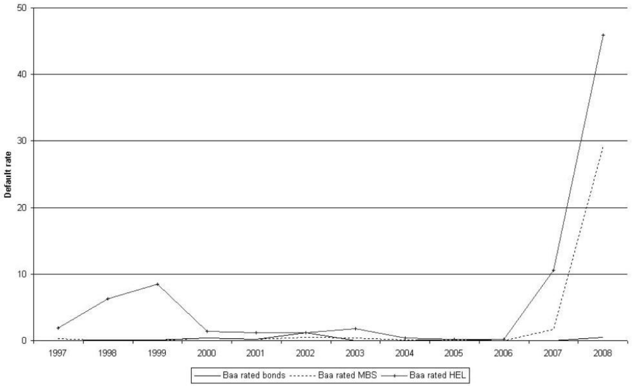
Wie schlecht waren Ratings von Verbriefungen wirklich? Und warum?

Daniel Rösch

Leibniz Universität Hannover

Hamburg, December 3, 2010

Default Rates of Bonds vs. MBS/HEL Securitizations



Quotation

Cornell Financial Engineering Manhattan Advisory Board Members On Credit Crisis Panel

Robert Jarrow observed that bonds based on subprime mortgages - home mortgages issued to high risk individuals, with low loan to value and debt to income ratio - are complex derivative securities. Rating agencies such as Moody's and Standard & Poors, who provide letter grades (e.g. AAA, Baa, etc.) to such securities, did not correctly rate the bonds derived from subprime mortgages, and other bonds (e.g. Collaterized Debt Oblications) derived in turn from them. "Combined with misaligned incentives of the major players, these two observations are the root cause of the credit crisis," he said.

References

D. Roesch and H. Scheule.
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BIS Working Paper Series 2011 and Paolo Baffi Centre Research Paper No. 2009-78, 2009

D. Roesch and H. Scheule.
Credit Rating Impact on CDO Evaluation
Global Finance Journal 19 (3), 2009, 235-251

D. Roesch and H. Scheule.
Capital Incentives and Adequacy for Securitizations
Working Paper, Leibniz University of Hannover, The University of Melbourne, 2010

D. Roesch and H. Scheule.
Systematic Risk and Parameter Uncertainty in Mortgage Securitizations
Working Paper, Leibniz University of Hannover, The University of Melbourne, 2010

Agenda

1. Structured Finance and the Financial Crisis
2. Model Risk in Structured Finance
3. Summary and Outlook

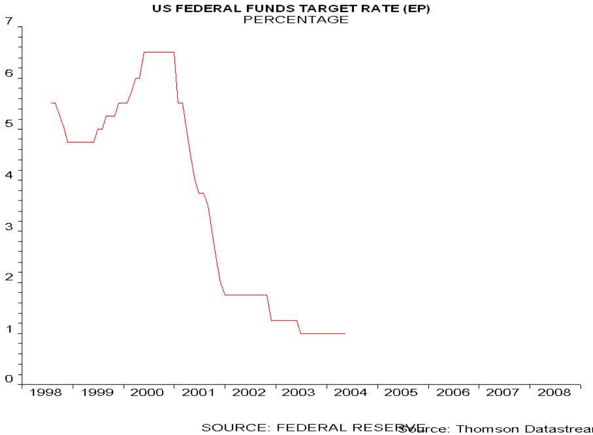
Agenda

Agenda

Background

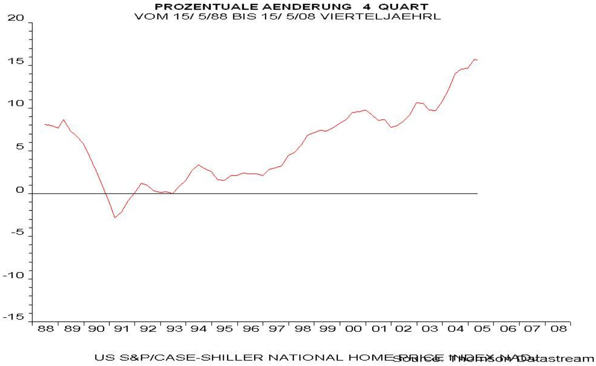
- 'The American Dream': Housing for everyone
- Since the early 1980's: Refinancing of housing loans via Mortgage Backed Securities (MBS)
- Growing appetite for risk in the banking industry
- Since the 1990's: Increasing volumes in Collateralised Debt Obligations (CDOs)
- Declining US interest rates since 2000 as accelerator
- Increasing house prices since 1990's and increasing household debt financing

US Interest Rates

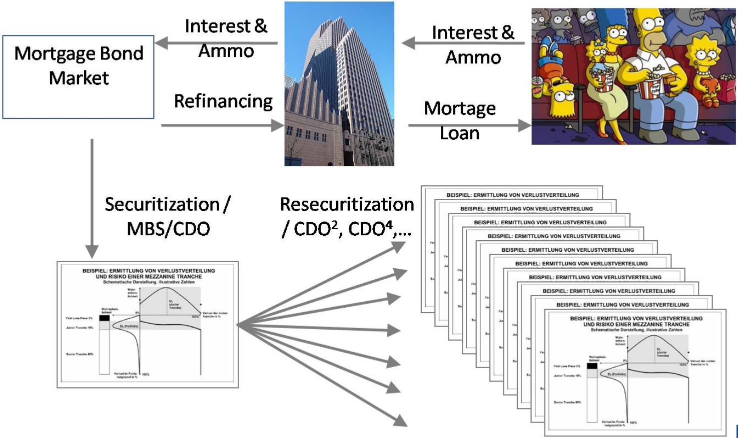


Source: Thomson Datastream

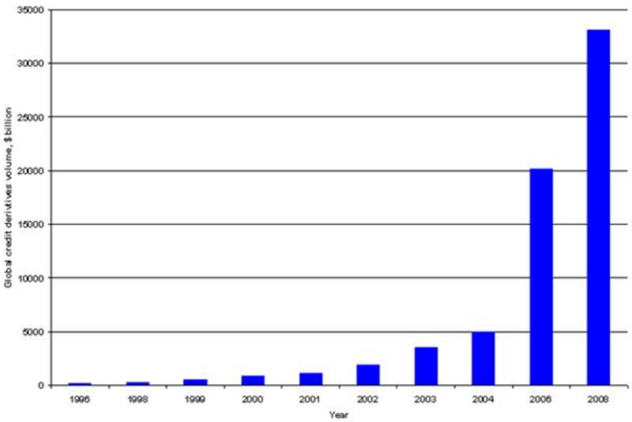
US Case Shiller House Price Index



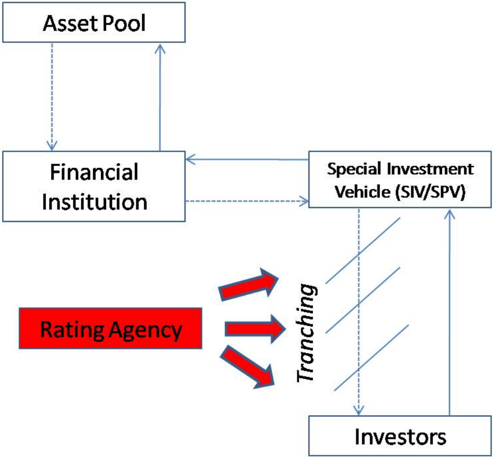
Refinancing via Securitizations/Stuctured Finance



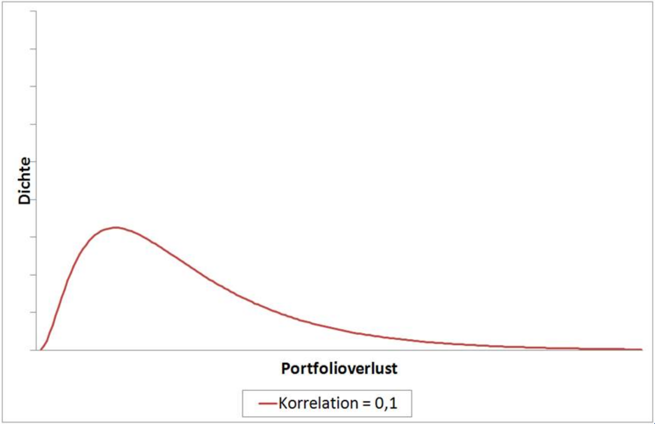
Highly Increasing Volumes in Credit Derivatives Market



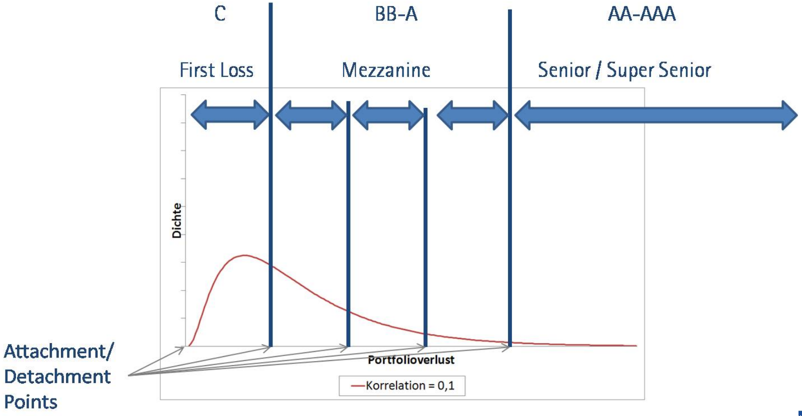
Basic Structure of Securitizations



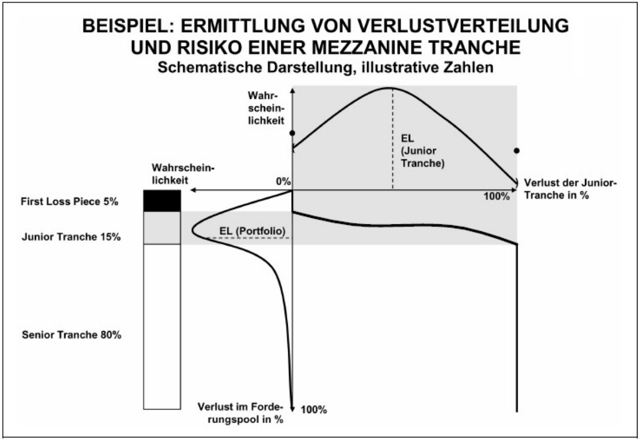
Pool Loss Distribution



Risk Assessment of Tranches



Tranche Loss Distribution



(Source: Österreichische Nationalbank, 2004)

How important are SF Ratings for Rating Agencies?

Year 2007 Moody's Fee Revenues of

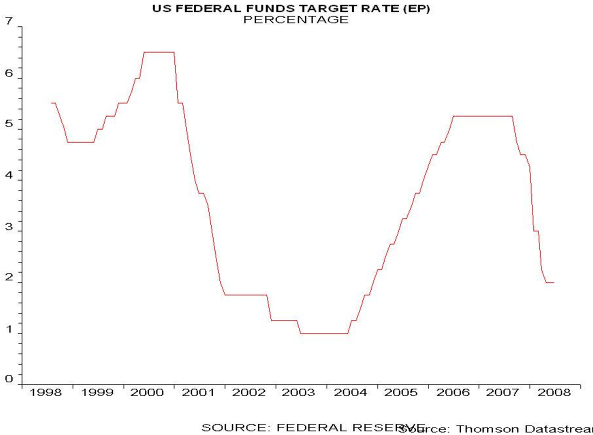
- \$873.3 million for structured finance ratings = 49% (1998: 32%)
- \$411.5 million for corporate issuer and issue ratings = 23% (1998: 33%)
- \$274.3 million for financial institution issuer and issue ratings = 15% (1998: 20%)
- \$220.8 million for public project and infrastructure ratings = 12% (1998: 15%)

In 2007

- 77% of fees due to origination ratings
- 23% of fees due to monitoring ratings

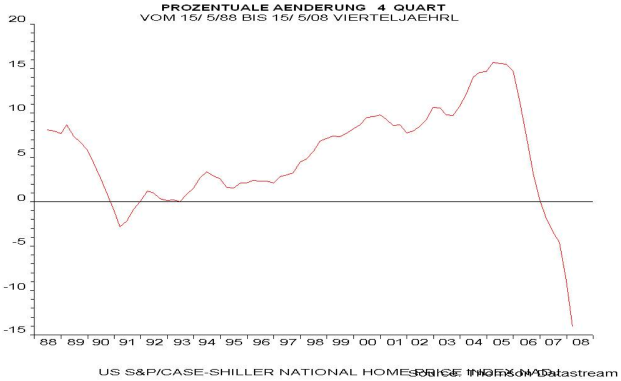
Agenda

Increasing Interest Rates

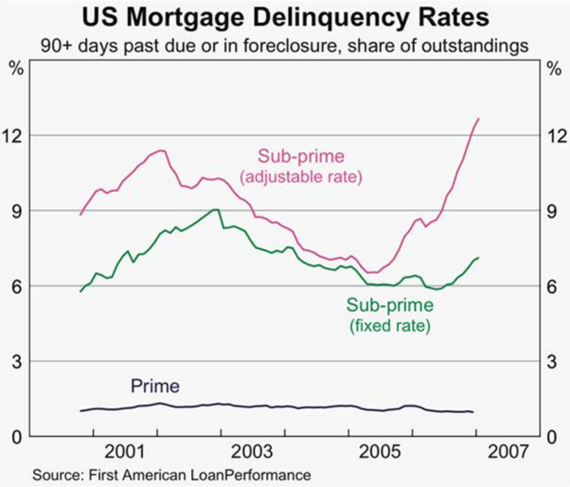


Source: Thomson Datastream

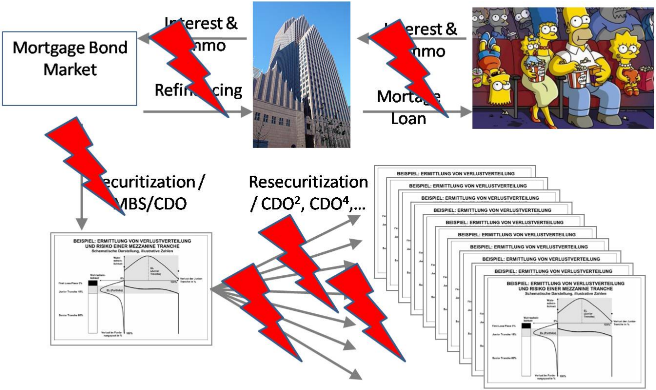
Drop of House Prices



Increasing Delinquency Rates



Breakdown and Chain Reaction



Some Striking Events

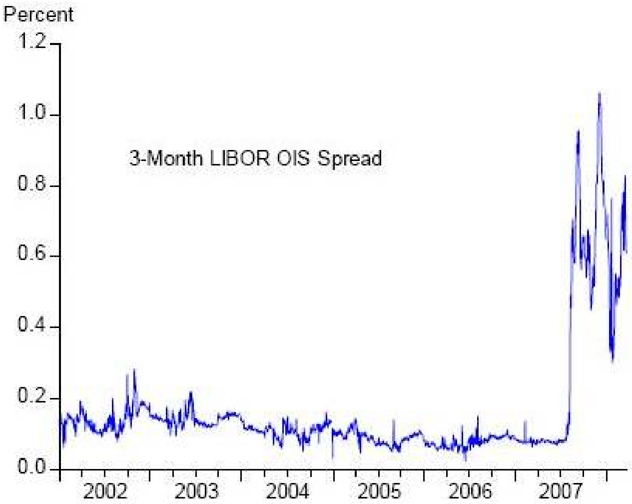
Year 2007

- 06-07: Announcements of MBS downgrades by Moody's and S&P
- 07/30: IKB announces losses due to ABCP programm
- 09: Northern Rock asks Bank of England for liquidity support
- 10: Further downgrades of Subprime MBS by Moody's and S&P

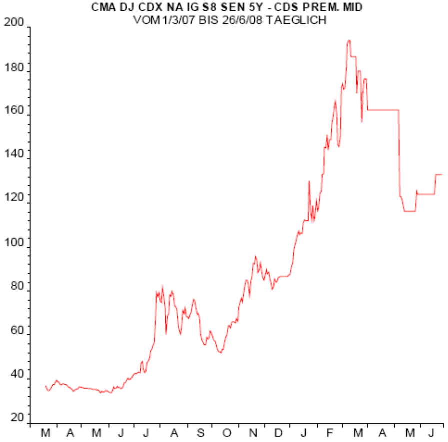
Year 2008

- 03/16: JP Morgan Chase acquires Bear Stearns
- 09/08: Nationalization of FannieMae and FreddieMac
- 09/15: Lehman Brothers' insolvency
- 09/15: Bank of America acquires Merrill Lynch
- 09/22: Goldman Sachs and Morgan Stanley resign Investment Bank status

Liquidity Black Hole



Sharp Rise of Credit Spreads



Agenda

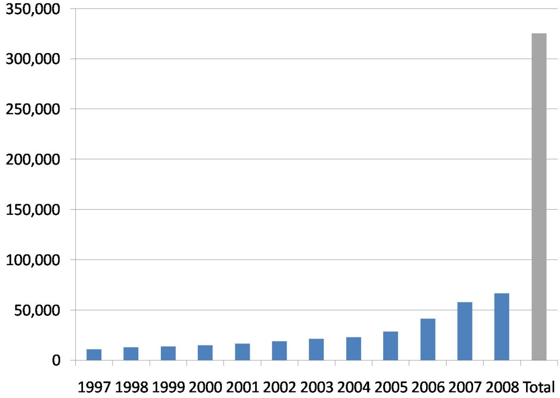
Agenda

Data

- Structured finance transactions which are rated by Moody's Rating Agency
- Characteristics of transactions, characteristics of tranches, ratings of tranches over time as well as occurrences of impairment events
- Time horizon is 1997-2008

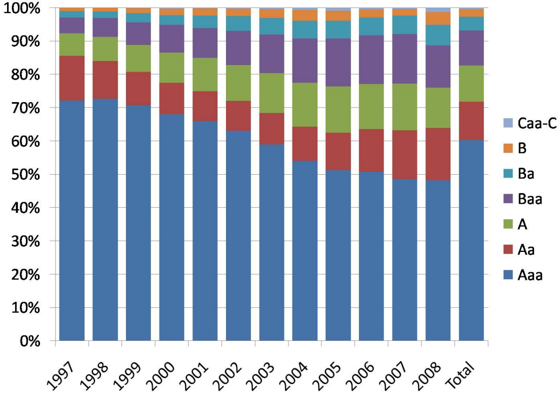
Descriptive statistics I

Numbers of observations, 1997-2008



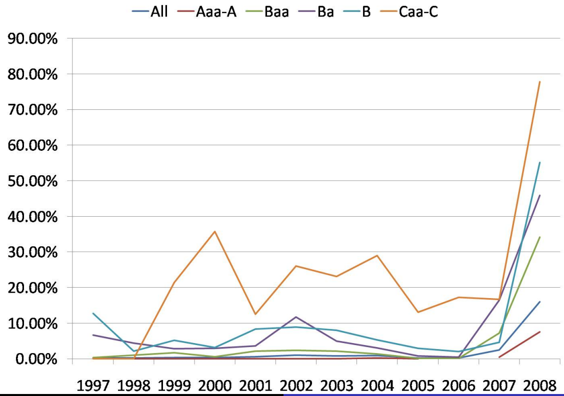
Descriptive statistics II

Relative frequencies, 1997-2008: rating at the beginning of a year



Impairments of Securitizations [Roesch and Scheule, 2009a]

Impairment rates, relative frequencies, 1997-2008: rating at the beginning of a year



Default process for an individual asset

- Asset return of borrower k in time period t belonging to asset pool i $(k = 1, ..., K; t = 1, ..., T, i = 1, ..., I)$, eg. Gordy and Howells (2006):

$$R_{kt} = \sqrt{\rho} \cdot X_{it} + \sqrt{1-\rho} \cdot \varepsilon_{kt}$$

- Borrower default event:

$$D_{kt} = 1 \Leftrightarrow R_{kt} < c_{it}$$

- Probability of default

$$\pi_{it} = \Phi(c_{it})$$

Portfolio default rate

- K_t assets are pooled to an asset portfolio with portfolio default rate:

$$P_{it} = \frac{1}{K_{it}} \sum_{k}^{K_{it}} D_{kt}$$

- Large homogeneous pool default density (Vasicek density):

$$f(p_{it}) = \frac{\sqrt{1-\rho}}{\sqrt{\rho}} \cdot \exp\left(\frac{1}{2}(\Phi^{-1}(p_{it}))^2 - \frac{1}{2\rho}(c_{it} - \sqrt{1-\rho} \cdot \Phi^{-1}(p_{it}))^2\right)$$

- Pool default cdf

$$F(p_{it}) = P(P_{it} < p_{it}) = \Phi\left(\frac{\sqrt{1-\rho}\Phi^{-1}(p_{it}) - c_{it}}{\sqrt{\rho}}\right)$$

Impairment process for a tranche

- Impairment of tranche j ($j = 1, ..., J_i$) if the portfolio default rate P_{it} in the portfolio exceeds the relative attachment level (or subordination level) AL_{ijt}:

$$D_{ijt} = 1 \Leftrightarrow P_{it} > AL_{ijt}$$

- Probability of a tranche impairment:

$$P(D_{ijt} = 1) = P(P_{it} > AL_{ijt})$$

Impairment process for a tranche

- After a few lines of math:

$$\begin{aligned} P(D_{ijt}=1) &= 1-\Phi\left(\frac{\sqrt{1-\rho}\,\Phi^{-1}(AL_{ijt})-\Phi^{-1}(\pi_{it})}{\sqrt{\rho}}\right) \\ &= \Phi\left(\frac{-\sqrt{1-\rho}\,\Phi^{-1}(AL_{ijt})+\Phi^{-1}(\pi_{it})}{\sqrt{\rho}}\right) \\ &= \Phi\left(\eta_{ijt}\right) \end{aligned}$$

- Thus, impairment probability depends on
  - Average portfolio asset quality;
  - Asset correlation;
  - Relative attachment level (subordination level) of a tranche.

Empirical (regression) model

- Model with omitted/erroneous information: $\widetilde{\eta}_{ijt} \neq \eta_{ijt}$

$$P(D_{ijt} = 1) = \Phi\left(\widetilde{\eta}_{ijt} + \Delta_\eta\right)$$

where $\Delta_\eta \equiv \eta_{ijt} - \widetilde{\eta}_{ijt}$: Measurement error

Probit Regression I [Roesch and Scheule, 2009a]

Variable	Model 3	Model 4	Model 5	Model 6 (prior GFC)	Model 7 (GFC)
Intercept	-5.6417***	-2.8000***	-4.5874***	0.2176***	-7.0547***
	0.1575	0.0750	0.1694	0.3047	0.2006
Baa	0.9849***	0.6949***	0.5668***	0.8263***	0.5472***
	0.0138	0.0143	0.0152	0.0481	0.0169
Ba	1.4267***	1.0748***	0.9934***	1.4125***	0.9244***
	0.0170	0.0172	0.0183	0.0510	0.0208
B	1.6326***	1.1510***	1.2224***	1.8561***	1.0900***
	0.0216	0.0212	0.0228	0.0558	0.0268
Caa	2.3478***	1.9833***	1.9779***	2.5822***	1.7801***
	0.0365	0.0356	0.0382	0.0665	0.0495
CDO	0.5059***		0.5925***	-0.3066***	2.1625***
	0.0263		0.0274	0.0428	0.0801
HEL	0.5885***		0.4660***	-0.4728***	1.9970***
	0.0245		0.0252	0.0419	0.0789
MBS	-0.2606***		-0.4380***	-1.1824***	1.0394***
	0.0253		0.0262	0.0475	0.0791
Resecuritisation	0.2355***		0.3450***	-0.0909	0.3954***
	0.0528		0.0561	0.1530	0.0634
Deal size	0.1220***		0.0994***	-0.1383***	0.1657***
	0.0071		0.0077	0.0151	0.0090
Subordination		-2.6234***	-3.4892***	-1.4095***	-4.0653***
		0.0602	0.0792	0.1708	0.0935
Thickness		-0.5138***	-0.6260***	-0.5851***	-0.5317***
		0.0388	0.0454	0.0893	0.0538
Year Dummies	Yes	Yes	Yes	Yes	Yes
Pseudo R-square	0.1355	0.1328	0.1476	0.0246	0.2231
R-square rescaled	0.4735	0.4643	0.5159	0.4048	0.4729
AUROC	0.9427	0.9416	0.9540	0.9507	0.9171

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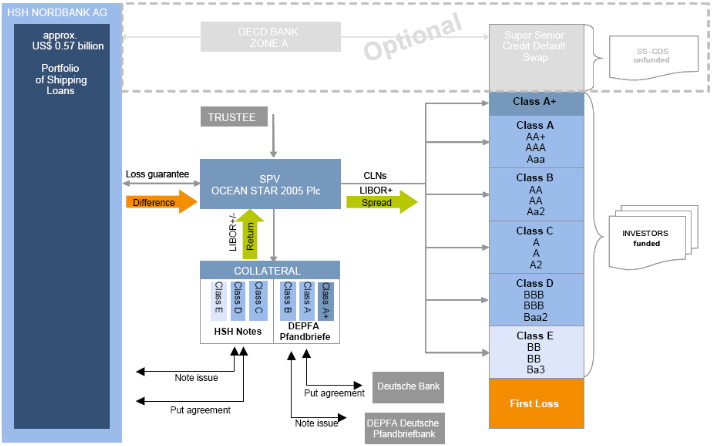
Agenda

2005 Ocean Star by HSH Nordbank

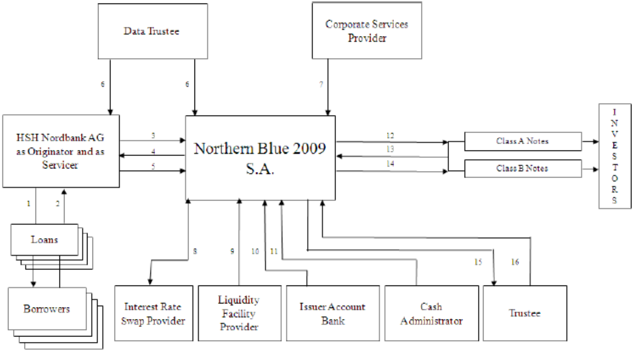


2005 Ocean Star by HSH Nordbank

Class	Initial Class Principal Amount	Interest Rate	ISIN/US-ISIN REG S	ISIN/US-ISIN 144A
Class A+	USD 700,000	3m USD LIBOR* + 0.20%	XS0230940610	US675068AA89
Class A	USD 28,600,000	3m USD LIBOR* + 0.30%	XS0230942152	US675068AB62
Class B	USD 25,700,000	3m USD LIBOR* + 0.45%	XS0230942582	US675068AC46
Class C	USD 42,800,000	3m USD LIBOR* + 0.75%	XS0230942580	US675068AD29
Class D	USD 23,400,000	3m USD LIBOR* + 1.50%	XS0230944281	US675068AE02
Class E	USD 9,700,000	3m USD LIBOR* + 4.60%	XS0230944794	US675068AF76

Class	S&P	Fitch	Moody's
Class A	AA+	AAA	Aaa
Class B	AA	AA	Aa2
Class C	A	A	A2
Class D	BBB	BBB	Baa2
Class E	BB	BB	Ba3

2009 NorthernBlue by HSH Nordbank



1. Origination of Loans
2. Payments of principal and interest on Loans
3. Sale and Transfer of Loans
4. Payment of Purchase Price
5. Servicing of Purchased Loan Receivables (including enforcement of Delinquent Loan Receivables, Defaulted Loan Receivables and Loan Collateral)
6. Data Trust Services
7. Corporate Services
8. Interest Rate Swap
9. Liquidity Facility
10. Holding of Issuer Accounts
11. Administration of Issuer Accounts (other than the Issuer Set-Off Reserve Account)
12. Issue of Notes
13. Note issue proceeds
14. Payments of interest and principal on Notes
15. Security over assets of the Issuer
16. Verification of, *inter alia*, Loan Losses

Complexity in Underlying Asset Pool

Table 1 - Summary

Number of Reference Claims	72
Number of Vessels	74
Current Portfolio Size:	$570,069,191
Highest Reference Claim Amount	$10,000,000
Highest Reference Claim Concentration	1.75%
Lowest Reference Claim Amount	$3,375,921
Lowest Reference Claim Concentration	0.59%
Average Reference Claim Amount	$7,917,628
Average Reference Claim Concentration	1.39%
Highest Portfolio LTV	74.6%
Lowest Portfolio LTV	18.6%
Weighted Portfolio LTV	39.7%
Weighted Average Life (years)	6.04

Table 4 - Distribution of Management Domicile

Management Domicile	Number of Reference Claims	Aggregated Outstanding Nominal Amount	% of Total	Weighted Average Remaining Term	Weighted Average Seasoning Term	Weighted Average LTV
Belgium	1	$10,000,000	1.8%	91.0	6.0	34.1%
Canada	1	$4,428,900	0.8%	103.0	43.0	40.4%
Croatia	1	$9,000,000	1.6%	60.0	53.0	35.5%
Cyprus	1	$10,000,000	1.8%	123.0	23.0	58.6%
Germany	45	$355,903,070	62.4%	138.3	17.7	37.7%
Greece	10	$81,558,333	14.3%	96.8	27.9	36.6%
Hong Kong	1	$10,000,000	1.8%	96.0	2.0	58.8%
Italy	1	$9,223,280	1.6%	104.0	34.0	43.8%
Japan	1	$8,348,892	1.5%	64.0	58.0	58.9%
Netherlands	3	$17,919,216	3.1%	134.4	11.6	52.2%
Norway	2	$9,625,000	1.7%	58.0	73.6	51.7%
Sweden	1	$10,000,000	1.8%	96.0	14.0	46.1%

Complexity in Underlying Asset Pool

Table 2 - Distribution of Balance Range

Cut-off Date Balance Range		Number of Reference Claims	Aggregated Outstanding Nominal Amount	% of Total	Weighted Average Remaining Term	Weighted Average Seasoning Term	Weighted Average LTV
>=	< 2,500,000	0	$0	0.0%	0.0	0.0	0.0%
>= 2,500,000	< 5,000,000	8	$30,790,009	5.4%	85.7	62.6	40.2%
>= 5,000,000	< 7,500,000	22	$137,091,546	24.0%	116.1	29.9	36.7%
>= 7,500,000	< 10,000,000	19	$172,187,636	30.2%	135.0	16.2	37.9%
>= 10,000,000	< 10,000,000	23	$230,000,000	40.3%	124.4	17.5	42.7%
	Total	**72**	**$570,069,191**	**100.0%**	**123.5**	**22.5**	**39.7%**
Minimum:	**$3,375,921**						
Maximum:	**$10,000,000**						
Average:	**$7,917,628**						

Table 3 - Distribution of Loan to Value Range

Loan to Value Range (LTV)		Number of Reference Claims	Aggregated Outstanding Nominal Amount	% of Total	Weighted Average Remaining Term	Weighted Average Seasoning Term	Weighted Average LTV
>= %	< 20%	1	$4,140,068	0.7%	67.0	71.0	18.6%
>= 20%	< 30%	12	$80,480,798	14.1%	107.9	35.3	26.7%
>= 30%	< 40%	31	$264,818,340	46.5%	133.7	17.0	34.9%
>= 40%	< 50%	14	$111,229,732	19.5%	126.5	29.2	44.6%
>= 50%	< 60%	12	$98,953,788	17.4%	109.0	14.8	55.4%
>= 60%	< 70%	1	$6,446,466	1.1%	147.0	25.0	62.6%
>= 70%	< 80%	1	$4,000,000	0.7%	58.0	87.0	74.6%
	Total	**72**	**$570,069,191**	**100.0%**	**123.5**	**22.5**	**39.7%**
Minimum:	**18.64%**						
Maximum:	**74.62%**						
Average:	**39.54%**						

Complexity in Underlying Asset Pool

Table 5 - Distribution of Remaining Term in Months

Remaining Term		Number of Reference Claims	Aggregated Outstanding Nominal Amount	% of Total	Weighted Average Remaining Term	Weighted Average Seasoning Term	Weighted Average LTV
>= 24	< 36	1	$4,062,500	0.7%	30.0	92.0	31.1%
>= 36	< 48	0	$0	0.0%	-	-	0.0%
>= 48	< 60	4	$14,977,640	2.6%	55.5	79.8	42.2%
>= 60	< 72	3	$25,113,959	4.4%	63.1	54.9	40.1%
>= 72	< 84	3	$16,040,354	2.8%	75.0	47.7	38.2%
>= 84	< 96	9	$59,925,000	10.5%	89.5	18.5	40.4%
>= 96	< 108	11	$115,305,731	20.2%	102.7	23.1	38.7%
>= 108	< 120	5	$37,529,308	6.6%	110.1	13.3	43.2%
>= 120	< 132	5	$37,617,954	6.6%	125.0	22.1	49.2%
>= 132	< 144	12	$93,703,688	16.4%	138.5	16.9	38.4%
>= 144	< 156	6	$30,194,057	5.3%	148.7	35.8	46.4%
>= 156	< 168	6	$65,925,000	11.6%	164.3	11.1	38.1%
>= 168	< 180	4	$30,000,000	5.3%	170.7	14.0	36.0%
>= 180	< 192	3	$39,674,000	7.0%	182.0	5.5	32.7%
	Total	**72**	**$570,069,191**	**100.0%**	**123.5**	**22.5**	**39.7%**
Minimum:	**30.0**						
Maximum:	**185.0**						
Average:	**119.7**						

Table 7 - Distribution of Vessel Type

Vessel Type	Number of Vessels	Aggregated Outstanding Nominal Amount	% of Total	Weighted Average Remaining Term	Weighted Average Seasoning Term	Weighted Average LTV
Container	37	$292,942,904	51.4%	143.9	20.5	38.8%
Tanker	14	$112,682,670	19.8%	105.7	29.9	35.1%
Bulker	12	$98,327,435	17.2%	95.2	16.9	42.8%
Product Tanker	5	$29,223,280	5.1%	111.5	16.5	46.3%
Chemical Tanker	4	$24,794,011	4.3%	115.1	26.5	46.5%
Car Carrier	1	$8,348,892	1.5%	64.0	58.0	58.9%
LPG Tanker	1	$3,750,000	0.7%	87.0	47.0	28.3%
Total	**74**	**$570,069,191**	**100.0%**	**123.5**	**22.5**	**39.7%**

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Complexity in Underlying Asset Pool

The following tables set forth the Loan Portfolio as at 30 April 2009.

General Data	
Cut-Off Date:	30,04,2009
Total Portfolio Volume:	EUR 1,174,538,407.85
No. of Loans:	651
No. of Borrowers:	242
Pool WAL (y):	3.80
WA Margin:	1.32%
Fixed Loans:	EUR 830,447,019.29
Floating Loans:	EUR 344,091,388.56

Rating	Volume (EUR)	%
Aa1	63,000,000.00	5.36
Aa3	45,352,348.13	3.86
A1	20,000,000.00	1.70
Baa3	40,192,307.69	3.42
Ba2	315,722,204.48	26.88
Ba3	548,559,301.05	46.70
B1	141,712,246.50	12.07
Grand Total	**1,174,538,407.85**	**100.00**

Complexity in...

- Underlying Asset Pool
- Waterfall Structure (Enhancement levels, CDS Protections,...)
- Documentation (300pages of legal descriptions + monthly reports)
- Pool Rating (see below)

Agenda

Incentive Effects

- Problems with CRAs (besides model risk):
  - Often CRAs are paid for securitization ratings by issuers/originators
  - CRAs are not liable for their judgements
  - Rating Shopping
- Incentive for too 'optimistic' ratings (in origination years)
- On the other hand CRAs publish rating performance statistics
- In order to stay credible, ratings are more conservative in monitoring years
- $\rightarrow$ *Incentive Effect* (Franke & Krahnen (2008), Crouhy et al. (2008)

Probit Regression II [Roesch and Scheule, 2009a]

Variable	Model 8	Model 9	Model 10	Model 11 (prior GFC)	Model 12 (GFC)
Intercept	-2.6520***	-3.2727***	-3.3453***	-3.2831***	-4.7431***
	0.0193	0.0264	0.0770	0.0789	0.1628
Baa		1.0302***	1.1717***	1.0443***	1.1979***
		0.0134	0.0146	0.0423	0.0157
Ba		1.4544***	1.5794***	1.5101***	1.5950***
		0.0164	0.0178	0.0433	0.0201
B		1.7405***	1.7628***	1.6905***	1.7774***
		0.0208	0.0224	0.0464	0.0270
Caa		2.5912***	2.7181***	2.4704***	2.9414***
		0.0344	0.0394	0.0616	0.0604
OY 1998	0.3606***	0.1266***	0.1171**	0.1030**	0.5618***
	0.0350	0.0446	0.0477	0.0486	0.2010
OY 1999	0.4210***	0.1307***	0.1160***	0.1294***	0.1775***
	0.0335	0.0423	0.0469	0.0473	0.2043
OY 2000	0.4817***	0.1095**	0.0866	0.0745	0.3565***
	0.0339	0.0426	0.0474	0.0486	0.1893
OY 2001	0.3010***	-0.0353	-0.0878***	-0.1836***	0.7052***
	0.0341	0.0428	0.0488	0.0526	0.1750
OY 2002	0.2784***	0.0618	0.0282***	-0.2806***	1.1220***
	0.0324	0.0400	0.0490	0.0596	0.1679
OY 2003	0.1400***	0.0613	-0.0233***	-0.8856***	1.1371***
	0.0329	0.0404	0.0521	0.1153	0.1660
OY 2004	0.2993***	0.2212***	0.1029***	-0.8876***	1.1386***
	0.0281	0.0346	0.0497	0.1611	0.1640
OY 2005	0.8911***	1.0017***	0.8465***	-1.0269***	1.8801***
	0.0219	0.0279	0.0445	0.2151	0.1623
OY 2006	1.6489***	1.7959***	1.5317***		2.5416***
	0.0207	0.0267	0.0435		0.1620
OY 2007	2.0051***	2.2405***	1.5700***		2.5816***
	0.0226	0.0286	0.0447		0.1623
Year Dummies	No	No	Yes	Yes	Yes

Probit Regression II [Roesch and Scheule, 2009a]

		All years			prior GFC			GF
Variable	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Mod
Intercept	-2.6666***	-20.5275***	-14.5172***	-3.3839***	-8.3009***	-10.6136***	-1.9064***	-25.752
	0.0781	0.2852	0.3355	0.0824	0.5122	0.5702	0.0176	0.
Baa	1.0849***	1.1121***	1.1182***	1.0418***	1.0367***	1.1168***	1.1585***	1.151
	0.0139	0.0138	0.0140	0.0421	0.0417	0.0432	0.0154	0.
Ba	1.5241***	1.5944***	1.5976***	1.5260***	1.5595***	1.6511***	1.5786***	1.610
	0.0170	0.0173	0.0175	0.0430	0.0432	0.0454	0.0197	0.
B	1.7323***	1.8604***	1.8897***	1.7317***	1.8248***	1.9094***	1.7911***	1.836
	0.0215	0.0225	0.0228	0.0458	0.0474	0.0491	0.0264	0.
Caa	3.0060***	2.8240***	3.1527***	2.6315***	2.8019***	2.7880***	3.1612***	2.718
	0.0417	0.0397	0.0437	0.0604	0.0628	0.0629	0.0612	0.
TSO	-0.2554***		-0.1692***	0.0274***		0.0644***	-0.3807***	
	0.0042		0.0049	0.0057		0.0062	0.0055	
SVO		0.7006***	0.4759***		0.2062***	0.2901***		0.871
		0.0109	0.0129		0.0206	0.0224		0.
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Pseudo R-square	0.1360	0.1364	0.1400	0.0195	0.0200	0.0204	0.2031	0.
R-square rescaled	0.4755	0.4767	0.4895	0.3213	0.3285	0.3362	0.4305	0.
AUROC	0.9399	0.9376	0.9424	0.9184	0.9181	0.9187	0.8953	0.

Agenda

Rating Through the Cycle

- **Pool rating philosophy** affects perceived CDO risk structure
- 'Point in Time' vs. 'Through the Cycle'
- Using TTC Rating an originating bank retaining equity tranches underestimates its insolvency risk [Roesch and Scheule, 2009b]
  - It underestimates credit risk of retained tranches
  - It overestimates credit risk of sold tranches (spread is too high)
- Reversal in economic downturns

Risk Under- and Overestimation [Roesch and Scheule, 2009b]

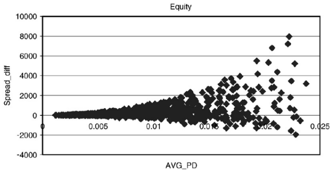
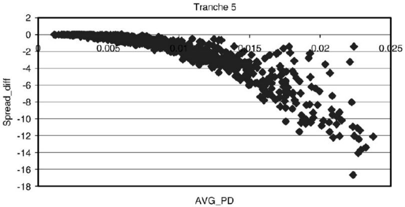


Fig. 3. Equity spread differences for various economic scenarios. 1000 scenarios are generated using simulated paths of the macroeconomic factor; term structures of default probabilities are derived from the economic scenarios; figures shows the difference of the equity spreads from PIT and TTC rating.



Risk Under- and Overestimation [Roesch and Scheule, 2009b]

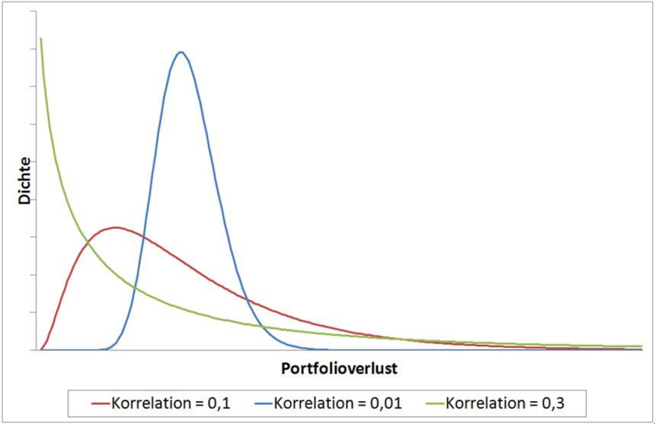
Table 3
Descriptive statistics for spread differences; base case

	Average spread difference	Median	Standard deviation	Min	Max
Equity	445.15	161.40	1630.29	−7670.71	37301.81
Tranche 2	−14.54	−36.25	146.28	−940.02	3309.05
Tranche 3	−25.05	−22.19	34.80	−106.49	770.061
Tranche 4	−13.35	−8.65	16.18	−80.41	189.61
Tranche 5	−2.32	−0.93	3.86	−36.22	0.03
Senior	−0.01	0	0.09	−2.84	0.03

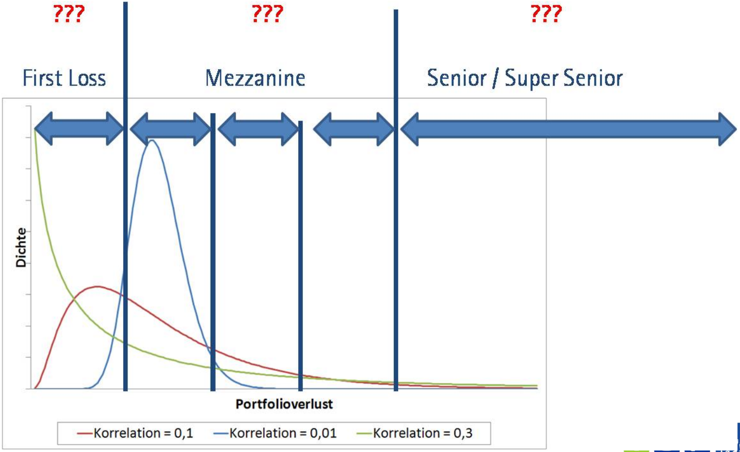
IBF Leibniz Universität Hannover

Agenda

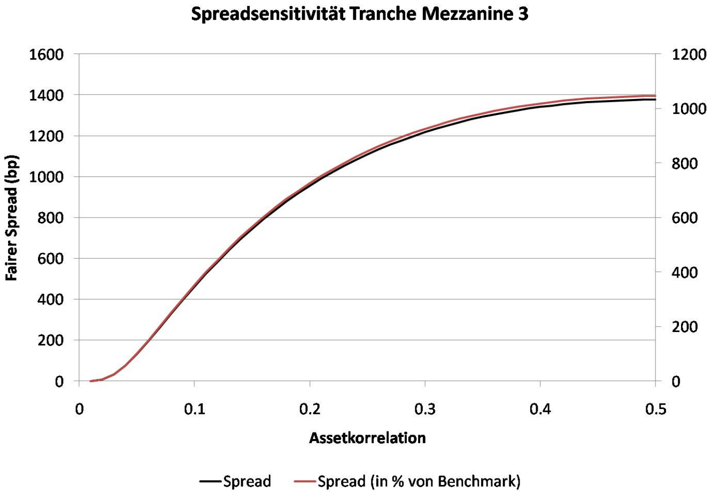
Sensitivity of Loss Distribution to Correlation



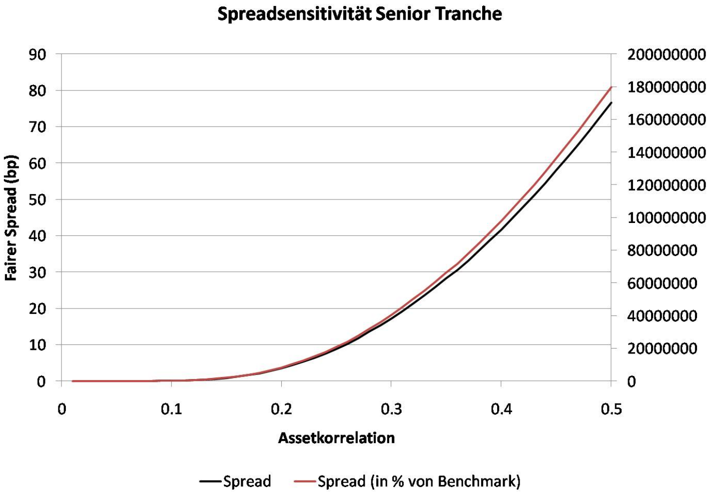
Sensitivity of Loss Distribution to Correlation



Sensitivity of Tranche Risk to Correlation



Sensitivity of Tranche Risk to Correlation



Agenda

Sensitivity to Macroeconomic Shocks

- Securitisations are much more sensitive to macroeconomic shocks than bonds [Coval, Jurek and Stafford, 2009]
- Risk is more volatile
- Performance is much worse in economic downturns

Model Extension [Roesch and Scheule, 2010b]

- Introducing a 'super-factor'

$$X_{it} = \sqrt{\delta} \cdot X_t^* + \sqrt{1-\delta} \cdot U_{it}$$

- Tranche impairment probability as a function of the systematic factor

$$P(D_{ijt} = 1 | X_t^*) = \Phi\left(\frac{\Phi^{-1}(\pi_{it}) - \sqrt{1-\rho}\Phi^{-1}(AL_{ijt}) - \sqrt{\rho}\sqrt{\delta}X_t^*}{\sqrt{\rho}\sqrt{1-\delta}}\right)$$
$$= \Phi\left(\eta_{ijt}/\sqrt{1-\delta} + b \cdot X_t^*\right)$$

Model Extension [Roesch and Scheule, 2010b]

- Regression model

$$P\left(D_{ijt}=1|X_t^*\right)=\Phi\left(\beta' x_{ijt}+b\cdot X_t^*\right)$$

- Relation to 'Asset Correlation'

$$P\left(D_{ijt}=1|X_t^*\right)=\Phi\left(\frac{\widetilde{\beta}' x_{ijt}+\sqrt{\delta}\cdot X_t^*}{\sqrt{1-\delta}}\right)$$

where $\delta=\frac{b^2}{1+b^2}$ and $\widetilde{\beta}=\beta\cdot\sqrt{1-\delta}$

Systematic Risk of Bonds vs. Tranches

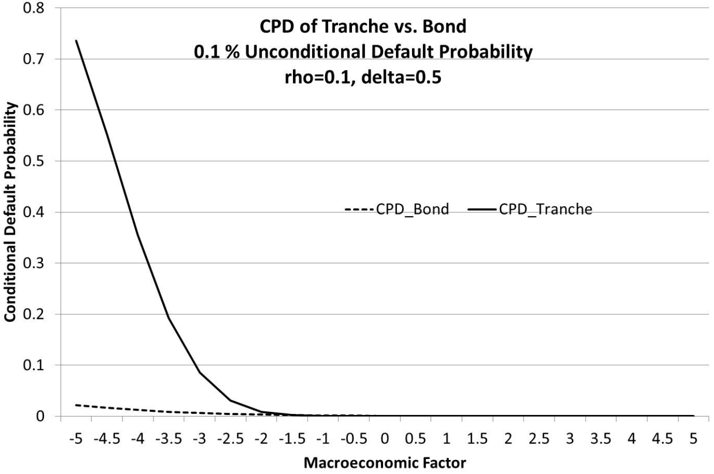
- Conditional PD of Bond

$$P\left(D_t^B = 1|X_t^*\right) = \Phi\left(\frac{\Phi^{-1}(\pi) - \sqrt{\rho\delta}X_t^*}{\sqrt{1-\rho\delta}}\right)$$

- Conditional PD of Tranche

$$P(D_t^{Tr} = 1|X_t^*) = \Phi\left(\frac{\Phi^{-1}(\pi) - \sqrt{\delta}X_t^*}{\sqrt{1-\delta}}\right)$$

Systematic Risk of Bonds vs. Tranches



Sensitivity of Bonds vs. Tranches

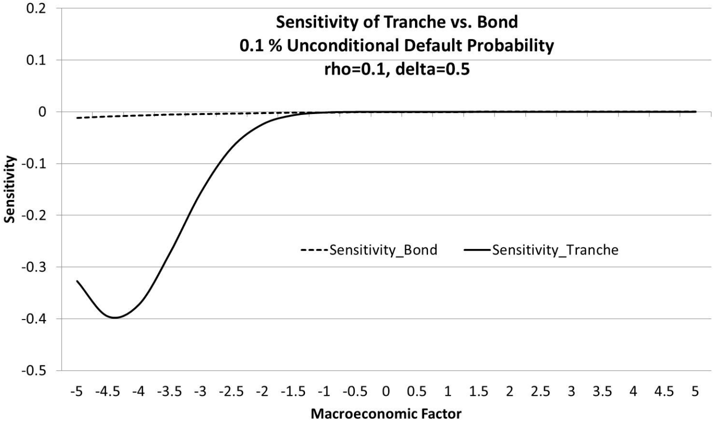
- Bond

$$\kappa^B(X_t^*) = \frac{\partial P\left(D_t^B = 1 | X_t^*\right)}{\partial X_t^*} = \phi\left(\frac{\Phi^{-1}(\pi) - \sqrt{\rho\delta}X_t^*}{\sqrt{1-\rho\delta}}\right) \cdot \frac{-\sqrt{\rho\delta}}{\sqrt{1-\rho\delta}}$$

- Tranche

$$\kappa^{Tr}(X_t^*) = \frac{\partial P\left(D_t^{Tr} = 1 | X_t^*\right)}{\partial X_t^*} = \phi\left(\frac{\Phi^{-1}(\pi) - \sqrt{\delta}X_t^*}{\sqrt{1-\delta}}\right) \cdot \frac{-\sqrt{\delta}}{\sqrt{1-\delta}}$$

Sensitivity of Bonds vs. Tranches



Empirical Results [Roesch and Scheule, 2010b]

	MBS				HEL			
	all	all	pre-2008	pre-2007	all	all	pre-2008	pre-2007
Intercept	-2.8868***	-3.6646***	-3.7164***	-3.9115***	-2.3595***	-3.0967***	-3.4228***	-3.6745***
std error	0.1466	0.1713	0.0994	0.1270	0.1897	0.2207	0.1607	0.1746
Baa		1.2830***	1.2929***	0.9834***		1.0628***	1.2339***	1.4815***
std error		0.0255	0.1046	0.1464		0.0213	0.0421	0.1216
Ba		1.3732***	1.4816***	1.3998***		1.8955***	2.1133***	2.1021***
std error		0.0312	0.1082	0.1400		0.0284	0.0477	0.1276
B		1.4019***	1.6938***	1.7304***		2.3011***	2.4644***	2.8351***
std error		0.0357	0.1079	0.1347		0.0432	0.0851	0.1380
Caa		2.4143***	2.6824***	2.7825***		2.7984***	2.9813***	3.0740***
std error		0.0646	0.1259	0.1522		0.0849	0.1400	0.1932
b	0.4987***	0.5782***	0.3166***	0.1075	0.6529***	0.7564***	0.5102***	0.4382***
std error	0.1039	0.1197	0.0754	0.0481	0.1338	0.1555	0.1121	0.1051
Obs	164002	164002	129466	100607	86386	86386	66634	48295
AIC	23290	18281	2460	1414	34078	24864	7054	1477

Empirical Results [Roesch and Scheule, 2010b]

Table: Comparison of estimated implied asset correlations for securitizations and bonds

This table shows the estimates for the implied asset correlations which given by $\frac{b^2}{1+b^2}$ where b is the coefficient of the systematic factor

	Aaa-A	Baa	Ba	B	Caa
MBS	0.5925	0.4079	0.3440	0.2067	0.3490
HEL	0.5914	0.3754	0.4383	0.3259	0.5387
Bonds	0.2430	0.2101	0.2248	0.1690	0.1403

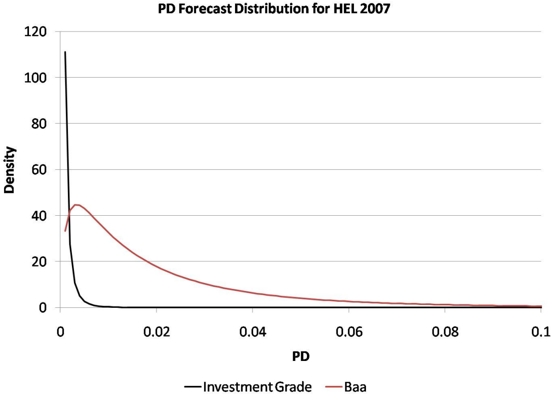
Agenda

Estimation Error

- Parameters (correlations) are unknown - even if model is known
- Estimation from short time series [Hamerle and Roesch, 2005)]
- Estimation errors are (even) more severe for tranches than for pools/portfolios [Heitfield, 2009]
- Effect on VaR prediction for portfolios of tranches?

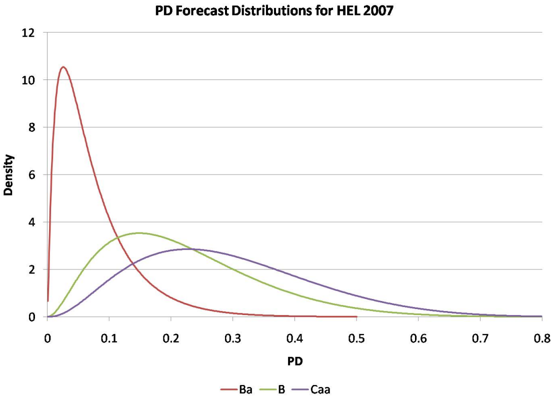
Step 1: Out-of-time Prediction including Macroeconomic Sensitivity

PD predictions HEL 2007, rating classes Aaa-A and Baa



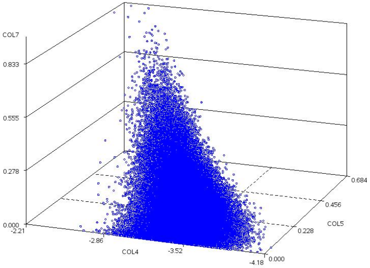
Step 1: Out-of-time Prediction including Macroeconomic Sensitivity

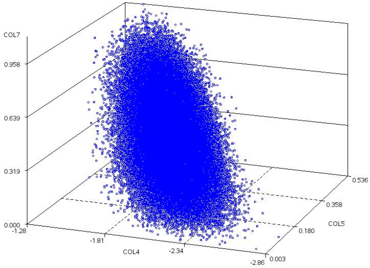
PD predictions HEL 2007, rating classes Ba to Caa



Step 2: Out-of-time Prediction including Macroeconomic Sensitivity and Model Risk

Simulated VaR 99.98 predictions HEL 2007, rating classes IG and Baa





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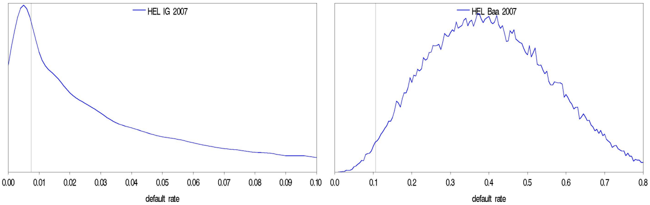

Agenda

Some Lessons Learned - or - Some Old Wine in New Bottles

- Finally people realized (painfully) that
  - Credit risk is a rocky playground
  - Model/parameter/estimation errors come on top! -¿ Leverage!
  - The information content of agency ratings is limited
    $\rightarrow$ *Are CRA's or investors to blame?*
  - Through-the-cycle ratings are sticky (do not contain macro factors) and this may be problematic for investors (cf. Roesch, 2005; Roesch & Scheule, 2005)
- The future of securitisations
  - Only simple structures: No more CDO^2 etc.
  - High degree of standardisation
  - Transparency of ratings
  - Regulation of structured finance products (regulatory capital, horizontal/vertical retention of tranches), [Roesch and Scheule, 2010a]
  - Addressing model risk

Some Old Wine in New Bottles

- 'Know your risks'
- Know the knowns and (try to) know the unknowns -¿ Model risk
- Regulation of rating agencies
- Procyclicality
- Stress-testing and model risk

Some Old Wine in New Bottles

- 'Know your risks'
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