



FALIA Invitational Seminar in Japan
“Risk Management Course”

Product Development and Control of Pricing Risk

November 11, 2016

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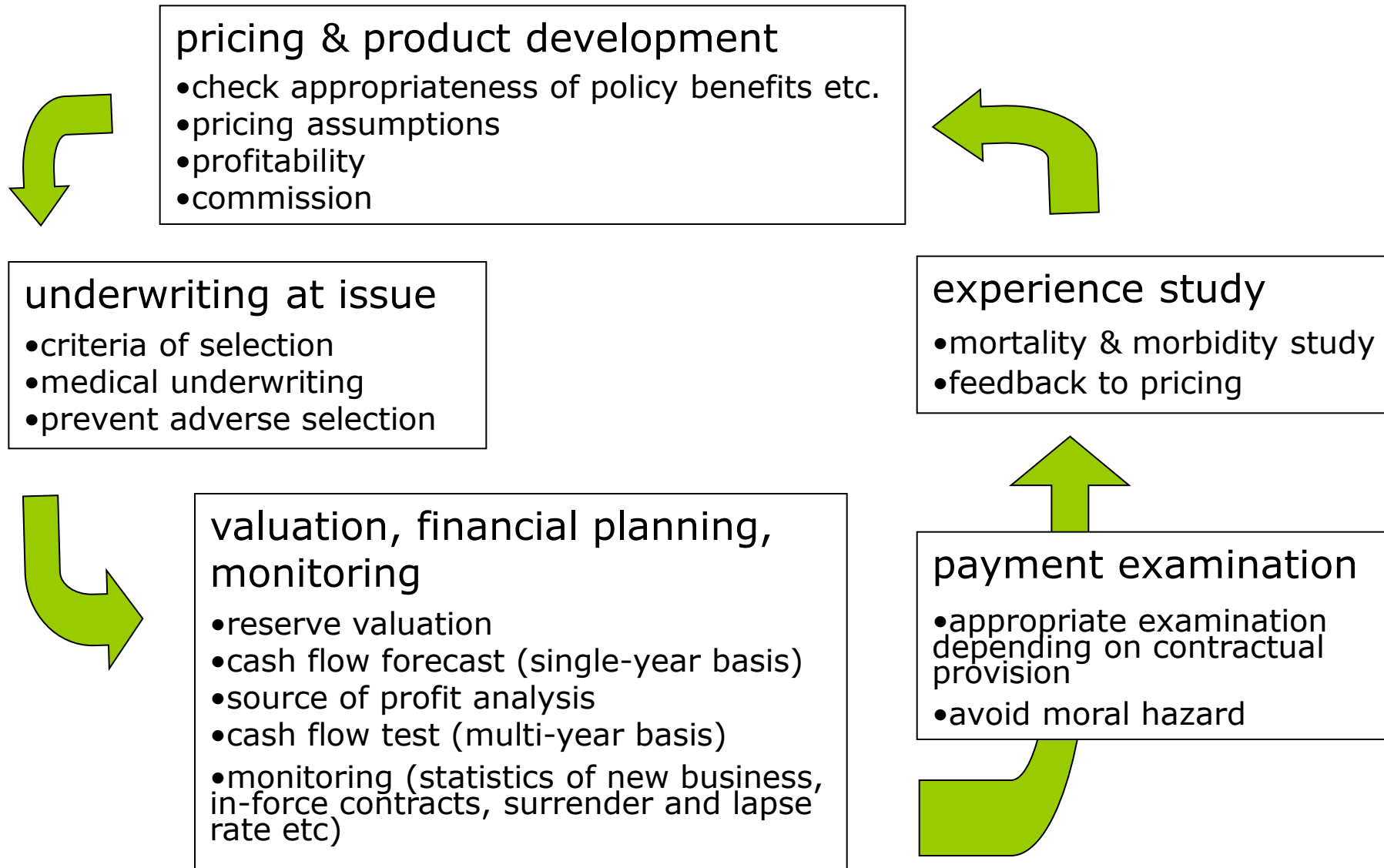
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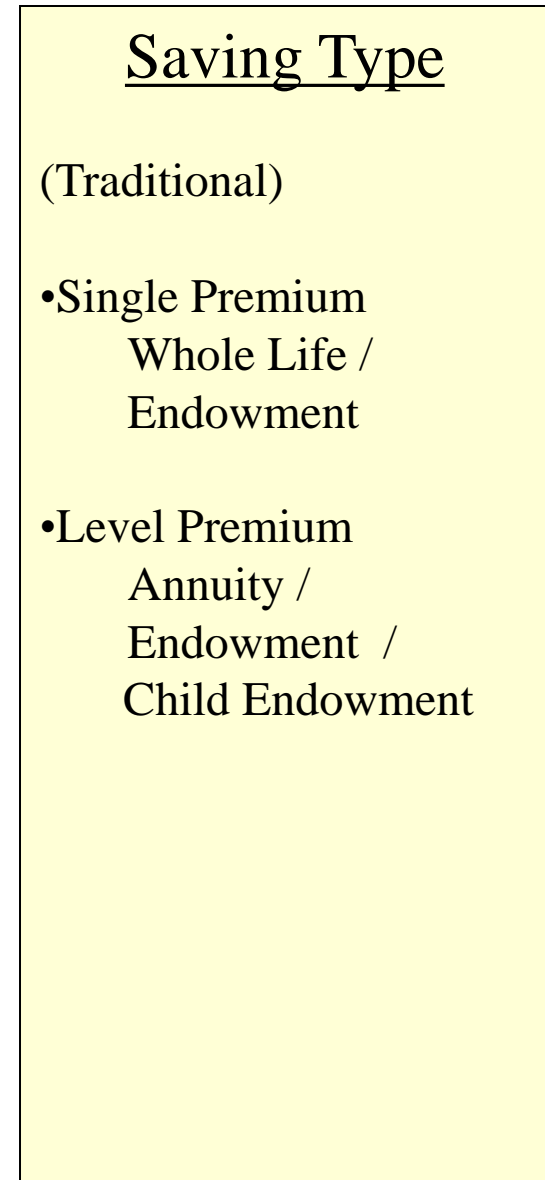
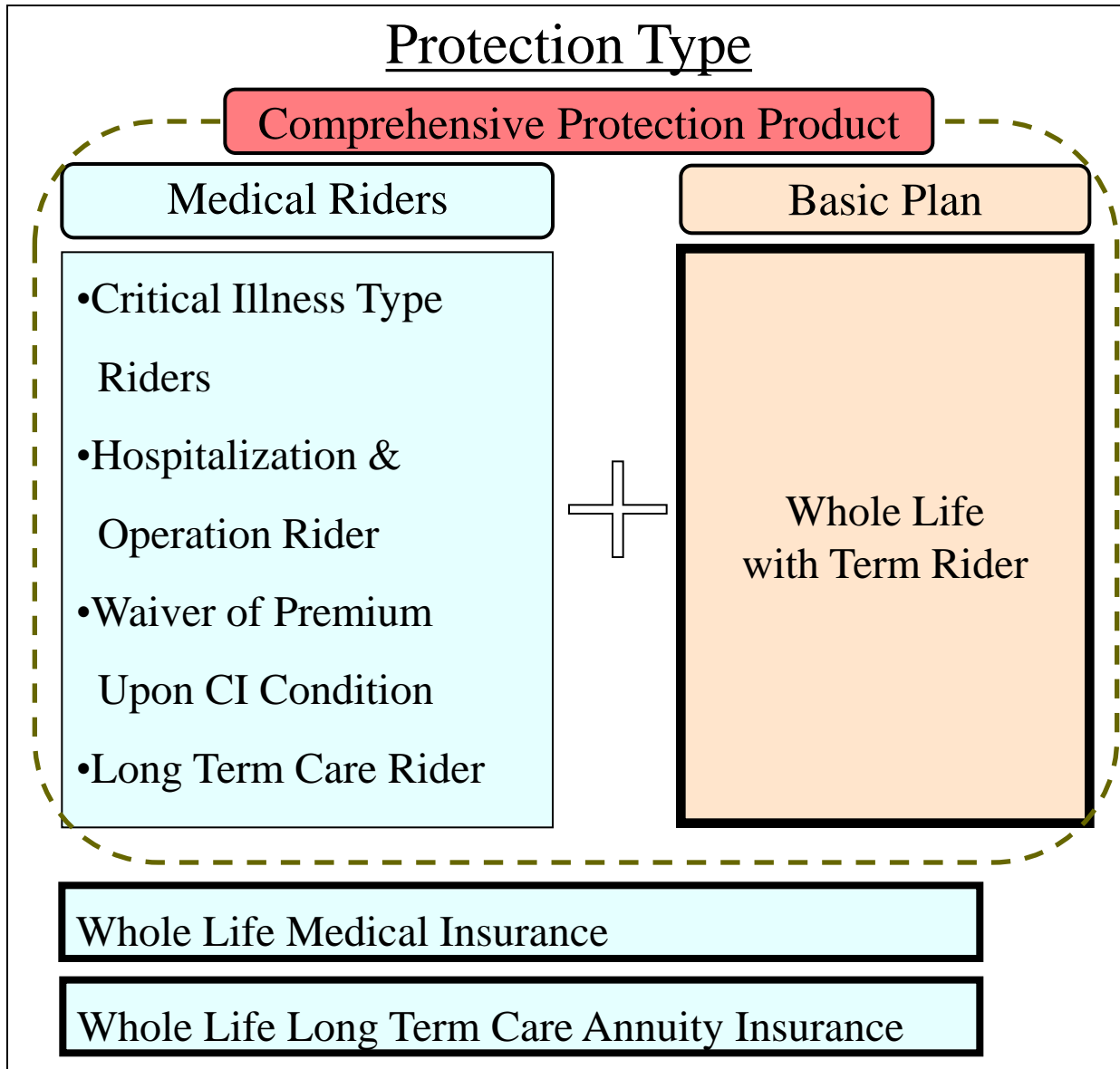
1. Risk Management Cycle of Insurance Underwriting Business



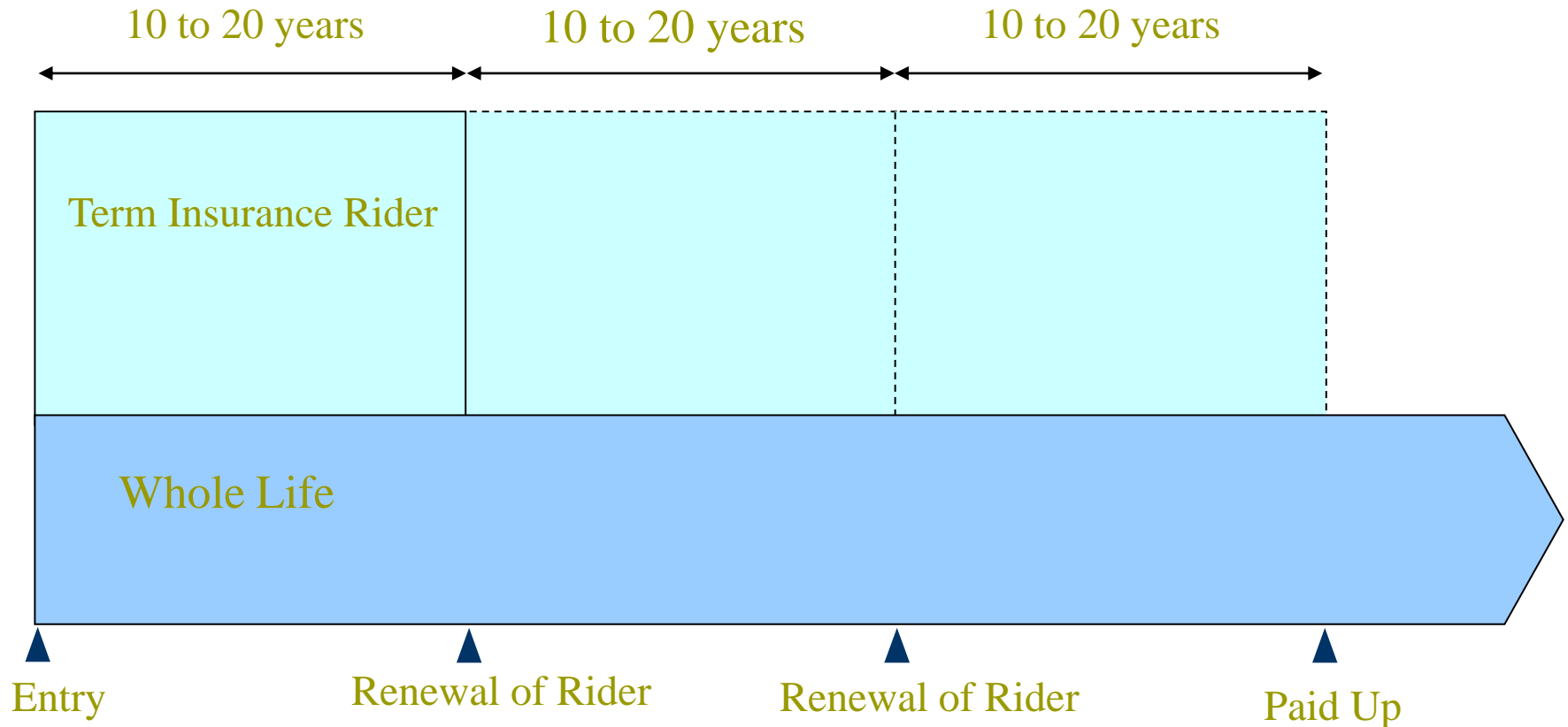
2. Pricing & Product Development



2.1 Product Lineup in Summary



2.1 Product Lineup in Summary (Whole Life with Term Rider)



Premium rates are normally guaranteed for the entire policy duration.
(Changeable at renewal as for riders)

2.2 Decision Factors for Pricing

- Competitiveness & Marketability
 - Premium Rates, Rate of Return (Policy Holders' interest)
 - Commission Rates (Agents' interest)

- Profitability & Capital Efficiency (Company's interest)
 - Profit Margin, EV, IRR

- Capital Adequacy & Solvency
 - Need to establish policy reserve properly
 - Need to follow risk management policy
 - Solvency on statutory basis is needed to be monitored periodically
 - Solvency on economic value basis is also needed to be monitored periodically.

2.3 Pricing & Product Development

- Product Development Process -



2.3 Product Development Process

- ❑ Product Specs
 - Cooperation between Product Development, Actuary, Sales
- ❑ Expected Sales Volume
- ❑ Technical Design
 - Benefit Features, Premium Rates, Commissions, Profitability Test
- ❑ Checking Product Design & Pricing in terms of Risk Management at the time of Product Development
 - Risk management check sheet is filled to double-check adequacy of product design and pricing
- ❑ Schedule IT & Operations development
 - Feasibility for IT & Operation is checked at the time of PD.
- ❑ Prepare Documents Submitted to FSA
- ❑ Internal Approval Process
- ❑ Legal Check of Policy Wording

2.3.1 Risk Management at the Time of Product Development

- The appropriateness of product design and pricing shall be confirmed from a view of insurance underwriting risk management, such as specified below:
 - Assessment of product design.
 - Validation of premiums rates.
 - Verification of asset management risk.

- Appropriateness of the underwriting scope shall be validated.
 - Age limit for entry.
 - Policy term and premium payment term.
 - Maximum/minimum amount of sum assured.
 - Other items, if deemed necessary.
 - Scope of sales shall be set in view of not only sales policy but also insurance underwriting risk, if deemed necessary.

2.3.1 Risk Management at the Time of Product Development

- Appropriateness of the selection criteria shall be validated.
 - Criteria related to medical selection.
 - Criteria related to occupation of life insured.
 - Criteria related to financial conditions of life insured.
 - Criteria related to appropriateness of sum assured.
 - Criteria related to claim examination.

- Feasibility of operations related to new business, maintenance and claims payment shall be validated.

- Check Solvency on economic value basis as well as statutory basis.
 - Test against current market conditions such as yield curve or implied volatility

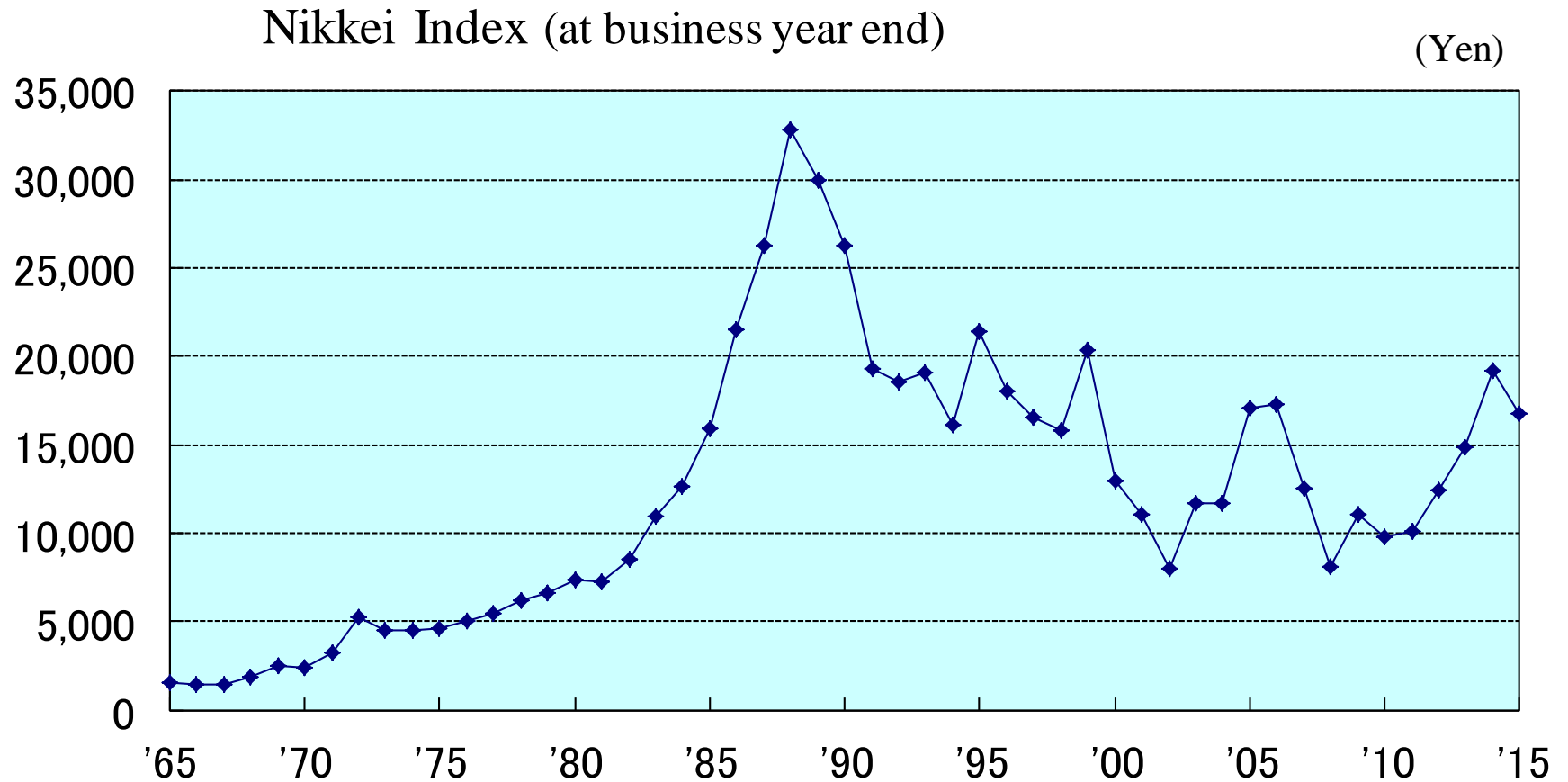
2.3.2 Regulations

- ❑ All new products including premium rates must be approved by FSA, any minor change of product feature as well.
- ❑ What FSA checks are:
 - Formulae of the premium rates calculation
 - Pricing assumptions
 - Liability Reserves and surrender values
- ❑ All policy conditions as well
- ❑ Liability reserve assumptions for Mortality and Interest rate are defined by FSA as Standard Valuation assumptions.

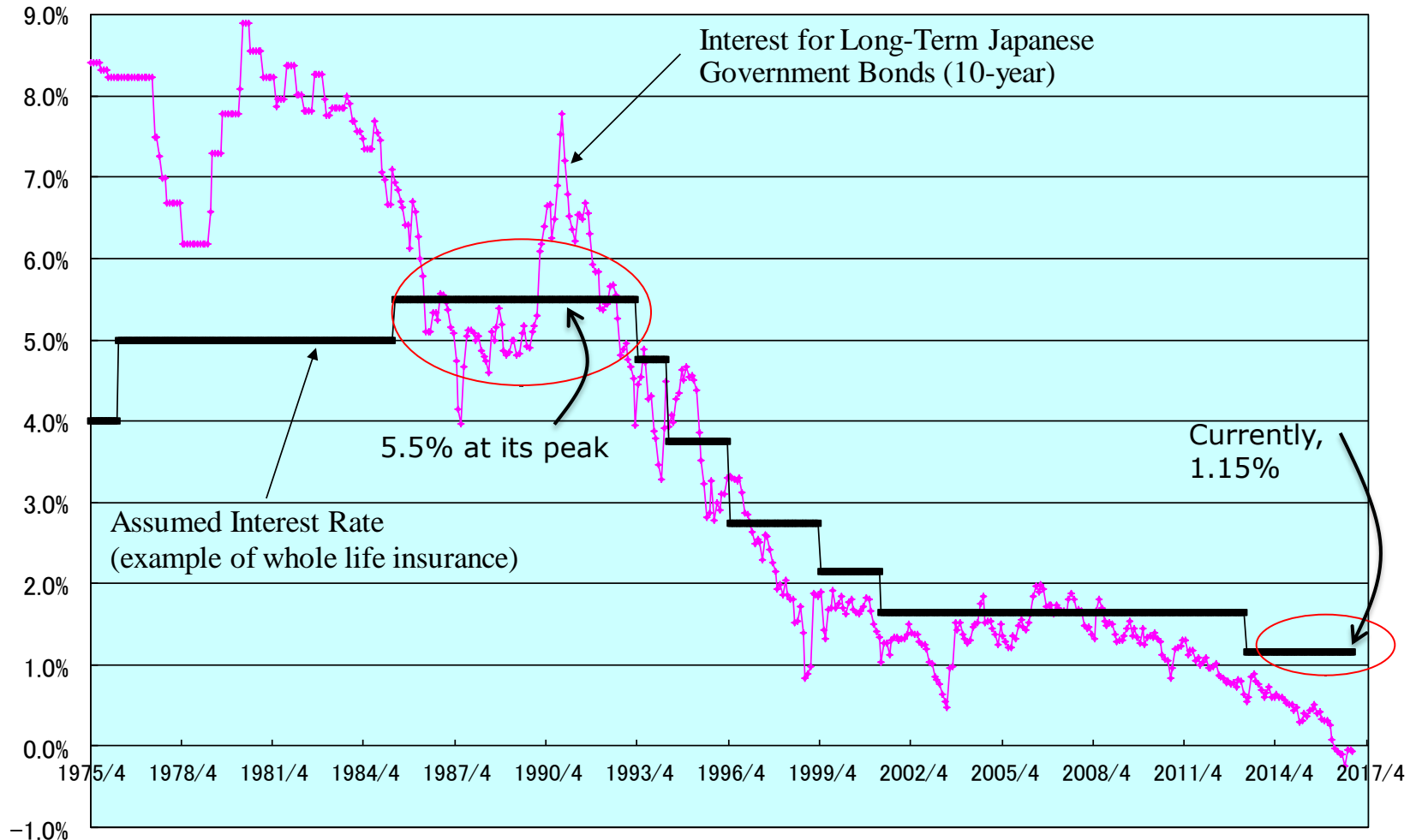
2.4 Pricing & Product Development - Topics in Japan -



2.4.1 Nikkei Index



2.4.2 Shifts in Japanese Government Bond (10yr) & Assumed Interest Rate



2.4.3 Amendments to the Assumed Interest Rate / Accrual of Negative Spread

■ 1970s~1980s

- Increases of the assumed interest rate (competition)
Highest assumed interest rate was 6.25% (10 years)
- Guarantee of a high assumed interest rate for long-term insurances
such as whole life insurance 5.5%

■ Since the 1990s

- Substantial decline of market interest rates over the long term
- Repeated reductions of the assumed interest rate

■ The present

Debts from contracts with a high assumed interest rate from the past that still remain = “negative spread”

2.4.4 Liability Reserve Balance (by Contract Year)

Contract Year	Liability Reserve Balance (million yen)	Assumed Interest Rate
~ FY1980	769,068	2.75% ~ 5.50%
FY1981 ~ FY1985	1,332,620	2.75% ~ 5.50%
FY1986 ~ FY1990	4,779,824	2.75% ~ 5.50%
FY1991 ~ FY1995	4,132,593	2.75% ~ 5.50%
FY1996 ~ FY2000	1,567,059	2.00% ~ 2.75%
FY2001 ~ FY2005	1,946,711	1.50%
FY2006 ~ FY2010	3,757,633	1.50%
FY2011	996,264	1.50%
FY2012	1,042,877	1.50%
FY2013	869,614	1.00%
FY2014	1,158,131	1.00%

(Note 1) The value for the “Liability Reserve Balance” is the amount as of the end of FY2014. Furthermore, liability reserves for individual insurance and individual annuity (excluding separate account liability reserves and contingency reserves) are listed.

(Note 2) For the “Assumed Interest Rate” the main assumed interest rate pertaining to the liability reserve by contract year is listed.

2.4.6 Changes in the Population Mortality Rate

Males (Unit: ‰)

Age	1990	1995	2000	2005	2010
20s	0.83	0.75 (90)	0.63 (76)	0.56 (67)	0.51 (61)
30s	0.78	0.79 (101)	0.77 (99)	0.74 (95)	0.69 (88)
40s	1.55	1.44 (93)	1.47 (95)	1.43 (92)	1.28 (83)
50s	4.05	4.06 (100)	3.92 (97)	3.57 (88)	3.17 (78)
60s	11.32	10.66 (94)	9.23 (82)	8.83 (78)	8.10 (72)
70s	26.41	26.24 (99)	23.84 (90)	21.23 (80)	18.42 (70)

Females (Unit: ‰)

Age	1990	1995	2000	2005	2010
20s	0.30	0.29 (97)	0.25 (83)	0.26 (87)	0.24 (80)
30s	0.42	0.40 (95)	0.38 (90)	0.37 (88)	0.36 (86)
40s	0.89	0.83 (93)	0.78 (88)	0.75 (84)	0.71 (80)
50s	2.17	2.11 (97)	1.96 (90)	1.76 (81)	1.67 (77)
60s	4.81	4.57 (95)	3.83 (80)	3.64 (76)	3.40 (71)
70s	13.24	11.82 (89)	9.99 (75)	8.90 (67)	7.67 (58)

Numbers in parenthesis represent the index when 1990 has been set at 100.

2.4.6 Increase in average life expectancy of Japanese

Average life expectancy at 60

Based on Population Life Table		Male	Female
Year	1965	15.20 years	18.42 years
	1970	15.93 years	19.27 years
	1975	17.38 years	20.68 years
	1980	18.31 years	21.89 years
	1985	19.34 years	23.24 years
	1990	20.01 years	24.39 years
	1995	20.30 years	25.35 years
	2000	21.44 years	26.85 years
	2005	22.09 years	27.66 years
	2010	22.75 years	28.28 years

2.4.7 Changes in Premiums

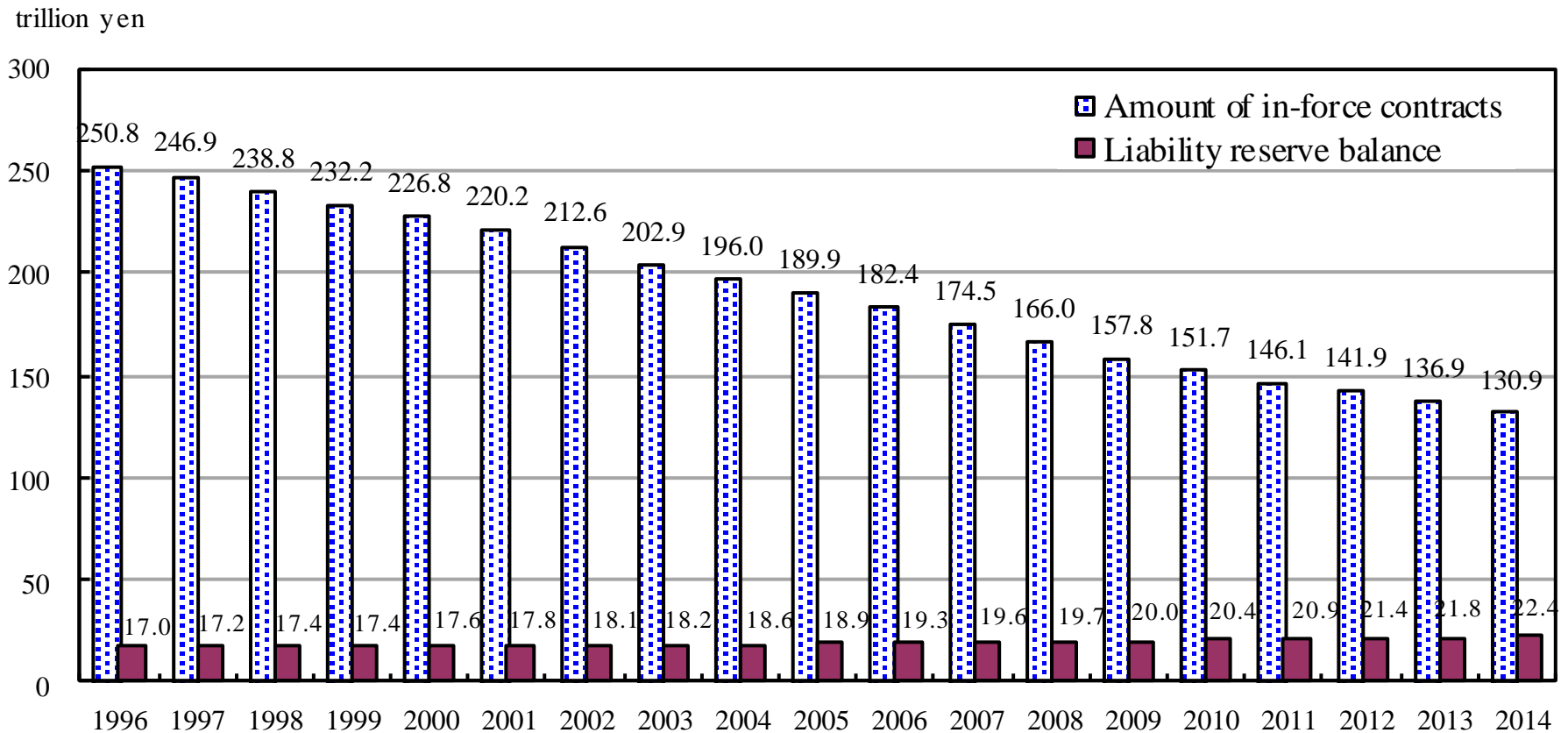
Male, annual payment, level premium, insurance payout amount of 1 million yen

(yen)

		1987.1~	1990.4~	1993.4~	1994.4~	1996.4~	1999.4~	2001.4~	2007.4~	2013.4~
Whole life insurance	Enrollment at age 35 Paid up at age 65	14,430	13,675	15,019	17,730	21,301	23,965	26,840	26,338	29,916
Term insurance rider	Enrollment at age 35 10 year policy term	4,770	4,245	4,032	4,032	3,797	3,601	3,589	3,507	3,490

2.4.8 Changes in the Demographic Structure and the Reduction of In-Force Contracts

Shifts in the Amount of In-Force Contracts and the Liability Reserve Balance (Individual Insurance and Individual Annuity)



2.4.9 8 Bankruptcies since April 1996

Time of year	Company name
1997	Nissan Life
1999	Toho Life
2000	Daihyaku Life Taisho Life Chiyoda Life Kyoiei Life
2001	Tokyo Life
2008	Yamato Life

3. Valuation and risk management



3.1 What are Standard Liability Reserves?

■ Overview

- a. Introduced through the revisions to the Insurance Business Law from FY1996.
- b. In order to ensure the solvency and retain the soundness of insurance companies, as a rule all insurance companies must accumulate standard liability reserves. This is done by utilizing the funding method (net level premium method) and the actuarial assumptions (standard interest rate and standard life table) set down by the supervisory authorities.
- c. The actuarial assumptions at the time of the contract apply until the termination of the contract (lock-in).

3.2 Standard Liability Reserves

-Standard Interest rates-



3.2 Standard Liability Reserves (Interest rates)

■ Standard Interest Rate

- a. Are calculated every year on the basis of the smaller of the 3-year and 10-year averages of JGB in consideration of the safety margin corresponding to the level of the subject interest rates.
- b. Safety Margin

Subject Interest Rate	Safety Margin
0.0%~1.0% portion	0.90
1.0%~2.0% portion	0.75
2.0%~4.0% portion	0.50
Over 4.0% portion	0.25

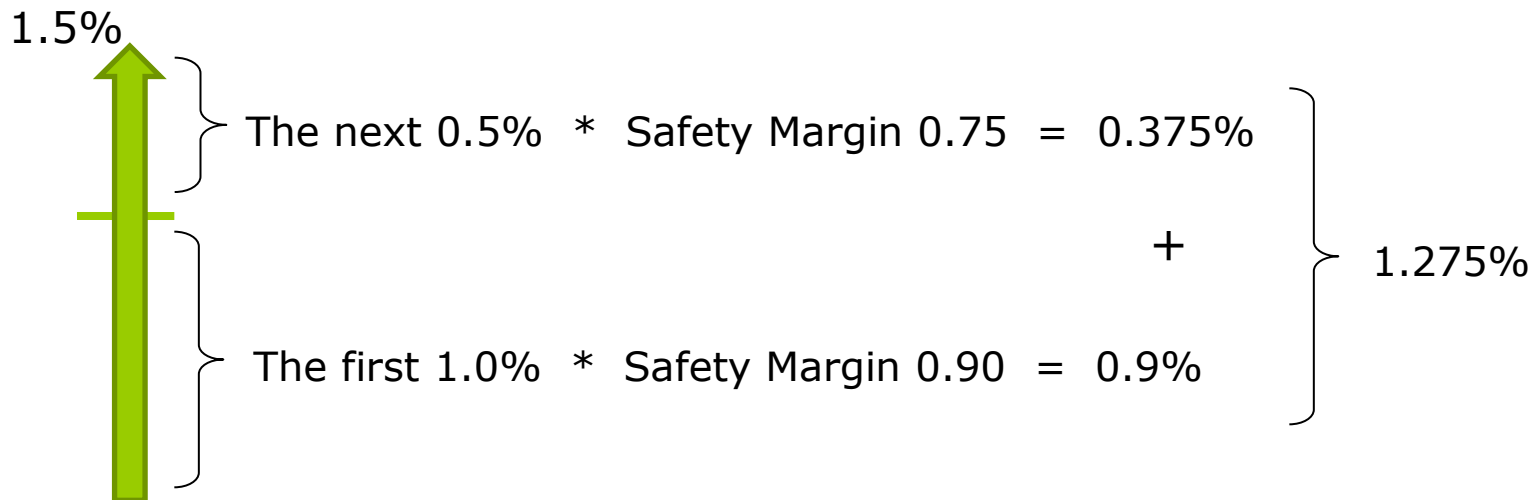
- c. Shifts in the Standard Interest Rate

Contract Year	Applicable Standard Interest Rate
FY1996~1998	2.75%
FY1999~2000	2.00%
FY2001~2012	1.50%
FY2013~	1.00%

3.2 Standard Liability Reserves (Interest rates)

■ Standard Interest Rate (Calculation Example)

If the interest rate of 10-year JGB (the smaller of the 3-year and 10-year averages) was 1.5% ...



Safety Margin

Subject Interest Rate	Safety Margin
0.0%~1.0% portion	0.90
1.0%~2.0% portion	0.75
2.0%~4.0% portion	0.50
Over 4.0% portion	0.25

3.2 Standard Liability Reserves (Interest rates) (Cont'd)

- The Standard interest rate will go down further to 0.25% in 2017.

Shifts in the Standard Interest Rate

Contract Year	Applicable Standard Interest Rate
FY1996~1998	2.75%
FY1999~2000	2.00%
FY2001~2012	1.50%
FY2013~2016	1.00%
FY2017~	0.25%

3.2 Standard Liability Reserves (Interest rates) (Cont'd)

- Revision of the calculation rule of Standard interest rates
(Applied to contracts issued from April 2015)
 - To reflect recent trend of interest rates, for single premium products

<Background of the Revision>

There have been changes in circumstances surrounding life insurance industry, compared with the time when the existing system was introduced (1996).

- (1) Increase of savings type products such as Single premium whole life insurance.
- (2) Diversification of investment assets such as increase in the 20-year government bond.
- (3) Sophistication of the investment methodology matching the liability characteristics of the savings type products.(ALM)

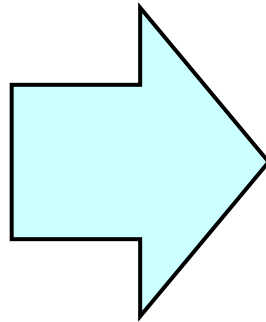
3.2 Standard Liability Reserves (Interest rates) (Cont'd)

■ Summary of the Revision

- Establishment of the Standard interest rates applied to single premium products exclusively. (Applicable to contracts issued from April 2015)

<Before the Revision>

Applied to any kind of products



<After the Revision>

For level premium products
(same as before)

For single premium products
(whole life)

New

For single premium products
(other than whole life)

New

For single premium products (whole life)

- Calculation of the standard interest rate **four times a year** (Before: once a year)
- Based on the **average of the yield of the 10-year government bond and the 20-year government bond** (Before: 10-year government bond)
- Based on the **the smaller of the past 3-month and 1-year averages** (Before: the smaller of the 3-year and 10-year averages)



Reflect recent trend of interest rates

3.3 Standard Liability Reserves -Standard Life Table-



3.3 Standard Liability Reserves(Life table)

■ Standard Life Table

- a. The life table is created by IAJ* as actuarial assumptions for standard liability reserves and is validated by Commissioner of FSA**.

* IAJ : Institute of Actuaries of Japan

** FSA : Financial Service Agency

- b. They are created from experiential data from life insurance companies.

3.3.1 Changes in the Population Mortality Rate

Males (Unit: ‰)

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70s	13.24	11.82 (89)	9.99 (75)	8.90 (67)	7.67 (58)

Numbers in parenthesis represent the index when 1990 has been set at 100.


3.3.2 Overview of Amendments to the Standard Life Table

- The standard life table has been amended for the first time in 11 years to reflect the improvement in mortality rates in recent years, primarily for elderly, with these amendments being applied to new contracts from April 2007 onward.
- The population mortality rate is on a decreasing trend,
primarily for the elderly.
 - ⇒ Increasing risk of longevity
 - ⇒ Increasing risks for after the start of individual annuity and 3rd sector insurance (health-care, nursing care, accidents, etc.)

3.3.2 Overview of Amendments to the Standard Life Table (Cont'd)

■ Overview of the Amendments

- Reduction of the standard life table used for death protection product and annuitization, primarily for elderly generations
- Start-up of 3rd sector standard life table

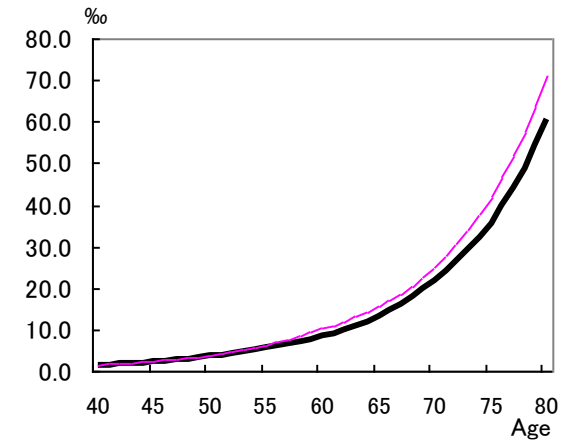
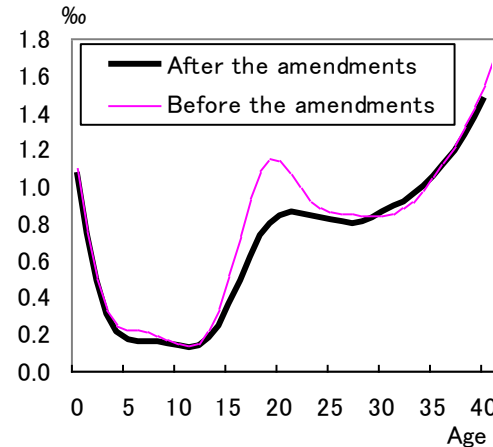
	Life table before the amendments		Life table after the amendments
1st sector (for death protection product)	Life insurance standard life table 1996 (for death protection product)		Life insurance standard life table 2007 (for death protection product) [Amended]
1st sector (for annuitization)	Life insurance standard life table 1996 (for annuitization)		Life insurance standard life table 2007 (for annuitization) [Amended]
3rd sector (for health-care, nursing, accidents, etc)	None		3rd sector standard life table 2007 [Start-up]

3.3.2 Overview of Amendments to the Standard Life Table (Cont'd)

- Comparison of the standard life table (for death protection product) before and after the amendments
The range of the reductions averaged 12.4% for men and an average of 17.8% for women.

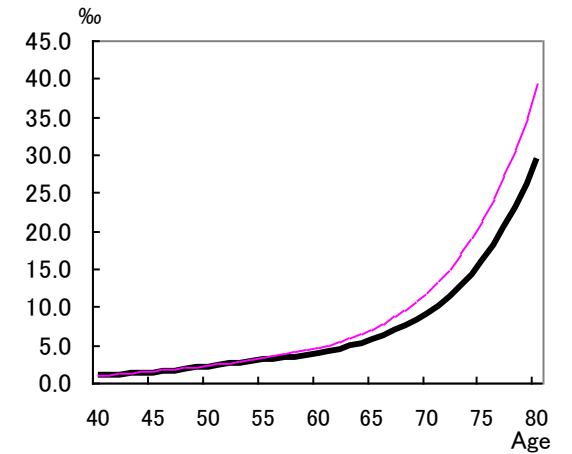
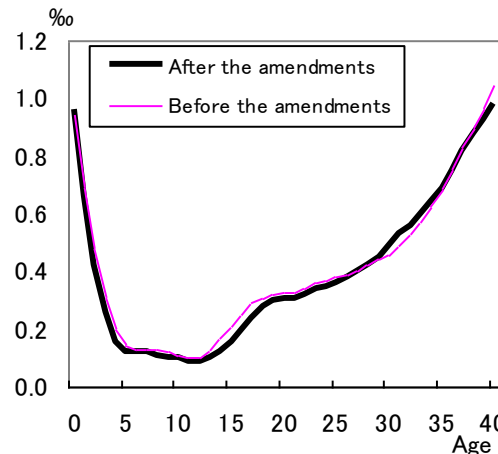
Male, for death protection product

Age	Before the amendments	After the amendments
20s	1.14	0.84 (74%)
30s	0.84	0.86 (102%)
50s	3.79	3.65 (96%)
80s	71.32	60.39 (85%)



Female, for death protection product

Age	Before the amendments	After the amendments
20s	0.33	0.31 (94%)
30s	0.46	0.49 (107%)
50s	2.33	2.16 (93%)
80s	39.49	29.60 (75%)

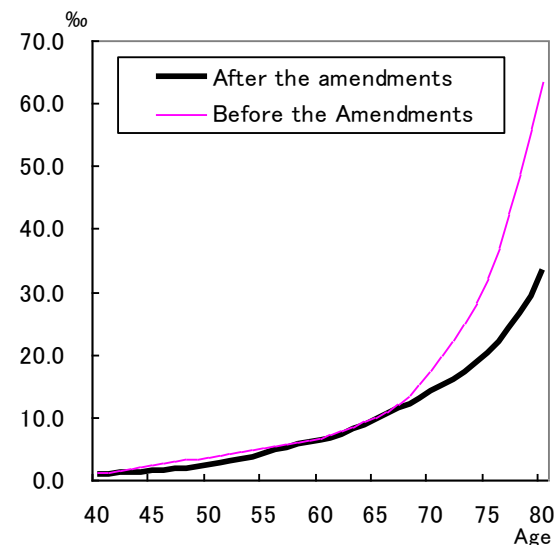


3.3.2 Overview of Amendments to the Standard Life Table (Cont'd)

■ Comparison of the standard life table (for annuitization) before and after the amendments

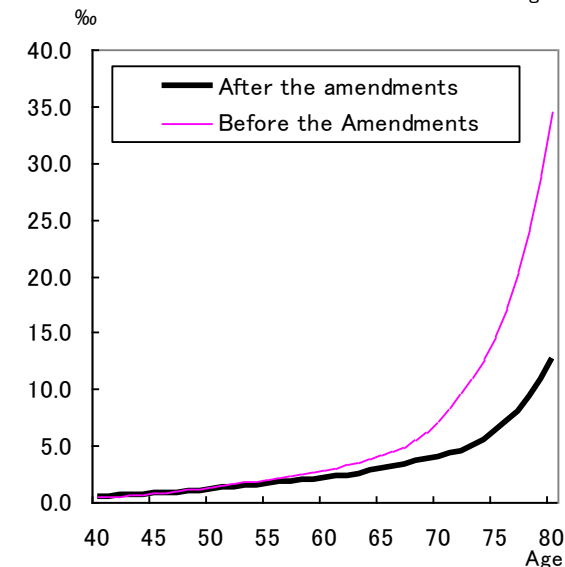
Male, for annuitization

Age	Before the amendments		After the amendments	
	Mortality rate	Average life expectancy	Mortality rate	Average life expectancy
60s	6.75	22.52	6.42 (95%)	26.96 (+4.44)
70s	17.63	14.35	14.11 (80%)	19.08 (+4.73)
80s	63.60	7.77	33.57 (53%)	12.19 (+4.42)
90s	186.12	3.96	83.18 (45%)	7.20 (+3.24)



Female, for annuitization

Age	Before the amendments		After the amendments	
	Mortality rate	Average life expectancy	Mortality rate	Average life expectancy
60s	2.84	26.85	2.18 (77%)	34.27 (+7.42)
70s	7.24	17.76	4.10 (57%)	25.13 (+7.37)
80s	34.58	9.73	12.75 (37%)	16.44 (+6.71)
90s	140.47	4.68	48.51 (35%)	9.57 (+4.89)



3.3.2 Overview of Amendments to the Standard Life Table (Cont'd)

Average life expectancy at 60

Based on Population Life Table		Male	Female
Year	1965	15.20 years	18.42 years
	1970	15.93 years	19.27 years
	1975	17.38 years	20.68 years
	1980	18.31 years	21.89 years
	1985	19.34 years	23.24 years
	1990	20.01 years	24.39 years
	1995	20.30 years	25.35 years
	2000	21.44 years	26.85 years
	2005	22.09 years	27.66 years
	2010	22.75 years	28.28 years
Life insurance standard life table 2007 (annuitization)		26.96 years	34.27 years

3.4 Standard Liability Reserve system - 3rd Sector -



3.4.1.1 Diversification of 3rd Sector Product

Diversification of benefit targets

Medical care activities such as hospitalization/Surgery

Hospitalization
Surgery
Outpatient
Discharged
Other medical care activities
High precision medical care, organ transplants
Home-based (terminal) medical care, special organ therapy, etc.

Diseases

Taken ill by specific diseases
External injuries
No accidents
etc.

Conditions of the body

Invalid
Nursing care
Life expectancy 6 months
etc.

Diversification of claim reasons

Diseases
Accidents
Lifestyle diseases
Women-specific ailments
Three major adult diseases
Cancer
Dentistry
Specific injuries (fracture, torn tendon, etc)
Intractable diseases
Serious chronic diseases etc.

Diversification of claim models

Lump sum, annuity (defined, living), premium payment exemption, living needs
Amount reflecting hospital inpatient days/outpatient days, reimbursement, fixed amount
Claim limits (hospitalization day limit, claim number limit, total claim limit, no limit for specific diseases, etc.)
Claim conditions (setting for fixed symptom period, hospitalized for more than OO days, waiting period)
Public health system linkage
etc.

Diversification of entry requirements

Women only, children only, pregnant women only
Relaxation of underwriting selection, no selection
etc.

Diversification of contract models

Main contract, rider
Sale of combined main contracts
Possible addition of single rider, addition only possible with other riders

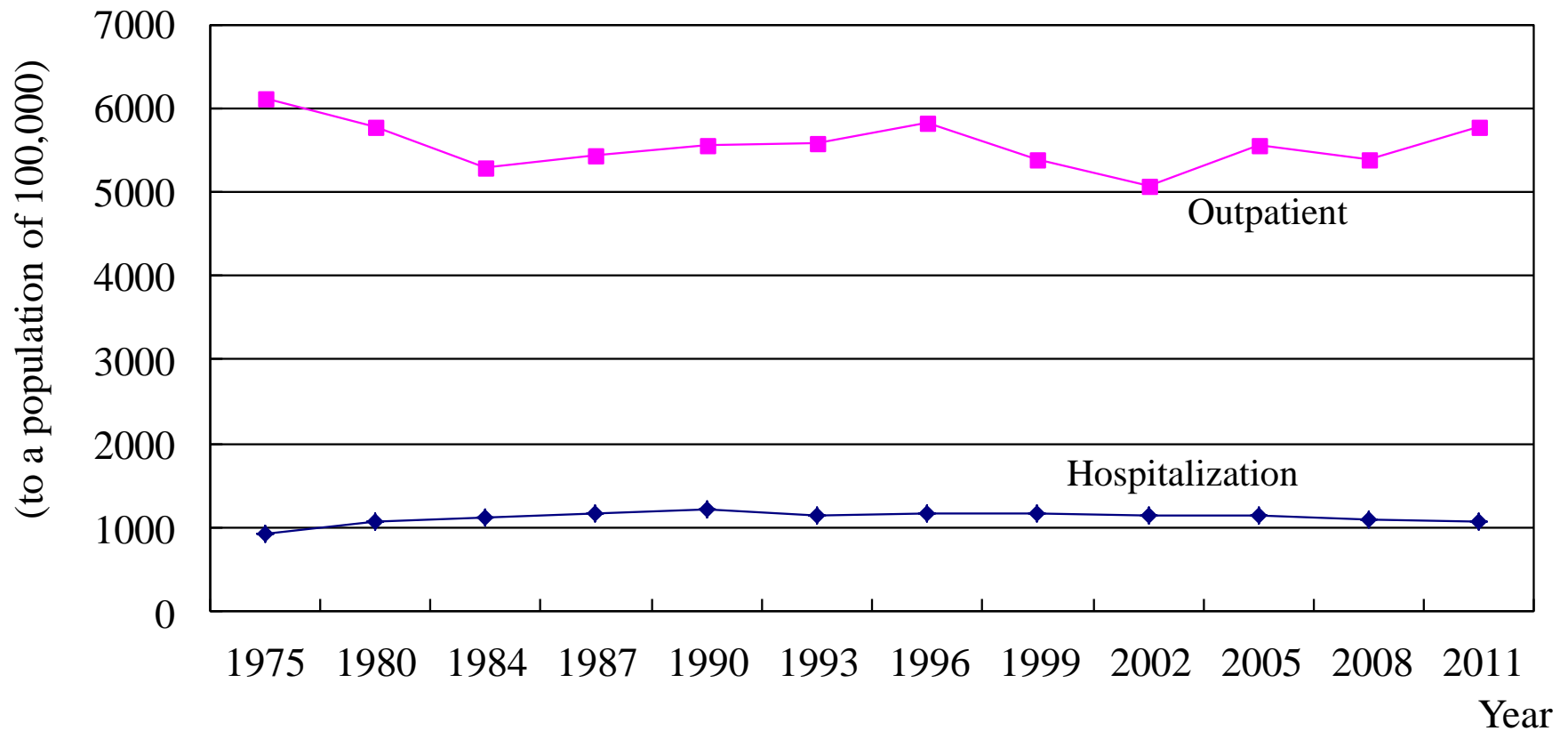
3.4.1.2 Risk Features of 3rd Sector Product

★ Many “uncertain”, “non-transparent” risk features

1. Unstable rate of incidence
 - Due to insufficient long-term and stable data
 - Due to fluctuations in risk levels (individual difference) of insured
2. Due to influences of changes in medical technology
3. Due to influences of changes in the structure of diseases
4. Due to influences of public medical care system
5. Consumer trends
 - ① Invasion of adverse selection
 - Long-term hospitalization in order to claim benefits, unbalanced risks of the insured
 - ② Concentrated risks
 - In general, contracts do not expire when claims, such as hospitalization benefits, are made.
Insured whose health conditions are bad and require repeated hospitalizations are more likely to continue their contracts

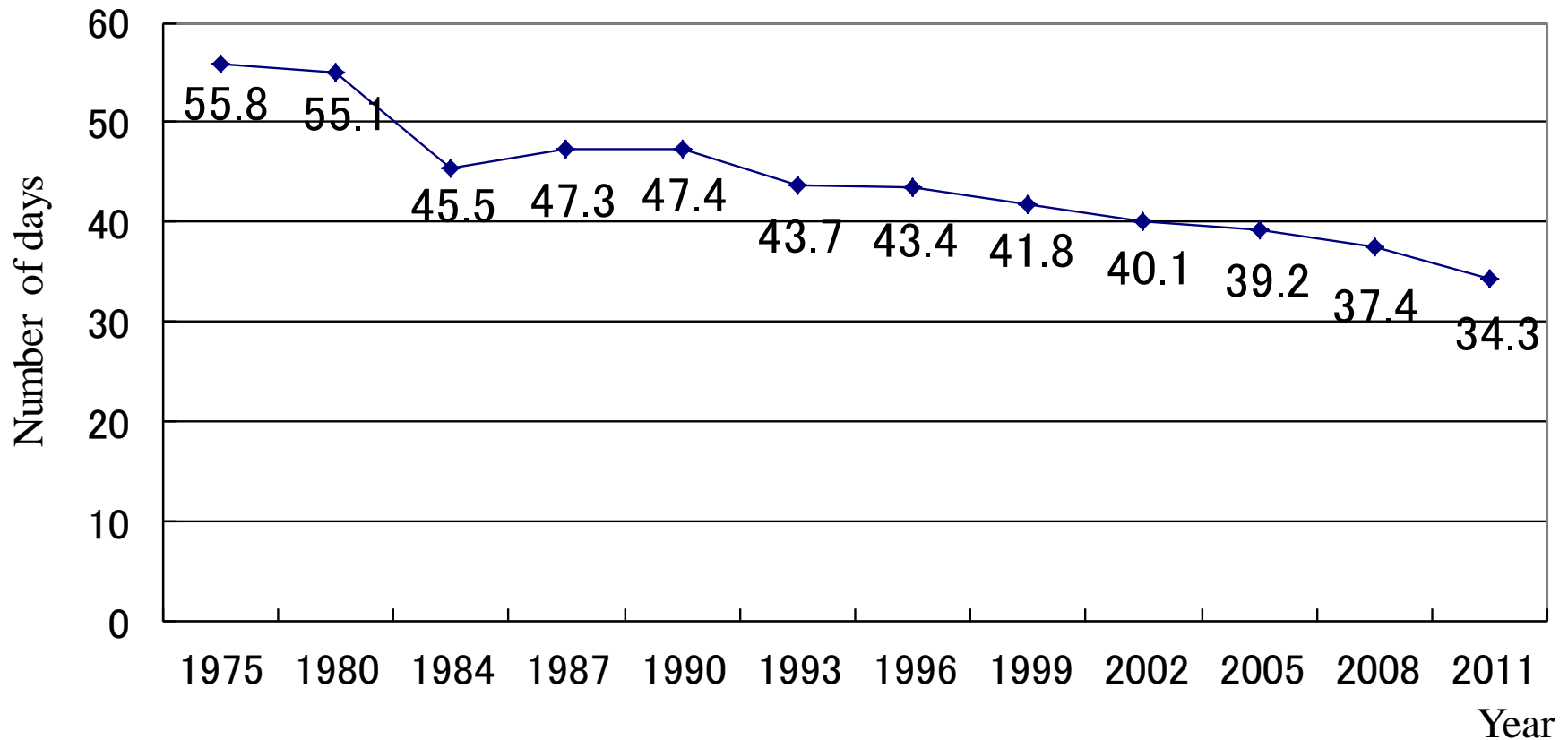
3.4.1.3 Trend of National Treatment Rate at Health Institutions

Rate of public receiving treatment is almost flat



3.4.1.4 Trend of National Average Hospital Inpatient Day

Average hospital inpatient days (per hospitalization) is decreasing



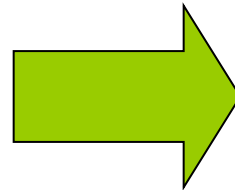
3.4.1.5 Diversification of Medical Operations

Medical operation becoming diversified with improvements in medical technology

<Medical operations covered by public health insurance>

1986

499 types

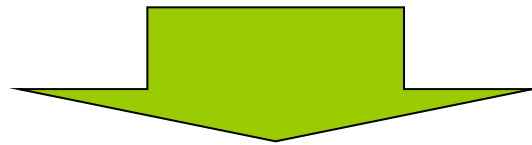


2010

1,172 types

3.4.2 Revisions to Standard Liability Reserve System (Setting Standard Mortality table for 3rd Sector Products)

- ① Declining national mortality rate (Increasing older population)
 - ⇒ worries over deterioration of medical insurance expenditures due to an increasing older population requiring high rates of hospitalization
- ② Greater customer needs for 3rd sector products such as health insurance, etc.



One of the actions taken by competent authorities with a view to secure healthier financial positions for insurance companies and provide better protection for policy holders

= Introduction of [3rd Sector Standard Life Table]
(Implemented from 2007 Apr.)

3.4.3 Standard Life Table for 3rd Sector Products

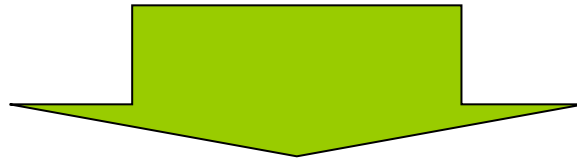
Lower mortality rates than those used in death protection products
because of accompanying living risks

Males	①	②	
	Death Protection	3rd Sector	② ÷ ①
50s	0.00365	0.00259	71%
60s	0.00834	0.00658	79%
70s	0.02193	0.01798	82%

Females	①	②	
	Death Protection	3rd Sector	② ÷ ①
50s	0.00216	0.00135	63%
60s	0.00379	0.00264	70%
70s	0.00914	0.00670	73%

3.4.4 Revisions to Medical Insurance Premiums (Company's Response to Law Revisions)

- ★ 2007 Apr. With the introduction of the “3rd Sector Standard Life Table”, Medical insurance premiums were revised
- ★ ① Declining mortality rate \Rightarrow increased premiums
- ★ ② Shortening of hospitalization \Rightarrow decreased premiums



<**Whole-life type** medical insurance>

Premiums **trend to increase**

<**Term-type** medical insurance>

Premiums **trend to decrease**

3.4.5 Enactment of 3rd Sector Liability Reserve Accumulation Rules

★ Introduced gradually from 2006

- ① Confirmation of adequacy of liability reserve using **stress tests**
- ② **Disclosure**
 - Disclosure of benefit claim **status** (ratio of benefit claims to the premium)
 - Disclosure of stress test implementations
- ③ **Monitoring** by FSA
 - Submission of ratio of actual claim rates to assumed claim rates to competent authorities
- ④ Securing of implementation of **right to change actuarial assumption**

3.4.6 Enactment of 3rd Sector

Liability Reserve Accumulation Rules

~ Implementation of Stress Test ~

Confirm whether assumed insurance incidence rates applied to insurance premiums duly cover risks of the insurance.

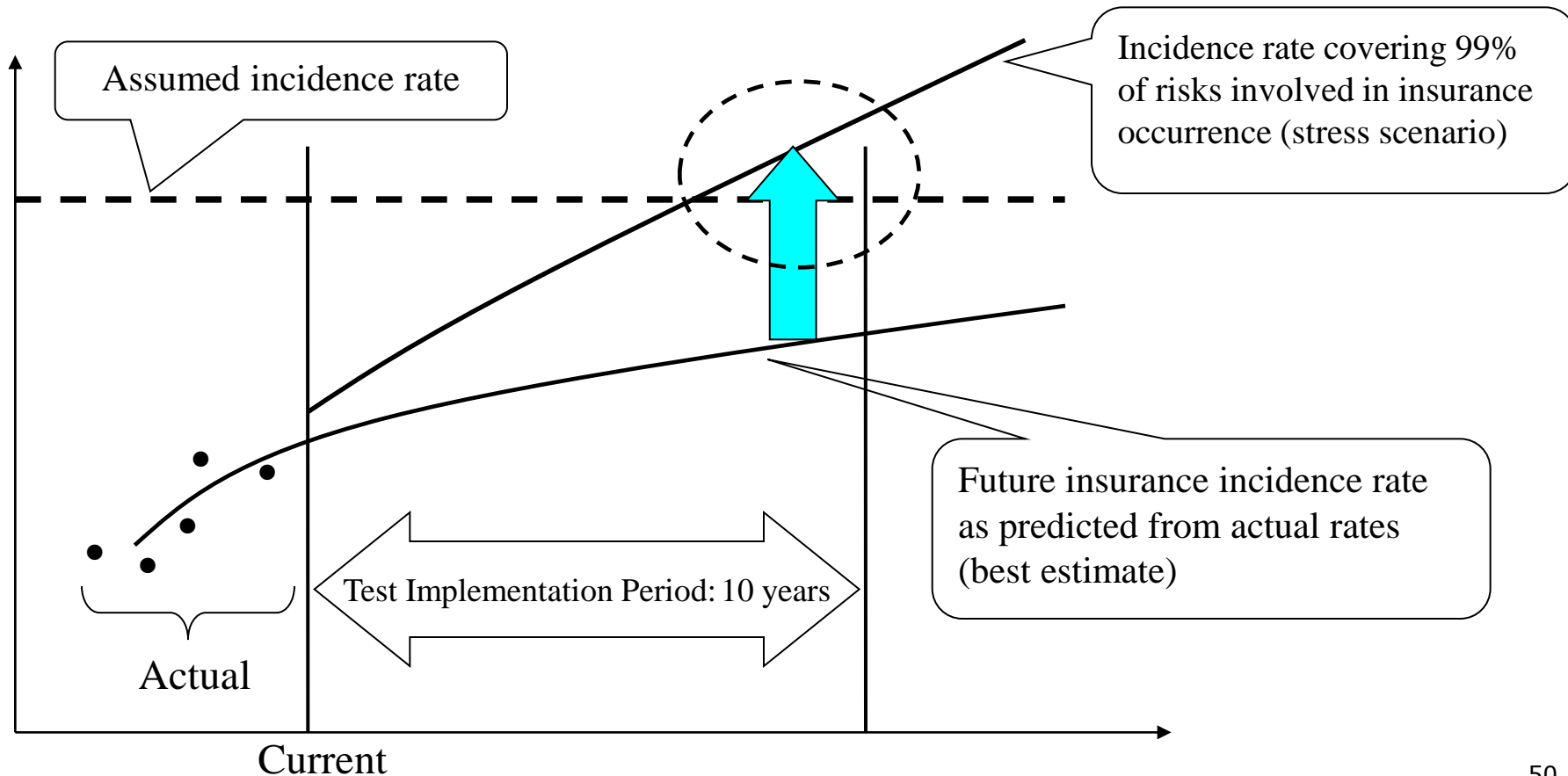
- Based on actual insurance incidence rates, confirm whether assumed incidence rates used for valuation cover 99% of risks during the test period (10 years in the future).
- If not sufficient, to top up liability reserves or claim fluctuation reserves.

3.4.6 Enactment of 3rd Sector

Liability Reserve Accumulation Rules

~ Implementation of Stress Test ~

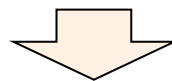
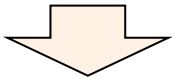
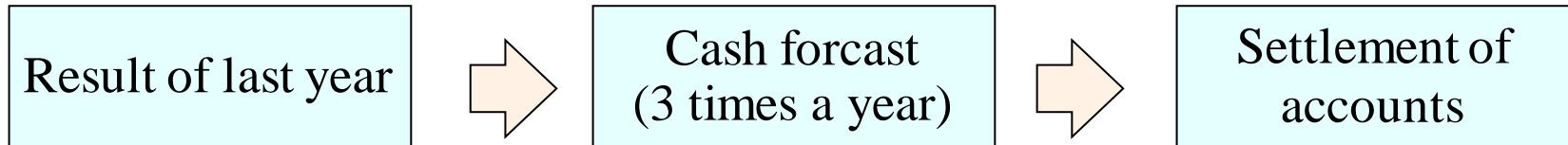
- ★ Under the stress scenario, liability reserves or claim fluctuation reserves will be topped up if inadequacies are predicted for the future.



3.5 risk management

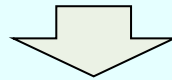


3.5.1 Risk management (single year basis)



(Abstract of forecast)

estimate the amount of contract in force at the end of business year



loading of premium and cost ... loading profit

net premium and payment of claim ... mortality profit

interest income ... interest surplus

... etc (such as capital gain)

3.5.2 Risk management (future balance analysis)

- Standard valuation system is locked in at policy signing.
 - It is obligatory to check the adequacy of reserves
based on future balance analysis

- Appointed actuaries make that judgment based on IAJ's "Practical Standards of Life Insurance Company Actuaries."
 - If reserve is lacking, then accumulation is necessary.

In 2007, additional reserve on whole life policy issued before 1996 was established.

4. Experience Study (Mortality & Morbidity Study)



4.1. Overview

□ Subject

- Individual insurance / annuity

□ Classes

- 1st sector (life products)
 death benefit product / annuity
- 3rd sector (medical products)
 - ▪ ▪ feature of benefit

□ Research method

- research by fiscal year basis

□ Definition

- A/E ratio ▪ ▪ ▪ actual to expected loss ratio
- Expected rate
 - Mortality ▪ ▪ ▪ standard mortality table 2007
 - Morbidity ▪ ▪ ▪ Pricing basis

4.2 Mortality Study (Method)

- Use standard mortality table 2007
as expected mortality rate.

- Analysis by following classes
 - Sex
 - Attained age
 - Policy year
 - Cause of death
 - Underwriting method
 - Sum insured
 - Etc...

4.3 Morbidity Study - Critical Illness (Method)

- Use Pricing assumption as expected morbidity rate.

- Analysis by following classes
 - Sex
 - Attained age
 - Policy year
 - Cause
 - Sum insured
 - Occupation
 - Etc...

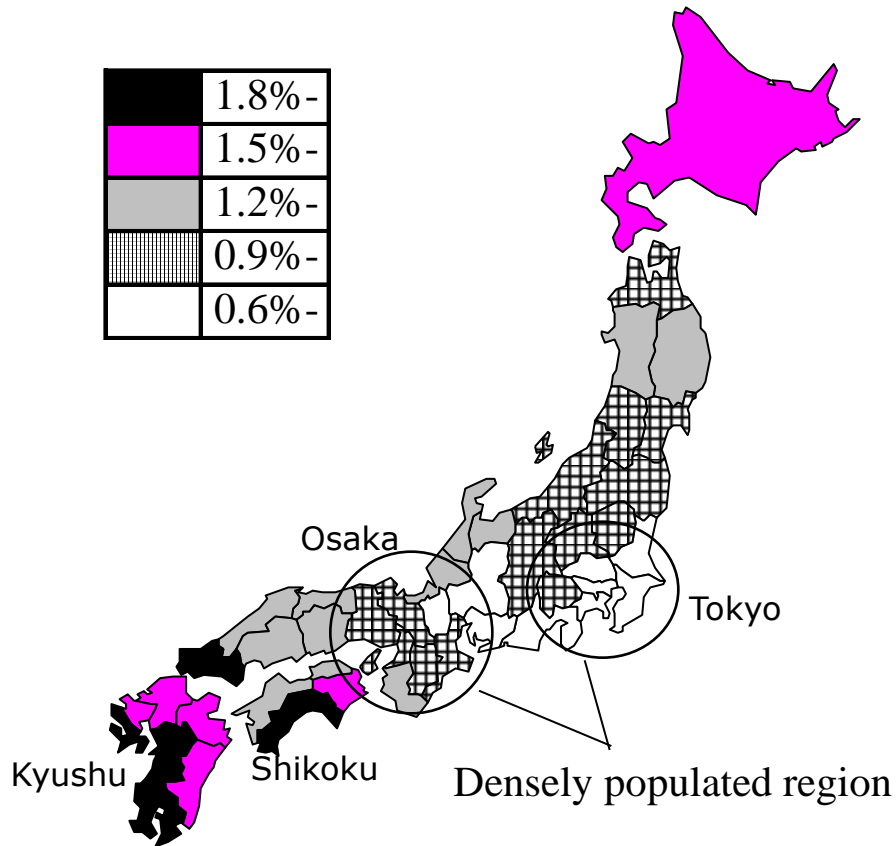
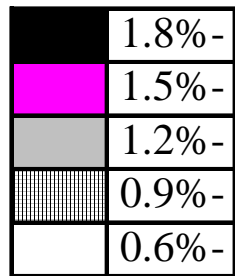
4.4 Morbidity Study - hospitalization(Method)

- Use Pricing assumption as expected morbidity rate.

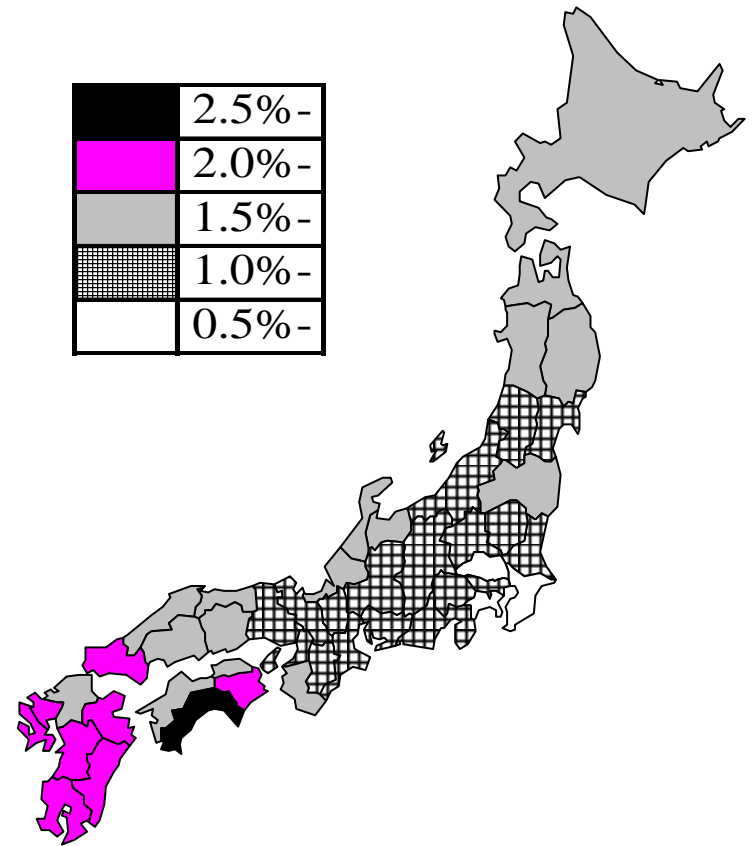
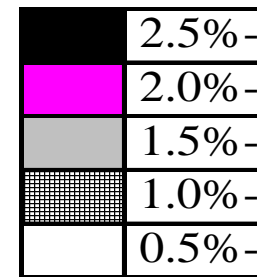
- Analysis by following classes
 - Sex
 - Attained age
 - Policy year
 - Cause
 - Sum insured
 - Occupation
 - Prefecture
 - Etc...

4.4 Morbidity Study - hospitalization (Result by Region)

No. of hospitalization
(per 100,000 population)

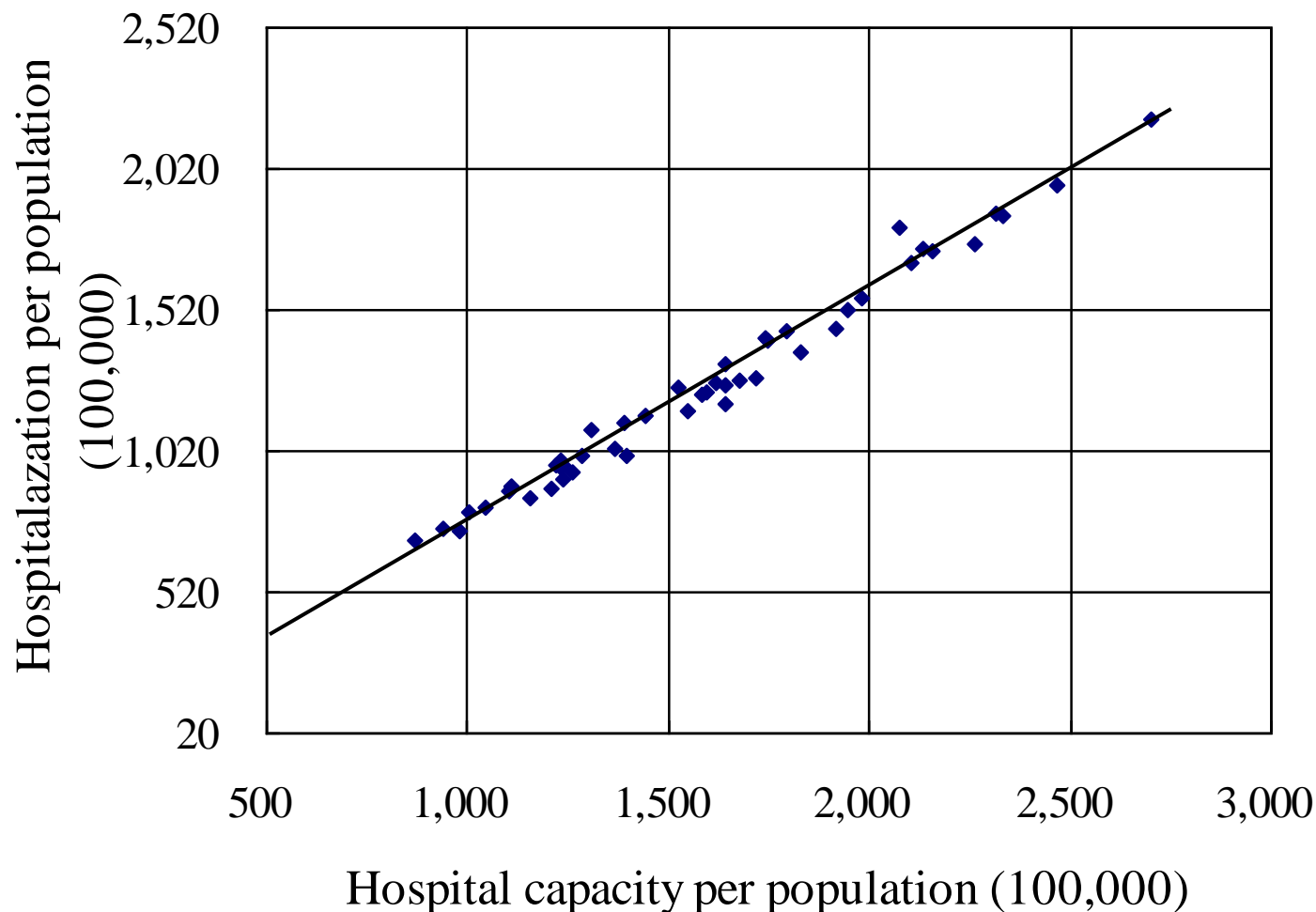


No. of beds in hospital
(per 100,000 population)



4.4 Morbidity Study - hospitalization (Result by Region) (Cont'd)

Corelation between hospital capacity and hospitalization by prefecture
(for sickness hospitalization)



5. Summary



5. Summary

- Building risk management cycle of insurance underwriting business is the “minimum standard” for life insurer.
 - Pricing
 - Check at the time of PD
 - Monitoring & Experience Study
 - Reserving
 - Financial Control

- Introducing risk management policy explicitly will be helpful.

(reference 1)

Effect of the East Japan Earthquake

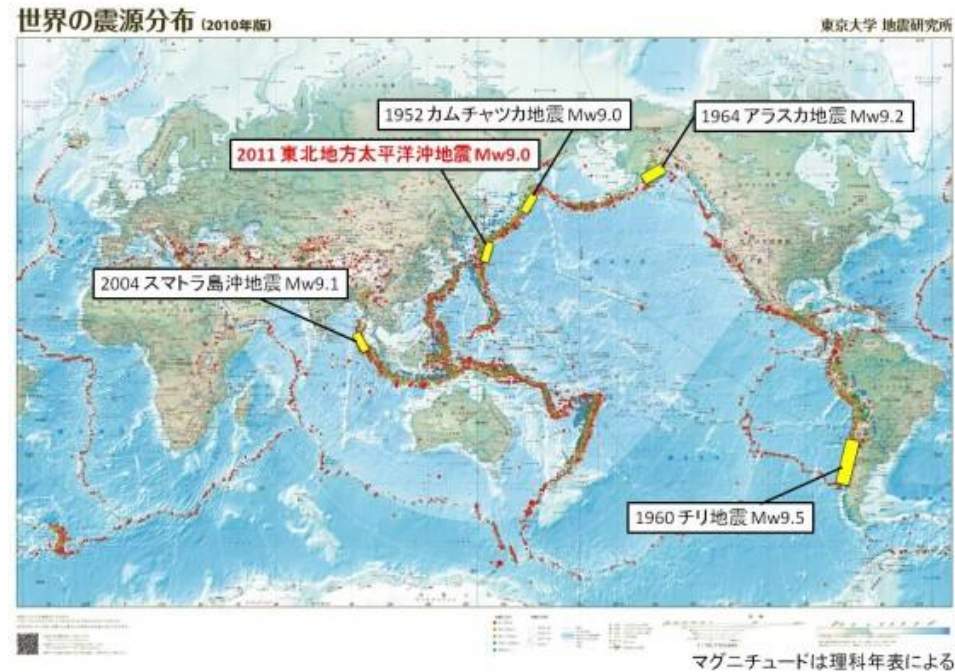
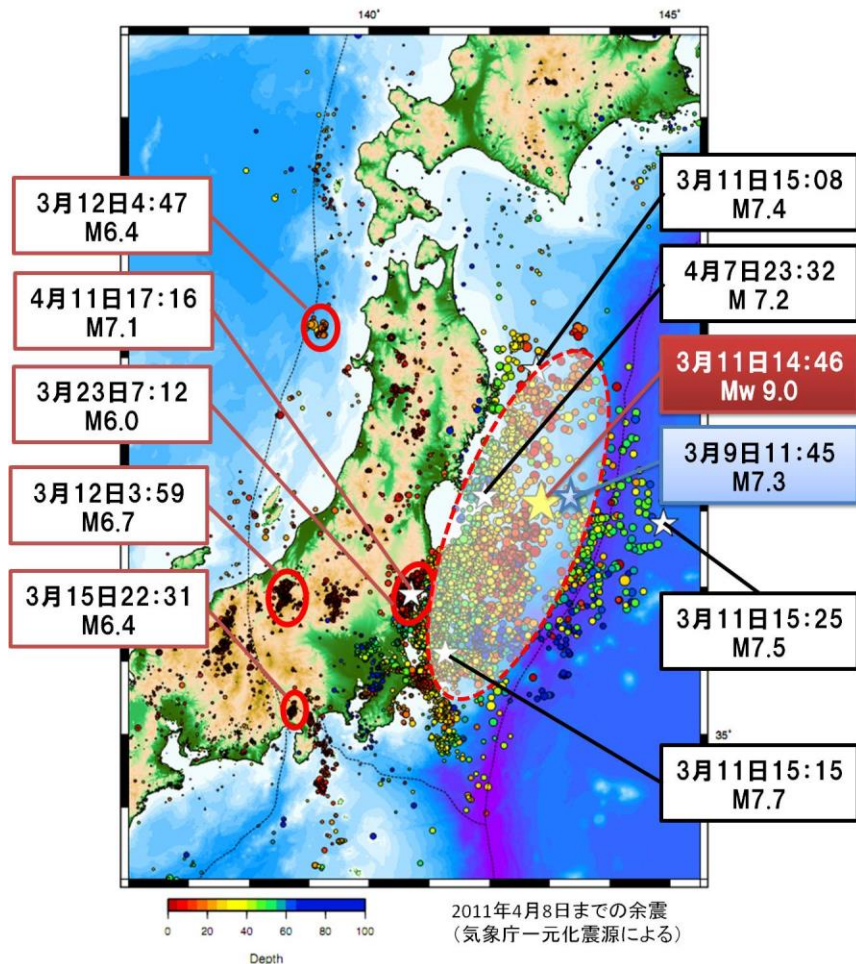


(1) Overview of the Earthquake

Date March 11, 2011

Magnitude 9.0 (greatest ever observed in Japan)

Epicenter Tohoku region

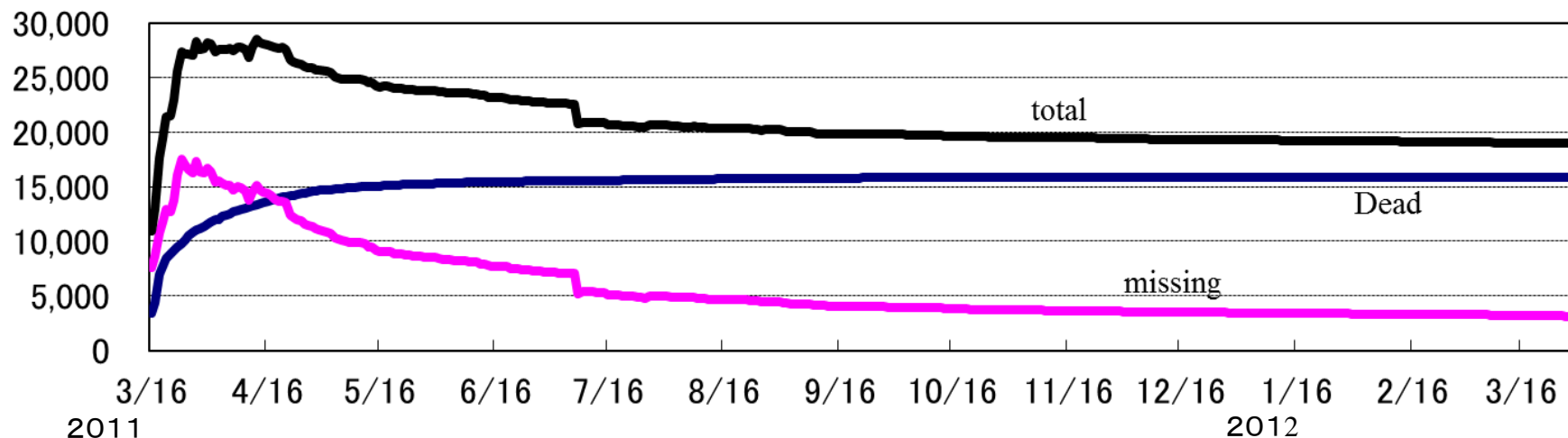


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Earthquake Research Institute; The university of Tokyo

(2) Damage (as of 31/3/2012)

Dead 15,854

Missing 3,089



(3) Effect on the mortality rate

Casualty of the earthquake (approximately 19,000) increased mortality rate of 2011 by approximately 1.5%

Deaths in Japan

(million)

2008	2,009	2010	2011	casualty of earthquake
1.14	1.14	1.20	1.25	0.02

1.5%