The Credit Crisis as a Problem in the Sociology of Knowledge

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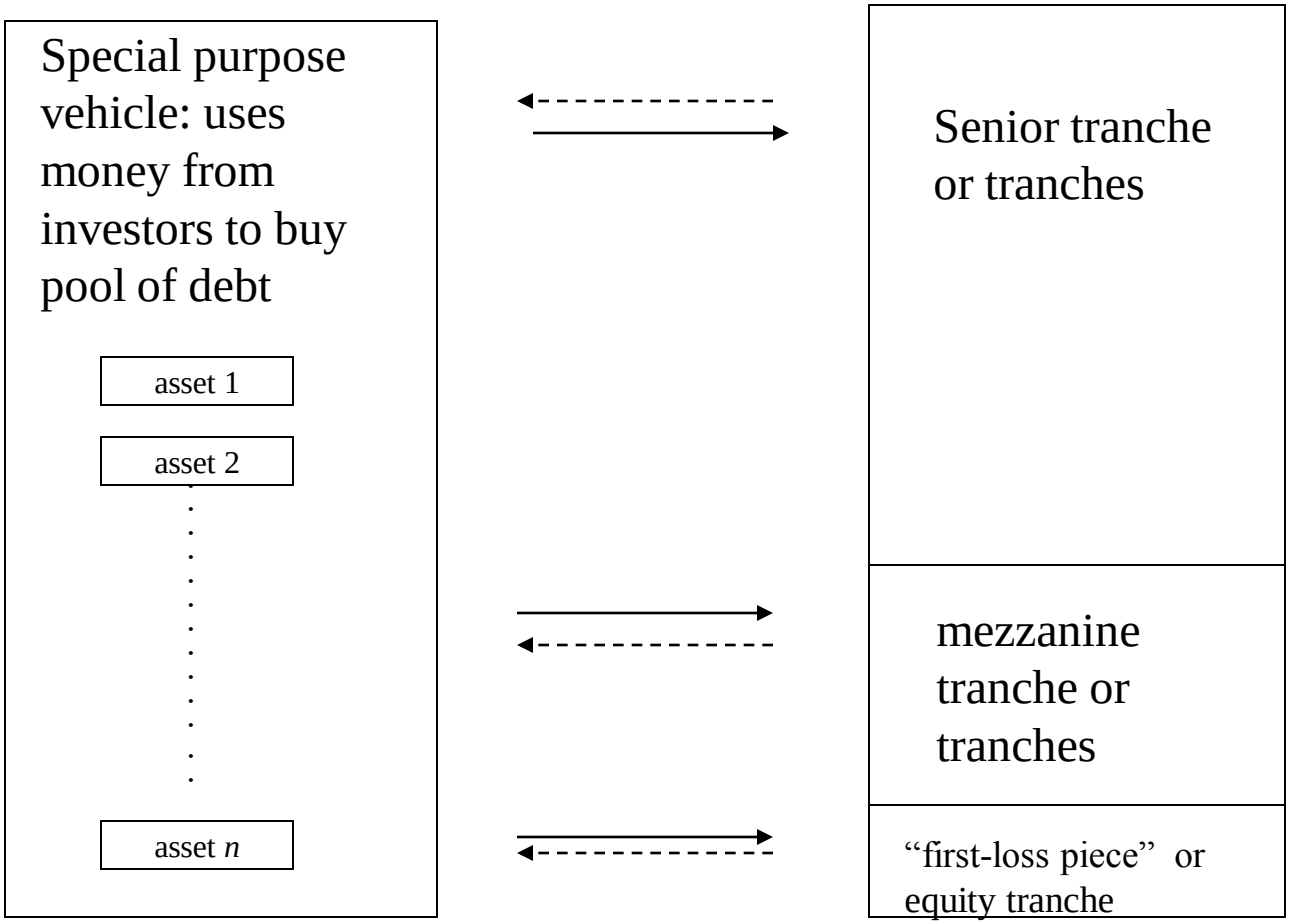
Thanks to Bruce Worton, School of Mathematics, University of Edinburgh, for graphing the large-pool probability density function.

Causes of credit crisis multifaceted: macro-economic imbalances; search for yield; bubble behaviour; pressures to imitate; remuneration structures; procyclicality in leverage ratios & risk measures; etc; etc

but a particular set of financial instruments are at its heart … CDOs of ABSs (collateralised debt obligations whose asset pools are asset-backed securities).



An ABS or CDO

capital investments by investors

payments to investors

Sources:

• 76 loosely oral-history interviews with people involved in CDO, credit default swap, ABS market: before crisis (29), after crisis (47). 17 of latter re-interviews of people interviewed before crisis. Includes 31 structurers/traders/brokers; 13 ‘quants’ (modellers); 4 regulators; 14 rating agency employees. London=54; NY=18; elsewhere=4.

• trade press (e.g. *Creditflux*, *Risk*)

• technical literature (inc. texts, handbooks)

• quantitative data (e.g. British Bankers’ Association surveys)

Focus on **clusters of evaluation practices**: sets of ways in which groups of market participants generate knowledge of the economic value of financial instruments.

Substantially different clusters of practices can surround even very similar instruments: ABS (asset-backed securities) and CDOs (collateralised debt obligations).

1) In this case (ABSs and CDOs) evaluation practices are **path-dependent outcomes of historical contingencies**

2) Evaluation practices linked to **distinctive ontologies**: distinctive presuppositions about properties of economic world (e.g. “credit correlation”).

3) Evaluation practices become **organizational routines (**sometimes in **separate** groups or departments).

4) In modern debt markets, evaluation practices **regulate actions** and become **means of governance** via credit ratings.

5) “Two-step” evaluation of ABS CDOs (component ABSs evaluated by one group, then CDO structure by another) gave rise to fatally attractive apparent **arbitrage** opportunity.

Part 1. Knowing ABSs

Part 2. Knowing Corporate CDOs

Part 3. CDOs of ABSs.

PART 1: ASSET-BACKED SECURITIES (ABSs)

Assets bought by special purpose vehicle include **residential mortgages**, auto loans, credit card receivables, etc.

First modern US mortgage-backed securities, 1970. **Government programme**: investors made good in the event of mortgage defaults.

“The American mortgage” (Green and Wachter): long-term, fixed-rate, no prepayment penalty.

“The mortgage instrument becomes so perfect for the borrower that a large economic benefit is taking away from the other participants, including the long-term investor” (Lewis Ranieri, Salomon Brothers)

Gradual shift from government-backed to private-label, and prime to subprime. Mezzanine investors worry about default; prepayment still dominant concern of senior.

Additional riskiness of subprime offset by:

- *excess spread* (cash flow from mortgage interest exceeds payments to investors by considerable margin; creates ‘reserves’)

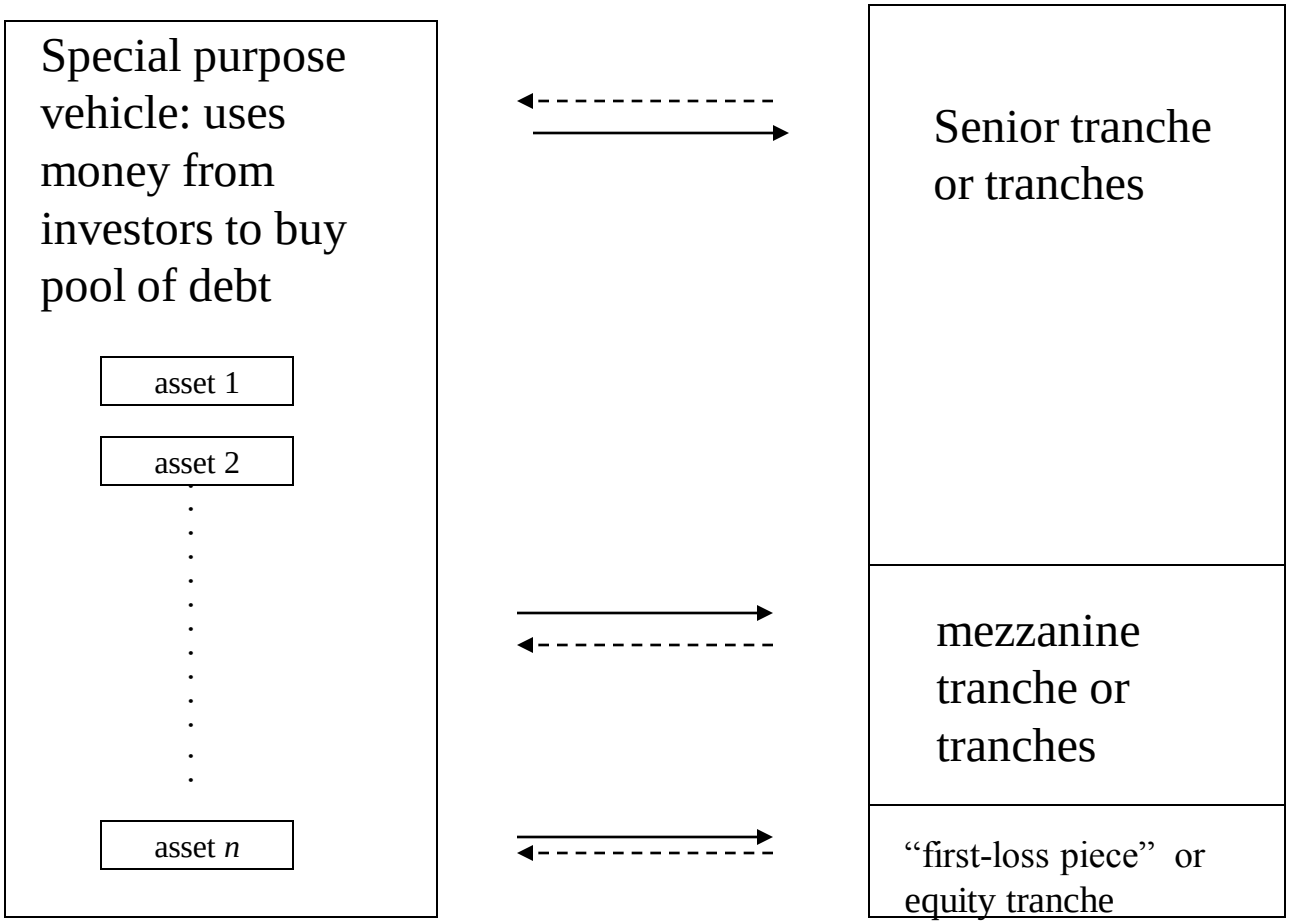
- *over-collateralisation* (total assets held by ABS exceeds securities sold to investors)

ABS ratings practices:

- no equivalent of Gaussian copula; no explicit notion of correlation
- rating via stress scenarios (eg AAA: Great Depression default rates) and "conditional independence"
- logistic regression or hazard rate default models (using FICO, loan-to-value ratio, documentation, etc.) used to capture **relative** riskiness of mortgage pools
- Ratings penalties for geographical concentration
- wide reputation as safe, stable asset class ('no ABS security has ever defaulted', Feb 2001)

PART 2: KNOWING CORPORATE COLLATERALISED DEBT OBLIGATIONS (CDOs)

‘Corporate CDOs’ are those whose pools of assets are loans made (usually by banks) to corporations or bonds issued by those corporations



A CDO (simplified and not to scale)

◄- - - - - - - - - - - - - capital investments by investors

——————► payments to investors

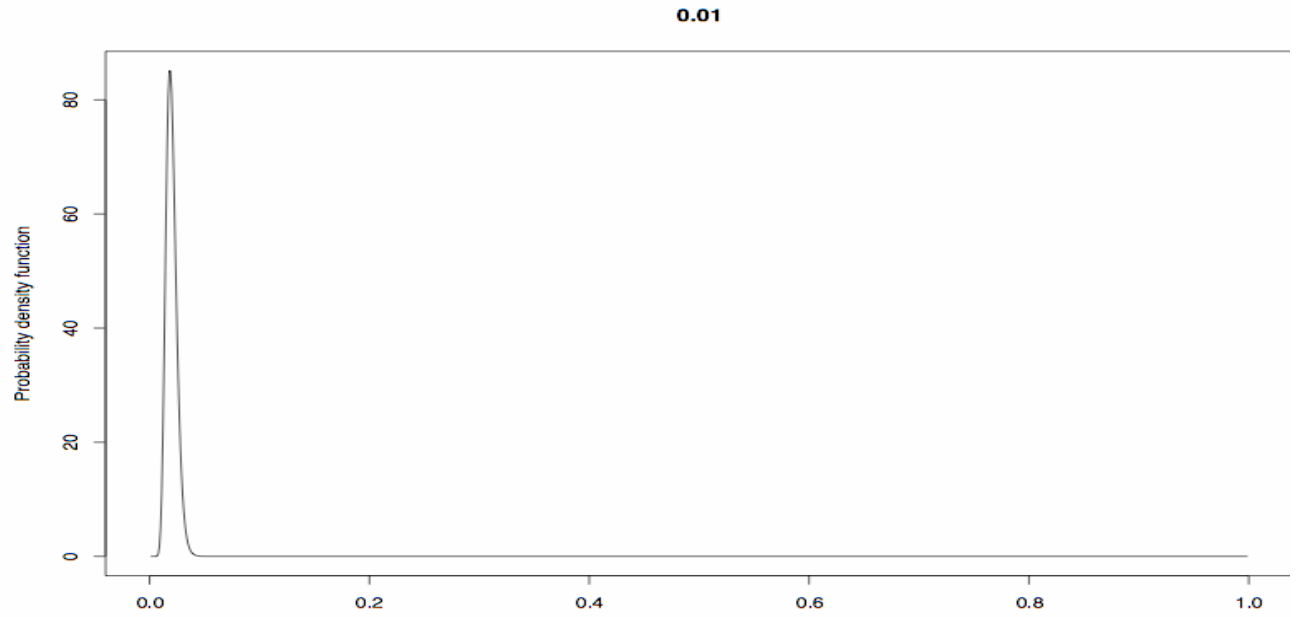
Same structure, but different evaluation practices evolve.

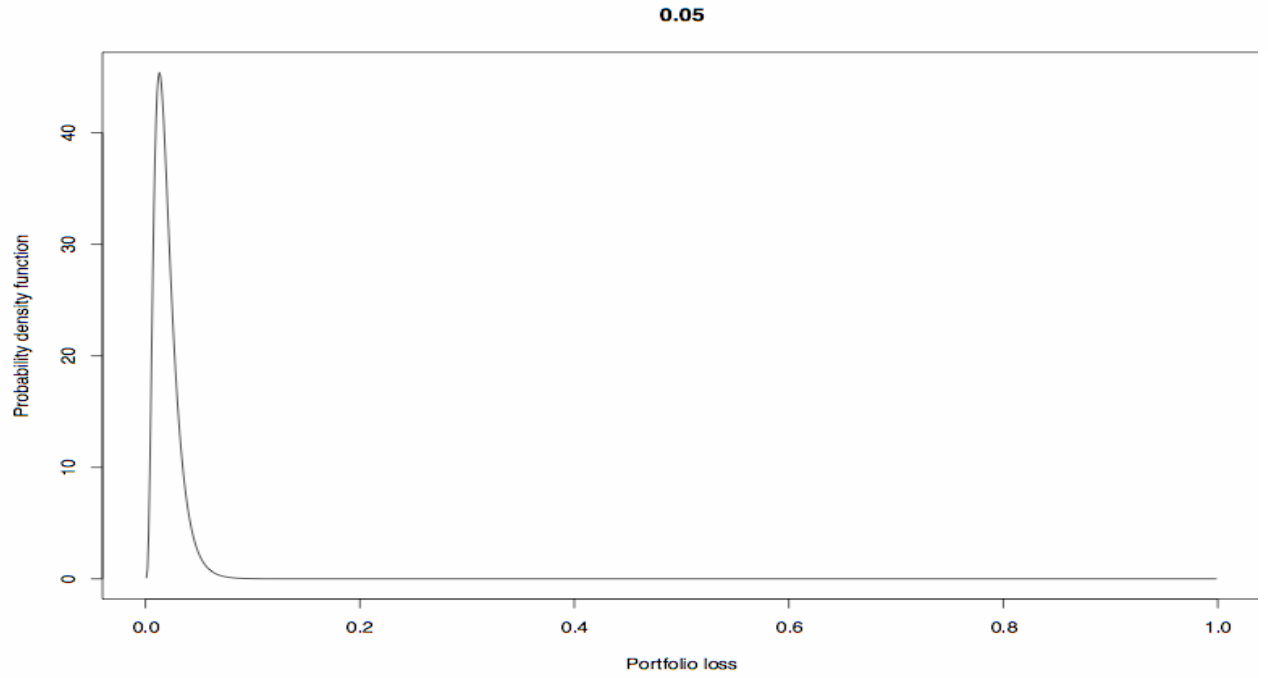
First in banks (from 1996), then in rating agencies (from Nov 2001, Standard and Poor's *CDO* Evaluator): Gaussian copula models

A copula function (a formulation introduced to mathematical statistics by Abe Sklar in 1959) "joins together" variables that are uniformly distributed on the interval [0,1] in such a way as to yield a specific multivariate joint distribution function. (A "Gaussian copula" yields the distribution function of a multivariate normal distribution.)

The shape of the probability distribution of different levels of loss is very dependent on the level of correlation (explicitly modelled)

Slides that follow use the simplest Gaussian copula model (Vasicek's single-period large homogeneous pool model) to show probability distribution of losses on large, highly granular portfolio of loans or bonds, each with default probability 0.02, recovery rate of zero, and identical pair-wise asset-value correlations, as the level of that correlation varies.


0.01
Probability density function
0
20
40
60
80
0.0
0.2
0.4
0.6
0.8
1.0


0.05
Probability density function
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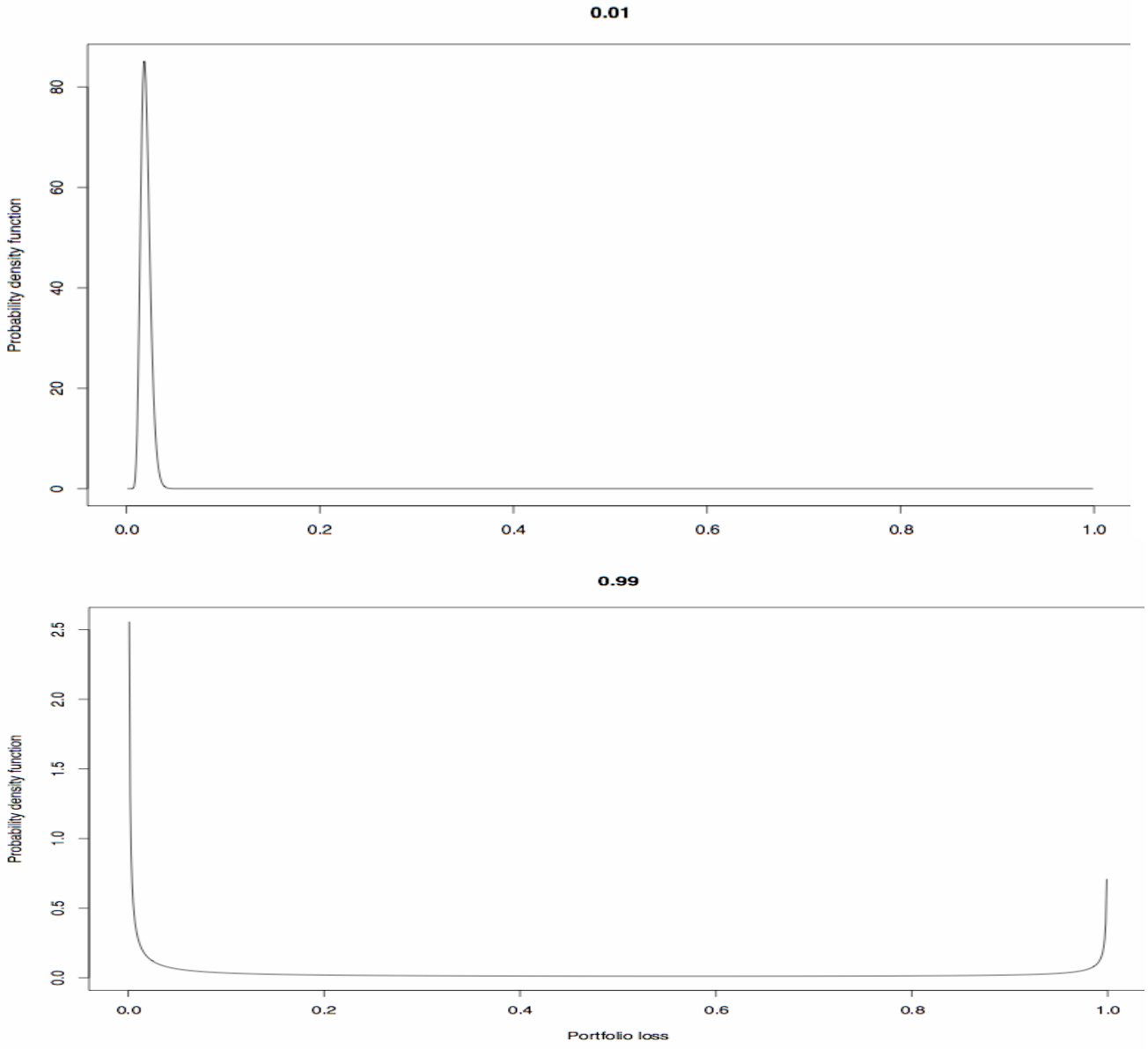
Portfolio loss


0.01
Probability density function
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0.2
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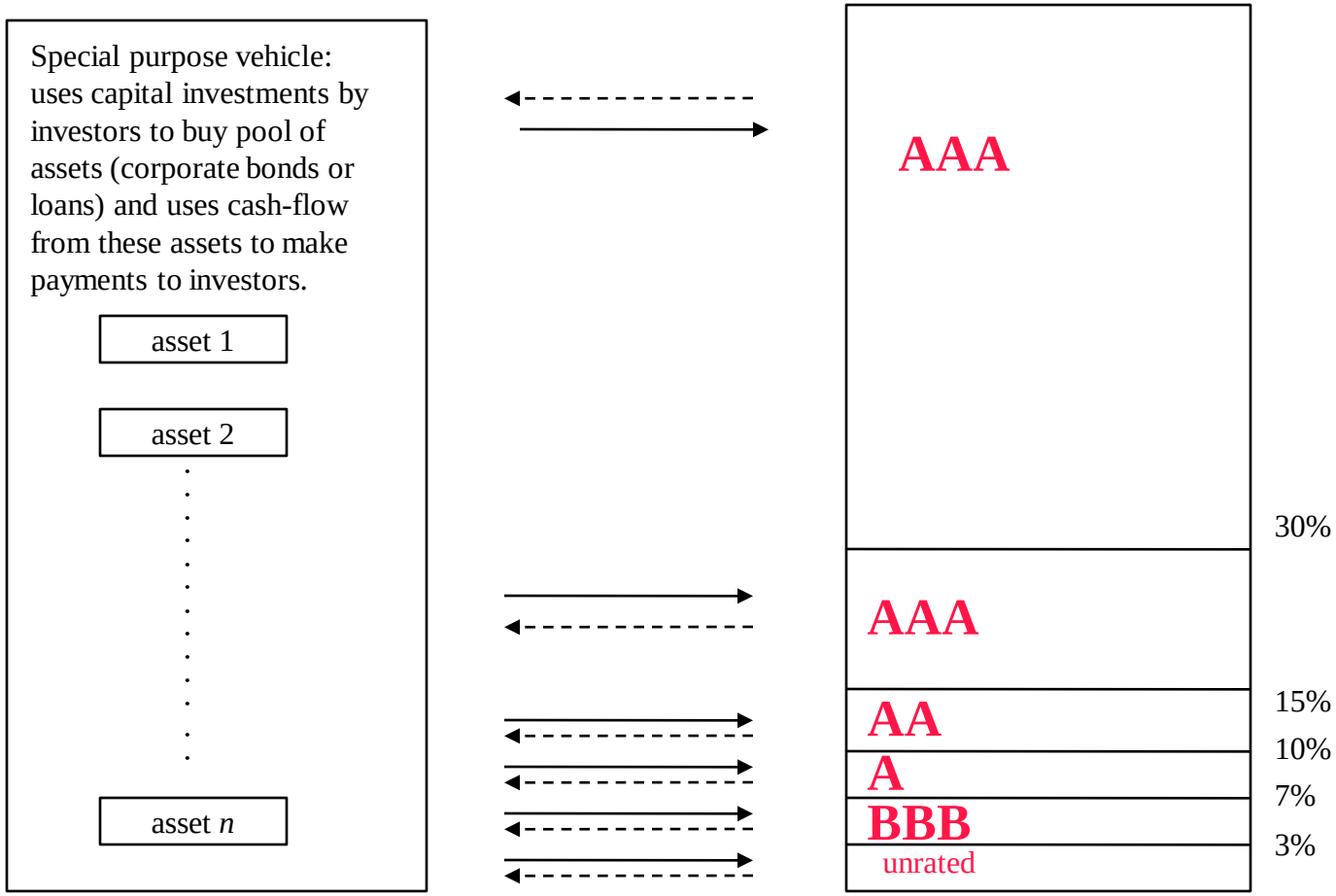
Probability density function
0.0
0.5
1.0
1.5
2.0
2.5
0.0
0.2
0.4
0.6
0.8
1.0
Portfolio loss

“Correlation” is the correlation between the market values of the assets of pairs of corporations. But those market values not observable:

1.Banks and Fitch: use stock prices as proxy

2.S&P: some econometric work on estimating correlation from clustering of defaults, but consistency with pre-Gaussian evaluation practices also influences choices.

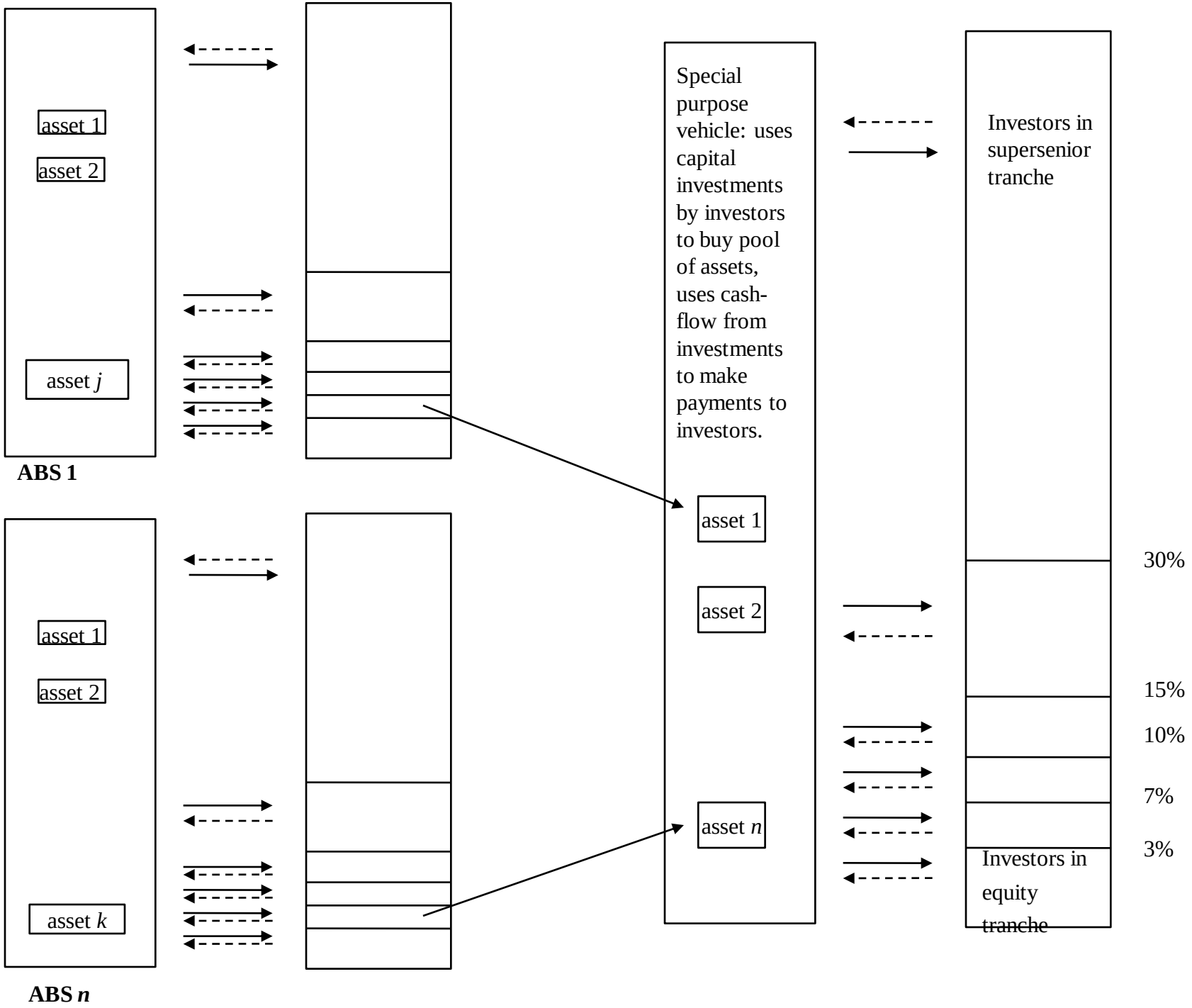
3.Moody’s: ratings transitions.



A corporate CDO (simplified), with typical tranche ratings

PART 3 : CDOs of ABSs

The asset pools of the original CDOs, discussed in section two, were loans made to corporations or bonds issued by them. This part of talk deals with the later (1999 onwards) ‘Russian doll’ CDOs in which the assets in the CDO’s pool are themselves complex securities (ABSs: asset-backed securities).

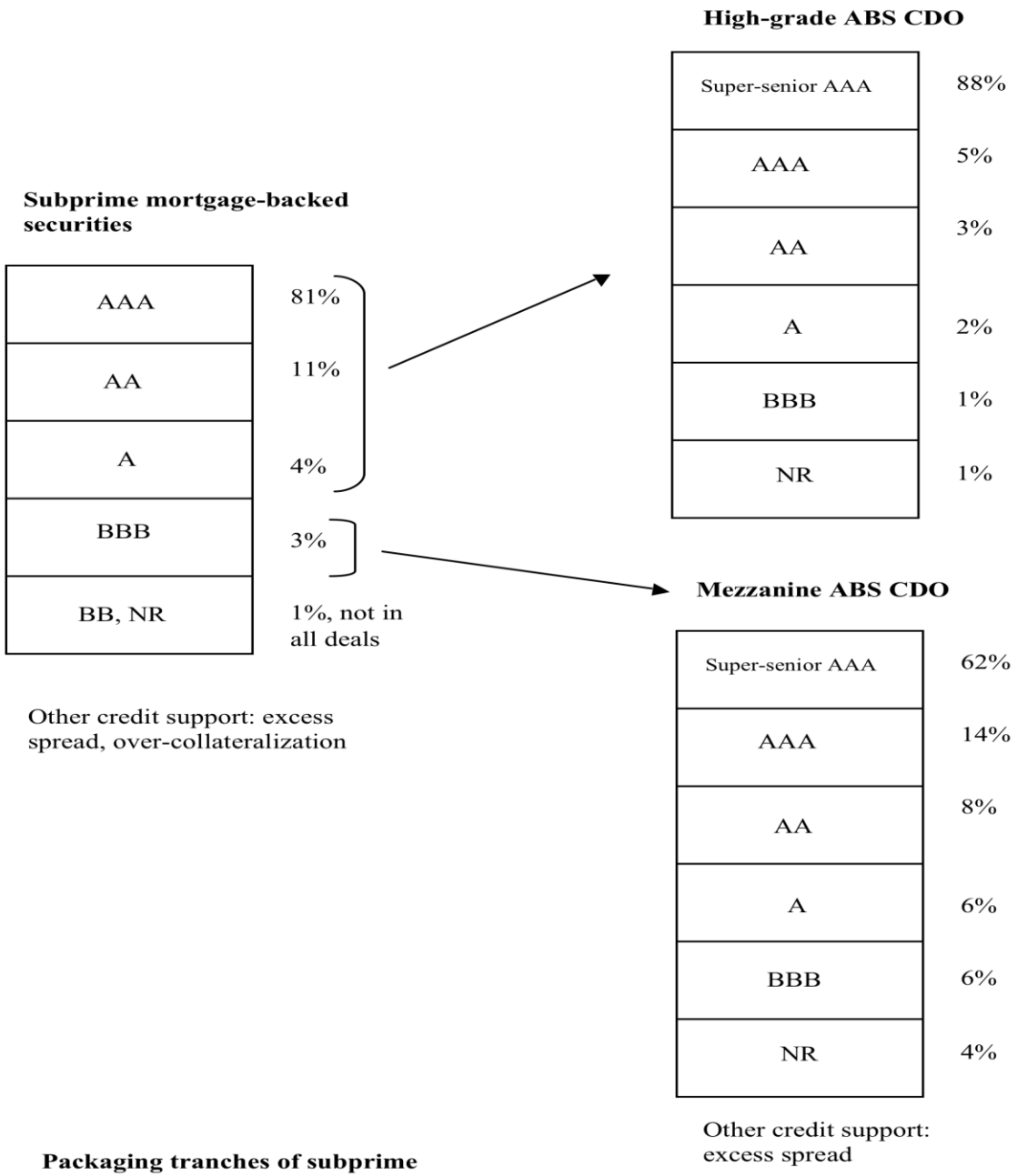

asset 1
asset 2
asset j
ABS 1
asset 1
asset 2
asset k
ABS n
Special purpose vehicle: uses capital investments by investors to buy pool of assets, uses cash-flow from investments to make payments to investors.
asset 1
asset 2
asset n
Investors in supersenior tranche
30%
15%
10%
7%
3%
Investors in equity tranche

By 1999, ABSs and CDOs organisationally separate in banks, rating agencies.

Two-step rating of ABS CDOs. ABSs rated by ABS group, then CDO group used existing Gaussian copula models to rate ABS CDOs as if ABSs were corporate bonds. Similar correlation parameters: e.g. 0.3 (S&P).

Packaging a diversified pool of low-correlation assets enables AAA tranches to be created from BBB raw materials. (One coin can easily turn up tails; 20 independently-tossed coins most unlikely to do so.)

But in rating ABS CDOs in two-step process, the “free lunch” of diversification was being consumed twice: first, implicitly, in the rating of the ABSs; then, explicitly, in the rating of the CDO.



Packaging tranches of subprime mortgage-backed securities into ABS CDOs.
Courtesy Douglas Lucas.
Tranche sizes not shown to scale.
"NR" means "not rated."

Issuance of ABS CDOs in 2006-7:

1. High-grade $200 billion
2. Mezzanine $160 billion

Losses on ABS CDOs: $290 billion

Sources: Citigroup Global Markets, “Does the world need securitization?” (Dec 12, 2008); IMF, October 2008 estimate.

	CDO Evaluator three-year default prob. assumptions, as of June 2006 (percent)	Realized incidence of default, as of July 2009 (percent)
AAA	0.008	0.10
AA+	0.014	1.68
AA	0.042	8.16
AA-	0.053	12.03
A+	0.061	20.96
A	0.088	29.21
A-	0.118	36.65
BBB+	0.340	48.73
BBB	0.488	56.10
BBB-	0.881	66.67

***CDO Evaluator* three-year default probability assumptions versus realized default rate of US subprime mortgage-backed securities issued from 2005 to 2007.**

Sources: Nomura Securities, 'Bond Rating Confusion', June 14 & 29, 2006; Standard & Poor's, 'Structured Finance Rating Transition and Default Update', July 24, 2009.

Benmelech and Dlugosz: ‘two main candidate explanations’

1. Agencies ‘deliberately aggressive in rating.’

There is *some* evidence of this (see below), but not of sufficient magnitude to explain huge shift in default rates.

2. ‘Model error’

Benmelech & Dlugosz, ‘The Credit Rating Crisis’ (NBER 2009)

On (probable) over-leniency: Ashcraft et al. ‘MBS Ratings and the Mortgage Credit Boom’ (2009): controlling for insurance, excess spread, geog.concentration, expected default rate, **subordination level** (total size of tranches below AAA) **declines by 20%, mid-’05 to mid-’07**

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But there’s a third explanation: **counter-performativity**: widespread arbitrage of rating-agency models changed economic processes in way that made models less accurate.

The twin counterperformative processes:

- **packaging mortgages into ABSs changes mortgages** S&P *Levels* and other regression-style default models increasingly influential; 'soft' information not collected or ignored; volume incentives. Growing use of models weakens their predictive power (Rajan, Seru & Vig).

- **packaging ABS into CDOs changes ABSs** Adelson & Jacob: insurers/buyers of mezzanine (BBB) tranches of ABSs (own capital at stake) had been brake on increasing ABS risk; replaced by purchases by ratings-model-driven CDOs which passed on risks to investors

Adelson & Jacob, 'Risk-Management Lessons from the Subprime Problem' www.adelsonandjacob.com, March 2008

Rajan, Seru & Vig, 'The Failure of Models that Predict Failure' ssrn.com/abstract=1296982, October 2008

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