TD Bank Financial Group

Risk Management at a Leading Canadian Bank
An Actuarial Science Graduate's View

Yu Zhou
Quantitative Analytics, Group Risk Management
TD Bank Financial Group

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Motivations

- "Actuaries might have been the most quantitative people in the financial industry for a long time. However this unique position has been severely challenged since about a decade or two ago when the investment banks began to hire so-called "rocket scientists" – people with Ph.D. degree in physics and other quantitative fields…"
- "As the insurance and banking businesses converge it is hard to imagine that traditional approaches to risk measurement – like actuaries work on the insurance side and quants work on the banking side – can still be applied in isolation…"
- "Many problems in practice might need combined skills in actuarial science and financial engineering to solve…"

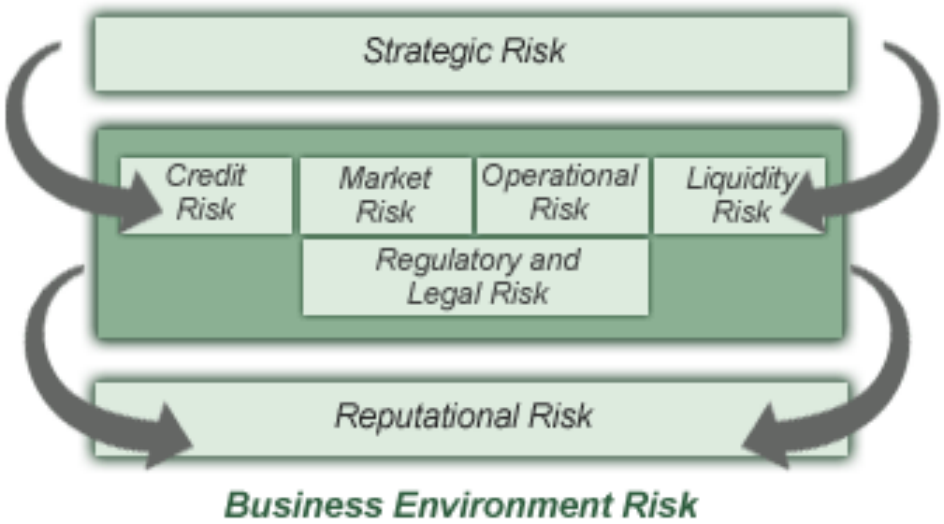
- by David X. Li

Objectives

- To review a leading Canadian Bank's Enterprise Risk Management (ERM) framework
- To provide an overview of the following Risk Management:
  - Market Risk
  - Credit Risk
  - Operational Risk
- To introduce Credit Derivatives
- To review Tranched Portfolio Credit Products
  - Credit Default Swaps (CDS)
  - Credit Derivatives Indices
  - Nth to Default Baskets
  - Collateralized Debt Obligations (CDOs)
  - Single Tranche Trading
  - CDO of CDOs (CDO Squareds)

Goals of Risk Management

- The primary goal of Risk Management is to support the Bank's goal to earn satisfactory returns from our various business activities within an acceptable level of risk. *



*TD Bank Financial Group Annual Report 2004

Enterprise Risk Management – The Framework

Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives. *(COSO* Enterprise Risk Management – Integrated Framework)*

Strategic Risk

Credit Risk | **Market Risk** | **Liquidity Risk** | **Operational Risk** | **Regulatory & Legal Risk**

Reputational Risk

*COSO – Committee of Sponsoring Organizations of the Treadway Commission

Risk Management

- The Risk Management function contributes to the Bank successfully achieving its business and strategic objectives by providing oversight and enabling the businesses and corporate support functions to effectively manage their risk exposures to an acceptable level.

- Risk Management Division is organized around three key risk categories within the Enterprise Risk Management Framework:
  - Market Risk
  - Credit Risk
  - Operational Risk

Market Risk

Market risk is the potential for loss from changes in the value of financial instruments. The value of a financial instrument can be affected by changes in:

- Interest rates;
- Foreign exchange rates;
- Equity and commodity prices;
- Credit spreads.

Market Risk in Trading Activities

The four main trading activities that expose us to market risk are:

- *Market-making.* We provide markets for a large number of securities and other traded products. We keep an inventory of these securities to buy from and sell to investors, profiting from the spread between bid and ask prices. Profitability is driven by trading volumes.
- *Sales.* We provide a wide variety of financial products to meet the needs of our clients, earning money on these products from mark ups and commissions. Profitability is driven by sales volumes.
- *Arbitrage.* We take positions in certain markets or products and offset the risk in other markets or products. Our knowledge of various markets and products and how they relate to one another allows us to identify and benefit from pricing anomalies.
- *Positioning.* We aim to make profits by taking positions in certain financial markets in anticipation of changes in those markets. This is the riskiest of our trading activities and we use it selectively.

How We Manage Market Risk in Trading Activities

- Trading Limits on **key measurements of market risk:**
  - Notional limits
  - Credit Spread limits
  - Yield Curve shift limits
  - Loss exposure limits
  - Stop-loss limits
  - For options and exotic products, impacts of volatilities, correlations, time-decay
- Value at Risk (VaR)
- Stress Testing

How We Manage Market Risk in Trading Activities

- Value-at-Risk (VaR)

  A value-at-risk (VaR) calculation is aimed at making a statement of the form "We are *X* percent certain that we will not lose more than *V* dollars in the next *N* days." The variable *V* is the VaR, *X* is the confidence level, and *N* is the time horizon.[1]

- Stress Testing: A formalized "what if" analysis that...

  Stress testing involves estimating how the portfolio would have performed under some of the most extreme market moves seen in the last 10 to 20 years. It can be considered as a way of taking into account extreme events that do occur from time to time but that are virtually impossible according to the probability distributions assumed for market variables.[1]

Credit Risk

Credit risk is the potential for financial loss if a borrower or counterparty in a transaction fails to meet its obligations.

How We Manage Credit Risk

- Setting guidelines to limit portfolio concentrations of credit exposure by country, industry and affiliated group.
- Approving the discretionary limits for officers throughout the Bank for extending lines of credit.
- Setting standards for measuring credit exposure.
- Approving the **"scoring"** techniques used in extending personal credit.
- Approving all policies relating to all Bank products that entail credit risk.
- Setting criteria for rating risk on business accounts, based on a **21-category rating system.**

Operational Risk

Operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

How We Manage Operational Risk

- Establishing the Bank's Operational Risk Framework.
- Consulting with the regulators on implementation and examination issues relating to Operational Risk.
- Designing and developing the components of the Bank's Operational Risk Framework, including: operational risk policy, identification and assessment process and standards for reporting.
- Working with the Business Units and Corporate Groups in a federal model to implement and continuously improve operational risk management including compliance and fraud.
- Oversight of Basel II Program for the Bank.

Basel II Program

Enterprise Credit and Operational Risk Overview

Basel project deliverables will fundamentally change the way the Bank manages and reports risk and capital.

Deliverables:

- Qualify for Advanced Internal Risk Based (AIRB) for Credit Risk and Standard Approach (SA) and working towards Advanced Measurement Approach (AMA) for Operational Risk.
- Credit Risk Projects
- Operational Risk Projects
- Internal Capital Assessment Projects

Credit Derivatives

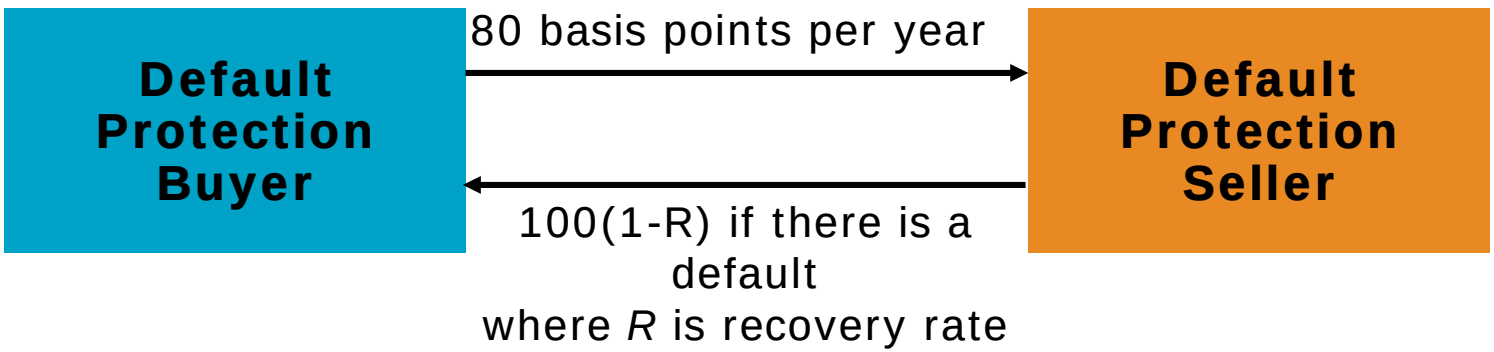
- Credit risk is the risk that an obligor does not honor his payment obligations.
- Credit derivatives are contracts where the payoff depends on the creditworthiness of one or more commercial or sovereign entities.
- A credit derivative is a derivative security that is primarily used to transfer, hedge or manage credit risk.
- A ***credit derivative*** is a derivative security that has a payoff which is conditioned on the occurrence of a ***credit event*****.** The credit event is defined with respect to a or several ***reference credit(s),*** and the ***reference credit asset(s)*** issued by the reference credit. If the credit event has occurred, the ***default payment*** has to be made by one of the counterparties.

Tranched Portfolio Credit Products

- Credit Default Swaps (CDS)
- Credit Derivatives Indices
- Nth to Default Baskets
- Collateralized Debt Obligations (CDOs)
- Single Tranche Trading
- CDO of CDOs (CDO Squareds)

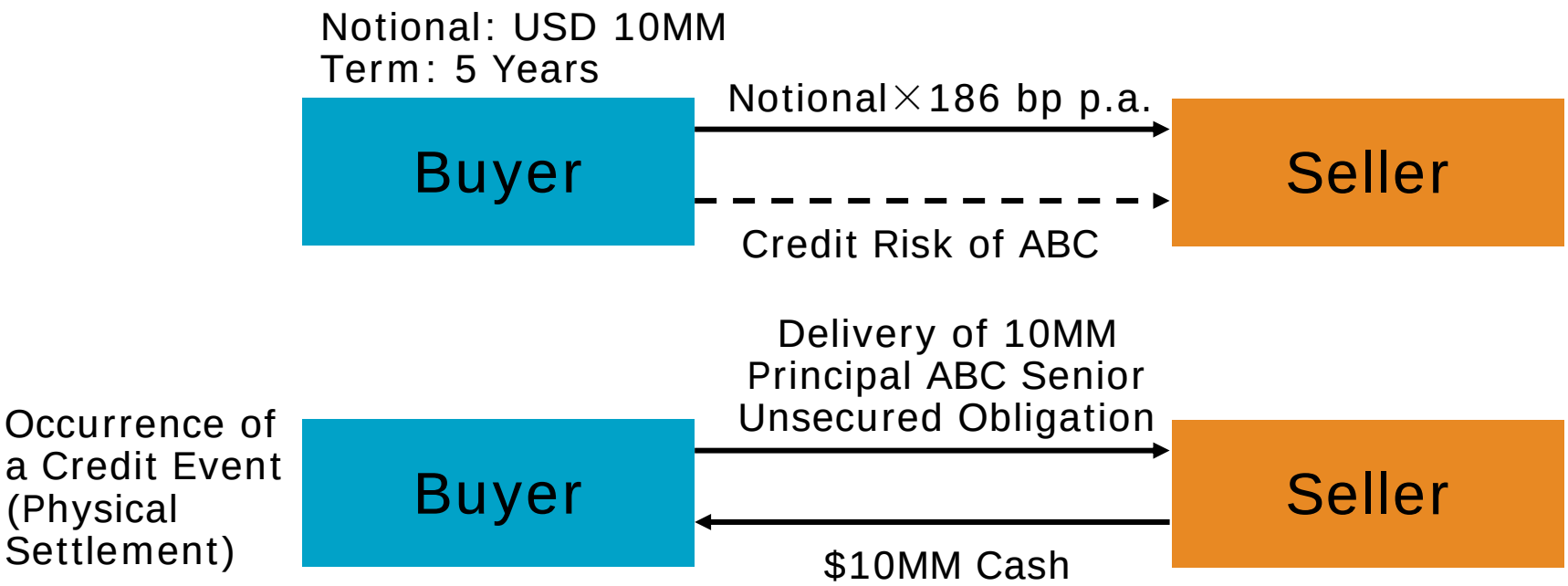
Credit Default Swaps (CDS)

- A credit default swap (CDS) is a contract that provides **insurance** against the risk of a default by particular company.
- "**Buyer**" of credit protection=pay credit spread="Short" credit risk
- "**Seller**" of credit protection=receive credit spread="Long" credit risk



Credit Default Swap Trade Mechanics

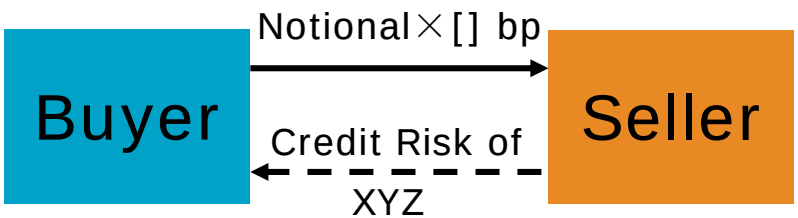
(Example: ABC (Baa1/BBB-) Senior Unsecured Default Swap)

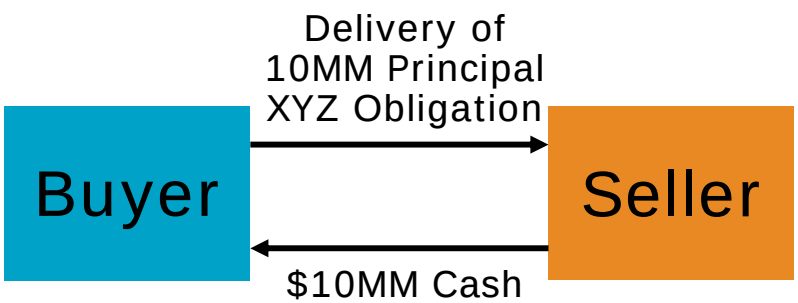


Credit Derivatives Indices

Dow Jones CDX.NA.IG

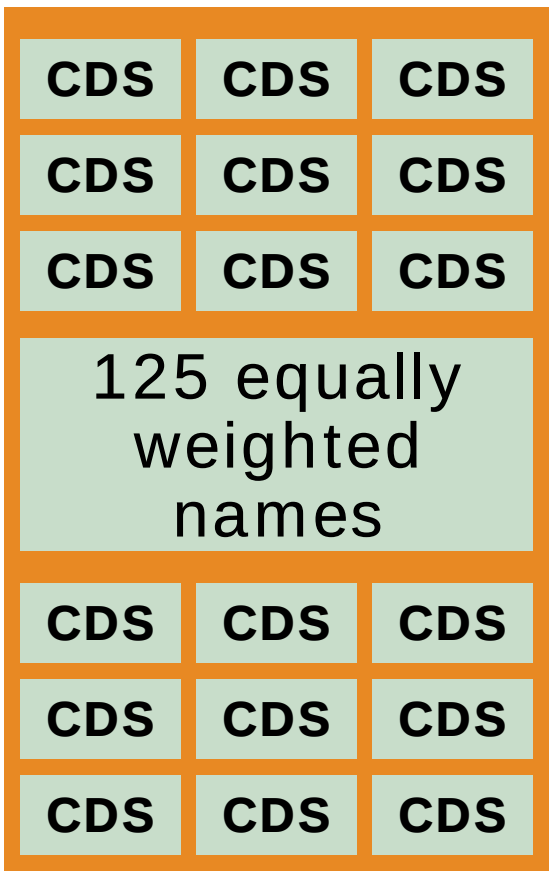
Single Name CDS





Occurrence of a Credit Event
(Physical settlement)

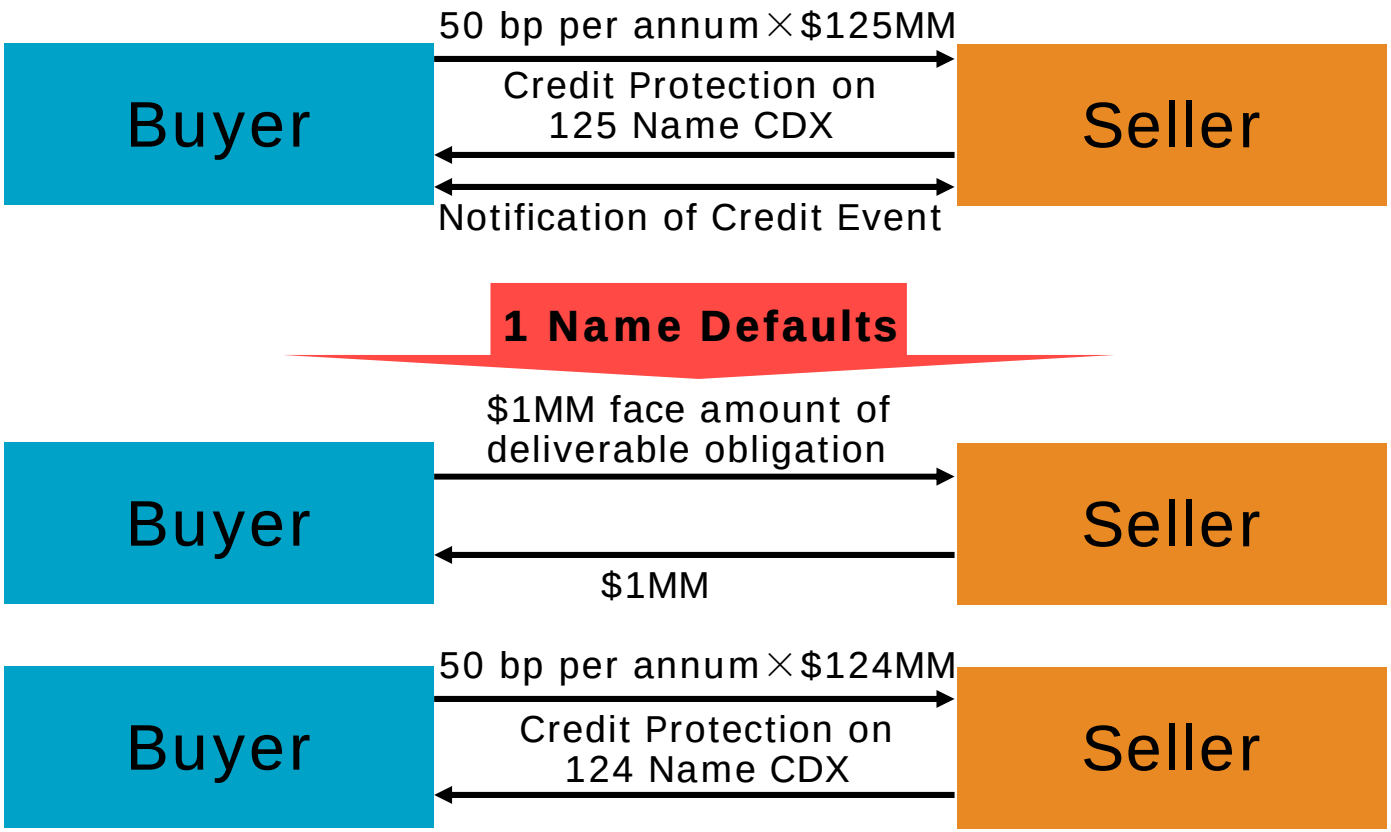
Index
Dow Jones CDX.NA.IG



*Morgan Stanley (2004)

Dow Jones CDX.NA.IG

Credit Event on a Reference Entity, $125MM Notional



*Morgan Stanley (2004)

Nth to Default Baskets

- Similar to CDS, except that the payments are defined with respect to a basket of obligors rather than a single name reference asset.
- Default payment is triggered by ***n***th default i.e. the ***n***th credit event.

Example: First to Default Swap

Reference Portfolio

SPAC 118bps $10MM

DUKE 32bps $10MM

GECC 27bps $10MM

VZ 24bps $10MM

2rd to 4th Default

1st to Default

Premium payment

188 bps on $**10**MM

Buyer → Seller

Following the **first** credit event Premium payments is terminated

Buyer → Bond → Seller

Seller → $10MM → Buyer

*Morgan Stanley (2004)

Example: 2nd through 4th to Default Swap

Reference Portfolio

SPAC 118bps $10MM

DUKE 32bps $10MM

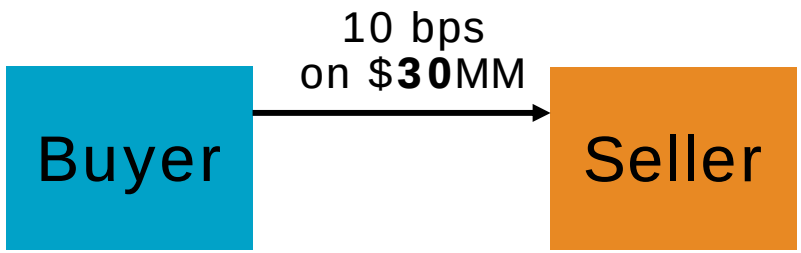
GECC 27bps $10MM

VZ 24bps $10MM

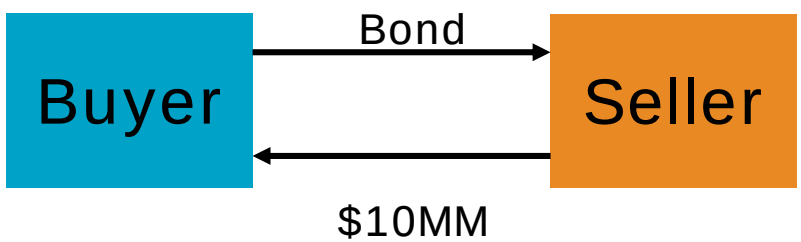
2rd to 4th Default

1st to Default

Premium payment



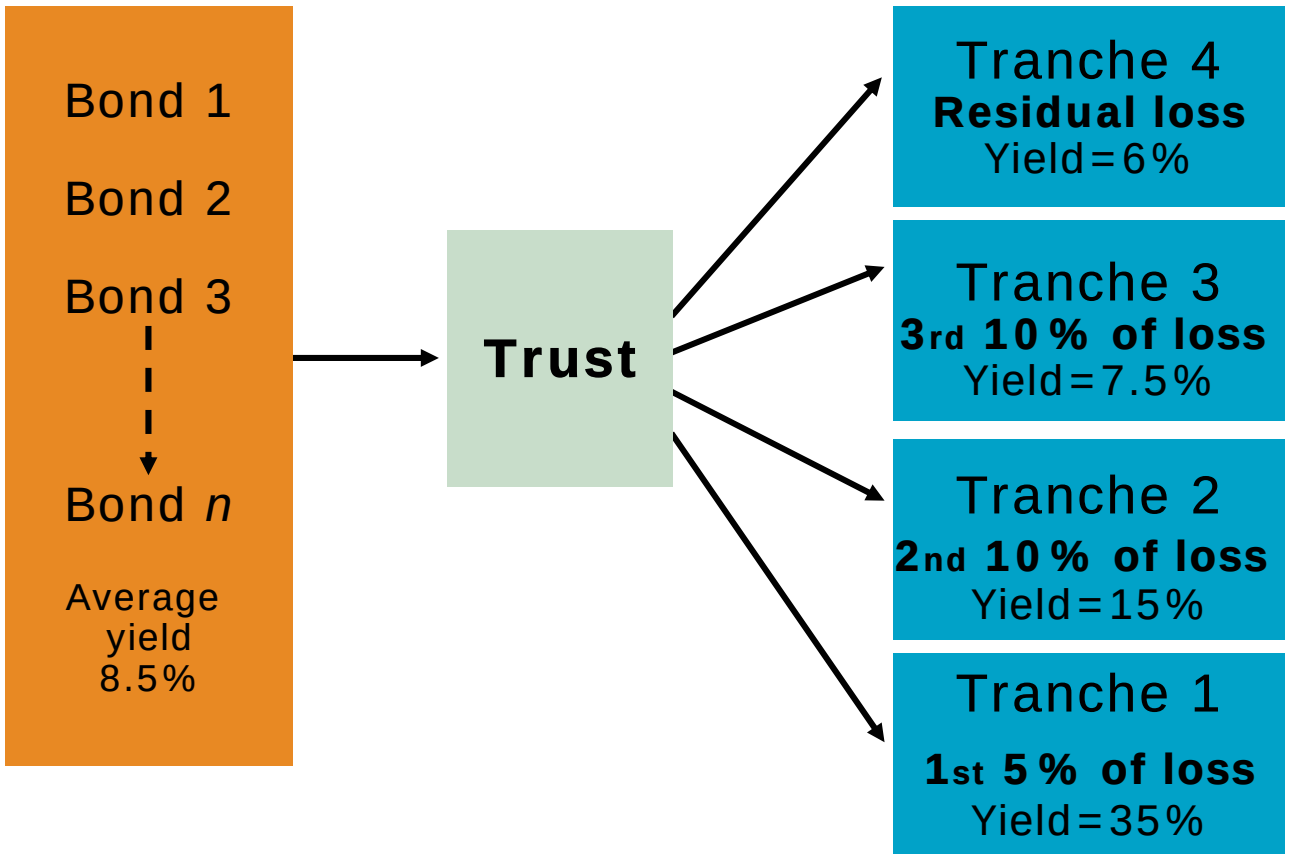
Following each credit event after the first: Notional on premium payment is reduced by $10MM



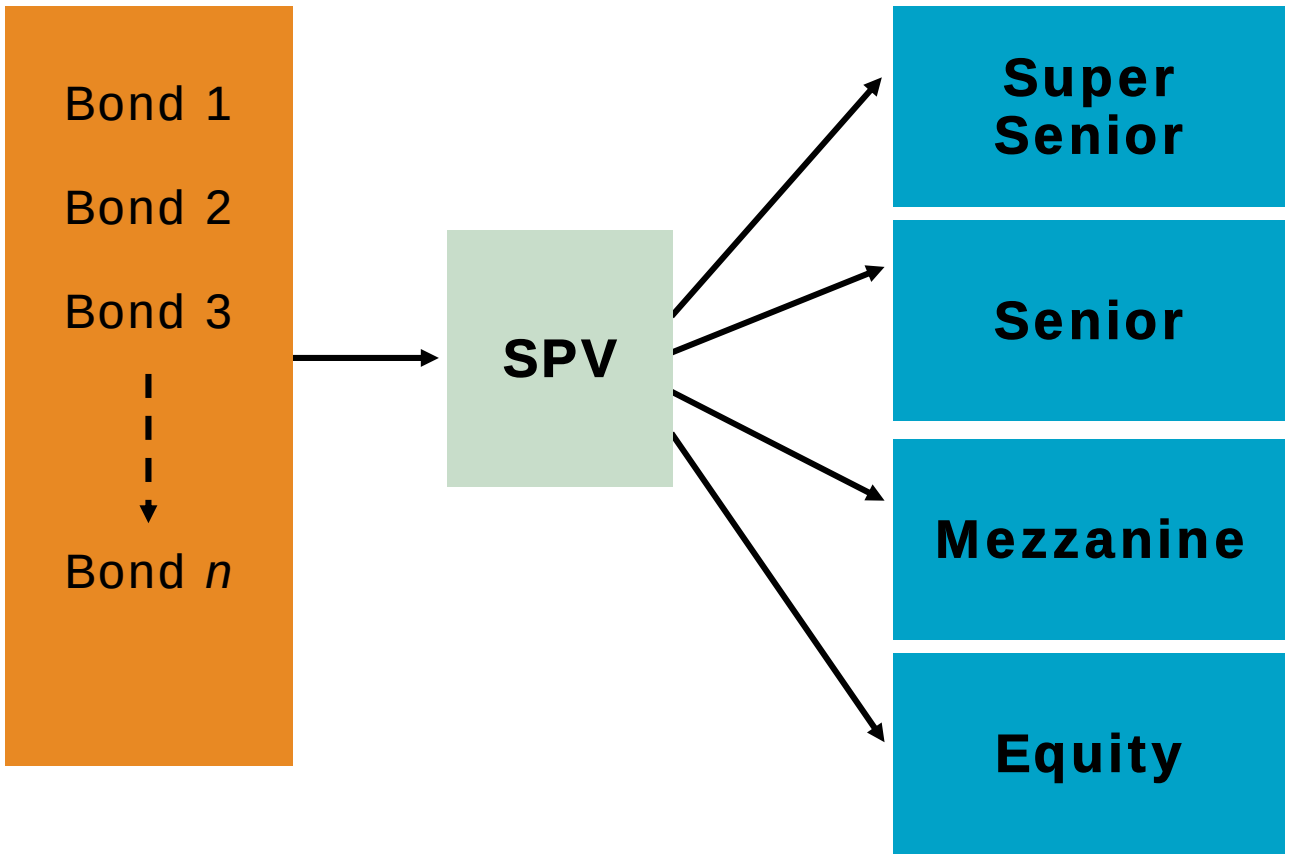
*Morgan Stanley (2004)

Collateralized Debt Obligations (CDOs)

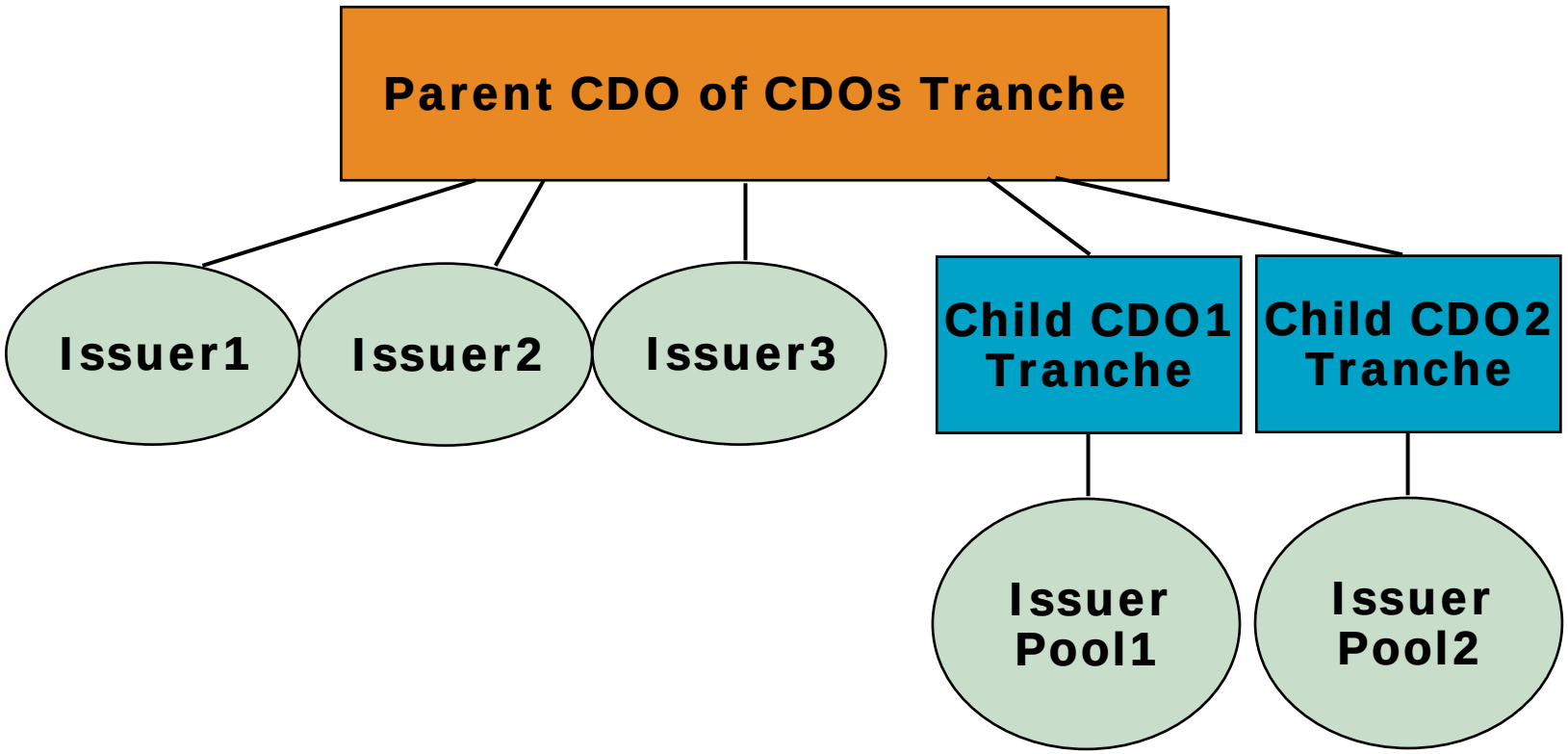
- A Collateralized Debt Obligation (CDO) is a way of packaging credit risk.[1]



Collateralized Debt Obligations (CDOs)

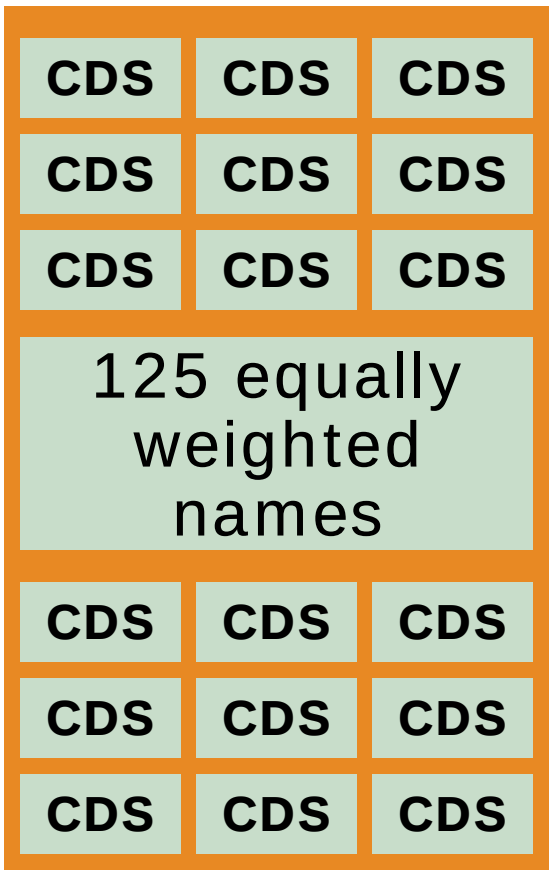


CDO of CDOs (CDO-squared)

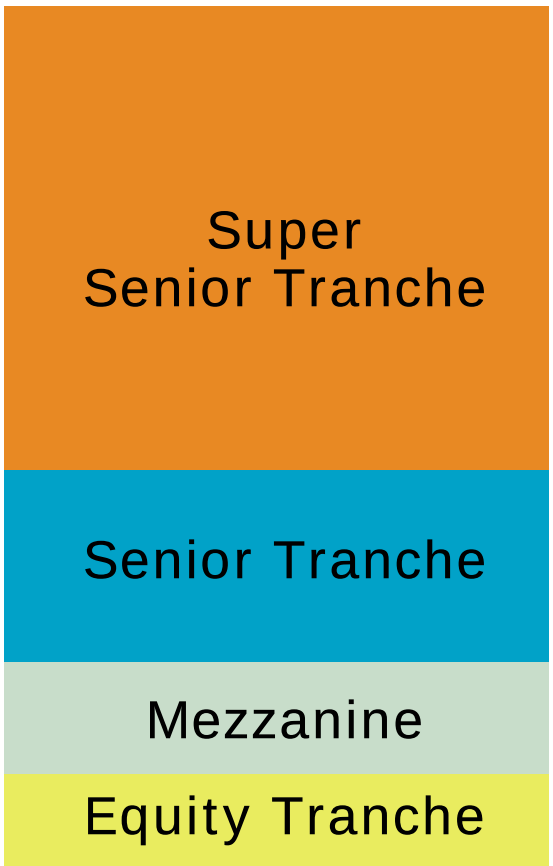


Tranched Dow Jones CDX

Index
Dow Jones CDX



Tranched
Dow Jones CDX

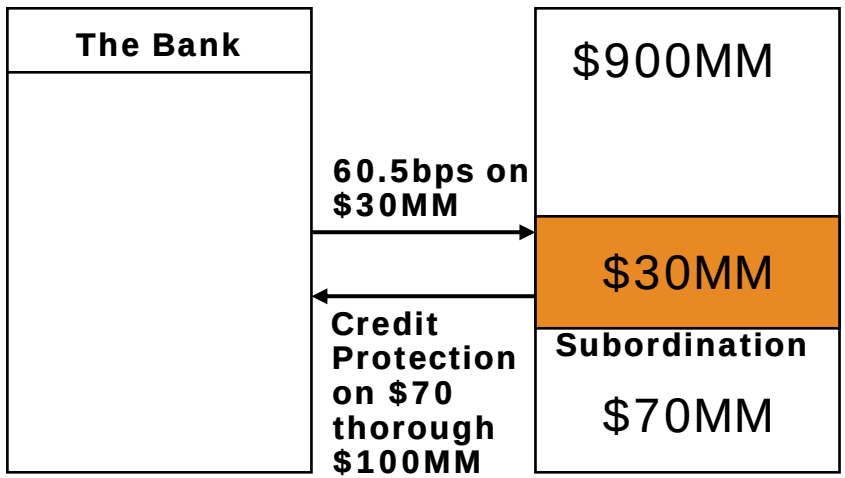


*Morgan Stanley (2004)

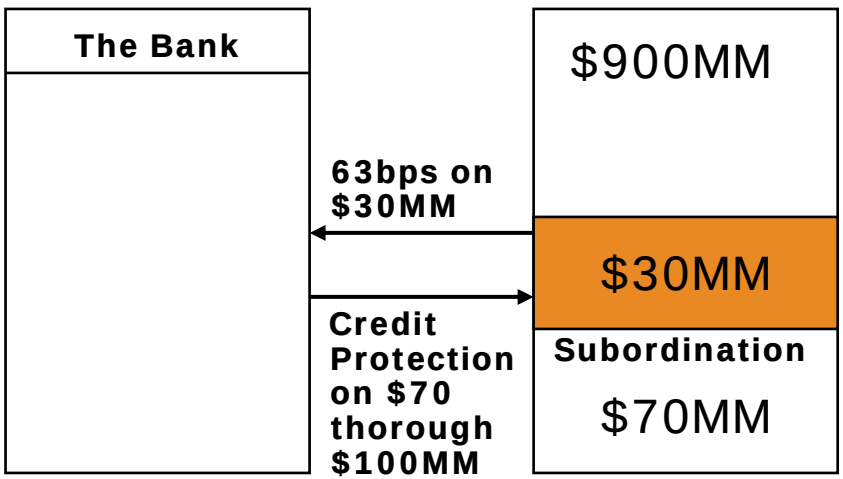
Example of $30 million Notional Transaction in 7 – 10% Tranche ($1 billion notional portfolio, $8 million per name)

- **As a protection Seller:**
  - Counterparty receives 60.5 bps paid quarterly on the Outstanding Notional Amount
  - Counterparty pays cumulative loss amounts in excess of $70MM, if any, subject to a maximum of $30MM
- **As a protection Buyer:**
  - Simulates Counterparty pays 63 bps on the Outstanding Notional Amount to the Bank
  - Counterparty receives cumulative loss amounts in excess of $70MM, if any, subject to a maximum of $30MM

Counterparty Sells Protection



Counterparty Buys Protection



*Morgan Stanley (2004)

Valuation of Nth to Default Swaps, CDOs, CDO^2

- Benchmark model: one factor Gaussian model
  - Student *t* copula
  - Clayton copula
  - Double *t* copula
  - Multifactor Gaussian, Marshall-Olkin
  - Random factor loadings
- Intensity models
- Structural models
- Monte Carlo Simulation

Conclusion

- Risk Management has become an evolving and challenging area and provides opportunities for both actuaries and financial engineers.
- Both insurance and banking industries are developing Enterprise Risk Management frameworks and are resolving risk management issues using their own respective perspectives.
- Many problems in practice might need combined skills in actuarial science and financial engineering to be solved.

Related Literature

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Questions & Comments

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