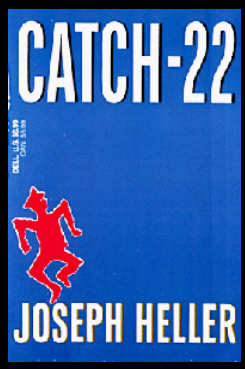
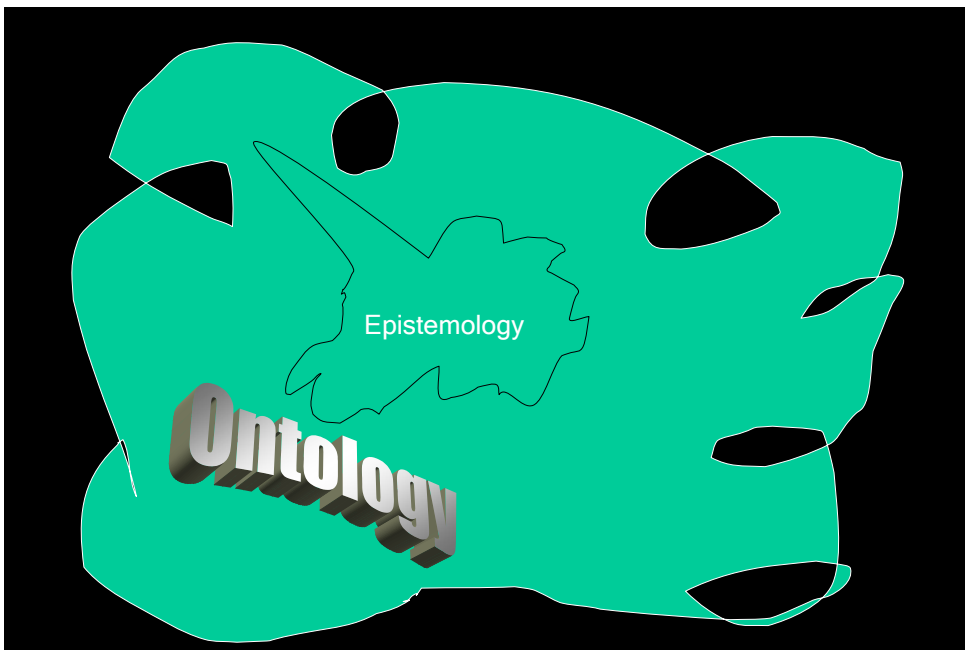
Catch-22?

("An Apocalyptic Masterpiece"-Sun-Times, Chicago)



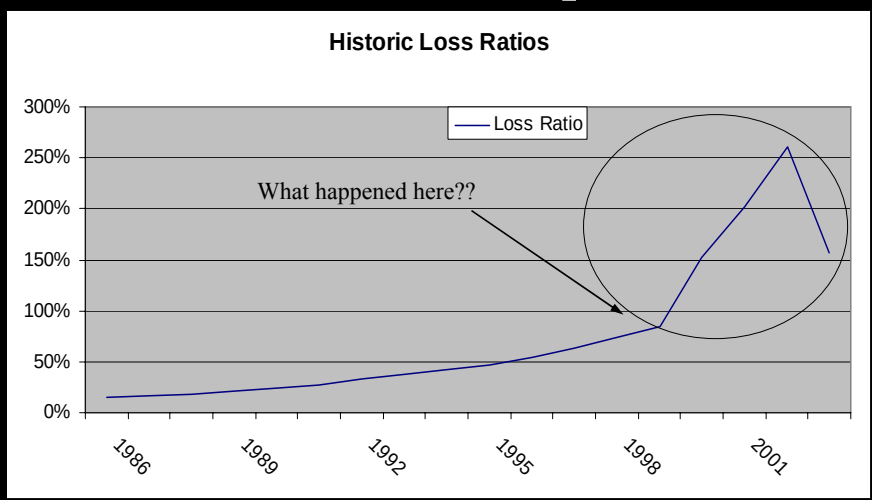


The risk premium is given by

$$\mu(\theta) = E[X \mid \Theta = \theta] = \int x f(x \mid \theta)\, dx.$$

Because the risk parameter Θ is unobservable in practice, **the risk premium can never be exactly known** and hence must be estimated from data.

An Overview of Experience



The First Clue

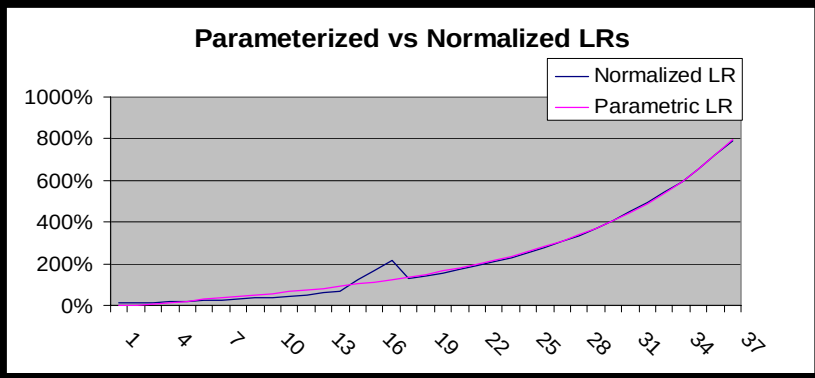
		Undiscounted Values				
		Earned	Incurred	Loss		
	Year	Premium	Claims	Ratio		
1	1986	230,464	33,717	14.6%		
2	1987	2,665,227	433,493	16.3%		
3	1988	5,648,025	1,022,830	**18.1%**	<=== First Clue Here!	
4	1989	6,105,780	1,286,820	21.1%		
5	1990	6,436,573	1,546,857	24.0%		

From Exhibit C Past Experience

Fun With Discount Rates!

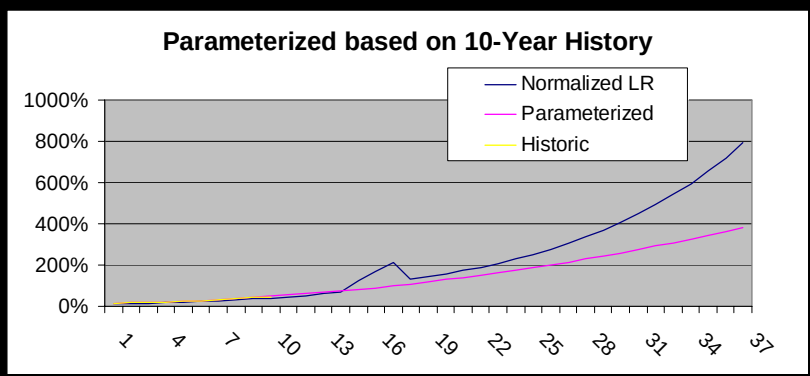
Discount Rate	PV of Profits
5%	(1,611,134)
8%	(325,393)
10%	140,797
12%	427,711
15%	656,841

Parametric Models



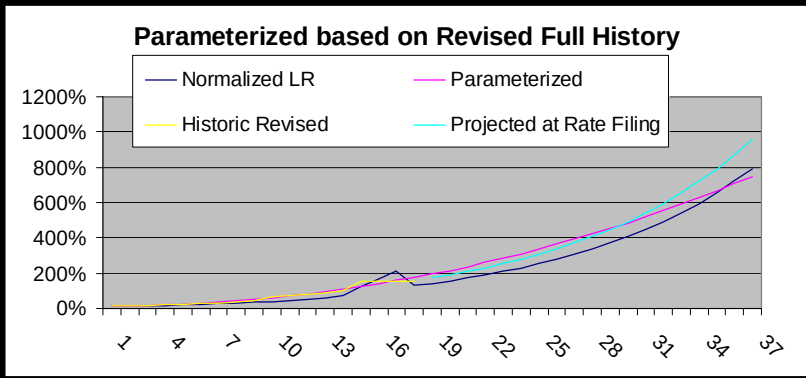
$$LR = A + B*t + C*exp(D*t)$$

Parametric Models



$$LR = A + B*t + C*exp(D*t)$$

Parametric Models



$$LR = A + B*t + C*\exp(D*t)$$

R Software

www.r-project.org

GNU license

WinBugs Software

mathstat.helsinki.fi/openbugs/

or

www.mrc-bsu.cam.ac.uk/bugs/

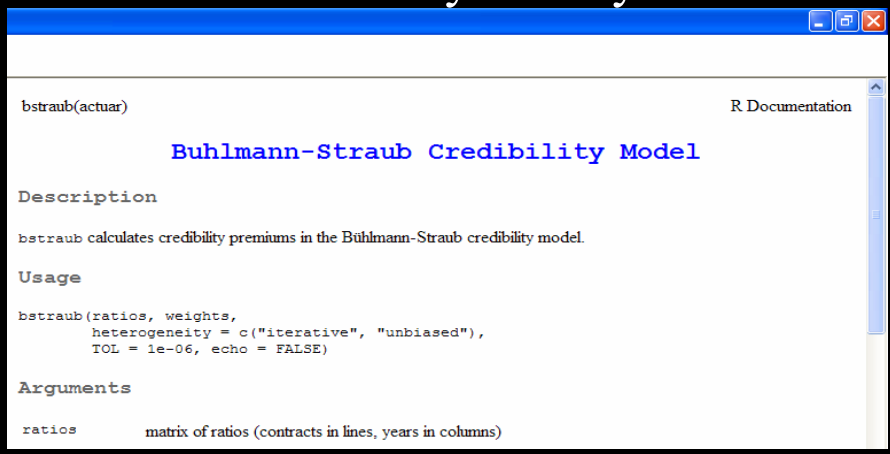
GNU license

OpenBugs can be run from R

Seriatim Methods

- Credibility Theory
- CAST
- Generalized Heterogeneity

Credibility Theory



bstraub(actuar) R Documentation

Buhlmann-Straub Credibility Model

Description

`bstraub` calculates credibility premiums in the Bühlmann-Straub credibility model.

Usage

```
bstraub(ratios, weights,
        heterogeneity = c("iterative", "unbiased"),
        TOL = 1e-06, echo = FALSE)
```

Arguments

`ratios`	matrix of ratios (contracts in lines, years in columns)

Except…

Credibility Theory

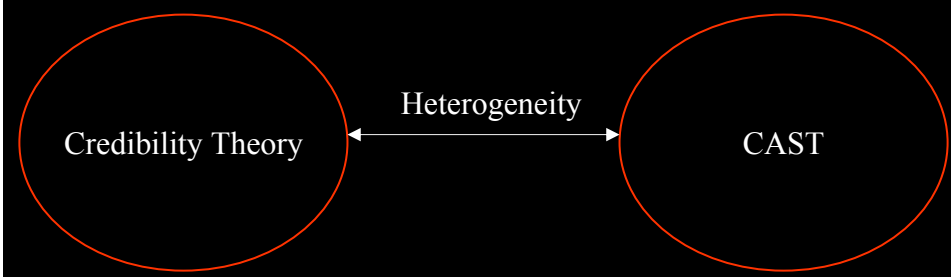
Except…

…one notes that the risk premium $\mu(\Theta_i)$ is time invariant

Cumulative Antiselection Theory

- Partition beneficiaries into 2 classes:
  - Healthy
  - Impaired
- Set assumptions and transition probabilities between the 2 classes, and
- Voilà!

Generalized Heterogeneity



Generalized Heterogeneity

- Partition beneficiaries into N classes
- Determine parameters using Bayesian techniques (ie, use WinBUGS or similar) and
- Voilà!

Generalized Heterogeneity

See the Additional Worked Examples article by Scollnik for using WinBUGS to address heterogeneity.

Bibliography

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"Actuarial Modeling with MCMC and BUGS", David Scollnik, NAAJ, April 1, 2001, pp.96 - 125

"Actuarial Modeling with MCMC and BUGS; Additional Worked Examples", David Scollnik, ARCH, January 1, 2000