

# An actuarial cross-dress: General insurance concepts for managing credit investment risk

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*New Zealand Society of Actuaries Conference 2010*

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22 November 2010



**Hullo  
POSSUMS!**

# Agenda

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- Motivation for this topic
- Preamble: the nature of credit investment risk
- Frequency: credit rating transitions
- Severity: individual defaults
- The challenge of aggregate loss modelling
- Findings

# Motivation

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- Recent increase in interest in corporate bonds (credit)
- Risk management
- Broader application of the actuarial toolkit
- Uncharted territory?



# Preamble: the nature of the risk

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- *Not* traditional risk-return analysis
- Our focus is default risk (structural, extreme)
- Perspective
  - investor's point of view
  - global exposure
- Look through the GI lens:
  - Frequency of claim: default
  - Severity of claim: capital loss given default
  - Combination of the two: aggregate portfolio loss
- Focus on credit rating evolution (data)



# Frequency: risk of default

- Assumption: link to credit rating is useful
- Problem: credit ratings are not static
- Question: so how do we expect ratings to evolve / settle?
- Answer: delve into the data!
- See S&P's 2009 Annual Global Corporate Default Study and Rating Transitions

Global Corporate Average Transition Rates, 1981-2009 (%)									
From/to	AAA	AA	A	BBB	BB	B	CCC/C	D	NR
<b>One year</b>									
AAA	88.21	7.73	0.52	0.06	0.08	0.03	0.06	0.00	3.31
	(5.09)	(4.84)	(0.87)	(0.18)	(0.26)	(0.20)	(0.40)	(0.00)	(2.41)
AA	0.56	86.60	8.10	0.55	0.06	0.09	0.02	0.02	4.00
	(0.54)	(4.87)	(3.99)	(0.75)	(0.26)	(0.25)	(0.07)	(0.08)	(1.92)
A	0.04	1.95	87.05	5.47	0.40	0.16	0.02	0.08	4.83
	(0.14)	(1.16)	(3.47)	(2.13)	(0.50)	(0.36)	(0.07)	(0.12)	(1.96)
BBB	0.01	0.14	3.76	84.16	4.13	0.70	0.16	0.26	6.68
	(0.07)	(0.24)	(2.34)	(4.44)	(1.80)	(1.05)	(0.25)	(0.27)	(1.86)
BB	0.02	0.05	0.18	5.17	75.52	7.48	0.79	0.97	9.82
	(0.06)	(0.16)	(0.40)	(2.44)	(4.94)	(4.78)	(0.93)	(1.06)	(2.92)
B	0.00	0.04	0.15	0.24	5.43	72.73	4.65	4.93	11.83
	(0.00)	(0.13)	(0.38)	(0.34)	(2.59)	(5.25)	(2.64)	(3.27)	(3.07)
CCC/C	0.00	0.00	0.21	0.31	0.88	11.28	44.98	27.98	14.37
	(0.00)	(0.00)	(0.74)	(1.05)	(1.34)	(7.86)	(12.81)	(12.90)	(7.57)

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# Frequency: Markov Chain Analysis

- Observations:
  - Invariance transition rates (lead diagonal) are high: sticky ratings
  - Standard errors are not grossly large for the rates that matter
  - We have a Markov chain (just invert the matrix)
- What does the chain say about equilibrium?
  - Solve for equilibrium state probabilities  $\Pi$  as per a No Claims Discount scheme
  - Based on following matrix  $\mathbf{T}$  (rounded rates, assumed invariance rates for D and NR are 1)...

	AAA	AA	A	BBB	BB	B	CCC/C	D	NR
AAA									
AA									
A									
BBB									
BB									
B									
CCC/C									
D									
NR									

...and solving for vector  $\Pi$  such that  $\mathbf{T} \cdot \Pi = \Pi$ , we obtain

$$\Pi = [0, 0, 0, 0, 0, 0, 0, 0, 0, 1] \quad (!!!)$$

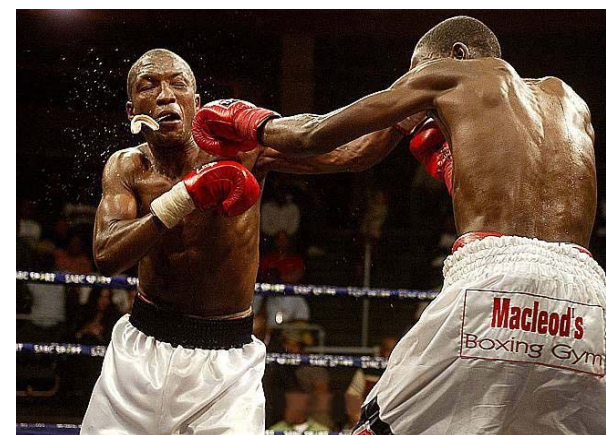
# Frequency: Simplified problem (insto focus)

- Take two: focus on investment grade transitions
- Collapse the others (junk + non-rated) into a super state
- We then need to solve for equilibrium based on  $\mathbf{T} =$

	AAA	AA	A	BBB	Sub-IG
AAA					
AA					
A					
BBB					
Sub-IG					

This renders  $\mathbf{\Pi} = [0, 0.01, 0.08, 0.24, 0.67]$

- The fund managers are right:
  - Active management required
  - The risk is asymmetric: defence first!
- Learn from GI:
  - Underwrite (don't buy)
  - Do not renew policy (sell bad apples)
  - Reinsure (credit default swaps?)



# Severity: Individual losses

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- Data are available on recovery rates,  $R$
- Capital losses given default are then simply  $1 - R$
- Observations from S&P study
  - Recovery rates oscillated between 30-90% over period 1987-2009
  - Poorer recoveries in times of recession
  - Recovery rates have a negative relationship with default rates
  - Recovery rates themselves have a non-trivial distribution (bimodal at extreme ends)
    - 20% have recoveries of only 0-10%
    - 14% have recoveries of par or higher!
- **Caution:** recovery rates will also depend logically on type of instrument held
  - Secured / unsecured
  - Repayment priority (senior / subordinate)
  - Other factors



# Aggregate loss

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- Challenging!
  - Compound distributions (e.g. poisson-exponential = gamma) would be nice
  - But frequency and severity are not independent
  - Severity distributions neither trivial nor homogeneous
  - Multi-period modelling requires assumption of stable credit rating distributions
- Simple modelling e.g. single year VaR for homogeneous (sub-) portfolios could be readily simulated



# Findings

- Transition rates fairly stable
- Movements of a full notch or more highly unlikely
- Error in average rates lowish for most significant rates
- Naïve Markov modelling vindicates claims made by fund managers
- Risk management a la GI could be beneficial
- Individual default loss modelling needs more research
- Aggregate loss modelling expected to be intractable (so KISS and simulate)

***You  
get back on your  
maths. I'll get back  
to being a  
megastar!***



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