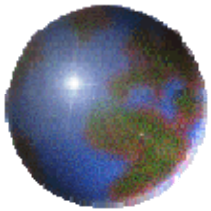
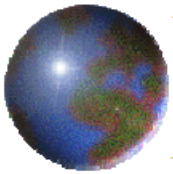


Credit Ratings and Securitization

Bachelier Congress

June 2010

John Hull



Agenda

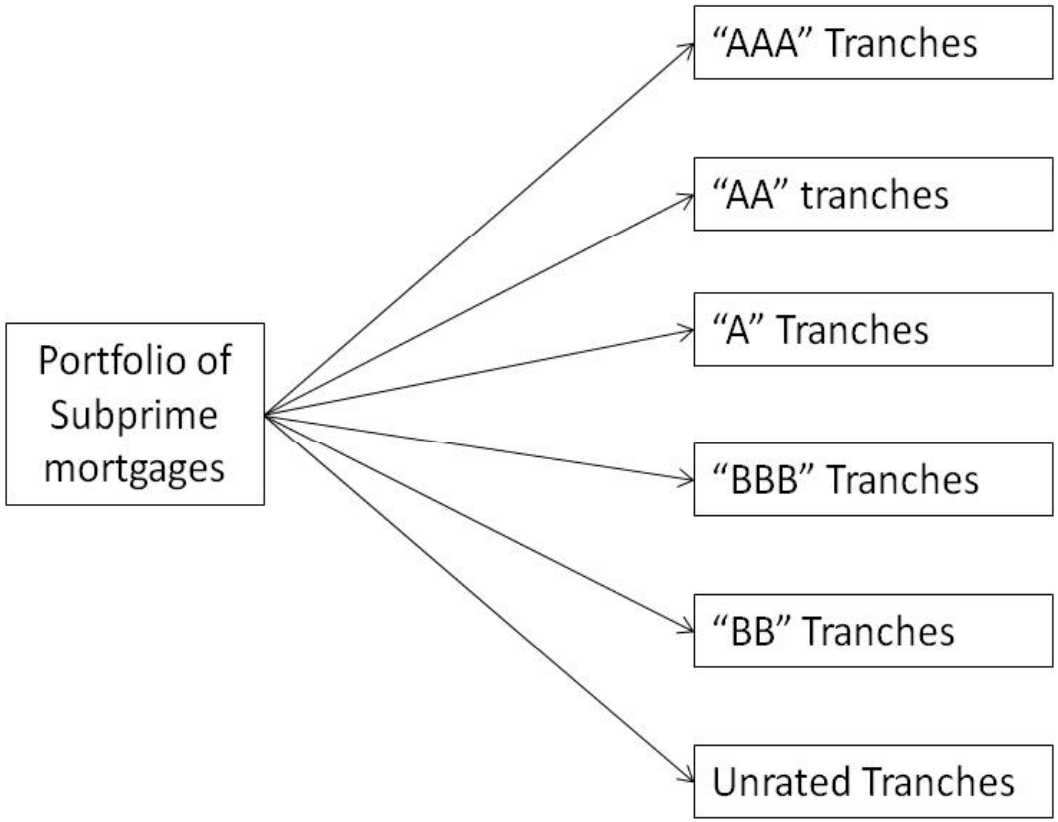
- To examine the derivatives that were created from subprime mortgages
- To determine whether the criteria used by rating agencies were reasonable
- To determine whether the AAA ratings assigned to tranches were reasonable, given the criteria used by rating agencies
- To identify some lessons for the future of structured finance

Papers Underlying Presentation

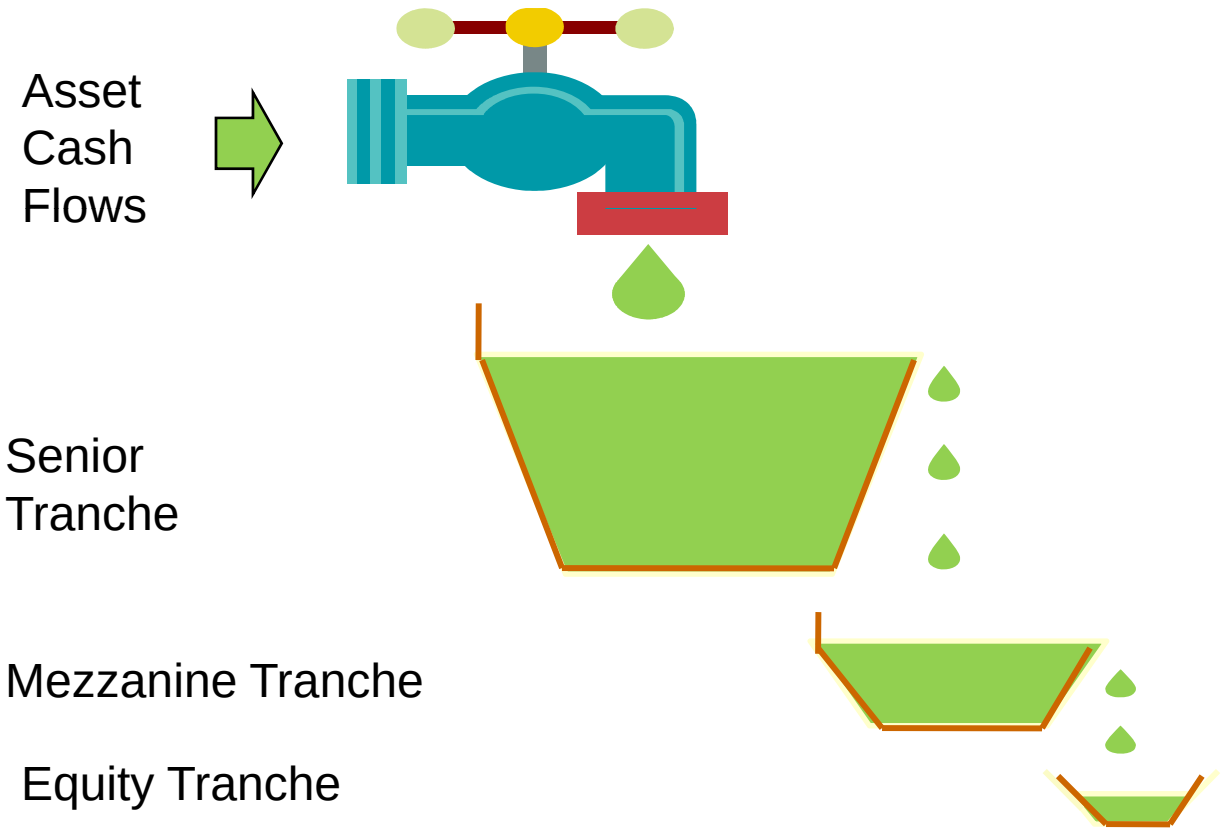
- "Ratings Arbitrage and Structured Products"
- "The Risk of Tranches Created from Residential Mortgages"

Both are joint with Alan White and can be downloaded from www.rotman.utoronto.ca/~hull

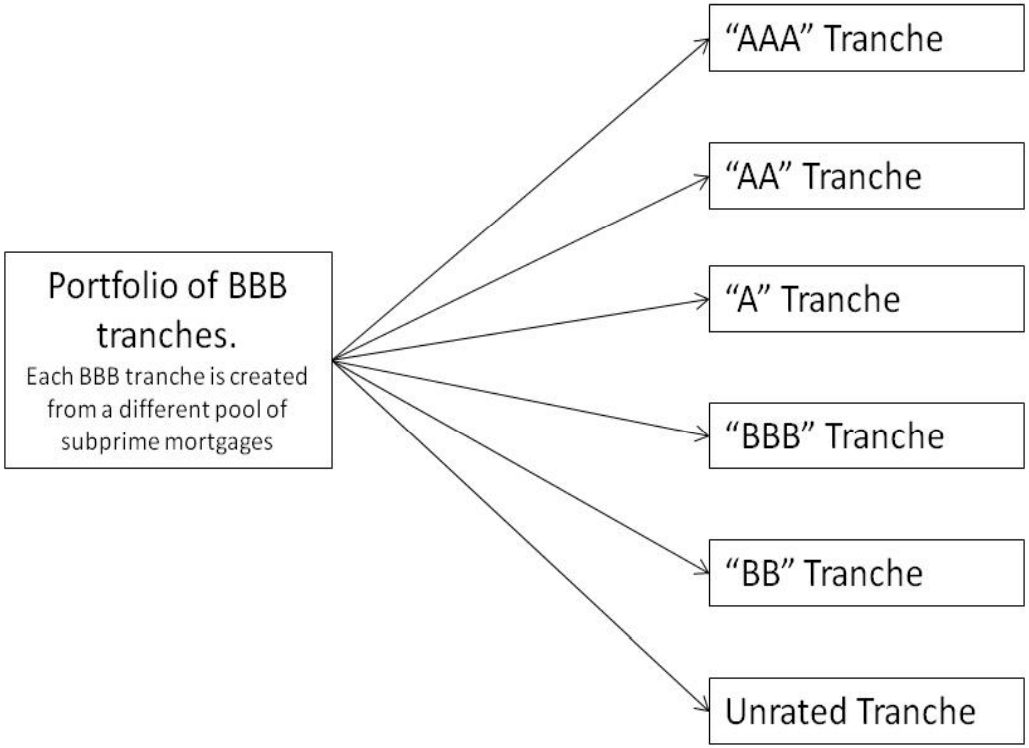
Asset Backed Security



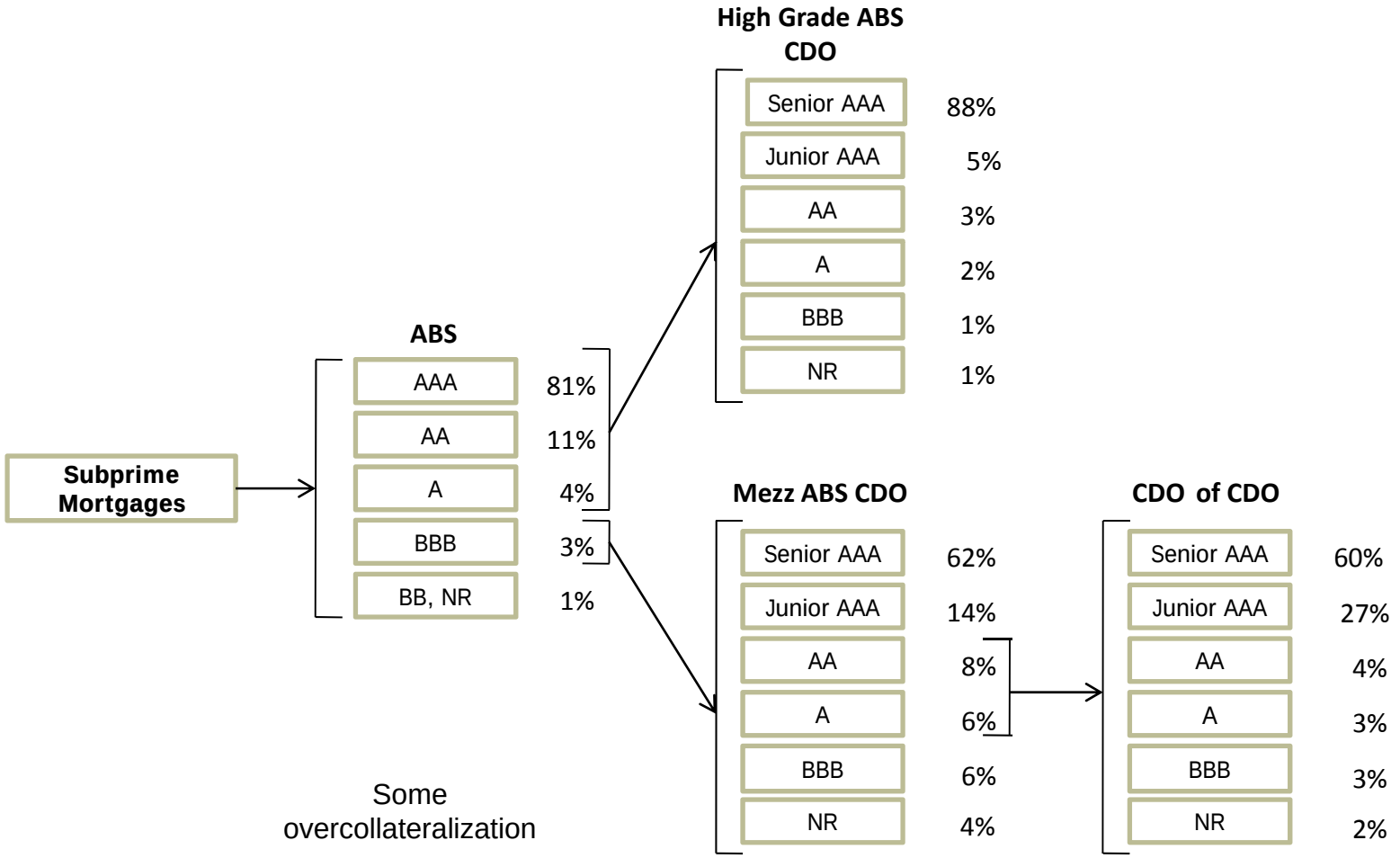
The Waterfall

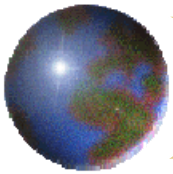


Mezz ABS CDO



The Pattern of Securitization



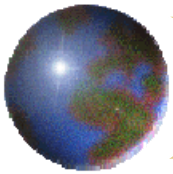


Rating Structured Products vs Rating Bonds

- Bond ratings are based on judgment and analysis; structured product ratings are based on a model
- Structured products required an assumption about correlation
- Design of structured products can easily be changed to achieve desired ratings
- Structured products are arguably more likely to be downgraded than bonds

The Criteria Used By Rating Agencies

- Moody's calculates the expected loss as a percent of principal, EL, on a tranche and tries to ensure that this is consistent with the expected loss on a similarly rated bond
- S&P and Fitch calculate the probability of a loss on a tranche PD and try to ensure that this is consistent with the probability of loss on a similarly rated bond



Were the Criteria Used by Rating Agencies Reasonable?

- What properties do we want a credit quality measure (EL or PD or something else) to have?
- Define the credit quality measure as q (credit quality goes down as q increases)
- We can measure the credit quality of a single asset or a portfolio of assets
- For a portfolio, there is a probability distribution, F, for the credit quality of the assets in the portfolio

Credit Quality Dominance

- Portfolio Y dominates Portfolio X with respect to a particular credit quality measure if

$$F_Y(q) \geq F_X(q)$$

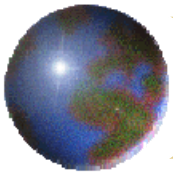
for all q with strict inequality for some q where F_X and F_Y are the probability distributions of q for the assets in Portfolios X and Y, respectively

- Credit quality dominance corresponds to strong first order stochastic dominance between the probability distributions of q for Y and X

Example

	Portfolio *A*	Portfolio *B*	Portfolio *C*
Asset 1 (*q*=1)	0%	80%	0%
Asset 2 (*q*=2)	100%	10%	90%
Asset 3 (*q*=3)	0%	10%	10%

B dominates *C* and *A* dominates *C*. There is no dominance between *A* and *B*

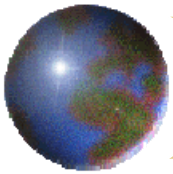


No-Arbitrage Condition

A necessary condition for a credit quality measure to be arbitrage-free is that, for every Portfolio X and every Portfolio Y that can be restructured from X, there be no credit quality dominance between X and Y.

Probability of Loss Does Not Satisfy the No-Arbitrage Condition

- To see this, we can restructure any Portfolio X into a new Portfolio Y consisting of two securities (or tranches)
- The first security is responsible for losses in the 0 to 50% range
- The second security is responsible for the remaining losses.
- Portfolio Y dominates portfolio X



Further Restructuring

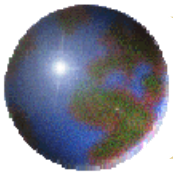
- Every time we create a new tranche we achieve an extra level of dominance
- If Portfolio Z has three tranches (0 to 25%, 25% to 50%, and 50% to 100%) it dominates Portfolio Y

Expected Loss Percentage (EL)

- Satisfies our necessary condition for no arbitrage (as does any monotonic function of EL)
- Allows bond portfolios to be rated in the same way as bonds
- Has much better properties than probability of loss
- But market participants that base valuations solely on EL are still liable to be arbitraged by market participants that use more complete valuation models

Relationship

- EL=PD×LGD
- For bonds an LGD of 60% is often assumed
- For the wide AAA tranche LGD<60%
- For thin junior tranches LGD is close to 100%
- S&P and Fitch were more conservative than Moody's for AAA tranches
- Moody's is more conservative for the thin junior tranches



Were AAA Ratings Reasonable: Assumptions

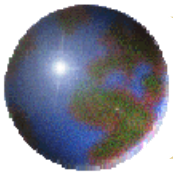
- Principal payments are sequential so that losses are borne by tranches in order of reverse seniority (not unreasonable as we are mostly concerned with high-default-rate situations)
- Homogeneity for mortgage defaults, mortgage principals, number of mortgages per pool, etc
- All mortgage pools have a 5 year weighted average life
- Mortgage pool is sufficiently large that actual default rate equals PD
- ABS losses modeled with one-factor copula model for default correlation.
- ABS CDO losses modeled with a two-factor copula model of default correlation

Minimum Attachment Point for AAA Tranche of ABS , EDR=10%, Copula Correlation=0.2

Model	Minimum Attachment Point
Gaussian Copula, Const Recovery Rate	13.6%
Double t Copula, Constant Recovery Rate	23.2%
Gaussian Copula, Stochastic Recovery Rate	26.6%
Double t Copula, Stochastic Recovery Rate	46.3%

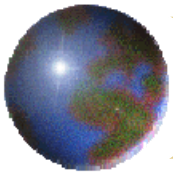
Minimum Attachment Point for AAA Tranche of ABS CDO Created from BBB-rated tranches (att=4%, det=5%) , EDR=10%, Copula Correlation=0.2. α is proportion of correlation that comes from a factor common to all mortgage pools

Model	α=0.25	α=0.5	α=0.75
Gaussian Copula, Const Recovery Rate	73.6%	95.4%	99.9%
Double t Copula, Stochastic Recovery Rate	100%	100%	100%



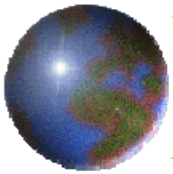
Explanation of Results

- When BBB tranches are thin the probability distribution for the loss on a tranche is quite different from that for the loss on a BBB bond
- Consider an extreme situation when tranches are very thin and α=1 so that all mortgage pools have the same default rate….



How Reasonable Were the Ratings, Given the Criteria Used?

- ABS ratings were not too unreasonable
- Mezz ABS CDOs ratings are much more difficult to defend
- Mezz ABS CDOs accounted for only about 3% of all securitizations
- But the tranches were widely used to create synthetic products.



Lessons from the Crisis for Structured Products

- When evaluating credit derivatives (particularly, when evaluating how they will perform in extreme market conditions), it is important to take account of
  - tail default correlation
  - dependence of recovery rates on default rates
- Thin tranches have “all or nothing” risk characteristics and should be treated with caution
- Structured products should not be considered to be equivalent to similarly rated bonds
- It is important to understand what ratings measuree and their limitations

Lessons from the Crisis for Structured Products continued

- Resecuritization was a badly flawed idea
- We should aim to achieve diversification benefits with the first level of securitization
- Can we securitize across asset classes? Basing securitization on the price of a single good is dangerous
- Transparency is important. Issuers should provide scenario analysis software