C-ROSS

— Actuarial Perspective

中国精算师协会
China Association of Actuaries
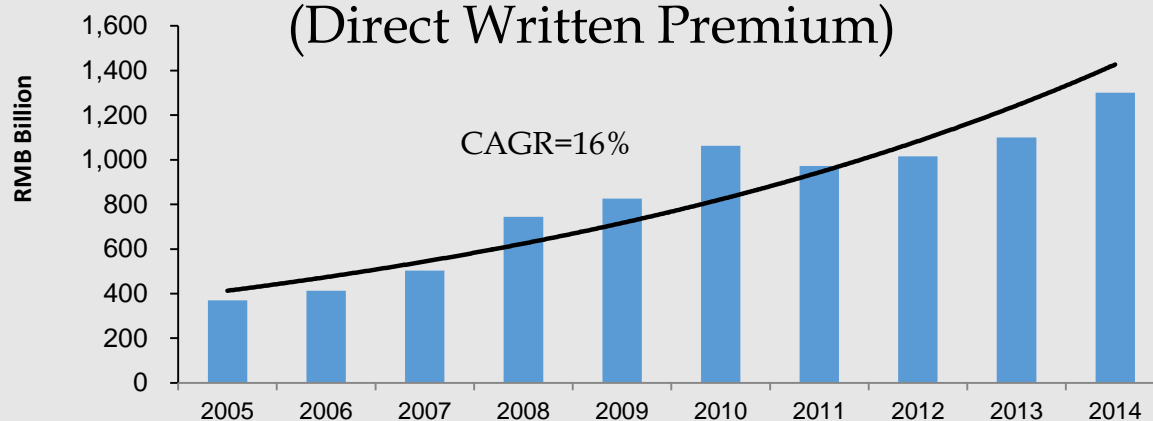
2015/06/12

Overview of China Insurance Market

Life Market Size (Direct Written Premium)

CAGR=16%

Non-Life Market Size (Direct Written Premium)

CAGR=20%

❑ Life Insurance

- The past ten years have been the golden era for the rapid growth of the life insurance market in China.
- Main drivers were:
  - Continuous high growth in GDP
  - Aging population
  - Urbanization
  - Change in the social benefits.
- Insurance premium mainly came from participating business and bancassurance channel
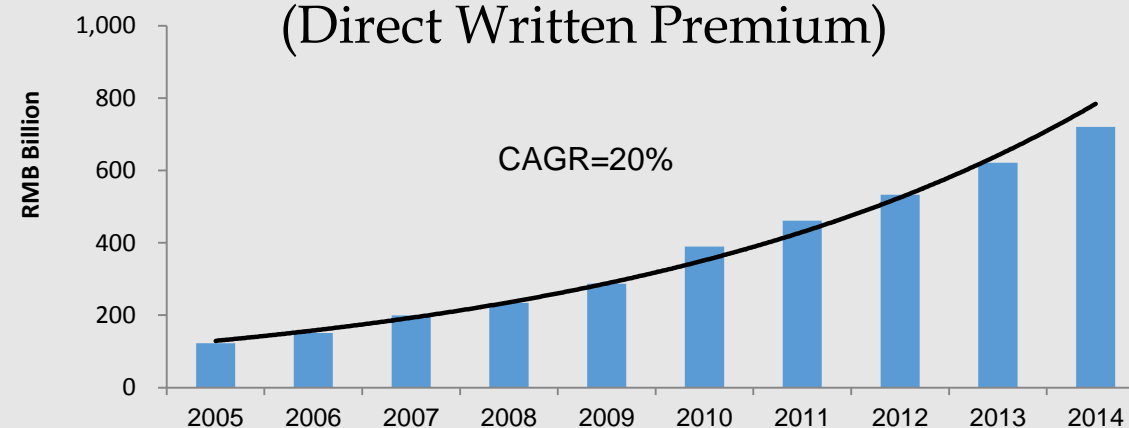
❑ Non-Life Insurance

- Motor insurance has dominated the Chinese non-life market. Commercial property insurance, agriculture insurance and liability insurance are the next three most significant product lines.
- Motor insurance class of business will continue to dominate given the enormous growth in the motor industry and high demand from consumers for car ownership.
- Natural catastrophe events in China in recent years have raised awareness of the need for property insurance and catastrophe insurance.

Total Asset Under Management

Total AuM of China's insurance industry
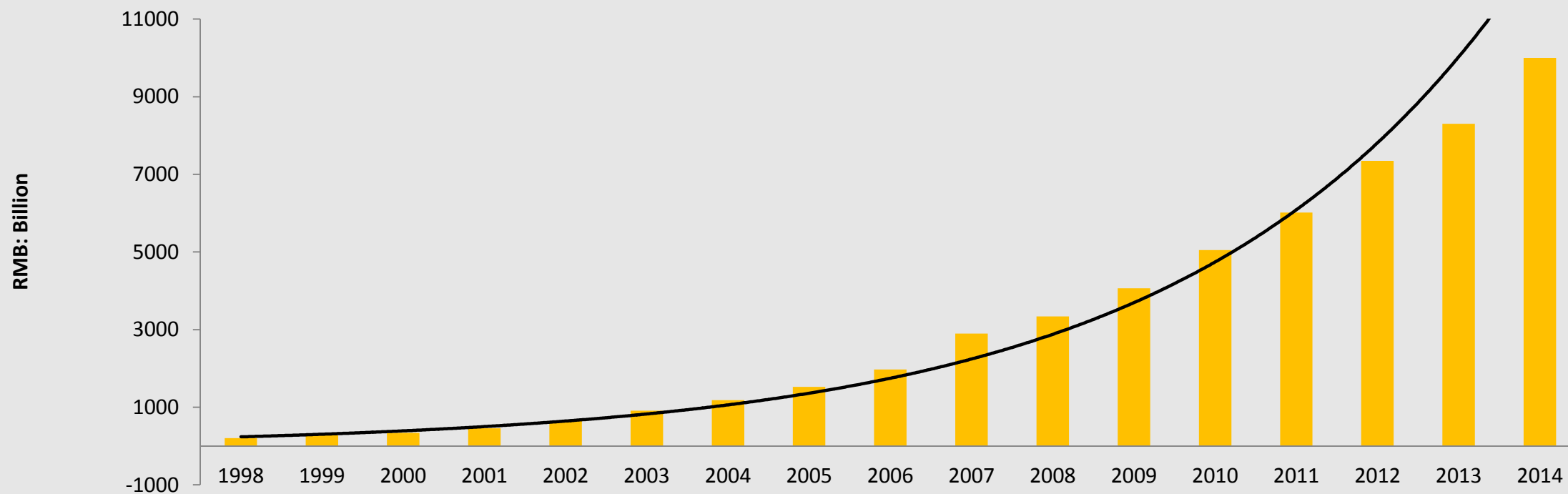
Industrial profile：change fast / versatile / complex

Insurance business

> Traditional

- Participating (cash dividend / reversionary bonus)
- Universal life
- Unit linked
- Variable annuity

Invested Assets

> Cash
> Government bond
> Certificate of deposit

- Corporate bond
- Mutual fund
- Stock
- Real estate
- PE
- Oversea investments

Market Participants

> 170 Insurers
- Life insurers
- P&C insurers
- Reinsurers

- Asset management firm
- Health insurers
- Pension companies
- Insurance groups
- Conglomerates
- Mutual insurers

Marketization Process of China's Insurance Industry

- **Deregulation of Investment：**

  - Relax the different asset classes for investment choices

  - Release the upper limits of investment restrictions

  - Investment regulatory on investment products change from approval process to registration only

- **Deregulation of Product Pricing：**

  - Traditional life（2013）

  - Universal life （2015）

  - Participating life（2015）

  - Auto insurance（2015）

China Solvency I   (2003-2015)

Contents

- Approval Asset and Liability
- Risk measure：volume driven
- Ratio based capital requirement
  - 16%/18% of net premium(non-life)
  - 4% of statutory reserve（life）

Features

- Undefined and incomplete of reveal different kind of risks
- Capital requirement solo
- Sensitive to the liability block
- Insensitive to asset side and operating behavior

- Historical significance – control the industrial risk fundamentally
- Not adapted to :
  - Business development and risk profile.
  - Market oriented reform of insurance market.
  - Position of insurance in the financial industrial.

Agenda

1. *Initiation the reform（2012）& born of C-ROSS*

2. *Actuarial perspective-Traditional Field*

3. *Actuarial perspective-New World*

Beginning of the story

1. INITIATION THE REFORM（2012）& BORN OF C-ROSS

Initiation of the reform（2012） and born of C-ROSS

- Risk exposure increasing
- Demand of risk management
- Market-oriented strategy of "release the front-end, hold the back-end"

- Insurance regulatory become convergence international.
- The world consistent banking capital requirement rules.

Chinese

Full name：中国风险导向的偿付能力体系

Simplified name：偿二代

English

Full name：China Risk Oriented Solvency System

Simplified name：C-ROSS

Timeline of C-ROSS

Step 1
Overall Planing

Step 2
Review and Pre-Research

Step 3
Conceptual Framework

Step 4
Technical standards

Step 5
Implementation

- Where to go
- How to go
- How long

- C-SI review
- USA/Europe
- Emerging Market

- **17 Technical Standards：**
  Pillar I （9）
  Pillar II （3）
  Pillar III （3）
  Group （1）
  Reporting （1）

Transitional Arrangements

Mar 2012 **Oct 2012** **May 2013** **Dec 2014** **Feb 2015**
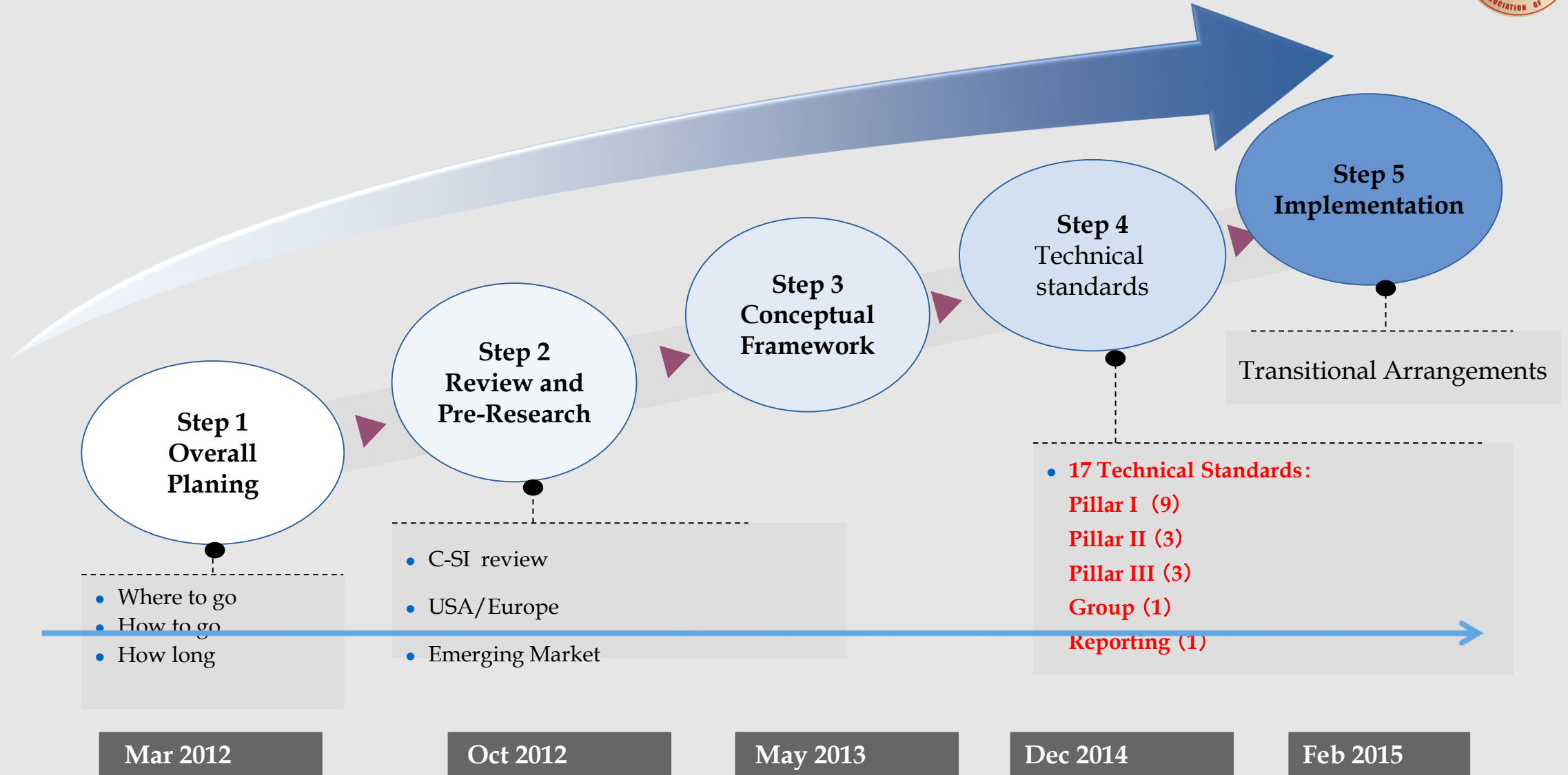
Three principles of the reform and C-ROSS

Risk-Based

Well defined regulatory model oriented to complicated risk profiles

Marketization
soften the front end and harden the back end

Internationalization

International harmonization

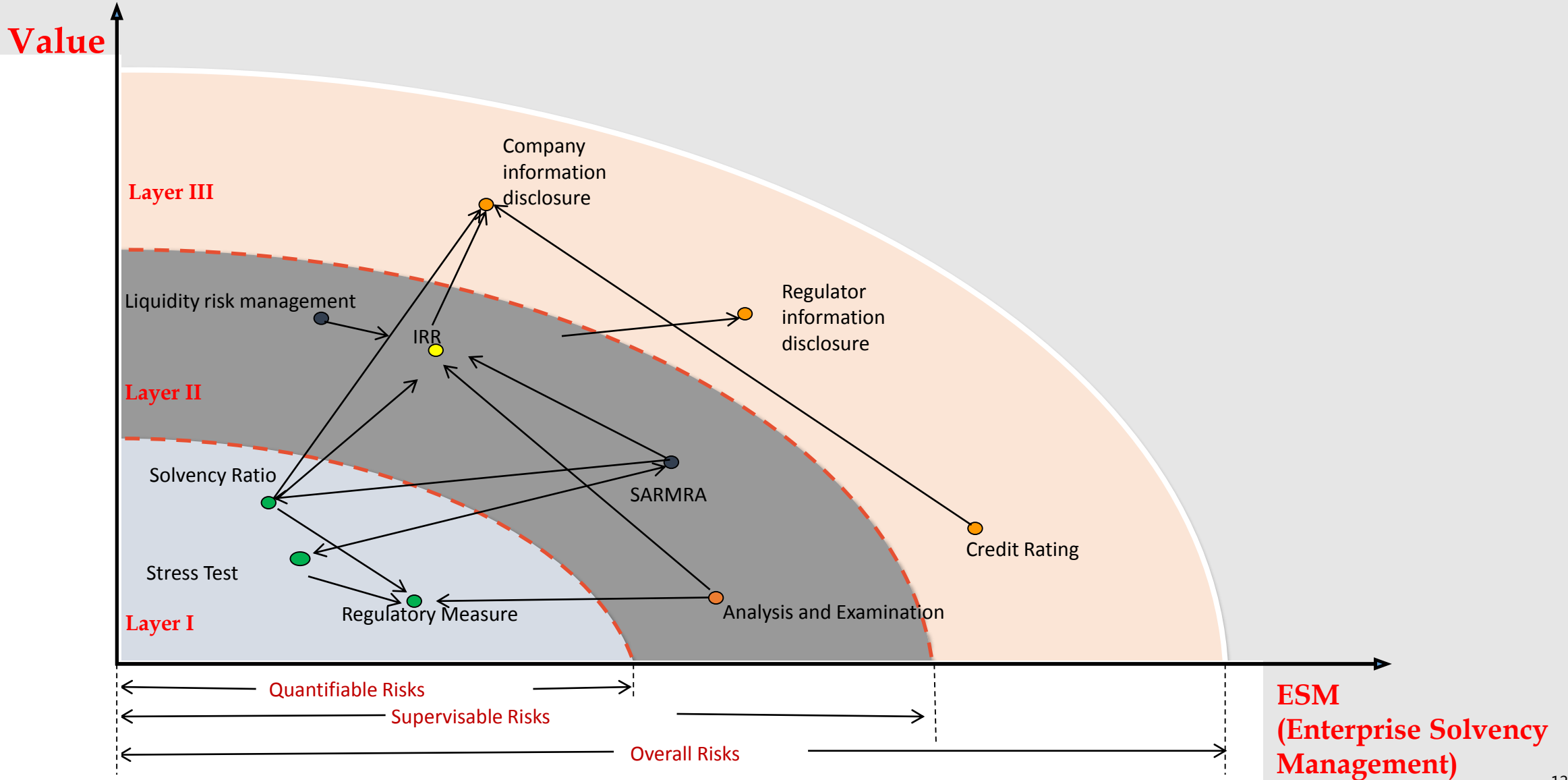- **Born of C-ROSS（Feb.13 ,2015）:**
  - Main technical standards －－17 files，TS1-TS17
  - C-ROSS transition period

Quantitative Capital Requirement

Regulatory Tools
1. Capital requirement:
   1. Insurance Risk
   2. Credit Risk
   3. Market Risk
2. Real Capital
   Capital stratification
3. Stress test
4. Regulatory measure

Regulatory Discipline
- Comprehensive Solvency Ratio
- Core Solvency Ratio

Qualitative Supervisory Requirement

Regulatory Tools
1. Integrated Risk Rating(IRR)
   1. Liquidity Risks
   2. Operation Risk
   3. Strategy Risk
   4. Reputation Risk
2. Solvency Aligned Risk Management Requirements and Assessment(SARMRA)
3. Analysis and Examination (A&E)
4. Regulatory Measure

Regulatory Discipline
- IRR Ratings
- Control Risk Scores

Market Discipline Mechanism

Regulatory Tools
- Information Disclosure
  - Company
  - Regulator
- Credit Rating

Market Discipline
- … …
- … …

TSNo.1-TSNo.17(主干技术标准17 项监管规则)

☐ **Solvency ratio**

  ☐ No.3 Valuation of Life insurance liabilities

  ☐ No.9 Stress testing

    ☐ No.1 Actual capital

    ☐ No.2 Required capital

      ☐ Insurance risk : No.4 Non-life insurance + No.5 Life insurance + No.6 Reinsurance

      ☐ Asset/AL risk: No.7 market risk + No.8 credit risk

      ☐ Control risk: No.11 SARMRA

☐ **Risk management scoring**

  ☐ No.10 Risk rating + No.11 Solvency Aligned Risk Management Requirements and Assessment (SARMRA) + No.12 Liquidity risk

☐ **Disclosure & Reporting**

  ☐ No.13 Disclosure principle + No.14 Information exchange + No.15 Credit Rating of insurance companies

  ☐ No.16 Solvency reporting

☐ **Group** No.17 Insurance group

Real Capital——TSNo.1

- ❑ **Definition:** Available capital with four key characteristics:
  - ▪ **Permanence**
  - ▪ **Subordination**
  - ▪ **Availability**
  - ▪ **Absence of Encumbrances**
- ❑ **Categorization:** Distinguish available capital resources from high quality to low quality according to their loss absorbing capacity：
  - ▪ **Core**
    - ▪ **Tier 1**
    - ▪ **Tier 2**
  - ▪ **Supplemental**
    - ▪ **Tier 1**
    - ▪ **Tier 2**

Capital Requirement——TSNo.2

Solvency Risk: Inherent Risk，Control Risk
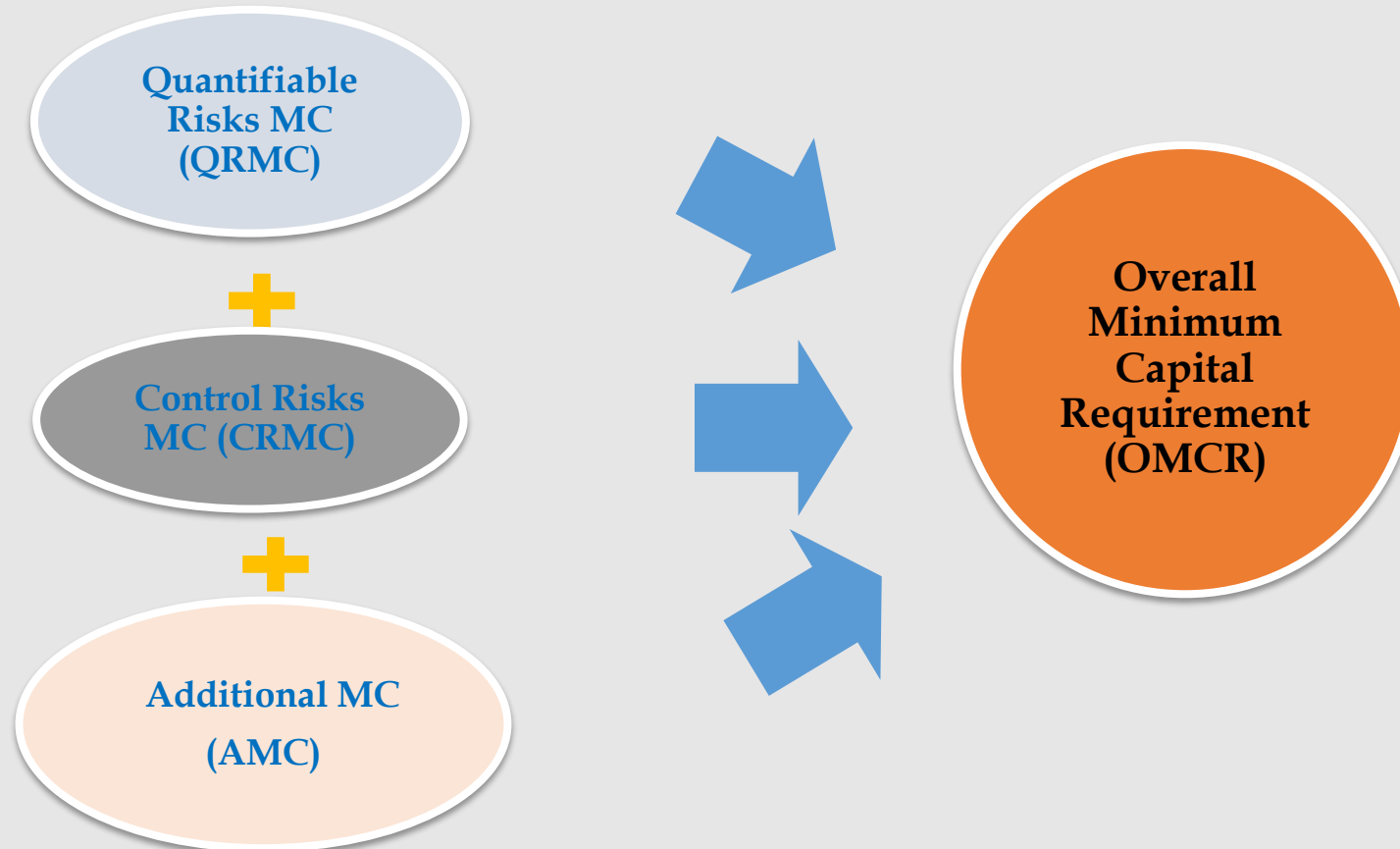
Capital Requirement——TSNo.2

❑ **Principle of measurement:**

   ❑ **Diversification：Correlation matrix**

   ▪ **Method/model/parameter： Standard and Unique**

   ▪ **Market/insurance/credit risk：Value-at-Risk**

   ▪ **Control risk：监管评价法Regulatory measure**

❑ **Methodology of measurement:**

   ▪ **Correlation matrix—two levels：TSNo.2**

   ▪ **Market/insurance/credit risk： TSNo.3-TSNo.8**

   ▪ **Control risk： TSNo.11**

MC Calculation——General

| Based on China's industry data | Fitting loss distribution | Calibrate at 99.5% percentile | Standard formula for MC |

❑ **Composite factor based method:**

MC=EX × RF

where: EX is the risk exposure; RF is the risk factor

RF = $RF_0 \times$ (1+K)，RF_0 is the **base risk factor**

K – **factor loading**:

$$K = \sum_{i=1}^{n} k_i = k_1 + k_2 + k_3 + \cdots + k_n$$

K_i is the ith factor loading (i=1,……,n), n is the number of characteristic factors

❑ **Scenario based method:**

Calculate one year VaR;

Applied on **catastrophe risk for non-life, interest rate risk and insurance risk for life insurers**

K-Factor Approach to Address Sophisticated Business Nature——non-life

K factor is introduced to reflect the characteristic of the business nature and risk

$$K = \sum\nolimits_{i=1}^{n} k_i = k_1 + k_2 + k_3 + \cdots + k_n$$

Entity-Specific K-Factor

- **The counterparty default risk of reinsurers, factor k_1 depend on whether the domestic reinsurer counterparty is legal entity or not, k_1 value is set and assigned as follows:**

$$K_1 = \begin{cases} 0 & \text{legal entity} \\ 0.05 & \text{non legal entity} \end{cases}$$

Risk-Specific K-Factor

- **The counterparty default risk of the reinsurers' risk exposure, factor k_1 depend on whether the counterparty provides asset – backing securities, k_1 value is set and assigned as follows:**

$$K_1 = \begin{cases} -0.25 & \text{with asset backing securities} \\ 0.25 & \text{without asset backing securities} \end{cases}$$

Pillar I: Control Risk-Regulatory measure

SARMRA =

- Framework and environment (20%)
- Purpose and tools (10%)
- Insurance risk management (10%)
- Market risk management (10%)
- Credit risk management (10%)
- Operational risk management (10%)
- Strategic risk management (10%)
- Reputational risk management(10%)
- Liquidity risk management (10%)

2 COMPONENTS

System robustness 40%

System effectiveness 60%

4 LEVEL

S

- completely compliance -> 100
- Mostly compliance -> 80
- Partially compliance -> 50
- Not compliance -> 0

The final score of SARMRA is the weighed average of the 9 parts scores.

$$MC_{control} = Q \times MC_{quan}$$

$$Q = -0.005 \times S + 0.4$$

> $S >= 80,$ $MC_{control} <= 0$

> $S < 80,$ $MC_{control} > 0$

- An insurer with robust and effective risk management system could be offset the CR.
- The results of SARMRA will affect the CRMC directly.

Pillar I: Stress Testing

- ❑ **Frequency: per year**
- ❑ **Basic scenario**
    - ❑ **Company level**
    - ❑ **two years forward**
- ❑ **Stress scenario**
    - ❑ **必测 – Required**
    - ❑ **自测 – Optional**
    - ❑ **反向 – Reverse**

Pillar II： Integrated Risk Rating

Integrated Risk Rating（IRR）

A B C D

Pillar I Quantitative Risks
- Insurance Risk
- Market Risk
- Credit Risk
- Pro-Cyclical Risk
- Systemically Important Risk

Pillar II Qualitative Risks
- Operation Risk
- Strategy Risk
- Reputation Risk
- Liquidity Risk

Regulator assesses the overall risk of the insurance company quarterly

Pillar II : Integrated Risk Rating

Rating	Quantitative risk	Qualitative risk
A	Solvency ratio meet regulatory requirements	Small operational risk, strategic risk, reputational risk and liquidity risk
B	Solvency ratio meet regulatory requirements	Relatively small operational risk, strategic risk, reputational risk and liquidity risk
C	Solvency ratio meet or not meet regulatory requirements	Relatively big risks such as operational risk, strategic risk, reputational risk or liquidity risk
D	Solvency ratio meet or not meet regulatory requirements	Severe risks such as operational risk, strategic risk, reputational risk or liquidity risk

Pillar II : Integrated Risk Rating

Weighted average method

level and volatility of solvency ratio

IRR

quantitative risks×50%

qualitative risks×50%

Core solvency ratio /
Comprehensive solvency ratio

Operational risk×50%

Strategic risk×15%

Reputation risk×10%

Liquidity risk×25%
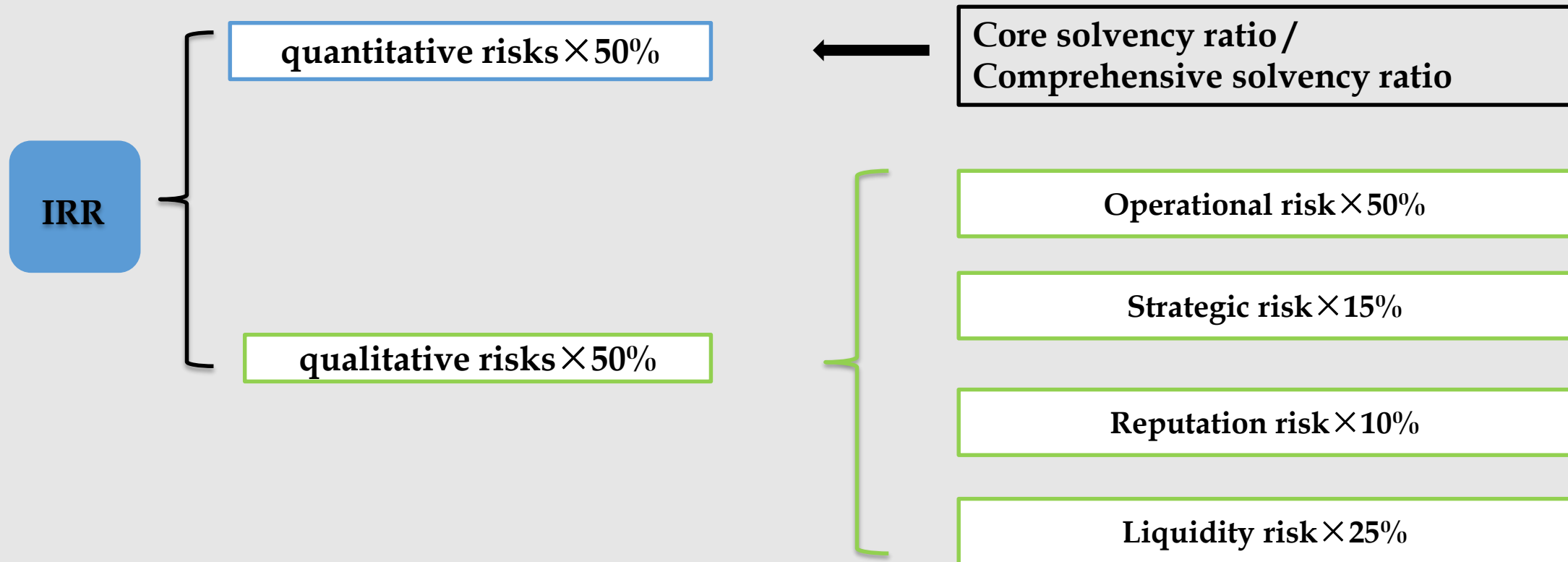
risk factors: external environment, the distribution characteristic, expected loss and historical data etc.

Non-quantifiable risks are assessed according to a set of standards.

The assessment model for operational risk under C-ROSS:

Personnel — recruitment, dismissal, training, leadership and sustainable development planning, performance management, compensation and so on

Process — internal control processes/experiential and trends of Op risk

IT system — system design defects, software/hardware failure or insufficiency, information security, data quality risk

Industry — the overall level and trends of industry's operational risk

External — Laws/regulations/regulatory policies/force majeure

25

Pillar II : Solvency Aligned Risk Management

Risk Management Requirement and Regulatory Assessment
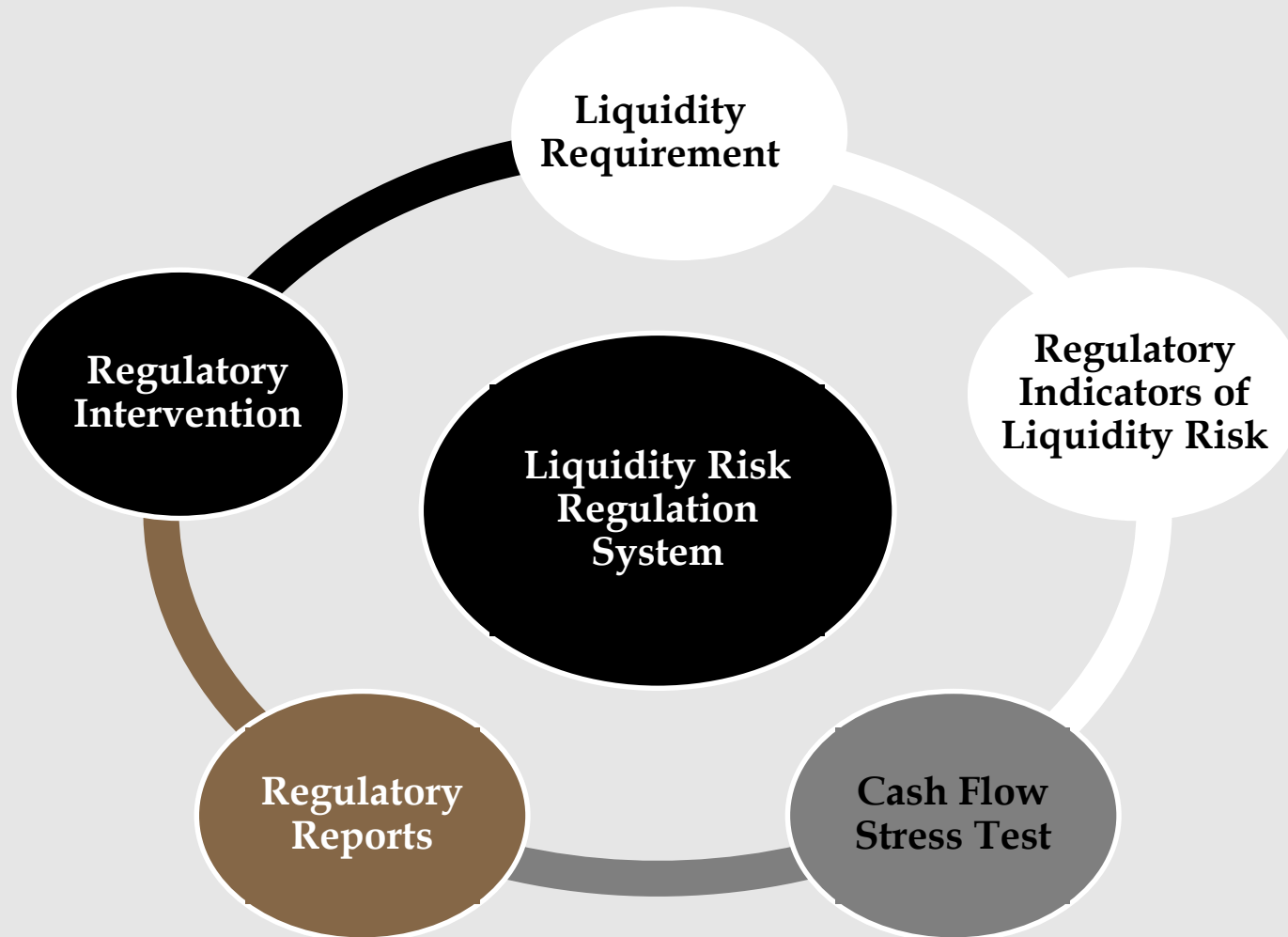
Risk Management Requirement

Regulator publishes requirements on risk management

Risk Management Evaluation

Regulator evaluates the risk management abilities of the insurers

Pillar II: Liquidity Risk Regulation

Pillar II：Analysis & Examination (A&E)

Three categories of Analysis & Examination:

- **Supporting A&E**
  - Data accuracy and behavior compliance
  - Analysis of quantifiable regulatory indicators
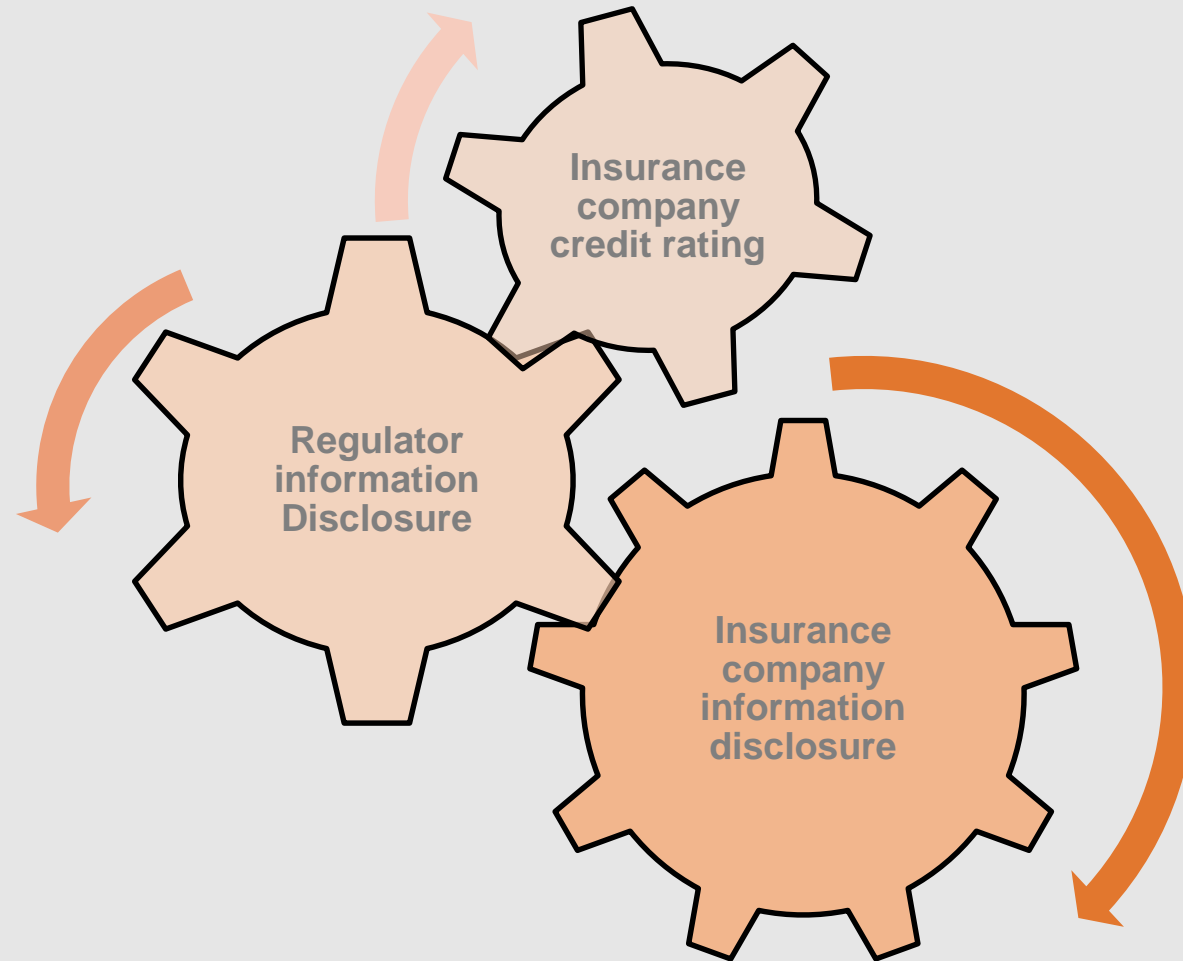 - Unquantifiable risk analysis & examination

- **Calibration A&E**
  - Model mis-specification risk (both quantitative and qualitative models)
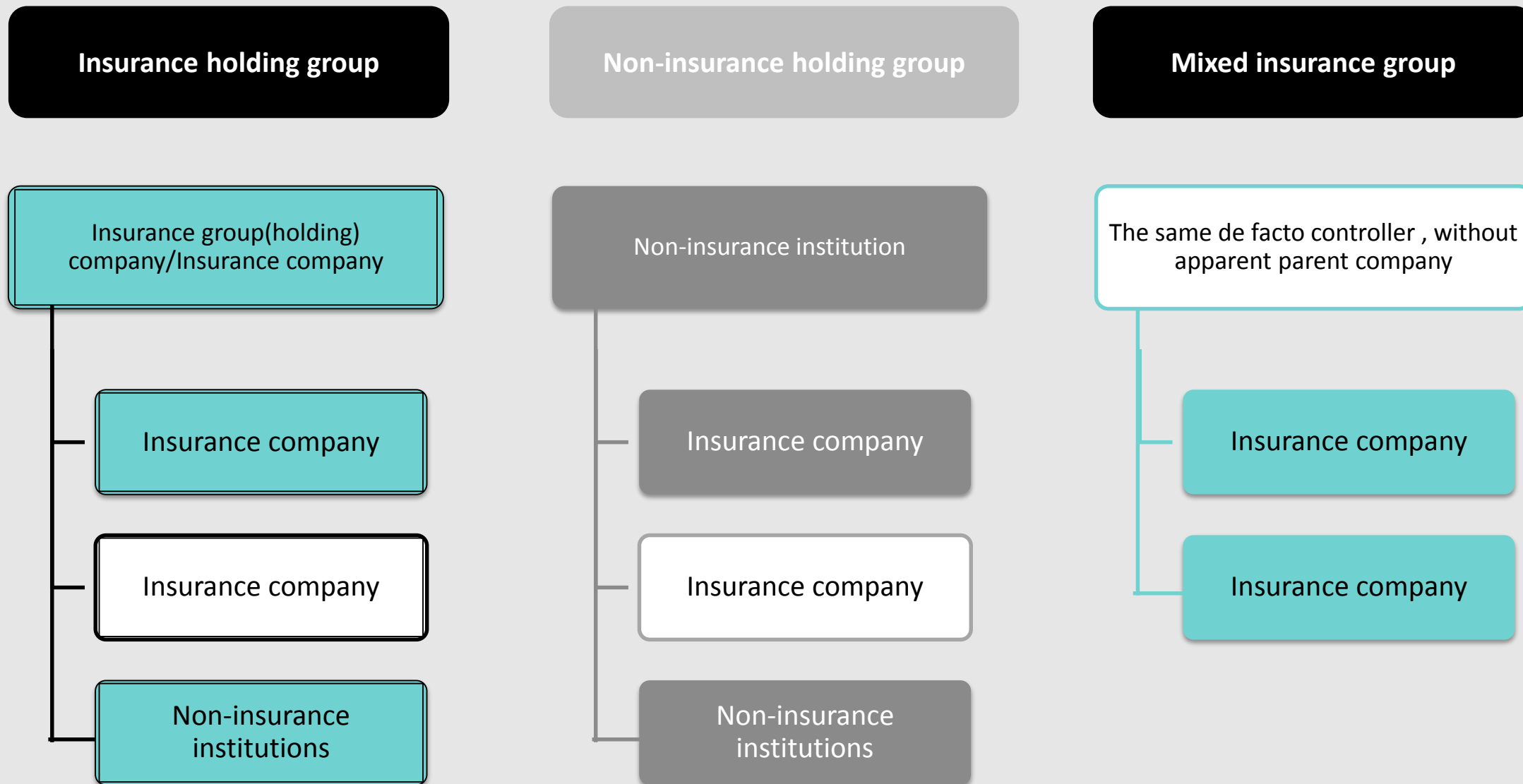 - Omitted risks

- **Extended A&E**
  - New types of risks
  - Macro prudential
  - Other

Pillar III – Market Discipline

Insurance company credit rating

Regulator information Disclosure

Insurance company information disclosure

Approach to Group/Financial conglomerates
Scope of Applications

Insurance holding group	Non-insurance holding group	Mixed insurance group
Insurance group(holding) company/Insurance company	Non-insurance institution	The same de facto controller , without apparent parent company
Insurance company	Insurance company	Insurance company
Insurance company	Insurance company	Insurance company
Non-insurance institutions	Non-insurance institutions	

Thinking

2. *ACTUARIAL PERSPECTIVE- TRADITIONAL FIELD*

Product development—TS everywhere

- Market analysis

  - Asset driven

  - Channel risk

- Actuarial assumption

  - Experience / industrial /financial market /shareholder（investor）

- Profit measure

  - turnover/risk profile/investment strategy

Liability valuation—TS3/4/5/6

- Purpose of valuation
  - Risk appetite of shareholder
  - No actuarial independent tolerance—conservation usually
- Methodology
  - Static：Best estimation + Risk margin
  - Dynamic：Consistent with financial asset model
- Assumption
  - Parameters /Models / calibration
- New components：
  - Policy portfolio
  - Factors：lapse/expense/behavior/channel

Valuation of Insurance Liabilities Under C-ROSS

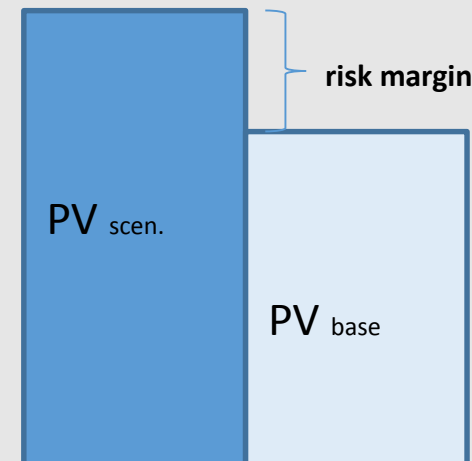| Moving Average Risk Free Rate | Transition Rate | Ultimate Rate |
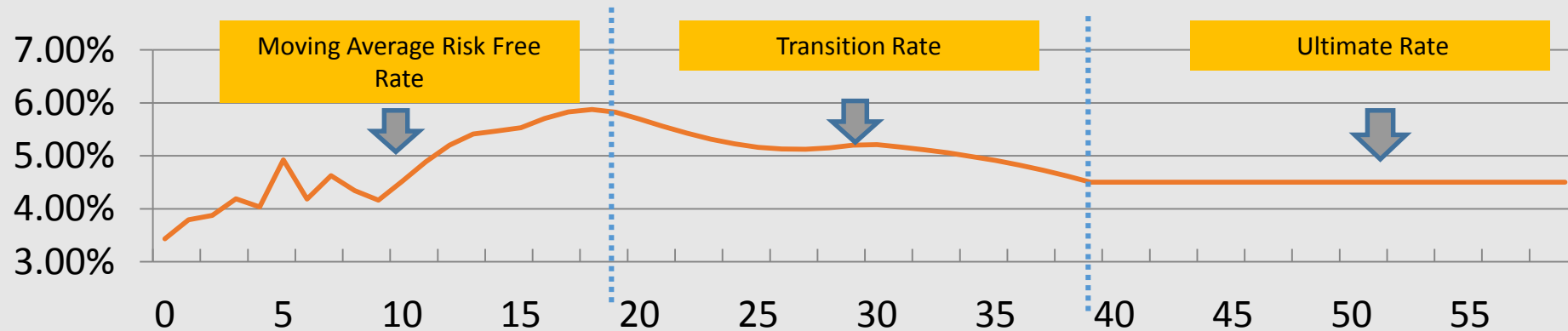
Risk Margin Calculation

Approach 1: Cost of Capital

- Article 21 of the Regulatory Standards No. 3: Insurance liabilities for life insurance contracts states the cost of capital method should be adopted in calculating risk margin

Approach 2: Scenario Based

risk margin

PV scen.

PV base

34

Experience analysis—TS2/3/4/5/6/11

- Multi-purpose

  - Risk profile
  - Multi-interest driven：product/valuation/risk management/solvency/capital

- Input

  - Internal：business/management
  - Operating environment：macro-economic/financial market/industrial

- Methodology

  - Risk measure
  - Dynamic model

Insurance Risk Minimum Capital (Non-Life) – Premium Risk

- Following slide 18, Premium Risk is calculated using the Composite Factor Based Approach.
- For each LoB, the RF0 is defined as follows (i.e., in layers) and applied on **12mm net written premium**.

	1st Layer		2nd Layer		3rd Layer		4th Layer		5th Layer	
Premium Risk	Threshold	RF0	Threshold	RF0	Threshold	RF0	Threshold	RF0	Threshold	RF0
Motor	1 bn	9.30%	5 bn	9.25%	20 bn	9.04%	40 bn	8.66%	> 40 bn	8.43%
Property	0.1 bn	40.2%	1.1 bn	39.0%	2.6 bn	36.2%	4.6 bn	32.8%	> 4.6 bn	29.1%
Marine/Hull	0.1 bn	28.0%	1.1 bn	27.5%	2.6 bn	26.9%	4.6 bn	25.9%	> 4.6 bn	24.6%
Liability	0.1 bn	14.5%	1.1 bn	13.7%	2.3 bn	12.2%	3.7 bn	10.6%	> 3.7 bn	9.0%
Agriculture	0.1 bn	33.8%	1.1 bn	32.0%	2.6 bn	28.1%	4.6 bn	23.6%	> 4.6 bn	18.9%
Guarantee	0.1 bn	46.7%	1.1 bn	45.8%	2.6 bn	43.6%	4.6 bn	40.7%	> 4.6 bn	37.3%
Accident (s.t.)	0.1 bn	8.5%	0.3 bn	7.8%	0.6 bn	6.7%	1 bn	5.4%	> 1 bn	3.5%
Health (s.t.)	0.1 bn	20.8%	0.6 bn	19.7%	1.2 bn	16.6%	1.9 bn	13.0%	> 1.9 bn	8.4%
Life (s.t.)	0.1 bn	8.5%	0.3 bn	7.8%	0.6 bn	6.7%	1 bn	5.4%	> 1 bn	3.5%
Other		9.8%		9.8%		9.8%		9.8%		9.8%

Then, k-factors are applied:

1) Combined ratio,
2) Change in combined ratio (applicable to Motor only), and
3) Non-proportional cession ratio

	k1	Combined Ratio (C)	k2	Change in Combined Ratio ($\triangle$C)	k3	Non-Proportional Cession Ratio (NE)
	-5%	C∈（0，95%]	-5%	$\triangle$C∈（-∞，-1%]	12.7%	NE∈（-∞，-1%)
	0%	C∈（95%，100%]	0%	$\triangle$C∈（-1%，1%]	1.2%	NE∈[-1%，0)
Motor	5%	C∈（100%，105%]	5%	$\triangle$C∈（1%，2%]	0.0%	NE∈[0，2.5%)
	10%	C∈（105%，∞]	10%	$\triangle$C∈（2%，∞]	-1.2%	NE∈[2.5%，5%)
					-3.5%	NE∈[5%，∞)

K-factors for Premium Risk (Motor)

Insurance Risk Minimum Capital (Non-Life) – Reserving Risk

- Same as Premium Risk, Reserving Risk is calculated using the Composite Factor Based Approach.
- For each LoB, the RF0 is defined as follows (i.e., in layers) and applied on **net unpaid claims reserve**.

Reserving Risk										
	1st Layer		2nd Layer		3rd Layer		4th Layer		5th Layer	
	Threshold	RF0	Threshold	RF0	Threshold	RF0	Threshold	RF0	Threshold	RF0
Motor	0.5 bn	11.45%	2.5 bn	11.37%	10 bn	11.02%	20 bn	10.40%	> 20 bn	10.03%
Property	0.1 bn	64.1%	0.7 bn	63.2%	1.4 bn	61.4%	2.2 bn	59.4%	> 2.2 bn	57.3%
Marine/Hull	0.1 bn	63.2%	0.6 bn	62.0%	1.3 bn	59.6%	2.2 bn	56.4%	> 2.2 bn	51.3%
Liability	0.1 bn	42.2%	0.6 bn	41.4%	1.3 bn	39.9%	2.2 bn	38.0%	> 2.2 bn	35.0%
Agriculture	0.1 bn	39.8%	0.6 bn	38.5%	1.3 bn	35.8%	2.2 bn	32.5%	> 2.2 bn	27.8%
Guarantee	0.1 bn	50.5%	0.6 bn	49.5%	1.3 bn	47.3%	2.2 bn	44.5%	> 2.2 bn	40.2%
Accident (s.t.)	0.1 bn	19.3%	0.2 bn	18.4%	0.3 bn	16.9%	0.6 bn	14.8%	> 0.6 bn	13.0%
Health (s.t.)	0.1 bn	24.7%	0.2 bn	23.6%	0.4 bn	21.6%	0.8 bn	18.9%	> 0.8 bn	16.8%
Life (s.t.)	0.1 bn	19.3%	0.2 bn	18.4%	0.3 bn	16.9%	0.6 bn	14.8%	> 0.6 bn	13.0%
Other		17.0%		17.0%		17.0%		17.0%		17.0%

K-factors for Reserve Risk		
		Reserve Deviation Ratio
	k1	(R)
All lines of business	5%	R∈ (-∞, -5%]
	0%	R∈ (-5%, 5%]
	5%	R∈ (5%, 10%]
	10%	R∈ (10%, ∞]

Then, k-factor is applied:

- **Reserve Deviation Ratio = average(1st prior quarter's reserve deviation ratio, 2nd prior quarter's reserve deviation ratio)**
- For all LoBs, MC is increased if reserve deviates more than +/- 5%, indicating a significant insufficiency or redundancy in unpaid claims reserve.
- Effectively ensuring reserve accuracy can help reduce MC on insurance risk.

Counterparty risks are applied to reinsurance business

Reinsurer solvency ratio criteria		Counterparty risk factor
On-shore reinsurer	Above 200%	0.005
	[150%, 200%)	0.013
	[100%, 150%)	0.047
	[50%, 100%)	0.261
	Below 50%	0.745
Off-shore reinsurer	Both Core and Comprehensive solvency ratio has met regulator's requirement — Collateral part	0.087
	Both Core and Comprehensive solvency ratio has met regulator's requirement — Non-collateral part	0.588
	Otherwise	0.867

Challenge and promotion

3. ACTUARIAL PERSPECTIVE-NEW WORLD

Three Changes Happened

C-SI

From turnover-orientation to risk-orientation

- Increase the risk-sensitivity and risk-coverage
- Create incentives of more complexity risk-taking and risk management
- Transform the industry focus from scale to risk & value

From single approach to integrated approach

- Uniform framework of financial reporting, value valuation and capital management, to minimize the inconsistency of decision-making base
- Balance sheet, capital allocation, risk management and performance measure are **mixed in one "basket"**

C-ROSS

From country focus to market focus

- China is the largest emerging insurance market
- Emerging markets shared many common key features
- As compatible system, C-ROSS could provide helpful experiences to other emerging markets

New world——feel

- **Views of risk**

  - **Insurance risk（risk management） vs insured objective（actuarial）**

  - **Face to the dynamic objectives**

- **Expanding boundary**

  - Risk profile

  - Multi-dimension driven(Variables)：product/valuation/risk management/solvency/capital

New world——real happen

- **Insurance risk**—individual vs portfolio
  - Is actuary do have clear concept of insurance risk?
  - Do the traditional actuarial tech. work well?

- **Market risk**—We are actuary in nature
  - What's actuary could contribute？ **Borderline of Act. and Inv.**
  - New data／models／modeling

- Asset and liability management
  - **Tradeoff**：Return／risk cost ； Face to the dynamic objectives
  - Asset allocation with liability constrain to get reward from solvency

- Capital/solvency：Push actuary to care the **capital** directly：
  - Real capital（accounting）／Risk capital

Q&A

中国精算师协会

CAA