



**“Tail Risk Measures”  
or  
Instead of New Data Sources, why not try  
some new uses for existing data?**

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**Wharton Financial Institutions Center Conference:  
*Modeling Retail Credit Risk After the Sub-Prime Crisis*  
June 11-12, 2009**

## Faulty premises about Structured Credit Ratings:

- **“A Rating is a Rating is a Rating.”**

A bond and a tranche may have the same rating but they do not behave the same way for all credit situations. In fact their behavior is markedly different when tail events occur.

- **“A single Rating describes fully the credit (default) risk of a rated tranche.”**

A securitization is a complex structure. The credit risk in a securitization tranche is necessarily complex. A single metric cannot capture all the manifestations of credit (including migration) risk in a tranche.

For example, two securitization tranches may have the same probability of being hit but the loss sustained for a given credit event or the possibility of downward migration may be very different.

## Faulty premises:

- **“It is adequate to look at a rated tranche on a Stand-alone basis.”**

An investor buys an exposure to a securitization tranche and puts it into a very large portfolio of other securities. This is the only meaningful way of measuring the tail risk of a tranche, not by viewing it in isolation.

- **“Ratings are adequate a characterizations through the cycle, as they capture stress.”**

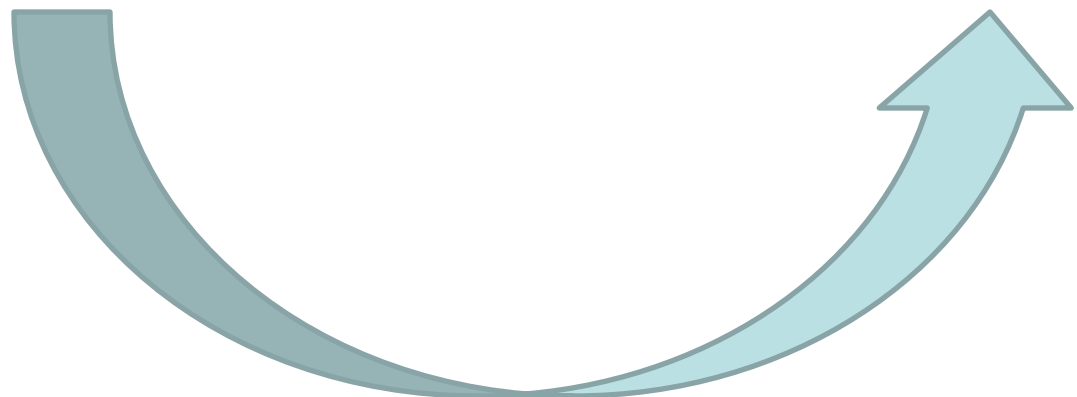
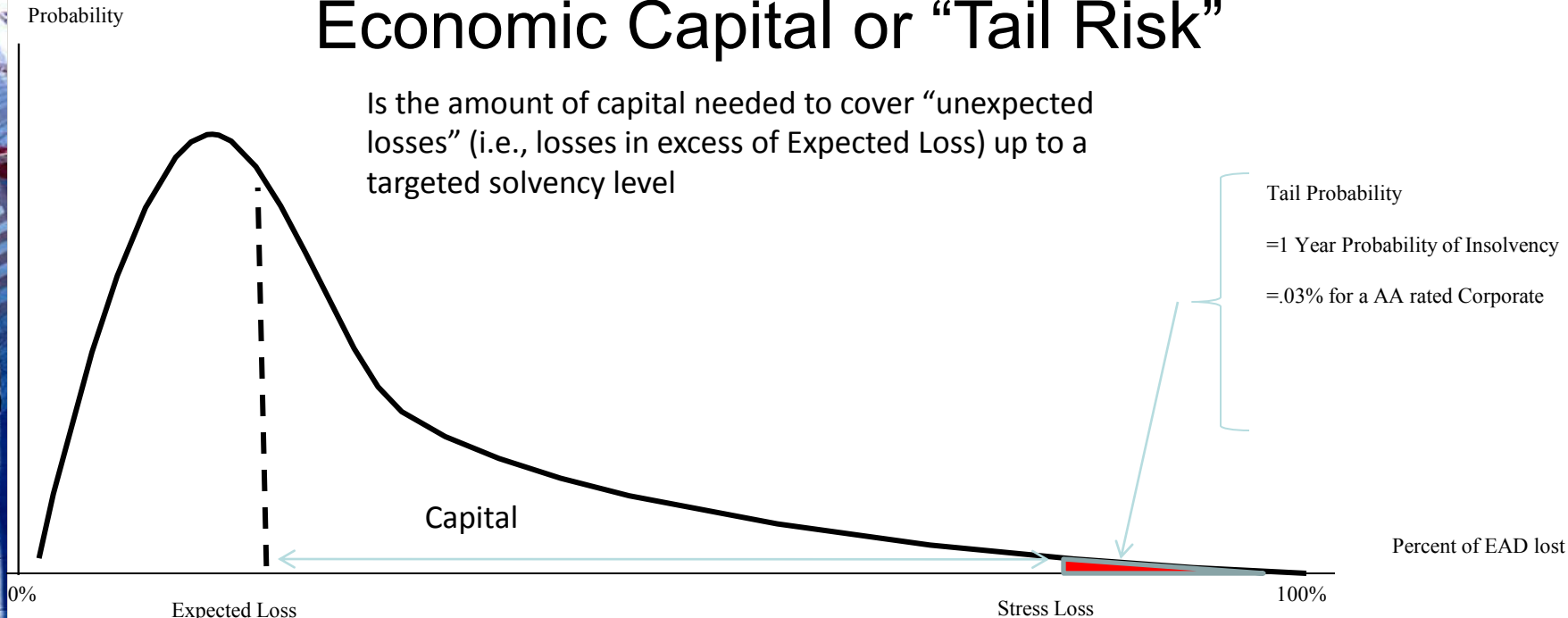
The underlying portfolio’s credit characteristics change from month to month, especially in bad times. Some of the tail risk metrics of the tranche are very sensitive to the changing credit characteristics of the underlying pool of loans. Such metrics can be useful to an investor as signals to sell even though there may be no ratings downgrade.

## Why use a new risk measure?

- Ratings by the major NRSROs for structured products have been discredited.
- The traditional NRSRO ratings measure the probability of default or expected loss.
- Today it is obvious: if you do not have a measure of how a security behaves “in the tail” you do not have a complete picture of the credit risk.
- Prior to 2007, this seemed unnecessary to many since the securitization market had never experienced a “tail event”.

# Economic Capital or “Tail Risk”

Is the amount of capital needed to cover “unexpected losses” (i.e., losses in excess of Expected Loss) up to a targeted solvency level

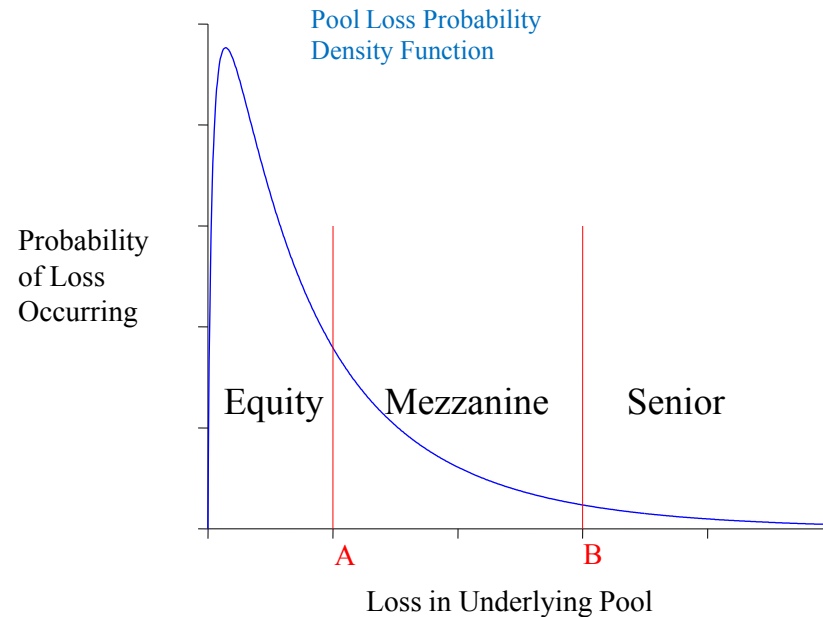


Relation driven by degree of portfolio diversification and asset correlation

## The “Look Through” Concept

- A proper risk analysis of a structured security can only be done by “looking through” the structure to the primitive (loans or bonds) assets.
- The analysis should start from credit characteristics of the primitive assets and then build up through the structure.
- **Cash flow scenarios are not enough – the “look through” analysis must generate appropriate risk metrics – an estimate of the loss probability distribution.**
- A “look through” analysis precludes erroneous modeling of a securitization tranche as a bond.
- A look through analysis can provide significant insights on structured credit risk, while relying upon existing primitive asset risk measures. **Old data used in a new way!**

# Tail Risk Measures Require Modeling both the Assets and Liabilities (Structure) of a Securitization



If the Mezzanine tranche in this pool started at point A, but was thinner (shorter distance from A to B), the mezzanine piece would have the same PD but a higher EL, for a given underlying pool construction. The thinner mezzanine piece would unequivocally drive up the senior piece's PD, because the point B would be further to the left (and the area under the PDF to the right of B would be larger).

## Methodology References: ECap for Structured Credit

- Michael Pykhtin and Ashish Dev, “Credit risk in asset securitizations: an analytical model” published in Risk (cutting edge), May 2002.
- Michael Pykhtin and Ashish Dev, “Course-grained CDOs” published in Risk (cutting edge), Jan 2003.
- Michael Gordy and David Jones, “Random Tranches” published in Risk (cutting edge), March 2003.
- Michael Gordy, “A Risk-Factor Model Foundation for Ratings-Based Bank Capital Rules” published in Ashish Dev (ed), Economic Capital, Risk Books, 2004

# Asset-Side Risk Modeling

In order to estimate pool risk characteristics (pool PDs and LGDs), we define a limited number of pool “segments” based on commonly used ranges of “risk characteristics

- CLTV: < 70%; 70-79%; 80-89%; 90-99%; ≥100%
- Days-Past-Due: current - 29 DPD; 30-59DPD; 60-89DPD; 90-179DPD; defaulted; unknown DPD status.
- Origination FICO: >720; 660-720; 600-659; <600

There are inherently a total of  $5 \times 6 \times 4 = 120$  segments into which we divide each RMBS deal’s pool of underlying loans.

- There is a specific, empirically determined PD and LGD assigned to each of these segments.
- We upgrade the loan’s month-to-month LTV by applying principle payments (to the numerator of the LTV ratio) and quarterly changes in the Case-Schiller regional housing price index (to the denominator).

All of this work is done for each loan each month for the thousands of loans in each of the 10 RMBS deals we analyzed.

## Asset Side: Bucketed Loan Data

- Map collateral balances to segments defined by FICO, Delq Status, Age and LTV

Month	date	count	balance	LTV	FICO	DQSTAT	AGE	GROUP
1	200510	225	43770422	<70.00	LTV >=720 FICO	0-29 DAYS	<=1 YEAR	Group 1
1	200510	110	22566484	<70.00	LTV >=720 FICO	0-29 DAYS	<=1 YEAR	Group 2
1	200510	180	54211426	80-89	LTV >=720 FICO	0-29 DAYS	<=1 YEAR	Group 3
1	200510	0	0	100+	LTV >=720 FICO	0-29 DAYS	<=1 YEAR	Group 4

- Map PD and LGD Estimates to each loans and balances in each bucket

LGD	LTV
13%	<70
17%	70-79
22%	80-89
26%	90-99
30%	100+

elapsed	month	total_bal_INTEX	lgd_pool_PFG	pd_pool_TU	grp_name
1	04 2007	1194614496	0.130434783	0.045888415	ALL GROUPS
2	05 2007	1183328805	0.130434783	0.045888415	ALL GROUPS
3	06 2007	1173545405	0.240800333	0.045888415	ALL GROUPS
4	07 2007	1160416941	0.244626649	0.056193075	ALL GROUPS
5	08 2007	1147574703	0.246814625	0.056193075	ALL GROUPS
6	09 2007	1137868124	0.252309659	0.056193075	ALL GROUPS
7	10 2007	1130494942	0.257297156	0.062874179	ALL GROUPS
8	11 2007	1120474784	0.262004592	0.062874179	ALL GROUPS
9	12 2007	1111966509	0.266938718	0.062874179	ALL GROUPS
10	01 2008	1098174483	0.2718363	0.068796628	ALL GROUPS
11	02 2008	1086142046	0.275261404	0.068796628	ALL GROUPS
12	03 2008	1068932034	0.276966769	0.068796628	ALL GROUPS

## Liability Side: Deriving Tranche Detachment and Thickness

### “Y” Structure

This type of structure can be illustrated by a diagram below

1A1	1A3	1A6	1A8	1A4	1A5	2A1	AR	PO
				1A7				
M								
B1								
B2								
B3								
B4								
B5								

## Liability Side: Deriving Tranche Detachment and Thickness Linear Structure

tranche	desc	notional	group(s)	tranche_orig	orig_enh (%)	orig_support_amt	orig_deal_basis	Detachment
A1	SEN_FIX	0	0	210,982,000	27.92	81,711,638.67	292,693,638.67	100
A2	SEN_NAS_FIX	0	0	46,885,000	11.90	34,826,638.67	292,693,638.67	27.92
A3	SEN_FIX	0	0	1,280,000	11.46	33,546,638.67	292,693,638.67	11.90
M1	JUN_FIX	0	0	16,639,200	5.78	16,907,438.67	292,693,638.67	11.46
M2	JUN_FIX	0	0	5,635,800	3.85	11,271,638.67	292,693,638.67	5.78
M3	JUN_FIX	0	0	4,293,900	2.38	6,977,738.67	292,693,638.67	3.85
B1	JUN_FIX_NO	0	0	2,683,700	1.47	4,294,038.67	292,693,638.67	2.38
B2	JUN_FIX_NO	0	0	2,147,000	0.73	2,147,038.67	292,693,638.67	1.47
B3	JUN_FIX_NO	0	0	2,147,038	0	-	292,693,638.67	0.73

- provides collateral group, group balance (orig\_deal\_basis), credit support in dollar amount (orig\_support\_amt) and monthly updated attachment (orig\_enh)
- no detachment information – needs to be derived from deal structure

A1
A2
A3
M1
M2
M3
B1
B2
B3

For a linear structured deal

- the orig\_support\_amt is the total balance of the tranches below it
- the INTEX enhancement is replicated by sum(tranches below)/deal balance
- the detachment is the attachment of the tranche above

# Liability Side: Deriving Tranche Detachment and Thickness

## “H” Structure

### “H” Structure

- Two sets of mezzanine tranches, supported by each collateral group respectively
- Each set of mezzanine tranches supports its own senior tranches
- The orig\_deal\_basis shows the original balance of each collateral group

### How to replicate the enhancement

- Separate the tranches into two sets by collateral group
- Treat each set as an independent single group deal

IA3 Super										
IA4										
Supporting	IAP	IA1	IA5	IA6	IA7	IA8	IA9	IA10	IA11	RI
IMI										
IM2										
IM3										
IB1										
IB2										
IB3										

IIA1	RII	RIII	IIAP
IIM1			
IIM2			
IIM3			
IIB1			
IIB2			
IIB3			

## Liability Side: Deriving Tranche Detachment and Thickness

### Combination of Above Features

- Group 4 is actually a combination of group 2 + 3, as its orig\_deal\_basis is the sum of those two.
- It is an “H” structure with two legs – group 1 and group 2+3; the latter itself is a “Y” structure

IA1	IAP	RI
IM1		
IM2		
IM3		
IB1		
IB2		
IB3		

IIA1	RII	RIII	IIIA1	IIIA3	IIAP
			IIIA2		
IIM1					
IIM2					
IIM3					
IIB1					
IIB2					
IIB3					

## Sample Tail Risk Metrics

- On a monthly basis, Tail Risk Metrics could be used to provide the following measures for any reviewed security:
  1. Expected Loss for the tranche
  2. Loss at the Confidence Interval (“LCI”) for the tranche (sometimes called Stress Loss)
  3. Unexpected Loss for the tranche (“tail risk”)
  4. Notional RAROC (Risk Adjusted Return on Capital) based on the Unexpected Loss, the Spread at origination, and the Expected loss rate for the tranche
  
- A sample Tail Risk Metric report is shown on the next page, for a real RMBS deal.

# Sample P-SaT Report

## RMBS Deal RFC07QS2, Tranche A4

Date	Pool Wtg Avg PD	Pool Wtg Avg LGD	Tranche Expected Loss	Tranche PD	Loss Confidence Interval	Unexpected Loss	RAROC	Fitch Rating
Feb-07	0.84%	17.81%	0	0.00%	0.00%	0.00%	2442.00%	AAA
Mar-07	1.23%	17.72%	0	0.00%	0.00%	0.00%	2442.00%	AAA
4/1/2007	1.22%	17.70%	0	0.00%	0.00%	0.00%	2442.00%	AAA
May-07	1.32%	17.58%	0	0.00%	0.00%	0.00%	2442.00%	AAA
Jun-07	1.71%	17.59%	0	0.00%	0.00%	0.00%	2442.00%	AAA
Jul-07	2.37%	17.85%	0	0.00%	0.00%	0.00%	2441.97%	AAA
Aug-07	2.56%	17.97%	0	0.00%	0.00%	0.00%	2441.96%	AAA
Sep-07	3.26%	18.41%	0	0.00%	0.00%	0.00%	2441.84%	AAA
Oct-07	4.08%	18.93%	0	0.00%	0.01%	0.02%	1506.17%	AAA
Nov-07	4.74%	19.49%	0	0.00%	0.03%	0.09%	285.69%	AAA
Dec-07	5.54%	20.11%	0	0.00%	0.07%	0.33%	74.69%	AAA
Jan-08	6.20%	20.79%	0	0.00%	0.14%	0.71%	34.55%	AAA
Feb-08	7.51%	21.32%	0	0.00%	0.35%	1.62%	14.97%	AAA
Mar-08	8.53%	21.68%	0	0.01%	0.62%	2.34%	10.25%	AAA
Apr-08	9.25%	21.84%	0	0.01%	0.84%	2.78%	8.56%	AAA
May-08	10.04%	21.88%	0	0.02%	1.18%	3.27%	7.19%	AAA
Jun-08	10.53%	22.01%	0	0.02%	1.63%	3.77%	6.13%	AAA
Jul-08	11.29%	22.04%	0	0.03%	2.27%	4.29%	5.25%	AAA
Aug-08	11.51%	22.11%	0	0.04%	2.89%	4.67%	4.69%	BBB
Sep-08	12.47%	22.25%	0	0.07%	4.38%	5.41%	3.75%	BBB

# Benefits of ECap and Other Tail Risk Measures

- Tail risk measures are quantitative and are more transparent than conventional NRSRO ratings.
- A Tail risk metric could be used as a ratings “suffix” to satisfy the SEC requirement that NRSRO ratings distinguish between corporate bonds and structured transactions. This metric would be much more meaningful than “.sf” or some cosmetic suffix.
- Tail risk metrics can help investors more easily compare risk across similarly rated potential investments.
- Tail risk metrics are a “leading indicator” of change in risk and offer investors an early warning signal.
- None of the major NRSROs today publish this type of metric. Adoption of Tail risk metrics will challenge the existing ratings orthodoxy and introduce competition.