

Risk Caused by Catastrophic Downturns of the National Economy

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1. Finnish experience in 1990's:

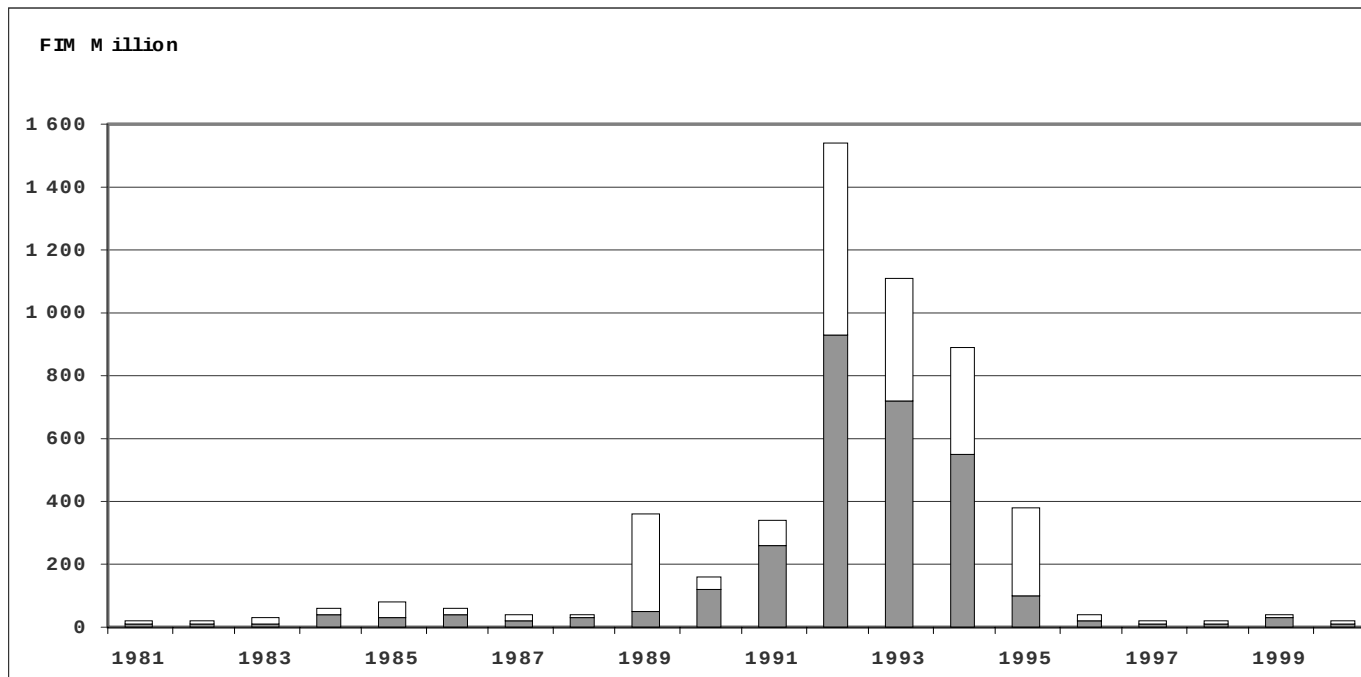
The losses of surety (guaranty) insurance

2. Economic business cycle

3. Model for credit loss cycle

4. Simulations and conclusions

1. Finnish experience in 1990's

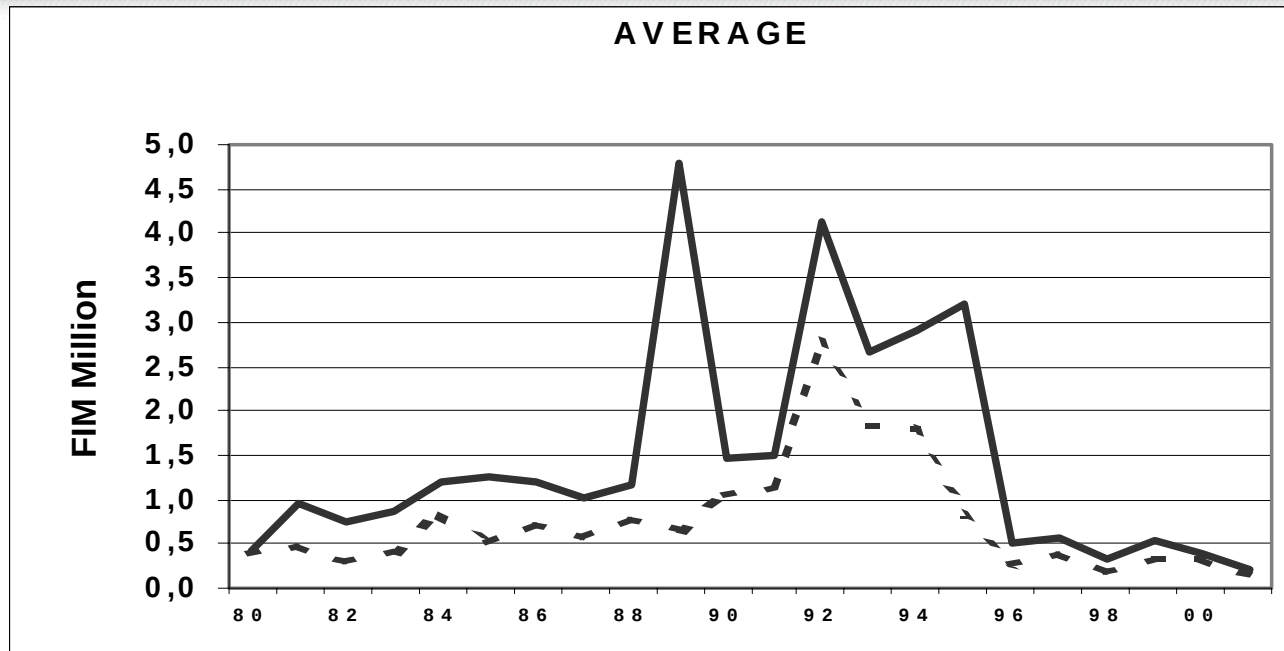


Surety Insurance of the Statutory Pension System:

- Losses between 1981-2001
- Dark part : final losses

- **Provoked** by recession:

- BNP drop 1991-1993 12 per cent



- Average claim size (total/final):
 - Standard deviation has similar pattern
- Claim size **distribution changed** during recession
- Losses may reach **catastrophic dimensions** for **several years** (time dependence)
⇒ Standard models do not fit well!

2. Economic Business Cycle

- Two-state Markov model for business cycle (Hamilton 1989).

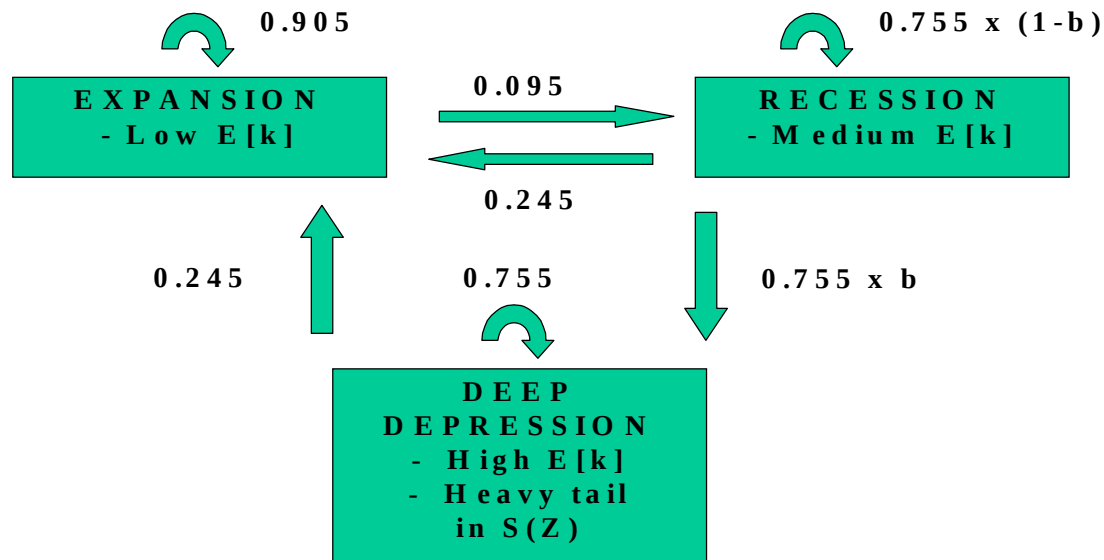
State $\mathbf{bc}(t)$:

$\mathbf{bc}(t) = 1$, expansion at time t
 $\mathbf{bc}(t) = 2$, recession at time t

- Transition probabilities:

$$\mathbf{p}(ij) = \text{Prob}\{\mathbf{bc}(t) = i \mid \mathbf{bc}(t-1) = j\}$$

3. Model for credit loss cycle



- Target: Simple and parsimonious model
- A state for **deep depression** added
=> **Catastrophic** depression may occur
- Constrain: Expansions = Hamilton
- Only **one additional parameter b (p)**

4. Simulations and Conclusions

- How to find $\mathbf{p}$ (b)?

$\mathbf{p} = \text{Prob}\{\text{recession} \Rightarrow \text{deep depression}\}$

1) Define suitable limiting distribution

$$\mathbf{vP} = \mathbf{v} \quad (\mathbf{P} \text{ transition matrix})$$

2) Then pick corresponding $\mathbf{p}$

$\mathbf{v}$	$\mathbf{p}$
(0.72 0.25 <u>0.03</u>)	0.1
(0.72 0.21 <u>0.07</u>)	0.25
(0.72 0.14 <u>0.14</u>)	0.5

$$\Rightarrow 0.1 \leq \mathbf{p} \leq 0.5$$

- Simulated: 5000 times **100 years**
Probability of ruin **1** per cent
- The source of randomness:
 - Credit loss cycle
 - Expected loss $E(bc)$ varies
- **P** pure risk premium, **U₀** initial reserve
- $E(\text{expansion}) = 1$, $E(\text{recession}) = 2$,
 $E(\text{depression}) = 10$:

p		0.1	0.25	05
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P		1.5	1.8	2.4
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U₀		58	78	95
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b) $p = 0.25$:

E(recession)		2	1	6
E(depression)		2	10	6
P		1.3	1.6	2.4
U₀		12	78	62

CONCLUSIONS

- **Simple** Markov model **captures** credit loss cycle
- **Catastrophic** downturn included in model
 - => 1) Premiums clearly higher
 - 2) **Reserves much larger**
 - => Difficult even for statutory system
- Reinsurance?

