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**Choice of a risk measure for supervisory purposes:  
possible amendments to the  
Framework for Consultation**

This paper addresses the choice of a risk measure for solvency purposes, in particular to calculate new capital requirements. The current Framework for Consultation (document MARKT/2515/06) already defines such a risk measure (cf. § 1.1 of the present document). Nevertheless, CEIOPS recommends amending the Framework to introduce a different risk measure (TVaR). In addition this alternative risk measure would be based on a new definition of "ruin". These two possible major changes should be examined by EIOPC, before any final decision is taken.

The paper is divided in three parts:

- background information (current definitions, important issues to address);
- discussion on the definition of ruin, and possible amendment of the Framework;
- discussion on the choice of VaR vs. TVaR, and possible amendment of the Framework.

## **1. BACKGROUND INFORMATION**

### **1.1. Amended Framework for Consultation**

Paragraph 17 of the Amended Framework for Consultation introduces a risk measure for SCR purposes:

*"The Solvency Capital Requirement (SCR) reflects a level of capital that enables an institution to absorb significant unforeseen losses and that gives reasonable assurance to policyholders and beneficiaries. [...] The parameters in the SCR should be calibrated in such a way that the quantifiable risks to which an institution with a diversified portfolio of risks is exposed are taken into account and based on the amount of economic capital corresponding to a ruin probability of 0.5% (Value at Risk of 99.5%) and a one year time horizon. This percentage reflects a working hypothesis. Ruin occurs when the amount of admissible assets is lower than the amount of technical provisions as defined in paragraph 16<sup>1</sup>. [...] These principles shall apply regardless of whether a standard formula or an internal model is used."*

Main features of the current definition of risk measure are the following:

- The "ruin" event (i.e. the worst-case scenario, which likelihood should be limited) occurs when the amount of admissible assets is lower than the total amount of technical provisions.
- The chosen risk measure is Value at Risk (VaR), which is the maximum potential loss under a certain probability level and over a certain time horizon.
- Parameters for estimating VaR are a one-year time horizon and a 0.5% probability.

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<sup>1</sup> Paragraph 16 of the Framework of Consultation.

CEIOPS' latest advice (cf. Consultation Paper n° 20 and paper on the "Choice of a risk measure for supervisory purposes") is to change both the definition of ruin and the chosen risk measure. On the other hand, the one-year time horizon is not questioned by CEIOPS and the chosen protection level (0.5% confidence level) is considered appropriate<sup>2</sup>.

## **1.2. Definition of a risk measure: purposes and main issues to address**

A "risk measure" is a function that assigns an amount of capital to a certain probability distribution: the higher the underlying risk level is, the higher the resulting amount of capital is.

Within the Solvency II framework, both capital requirements (the Solvency Capital Requirement, or SCR, and the Minimum Capital Requirement, or MCR) should reflect the risk-standing of the undertaking. From a practical perspective, the new solvency regime will assign an amount of capital to the company's risk profile, which exactly corresponds to defining a "risk measure". It is essential to define a clear risk measure, since it will serve as a benchmark for the standard formula and the various internal models (full or partial) that companies may develop. This common benchmark will ensure consistency between the standard approach and the individual ones.

For solvency purposes, the probability distribution to consider is the distribution of the company's economic wealth, i.e. its available capital. Indeed, capital acts as a cushion against unforeseen losses and reduces the probability of insolvency.

But there are different definitions for what "insolvency" means in practice. Among others, it relates to the definition of available capital, which is needed to build the adequate probability distribution. This question is addressed in part 2 of this paper (definition of ruin).

To design a full risk measure, a function has then to be chosen to link the amount of capital with the probability distribution; the Value at Risk (VaR) and Tail Value at Risk (TVaR) functions are most commonly used. Part 3 of this paper is dedicated to the choice of such a function and of the corresponding parameters.

## **2. DEFINITION OF RUIN**

### **2.1. Possible definitions of ruin: discussion**

Ruin corresponds to the worst-case scenario the insurance regulator wants to avoid. Different situations may be seen as unacceptable from this perspective. Figure 1 presents an insurer's simplified balance-sheet in five possible financial situations, some of which should be avoided.

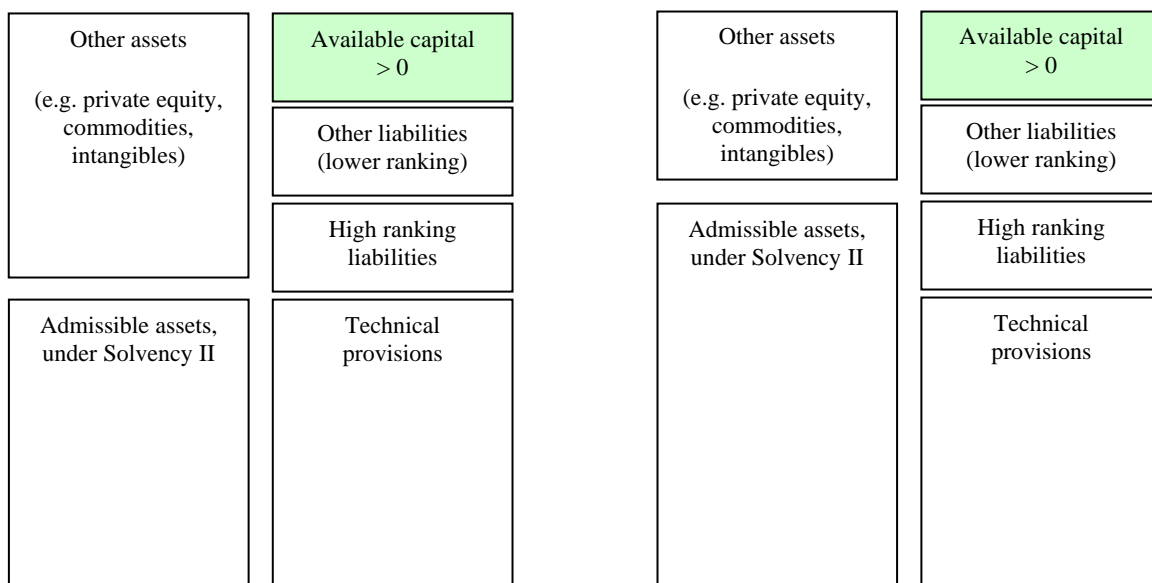
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<sup>2</sup> Although for TVAR the confidence level itself would have to be recalibrated in order to deliver the same level of protection (e.g. by choosing a 1% confidence level).

Let us consider the three following ruin situations:

- Situation n° 1: admissible assets do not cover technical provisions anymore, which means that if all technical liabilities had to be settled immediately, selling all admissible assets would not be sufficient (but there might be other assets and liabilities).
- Situation n° 2: taking account of all liabilities (technical provisions plus others) and assets (admissible or not), the assets do not cover the liabilities, which means available capital is negative.
- Situation n° 3: admissible assets do not cover the sum of technical provisions and other high-ranking liabilities (e.g. commitments towards the Social Security)<sup>3</sup>.

*Figure 1: five possible financial situations (stylised balance-sheets)*



**a) Situations 1 and 2 are avoided but not situation 3**

**b) Situations 1, 2, 3 and 4 are all avoided**

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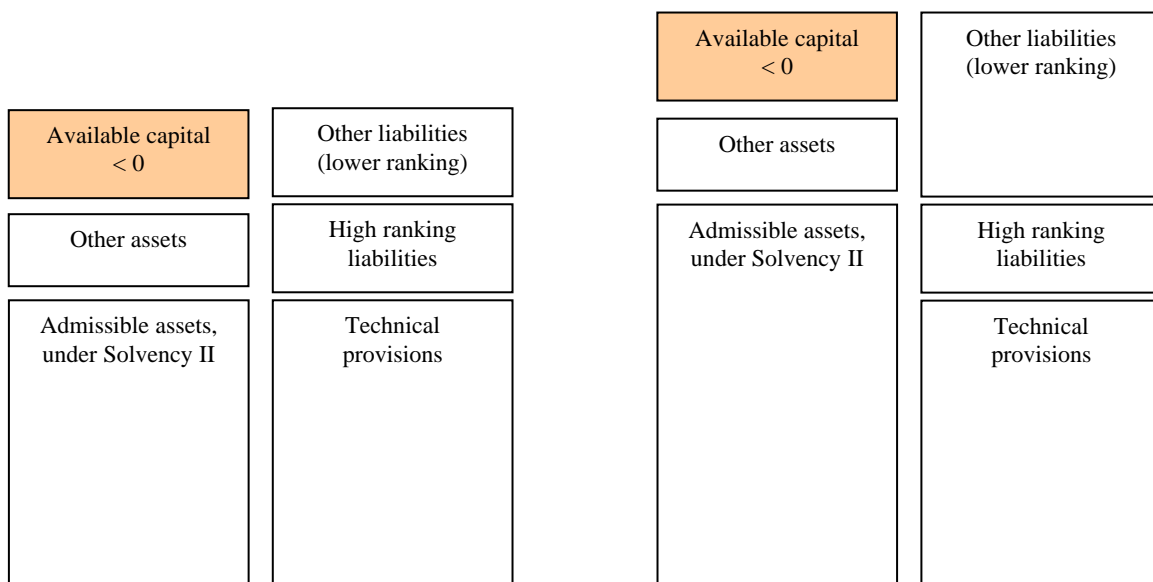
<sup>3</sup> According to article 10 of the Winding-up Directive, when an insurance company is wound-up, the precedence of policyholders' claims over other liabilities may be absolute (option a) or not (option b):

**Article 10 : Treatment of insurance claims**

1. Member States shall ensure that insurance claims take precedence over other claims on the insurance undertaking according to one or both of the following methods:

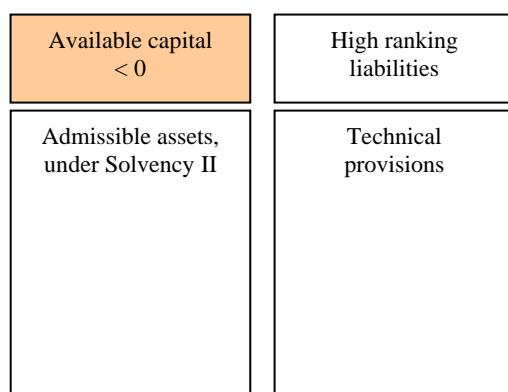
- (a) insurance claims shall, with respect to assets representing the technical provisions, take absolute precedence over any other claim on the insurance undertaking;
- (b) insurance claims shall, with respect to the whole of the insurance undertaking's assets, take precedence over any other claim on the insurance undertaking with the only possible exception of:
  - (i) claims by employees arising from employment contracts and employment relationships,
  - (ii) claims by public bodies on taxes,
  - (iii) claims by social security systems,
  - (iv) claims on assets subject to rights in rem.

2. Without prejudice to paragraph 1, Member States may provide that the whole or a part of the expenses arising from the winding-up procedure, as defined by their national legislation, shall take precedence over insurance claims.



**c) Situation 1 is avoided, but not situations 2 and 3; in case of winding-up, claims are settled**

**d) Situations 1 and 3 are avoided, but not situation 2**



**e) Situation 1 is avoided, but not situations 2 and 3; in case of winding-up, claims are not settled, because of higher ranking liabilities**

Ruin situation n° 1 corresponds to the current definition of ruin in the Amended Framework for Consultation; situations n° 2 and n° 3 are very similar to CEIOPS' advice. Indeed CEIOPS recommends that ruin should be “*the point where assets no longer exceed technical provisions and other liabilities*”, or at least “*the point where assets no longer exceed technical provisions (valued for solvency purposes) and other liabilities (to the extent these are not treated as available capital).*”

Ruin definition n° 1 closely focuses on the matching of admissible assets with technical liabilities, which is an important sound management principle.

Yet, as figure 1 shows it, there may be situations in which admissible assets exactly cover technical provisions, but where available capital is negative. In practice, if there are some higher-ranking liabilities, the company may be obliged to sell its admissible assets to fulfil these commitments, before claims are settled in case of winding-up, so the company may fail to pay part of the claims (cf. example e). In the same way, on a going-concern basis, in case available capital is negative, the company may deliberately decide to settle other liabilities before claims and remaining assets would be insufficient to meet insurance commitments (cf. example d). In both cases, the definition of ruin as stated in situation 1 does not provide full protection for policyholders' interests.

The weakness of the current definition of ruin (situation n° 1) comes from the fact that "other liabilities" (higher-ranking or not) are treated as "available capital" for supervisory purposes. Now, one may expect "available capital" in the scope of this definition to be the same as eligible elements to cover the SCR. Since "other liabilities" can hardly be considered eligible capital elements, the definition of ruin n° 1 is not fully satisfactory.

On the other hand, ruin situation n° 2 corresponds to the definition of ruin often used for internal modelling purposes, since it relates to the definition of economic capital (i.e. excess of assets over liabilities).

One could argue that definition n° 2 does not discriminate between the various types of assets covering technical provisions (eligible or not), or between the various tiers of available capital. Should the insurance company use an internal model, specific constraints may be included in the model so that unacceptable situations (e.g. all available capital is tier 3) may also be treated as "ruin" realizations.

Finally, ruin situation n° 3 might be considered as a middle term between situations n° 1 and n° 2. Indeed, assuming the company is on the verge of situation n° 3, senior liabilities such as commitments to the State or the policyholders are not jeopardized yet. On the other hand, lower ranking liabilities may not be met, since available capital may be negative (cf. example d). From a policyholder's perspective, this situation may seem acceptable, even though the financial health of the company is seriously weakened.

## **2.2. Questions for Member States**

The following definitions of ruin may be considered:

- Definition n° 1 (present definition): "Ruin occurs when the amount of admissible assets is lower than the amount of technical provisions as defined in paragraph 16<sup>4</sup>."
- Definition n° 2 (CEIOPS proposal): "Ruin occurs when the amount of available capital falls under zero, i.e. when assets no longer exceed technical provisions and other liabilities (to the extent they are not treated as available capital)."

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<sup>4</sup> Paragraph 16 of the Framework of Consultation.

- Definition n° 3: "Ruin occurs when the amount of assets is lower than the sum of senior liabilities (e.g. tax, social security, and staff liabilities) and technical provisions as defined in paragraph 16<sup>5</sup>."
- Definition n° 4: "Ruin occurs when the amount of eligible capital (as defined for supervisory purposes) falls under an absolute floor (e.g. MCR absolute floor, still to be defined)."

**(1) Do Member States support the definition of ruin proposed by CEIOPS in Consultation Paper n° 20 (i.e. definition n° 2)?**

### **3. CHOICE OF A RISK MEASURE: VAR VERSUS TVAR**

#### **3.1. Existing risk measures**

Assuming the ruin event has been defined, the risk measure will assign an amount of capital to the corresponding probability distribution. Insurance companies commonly use 3 types of risk measures:

- Value at Risk (VaR): It is the maximum potential loss (i.e. decrease in available capital) under a certain probability of ruin ( $\alpha$  %), over a certain time horizon ( $x$  years). Assuming VaR equals 100, the probability for ruin to occur in the  $x$  following years will amount to  $\alpha$  %, provided the company holds 100 of capital. VaR enables the company to precisely assess the likelihood of the adverse scenario, knowing the initial amount of its own funds.
- Tail Value at Risk (TVaR): It is the expected loss that will affect the company under ruin circumstances, given that ruin occurs with a certain probability ( $\alpha$  %) and over certain time horizon ( $x$  years). Assuming TVaR equals 115, it means that in the worst cases (the  $\alpha$  % situations in which ruin occurs in the  $x$  following years), the company will lose 115 in the average. If the company holds 115 of capital, it should therefore survive the worst-case scenarios roughly half of the time<sup>6</sup>.
- VaR using a multiplier: It equals VaR multiplied by a given number  $k$ . It corresponds to the cumulative loss when the VaR scenario occurs  $k$  times in a row.

For internal modelling purposes, most direct insurers use VaR (with a multiplier or not), whereas reinsurers often refer to TVaR<sup>7</sup>. This is not surprising, since reinsurers are especially interested in extreme events and worst-case scenarios.

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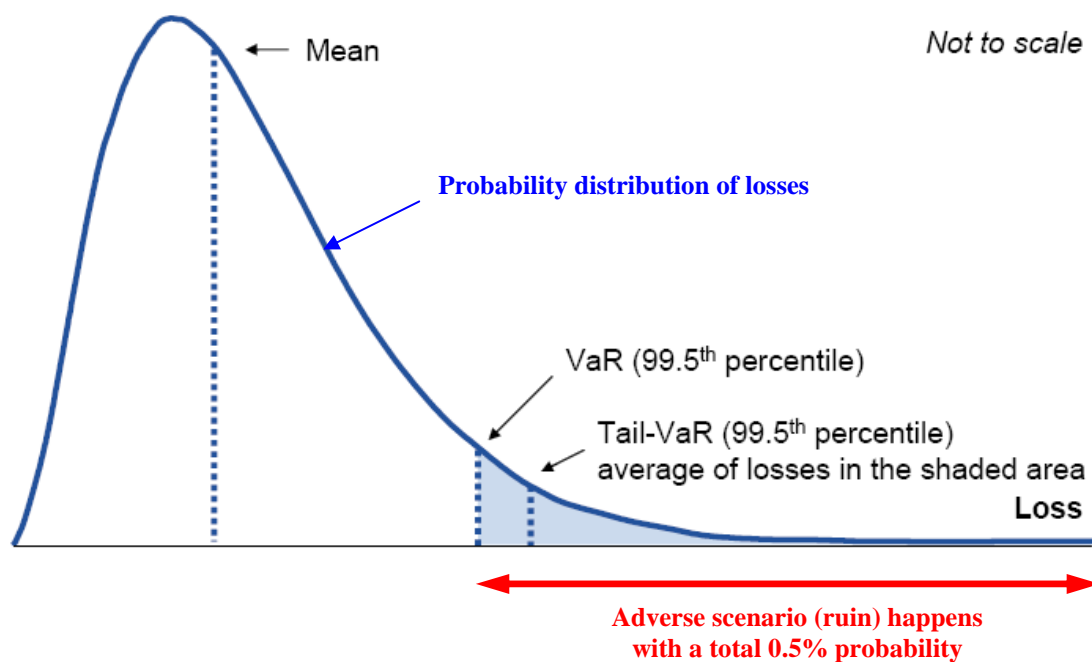
<sup>5</sup> Paragraph 16 of the Framework of Consultation.

<sup>6</sup> Indeed, by rough approximation, the loss will be equal or higher than its mean ( $\sim$ TVaR) with a 50% probability and equal or lower than its mean with a 50% probability. The exact percentages nevertheless depend on the tail of the distribution.

<sup>7</sup> Cf. CEA Working Paper on VaR and TailVaR.

Figure 2 represents how VaR and TVaR are derived from a probability distribution with a 99.5% confidence level (i.e. with a 0.5% ruin probability), over one-year.

Figure 2: graphical definition of VaR and TVaR



Form a theoretical point of view, VaR using a multiplier is not as precise a risk measure as simple VaR and TVaR. Indeed, the latter provide the company with the amount of capital to hold to survive under a specific confidence level (e.g.  $1 - \alpha$  %). Conversely, VaR using a multiplier assumes the adverse event happens  $k$  times in a row, but we do not know the probability of such a scenario. For instance, the  $k$  adverse events may be fully independent (e.g. natural catastrophes happening at different places in the world), so that the probability would be  $(\alpha \%)^k$ , very small. On the other hand, the first adverse event could trigger all the following ones (e.g. a repeating IT failure) and the probability would be  $\alpha$  %, much higher.

On the other hand, VaR using a multiplier is currently used by banking companies, to evaluate their market risk exposure (regarding their trading book).

Since VaR with a multiplier is just a variant of simple VaR, the next paragraph only tackles the respective merits of simple VaR and TVaR.

### 3.2. Discussion: respective merits of VaR and TVaR

Within the current Framework for Consultation, VaR is the preferred risk measure, which is supported by the Comité Européen des Assurances (cf. CEA Working Paper on the risk measures VaR and TailVaR). Yet, CEIOPS strongly advocates for TVaR (cf. Answers to the second wave of Calls for Advice – CfA n° 10, draft Consultation Paper n° 16).

The following table summarises the respective merits of the two approaches, according to CEIOPS and the CEA:

Perspective	VaR	TailVaR
<b>Theoretical qualities</b>	<p>VaR is not a "coherent" measure, which means it does not respect all actuarial qualities for such a measure. In particular, it is not "sub-additive": VaR (risk A + risk B) might be higher than the sum of VaR (risk A) and VaR (risk B), which is not logical since there should be risk mitigation between A and B. Under certain circumstances, VaR may underestimate the level of exposure.</p> <p>On the other hand, from a practical perspective, VaR in the tail region of the distribution (e.g. 99.5%) would be roughly sub-additive.</p>	<p>TailVaR is a coherent risk measure; it is therefore recommended by the International Actuary Association. In particular, it is sub-additive.</p> <p>Therefore, unlike VaR, TailVaR never underestimates the the level of exposure.</p>
<b>Day to day risk management</b>	<p>VaR is easy to explain to top-management and other stakeholders. It is therefore easy to implement throughout the company and to embed in the company's risk culture (so as to improve risk management).</p> <p>99.5% VaR focuses on the worst 9950<sup>th</sup> loss out of 10 000 simulations: it is the worst scenario under "normal" circumstances. It does not focus on extreme events.</p>	<p>TailVaR requires more mathematical background to be understood and implemented. It is more difficult to embed in the company's culture.</p> <p>99.5% TailVaR focuses on what happens in the 50 worst scenarios out of 10 000 simulations: it tackles large risks and extreme events. Such risks often trigger bankruptcy: studying them should improve extreme events management and limit the probability of insolvency.</p>
<b>Implementation</b>	<p>VaR refers to "normal" circumstances (see previous box): it is easier to collect data and make realistic assumptions.</p> <p>Since VaR refers to one worst-case scenario (the 99.5% confidence level), it is easy to design a proxy stress-test to calculate VaR. You just have to define the 99.5% scenario.</p>	<p>Companies often lack the necessary data to simulate extreme events (e.g. an event like Katrina happens only once in 35 years, so it is impossible to conduct proper statistical analysis). Companies sometimes have to make haphazard assumptions to assess TailVaR, so results are potentially marred with a significant modelling error.</p>
<b>Consistency with the other financial sectors</b>	<p>VaR is the most commonly used risk measure in all financial sectors. For instance, banks use VaR to assess market risk.</p>	<p>99.5% TailVaR is similar to an "expected loss under default", where default corresponds to breaching the 99.5% percentile. Such a concept is used under the Basel II most advanced approach to credit risk ("loss given default" or LGD).</p>
<b>In place within companies / administrative burden</b>	<p>VaR is already often used by direct insurers (77% of respondents to a worldwide SOA survey).</p>	<p>TVaR is the preferred risk measure of reinsurance companies, which often have already developed internal models.</p>

### **3.3. Introduction of an equivalence principle: allowance for alternative risk measures**

Both CEIOPS and the CEA, even though they favour different risk measures, advocate for some more flexibility. More precisely, the Framework for Consultation should define a preferred risk measure, which would serve as a benchmark to assess the level of protection conferred to policyholders, but this should not prevent the use of alternative risk measures by insurance companies using an internal model to calculate the SCR, as long as they can demonstrate that they can adjust the output of this model to deliver an assessment of the capital required to meet the prescribed benchmark level of protection.

For instance, under certain assumptions, VaR 99.5% and TVaR 99% over a one-year time horizon lead to comparable results. The CEA document quotes other examples of such equivalence.

In practice, a company may be allowed to refer to an alternative risk measure, if it can show the supervisor that it is possible to derive the benchmark level of protection from the output of its internal model. CEIOPS paper provides some guidance on how these “equivalence criteria” may be verified under the supervisory review process.

### **3.4. Questions for Member States**

Members States are asked the following questions regarding the risk measure that should serve as a benchmark to calculate the SCR:

- (2) Should TVaR become the new preferred risk measure, as CEIOPS suggests in Consultation Paper n° 20?**

**In this case, are the 99% confidence level and the one-year time horizon appropriate parameters to calculate TVaR?**

Whatever the preferred risk measure may be, Member States may wish to allow for some flexibility, provided the alternative risk measure gives equivalent protection to policyholders.

For instance, as long as the corresponding capital requirement satisfies certain equivalence criteria, when compared with the preferred risk measure:

- the company may refer to either VaR or TVaR to calculate its SCR, when using an internal model;
- it may also use different levels of confidence and time-horizons to compute its capital requirement.

- (3) For internal modelling purposes, would Member States allow the use of alternative risk measures, provided that policyholders are granted the same level of protection?**

- Annexes:
- CEA Working Paper on the risk measures VaR and TailVaR
  - CEIOPS Consultation Paper n° 20 (extracts)
  - CEIOPS Paper on the "Choice of risk measure for solvency purposes"

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## Annex 1: extracts from Consultation Paper n° 20

### *Definition of ruin*

- 2.29 In Cfa 10.125, CEIOPS proposed that the unacceptable level of capital which serves as a benchmark for the calculation of the SCR should be defined as the point where assets no longer exceed technical provisions (valued for solvency purposes) and other liabilities.
- 2.30 CEIOPS recognises that the Commission's *Amended Framework for Consultation* suggests defining ruin as the point where the amount of admissible assets no longer exceeds the amount of technical provisions. This differs from CEIOPS' suggestion in two points:
- Firstly, the ruin definition in the Commission's framework only refers to technical provisions, and not also to other liabilities;
  - Secondly, it refers only to admissible assets, whereas CEIOPS' ruin definition does not make a distinction between admissible and non-admissible assets.
- 2.31 Concerning the first point, CEIOPS believes that it is important from the point of view of policyholder protection to also include other liabilities into the definition of ruin. For example, in some cases, certain types of 'other liabilities' might rank higher than technical provisions in relation to the entirety of the obligations of the undertaking; in such a case, in order that the obligations of the insurer could be transferred to a third party, it would not suffice that the technical provisions alone could be covered by assets.
- 2.32 More generally, the 'simplified balance sheet concept' that underlies the calculation of the SCR implies that ruin should be defined as the point where assets no longer exceed liabilities. Liabilities include all 'other liabilities' apart from technical provisions that are not treated as available capital (which is conceptually seen as the difference between assets and liabilities).
- 2.33 CEIOPS therefore proposes to uphold its previous advice, i.e. to include 'other liabilities' in the definition of ruin. Concerning this proposition, the following two issues arise:
- Which types of 'other liabilities' should be included in the ruin definition?
  - Which valuation basis should be used for these 'other liabilities'?
- 2.34 The second question is addressed in section 3. With regards to the first question, under an approach consistent with the 'simplified balance sheet' concept underlying the SCR calculation, each liability not included in the ruin definition would principally have to be treated as available capital. However, concerning the ongoing discussions on the definition of eligible capital elements to cover solvency requirements, it seems important not to pre-empt decisions in this field. Therefore, most CEIOPS' Members propose to specify the ruin definition such that it refers to those other liabilities that

are not counted as available capital. For example, the following wording could be used:

*The unacceptable level of capital which serves as a benchmark for the calculation of the SCR should be defined as the point where assets no longer exceed technical provisions (valued for solvency purposes) and other liabilities (to the extent these are not treated as available capital).*

- 2.35 An alternative solution supported by some CEIOPS' Members would be to include those other liabilities in the ruin definition which, in the case of insolvency, rank ahead of policyholder obligations. However, such an approach may not be consistent with the definition of eligible capital (in cases where other liabilities with 'lower rank' than technical provisions would not be treated as available capital).