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Managing Risk by Creating and Exercising Accurate Modeling

IIR CDO Summit

June 2006

Outline

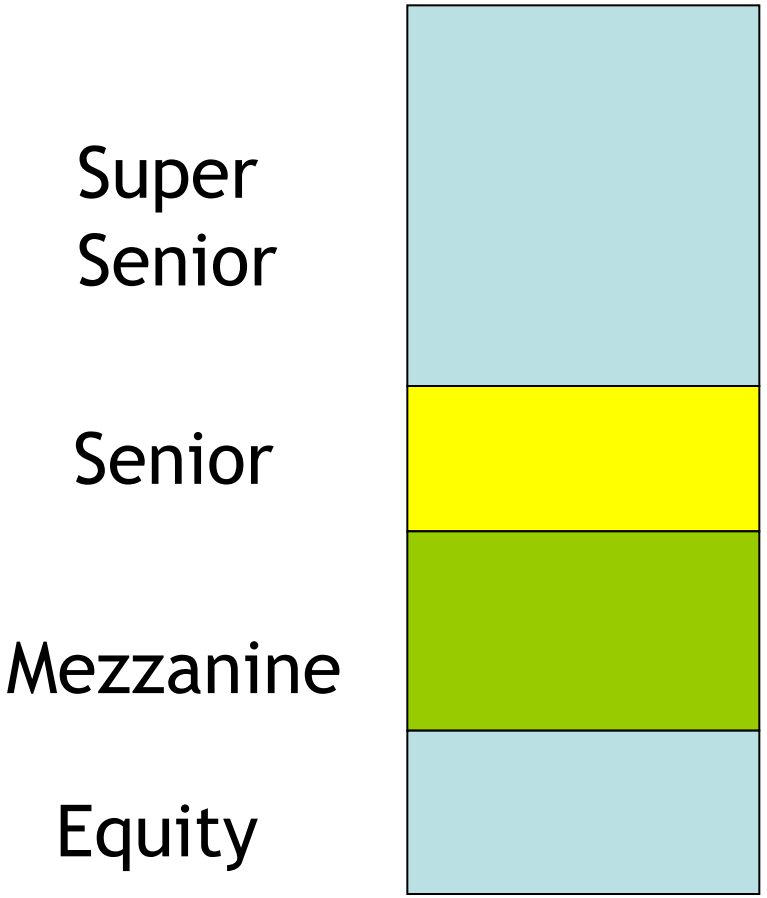
- Capturing relevant parameters for CDO transactions
- Model assumptions and blindspots
- Aggregating risk across a portfolio of investments

CDO Description

- Assets (corporate, ABS, cash and synthetic)
- Liabilities (fixed, floating, cash and synthetic)

Challenge of CDO Modeling

Defaults impact each investor differently. Cannot make the bankers' assumption that each default is a loss.



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Relevant Parameters

- Assets:
  - Detailed portfolio listing
  - Individual obligor identifier
  - Principal amortization schedules
  - Re-investment rule/assumption
  - Default probability and recovery
  - Industry designation (for correlation assumptions)
  - Underlying asset payment dates
  - Coupon reset for floating-rate assets

ABS Amortization Schedules

126671PK6		210805CY1		36185NRV4	
03/27/2002	1.000000000	03/15/2000	1.000000000	03/27/2002	1.000000000
04/25/2002	1.000000000	11/01/2000	0.991000773	04/25/2002	1.000000000
05/28/2002	1.000000000	05/01/2001	0.972574681	05/28/2002	1.000000000
06/25/2002	1.000000000	11/01/2001	0.960814325	06/25/2002	1.000000000
07/25/2002	1.000000000	05/01/2002	0.944308644	07/25/2002	1.000000000
08/26/2002	1.000000000	11/01/2002	0.921888989	08/26/2002	1.000000000
09/25/2002	1.000000000	05/01/2003	0.903087604	09/25/2002	1.000000000
10/25/2002	1.000000000	11/03/2003	0.879795044	10/25/2002	1.000000000
11/25/2002	1.000000000	05/03/2004	0.848032582	11/25/2002	1.000000000
12/26/2002	1.000000000	11/01/2004	0.842090185	12/26/2002	1.000000000
01/27/2003	1.000000000	05/02/2005	0.828006480	01/27/2003	1.000000000
02/25/2003	1.000000000	11/01/2005	0.802855926	02/25/2003	1.000000000
03/25/2003	1.000000000	05/01/2006	0.779411009	03/25/2003	1.000000000
04/25/2003	1.000000000	11/01/2006	0.765490993	04/25/2003	1.000000000
05/27/2003	1.000000000	05/01/2007	0.741315885	05/27/2003	1.000000000
06/25/2003	1.000000000	11/01/2007	0.727262321	06/25/2003	1.000000000
07/25/2003	1.000000000	05/01/2008	0.703405342	07/25/2003	1.000000000
08/25/2003	1.000000000	11/03/2008	0.688334902	08/25/2003	1.000000000
09/25/2003	1.000000000	05/01/2009	0.666851735	09/25/2003	1.000000000
10/27/2003	1.000000000	11/02/2009	0.649411651	10/27/2003	1.000000000
11/25/2003	1.000000000	05/03/2010	0.553565235	11/25/2003	1.000000000
12/26/2003	1.000000000	05/02/2011	0.549193396	12/26/2003	1.000000000
01/26/2004	1.000000000	11/01/2011	0.547283434	01/26/2004	1.000000000
02/25/2004	1.000000000	05/01/2012	0.536407142	02/25/2004	1.000000000
03/25/2004	1.000000000	11/01/2012	0.532164653	03/25/2004	1.000000000
04/26/2004	1.000000000	05/01/2013	0.519554296	04/26/2004	1.000000000
05/25/2004	1.000000000	11/01/2013	0.513210004	05/25/2004	1.000000000
06/25/2004	1.000000000	05/01/2014	0.476875086	06/25/2004	1.000000000
07/26/2004	1.000000000	11/03/2014	0.470530794	07/26/2004	1.000000000
08/25/2004	1.000000000	05/01/2015	0.337629792	08/25/2004	1.000000000
09/27/2004	1.000000000	11/02/2015	0.334453148	09/27/2004	1.000000000
10/25/2004	1.000000000	05/02/2016	0.283442307	10/25/2004	1.000000000
11/26/2004	1.000000000	05/01/2017	0.226504300	11/26/2004	1.000000000
12/27/2004	1.000000000	05/01/2018	0.179778780	12/27/2004	1.000000000
01/25/2005	1.000000000	11/01/2018	0.178694329	01/25/2005	1.000000000
02/25/2005	1.000000000	05/01/2019	0.093604338	02/25/2005	1.000000000
03/28/2005	1.000000000	05/01/2020	0.000025267	03/28/2005	1.000000000
04/25/2005	0.333501698	11/02/2020	0.000000000	04/25/2005	1.000000000
05/25/2005	0.252962014			05/25/2005	1.000000000
06/27/2005	0.236002975			06/27/2005	0.808019730
07/25/2005	0.220180092			07/25/2005	0.390121381
08/25/2005	0.205418307			08/25/2005	0.093675531
09/26/2005	0.000000000			09/26/2005	0.074121381

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Relevant Parameters

- Liabilities:
  - Detailed waterfall rules
  - Coverage tests for diversion of interest and principal
  - Deal payment dates and interest rate settings
  - PIK, turbo, equity caps, fees
  - Re-investment period and test-based re-investment
  - Interest rate hedge payments
  - Liability amortization

Modeling: Best (Only?!) Method

- Asset-specific and Waterfall-specific
- Stochastic defaults with Monte Carlo method
- Keep records of ALL payments from ALL assets to ALL tranches
- Programming effort is arduous, painstaking, must maintain simplicity of code

Inclusion of the Waterfall

- Important! Many models simply compute the stochastic asset behavior and then run scenario-based cashflow (waterfall) calculations.

- Presence of OC and IC tests drastically impacts transaction performance with defaults

- For every Monte Carlo assignment of default times, run the waterfall!

Synthetic CDO Waterfall

Payment Date Waterfall	Parameter	Key
Unpaid Admin expenses plus negative Offset Spread	0.01%	1
Reserve Amount: Spreads in excess of 250 bps pa	250	3
Portfolio Management Fee	0.15%	1
Stipulated Fixed Rate Payment (Super Senior)	0.15%	2
Stipulated Fixed Rate Payment (Tranche A)	0.85%	2
Stipulated Fixed Rate Payment (Tranche B)	2.00%	2
Stipulated Fixed Rate Payment (Tranche C)	3.50%	2
Stipulated Fixed Rate Payment (Tranche D)	5.00%	2
Liability: Costs and Expenses for Bank and ACA (pro rat	$1,000,000	4
Liability: Bank Structuring Fee	$3,000,000	4
Reserve Amount to cure O/C Test Failure		5
Liability: ACA Structuring Fee	$1,000,000	4
Subordinated, Unlikely, and Miscellaneous Administrative	0.00%	1
Tranche E Guaranty Premium Account	$0	6
Tranche E Account	$100,000,000	4

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Deal Payment Dates

First date is the Effective Date

Deal Payment Dates		
11/1/2002	1.707%	11/1/2002
2/3/2003	1.350%	1/27/2003
5/1/2003	1.310%	4/24/2003
8/1/2003	1.116%	7/25/2003
11/3/2003	1.163%	10/27/2003
2/2/2004	1.131%	1/26/2004
5/4/2004	1.179%	4/26/2004
8/2/2004	1.694%	7/26/2004
11/1/2004	2.160%	10/25/2004
2/1/2005	2.743%	1/27/2005
5/2/2005	3.210%	4/27/2005
8/1/2005		7/27/2005
11/1/2005		10/27/2005
2/1/2006		1/27/2006
5/1/2006		4/26/2006
8/1/2006		7/27/2006
11/1/2006		10/27/2006
2/1/2007		1/27/2007
5/1/2007		4/26/2007
8/1/2007		7/27/2007
11/1/2007		10/27/2007
2/1/2008		1/27/2008
5/1/2008		4/26/2008
8/1/2008		7/27/2008
11/3/2008		10/29/2008
2/2/2009		1/28/2009
5/1/2009		4/26/2009
8/3/2009		7/29/2009
11/2/2009		10/28/2009
2/1/2010		1/27/2010
5/3/2010		4/28/2010
8/2/2010		7/28/2010
11/1/2010		10/27/2010
2/1/2011		1/27/2011
5/2/2011		4/27/2011
8/1/2011		7/27/2011
11/1/2011		10/27/2011
2/1/2012		1/27/2012
5/1/2012		4/26/2012
8/1/2012		7/27/2012

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ABS CDO Waterfall

Payment Date Waterfall	Parameter	Key	Notional Amount
Trustee, Pref Share Paying Agent, Administrator, Taxes,	$135,000	6	$0
Senior Collateral Management Fee (0.23% pa) and Struct	0.25%	1	$725,000,000
Class A-1S Interest and A-1SW Insurance Premium	0.62%	21	$471,500,000
Class A-1J Interest	0.90%	21	$108,000,000
Class A-2 Interest	1.50%	21	$51,000,000
Classes A-1 & A-2 Principal (if a Senior Coverage Test fai	50,403	51	$0
Class A-3 Interest	2.25%	21	$36,000,000
Classes A-1, A-2, & A-3 Principal (if a Class A-3 Coverag	7,050,403	52	$0
Class B-V Interest	4.50%	21	$15,000,000
Class B-F Interest	5.0%	2	$7,000,000
Classes A-1, A-2, A-3, B-V, & B-F Principal (if a Class B	0	53	$0
Class C Interest	11.5%	2	$3,000,000
Classes A-1, A-2, A-3, B-V, B-F, & C Principal (if a Class	0	54	$0
Reinvest in Assets (if the Additional Coverage Test fails)	4	50	$0
Subordinated Collateral Management and Structuring Age	0.20%	1	$725,000,000
Preference Share (capped at 16% of dividend yield)	17.9%	24	$29,875,000
Turbo down the Class C (pro rata turbo of C, B-V, and Eq	12.12	43	$0
Turbo down the Class B-V (pro rata turbo of C, B-V, and E	9.68	43	$0
Remaining Proceeds to the Preference Shares	$100,000,000	4	$0

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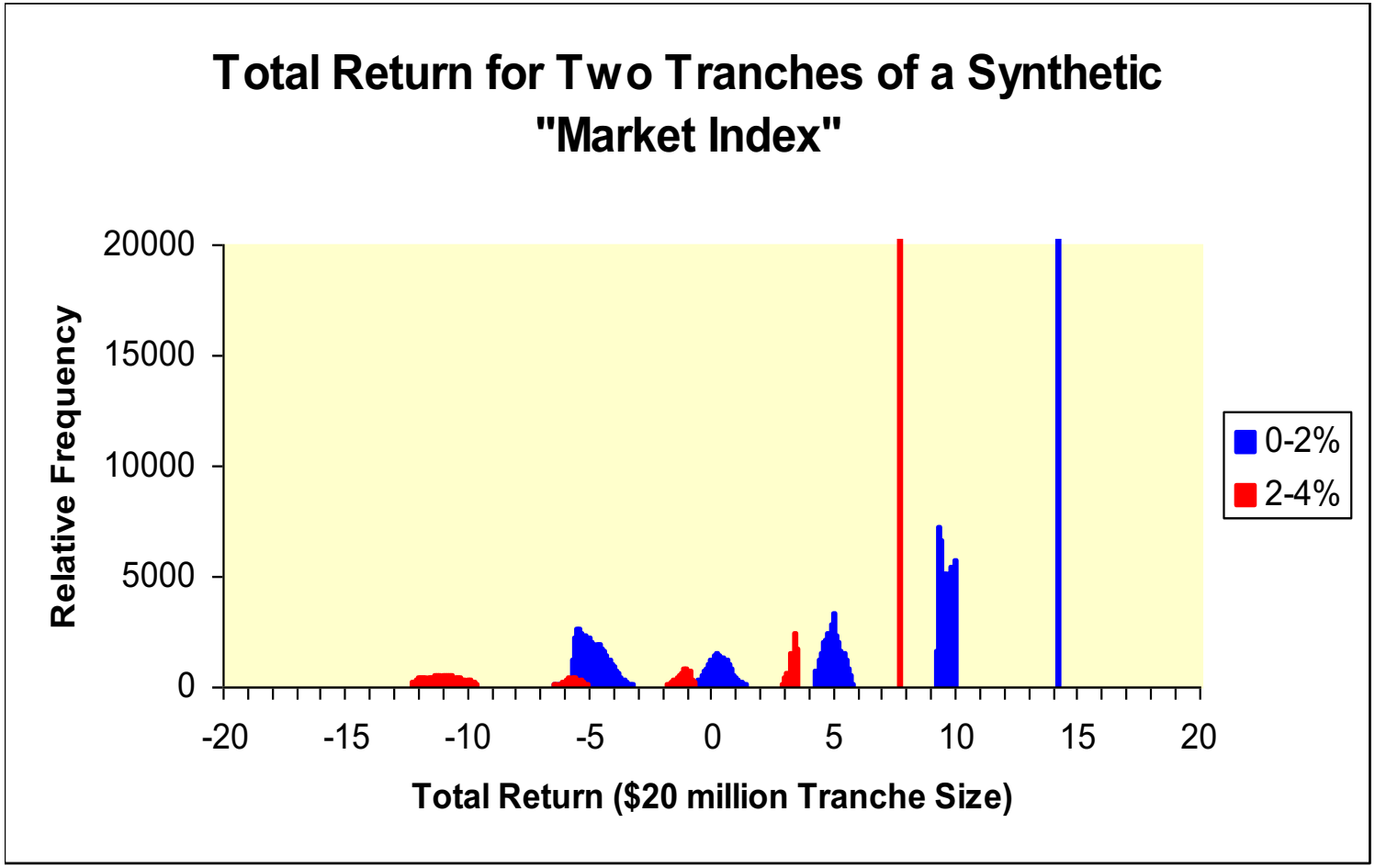
“Market Index” Single Tranche



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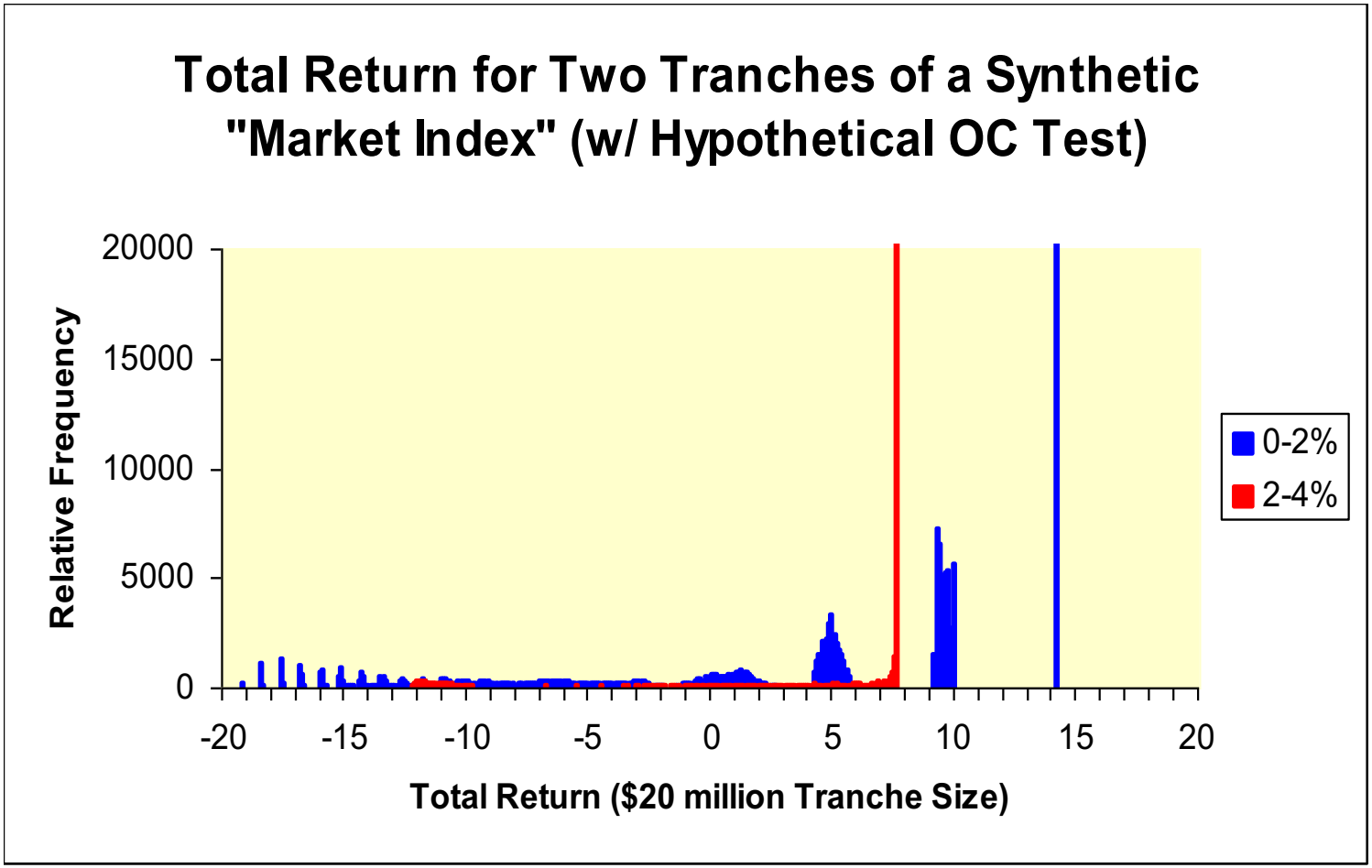
Single Tranche w/ OC Test !



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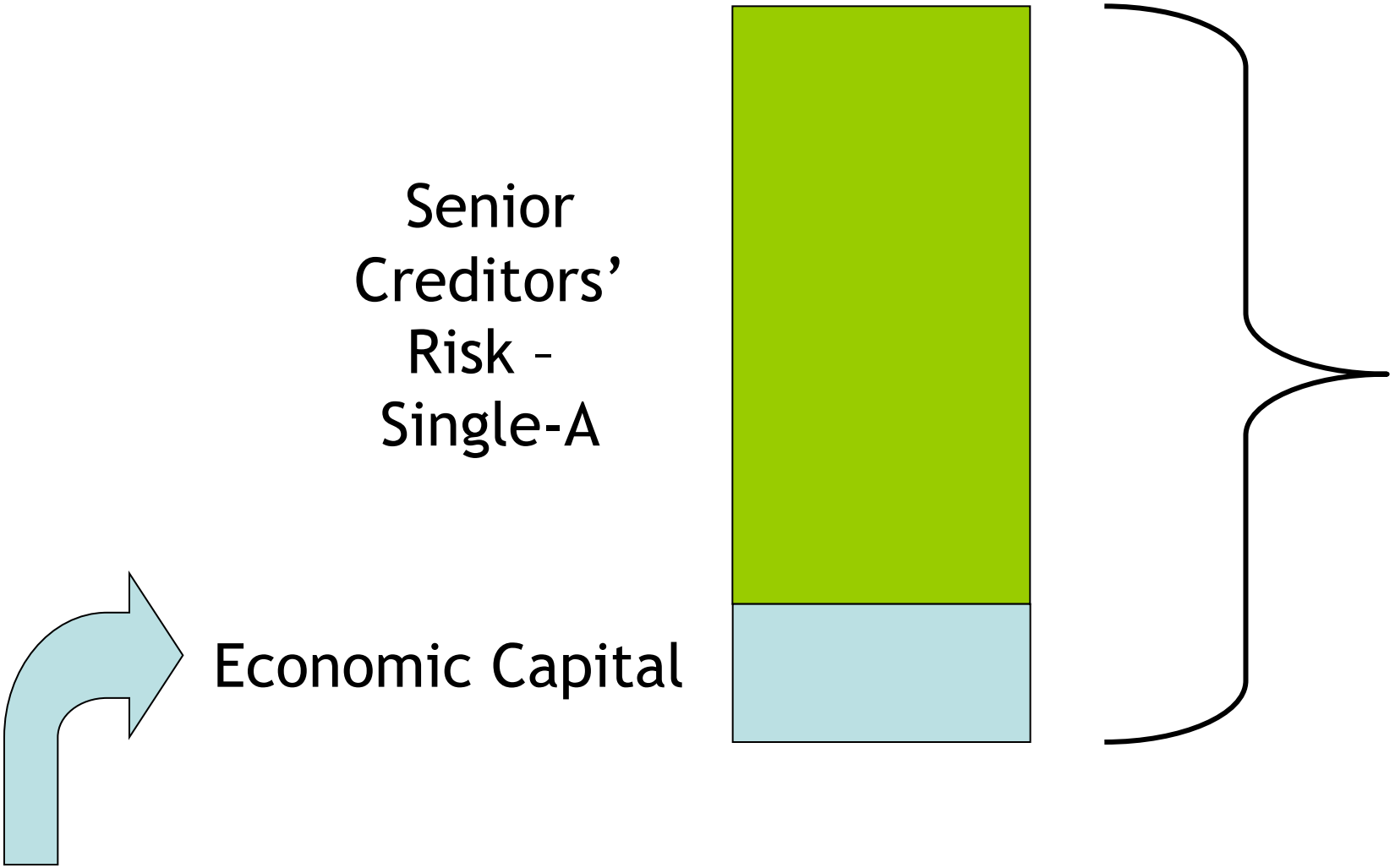
Model Assumptions and Blindspots

- Re-investment (spread? Default assumption?)
- Asset amortization (ABS and leveraged loans are variable)
- Asset recovery (don't assume away the risk)
- Asset default likelihood (don't rely on scenarios)
- Option to terminate early
- Correlation!
- Be cautious on pricing …

Aggregating Risk Across a Portfolio

- Portfolio may be the investments and risk positions of an entire firm or, on a smaller scale, a business unit
- Consider this firm or business unit to be a portfolio of assets
- With a CDO analogy, how thick must the equity tranche be to give the remaining debt tranche a desired credit quality?
- Economic capital of the firm or business unit

CDO Analogy



Equity "must" pay at least the target return (Cost of Capital)

Multiple Transaction Modeling

- Read all asset portfolios and “merge” them to identify overlap exposures
- Generate default times (Monte Carlo) for each risk
- Run individual waterfalls for each deal
- Repeat steps 2 and 3 “many” times to generate a probability density function (histogram) of outcomes

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Shareholder Value

SV = Expected Income – Economic Capital * Cost of Capital

Investment risks (ie, default losses) and returns reflected here

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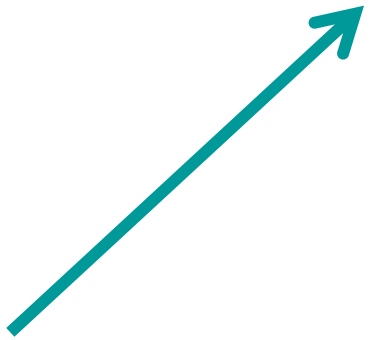
Shareholder Value

SV = Expected Income – Economic Capital * Cost of Capital



Fully includes all risks and diversification benefits (ie, correlations) as well as investment returns

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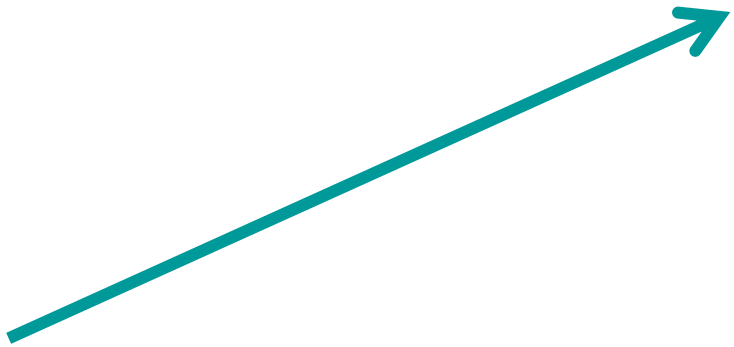
Shareholder Value

SV = Expected Income – Economic Capital * Cost of Capital



Prescribed by senior management as the target return for equity investors

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Evaluate a New Transaction

- New trade can be an entire deal, a single exposure, or a single-name hedge for portfolio management

- Results depend on credit ratings, default probabilities, and correlation assumptions

SV = Expected Income – Economic Capital * Cost of Capital

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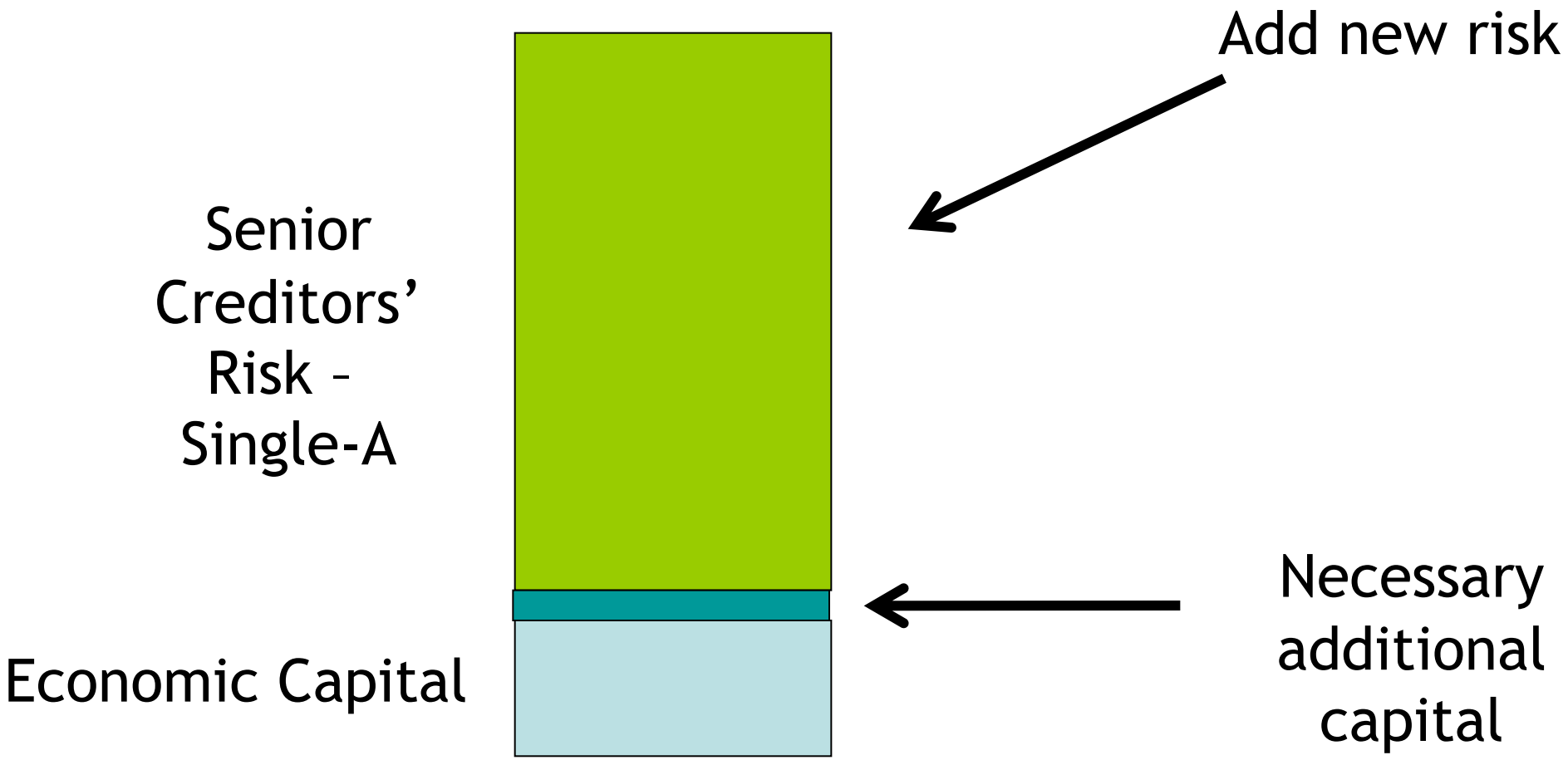
Evaluate a New Transaction

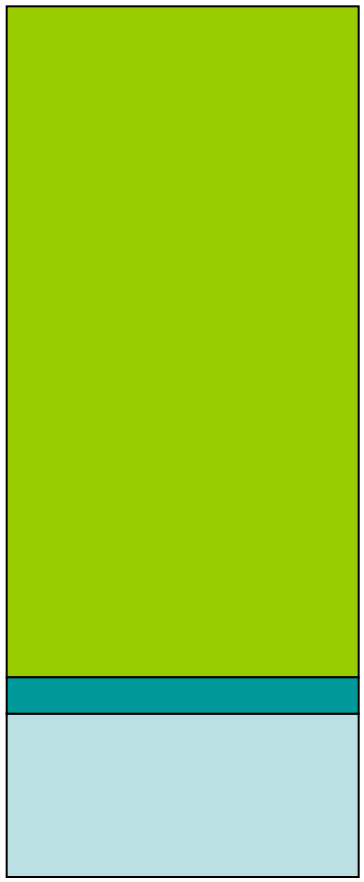


SV = Expected Income – Economic Capital * Cost of Capital

Evaluate a New Transaction

Add new risk

Senior Creditors' Risk – Single-A



Economic Capital

Does SV increase or decrease?

Δ SV = Δ Expected Income – Δ Economic Capital * Cost of Capital

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Evaluate Single-Name Exposure

- For each obligor, can determine the impact to firm-wide capital of "erasing" its default
- This (small) impact is the "marginal capital" for the obligor
- Marginal capital is a superior measure of single-name exposure since it fully incorporates credit quality, position size, and CDO subordination
- Firm-wide Single-Risk limits

Summary

- Capturing relevant parameters for CDO transactions
- Model assumptions and blindspots
- Aggregating risk across a portfolio of investments