Loss reserves and financial risk
The rich and the poor

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Loss reserves
The significance of financial risk

- Aggregation of risk components:
  - insurance risk
  - investment risk

- Significance of selected investment strategy

Approach

- Two models:
  - One describing financial risk
  - Another dealing with insurance risk
- Integration of models
  - Trough Monte Carlo simulation

Case study

- Invest loss reserves for bodily injury part of motor portfolio - 1985 - 1999
- Portfolio in runoff
- Estimate a total of 462 mill NOK in future payments

Financial model

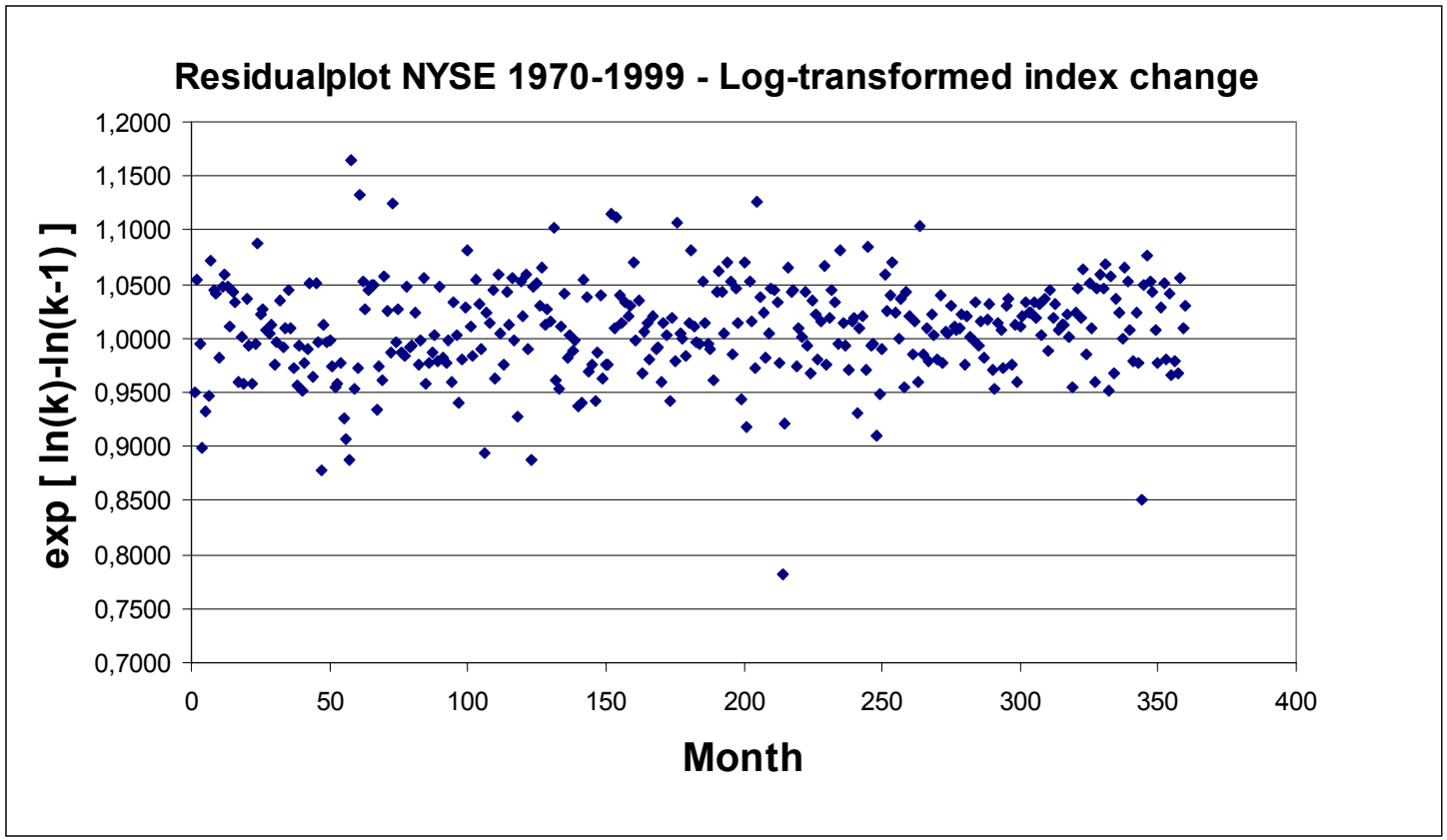
- Possible elements:
  - Stock investments
  - Bond investments
  - Property investments (excluded in case)
  - Liquidity (excluded in case)

- Investment strategy part of the setup

- Integration for total investment return
  - Trough Monte Carlo simulation

Stock market model

Log transformed stock price



Mathemathical model
(stock price S at time k)

- Monthly
- Standard Random Walk on log scale

$$S_k = S_{k-1} \cdot e^{\varepsilon_k}$$

$$\ln S_k = \ln S_{k-1} + \varepsilon_k \quad , \text{k=1 to 360}$$

- Historical trend - volatility and correction handled automatically
- Model ignores time dependence in volatility

Optimum criteria

- CAPM not successful
- Value at Risk

$$P(\Delta S_t < VaR) = \alpha$$

Simulated reserve

$$R_t = B_t + (S_{1,t} + \ldots + S_{m,t}) - X_t$$

Bonds **Equities** **Claims**

Optimal investment of reserves

Rebalance:

$$q = \min\{\frac{\sum_{j=1}^{m} S_{j,t}}{R_t}, 0.35\}$$

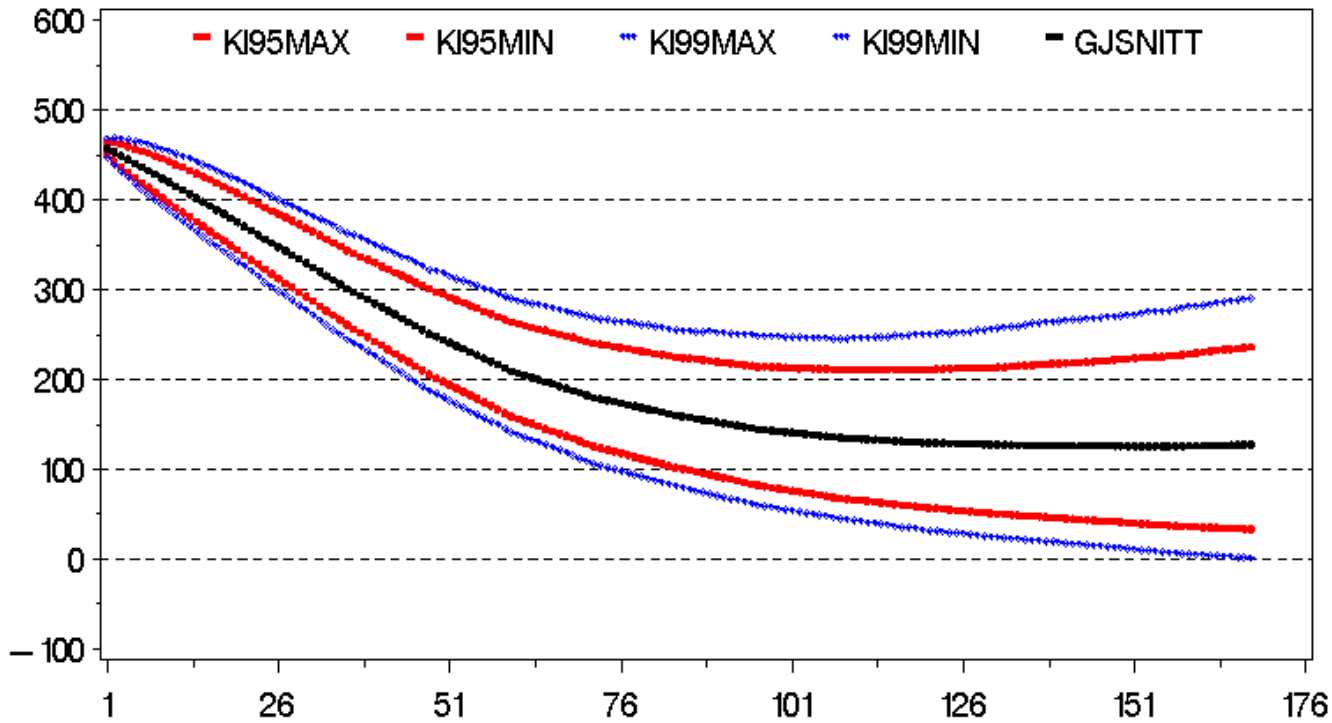
Norwegian legal restriction

Value at risk:

Obtain 10000 simulations at t=168 (14 years) R(1,168), … , R(10000,168), with the 100th smallest value as estaimate of 1% VaR

Simulated reserve over 14 years

Great Britain,USA,France and Norway
5% interest rate - 3,5% inflation - 10000 iterations
Choice og investment: 30% stocks, 70% bonds



NOK Mil

Month

Interest rate and inflation

Development of reserves over 14 years - 4 markets

Great Britain,USA,France and Norway

10000 iterations

	Inflation p.a.	Interest rate p.a.	Share invested in stock	Share invested in bond	Expected return mill. NOK	95% CI	99% CI
0,5% difference	2,0 %	2,5 %	20,6 %	79,4 %	64	18	1
	3,5 %	4,0 %	12,6 %	87,4 %	44	13	1
	5,0 %	5,5 %	9,1 %	90,9 %	37	11	1
1,5% difference	2,0 %	3,5 %	42,3 %	57,7 %	172	43	1
	3,5 %	5,0 %	30,0 %	70,0 %	128	34	1
	5,0 %	6,5 %	23,1 %	76,9 %	110	30	< 1
2,5% difference	2,0 %	4,5 %	53,8 %	46,2 %	255	58	<1
	3,5 %	6,0 %	41,1 %	58,9 %	202	50	1
	5,0 %	7,5 %	32,9 %	67,8 %	178	46	1
3,5% difference	2,0 %	5,5 %	60,8 %	39,2 %	318	70	1
	3,5 %	7,0 %	48,9 %	51,1 %	265	63	<1
	5,0 %	8,5 %	40,5 %	59,4 %	240	59	<1

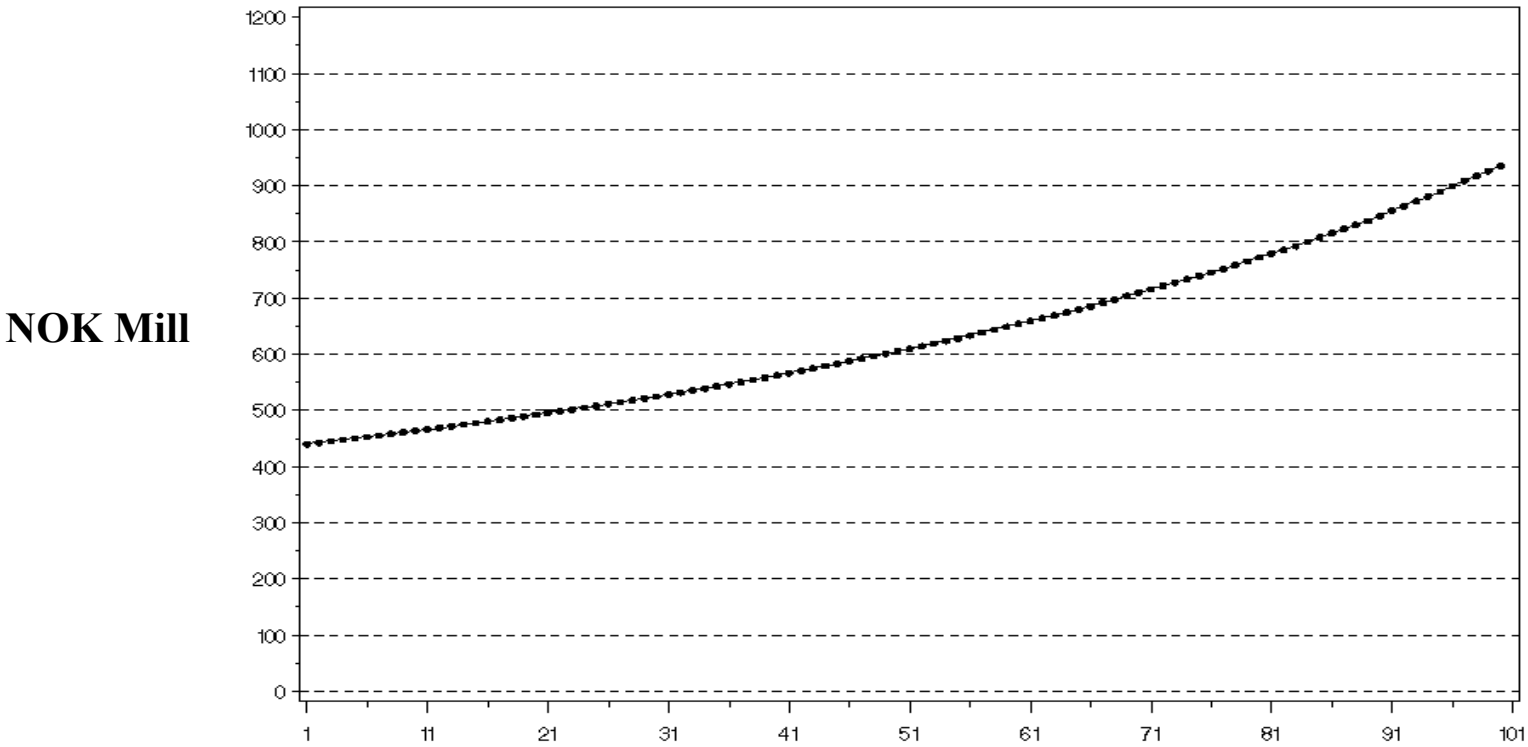
Investment market

	Share invested in stock	Share invested in bond	Expected return mill. NOK	95% CI	99% CI
USA	13,8	86,2	74,4	161	1
Norway	7,8	92,2	69,5	147	1
Great Britain	9,7	90,3	73,4	160	1
France	9,2	90,8	69,5	158	1

Minimal reserve given investment strategy

Minimal reserve pr share invested in the asset market

462 mill NOK– 14 years – 5% interest rate – 3,5% inflation – Great Britain



Concluding remarks

- Size of capital base:
  - Important for a general insurance company
  - Higher return if capital permits the use of high yielding (but risky) investments

- Modern technology:
  - Allows us to quantify
  - The challenge nowadays not technical but how to obtain the correct risk model