Risk Management

The Art and Science of Financial Modeling

Part 1
Tuesday, July 20, 2021
12:25 pm-1:40 pm

Part 2
Tuesday, July 20, 2021
2:10 pm-3:00 pm

SOCIETY OF FINANCIAL EXAMINERS

INS Companies:
Richard Foster, Financial Regulation Manager
Cheryl Plozizka, Financial Regulation Senior Manager
Kelly Willison, Financial Senior Manager

Rutter Associates, LLC:
Bob Selvaggio, Ph.D.

RUTTER ASSOCIATES LLC

Session Agenda

Part 1

- What is financial risk?
- What is Financial Risk Management
- Key Financial Risks and Key Metrics

Part 2

- Models for Risk and Valuation
- Questions

Session Presenters

Richard Foster
Financial Regulation
Manager

Cheryl Plozizka
Financial Regulation
Senior Manager

Bob Selvaggio, Ph.D.
Co-Owner and President
Head of Analytics
Rutter Associates, LLC

Kelly Willison
Financial Senior
Manager

Session 2

Models for Risk And Valuation

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All models are wrong

but some are useful

George E.P. Box

Models for Risk Valuation

A model is a framework, a simplified version of reality that allows us to understand (if the model is a good one) how a given system "works". Milton Friedman wrote in Essays in Positive Economics that:

The relevant question to ask about the assumptions of a theory is not whether they are descriptively realistic, for they never are, but whether they are sufficiently good approximation for the purpose in hand. And this question can be answered only by seeing whether the theory works, which means whether it yields sufficiently accurate predictions.

For our purposes, we can substitute "model" for "theory"

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Models for Risk and Valuation

All financial assets require models for risk assessment; Level 2 and Level 3 Assets and Derivatives also require models for valuation.

Level 1

Financial instruments are traded in active markets for identical assets or liabilities that the entity can access for market quotes at the measurement date. Examples include high-liquidity government bonds and derivatives (e.g., futures and listed options), equity and cash products traded on high-liquidity exchanges.

Level 2

Financial instruments are valued with valuation techniques (i.e., models) where all significant inputs into the valuation are based on observable market data, or where the fair value can be determined by reference to similar instruments trading in active markets. Examples include municipal bonds, IG corporates, Agencies and Sovereigns, interest rate swaps.

Level 3

Financial instruments are those that require valuation models with inputs that are not based on observable market data, i.e., inputs that themselves are model based. Examples include high-yield bonds, leverage loans, private-label securities and mortgage loans that rely on credit models and/or prepay models for inputs, private equity shares, complex derivatives such as basket derivatives requiring correlation models, CLOs and CDOs.

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Models for Risk and Valuation

Let's discuss two of the prominent Level 3 investment asset types we are encountering in the insurance industry at the moment, discuss how these are used in product risk assessment and how we model them, and then cover what needs to be done to make as sure as possible that insurer models "yield sufficiently accurate predictions".

We have found that some very sophisticated insurance institutions do not perform adequate model risk diligence and mitigation.

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CLOs and Combo Notes

A Combo Note (or "Secured Note") is comprised of equity and selected debt tranches of a unique leveraged loan Collateralized Loan Obligation (or CLO), repackaged into a single security. Some of the individual tranches are below investment grade, and some above, and the specific tranches and par amounts of each are combined to achieve an investment grade rating for the Combo Note.

The risk profiles of the Combo Notes my staff and I have been hired to analyze are generally more favorable than those of equivalently rated tranches of the underlying CLOs, however this result is not universal.

Source: loan_1548841052.jpg (1280×851) (wp.com)

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CLOs and Combo Notes

A "typical" Leveraged Loan:

- Senior secured corporate loan to a high yield company
- Ranks ahead in capital structure of the company's unsecured high yield bonds
- Non-investment (i.e., "junk") grade
- Floating-rate debt instrument issued at a spread over LIBOR (LET's DISCUSS)
- Syndicated to multiple lenders in a manner similar to a bond offering

Source: loan_1548841052.jpg (1280×851) (wp.com)

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CLOs and Combo Notes

Leveraged Loan CLO:

- Issuer repackages a diversified pool of leveraged loans into a reference collateral portfolio.
- Principal and interest proceeds of the collateral portfolio are subsequently sold to investors in the form of debt securities (tranches) with various levels of senior claim on this collateral.
- The typical pool of loans is comprised of 150-300 issuers from upwards of 20 different industries (there are thousands of issuers of leveraged loans worldwide).
- A first-loss equity tranche holds a claim on excess cash flows after obligations on each debt tranche have been met.
- The issued tranches receive payments via a waterfall that pours cash flows from the underlying collateral pool beginning at the top of the CLO capital structure (the most senior tranches) and then flowing down to the mezzanine tranches and finally to the bottom of the capital structure (junior and then equity tranches).
- The cash flows from the underlying collateral pool are at risk to high default rates and low recoveries especially as the CLO comes to the end of its reinvestment period.

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Models for Risk and Valuation:

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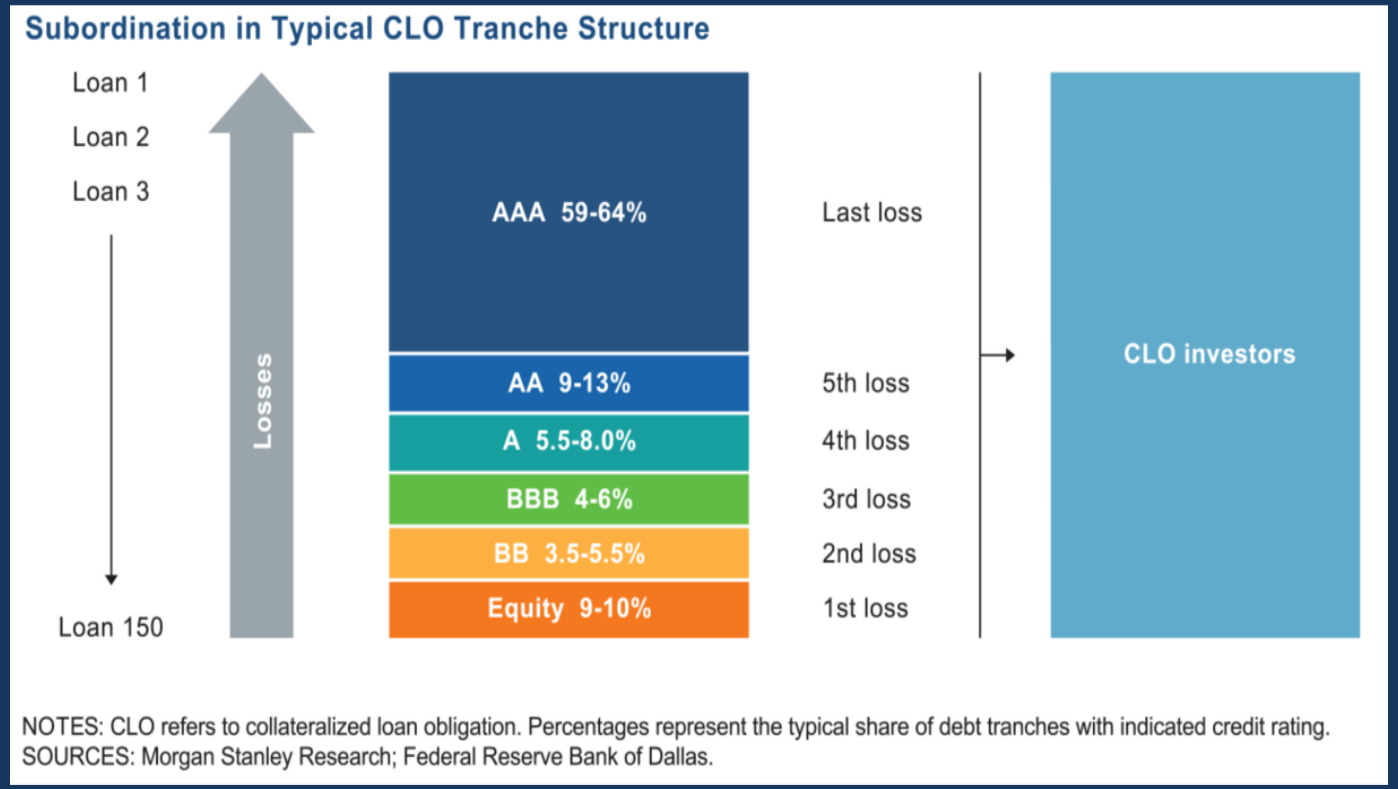

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CLOs and Combo Notes

Analytics Required to Analyze a Combo Note

- Models for default probabilities and recovery rates of each leveraged loan in the collateral pool and a simulation engine to drive scenarios.
- Model for default correlation among loans in the collateral pool.
- Model or assumptions about loan prepayments.
- Model of cash flow "waterfall" for CLO structure that simulates cash flows for each CLO tranche from senior (AAA) to equity (unrated). Aggregate cash flow depends on loan spreads and loan performance. There are a number of "rules of the game" for CLOs that can lead to diversion of cash flows among tranches including overcollateralization tests and interest coverage tests. These need to be modeled properly.
- Model to aggregate cash flows from tranches selected for Combo Note into a single security.

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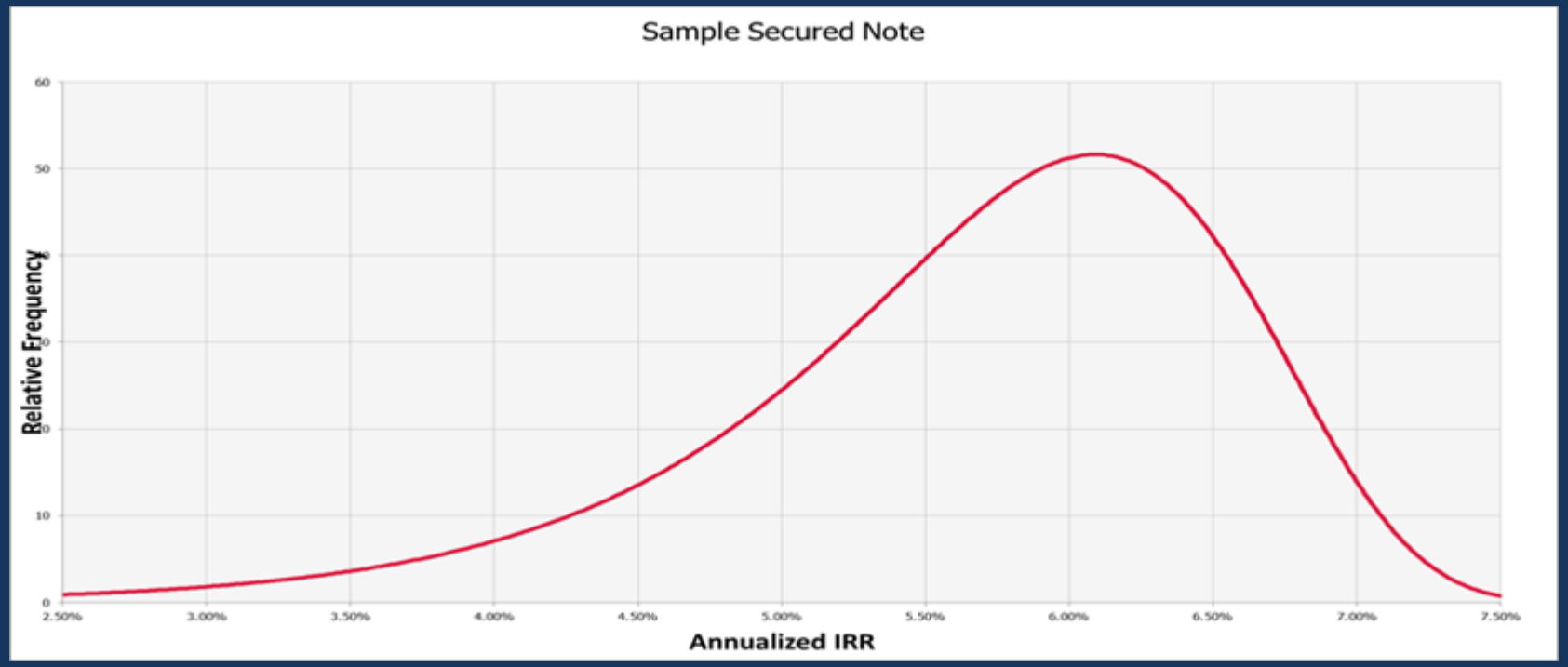
Models for Risk and Valuation:

The Valuation and Risk Assessment of CLOs and Combo Notes



Combo Note	Sharpe Ratio	Sortino Ratio	Mean IRR
	4.016	3.264	5.72

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CRE Loans and CMBS

- Regulatory Capital Constraints disadvantage banks in this space.
- Life Insurers looking for longer-term assets with stable cash flows favor commercial mortgage loans. On average these account for about 10% of insurers' investment portfolios.
- We look for low LTV (circa 60%) and high DSCRs (NOI/Annual Debt Service – generally 1.5 and above).
- We look for an explanation of the CRE sectors that are relatively more/less attractive especially in the pandemic and post-pandemic environment.

Source: assessment-1024x819.jpg (1024×819) (ohio-dip.com)

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CRE Loans and CMBS

- We look for the use of systems such as Moody's Commercial Mortgage Metrics that use econometric methods to simulate forward looking LTVs and DSCRs and generate expected and unexpected (i.e., tail) loss estimates on the individual loan and portfolio levels, e.g.,:

> Our framework first models the CRE collateral's stochastic process, as driven by both market-wide and idiosyncratic factors. We then apply a Monte Carlo technique to simulate the future paths of the collateral's net operating income (NOI) and market value. A CRE loan's credit event is double-triggered by the collateral's financial condition at the time of default: both the sustainable NOI falls below the total debt service, and the property's market value falls below the total outstanding loan balance.

- Some companies build their own in-house models.
- Important to gauge OVERCONCENTRATIONS in this asset class.
- Extension to CMBS requires a *cash flow* engine.

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Models for Risk and Valuation:

The Valuation and Risk Assessment of CRE Loans and CMBS

From NAIC:

In recent years, more sophisticated analytical tools have been developed. These take the form of probabilistic computer simulations of commercial mortgage performance under a variety of different scenarios. The scenarios may be externally specified, or user-generated but specify probabilistic distributions of growth rates in NOI and value of the property, which are applied to the NOI and value of the subject property over the life of the commercial mortgage loan. Depending on the scenario specified, the projected performance of the income and value of the property may be better or worse than that assumed in the DCF analysis.

At each point in time over the anticipated life of the loan, using multiple (1,000+) random draws from the specified distribution of growth rates, distributions of DCR and LTV are calculated. Each set of DCR and LTV is fed into an empirically derived econometric equation that generates:

- Probability of default (PD), a percentage from 0% to 100% that measures how likely there will be a credit event.
- Loss given default (LGD) if a credit event should occur, what percentage of the value of the loan will be lost, given that LTV
- Exposure at default (EAD), the outstanding loan balance.
- Expected loss (EL), multiply PD (%) x LGD (%) x EAD ($), to summarize, expressed either in dollars, or in basis points of the loan. When expressed as basis points of the loan, it may be converted to an annualized percentage measure and considered yield degradation (YD) of the expected return of the loan.

When multiple draws are performed, a statistical distribution of each of these measures at each point in the life of the loan and at maturity is developed. This includes both the mean of each measure (the expected value) and the standard deviation (the variability). It should also be noted that Debt Service Coverage (DSC) and LTV can substitute for each other in certain circumstances. For instance, a temporary decline in NOI may be compensated for by a conservative LTV such that a default does not necessarily occur when DSC drops below 1. However, value is ultimately a result of income generation, and an extended decline may be unrecoverable.

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Models for Risk and Valuation:

Making Sure They are Useful, Not Harmful

Too many financial institutions pay scant attention to model risk. Every model used should be well-documented and validated.

At a minimum, documentation should include:

- The theoretical framework of the model, frameworks of other competing models and the rationale for model choice;
- The assumptions underlying the model;
- The business purpose (e.g., CVaR? VaR? Valuation? Economic Capital?);
- Estimation/calculation methodologies (e.g., econometric diagnostics).

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Models for Risk and Valuation:

Making Sure They are Useful, Not Harmful

Proper Validation provides effective challenge. It ensures that the choice of the model and implementation are sound and identifies the impacts of potential model limitations. The process (conducted by qualified independent internal or external personnel) includes:

- Assessment of reasonableness of key model assumptions for the tasks at hand
- Assessment of reasonableness of model outputs given varying inputs
- Review of outputs from competing vendor-driven or internal models if available
- Assessment of competency of staff writing and running the models (knowledge, training, usage)
- Assessment of appropriateness of the interpretation and reporting of output data (i.e., turning those data into information).

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Models for Risk and Valuation:

Making Sure They are Useful, Not Harmful

For example, in reviewing the CLO and Combo-Note investments of insurers we hope to see (but rarely do) model documentation and validation studies covering the engineering of the waterfall structure, the stochastic processes of loan default and recovery simulations, portfolio default correlation assumptions or calculations, tranche-level correlation assumptions, discount rates used for valuation, stress scenarios run for risk analysis, etc.

Note:

OTC Derivative dealers ***explicitly recognize*** Model Risk and ***charge for it***. For example, given uncertain inputs to Level 3 derivative valuation, they will use an input value that biases the cost of the derivative in a manner that protects them against "being wrong" with 95% confidence.

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3rd Code 488

Presenter Contacts

Richard Foster
Financial Regulation Manager
The INS Companies
Mobile: 308.430.5377
Email: rfoster@theinscompanies.com
Visit: www.theinscompanies.com

Robert D. Selvaggio, Ph.D.
Co-Owner and President
Head of Analytics
Rutter Associates, LLC
Mobile: 914.500.5373
Email: rselvaggio@rutterassociates.com
Visit: https://www.rutterassociates.com/

Cheryl Plozizka
Financial Regulation Senior Manager
The INS Companies
Mobile: 704.640.4776
Email: cploziska@insris.com
Visit: www.theinscompanies.com

Kelly Willison
Financial Regulation Senior Manager
The INS Companies
Mobile: 917.535.3378
Email: kwillison@insris.com
Visit: www.theinscompanies.com

Questions