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Paramount Role of Technology and Mathematical Modeling in Financial Risk Management

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Outline

- Life in Finance
- Real Challenges
- Human Challenges
- Technology Choices and Issues

Life in Finance

- What is it ?
  - Distinct from business
  - Corporate/municipal/structured investment banking
  - Asset management (investment)
- What's the culture ?
  - Smart people beat the market
  - Not much deep thought
- What's the challenge ?
  - Many challenges!
  - Not what one might think ….

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Real Challenges

- Investment decision
- Modeling risk-return across an entire firm
- Enterprise Risk Management (ERM) and QEM extension
- Data and Organization

What makes “good investments” good?

- Simple example: should I buy a 5-year, double-B bond that yields L+200?
- Reject the answer “it depends on whether the bond defaults”
- What does market efficiency mean?
- Do bonds default in a random manner? Or should we have been able to choose bonds that would not default?

One Answer

- Bonds default randomly but with different probabilities that are ideally known *a priori*
- The investor calculates the capital required to own the bond
- The yield of the bond must give an adequate return on capital
- The capital depends strongly on the investor's current portfolio
- Different investors will compute different capital requirements

Interesting Observations

- Instead of calculating capital, the investor can use rating agency or regulatory capital, but …
- This is a hard problem! The investor must "know" his or her entire portfolio!
- Senior management choices (firm credit quality, target return for the shareholders) are critically important
- Consideration of CDOs or other structured finance investments further adds to the challenge

Risk-Return Measures

- Determine the “Economic Capital” for a risky portfolio as the amount of cash that gives a desired credit strength for lenders to the firm (VAR or “ELVAR” methodologies)
- Determine “Shareholder Value” for the portfolio as the net expected return minus the product of the Economic Capital and the “Cost of Capital”
- Requires extensive modeling and data capability

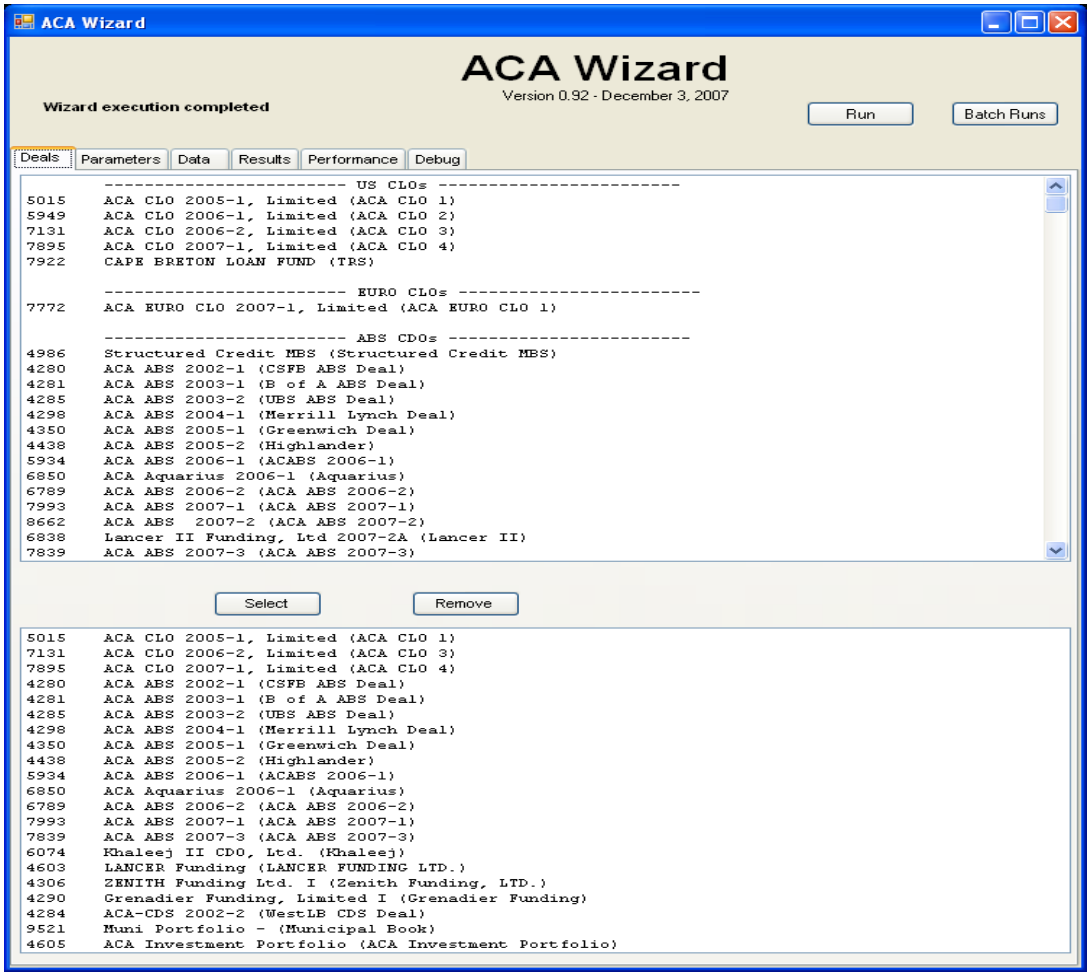
Risk-Return Measures

- Also known as “Economic Value Added”, “EVA”, “Shareholder Value Added”, “SVA”

- Senior management determines both the desired credit strength and the Cost of Capital (which is a target return for firm equity investors)

Data and Organization

This table is for illustrative purposes only



List of Firm-Wide Risk Portfolios

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Data and Organization

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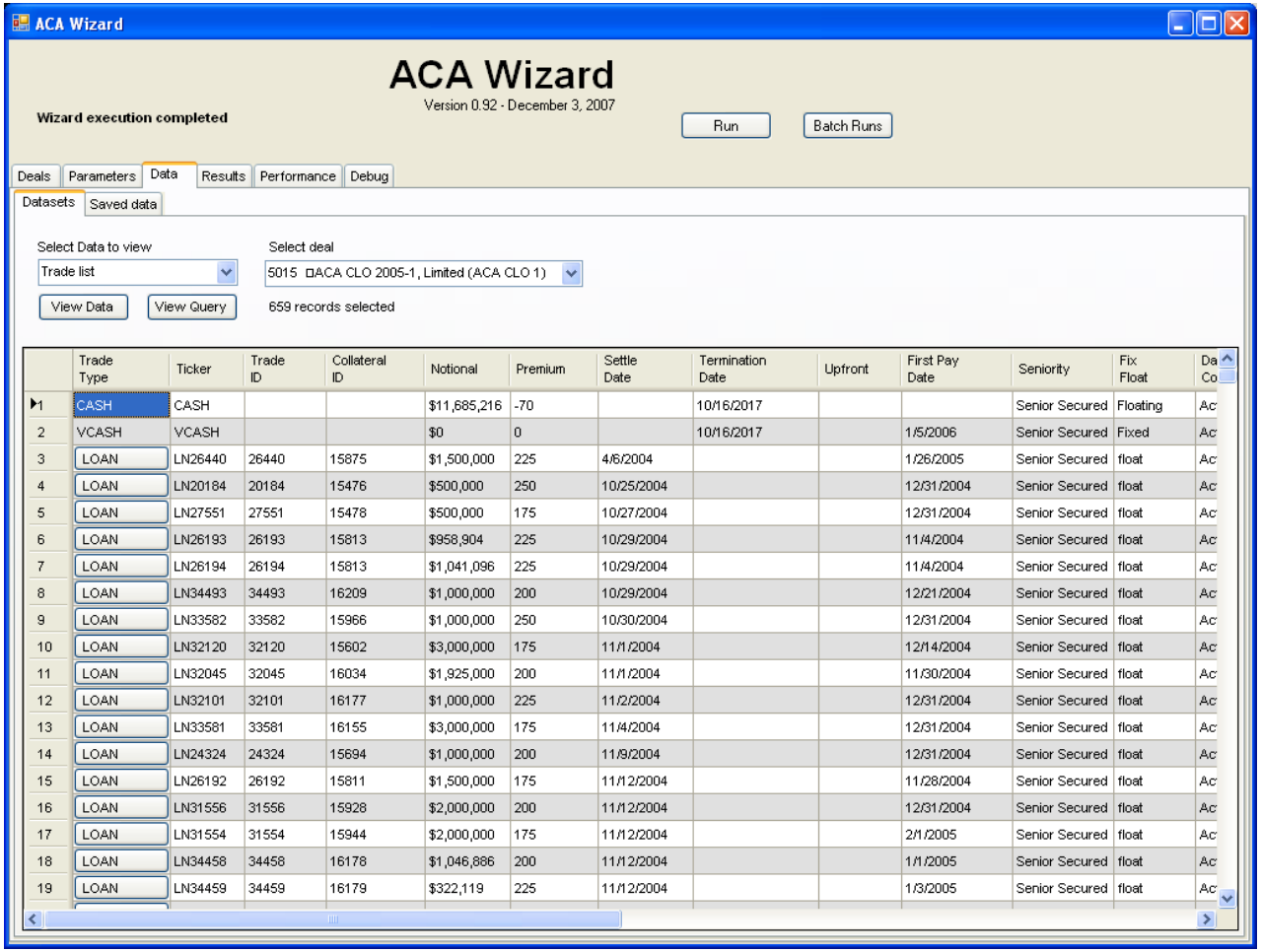
Positions Within a Portfolio



	Trade Type	Ticker	Trade ID	Collateral ID	Notional	Premium	Settle Date	Termination Date	Upfront	First Pay Date	Seniority	Fix Float	Da Co
1	CASH	CASH			$11,685,216	-70		10/16/2017			Senior Secured	Floating	Ac
2	VCASH	VCASH			$0	0		10/16/2017		1/5/2006	Senior Secured	Fixed	Ac
3	LOAN	LN26440	26440	15875	$1,500,000	225	4/6/2004			1/26/2005	Senior Secured	float	Ac
4	LOAN	LN20184	20184	15476	$500,000	250	10/25/2004			12/31/2004	Senior Secured	float	Ac
5	LOAN	LN27551	27551	15478	$500,000	175	10/27/2004			12/31/2004	Senior Secured	float	Ac
6	LOAN	LN26193	26193	15813	$958,904	225	10/29/2004			11/4/2004	Senior Secured	float	Ac
7	LOAN	LN26194	26194	15813	$1,041,096	225	10/29/2004			11/4/2004	Senior Secured	float	Ac
8	LOAN	LN34493	34493	16209	$1,000,000	200	10/29/2004			12/21/2004	Senior Secured	float	Ac
9	LOAN	LN33582	33582	15966	$1,000,000	250	10/30/2004			12/31/2004	Senior Secured	float	Ac
10	LOAN	LN32120	32120	15602	$3,000,000	175	11/1/2004			12/14/2004	Senior Secured	float	Ac
11	LOAN	LN32045	32045	16034	$1,925,000	200	11/1/2004			11/30/2004	Senior Secured	float	Ac
12	LOAN	LN32101	32101	16177	$1,000,000	225	11/2/2004			12/31/2004	Senior Secured	float	Ac
13	LOAN	LN33581	33581	16155	$3,000,000	175	11/4/2004			12/31/2004	Senior Secured	float	Ac
14	LOAN	LN24324	24324	15694	$1,000,000	200	11/9/2004			12/31/2004	Senior Secured	float	Ac
15	LOAN	LN26192	26192	15811	$1,500,000	175	11/12/2004			11/28/2004	Senior Secured	float	Ac
16	LOAN	LN31556	31556	15928	$2,000,000	200	11/12/2004			12/31/2004	Senior Secured	float	Ac
17	LOAN	LN31554	31554	15944	$2,000,000	175	11/12/2004			2/1/2005	Senior Secured	float	Ac
18	LOAN	LN34458	34458	16178	$1,046,886	200	11/12/2004			1/1/2005	Senior Secured	float	Ac
19	LOAN	LN34459	34459	16179	$322,119	225	11/12/2004			1/3/2005	Senior Secured	float	Ac

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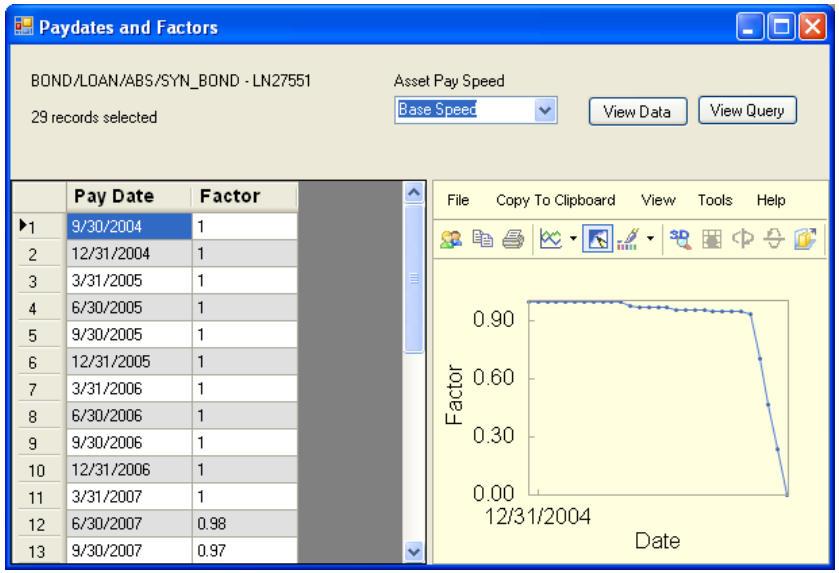
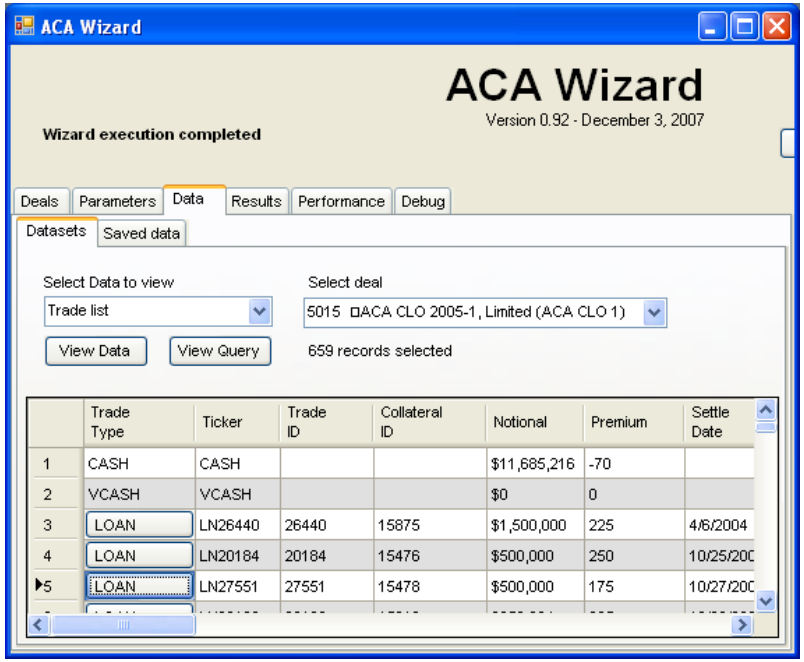
Data and Organization

Additional layer/dimension to data





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Data and Organization

- Data drives the financial world … nothing else matters as much
- Critical to have high-quality data relevant to all risk positions
- How to measure quality of data ?
- Information Technology – applied correctly – is the first requirement
- Role of mathematical modeling

Risk Management

- Data must be immediately accessible and trustworthy
- Sophisticated mathematical modeling tells you what the data means (sounds simple, but that's it)
- Modeling is also the best test for data quality
- Communication of risk issues across the firm
- Benefits that you wouldn't have considered …

Human Challenges

- Financial firms have many people who speak diverse “languages”
- There may not be a common consensus that data dominates
- Should there be separation between Risk and Business ?
- Who is responsible for data ?

Human Challenges

- Who is responsible for data ?
- IT must report to the person/role responsible for data
- What does responsibility for data mean ?
- The need to “evangelize” for data
  - Where a firm needs its best people
  - Will fail without leadership
  - One area in which “multi-skilled” people are necessary
  - Engineering and sciences are the best backgrounds

Technology Choices and Issues

- Microsoft Excel
  - Amazingly versatile tool
  - Convenient user interface …. Sometimes too convenient!
  - Bridges a gap between “people of different languages”
  - Ultimately not for production, but you’d be surprised
- Microsoft .Net
  - Choice of my firm
  - Performance, user interface, database interaction, scalable!
  - Even parallel processing for Monte Carlo simulations

Technology Choices and Issues

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 fa	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 E	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 Clas	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 Ec	12.12	43	$0
Turbo down the Class B-V (pro rata turbo of C, B-V, and	9.68	43	$0
Remaining Proceeds to the Preference Shares	$100,000,000	4	$0

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- CDO Waterfall Representation
  - Old Excel version
  - Now in SQL server accessible with .Net web application
  - Two dimensions expanded to many dimensions!
  - Good rule of “develop in spreadsheet”

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Technology Choices and Issues

- Creative destruction is the right idea, but …
  - Legacy systems
  - “Loyalty” to a system
  - Why is change so hard?

- When healthy
  - Always building
  - Developers learning and moving up or across

Summary

- Life in Finance
- Real Challenges
- Human Challenges
- Technology Choices and Issues