this adjustment is to cover the effects of uncertainty about the amount and timing of future cash flows arising from an insurance contract.
The standard gives its formal definition:

> *“The **risk adjustment** shall be the maximum amount the insurer would rationally pay to be relieved of the risk that the ultimate fulfilment cash flows exceed those expected.”*[1]

[1] This definition is the result of lot of discussions

Therefore, as an explicit estimate of uncertainty of an insurance contract, the risk adjustment shall reflect all risks arising from this contract, and only those ones. It should not take into account investment risks not affecting amounts paid to policyholders, asset-liability mismatch risks or general operational risk.
Following the *Exposure Draft*:

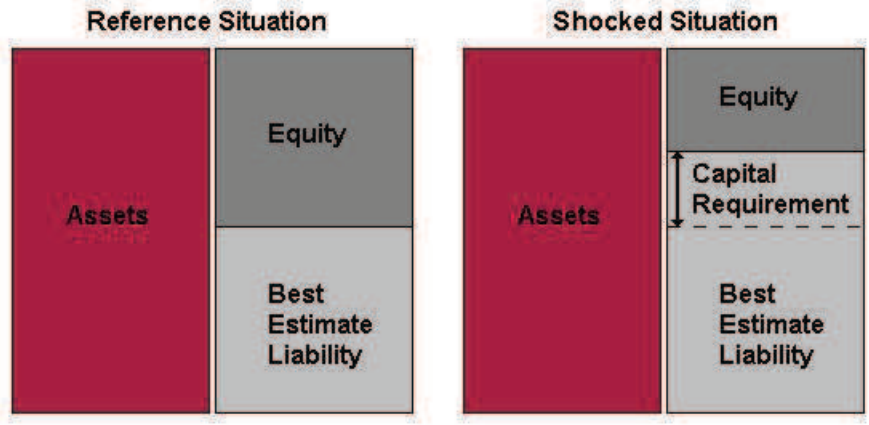
> *"An insurer shall estimate the **risk adjustment** at the level of a **portfolio** of insurance contracts. Therefore, the risk adjustment shall reflect the effects of diversification that arise within a portfolio of insurance contracts, but not the effects of diversification between that portfolio and other portfolios of insurance contracts."*

A portfolio is commonly defined as:

> *"A **portfolio** is a collection of insurance contracts that are subject to broadly similar risks and managed together as a single pool."*

The sum of the first and the second blocks gives the Best Estimate of liability which represents a basic scenario.
As the risk adjustment represents an additional amount the insurer should hold to cover his risks, it needs to be estimated by shocking basis assumptions (used for the determination of the Best Estimate).
The capital requirement deducted from the difference between the shocked liability and the Best Estimate of liability is the risk adjutsment.
These ideas lead to a risk adjustment which could be illustrated as below:

Table 4.2: Capital requirement



The three following approaches are allowed for the estimation of the risk adjustment:

1. **The Cost of Capital approach: CoC**
   The idea underneath this method is that the insurer have to hold and maintain a sufficient amount of capital to be able to face his obligations towards policyholders in case deviations from the Best Estimate amount of liability occur.
   This capital should be determined for each year of the insurance contract lifetime. The present value of the Cost of Capital is obtained by applying to these amounts a Cost of Capital factor and a discount factor.
   This Cost of Capital factor is usually set around 6%. This methodology can be summarised by the following formula:

   $$Risk\ adjustment = \sum_{i=1}^{n} Capital_i * Factor * v^i$$

   With

   - i : the period
   - n : the maturity of the contract
   - v : the discount rate
   - $Capital_i$: the amount of capital needed to fulfil the insurer obligations in period i

2. **The confidence level approach: Value at Risk (VaR)**
   The aim of this approach is to compensate uncertainty by adding an amount to the expected value in order to ensure with a set level of confidence that the insurer will be able to face his obligations.
   The probability space $(\Omega, \mathcal{F}, \mathbb{P})$ is set as the domain of all future random variables. In a first time, the probability distribution of the present value of the cash flows, usually noted f_X, needs to be estimated. Formally:

   $$f_X(x) = \mathbb{P}[X = x]$$

   The estimated cumulative distribution function, usually noted F_X, can be deducted from f_X. Formally:

   $$F_X(x) = \mathbb{P}[X \leq x]$$

   For a set confidence of level, $0 \leq \alpha \leq 1$, the Value at Risk is the smallest x such that the probability that X exceeds x is no larger than $1 - \alpha$.
   It is formally defined as follows:

   $$\begin{aligned} VaR_\alpha(X) &= inf\{x \in \mathbb{R} : \mathbb{P}(X > x) \leq 1 - \alpha\} \\ &= inf\{x \in \mathbb{R} : \mathbb{P}(X \leq x) \geq \alpha\} \\ &= inf\{x \in \mathbb{R} : F_X(x) \geq \alpha\} \\ &= F_X^{\leftarrow}(\alpha) \end{aligned}$$

Where $F_X^{\leftarrow}$ denotes the generalised inverse function of F_X.
This amount represents the provisions the insurer would need to hold to be able to face his obligations for the set confidence level α.
The risk adjustment is finally deducted by reducing this amount by $\mathbb{E}_{\mathbb{P}}(X)$ the mean of the distribution which is nothing else than the Best Estimate:

$$Risk\ adjustment = VaR_\alpha(X) - \mathbb{E}_{\mathbb{P}}(X)$$

3. **The conditional tail expectation approach: Tail Value at Risk (Tail VaR)**
Using this technique for the calculation of the risk adjustment, permits to take into consideration some potential extreme losses situated in the tail of the claim distribution.
As the Tail Value at Risk is a measure of expectation in the tail of the distribution, it permits to account for the severity as well as for the probability of a loss.
For $X \in \mathcal{L}(\mathcal{F})$ and $0 < \alpha < 1$:

$$\begin{aligned} TVaR_\alpha(X) &= \mathbb{E}_{\mathbb{P}}\left[X : X > VaR_\alpha(X)\right] \\ &= \mathbb{E}_{\mathbb{P}}\left[X : X > inf\left\{x \in \mathbb{R} : \mathbb{P}(X \leq x) > \alpha\right\}\right] \\ &\geq VaR_\alpha(X) \end{aligned}$$

The risk adjustment should be remeasured at the end of each reporting period.
It usually declines over time as the insurer is released from risk although in some situation it could also increase.
In both situations, these changes would have to be recognised in the Income Statement.

Following comments, the boards may redefine the risk adjustment as the compensation the insurer requires to bear the risk that the ultimate fulfilment cash flows exceed those expected or as an amount reflecting both favourable and unfavourable changes in the amount and timing of fulfilment cash flows.

4.1.4 Fourth block: The residual margin

The residual margin should be calibrated to eliminate any gain at inception of the contract.
Therefore, it would be determined at inception when the present value of the fulfilment cash flows is less than zero.
The standard precises that:

> *"An insurer shall determine the **residual margin** at a level that aggregates insurance contracts into a portfolio of insurance contracts and, within a portfolio, by similar date of inception of the contract and by similar coverage period."*

*"An insurer shall recognise the **residual margin** determined at initial recognition as income in profit or loss over the coverage period in a systematic way that best reflects the exposure from providing insurance coverage, as follows:*

- *on the basis of the passage of time, but*
- *on the basis of the expected timing of incurred claims and benefits, if that pattern differs significantly from the passage of time."*

Nevertheless, following comments the boards may redefine this residual margin requiring its re-evaluation at each period.

4.2 Reinsurance contract

Because the Board has identified no reason for different measurement approaches for direct insurance liabilities and reinsurance liabilities, the proposals in the *Exposure Draft* would also apply to reinsurance contracts that an insurer holds.
Nevertheless, a cedant faces the risk that the reinsurer may default so the Board proposes the following precision:

*"The cedant shall estimate the **present value of the fulfilment cash flows** for the reinsurance contract in the same manner as the corresponding part of the present value of the fulfilment cash flows for the underlying insurance contract or contracts, after remeasuring the underlying insurance contract(s) on initial recognition of the reinsurance contract. In addition, the cedant shall consider the risk of non-performance by the reinsurer on an expected value basis when estimating the present value of the fulfilment cash flows."*

In other words, in measuring his reinsurance contracts, the insurer should not consider his own risk of non-performance.

4.3 Modified approach for short term contracts

To simplify short term contracts valuation, the IASB decided to define a modified approach of its measurement model.
Analysing these contracts requires the following two definitions:

*"A **short term contract** is an insurance contract that meets both of the following two conditions:*

- *The coverage period of the contract is approximately one year or less*
- *The contract does not contain embedded options or other derivatives that significantly affect the variability of cash flows, after unbundling any embedded derivatives."*

> *"An insurance contract is **onerous** if, at initial recognition or subsequently, the present value of the fulfilment cash flows relating to future insured claims that are within the boundary of an existing contract exceeds the carrying amount of the pre-claims obligation."*

A premium allocation model is proposed as a modified measurement for the pre-claims liabilities of some short-duration insurance contracts (unless the contract is onerous): The board proposes that the insurer shall:

- measure its pre-claims liability by allocating premiums over the coverage period
- measure its claims liability at the present value of the fulfilment cash flows

With the following definitions:

> *"The **pre-claims liability** is the pre-claims obligation less the expected present value of future premiums, if any, that are within the boundary of the existing contract."*
>
> *"An insurer shall measure its pre-claims obligation at initial recognition as:*
>
> - *the premium, if any, received at initial recognition, plus the expected present value of future premiums, if any, that are within the boundary of the existing contract; less*
> - *the incremental acquisition costs."*
>
> *"Subsequently, the insurer shall reduce the measurement of the pre-claims obligation over the coverage period in a systematic way that best reflects the exposure from providing insurance coverage, as follows:*
>
> - *on the basis of the passage of time, but*
> - *on the basis of the expected timing of incurred claims and benefits, if that pattern differs significantly from the passage of time."*

In the specific case of onerous contracts the *Exposure draft* proposes:

> *"The insurer shall recognise an additional liability and a corresponding expense, measured as the difference between the carrying amount of the pre-claims obligation and the present value of the fulfilment cash flows. To determine whether insurance contracts are onerous and, if applicable, to measure the amount of the additional liability, the insurer shall aggregate the insurance contracts into a portfolio and, within a portfolio, by similar date of inception. An insurer shall update the measurement of that additional liability at the end of each reporting period and reverse it to the extent that the insurance contract is no longer onerous."*

4.4 Explicit risk adjustment versus composite margin

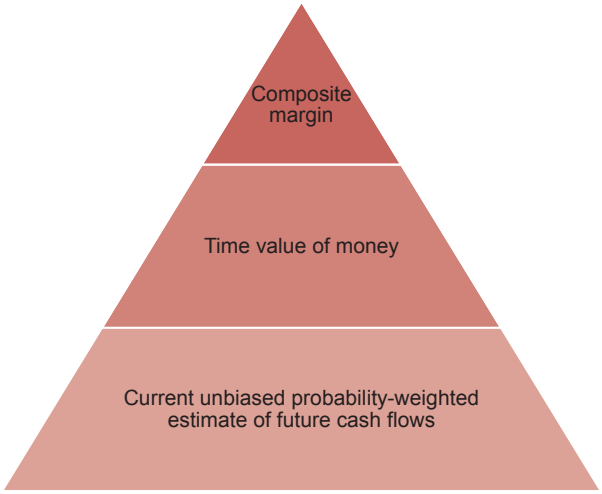
The insurance contracts project is carried out in collaboration between the European IASB and the American FASB. Even if the two boards seem to agree on several points, one of their main divergence approach concerns the risk adjustment.
The FASB considers that the measurement model should combine the risk adjustment and the residual margin in a single composite margin.
Therefore, at initial recognition, an insurer would measure a contract as the sum of:

1. An explicit, unbiased and probability-weighted estimate of the future cash out flows less the future cash inflows that will arise as the insurer fulfils the insurance contract
2. A discount rate that adjusts those cash flows for the time value of money
3. A composite margin that eliminates any gain at inception of the contract

Where the concept of composite margin would refer to the amount released over both the coverage period and the claims handling period on the basis of the insurer's exposure from the provision of insurance coverage, and the insurer's exposure from uncertainties associated with future cash flows.

This model can be illustrated by the following figure:

Table 4.3: Measurement model proposed by FASB



This alternative approach would not give rise to differences at inception, however, differences would arise in subsequent measurement of the insurance contract.

While the major advantage of the risk adjustment is the useful information it represents by showing an explicit measurement for uncertainty, the fact that it is difficult to audit may be a point in favor of an unique composite margin.

The comments following these proposals have shown a geographic split between supporters of each model.
The explicit risk adjustment approach is generally supported in Europe, Canada, Asia-Pacific, by auditors and by life insurers as it would provide a current measure of insurance risk and be consistent with Solvency II requirements.
The composite margin approach is usually supported in USA, Japan and by non life insurers as they consider that the explicit risk adjustment introduces bias, is not comparable, not observable, not testable and inconsistent with the fulfilment value approach.

Chapter 5

Presentation and disclosure

Under many existing models, and particularly for life insurance, clear and relevant informations about the financial situation of an insurer are lacking.
To remedy this situation, the *Exposure Draft* proposes a presentation of the statement of financial position and a presentation of the statement of comprehensive income that will help users of an insurer's financial statements understand important performance factors. This presentation will also have to fit with the proposed measurement approach for insurance contracts.

5.1 Presentation

The insurer has to provide relevant informations concerning:

- The statement of financial position:
  The Balance Sheet
- The statement of comprehensive income:
  The Income Statement also known as Profit and Loss (P&L)

5.1.1 Statement of financial position

The board gives the following guidance:

> *"An insurer shall present each portfolio of insurance contracts as a single item within insurance contract assets or insurance contract liabilities."*
>
> *"An insurer shall not offset reinsurance assets against insurance contract liabilities."*
>
> *"An insurer shall present:*
>
> - *the pool of assets underlying unit-linked contracts as a single line item, and not commingle it with the insurer's other assets*

- *the portion of the liabilities from unit-linked contracts linked to the previous pool of assets as a single line item and not commingle it with the insurer's other insurance contract liabilities."*

5.1.2 Statement of comprehensive income

The proposals contained a new presentation for the statement of comprehensive income, which would follow the proposed measurement model.
Following boards recommendations, an insurer is required to present all income and expense arising from insurance contracts in Profit and Loss.
Therefore, the insurer shall at least considers the following amount:

1. An underwriting margin:
    - The change in risk adjustment
    - The release of residual margin
2. Gains and losses at initial recognition:
    - Gains on reinsurance contracts bought by a cedant
    - Losses on insurance contracts acquired in a portfolio transfer
    - Losses at initial recognition of an insurance contract
3. Acquisition costs that are not incremental at the level of an individual contract
4. Experience adjustments and changes in estimates:
    - Experience adjustments: Differences between actual cash flows and previous estimates of those cash flows.
    - Changes in estimates of cash flows and changes in discount rates.
    - Impairment losses on reinsurance assets
5. Interest on insurance contract liabilities

Since they represent settlements of insurance contract assets or liabilities rather than revenues or expenses, premiums and claims generally would not be presented in the statement of comprehensive income. However, related information must be provided in the notes. It leads to significant changes in the way profits and losses are presented.

The following tables show the presentation of statement of comprehensive income under both phases of *IFRS - 4*:

Table 5.1: Presentation of statement of comprehensive income nowadays

	Inception	**...**	**End of period**
Premiums	(a)		(a)
Investment returns			(b)
Revenues	**(a)**		**(c)=(a)+(b)**
Benefits			(d)
Bonus paid to policyholder			(e)
Expenses			**(f)=(d)+(e)**
Changes in reserves		(f)	(f)
Bonus fund		(g)	(g)
Other		**(i)=(f)+(g)**	**(i)=(f)+(g)**
P&L	**(a)**	**(i)**	**(c)+(f)+(i)**

Table 5.2: Presentation of statement of comprehensive income under *IFRS 4 - Phase II*

	Inception	**...**	**End of period**
Change in risk adjustment		(a)	(a)
Release of residual margin		(b)	(b)
Underwriting margin		**(c)=(a)+(b)**	**(c)=(a)+(b)**
Gain or loss at initial recognition	**(d)**		**(d)**
Non incremental acquisition costs	**(e)**		**(e)**
Experience adjustments		(f)	(f)
Changes in estimates		(g)	(g)
Experience adj. and changes in est.		**(h)=(f)+(g)**	**(h)=(f)+(g)**
Interest on contract liabilities		**(i)**	**(i)**
P&L	**(d)+(e)**	**(c)+(h)+(i)**	**(c)+(d)+(e)+(h)+(i)**

Those two tables are pointing out the fact that the new Income Statement presentation does not directly consider premiums and benefits which was the heart of the early P&L vision. Instead, the new statement of comprehensive income focuses on changes in risks

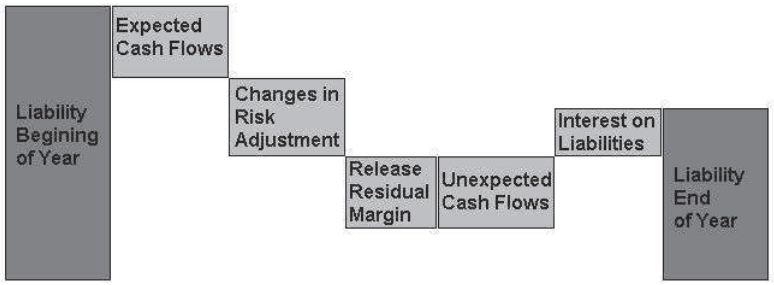
and in margins during the period.

For short-duration contracts subject to the alternative measurement approach for pre-claims liabilities, the underwriting margin would be disaggregated into line items reflecting:

- Premium revenues, claims and other expenses
- Amortisation of incremental acquisition costs
- Changes in additional liabilities for onerous contracts

From the beginning to the end of the period, the insurer will deduce the new liability as shown in the following figure:

Table 5.3: Balance Sheet liabilities under *IFRS 4 - Phase II*



5.2 Disclosure

The boards give the following guidance:

> *"To help users of financial statements understand the amount, timing and uncertainty of future cash flows arising from insurance contracts, an insurer shall disclose qualitative and quantitative information about:*
>
> - *the amounts recognised in its financial statements arising from insurance contracts; and*
> - *the nature and extent of risks arising from insurance contracts."*
>
> *"An insurer shall consider the level of detail necessary to satisfy the disclosure requirements and how much emphasis to place on each of the various requirements. An insurer shall aggregate or disaggregate information so that useful information is not obscured by either the inclusion of a large amount of insignificant detail or the aggregation of items that have different characteristics."*
>
> *"Examples of aggregation levels that might be appropriate are:*
>
> - *Type of contract*
> - *Geography*
>   *For instance the country or the region."*
>
> *"An insurer shall disclose information about the amounts recognised in its financial statements in sufficient detail to help users of its financial statements evaluate the timing, amount and uncertainty of future cash flows arising from insurance contracts, including:*
>
> - *Reconciliation from the opening to the closing aggregate contract balances*
> - *The methods and inputs used to develop the measurements."*

Chapter 6

Comparison with *Solvency II*

As *Solvency II* is an European directive that aims to codify and harmonise European insurance regulation, it is interesting to compare it to the IASB's project.

6.1 *Solvency II*

Similarly to *Basel II* regulations for the banking sector, *Solvency II* directive proposes a framework constructed around three pillars in order to reflect new risk management practices and to define required capital.

6.1.1 Pillar I: Qualitative and quantitative requirements

The first pillar requires insurers to hold and maintain enough capital to ensure that they are adequately protected against adverse events with a 99.5% probability over a one-year period. Therefore, the heart of this pillar is the understanding by insurers of the nature of their risk exposure in order to hold sufficient regulatory capital.
The directive proposes guidance for the calculation of capital requirements using either a standard formula or an internal model.
Solvency II identifies two levels of capital requirement and defines:

1. The **technical provision** as the amount an insurer would have to pay for an immediate transfer of its obligation to another entity.
   This amount represents the sum of the Best Estimate of liabilities plus a risk margin.

2. The **Solvency Capital Requirement (SCR)** as the capital required to ensure that the insurer will be able to meet his obligations over the next year with a probability of at least 99.5%. This capital provides a 1-in-200-year level of protection.

3. The **Minimum Capital Requirement (MCR)** as the capital required to ensure that the insurer will be able to meet his obligations over the next year with a

probability of at least 85%. This capital provides an approximate 1-in-6-year level of protection.
The MCR is bounded between 25% and 45% of the SCR and represents the threshold below which a supervisor intervenes.

6.1.2 Pillar II: Governance and risk management requirements

The second pillar focuses on supervision process, risk management process, as well as on companies' internal control. This pillar requires the insurer to demonstrate that he holds an appropriate amount of capital for all the risks he faces.
Supervisors may require an additional capital if they consider that the level of capital determined by the insurer is insufficient.

6.1.3 Pillar III: Disclosure and transparency requirements

The third pillar deals with the improvement of market transparency and discipline in the insurance industry.
The purpose of this pillar is to harmonise reporting to supervisors, to improve financial reporting rules by including various types of information needed by supervisors and information not normally available in the public domain.

6.2 Main differences between *IFRS 4 - Phase II* and *Solvency II*

1. **The scope:**
   As *Solvency II* applies to all contracts of an insurer, only insurance contracts, reinsurance contracts and instruments with a discretionary participation feature are concerned by *IFRS 4 - Phase II*.

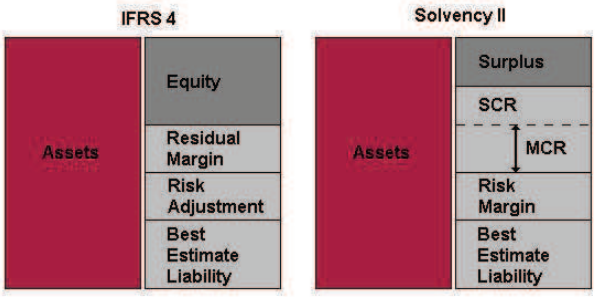
2. **The discount rate:**
   Whereas *Solvency II* requires a risk free rate plus an illiquidity premium, *IFRS 4 - Phase II* only gives guidance in the determination of the appropriate discount rate[1].

3. **The technical provision requirements:**
   The aim of *Solvency II* directive is to protect the policyholder by requiring the insurer to hold a sufficient amount of capital. This as opposed to the *IFRS 4 - Phase II* vision which is a shareholder view that focuses on improving quality and comparability of market informations.

[1] As discussed in Chapter 4 - Valuation of the contract, 4.1.2 - Second Block: The time value of money

These two points of view lead to divergent Balance Sheet presentations as shown below:

Table 6.1: *IFRS 4 - Phase II* and *Solvency II* liabilities



4. **The risk margin and the risk adjustment:**
   While *Solvency II* prescribe a risk margin using the Cost of Capital approach with confidence level of 6%, *IFRS 4* allows the use of the confidence level and of the conditional tail expectation approaches for the determination of the risk adjustement.

5. **The residual margin:**
   As *IFRS 4 - Phase II* proposes a residual margin to eliminate any gain at the inception of the insurance contract, *Solvency II* assumes no residual margin.

Part III

Theoretical model for a traditional mixed endowment insurance

The first product chosen for the study of the new standard impacts is a traditional mixed endowment insurance which is a typical product on the Swiss insurance market.

The first chapter of this part is dedicated to the presentation of the traditional mixed endowment.
The following next two chapters are then dealing with the valuation of the mixed endowment under *IFRS 4 - Insurance Contracts - Phase I* and under *IFRS 4 - Insurance Contracts - Phase II*.

Notations and concepts related to this part are collected in:

- *Annex 2 - Life insurance formulas*
- *Annex 3 - Provisioning for mixed endowment*

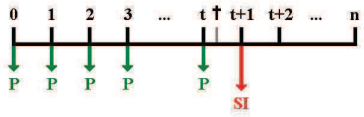
Chapter 1

Overview on the traditional mixed endowment insurance

We consider a n-year traditional mixed endowment insurance contract, under which both parties faces obligations.
On one hand, the x-year old policyholder commits to pay a premium P at each beginning of period (we consider either a yearly or a monthly decomposition).
And on the other hand, the insurer commits himself to pay the sum insured SI as a compensation either if:

- The policyholder dies during the n years:

Table 1.1: Mixed endowment where the policyholder dies in the period t



- The policyholder is alive at the end of the n years:

Table 1.2: Mixed endowment where the policyholder survives

According to this description, the insurer is subject to a risk of mortality. Indeed, the sooner the policyholder dies, the less premium the insurer will receive and the sooner he will have to pay the sum insured.

1.1 The premiums

The yearly premium P is a fixed amount defined by the contract.
While the policyholder is alive, the insurer receives the premium P at each beginning of period.
One part of this premium is used by the insurer to cover his costs, a second part covers the risk he faces and the remaining amount is the savings part:

$$P = Costs\ Premium + Risk\ Premium + Savings\ Premium$$

The costs premium

We consider the widely used α - β - γ costs model as explained in 2003 by Michael Koller in *Lebensversicherungsmathemathik*. The costs premium CP is described as the sum of:

$$CP = \alpha\ costs + \beta\ costs + \gamma\ costs$$

This amount is independent of the evaluation date t and only depends on:

1. Acquisition costs: α costs
   They represent expenses that the insurer faces in issuing a new business.
   The largest part of these costs is usually composed by commissions to sales agents but it also includes medical examiners fees, underwriting fees or inspection costs.
   While the insurer has to pay the whole amount of α costs at the inception, its reimbursement by the policyholder is deferred over the lifetime of the contract.
   Acquisition costs can be priced to the policyholder in percentage of the sum insured. At the inception of the contract, an amount between 3% and 5% of SI is deducted from the paid premium to cover acquisition costs.
   Nevertheless, acquisition costs are usually priced to the policy holder in percentage of the premium. At each beginning of period, an amount between 3% and 5% of P is deducted from the paid premium to cover acquisition costs.
   It clearly leads to a major problem of insurance contract for regular premiums: at inception, acquisition costs that the insurer has to pay are higher than the premium he receives. This problem does not appear if the policyholder pays one unique premium at the inception of the contract.

2. Collection costs: β costs
   They represent costs linked to the collection of the premium.
   Even if these costs represent a fixed amount for the insurer (they should not depend

on the amount of the premium), they are usually priced in percentage of the gross premium. At each beginning of period between 2% and 3% of P are deducted to cover the collection of the premium.

3. Administrative costs: γ costs
   They represent costs arising from the insurer activity.
   Among other, employee costs, rent of the offices, lease of business premises or electricity fees are part of administrative costs.
   Administrative costs are usually priced in permillage of the sum insured: at least between 1‰ and 3‰ of SI are dedicated to administrative costs.

The net premium NP is obtained by reducing the gross premium P by the amount of these costs:

$$NP = P - CP$$

The risk premium

As the insurer faces a risk in covering the policyholder, he retains a part of the premium in compensation.
This part is called risk premium $RP(t)$ and depends on the period t, on the sum at risk at this period $SaR(t)$ and on the expected mortality rate for this period q_{x+t}:

$$RP(t) = SaR(t) * q_{x+t}$$

With

- $SaR(t)$: the sum at risk for the period t

  $$SaR(t) = max(SI - {}_{t-1}V_x \ ; \ 0)$$

  Because for the mixed endowment ${}_{t-1}V_x$ is lower than SI in each period t:

  $$SaR(t) = SI - {}_{t-1}V_x$$

- ${}_{t-1}V_x$: the provision in the period $t-1$ for the $x+t$-year old policyholder (x-year old at inception)

- q_{x+t} : the probability that an $x+t$-year old policyholder dies in the next year

The savings premium

At each beginning of period t, the savings premium $SP(t)$ is the remaining part of the premium after taking away the costs premium and the risk premium:

$$SP(t) = P - CP - RP(t)$$

In each beginning of period, the savings premium is invested by the insurer, which guarantees to the policyholder a technical interest rate i.
It leads to the technical discount factor $v = \frac{1}{1+i}$

1.2 The benefits

Considering P the contractually set premium and x the age of the policyholder, the sum insured SI can be deducted by applying the following formula:

$$SI = NP * \frac{\ddot{a}_{x:\overline{n}|}}{A_{x:\overline{n}|}}$$

These are traditional insurance notations which are explained in *Annex 2 - Life insurance formulas.*
In the particular case of one unique premium UP (leading to an unique net premium UNP) defined at the beginning of the contract, the formula becomes:

$$SI = UNP * \frac{1}{A_{x:\overline{n}|}}$$

This amount is set at inception and remains the same over the lifetime of the contract.

For this product, we assume the possibility for the policyholder to surrender his contract at any time during the n years.
In such a situation, the policyholder will immediately stop paying premiums and will receive at the end of the period from the insurer an amount depending on t the age of the contract and therefore on the number of premium paid. This amount, the surrender value $SV(t)$, is contractually defined and depends on the provisions at date t and on the present value of all future expected α costs:

$$SV(t) = {}_tV_x - PVE\alpha(t)$$

With

- $E[\alpha, t]$: the expected future α costs in period t depending on the policyholder survival probability

  $$E[\alpha, t] = \alpha\ costs * {}_tp_x$$

- $PVE\alpha(t)$: the present value of all future periods expected α costs (viewed from inception)

  $$PVE\alpha(t) = \sum_{k=t+1}^{n} E[\alpha, k] * v^{k-t}$$

To summarise, by construction of the contract, benefits that the insurer may have to pay are:

- the sum insured SI at the end of the contract if the policyholder survives
- the sum insured SI at the end of the period if the policyholder dies before the end of the contract
- the surrender value SV at the end of the period if the policyholder decides to surrender his contract

Chapter 2

Provisioning under *IFRS 4 - Insurance contracts - Phase I*

The first phase of *IFRS 4 - Insurance contracts* allows insurers to continue their current practices.

> *"An insurer may continue the following practices:*
>
> 1. *measuring insurance liabilities on an undiscounted basis.*
> 2. *measuring contractual rights to future investment management fees at an amount that exceeds their fair value as implied by a comparison with current fees charged by other market participants for similar services. It is likely that the fair value at inception of those contractual rights equals the origination costs paid, unless future investment management fees and related costs are out of line with market comparables.*
> 3. *using non-uniform accounting policies for the insurance contracts (and related deferred acquisition costs and related intangible assets, if any) of subsidiaries, except as permitted by paragraph 24. If those accounting policies are not uniform, an insurer may change them if the change does not make the accounting policies more diverse and also satisfies the other requirements in this IFRS."*
>
> IASB. *IFRS 4 - Insurance contracts*. Consolidated version December 2009.

> *"An insurer may change its accounting policies for insurance contracts if, and only if, the change makes the financial statements more relevant to the economic decision-making needs of users and no less reliable, or more reliable and no less relevant to those needs. An insurer shall judge relevance and reliability by the criteria in IAS 8."*
> IASB. *IFRS 4 - Insurance contracts*. Consolidated version December 2009.

> *"An insurer need not change its accounting policies for insurance contracts to eliminate excessive prudence. However, if an insurer already measures its*

insurance contracts with sufficient prudence, it shall not introduce additional prudence."
IASB. *IFRS 4 - Insurance contracts.* Consolidated version December 2009.

Current practices in Switzerland are usually Swiss GAAP and US GAAP.
In this chapter, the model of valuation of insurance contract studied will be Swiss GAAP, which is a cash flows-based model, deriving the provision from premiums and benefits. Following Swiss GAAP requirements, the insurer has to determine his provisions as if there were no surrender option. Considering the fact that the surrender value is priced in a way that the insurer never makes losses, it does not need to be modeled.

2.1 The premiums

While the policyholder is alive, the insurer receives a premium P at each beginning of period.
As mentioned before, this premium is split in three parts:

$$P = CP + RP(t) + SP(t)$$

And the net premium is the following fixed amount:

$$NP = P - CP$$

2.1.1 The expected premium

At the inception of the contract, the insurer is expected to receive n premiums. In particular, he is expecting to receive a premium P from the policyholder at each beginning of period. Nevertheless, the insurer may not get it in case the insured died in a previous period. It leads to the introduction of the concept of expected premium $EP(t)$, which is the amount (viewed from 0) that the insurer is expecting to receive at the beginning of period t given the survival probability of the policyholder (probability-weighted premium):

$$EP(t) = NP * {}_tp_x$$

Because the insurer faces costs and because it would make no sense to include them in the probability-weighted premium, the expected premium calculation is done using the net premium and not the gross premium.

2.1.2 The present value of expected premiums

As the insurer faces the risk that the policyholder dies before the maturity of the contract, he faces the risk to receive less than n premiums. At each beginning of period t, the insurer has to consider the death probability of the policyholder in the next periods to deduct the sum of the future expected premiums. Viewed from the inception, in

each beginning of period t, the insurer can deduce the present value of expected future premiums $PVEP(t)$ given all future expected premiums $EP(k)\ for\ k > t$ and given the discount rate v:

$$PVEP(t) = \sum_{k=t+1}^{n} EP(k) * v^{k-t}$$

2.2 The benefits

By definition of the contract, the insurer may have to pay:

- the sum insured SI at the end of the contract if the policyholder survives
- the sum insured SI at the end of the period if the policyholder dies before the end of the contract
- the surrender value SV at the end of the period if the policyholder decides to surrender his contract

As Swiss GAAP ignores the surrender option, the benefit B only represents the sum insured SI in case of death or in case of survival.

2.2.1 The expected benefit

As mentioned earlier, if the policyholder dies during the period t, the insurer has to pay the sum insured at the end of the period t, meaning at the beginning of the period $t+1$ (to simplify comparison with premiums).
Therefore, at each beginning of period, the insurer is expecting to pay a benefit B in case the policyholder died in the previous period.
The concept of expected benefit $EB(t)$ refers to the amount (viewed from 0) that the insurer is expecting to pay at the beginning of period t given the death probability and the survival probability of the policyholder:

$$EB(t) = \begin{cases} SI * {}_{t-1|1}q_x & if\ t < n \\ SI * {}_{n-1}p_x & if\ t = n \end{cases}$$

With

- ${}_{t-1|1}q_x$: the probability that the x-year old policyholder dies in the period $t-1$
- ${}_{n}p_x$: the probability that the x-year old policyholder survives during the lifetime of the contract

2.2.2 The present value of expected benefits

Viewed from the inception, the insurer knows each beginning of period expected benefit. Thus he can deduce for each period t the present value of expected future benefits $PVEB(t)$ considering all future expected benefits $EB(k)$ for $k > t$ and given v the discount rate:

$$PVEB(t) = \sum_{k=t+1}^{n-1} EB(k) * v^{k-t} + EB(n) * v^{n-t}$$

2.3 The provision

The provision ${}_tV_x$ is defined for each period t as the difference between the present value of future expected benefits and the present value of future expected premiums:

$${}_tV_x = PVEB(t) - PVEP(t)$$

We must be careful that in all previous definitions the evaluation point was the inception of the contract.
However, to determine the provision ${}_tV_x$ the evaluation date is translated to the period t, which leads to modifications in death and survival probability and in discounting.

$$\begin{aligned} {}_tV_x &= PVEB(t) - PVEP(t) \\ &= SI * A_{x+t:\overline{n-t}|} - NP * \ddot{a}_{x+t:\overline{n-t}|} \end{aligned}$$

The provision at the beginning of the period t represents the difference between:

- The amount that the insurer is expecting to pay for a $x+t$-year old policyholder for a $n-t$-year temporary mixed endowment insurance
- The amount that the insurer is expecting to receive from an $x+t$-year old policyholder in the next $n-t$ years

Developing previous formula gives:

$$\begin{aligned} {}_tV_x &= PVEB(t) - PVEP(t) \\ &= SI * A_{x+t:\overline{n-t}|} - NP * \ddot{a}_{x+t:\overline{n-t}|} \\ &= SI * \left(\sum_{k=0}^{n-t-1} v^{k+1} *_{k|1} q_{x+t} + v^{n-t} *_{n-t} p_{x+t} \right) - NP * \sum_{k=0}^{n-t-1} v^k *_k p_{x+t} \end{aligned}$$

This way to deduce provisions is defined as the prospective method, because it focuses on the future.
For testing purpose, the retrospective method is presented in *Annex 3 - Provisioning for mixed endowment.*

Chapter 3

Provisioning under *IFRS 4 - Insurance contracts - Phase II*

The second phase of *IFRS 4 - Insurance contracts* describes a measurement model requiring the determination of the provisions following a cash flows approach.
The insurer shall measure an insurance contract as the sum of:

1. The expected value of the future cash flows arising from the insurance contract
2. A discount rate adjusting these cash flows for the time value of money
3. An explicit risk adjustment reflecting the uncertainty about the amount and timing of those future cash flows
4. A residual margin eliminating any gain at inception of the contract

3.1 First and second blocks: the best estimate

This part is similar to the Swiss GAAP valuation.
But following the *Exposure Draft*, the insurer has to consider second order assumptions.

While *IFRS 4 - Phase I* valuation considers the following parameters:

- The costs priced in the contract
- A first order mortality table
- The technical interest rate priced in the contract

the second phase valuation requires:

- The real costs faced by the insurer
- A second order mortality table

- A surrender table
- The real world interest rate curve

In this chapter, second order amounts will be identified by an *.

3.1.1 First block: the expected value of cash flows

The purpose of this first block is the projection of all future expected cash flows linked to the insurance contract.

What are the cash flows arising from a mixed endowment?

Basically, expected premiums and expected benefits are identified as cash flows linked to the insurance contract.
As they are part of the premium, costs, that are also relevant cash flows, are studied with the premium cash flow.
On the opposite, the profit sharing is considered as a cash flow only when it is paid out, meaning only at the end of the contract.

The expected premiums

While the policyholder is alive, the insurer receives a premium P at each beginning of period.
He must deduct from this premium the real costs he faces:

$$CP^* = Real\ \alpha\ costs + Real\ \beta\ costs + Real\ \gamma\ costs$$

Thus, the insurer really receives the following net premium:

$$NP^* = P - CP^*$$

As for Swiss GAAP, at the inception of the contract, the insurer is expected to receive n premiums. In particular, he is expecting to receive a premium P from the policyholder at each beginning of period.
Nevertheless, the insurer may not get it in case the insured died or surrendered in a previous period. It leads to the concept of expected premium $EP^*(t)$, which is the amount (viewed from 0) that the insurer is expecting to receive at the beginning of period t (probability-weighted premium):

$$EP^*(t) = NP^* * {}_tp_x^* * (1 - \sum_{k=0}^{t-1} s_k * {}_kp_x)$$

With

- ${}_tp_x^*$: the second order probability that the x-year old policyholder is still alive at the beginning of the period t

- s_{t-1} : the probability that an insurance contract is surrendered during its period $t-1$

Because the insurer faces costs and because it would make no sense to take them away from the probability-weighted premium, the expected premium calculation is done using the net premium and not the gross premium.

The expected benefits

By definition of the contract, the insurer has to pay either:

- the sum insured SI at the end of the contract if the policyholder survives
- the sum insured SI at the end of the period if the policyholder dies before the end of the contract
- the surrender value SV at the end of the period if the policyholder decides to surrender his contract

As explained earlier, if the policyholder dies or surrenders during the period t, the insurer has to pay a benefit B at the end of the period t, meaning at the beginning of the period $t+1$ (to simplify comparison with premiums).
Therefore, at each beginning of period, the insurer is expecting to pay a benefit B in case the policyholder died or surrendered in the previous period.
The concept of expected benefit $EB^*(t)$ refers to the amount (viewed from 0) that the insurer is expecting to pay at the beginning of period t given the death probability of the policyholder and the surrender probability of the contract:

$$EB^*(t) = \begin{cases} SI * {}_{t-1|1}q_x^* + SV * s_{t-1} & if\ t < n \\ SI * {}_{n-1}p_x^* & if\ t = n \end{cases}$$

With

- ${}_{t-1|1}q_x^*$: the second order probability that the x-year old policyholder dies in the period $t-1$
- s_{t-1} : the probability that an insurance contract is surrendered during its $t-1$ period
- ${}_np_x^*$: the second order probability that the x-year old policyholder survives during the lifetime of the contract

3.1.2 Second block: the discounting

Following IASB's requirements, the discount rate has to be consistent with observable current market prices and has to reflect risks and uncertainty not present in other blocks. The guidance allows the use of either a bottom-up or a top top-down approach. To apply the bottom-up approach one could use a swap curve adjusted by an illiquidity premium.

Since there is no detailed guidance today on how to derive the illiquidity premium and since we are analysing one single policy, we use the swap curve and set the illiquidity premium at zero.
We define the following notations:

- i_t : the real world interest rate in period t
- v_t : The real world discount factor in period t

The present value of expected premiums

The insurer faces the risk to receive less than n premiums if the policyholder dies or surrenders before the maturity of the contract.
At the beginning of each period t, the insurer has to consider the death probability of the policyholder in the next periods and the surrender probability to deduce the sum of the future expected premiums. Viewed from the inception, in each beginning of period t, the insurer can deduce the present value of expected premiums $PVEP^*(t)$ given all future expected premiums $EP^*(k)$ for $k > t$ and given the real world discount rate v_t:

$$PVEP^*(t) = \sum_{k=t+1}^{n} EP^*(k) * v_k$$

The present value of expected benefits

Viewed from the inception, the insurer knows each beginning of period expected benefit. Thus he can deduct for each period t the present value of expected benefits $PVEB^*(t)$ considering all future expected benefits $EB^*(k)$ $for k > t$ and given the real world discount rate v_t:

$$PVEB^*(t) = \sum_{k=t+1}^{n-1} EB^*(k) * v_k + EB^*(n) * v_n$$

3.1.3 First and second blocs: the best estimate

The provision ${}_tV_x^*$ is defined for each period t as the difference between the second order present value of expected future benefits and the second order present value of expected future premiums:

$${}_tV_x^* = PVEB^*(t) - PVEP^*(t)$$

We must be careful that in all previous definitions the evaluation point was the inception of the contract.
However, to determine the provision ${}_tV_x^*$ the evaluation date is translate to the period t, which leads to modifications in death and survival probabilities and in discounting.

3.1.4 The result and the profit sharing

During his exercise, the insurer may realise some profit by pricing higher costs than real ones, facing less benefits than expected or observing a real interest rate higher than the technical one.
In general terms, in each period, the insurer realises a result (can either be a gain or a loss) depending on differences observed between priced amounts and real amounts:

- Difference between priced costs and real costs leads to gains
- Presence of surrender leads to gains
- Difference between first order mortality and real mortality can either lead to gains or losses
- Difference between technical interest rate and real world interest rate can either lead to gains or losses

In other words, the insurer result is:

$$\begin{aligned} Result &= Result\ on\ savings\ fund \\ &+ Result\ on\ expected\ premiums \\ &+ Result\ on\ expected\ benefits \end{aligned}$$

With

1. $Result\ on\ savings\ fund = Real\ fund\ value - Technical\ fund\ value$
2. $Result\ on\ expected\ premiums = EP^* - EP$
3. $Result\ on\ expected\ benefits = EB - EB^*$

If this result is positive, we assume that the insurer invests 80% of this profit as a bonus reserve, which will be distributed to the policyholder with his benefit.
The remaining 20% are reversed to shareholders.

3.2 Third block: the risk adjustment

Following *Exposure Draft* recommendations, at a portfolio level and at each reporting period, the risk adjustment has to be determined in order to reflect the risk that the ultimate fulfilment cash flows exceed those expected.
The insurer may either use a Cost of Capital (CoC), a confidence level (VaR) or a conditional tail expectation (Tail VaR) approach in determining this adjustment.
To calculate this third block, a pseudo-stochastic approach constructed around two risks has been chosen.

3.2.1 The economic risk

The economic risk refers to:

1. **The parameter error:**
   Setting wrong parameters may lead to deviations from the Best Estimate.
   To catch this error, several scenarios are generated changing the following assumptions:

   - The real costs
   - The real world interest rate
   - The surrender probability

   This operation leads to an estimation of the distribution of the provisions.
   By setting a confidence level $\alpha\%$ (for instance 70%), an economic capital EK can be determined as the difference between the quantile $q_{\alpha\%}$ and the mean (which is nothing else than the Best Estimate).

2. **The stochastic error:**
   An insufficiently large portfolio may cause deviations from the expected value.
   As we assume a sufficiently large portfolio, this error can be caught only by increasing the confidence level (for instance 72.5%).

3. **The model error:**
   It arises from the risk that the assume model is not exactly fitting reality.
   This error can be caught by increasing the confidence level (for instance 75%).

3.2.2 The non economic risk

This risk refers to the mortality assumption error.
By applying a shock to the second order mortality table, a mortality capital MK can be defined as the difference between the provision using the shocked table and the Best Estimate.
The choice of an appropriate shock is a critical point.
As the mixed endowment suffers from a risk of mortality, a prudent approach requires to increase the mortality rate.

3.2.3 The risk adjustment

The two previous amounts have to be added, but considering a portfolio vision, there is some diversification:

$$Risk\ Adjustment = \sqrt{EK^2 + MK^2 + 2 * \rho * EK * MK}$$

Where ρ represents the correlation between EK and MK.
ρ is given by the following correlation matrix:

$$\Sigma = \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$$

The risk adjustment can be redefined using matrix writing:

$$Risk\ Adjustment = \sqrt{\begin{pmatrix} EK \\ MK \end{pmatrix}^T \cdot \Sigma \cdot \begin{pmatrix} EK \\ MK \end{pmatrix}}$$

3.3 Fourth block: the residual margin

The *Exposure Draft* requires the creation of a residual margin to eliminate any gain at the inception of the contract.
Despite the disagreement of some comments, currently, this margin should be determined in period 0 if the sum of the three first blocks leads to a negative amount and should not be remeasured over the life time of the contract.

$$Residual\ Margin = min(Best\ Estimate + Risk\ Adjustment\ ;\ 0)$$

Part IV

Theoretical model for old age annuity

The second product chosen for the study of the new standard impacts is an old age annuity which is also a typical product on the Swiss insurance market.

As for the traditional mixed endowment insurance, the first chapter is dedicated to the presentation of the product.
The following next two chapters are dealing with the valuation of the mixed endowment under *IFRS 4 - Insurance Contracts - Phase I* and under *IFRS 4 - Insurance Contracts - Phase II*.

Notations and concepts related to this part are collected in:

- *Annex 2 - Life insurance formulas*
- *Annex 4 - Provisioning for old age annuity*

Chapter 1

Overview on the old age annuity

We consider an old age annuity characterised by two periods:

1. The constitution period:
   This period is limited to n years during which the x-year old policyholder pays a premium P at each beginning of period.
   During all this time, the insurer has no obligations towards the insured in case of death.

2. The restitution period:
   This period is running from the end of the n-years till the death of the policyholder, who does not pay anything anymore but receives at each beginning of period a contractually set amount from the insurer, the payment Pay.

According to this description, the insurer is subject to a risk of longevity. Indeed, the later the policyholder dies, the longer the insurer will have to pay and therefore the more payments Pay he will have to give.

1.1 The premiums

The yearly premium P is a fixed amount defined by the contract.
While the policyholder is alive and the constitution period running, the insurer receives the premium P at each beginning of period t.
As for mixed endowment:

$$P = CP + RP(t) + SP(t)$$

$$NP = P - CP$$

1.2 The benefits

Considering P the contractually set premium and x the age of the policyholder, the amount of the annuity Pay is deducted from the following formula:

$$\begin{aligned} Pay &= NP * \frac{\ddot{a}_{x:\overline{n}|}}{{}_{n|}\ddot{a}_x} \\ &= NP * \frac{\ddot{a}_{x:\overline{n}|}}{v^n *_n p_x * \ddot{a}_{x+n}} \end{aligned}$$

These are traditional insurance notations which are explained in *Annex 2 - Life insurance formulas*. In the particular case of one unique premium UP (leading to an unique net premium UNP) defined at the beginning of the contract, the formula becomes:

$$\begin{aligned} Pay &= UNP * \frac{1}{{}_{n|}\ddot{a}_x} \\ &= UNP * \frac{1}{v^n *_n p_x * \ddot{a}_{x+n}} \end{aligned}$$

This amount is set at inception and remains the same over the lifetime of the contract.

Even if theoretically it could be interesting for the policyholder to claim the full sum of expected future payments at once, insurance markets are usually not offering surrender option.
For this old age annuity product, we assume that the policyholder will always prefer the fixed yearly payment to an unique capital, therefore, the surrender possibility makes no sense.

Chapter 2

Provisioning under *IFRS 4 - Insurance contracts - Phase I*

As mentioned earlier, under the first phase of *IFRS 4 - Insurance contracts* insurers are allowed to continue their current practices. And as current practices in Switzerland are usually Swiss GAAP and US GAAP, in this chapter, the model of valuation of insurance contract studied will be Swiss GAAP.
The reasoning is very similar to the one for the mixed endowment.

2.1 The premiums

While the policyholder is alive and the constitution period running, the insurer receives a premium P at each beginning of period.
As mentioned before, this premium is split in three parts:

$$P = CP + RP(t) + SP(t)$$

And the net premium is the following fixed amount:

$$NP = P - CP$$

2.1.1 The expected premium

At the inception of the contract, the insurer is expected to receive n premiums. In particular, he is expecting to receive a premium P from the policyholder at each beginning of period. Nevertheless, the insurer may not get it in case of the insured died in the previous periods. It leads to the expected premium $EP(t)$, which is the amount (viewed from 0) that the insurer is expecting to receive at the beginning of period t given the survival probability of the policyholder (probability-weighted premium):

$$EP(t) = \begin{cases} NP * {}_tp_x & if\ t < n \\ 0 & if\ t \geq n \end{cases}$$

Because the insurer faces costs and because it would make no sense to include them ins the probability-weighted premium, the expected premium calculation is done using the net premium and not the gross premium.

2.1.2 The present value of expected premiums

As the insurer faces the risk that the policyholder dies before the maturity of the contract, he faces the risk to receive less than n premiums. At each beginning of period t, the insurer has to consider the death probability of the policyholder in the next periods to deduct the sum of the future expected premiums. Viewed from the inception, in each beginning of period t, the insurer can deduce the present value of expected premiums $PVEP(t)$ given all future expected premiums $EP(k)$ for $k > t$ and given the discount rate v:

$$PVEP(t) = \sum_{k=t+1}^{n} EP(k) * v^{k-t}$$

2.2 The payments

By definition of the contract, the insurer has to give the payment Pay to the policyholder from the date n until his death.

$$\begin{aligned} Pay &= P * \frac{\ddot{a}_{x:\overline{n}|}}{{}_{n|}\ddot{a}_x} \\ &= P * \frac{\ddot{a}_{x:\overline{n}|}}{v^n *_n p_x * \ddot{a}_{x+n}} \end{aligned}$$

We remind that there is no surrender possibility for such a contract.

2.2.1 The expected payment

The concept of expected payment $EPay(t)$ refers to the amount that the insurer is expecting to pay at the beginning of period t given the survival probability of the policyholder:

$$EPay(t) = \begin{cases} 0 & if\ t < n \\ Pay * {}_tp_x & if\ t \geq n \end{cases}$$

Where ${}_tp_x$ denotes the probability that the x-year old policyholder is still alive at the beginning of the period t.

2.2.2 The present value of expected payments

Viewed from the inception, the insurer knows each beginning of period expected payment. Thus he can deduce for each period t the present value of expected payments

$PVEPay(t)$ considering all future expected payments $EPay(k)$ for $k > t$ and given the discount rate:

$$PVEPay(t) = \sum_{k=t+1}^{\infty} EPay(k) * v^{k-t}$$

2.3 The provision

The provision ${}_tV_x$ is defined for each period t as the difference between the present value of future expected payments and the present value of future expected premiums:

$${}_tV_x = PVEPay(t) - PVEP(t)$$

We must be careful that in all previous definitions the evaluation point was the inception of the contract.
However, to determine the provision ${}_tV_x$ the evaluation date is translated to the period t, which leads to modifications in death and survival probability and in discounting.

- If $t < n$:

$$\begin{aligned} {}_tV_x &= PVEPay(t) - PVEP(t) \\ &= Pay *_{n-t|} \ddot{a}_{x+t} - NP * \ddot{a}_{x+t:\overline{n-t}|} \end{aligned}$$

  The provision at the beginning of the period t represents the difference between:

  - The amount that the insurer is expecting to pay for a $x + t$-year old policyholder for an annuity starting in n
  - The amount that the insurer is expecting to receive from an $x + t$-year old policyholder in the next $n - t$ years

- If $t \geq n$:

$$\begin{aligned} {}_tV_x &= PVEPay(t) - PVEP(t) \\ &= Pay * \ddot{a}_{x+t} \end{aligned}$$

  The provision at the beginning of the period t represents the amount that the insurer is expecting to pay for a $x+t$-year old policyholder for an annuity starting now

Developing previous formulas gives:

- If $t < n$:

$$\begin{aligned} {}_tV_x &= PVEPay(t) - PVEP(t) \\ &= Pay *_{n-t|} \ddot{a}_{x+t} - NP * \ddot{a}_{x+t:\overline{n-t}|} \\ &= Pay * v^{n-t} *_{n-t} p_{x+t} * \ddot{a}_{x+n} - NP * \ddot{a}_{x+t:\overline{n-t}|} \\ &= Pay * v^{n-t} *_{n-t} p_{x+t} * \sum_{k=0}^{\infty} v^k * {}_kp_{x+n} - NP * \sum_{k=0}^{n-t-1} v^k * {}_kp_{x+t} \end{aligned}$$

- If $t \geq n$:

$$\begin{aligned} {}_tV_x &= PVEPay(t) - PVEP(t) \\ &= Pay * \ddot{a}_{x+t} \\ &= Pay * \sum_{k=0}^{\infty} v^k * {}_kp_{x+t} \end{aligned}$$

All notations are explained in *Annex 2 - Life insurance formulas*
This way to deduce provisions is defined as the prospective method, because it focuses on the future.
For testing purpose, the retrospective method is presented in *Annex 4 - Provisioning for old age annuity.*

Chapter 3

Provisioning under *IFRS 4 - Insurance contracts - Phase II*

The second phase of *IFRS 4 - Insurance contracts* describes a measurement model requiring the determination of the provisions following a cash flows approach.
The insurer shall measure an insurance contract as the sum of:

1. The expected value of the future cash flows arising from the insurance contract
2. A discount rate adjusting these cash flows for the time value of money
3. An explicit risk adjustment reflecting the uncertainty about the amount and timing of those future cash flows
4. A residual margin eliminating any gain at inception of the contract

3.1 First and second blocks: the best estimate

The same way as for mixed endowment:
While *IFRS 4 - Phase I* valuation considers the following parameters:

- The costs priced in the contract
- A first order mortality table
- The technical interest rate priced in the contract

the second phase valuation requires:

- The real costs faced by the insurer
- A second order mortality table
- The real world interest rate curve

In this chapter, second order amounts will be identified by an *.

3.1.1 First block: the expected value of cash flows

The purpose of this first block is the projection all future expected cash flows linked to the insurance contract.

What are the cash flows arising from an old age annuity?

Basically and as for the mixed endowment, expected premiums and expected benefits are identified as cash flows linked to the insurance contract.
On the opposite, the profit sharing is considered as a cash flow only when it is paid out, meaning only at the end of the contract.

The expected premiums

While the policyholder is alive and the constitution period running, the insurer receives a premium P at each beginning of period.
He must deduct from this premium the real costs he faces:

$$CP^* = Real\ \alpha\ costs + Real\ \beta\ costs + Real\ \gamma\ costs$$

Thus, the insurer really receives the following net premium:

$$NP^* = P - CP^*$$

Considering the second order mortality table, at the beginning of period t, the insurer is expected to receive the expected premium $EP^*(t)$ (probability-weighted premium):

$$EP^*(t) = \begin{cases} NP^* * {}_tp_x^* & if\ t < n \\ 0 & if\ t \geq n \end{cases}$$

Because the insurer faces costs and because it would make no sense to take them away from the probability-weighted premium, the expected premium calculation is done using the net premium and not the gross premium.

The expected payments

The concept of expected payment $EPay^*(t)$ refers to the amount that the insurer is expecting to pay at the beginning of period t given the second order survival probability of the policyholder (probability-weighted payment):

$$EPay^*(t) = \begin{cases} 0 & if\ t < n \\ Pay * {}_tp_x^* & if\ t \geq n \end{cases}$$

3.1.2 Second block: the discounting

Following IASB's requirements, the discount rate has to be consistent with observable current market prices and has to reflect risks and uncertainty not present in other blocks. As for the mixed endowment product, we use the swap curve and set the illiquidity premium at zero.
We define the following notations:

- i_t : the real world interest rate in period t
- v_t : The real world discount factor in period t

The present value of expected premiums

The insurer faces the risk to receive less than n premiums if the policyholder dies.
At each beginning of period t, the insurer has to consider the death probability of the policyholder in the next periods and the surrender probability to deduct the sum of the future expected premiums. Viewed from the inception, in the beginning of each period t, the insurer can deduce the present value of expected premiums $PVEP^*(t)$ given all future expected premiums $EP^*(k)$ for $k > t$ and given the real world discount rate v_t:

$$PVEP^*(t) = \sum_{k=t+1}^{n} EP^*(k) * v_k$$

The present value of expected payments

Viewed from the inception, the insurer knows each beginning of period expected payment. Thus he can deduce for each period t the present value of expected payments $PVEPay^*(t)$ considering all future expected payments $EPay^*(k)$ for $k > t$ and given the real world discount rate v_t:

$$PVEPay^*(t) = \sum_{k=t+1}^{\infty} EPay^*(k) * v_k$$

3.1.3 First and second blocs: the best estimate

The provision ${}_tV_x^*$ is defined for each period t as the difference between the second order present value of expected future payments and the second order present value of expected future premiums:

$${}_tV_x^* = PVEPay^*(t) - PVEP^*(t)$$

We must be careful that in all previous definitions the evaluation point was the inception of the contract.
However, to determine the provision ${}_tV_x^*$ the evaluation date is translate to the period t, which leads to modifications in death and survival probability and in discounting.

3.1.4 The result and the profit sharing

For this contract, if the insurer realise a profit during his exercise, he reverses:

- 90% as a bonus reserve, which will be distributed to the policyholder with his benefit
- 10% to shareholders

3.2 Third block: the risk adjustment

Following *Exposure Draft* recommendations, at a portfolio level and at each reporting period, the risk adjustment has to be determined in order to reflect the risk that the ultimate fulfilment cash flows exceed those expected.
The insurer may either use a Cost of Capital (CoC), a confidence level (VaR) or a conditional tail expectation (Tail VaR) approach in determining this adjustment.
To construct this third block, the same pseudo-stochastic approach constructed around two risks as for the mixed endowment product has been chosen.

3.2.1 The economic risk

The economic risk refers to:

1. **The parameter error:**
   Setting wrong parameters may lead to deviations from the Best Estimate.
   To catch this error, several scenarios are generated changing the following assumptions:

   - The real costs
   - The real world interest rate

   This operation leads to an estimation of the distribution of the provisions.
   By setting a confidence level $\alpha\%$ (for instance 70%), an economic capital EK can be determined as the difference between the quantile $q_{\alpha\%}$ and the mean (which is nothing else than the Best Estimate).

2. **The stochastic error:**
   An insufficiently large portfolio may cause deviations from the expected value.
   As we assume a sufficiently large portfolio, this error can be caught only by increasing the confidence level (for instance 72.5%).

3. **The model error:**
   It arises from the risk that the assume model is not exactly fitting reality.
   This error can be caught by increasing the confidence level (for instance 75%).

3.2.2 The non economic risk

This risk refers to the mortality assumption error.
By applying a shock to the second order mortality table, a mortality capital MK can be defined as the difference between the provision using the shocked table and the Best Estimate.
The choice of an appropriate shock is a critical point.
As the old age annuity suffers from a risk of longevity, a prudent approach requires to decrease the mortality rate.

3.2.3 The risk adjustment

The two previous amounts have to be added, but considering a portfolio vision, there is some diversification:

$$Risk\ Adjustment = \sqrt{EK^2 + MK^2 + 2 * \rho * EK * MK}$$

Where ρ represents the correlation between EK and MK.
ρ is given by the following correlation matrix:

$$\Sigma = \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$$

The risk adjustment can be redefined using matrix writing:

$$Risk\ Adjustment = \sqrt{\begin{pmatrix} EK \\ MK \end{pmatrix}^T \cdot \Sigma \cdot \begin{pmatrix} EK \\ MK \end{pmatrix}}$$

3.3 Fourth block: the residual margin

The *Exposure Draft* requires the creation of a residual margin to eliminate any gain at the inception of the contract.
Despite the disagreement of some comments, currently, this margin should be determined in period 0 if the sum of the three first blocks leads to a negative amount and should not be remeasured over the life time of the contract.

$$Residual\ Margin = min(Best\ Estimate + Risk\ Adjustment\ ;\ 0)$$

Part V

Results

This part presents the provisioning under both phases of *IFRS 4 - Insurance contracts* for the two products studied.

In order to improve comparability of the results for the traditional mixed endowment and for the annuity, the same assumptions have been set for the valuation of the provisions.

1. The costs are supposed to be priced as follows:

$$Acquisition\ costs = \alpha\ costs = 4.5\% * P$$

$$Collection\ costs = \beta\ costs = 3\% * P$$

$$Administrative\ costs = \gamma\ costs = 5\% * P$$

2. The real costs faces by the insurer are supposed to be:

$$Real\ acquisition\ costs = Real\ \alpha\ costs = 4\% * P$$

$$Real\ collection\ costs = Real\ \beta\ costs = CHF25$$

$$Real\ administrative\ costs = Real\ \gamma\ costs = CHF25$$

3. The table of mortality used by the insurer for the pricing is:

$$First\ order\ mortality\ table = \begin{cases} EKM\ 1995 & for\ men \\ EKF\ 1995 & for\ women \end{cases}$$

4. The table of mortality used by the insurer for the second phase of *IFRS 4* is:

$$Second\ order\ mortality\ table = \begin{cases} 70\%\ of\ EKM\ 1995 & for\ men \\ 70\%\ of\ EKF\ 1995 & for\ women \end{cases}$$

5. The contractually priced technical interest rate is:

$$i = 2.5\%$$

6. The first order discount factor is:

$$\begin{aligned} v &= \frac{1}{1+i} \\ &= 97.56\% \end{aligned}$$

7. The chosen discount curve based on the bottom-up approach is the swap curve for Swiss Francs as per 31.12.2010 with illiquidity premium set at zero:

$$i_t = \begin{cases} 0.24\% & for\ t = 0 \\ 0.52\% & for\ t = 1 \\ 0.83\% & for\ t = 2 \\ 1.14\% & for\ t = 3 \\ 1.42\% & for\ t = 4 \\ 1.60\% & for\ t = 5 \\ 1.83\% & for\ t = 6 \\ 1.98\% & for\ t = 7 \\ 2.11\% & for\ t = 8 \\ 2.22\% & for\ t = 9 \end{cases}$$

8. There is no first order surrender probability

9. The second order surrender probability is:

$$\forall t \in [0, n], \quad s_t = \begin{cases} 1\% & for\ the\ mixed\ endowment \\ 0\% & for\ the\ annuity \end{cases}$$

10. scenarios shocking costs, interest curve and surrender probability assumptions to determine the economic capital

11. A shocked mortality table to determine the mortality capital:

$$\begin{aligned} shocked\ mortality\ table &= 250\%\ of\ the\ second\ order\ table \\ &= \begin{cases} 175\%\ of\ EKM\ 1995 & for\ men \\ 175\%\ of\ EKF\ 1995 & for\ women \end{cases} \end{aligned}$$

12. The following matrix of correlation between economic and mortality risks:

$$\Sigma = \begin{pmatrix} 1 & 0.3 \\ 0.3 & 1 \end{pmatrix}$$

Chapter 1

Requirements for traditional mixed endowment insurance

The study concerns a contract with the following characteristics:

- Age of the policyholder : 30 years
- Sex of the policyholder : Masculine
- Maturity of the contract : 10 years
- Yearly premium : CHF1'000
- Sum insured : CHF9'974.72
- Profit sharing : 80% of the result if positive

Using the theoretical model described in *Part III* and testing the results with the several formulas in *Annex 3*, the provisions for the traditional mixed endowment under *IFRS 4 - Phase I* and under *IFRS 4 - Phase II* are collected in the following table:

Table 1.1: Table of provisions for traditional mixed endowment under both phases of *IFRS 4 - Insurance contracts*

Beginning of Year (BoY)	***IFRS 4 Phase I* Provisions**	**Best Estimate (Blocks 1 + 2)**	**Risk Adjustment (Block 3)**	**Residual Margin (Block 4)**	***IFRS 4 Phase II* Provisions**
0	0.00	-232.54	62.76	169.79	0.00
1	885.01	676.37	52.80	169.79	898.96
2	1'793.40	1'608.49	42.77	169.79	1'821.05
3	2'725.67	2'564.64	34.14	169.79	2'768.57
4	3'682.39	3'545.49	25.57	169.79	3'740.85
5	4'664.20	4'551.72	18.84	169.79	4'740.34
6	5'671.77	5'584.01	12.96	169.79	5'766.76
7	6'705.83	6'643.07	8.55	169.79	6'821.40
8	7'767.10	7'729.59	5.17	169.79	7'904.54
9	8'856.44	8'844.32	4.30	169.79	9'018.41
10	9'974.72	9'978.81	0.12	169.79	10'148.72

Under *IFRS 4 - Phase I* (meaning following Swiss GAAP) and as expected for a traditional mixed endowment, the provisions begins at 0 and increase to end at SI.

Under *IFRS 4 - Phase II* and because of prudent assumptions such as higher priced costs than real ones, the best estimate is a negative amount. It represents a gain for the insurer. As this gain is not completely removed by the risk adjustment, this product needs the creation of a residual margin at the inception of the contract to eliminate the insurer gain. This margin will not be re-measured during the lifetime of the insurance contract.

Furthermore, we clearly see that the second phase of the *IFRS 4 - Insurance contracts* project will require more provisions. Because our study focus on a mixed endowment and because the shock apply to the mortality table increase the mortality rate, this result is not surprising.

Previous results can be illustrated by the following figures:

Table 1.2: Yearly provisions for traditional mixed endowment under both phases of *IFRS 4 - Insurance contracts*

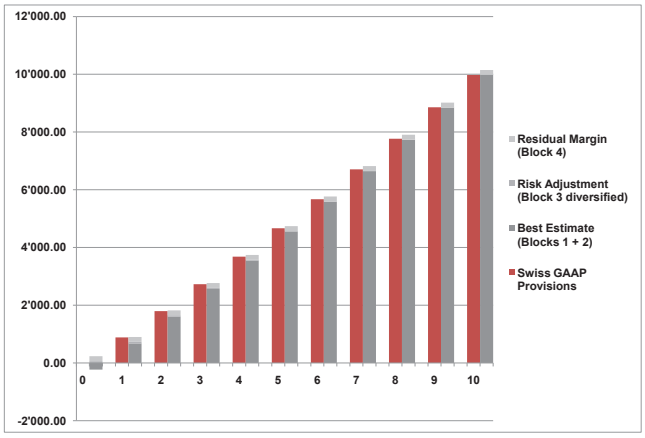
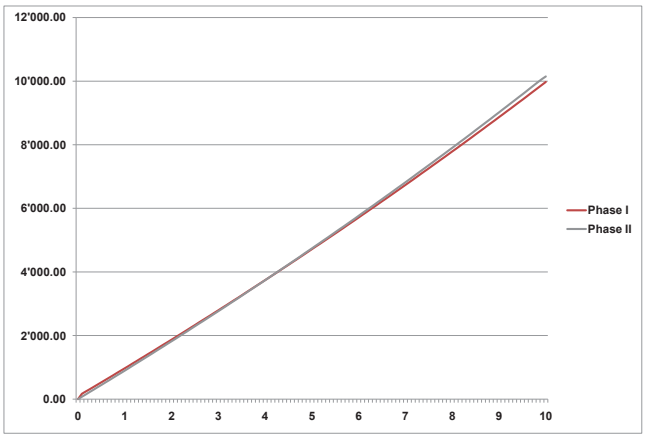


Table 1.3: Monthly provisions for traditional mixed endowment under both phases of *IFRS 4 - Insurance contracts*



Chapter 2

Requirements for old age annuity

The study concerns an old age annuity with the following characteristics:

- Age of the policyholder : 30 years
- Sex of the policyholder : Masculine
- Constitution period : 10 years
- Yearly premium : CHF1'000
- Payment : CHF467.32
- Profit sharing : 90% of the result if positive

Using the theoretical model described in *Part IV* and testing the results with the several formulas in *Annex 4*, the provisions for the old age annuity under *IFRS 4 - Phase I* and under *IFRS 4 - Phase II* are collected in the following table:

Table 2.1: Table of provisions for old age annuity under both phases of *IFRS 4 - Insurance contracts*

Beginning of Year (BoY)	***IFRS 4 Phase I* Provisions**	**Best Estimate (Blocks 1 + 2)**	**Risk Adjustment (Block 3)**	**Residual Margin (Block 4)**	***IFRS 4 Phase II* Provisions**
0	0.00	1'337.35	1'388.13	0.00	2'725.49
1	1'026.34	2'305.64	1'427.02	0.00	3'732.66
2	2'079.70	3'299.03	1'466.25	0.00	4'765.28
...					
9	10'278.03	11'017.24	1'741.18	0.00	12'758.42
10	11'578.77	12'239.33	1'777.88	0.00	14'017.21
11	11'408.90	12'080.88	1'805.91	0.00	13'886.79
12	11'235.82	11'919.27	1'833.91	0.00	13'753.18
...					
20	9'752.23	10'523.14	2'038.46	0.00	12'561.59
...					
30	7'743.67	8'584.58	2'161.93	0.00	10'746.51
...					
40	5'691.72	6'528.16	2'059.53	0.00	8'587.69
...					
50	3'636.61	4'410.07	1'806.21	0.00	6'216.28
...					
60	2'232.99	2'862.81	1'400.70	0.00	4'263.51
...					
70	1'447.06	1'924.68	1'025.74	0.00	2'950.43
...					
80	991.67	1'342.96	745.00	0.00	2'087.96
...					
88	653.11	734.16	283.64	0.00	1'017.80
89	467.32	467.32	0.00	0.00	467.32

Under *IFRS 4 - Phase I* (meaning following Swiss GAAP) and as expected for an old age annuity, the provisions begins at 0, increase till period 10 and then decrease to end at *Payment* in the last year of the mortality table.

Under *IFRS 4 - Phase II*, the best estimate is a positive amount that is even increased by the risk adjustment. Thus, the provision at inception is largely positive. Therefore, there is no need to create a residual margin.

For comparability purposes, the study has been conducted applying the same shocks than for the mixed endowment.
Although the study applies a shock increasing the mortality rate to an old age annuity that faces the risk of longevity, this results in higher provisions. This can be explained by the fact that the real world interest rate used is lower than the technical interest rate.

The results are illustrated in the following figures:

Table 2.2: Provisions for old age annuity under both phases of *IFRS 4 - Insurance contracts*

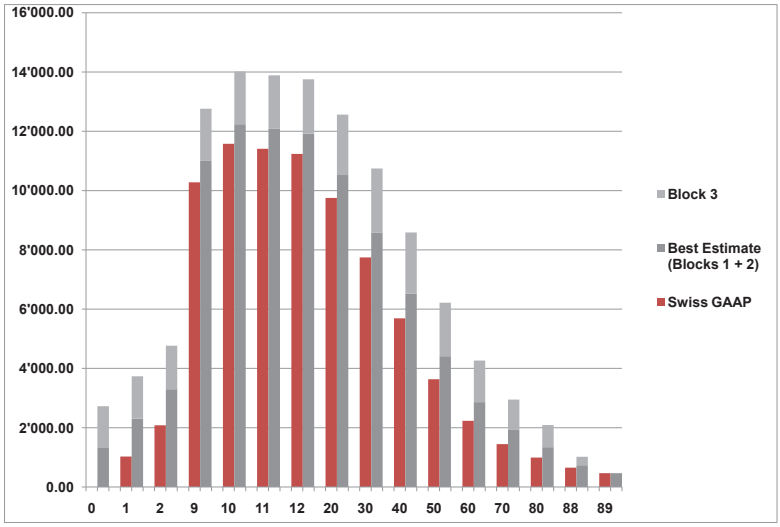


Table 2.3: Yearly provisions for old age annuity under both phases of *IFRS 4 - Insurance contracts*

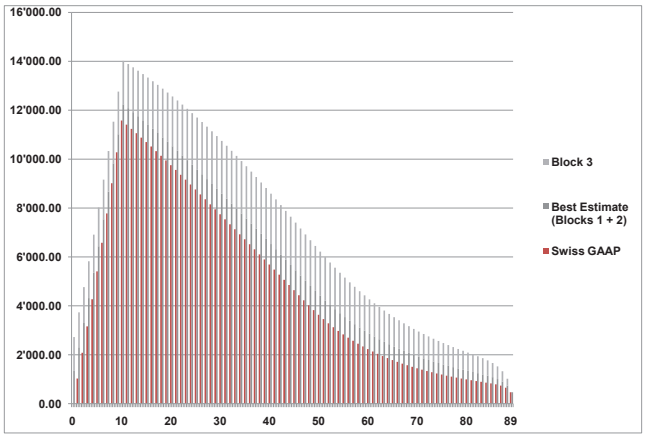
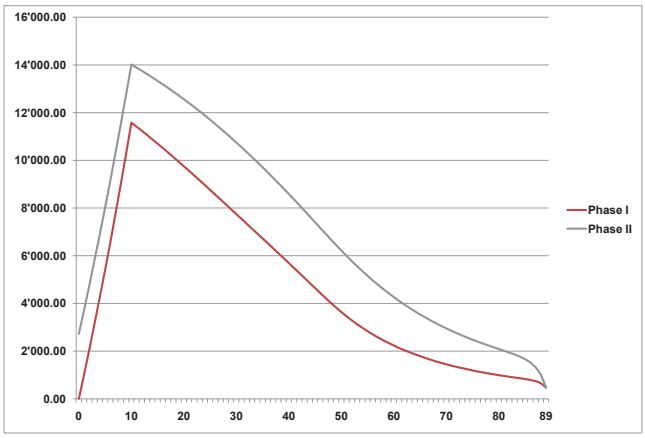


Table 2.4: Monthly provisions for old age annuity under both phases of *IFRS 4 - Insurance contracts*



Conclusions

Insurance accounting aims to provide relevant, comparable and sufficiently detailed informations about insurers' financial position and performance.

In this context, the European IASB and the American FASB are working together to offer the market an improved international *IFRS 4 - Insurance contracts* standard.
In 2010, the two boards have proposed a block-based measurement model included in an *Exposure Draft*. This aims to eliminate inconsistencies and weaknesses in existing practices by defining a comprehensive framework requiring insurers to provide relevant informations for economic decision making and by providing comparability across entities, jurisdictions and capital markets.

Following the *Exposure Draft* recommendations, a valuation model has been elaborated for a traditional mixed endowment and for an old age annuity.
This model has been constructed around a cash flows vision using a bottom-up approach in the discount rate determination. These concepts refer to the first two blocks of the measurement model, which represent the Best Estimate of Liability.
As European countries report under IASB's recommendations, the study has considered the four-block model with the explicit risk adjustment and the residual margin and not the three-block measurement model using an unique composite margin proposed by the American FASB.
The risk adjustment has been estimated by separating the economic risk and the mortality risk. The residual margin has been set as the amount eliminating any gain eventually realised at inception of the contract by the insurer. The technical provisions calculated applying the guidance available today in the *Exposure Draft* have been compared to the ones calculated with the well known Swiss GAAP valuation. This comparison has shown that higher provisions may be required by the new standard together with a brand new accounting presentation. However, it is important to note that the final standard may include some changes with respect to the current proposal. Still, it will bring significant changes in provisioning and accounting and its purpose will be to permit a better access to markets informations.

Glossary

ALR: Asset Liability Rate

ARC: Accounting Regulatory Committee

CEIOPS: Committee of European Insurance and Occupational Pensions Supervisors

Current Exit Value (CEV): The amount the insurer would expect to pay at the reporting date to transfer its remaining contract rights and obligations immediately to another entity

Current Fulfillment Value (CFV): The expected present value of the cost of fulfilling the obligation to the policyholder over time

DP: Discussion Paper

DPF: Discretionary Participation Feature

DSOP: Draft Statement Of Principle

ED: Exposure Draft

EFRAG: European Financial Reporting Advisory Group

FASB: Financial Accounting Standards Board

GAAP: Generally Accepted Accounting Principles

IAS: International Accounting Standards

IASB: International Accounting Standards Board
Created in April 2001 to succeed to IASC

IASC: International Accounting Standards Committee
Created in June 1973 by Sir Henry Benson in London to develop and promote IAS

IASCF: International Accounting Standards Committee Foundation
Created in 2001 to control IASB

IFAC: International Federation of Accountants

IFRIC: International Financial Reporting Interpretations Committee
Successor of SIC

IFRS: International Financial Reporting Standard
New name of the IAS since the 1^{st} of April 2001

Insurance Contract: One party (the insurer) accepts significant insurance risk from another party (the policyholder) by agreeing to compensate the policyholder if a specified uncertain future event (the insured event) adversely affects the policyholder

Insurance Contract Extinguished: The obligation specified in the insurance contract is discharged, canceled or expires

Insurance Contract Onerous: The present value of the fulfilment cash flows relating to future insured claims that are within the boundary of an existing contract exceeds the carrying amount of the pre-claims obligation

IOSCO: International Organisation of Securities Commissions

IWG: Insurance Working Group

MCEV: Market Consistent Embedded Value

Mixed Endowment Insurance: Contract which pays either if the policyholder dies during the life of the contract or is alive at the end

OCI: Other Comprehensive Income

Portfolio Collection of insurance contracts that are subject to broadly similar risks and managed together as a single pool

Pure Endowment Insurance: Contract which pays at its end if and only if the policyholder is alive

Residual Margin: Calibrated at inception to an amount that means the insurer recognises no gain entering into an insurance contract

Risk Adjustment: The maximum amount that an insurer would rationally pay to be relieved of the risk that the ultimate fulfilment cash flows exceed those expected

SAC: Standards Advisory Council

SIC: Standing Interpretations Committee

Unit Link Contract: Benefits are determined by the price of units in an internal or external investment fund

VaR: Value at Risk

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Part VI

Annex

Annex 1 - The standards

IAS 1 - Presentation of Financial Statements
Last amended on 24/03/2010
Related interpretations: SIC 15, 29, 32, IFRIC 1

IAS 2 - Inventories
Last amended on 23/01/2009
Related interpretations: SIC 32

IAS 3 - Consolidated Financial Statements
Originally issued in 1976
Effective from 01/01/1977
Superseded in 1989 by IAS 27 and IAS 28

IAS 4 - Depreciation Accounting
Withdrawn from 1999
Replaced by IAS 16, IAS 22 and IAS 38

IAS 5 - Information to Be Disclosed in Financial Statements
Originally issued in October 1976
Effective from 01/01/1997
Superseded in 1997 by IAS 1

IAS 6 - Accounting Responses to Changing Prices
Superseded by IAS 15

IAS 7 - Cash Flow Statements
Last amended on 24.03.2010

IAS 8 - Accounting Policies, Changes in Accounting Estimates and Errors
Last amended on 23.01.2009
Related interpretations: Most of SIC and IFRIC

IAS 9 - Accounting for Research and Development Activities

Superseded on 1999 by IAS 38

IAS 10 - Events After the Balance Sheet Date
Last amended on 27.11.2009
Related interpretations: SIC 7

IAS 11 - Construction Contracts
Last amended on 03.11.2008
Related interpretations: SIC 27, 32

IAS 12 - Income Taxes
Last amended on 12.06.2009
Related interpretations: SIC 21, 25, IFRIC 7

IAS 13 - Presentation of Current Assets and Current Liabilities
Superseded by IAS 1

IAS 14 - Segment Reporting
Superseded on 01/01/2008 by IFRS 8

IAS 15 - Information Reflecting the Effects of Changing Prices Withdrawn from December 2003

IAS 16 - Property, Plant and Equipment
Last amended on 12.06.2009
Related interpretations: SIC 13, 21, 29, 32, IFRIC 1, 4

IAS 17 - Leases
Last amended on 24.03.2010
Related interpretations: SIC 15, 27, 29, 32, IFRIC 4

IAS 18 - Revenue
Last amended on 23.01.2009
Related interpretations: SIC 13, 27, 31

IAS 19 - Employee Benefits
Last amended on 23.01.2009
Related interpretations: SIC 12

IAS 20 - Accounting for Government Grants and Disclosure of Government Assistance
Last amended on 23.01.2009
Related interpretations: SIC 10

IAS 21 - The Effects of Changes in Foreign Exchange Rates
Last amended on 12.06.2009
Related interpretations: SIC 7

IAS 22 - Business Combinations
Superseded on 2005 by IFRS 3

IAS 23 - Borrowing Costs
Last amended on 23.01.2009
Related interpretations: IFRIC 1

IAS 24 - Related Party Disclosures
Last amended on 20.07.2010

IAS 25 - Accounting for Investments
Superseded on 2001 by IAS 39 and IAS 40

IAS 26 - Accounting and Reporting by Retirement Benefit Plans
Last amended on 03.11.2008

IAS 27 - Consolidated and Separate Financial Statements
Last amended on 12.06.2009
Related interpretations: SIC 12, IFRIC 5
Superseded on 2013 by IAS 27, IFRS 10 and IFRS 12

IAS 28 - Investments in Associates
Last amended on 12.06.2009
Related interpretations: IFRIC 5
Superseded on 2013 by IAS 28 and IFRS 12

IAS 29 - Financial Reporting in Hyperinflationary Economies
Last amended on 23.01.2009
Related interpretations: IFRIC 7

IAS 30 - Disclosures in the Financial Statements of Banks and Similar Financial Institutions
Superseded on 2007 by IFRS 7

IAS 31 - Interests in Joint Ventures
Last amended on 12.06.2009
Related interpretations: SIC 13, IFRIC 5

IAS 31 - Interests In Joint Ventures
Superseded on 2013 by IFRS 11 and IFRS 12

IAS 32 - Financial Instruments: Presentation
Last amended on 24.12.2009
Related interpretations: SIC 12, IFRIC 2, 11
IAS 32 - Financial Instruments: Disclosure superseded in 2007 by IFRS 7

IAS 33 - Earnings per Share
Last amended on 12.06.2009

IAS 34 - Interim Financial Reporting
Last amended on 12.06.2009
Related interpretations: IFRIC 10

IAS 35 - Discontinuing Operations
Superseded on 2005 by IFRS 5

IAS 36 - Impairment of Assets
Last amended on 24.03.2010
Related interpretations: SIC 32, IFRIC 1, 10

IAS 37 - Provisions, Contingent Liabilities and Contingent Assets
Last amended on 12.06.2009
Related interpretations: SIC 27, 29, IFRIC 1, 5, 6

IAS 38 - Intangible Assets
Last amended on 24.03.2010
Related interpretations: SIC 29, 32, IFRIC 4

IAS 39 - Financial Instruments: Recognition and Measurement
Last amended on 24.03.2010
Related interpretations: SIC 27, IFRIC 2, 5, 9, 10
Superseded on 2013 by IFRS 9

IAS 40 - Investment Property
Last amended on 23.01.2009
Related interpretations: SIC 21

IAS 41 - Agriculture
Last amended on 23.01.2009

IFRS 1 - First-time Adoption of International Financial Reporting Standards

Last amended on 24.07.2010
Related interpretations: IFRIC 9

IFRS 2 - Share-based Payment
Last amended on 24.03.2010
Related interpretations: SIC 12, IFRIC 8, 11

IFRS 3 - Business Combinations
Last amended on 12.06.2009
Related interpretations: SIC 32, IFRIC 9

IFRS 4 - Insurance Contracts
Last amended on 01.12.2009
Related interpretations: SIC 27

IFRS 5 - Non-current Assets Held for Sale and Discontinued Operations
Last amended on 24.03.2010

IFRS 6 - Exploration for and evaluation of Mineral Resources?Assets
Last amended on 03.11.2008

IFRS 7 - Financial Instruments: Disclosures
Last amended on 01.07.2010

IFRS 8 - Operating Segments
Last amended on 20.07.2010

IFRS 9 - Financial Instruments

IFRS 10 - Consolidated Financial Statements

IFRS 11 - Joint Arrangements

IFRS 12 - Disclosure of Interests in Other Entities

IFRS 13 - Fair Value Measurement

Annex 2 - Life insurance formulas

$x = Insured's\ age\ at\ evaluation\ date$

$i = Technical\ interest\ rate$

$v = Discounting\ factor$
$= \frac{1}{1+i}$

$l_0 = Initial\ cohort\ of\ insureds$

$l_x = Number\ of\ insureds\ expected\ to\ be\ alive\ at\ age\ x$
$= l_0 * {}_xp_0$

$d_x = Number\ of\ insureds\ expected\ to\ be\ dying\ at\ age\ x$
$= l_x - l_{x+1}$
$= l_x * q_x$

${}_td_x = Number\ of\ deaths\ expected\ between\ ages\ x\ and\ x+t\ among\ l_0$

$q_x = Probability\ that\ an\ insured\ of\ age\ x\ dies\ in\ the\ next\ year$
$= \frac{d_x}{l_x}$
$= \frac{l_x - l_{x+1}}{l_x}$

$p_x = Probability\ that\ an\ insured\ of\ age\ x\ survives\ in\ the\ next\ year$
$= 1 - q_x$
$= \frac{l_{x+1}}{l_x}$

$$
\begin{aligned}
{}_tq_x &= \textit{Probability that an insured of age } x \textit{ dies in the next } t \textit{ years} \\
&= d_x + d_{x+1} + d_{x+2} + \cdots + d_{x+t-1} \\
&= \frac{l_x - l_{x+t}}{l_x}
\end{aligned}
$$

$$
\begin{aligned}
{}_tp_x &= \textit{Probability that an insured of age } x \textit{ survives in the next } t \textit{ years} \\
&= p_x * p_{x+1} * p_{x+2} * \cdots * p_{x+t-1} \\
&= \frac{l_{x+t}}{l_x}
\end{aligned}
$$

$$
\begin{aligned}
{}_{n|t}q_x &= \textit{Probability that an insured of age } x \textit{ dies between ages } x+n \textit{ and } x+n+t \\
&= {}_n p_x * {}_tq_{x+n} \\
&= \frac{l_{x+n} - l_{x+n+t}}{l_x}
\end{aligned}
$$

$$D_x = v^x * l_x$$

$$
\begin{aligned}
N_x &= \sum_{k=0}^{\infty} D_{x+k} \\
&= \sum_{k=0}^{\infty} v^{x+k} * l_{x+k}
\end{aligned}
$$

$$C_x = v^{x+1} * d_x$$

$$
\begin{aligned}
M_x &= \sum_{k=0}^{\infty} C_{x+k} \\
&= \sum_{k=0}^{\infty} v^{x+k+1} * d_{x+k}
\end{aligned}
$$

$$
\begin{aligned}
a_x &= \textit{Annuity with payments at each end of period} \\
&= \sum_{k=1}^{\infty} v^k * {}_kp_x \\
&= \frac{N_{x+1}}{D_x} \\
&= \frac{1 - (1+i)A_x}{i}
\end{aligned}
$$

$a_{x:\overline{n}|} = n - year\ temporary\ annuity\ paying\ at\ each\ end\ of\ period$

$$= \sum_{k=1}^{n} v^k * {}_kp_x$$

$$= \frac{N_{x+1} - N_{x+n-1}}{D_x}$$

$\ddot{a}_x = Annuity\ with\ payments\ at\ each\ beginning\ of\ period$

$$= \sum_{k=0}^{\infty} v^k * {}_kp_x$$

$$= \frac{N_x}{D_x}$$

$$= \sum_{k=0}^{\infty} A_{x:\overline{k}|}^{\ \ \frac{1}{}}$$

$$= \frac{1 - A_x}{d}$$

$\ddot{a}_{x:\overline{n}|} = n - year\ temporary\ annuity\ paying\ at\ each\ beginning\ of\ period$

$$= \sum_{k=0}^{n-1} v^k * {}_kp_x$$

$$= \frac{N_x - N_{x+n}}{D_x}$$

$$= \sum_{k=0}^{n-1} A_{x:\overline{k}|}^{\ \ \frac{1}{}}$$

$$= \frac{1 - A_{x:\overline{n}|}}{d}$$

$A_x = Insurance\ paying\ a\ capital\ of\ 1\ at\ the\ end\ of\ the\ period\ in\ case\ of\ death$

$$= \sum_{k=0}^{\infty} v^{k+1} * {}_{k|1}q_x$$

$$= \sum_{k=0}^{\infty} v^{k+1} *_k p_x * q_{x+k}$$

$$= \sum_{k=0}^{\infty} v^{k+1} * \frac{d_{x+k}}{l_x}$$

$$= \frac{M_x}{D_x}$$

$$
\begin{aligned}
A_{\underset{x:\overline{n}|}{1}} &= n-year\ temporary\ insurance\ paying\ a\ capital\ of\ 1 \\
&\quad\ at\ the\ end\ of\ the\ period\ in\ case\ of\ death \\
&= \sum_{k=0}^{n-1} v^{k+1} * {}_{k|1}q_x \\
&= \frac{M_x - M_{x+n}}{D_x}
\end{aligned}
$$

$$
\begin{aligned}
A_{\underset{x:\overline{n}|}{\frac{1}{}}} &= n-year\ temporary\ insurance\ paying\ a\ capital\ of\ 1 \\
&\quad\ at\ the\ end\ of\ the\ contract\ in\ case\ of\ survival \\
&= v^n * {}_np_x \\
&= \frac{D_{x+n}}{D_x}
\end{aligned}
$$

$$
\begin{aligned}
A_{x:\overline{n}|} &= n-year\ temporary\ insurance\ paying\ a\ capital\ of\ 1\ in\ both\ previous\ cases \\
&= A_{\underset{x:\overline{n}|}{1}} + A_{\underset{x:\overline{n}|}{\frac{1}{}}} \\
&= \sum_{k=0}^{n-1} v^{k+1} * {}_{k|1}q_x + v^n * {}_np_x \\
&= \frac{M_x - M_{x+n} + D_{x+n}}{D_x}
\end{aligned}
$$

Annex 3 - Provisioning for mixed endowment

Overview on the contract

x: Entry age

n: Maturity

t: Evaluation date

P: Yearly premium

UP: Unique premium

SI: Sum Insured

In case of periodic premiums, we have the following relations:

$$P = SI * \frac{A_{x:\overline{n}|}}{\ddot{a}_{x:\overline{n}|}}$$

$$SI = P * \frac{\ddot{a}_{x:\overline{n}|}}{A_{x:\overline{n}|}}$$

In case of one unique premium at the beginning of the contract, we have the following relations:

$$UP = SI * A_{x:\overline{n}|}$$

$$SI = UP * \frac{1}{A_{x:\overline{n}|}}$$

Provisioning using a prospective approach

The reserve is seen as the difference between the actuarial present value of future benefits and the actuarial present value of future net premiums.
This way of calculation is more convenient for durations beyond the premium-paying period.

$$
\begin{aligned}
{}_tV_x^{Prosp} &= PV(FutureBenefits) - PV(FuturePremiums) \\
&= SI * A_{x+t:\overline{n-t}|} - P * \ddot{a}_{x+t:\overline{n-t}|} \\
&= SI * \left(\sum_{k=0}^{n-t-1} v^{k+1} *_{k|1} q_{x+t} + v^{n-t} *_{n-t} p_{x+t} \right) - P * \sum_{k=0}^{n-t-1} v^k *_k p_{x+t} \\
&= SI * \left(\sum_{k=0}^{n-t-1} v^{k+1} *_k p_{x+t} * q_{x+t+k} + v^{n-t} *_{n-t} p_{x+t} \right) - P * \sum_{k=0}^{n-t-1} v^k *_k p_{x+t} \\
&= SI * \left(\sum_{k=0}^{n-t-1} v^{k+1} * \frac{\cancel{l_{x+t+k}}}{l_{x+t}} * \frac{d_{x+t+k}}{\cancel{l_{x+t+k}}} + v^{n-t} * \frac{l_{x+n}}{l_{x+t}} \right) - P * \sum_{k=0}^{n-t-1} v^k * \frac{l_{x+t+k}}{l_{x+t}} \\
&= SI * \left(\sum_{k=0}^{n-t-1} v^{k+1} * \frac{d_{x+t+k}}{l_{x+t}} + v^{n-t} * \frac{l_{x+n}}{l_{x+t}} \right) - P * \frac{\sum_{k=0}^{n-t-1} v^k * l_{x+t+k}}{l_{x+t}} \\
&= SI * \left(\frac{\sum_{k=t}^{n-1} v^{k+1} * d_{x+k}}{v^t * l_{x+t}} + \frac{v^{n-t} * l_{x+n}}{l_{x+t}} \right) - P * \frac{\sum_{k=t}^{n-1} v^k * l_{x+k}}{v^t * l_{x+t}} \\
&= SI * \frac{M_{x+t} - M_{x+n} + D_{x+n}}{D_{x+t}} - P * \frac{N_{x+t} - N_{x+n}}{D_{x+t}}
\end{aligned}
$$

Provisioning using a retrospective approach

The reserve is seen as the difference between the actuarial present value of past net premiums and the actuarial present value of past benefits.
This way of calculation is more convenient in a deferred period during which no benefit has been provided.

$$
\begin{aligned}
{}_tV_x^{Retro} &= PV(PastPremiums) - PV(PastBenefits) \\
&= P * \frac{\ddot{a}_{x:\overline{t}|}}{v^t *_t p_x} - SI * \frac{A^{1}_{x:\overline{t}|}}{v^t *_t p_x} \\
&= P * \frac{\sum_{k=0}^{t-1} v^k *_k p_x}{v^t *_t p_x} - SI * \frac{\sum_{k=0}^{t-1} v^{k+1} *_{k|1} q_x}{v^t *_t p_x} \\
&= P * \frac{\sum_{k=0}^{t-1} v^k *_k p_x}{v^t *_t p_x} - SI * \frac{\sum_{k=0}^{t-1} v^{k+1} *_k p_x *_1 q_{x+k}}{v^t *_t p_x} \\
&= P * \frac{\sum_{k=0}^{t-1} v^k * \frac{l_{x+k}}{\cancel{l_x}}}{v^t * \frac{l_{x+t}}{\cancel{l_x}}} - SI * \frac{\sum_{k=0}^{t-1} v^{k+1} * \frac{\cancel{l_{x+k}}}{\cancel{l_x}} * \frac{l_{x+k} - l_{x+k+1}}{\cancel{l_{x+k}}}}{v^t * \frac{l_{x+t}}{\cancel{l_x}}} \\
&= P * \frac{\sum_{k=0}^{t-1} v^k * l_{x+k}}{v^t * l_{x+t}} - SI * \frac{\sum_{k=0}^{t-1} v^{k+1} * (l_{x+k} - l_{x+k+1})}{v^t * l_{x+t}} \\
&= P * \frac{\sum_{k=0}^{t-1} v^k * l_{x+k}}{v^t * l_{x+t}} - SI * \frac{\sum_{k=0}^{t-1} v^{k+1} * d_{x+k}}{v^t * l_{x+t}} \\
&= P * \frac{N_x - N_{x+t}}{D_x * v^t *_t p_x} - SI * \frac{M_x - M_{x+t}}{D_x * v^t *_t p_x}
\end{aligned}
$$

Annex 4 - Provisioning for old age annuity

Overview on the contract

x: Entry age	**P:** Yearly premium
n: Date of beginning of the annuity	**UP:** Unique premium
t: Evaluation date	**SI:** Sum Insured

In case of periodic premiums, we have the following relations:

$$\begin{aligned} P &= SI * \frac{{}_{n|}\ddot{a}_x}{\ddot{a}_{x:\overline{n}|}} \\ &= SI * \frac{v^n *_n p_x * \ddot{a}_{x+n}}{\ddot{a}_{x:\overline{n}|}} \end{aligned}$$

$$\begin{aligned} SI &= P * \frac{\ddot{a}_{x:\overline{n}|}}{{}_{n|}\ddot{a}_x} \\ &= P * \frac{\ddot{a}_{x:\overline{n}|}}{v^n *_n p_x * \ddot{a}_{x+n}} \end{aligned}$$

In case of one unique premium at the beginning of the contract, we have the following relations:

$$\begin{aligned} UP &= SI *_{n|} \ddot{a}_x \\ &= SI * v^n *_n p_x * \ddot{a}_{x+n} \end{aligned}$$

$$\begin{aligned} SI &= UP * \frac{1}{{}_{n|}\ddot{a}_x} \\ &= UP * \frac{1}{v^n *_n p_x * \ddot{a}_{x+n}} \end{aligned}$$

Provisioning using a prospective approach

The reserve is seen as the difference between the actuarial present value of future benefits and the actuarial present value of future net premiums.
This way of calculation is more convenient for durations beyond the premium-paying period.

- If $t < n$:

$$\begin{aligned}
{}_tV_x^{Prosp} &= PV(FutureBenefits) - PV(FuturePremiums) \\
&= SI *_{n-t|} \ddot{a}_{x+t} - P * \ddot{a}_{x+t:\overline{n-t}|} \\
&= SI * v^{n-t} *_{n-t} p_{x+t} * \ddot{a}_{x+n} - P * \ddot{a}_{x+t:\overline{n-t}|} \\
&= SI * \frac{\sum_{k=n}^{\infty} v^k * l_{x+k}}{v^t * l_{x+t}} - P * \frac{\sum_{k=t}^{n-1} v^k * l_{x+k}}{v^t * l_{x+t}} \\
&= SI * \frac{N_{x+n}}{D_{x+t}} - P * \frac{N_{x+t} - N_{x+n}}{D_{x+t}}
\end{aligned}$$

- If $t \geq n$:

$$\begin{aligned}
{}_tV_x^{Prosp} &= PV(FutureBenefits) - PV(FuturePremiums) \\
&= SI * \ddot{a}_{x+t} \\
&= SI * \frac{\sum_{k=t}^{\infty} v^k * l_{x+k}}{v^t * l_{x+t}} \\
&= SI * \frac{N_{x+t}}{D_{x+t}}
\end{aligned}$$

Provisioning using a retrospective approach

The reserve is seen as the difference between the actuarial present value of past net premiums and the actuarial present value of past benefits.
This way of calculation is more convenient in a deferred period during which no benefit has been provided.

- If $t < n$:

$$\begin{aligned}
{}_tV_x^{Retro} &= PV(PastPremiums) - PV(PastBenefits) \\
&= P * \frac{\ddot{a}_{x:\overline{t}|}}{v^t *_t p_x} \\
&= P * \frac{N_x - N_{x+t}}{D_x * v^t *_t p_x} \\
&= P * \frac{\sum_{k=0}^{t-1} v^k *_k p_x}{v^t *_t p_x}
\end{aligned}$$

- If $t \geq n$:

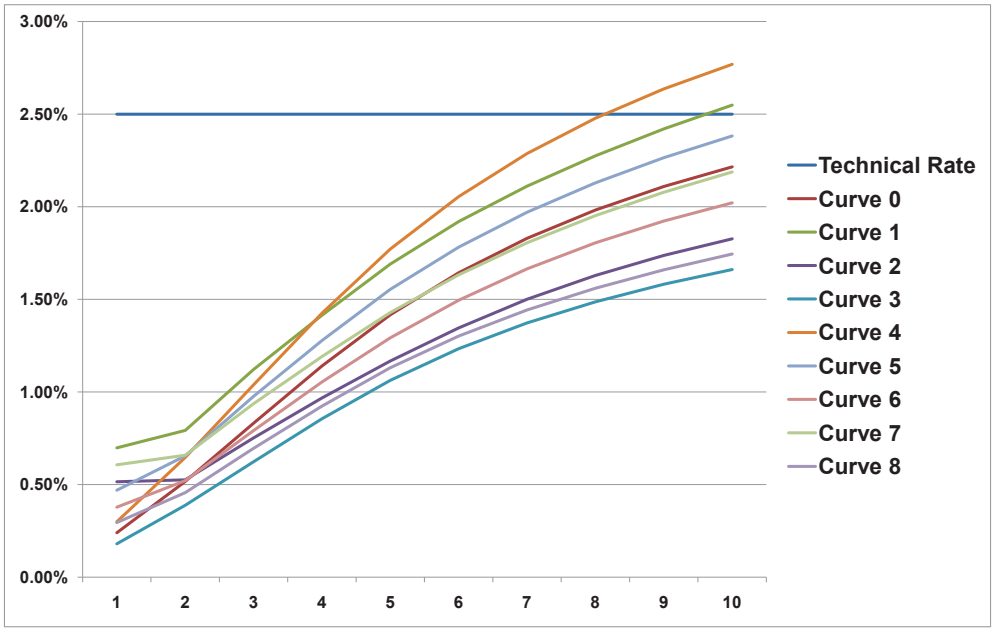
$$\begin{aligned}
{}_tV_x^{Retro} &= PV(PastPremiums) - PV(PastBenefits) \\
&= P * \frac{\ddot{a}_{x:\overline{n}|}}{v^t *_t p_x} - SI * \frac{\ddot{a}_{x+n:\overline{t-n}|}}{v^{t-n} *_{t-n} p_{x+n}} \\
&= P * \frac{N_x - N_{x+n}}{D_x * v^t *_t p_x} - SI * \frac{N_{x+n} - N_{x+t}}{D_{x+n} * v^{t-n} *_{t-n} p_{x+n}} \\
&= P * \frac{\sum_{k=0}^{n-1} v^k *_k p_x}{v^t *_t p_x} - SI * \frac{\sum_{k=0}^{t-n-1} v^k *_k p_{x+n}}{v^{t-n} *_{t-n} p_{x+n}}
\end{aligned}$$

Annex 5 - Interest rate scenarios

Table 2.5: Swap curve

Year	Curve 0	Curve 1	Curve 2	Curve 3	Curve 4	Curve 5	Curve 6	Curve 7	Curve 8
0	0.24%	0.70%	0.52%	0.18%	0.30%	0.47%	0.38%	0.61%	0.29%
1	0.52%	0.79%	0.53%	0.39%	0.65%	0.65%	0.52%	0.66%	0.46%
2	0.83%	1.12%	0.75%	0.62%	1.04%	0.98%	0.79%	0.94%	0.70%
3	1.14%	1.41%	0.97%	0.86%	1.43%	1.28%	1.05%	1.19%	0.92%
4	1.42%	1.69%	1.17%	1.06%	1.77%	1.55%	1.29%	1.43%	1.13%
5	1.64%	1.92%	1.35%	1.23%	2.06%	1.78%	1.50%	1.63%	1.30%
6	1.83%	2.11%	1.50%	1.37%	2.29%	1.97%	1.66%	1.81%	1.44%
7	1.98%	2.28%	1.63%	1.49%	2.48%	2.13%	1.81%	1.95%	1.56%
8	2.11%	2.42%	1.74%	1.58%	2.64%	2.26%	1.92%	2.08%	1.66%
9	2.22%	2.55%	1.83%	1.66%	2.77%	2.38%	2.02%	2.19%	1.74%

Table 2.6: Swap curves



Annex 6 - Mortality scenarios

Table 2.7: Mortality rates

Year	First order	Second order	Shocked
0	0.3096%	0.2167%	0.5419%
1	0.1177%	0.0824%	0.2060%
2	0.0805%	0.0564%	0.1409%
...			
20	0.2254%	0.1578%	0.3944%
21	0.2174%	0.1522%	0.3805%
22	0.2028%	0.1420%	0.3549%
...			
50	0.4166%	0.2916%	0.7291%
51	0.4598%	0.3218%	0.8046%
52	0.5070%	0.3549%	0.8873%
...			
70	2.3423%	1.6396%	4.0991%
71	2.5106%	1.7574%	4.3936%
72	2.6970%	1.8879%	4.7198%
...			
87	12.0365%	8.4255%	21.0639%
88	13.0355%	9.1248%	22.8121%
89	14.0695%	9.8487%	24.6217%
...			
100	27.7546%	19.4282%	48.5705%
101	29.2085%	20.4460%	51.1149%
102	30.6973%	21.4881%	53.7203%
...			
117	57.2058%	40.0440%	100.1101%
118	59.2501%	41.4751%	103.6877%
119	61.3289%	42.9302%	107.3255%

Table 2.8: Mortality curves