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The simulation of a deficiency on a plan termination basis in defined benefit pension plans

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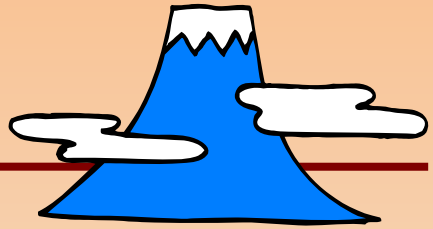
Outline



The merits of DB plan in our country

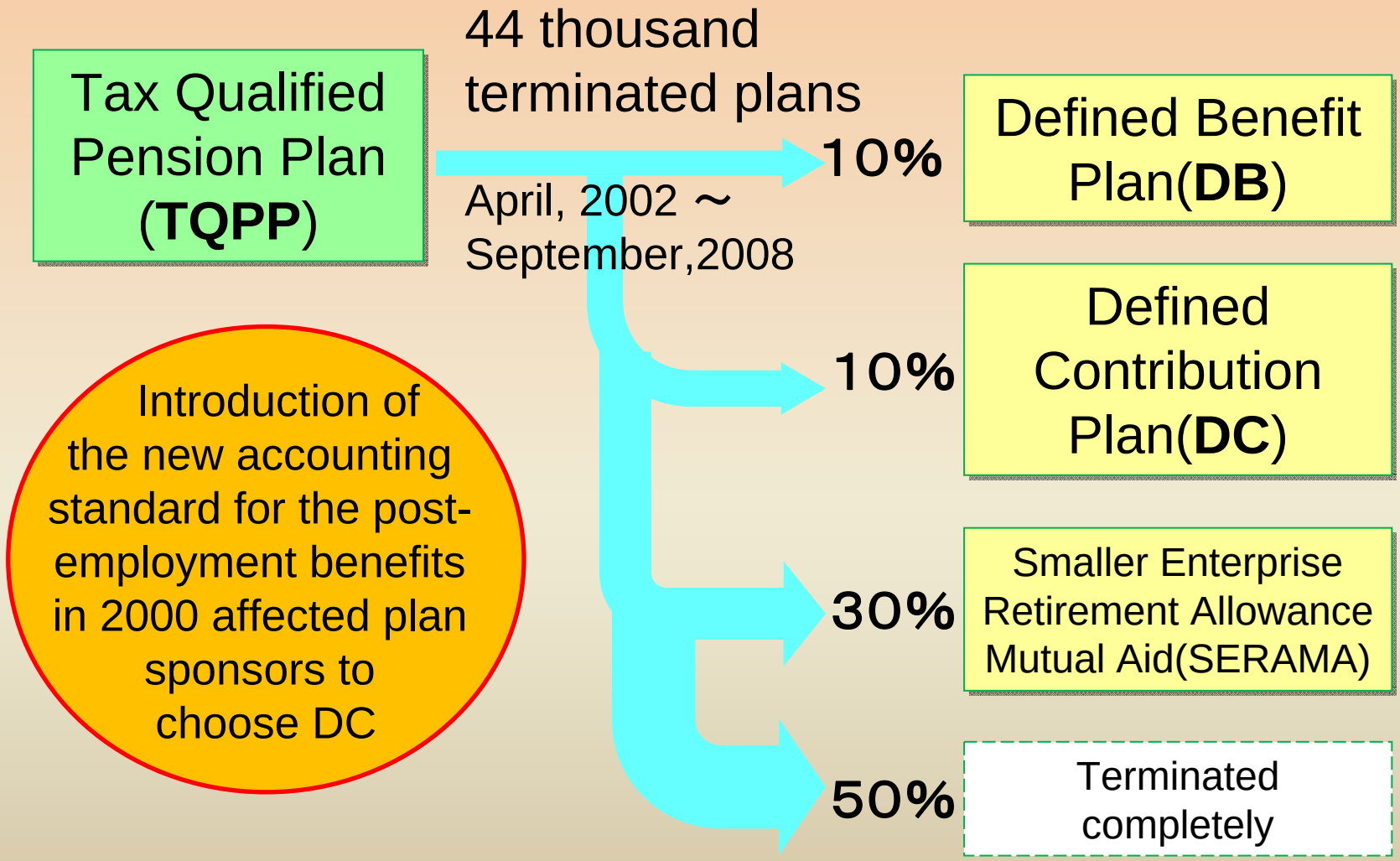
Employers avoid uncertainty of cost

They shift to DC plan or to terminate completely

However, it should not be easily accepted

Spotlight the simulation of fluctuation of cost

Corporate Pension Plan shifting



The merits of DB in our country

DB have following merits compared with DC as the preparation for post-employment

- No investment education cost on employees
- Employees can concentrate in their work
- Higher efficiency investment

etc

In addition employees would prefer DB to DC as they tend to favor cooperation over competition

The reason why employers do not select DB

Strict rules in comparison with TQPP

- **Plan continuation basis**
- **Plan termination basis**
  set minimum funding amount (MF)
  for each participant and pensioner

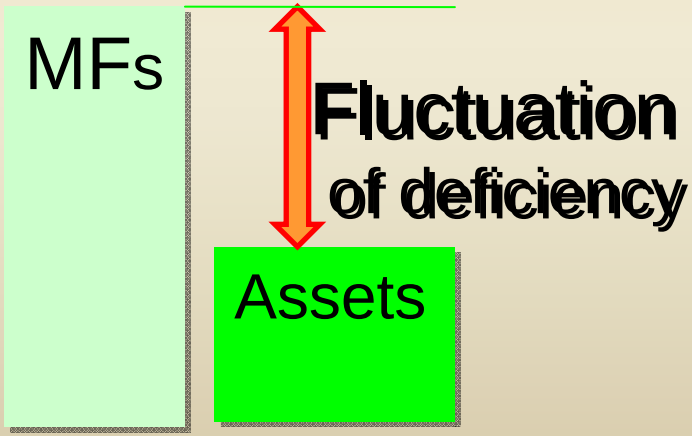
Different from TQPP, DB
- might be required to pay additional contribution every year
- is required to pay amounts of plan deficiency below MFs (=total of MF) at plan termination

The reason why employers do not select DB

Particularly small plan

Incomprehensible and troublesome feature in managing DB

Plan sponsor cannot forecast the cost in the worst scenario at plan termination



Therefore

Uneasiness

Factors affecting plan deficiency below MFs

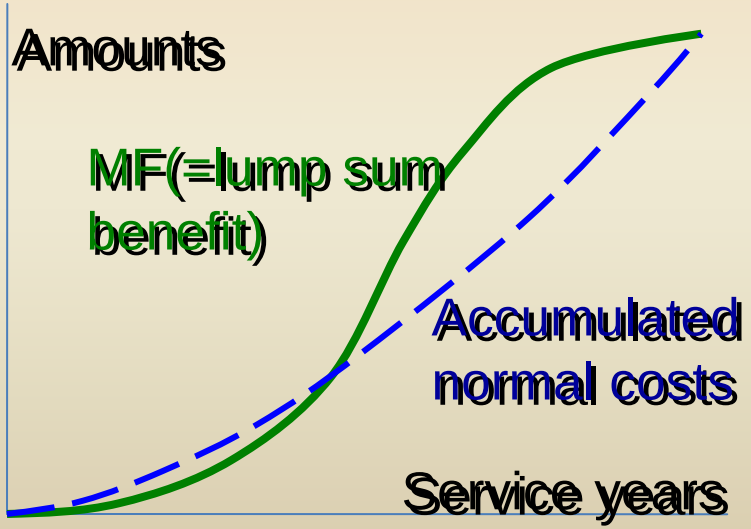
(1) Main factor of the fluctuation of deficiency is investment returns on plan assets.

Higher risk investment : ex. stocks or foreign bonds

(2) Shape of benefit curve

Backloaded benefits（so called S-shaped curve）

Actual salary increase is higher than assumed salary increase in final salary plans



Factors affecting plan deficiency below MFs

(3)Withdrawals under lack of plan assets

Under severe business environment plan sponsors often aim at high risk/return investment in order to lower contribution

Loss

	Before Withdrawal	Payment	After Withdrawal
(1)MFs	10,000	2,000	8,000
(2)Assets	6,000	2,000	4,000
(2)/(1)	60%		**50%**

Benefit payments cause to expand deficiency ratio

Simulation of plan deficiency below MFs

If plan sponsors had known the future deficiency, they could have changed the plan design and/or have reviewed plan asset allocation

Therefore

They can run DB at ease if they know it

It would lead to build confidence among members concerned with DB

Simulation of plan deficiency below MFs

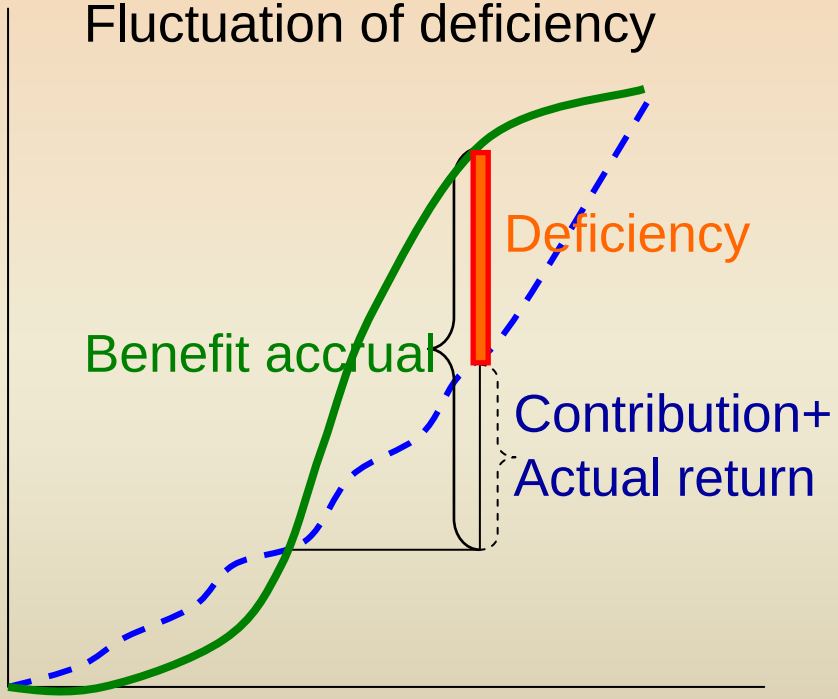
The reason why fluctuation of deficiency occurs

No fluctuation in DB where
benefit = contribution
+ actual investment return

But

- **Benefit linked with actual return is not allowed yet**

- **S-shaped curve benefit**



Simulation of plan deficiency below MFs

Misfortune for DB sponsors not to know the future fluctuation of the deficiency

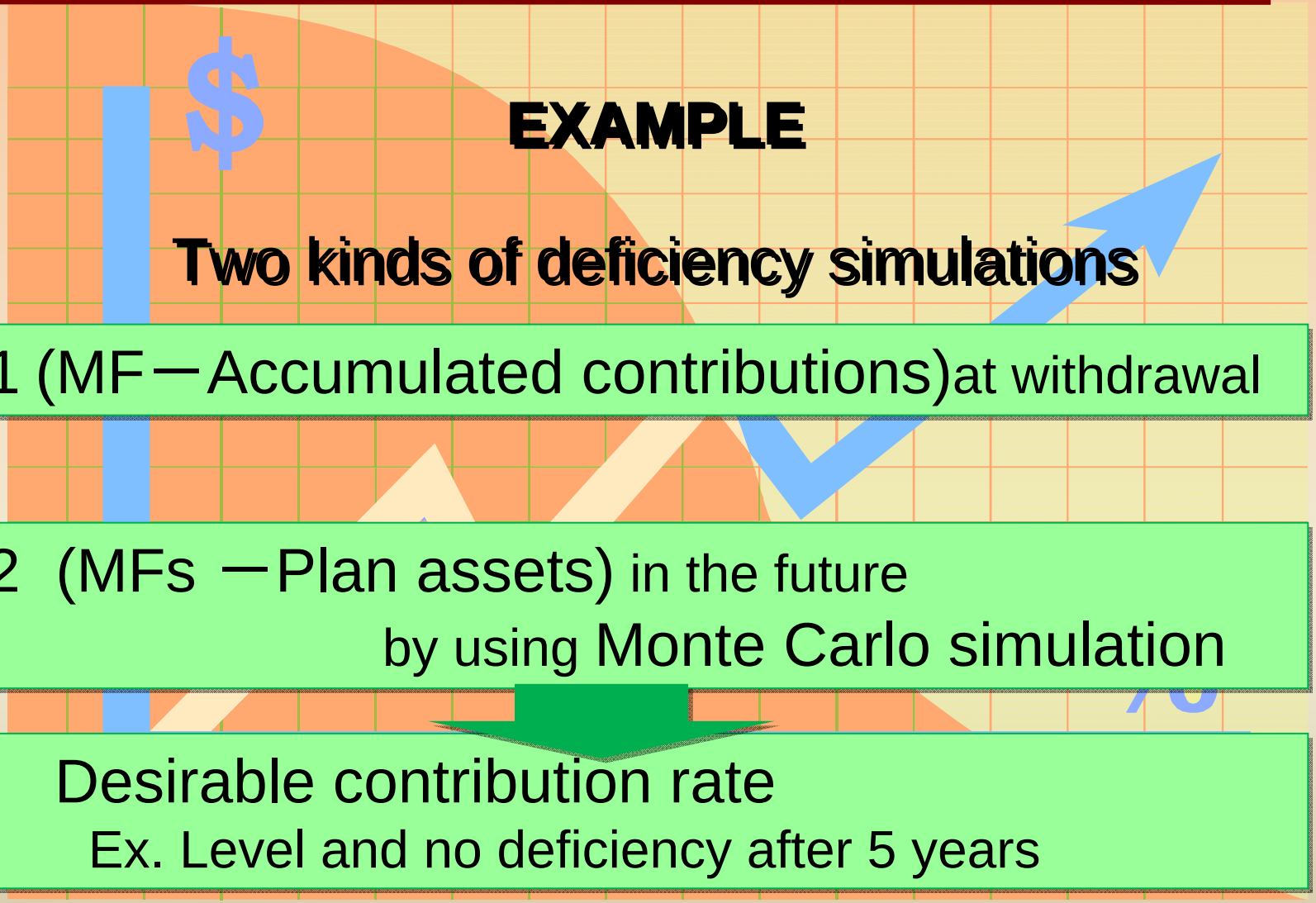
However **meaningless** if they cannot understand it and/or do not have willingness to understand it

Therefore

How about showing the result of deficiency simulation?

- Using probability distribution
- Using computer graphics to show them visually

Simulation of plan deficiency below MFs



EXAMPLE

Two kinds of deficiency simulations

1 (MF－Accumulated contributions)at withdrawal

2 (MFs －Plan assets) in the future
by using Monte Carlo simulation

Desirable contribution rate
Ex. Level and no deficiency after 5 years

Simulation of plan deficiency below MFs

Assumptions used in this simulation

■Benefit formulas

- Final salary pay plan
- Cash Balance plan (CB) which accumulates certain % of salary with actual return rate
  *Not allowed yet in DB Law in our country

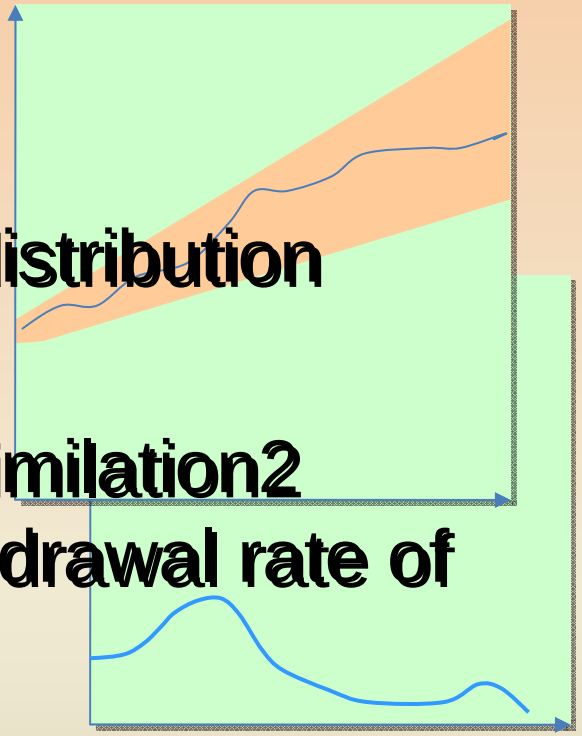
■Expected actual return rate on plan assets

normal distributed random variable
with μ = 2%, 3% σ = 2% , 5% each in Simulation2

Simulation of plan deficiency below MFs

■Actuarial assumptions

- The salary of participant
  is determined using normal distribution
  based on the range of salary
- Probability of withdrawal in Similation2
  is based on experienced withdrawal rate of
  small TQPP



- Assume that all assumptions are independent
  one another though it might not be so

Simulation of plan deficiency below MFs

■Participants Data etc

- In Simulation1
  - current ages 18 - 59 years old
  - past services 0 - 41 years

- In Simulation2
  - 80 participants and no pensioners at the starting point. (small plan)
  - Iteration in the Monte Carlo: 1,000 times

Simulation of plan deficiency below MFs

■MF in this simulation

MF is defined as
- lump sum benefit based on voluntary withdrawal
- amount paid when participant requests lump sum

Be careful that this definition is near to the definition of regulations of DB Law in Japan but is not same.

Simulation of plan deficiency below MFs

■How to use the results

Different assumptions lead different results

Particularly small plan

Not depend on the result itself excessively because of low credibility of assumptions

More important to take notice on the difference resulting from the difference of assumptions

Simulation-1

Case-No.	2	1	
Benefit Formula	Final Salary	Final Salary	
Reduction in voluntary	Yes	Yes	
Voluntary withdrawal	Yes	Yes	
Assumed Interest Rate	2.0%	2.0%	
Salary Increase Rate	normal +30%	normal increase	*
Actual Return Rate	2.0%	2.0%	

Simulation-1

Case-No.	7	6	
Benefit Formula	CB Plan	Final Salary	*
Reduction in voluntary	No	No	
Voluntary withdrawal	Yes	Yes	
Assumed Interest Rate	2.0%	2.0%	
Salary Increase Rate	normal increase	normal increase	
Actual Return Rate	2.0%	2.0%	

Simulation-2

Case-No.	1	3	
Benefit Formula	Final Salary	Final Salary	
Interest Guaranteed	0%	0%	
Interest Deductible	0%	0%	
Reduction in voluntary	Yes	Yes	
Assumed Interest Rate	2%	2%	
Withdrawal Rate	middle rate	middle rate	
Salary Increase Rate	normal increase	normal increase	
Pension Choice Rate	100%	100%	
Actual Return (μ)	2%	3%	*
Actual Return (σ)	2%	5%	*

Simulation-2

Case-No.	6	7	
Benefit Formula	Final Salary	CB Plan	*
Interest Guaranteed	0%	-100%	*
Interest Deductible	0%	0%	
Reduction in voluntary	No	No	
Assumed Interest Rate	2%	2%	
Withdrawal Rate	middle rate	middle rate	
Salary Increase Rate	normal increase	normal increase	
Pension Choice Rate	100%	100%	
Actual Return (μ)	2%	2%	
Actual Return (σ)	2%	2%	

Simulation-2

Case-No.	10	17	
Benefit Formula	CB Plan	CB Plan	
Interest Guaranteed	1%	1%	
Interest Deductible	0%	0%	
Reduction in voluntary	No	No	
Assumed Interest Rate	2%	2%	
Withdrawal Rate	middle rate	middle rate	
Salary Increase Rate	normal increase	normal increase	
Pension Choice Rate	100%	100%	
Actual Return (μ)	3%	3%	
Actual Return (σ)	5%	7%	*

Summary and Close

The merits of DB plans in our country

But

Employers avoid uncertainty of cost

Therefore

Explanation which plan sponsors have willingness to understand is important when they design or manage DB

Summary and Close

This paper focuses the spotlight on some ideas of the simulation of deficiency

And does not aim to explain techniques or results in detail

It would be grateful if this paper would open up discussions and be referred to plan designing and administration

Thank you for your attention.

All the opinions expressed in this paper are that of the author alone and do not necessarily reflect the views of his employer or JSCPA.

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