Financial Engineering and Structured Products

Module 3 – Cash Flows, Static Valuation & Credit Elements for Structured Finance

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**Assignment**

- **Reading**
  - Introduction and first 3 chapters of R&R (Securitization Law, Accounting and Corporate Structure)
  - Material on MBS – lecture slides and docs (CitiGroup, RBSGC, & JPM): focus on basics
  - Allman: Introduction and Chapters 1-2 (Excel, Dates, Day-Counts, & CF Generation)
  - Preinitz: Chapter 3 (Securitizing a Loan PF)

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**Plan for This Week**

- The Corporate Structure for Securitization
  - Finish-Up
- Allman Chapter 1-2 Material
- Static Valuation Model (BOTE)
- Elements of Credit Analysis for Structured Finance

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**Assignment**

- **Reading**
  - Read Chapters 4 & 5 of R&R
  - Allman: Introduction and Chapters 1-2
  - Allman: Chapter 3-4 (next)
- **Assignment**
  - See Website (2 problems)
    - Problem 1 due next Wednesday, February 26
    - Problem 2 due on Monday, March 3
Deconstructing the Corporation

1.5

- The Context for Describing Operations and Operational Risk
  - Structured Finance Micro-Market
    - Timely incremental movements of cash through accounts in the payment system
    - Risks associated w/corresponding title/custody arrangements governed under the indenture
  - Macro Market
    - Relationship between
      - Buyers
      - Sellers
      - Others (Agents, Professional support, Regulators and Data Vendors)

Deconstructing the Corporation

1.6

- The Context for Describing Operations and Operational Risk
  - Meta (Macro) Market
    - Mesh of Credit, Operating, and Governance systems
    - Through which Structured Transactions flow
    - Changing the velocity of money
    - Transforming the structures of capital & risk

Deconstructing the Corporation

1.7

- Market Micro-Structure
  - Operation
    - Servicing an amortizing loan pool is simple, compared to operating a corporation
    - Enables the true sale SPE (QSPE under FASB 140) to be amenable to rule-based governance and automation
      - Fortunate for the borrower as it facilitates the capture of cost-of-funds arbitrage
    - SPE is structured to satisfy bankruptcy-remoteness with rigorous constraints on scope of operations — the funding “machine”
      - Servicers, trustees, custodians, swap counterparties are the proverbial cogs in the machine

Deconstructing the Corporation

1.8

- Market Micro-Structure
  - Constitution: The Pooling and Servicing Agreement
    - The most important operational document is the PSA
    - Spells out precisely how to
      - Segregate cash inflows from the general accounts of the seller/servicer
      - Set up trust accounts
      - And to whom funds of the trust are distributed, including for reinvestment
    - All important to analysis when modeling the deal because it is the definitive, contractually binding transaction structure
**Deconstructing the Corporation**

- **Market Micro-Structure**
  - Payment Mechanics
    - Account structure enforces segregation of collections from the servicer/seller by passing the receivables directly into a trust account owned by the SPE
  - Following the Money – The Time Line
    - Record Date – end of each collection period
    - Collection Period (usually, 1 month)
      - Collection Account & the daily sweep – nothing is left exposed
    - Determination Date (focus on the asset side of SPE balance sheet)
      - Servicer summarizes the most recent collection period: interest, penalty interest, principal, prepays, delinquencies, defaults/recoveries, surety bond payments, etc.

- **Market Micro-Structure**
  - Following the Money – The Time Line (continued)
    - Calculation Date (focus on the liability side of SPE balance sheet)
      - Servicer establishes the amounts due bond holders and all third parties as a consequence of the Determination
      - Includes trigger provisions, reserve/spread accounts, etc
    - Distribution Date
      - Servicer passes the amounts Calculated to the paying agent with payment instructions to pay the ultimate recipients
    - Payment Date
      - Amounts sitting in the various sub-accounts are wired to their intended recipients (servicer, note holders, trustee, etc)

- **Deconstructing the Corporation**
  - Primary Market & the Closing
    - Lien on title is transferred to issuer in exchange for cash at closing
    - Investors receive the notes in exchange for cash at closing

- **Deconstructing the Corporation**
  - Operational Flows
    - Monthly payments (lockbox under control of trustee) to Notes
      - 3rd Parties not in flow
        - Ratings Agencies (annual fee)
        - Mark-to-market Advisories
        - Data Vendors
          - Data from trustee
          - Clean & normalize
          - Publish in raw form or with value-add
Deconstructing the Corporation

- Market Macro-Structure
  - Buyers
  - Sellers – Originator, (Transferor), Issuer (SPE)
- Agents
  - Intermediaries bringing buyer & seller together
  - Collateral Managers/Servicers/ Program Administrators
  - Custodians/Trustees
  - Clearing & Settlement Agents
  - Issuing & Paying Agents
- Professional Services – Lawyers & Accountants
- Regulators
- Data Vendors

Deconstructing the Corporation

- More About Agents
  - Arranging the Transaction (prior to Origination)
    - An Investment/Commercial Bank
      - Placement
      - Underwriting/Structuring the Transaction
    - Structuring: Creating the design for redistributing the risks of the pool across different classes of securities
      - According to prevailing market risk/return demands
      - Meeting investor appetite
      - In “compliance” with rating agency criteria
      - As the underwriter may become an investor, has the potential to represent both sides of the transaction
    - Servicer – Sell-side allegiance, carries out duties specified by PSA
    - Trustee – Buy-side allegiance, makes sure duties are properly being carried out

Deconstructing the Corporation

- More About Agents
  - Clearing Agent – collects funds and verifies transaction information
  - Settlement Agent – Finalizes sale and oversees transfer of ownership from seller to buyer
  - Data Vendors – Huge, new role in supporting this market
    - Aggregation and transmission of performance data (servicer reports) and trustee reports
    - Describing the “state” of a transaction adds value

Deconstructing the Corporation

- Market Meta-Structure: To Build A Better Model
  - Nationally Recognized Statistical Rating Organization (NRSRO)
    - SEC-licensed credit rating agency
    - Designs contracts for structured product origination and trading
      - Focus is on primary issuance
      - Little support for secondary trading
    - What is in the future?
  - Over the Counter Market
    - Can this be improved?
Questions?
• Now to Allman

Asset Cash Flow Generation
• Cash Flow (CF) Structure/Model for Assets
  • We begin with CF into the structure – Asset CF Generation
  • In general include interest, principal (both scheduled and unscheduled – prepayment of principal), defaults, and recoveries
  • Notional Asset CF – CF without giving affect to prepayments and defaults
  • Questions:
    • How will the assets exist over time?
    • What and how much data exists for the assets?
  • Depending on the answers to the questions we will consider
    • Loan level generation of CF, or
    • Representative Line generation

Asset Cash Flow Generation
• Loan Level vs. Representative Line
  • How do the assets exist over time?
    • The assets in a structured transaction are static (loans in pool don’t change) or they can revolve
  • For a static pool, loan level analysis is preferred
    • Now, what information exists?
      ▪ Detailed data required on each loan for Loan Level Analysis (LLA)
      ▪ If this is not the case, then Representative Line Analysis (RLA) is an alternative (think MBS pass-through securities – not so horrible)
  • Either way, cash flows can be generated
    • However, the more diverse a pool, the more distorted the result from Representative Line Analysis
    • See example: Rep_Lines.xls in Ch 02 Additional Files Folder

Asset Cash Flow Generation
• Loan Level vs. Representative Line Analysis
  • Again, how do the assets exist over time?
    • If the assets are revolving, the Representative Line Analysis seems more appropriate
  • Representative Line Analysis works best if the eligibility criteria for revolving collateral is narrowly defined and strictly adhered-to
    • In any event, we always assume that the eligibility criteria is fulfilled with the worst collateral that meets the criteria
  • Decision Tree
    • Revolving Pool?
      ▪ Yes. Use Representative Line Analysis
Asset Cash Flow Generation

- Loan Level vs. Representative Line Analysis
  - Decision Tree
    - Revolving Pool?
      - Yes. Use Representative Line Analysis
    - Revolving Pool? No
      - Is Loan Level Data Available?
        - Yes. Use Loan Level Analysis
        - No. Use Representative Line Analysis

- Model Builder
  - PMB uses single Representative Line Analysis
  - Useful to get started
  - For more elaborate LLA or for multiple line RLA, “simple” VBA enhancements remedy the situation (see Preinitz book) 1.21

Asset Cash Flow Generation – Model Builder

- The Input sheet for asset CF generation
  - The single representative line is based on a pool that pays interest and principal; includes as a minimum
    - Original balance & Current balance
    - Interest Rate
    - Original Term & Remaining Term
    - Additional (general case of assets’ yield off floating rate)

- Fixed Rate Amortization
  - CF are created by 1st calculating the level payment using PMT
  - Interest for period results from the period’s beginning balance
  - Subtract interest from payment gives period’s principal payment
  - Subtract period’s principal from beginning balance gives period’s ending balance

- Floating Rate Amortization
  - Prime consideration for Floating rate Amortization is how the CF is affected with rate changes
    - Either payment changes or term of the loan changes
  - Index off which the assets are based becomes yet another attribute to cause the need for multiple representative lines – one for each index
  - Organizing the indexes is the final point
    - Each index is a projected vector of rates as long as the number of periods (up to 360)
    - Storing in the input sheet would be inefficient – so we create a separate sheet for vectors 1.24

Asset Cash Flow Generation – Model Builder

- The Input sheet for asset CF generation
  - Floating Rate Amortization
    - While most deals have fixed rate collateral, a significant number are floating based; since more complex, we must be general enough in our approach to handle these
    - Additional Attributes of Floating rate Collateral
      - Rate Index and Margin
      - Lifetime Rate Cap and Floor
      - Periodic Rate Cap and Floor
      - Rate Reset Frequency and First Reset Date
    - The forward projecting assumption for the underlying index primarily drives the interest calculation 1.23
Asset Cash Flow Generation – Model Builder

- The Cash Flow sheet for asset CF generation
  - This is where the calculations for asset CF generation take place
  - When using the representative Line methodology, the Notional Schedule of amortization needs to be created
    - Called notional because it does not take into account prepayments, defaults or recoveries
    - Later, these aspects will be incorporated to create the actual amortization schedule
  - The notional schedule of amortization uses 6 columns
    1) Beginning Balance  4) Interest
    2) Periodic Interest Rate  5) Principal
    3) Payment  6) Ending Balance

Questions?

- BOTE: Back of the Envelope Analysis

Static Valuation Model

- BOTE: A Static self-consistent Valuation tool
  - Premise of Securitization
    - To employ capital more efficiently use financial assets rather than the entire balance sheet to raise working capital
    - Paradigm shift in financing – allows a company to grow and prosper at the speed of its own success, but only when
      - Firm is financially solvent
      - Diversified Financial Asset base – pooled payment risk of assets is less than firm
    - To grow, firm needs working capital locked up in its assets
    - Market understands value proposition of off-balance sheet financing
  - Securitizations are a special type of structured finance transaction whereby the funding arbitrage is achieved by transferring financial assets off-balance-sheet (with transparency and disclosure) through a well-designed capital structure
Static Valuation Model

- BOTE: A Static self-consistent Valuation tool
  - Back-of-the-envelope (BOTE) refers to the original, semi-self-consistent approach used for structured securities
  - Self-consistent because the valuation draws information about the transaction directly from the transaction’s performance data
  - Semi-self-consistent at the outset as loss expectations are derived from peer transactions
  - Fully-self-consistent to the extent actual performance progress is incorporated into the analysis
  - BOTE came into existence in the 80s
  - Now replaced by more sophisticated approaches that incorporate time and uncertainty in transaction value and risk – Monte Carlo
  - Yet, still useful in quick look analysis and in defining a taxonomy

Static Valuation Model

- Risk Measure and Rating Scale
  - Where the following scale is used to assign a rating $r$
    | Scale, $r$ | 5 | 4 | 3 | 1.5 – 2 | < 1.5 |
    | Rating     | Aaa | Aa | A | Baa | ≤ Ba |
  - Both CE and $E(L)$ are conventionally expressed as % of initial asset pool balance
  - $E(L)$ is established at closing
    - based on historical pool performance of homogeneous pools of receivables in a liquidation scenario
    - The single most important structuring variable

Static Valuation Model

- BOTE: A Static self-consistent Valuation tool
  - Essence of approach is tracking cash flow and confirming asset-liability parity
- Risk Measure and Rating Scale
  - Key parameters
    - Credit Enhancement (CE) for each class of security, $j = 1, 2, ...$
    - Expected Cumulative Loss, $E(L)$, on the entire collateral pool
  - The measure of security credit quality on each of the security classes, $j$, is expressed as
    \[ \frac{CE}{E(L)} = n_j \rightarrow r_j \]

Static Valuation Model

- Risk Measure and Rating Scale
  - CE or credit support can come from
    - Third party guarantees – e.g., FNMA
    - Capital in the transaction, contingently allocated to certain tranches with a specified priority – either internal or external
    - External CE – bond insurance, CDS, Letter of Credit (LOC), or other counterparty risk transfer mechanism (upon whom a component of risk assessment focuses)
    - Internal CE
      1. Excess Spread (XS) – Difference between asset earning and funding rate
      2. Reserves – Can be established at closing, funded or unfunded, possibly fed by XS, and dynamic w/ step-up/step-down provisions into XS or liability CF; only reserves funded at closing count in the CE calculation, that coming from XS are not included in Reserves CE, to avoid double counting against XS CE
      3. Subordination
Static Valuation Model

- **Risk Measure and Rating Scale**
  - CE or credit support can come from
    - Capital in the transaction, contingently allocated to certain tranches with a specified priority – either internal or external
      - Internal CE (Continued)
    - Overcollateralization
    - Triggers – Contingencies are established in the transaction such that, if satisfied, payment instructions under the trigger will shift creating a different priority

- **Transaction Analysis**
  - The 2 classes can be rated through the following steps
    - Determine the maximum amount of CE available to each class
    - Reduce the maximum to a *certainty-equivalent* amount
    - Compute ratio of CE to E(L)
    - Determine rating from scale
  - The CE available to each class is, in order of liquidity

<table>
<thead>
<tr>
<th>Class A</th>
<th>Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess Spread (XS)</td>
<td>Excess Spread (XS)</td>
</tr>
<tr>
<td>Reserve Account – 1%</td>
<td>Reserve Account – 1%</td>
</tr>
<tr>
<td>Subordination – 10%</td>
<td>NA</td>
</tr>
</tbody>
</table>

- **Transaction Analysis (Naïve)**
  - Reserve funding and subordination can be read right from the term sheet – not so with XS
    - Depends on defaults and prepayments which materialize over time – conundrum for the static BOTE method
    - Must be estimated as a maximum and then reduced to an *informed* certainty-equivalent amount
    - First step in computing XS is to compute gross spread (GS)
      \[
      GS = WAC - SF - WAI = 14 - 1 - 7.3 = 5.7
      \]
    - So considering 5-year term the total XS is, \[ XS = 5 \times 5.7 = 28.5 \% \]
Static Valuation Model

- Transaction Analysis (Naïve)
  - So we have the ratings
  
  | Class A CE | XS + reserve account + subordination |
  | Class A CE | XS + reserve account + subordination |
  | Ratio CE/E(L) | 39.5%/5%/8 |
  
  Rating: Aaa (or better)

- The flaw – amortization not taken into account, GS is not received for full 5-years on total amount outstanding at closing

1.37

Static Valuation Model

- Transaction Analysis (Accounting for Amortization)
  - Using average life (AL) concept – maturity of bullet-maturity equivalent, non-amortizing bond generating the same dollar amount of interest

\[ \bar{X} = \int_0^T \frac{P(t)}{P_0} \, dt \]

\[ \bar{X} = \frac{1}{1-(1+r)^{-T}} - \frac{1}{\ln(1+r)} = 33.45 \text{mo} \approx 2.8 \text{years} \]

- Yields \( \bar{X} = 2.8 \times 5.7 = 16.0\% \) (not 28.5\%)

1.38

- Transaction Analysis (Accounting for Amortization)
  - Using average life (AL) concept – maturity of bullet-maturity equivalent, non-amortizing bond generating the same dollar amount of interest

\[ WAL = \sum_{i=1}^{N} \frac{P_i}{P} t_i \]

where \( P \) : Total Asset Principal

\( P_i \) : Principal received at time \( t_i \) : Payment Dates

1.39

- Transaction Analysis (A Better Certainty-Equivalent)
  - Three adversities that further effect XS
    - Elevated Prepayments
    - Adverse Prepayments
    - Timing of receipt of XS vs. timing of losses
  - Elevated Prepayments (example of 100\% to 200\%)
    - Requires a CF model to track XS under elevated speeds

1.40
1.41
Static Valuation Model

- Elevated Prepayments (example of 100% to 200%)

<table>
<thead>
<tr>
<th>Prepayment</th>
<th>200%</th>
<th>150%</th>
<th>125%</th>
<th>100%</th>
<th>87.5%</th>
<th>75%</th>
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<tbody>
<tr>
<td>Initial</td>
<td></td>
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<tr>
<td>Amount</td>
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<td>Collared</td>
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<td>Collared</td>
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<td>Prepayment</td>
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<tr>
<td>Refinance</td>
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</tbody>
</table>

1.42
Static Valuation Model

- Transaction Analysis (A Better Certainty-Equivalent)
- Adverse Prepayments
  - Even if forecast prepayments materialize, the composition of prepayments and defaults is such that loans with above average coupon rates are more likely to refinance or default
    - Hence income from them cannot be counted upon
  - A stress test that can be carried out assumes that the top 20% of the loans by APR drop out at time zero
    - Measure the reduction on WAC, multiply by AL and subtract from total XS
      - See next slide

1.43
Static Valuation Model

- Transaction Analysis (A Better Certainty-Equivalent)

<table>
<thead>
<tr>
<th>XS reduction due to adverse prepayments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Pool</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>10%</td>
</tr>
<tr>
<td>20%</td>
</tr>
<tr>
<td>30%</td>
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<tr>
<td>40%</td>
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<td>70%</td>
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<tr>
<td>80%</td>
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<tr>
<td>90%</td>
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<tr>
<td>100%</td>
</tr>
</tbody>
</table>

1.44
Static Valuation Model

- Transaction Analysis (A Better Certainty-Equivalent)

- Timing of receipt of XS vs timing of losses
  - XS is most abundant at the outset of the transaction
  - Losses typically occur later in the transaction life-cycle
  - A material portion of the XS may leave the structure before it is needed/ utilized
    - Issuers want provisions to return unneeded XS before the end of the life-cycle and if so released, there is a net reduction in XS availability later on
    - This is XS that if not used will be lost back to the issuer – use-it-or-lose-it (UIOLI)
    - This amount should be calculated and accounted for
Static Valuation Model

- Transaction Analysis (A Better Certainty-Equivalent)
  - So taking these 3 elements into account, what is the better “certainty-equivalent” CE that remains
  - Given the 5% E(L), the earlier determined XS (AL adjusted) would be reduced further by
    - 2% total for elevated prepayments
    - 0.67% annual for adverse prepayments (=> 0.67 x 2.8 = 1.88)
    - And 4.33% for UIOLI
  - This leaves XS = 16 – 2 – 1.88 – 4.33 = 7.8%
    - Where the 16% is the XS with just the average life adjustment
  - Class A CE = 7.8 + 1 + 10 = CE/E(L) = 20/5 = 4.00 => Rating Aa
  - Class B CE = 7.8 + 1 = 8.8 => CE/E(L) = 8.8/5 = 1.76 => Rating Ba

Elements of Credit Assessment

- Sources of Credit Judgment and Intuition
  - Identifying salient drivers of a transaction and synthesizing them into credit understanding & insight
  - Reference Materials that support this include Source Material on:
    - Structure of Individual Transactions and their historical performance
    - Assets to be securitized and their historical performance
    - Methods used to assess the transaction’s payment certainty

- Source Material on the Transaction Structure
  - In addition to PSA …
  - Prospectus and Offering Memorandum or Circular

Static Valuation Model

- Shortcomings of the BOTE Analysis
  - It is only for investment-grade tranches (≥ BBB/Baa)
  - It portrays an integer scale and assigns the CE/E(L) to a rating in a somewhat arbitrary way (rounding)
  - Most important, it does not accommodate time or uncertainty (probability)
    - Time in that CE is measured at closing (t=0)
    - Loss, E(L) is measured at maturity (t=T)
    - An approach that recognizes time would keep track of evolving losses/prepayments and the impact on evolving CE
    - Recognizing uncertainty would incorporate deviations from an expected evolution of loss

Elements of Credit Assessment

- Source Material on the Transaction Structure
  - Accessible Summary of the Transaction
    - Cover Page of Prospectus
      - Size (how much is being raised) and Date of Initial Offering (Closing)
    - Tranche Description: Name, Size, Coupon, Maturity, Price, Average Life, Rating
    - Disclosure: Underwriter, Advisors, external CE providers, other parties
    - Provides key data from which capital structure and from which deterministic CE can be calculated – subordination, overcollateralization, reserve funds, spread accounts, yield supplements, etc.
    - If any tranches will be allotted outside the offering, these should be disclosed
  - Term Sheet (at front of Prospectus)
    - Discloses how the transaction is intended to work
    - Focuses on liabilities: Capital Structure, CE & pay down mechanics
    - Little asset-side static pool data, though AB requires disclosure of issuer static pool history (helpful, but does not complete E(L) expectation into Prospectus)
Elements of Credit Assessment

- Source Material on the Transaction Structure
  - Accessible Summary of the Transaction

- Transaction Analysis
  - Uses BOTE method for reviewing credit pieces
  - Workable using incomplete specification
  - Allows backing-out of E(L) used for rating

- Transaction Analysis (Example) – Consider Cover Page Liability

<table>
<thead>
<tr>
<th>Securities</th>
<th>Class Percentage</th>
<th>Rating</th>
<th>Risk Premium</th>
<th>Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>85.0%</td>
<td>AAA</td>
<td>6.50%</td>
<td>2.5 yrs</td>
</tr>
<tr>
<td>Class B</td>
<td>5.0%</td>
<td>A</td>
<td>3.00%</td>
<td>2.5 yrs</td>
</tr>
<tr>
<td>Class C</td>
<td>5.0%</td>
<td>BBB</td>
<td>4.00%</td>
<td>2.5 yrs</td>
</tr>
<tr>
<td>Equity</td>
<td>5.0%</td>
<td>NR</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

1.50

- Backing Out Implied E(L)
  - Assuming no reserve, zero XS and approximating the rating factor
  - Class A has 15% subordination => 15/5 = 3 = E(L)
  - Similarly for other classes (B: 8.5/2.8 = 3 = E(L))
  - Equity is 3.5% so residual CF is expected to be .5%

<table>
<thead>
<tr>
<th>Securities</th>
<th>Class Percentage</th>
<th>Rating Factor</th>
<th>Implied Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>85.0%</td>
<td>5.00</td>
<td>AAA</td>
</tr>
<tr>
<td>Class B</td>
<td>6.0%</td>
<td>2.00</td>
<td>A</td>
</tr>
<tr>
<td>Class C</td>
<td>5.0%</td>
<td>1.57</td>
<td>BBB</td>
</tr>
<tr>
<td>Equity</td>
<td>3.5%</td>
<td>0.00</td>
<td>NR</td>
</tr>
</tbody>
</table>

1.51

- Economic Arbitrage (for doing extra analysis on the collateral)
  - For Class A: 0.35 – 0.25 = 0.10 over an average life of 2.5 years = 25 bps

<table>
<thead>
<tr>
<th>Securities</th>
<th>Arbitrage per annum</th>
<th>Lifeline Arbitrage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>0.10%</td>
<td>25 bps</td>
</tr>
<tr>
<td>Class B</td>
<td>0.60%</td>
<td>210 bps</td>
</tr>
<tr>
<td>Class C</td>
<td>1.50%</td>
<td>320 bps</td>
</tr>
<tr>
<td>Equity</td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

1.52

Elements of Credit Assessment

- History of Structural Convergence
  - Until mid-1990s: Deals mostly consisted of
    - Sequential-pay credit tranches and static reserve funds
  - In mid-1990s, resultant over-collateralization is redressed:
    - Triggers more finely sculpt the waterfall while still defending against payment uncertainty
  - In early 2000s, spread compression, rising prepayment risk & aggressive use of prefunding allowed/encouraged:
    - Subclasses of money-market and term notes of staggered maturity
    - Use of here-to-fore agency CMO tranche structures
    - PAC, TAC, IO/PO, Z-class etc.
  - Where are we today? We have to go back to the collateral

1.53
Elements of Credit Assessment

- Credit risk in the SPE is the main Structural Driver
- Source of comprehensive analysis: vintage, static pool
  - Vintage: loans by same originator with homogeneous seasoning
  - Within vintages, underwriting characteristics are merged into a basic unit of analysis – the static pool
  - To avoid selection bias, pooling should proceed by a random selection of loans underwritten to a uniformly applied loan policy
- Once a pool-cut is available, the most important single measure is the cumulative loss on the pool, $E(L)$
  - An $E(L)$ that is properly determined can be placed in an envelope of capital protection (CE) that mitigates risk to security value over the life of risk exposure to loss
- But, what is Loss?

Elements of Credit Assessment

- Loss Lifecycle: Delinquency, Default, Loss & Recovery
  - Delinquency can cure, but only when obligor has made all payments currently due – not entirely so, today (beware)
    - Called: “recency” – if a payment is made or otherwise ordained
- The Empirical Loss Curve
  - Basis of Expected Loss Analysis
    - Loss occurrence does not move linearly across time
    - Rather an S-shaped unfolding of losses
    - Called the static pool loss curve or just loss curve
  - Vintage loss curves – assets of different risk grades from different lenders where, after a while they become iconic

Elements of Credit Assessment

- Loss Lifecycle: Delinquency, Default, Loss & Recovery
  - Typical loan delinquency states
    - 0-40 days: 0.03%
    - 41-90 days: 0.16%
    - 91-120 days: 0.49%
    - >120 days: 0.94%

  - Loss lifecycle: Delinquency, Default, Loss, & Recovery
    - blog.cq.com
    - Lily's notes on loss lifecycle
    - See table above

  - Loss occurrence does not move linearly across time
    - Rather an S-shaped unfolding of losses
    - Called the static pool loss curve or just loss curve

  - Vintage loss curves – assets of different risk grades from different lenders where, after a while they become iconic

Elements of Credit Assessment

- The Empirical Loss Curve
  - Industry vs. Issuer Loss Curve
    - Cumulative principal losses likely to occur in pool of loans
    - S-Curve to principal that pool is likely to lose in total
    - Ideally, issuer specific for specific collateral pool
  - Factors driving Loss Curve
    - Asset importance to borrower
    - Borrower creditworthiness
    - Asset value in secondary market (LTV)
    - Terms of the loan and term to maturity
**Elements of Credit Assessment**

- The Empirical Loss Curve

Automobile Loss Curve: Principal Losses at 10% (Hypothetical)

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**Elements of Credit Assessment**

- The Empirical Loss Curve

Hypothetical Curve Showing the Borrowers Equity Position

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**Elements of Credit Assessment**

- The Empirical Loss Curve

Issuer Loss Curves are the basis of predicting future losses on new transactions
- Practice originated with agencies
- With insufficient data, peer issuer curves can be used
- Loss Curves may be constructed in a spreadsheet
- Using an issuer’s vintage data, an average or base curve is built
- Data may be “cloned” to take advantage of all available data

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**Elements of Credit Assessment**

- The Empirical Loss Curve

Base Curve Construction
Elements of Credit Assessment

- The Empirical Loss Curve
  - New Loss Curve for Deal under Analysis is derived from a Consecutive Sequence of Vintage curves believed to be Representative of how the New Transaction will Perform
  - From this series an average curve is computed which becomes the base curve for the new transaction
  - Base Curve is normalized between 0 and 1
  - Each point is interpreted as the time-dependent ratio of current to ultimate loss
  - Cloning Data of Different Vintages

Elements of Credit Assessment

- The Empirical Loss Curve – Cloning Data
  - Cloning Data - See Table on next slide
    - Quarterly Data
    - Is the Loss Curve Complete?
      - Does it show the characteristic saturation/tapering?
    - How do we bootstrap to use all available vintage data
      - Use first curve to complete second – a composite – not an average
      - Use both additive and multiplicative methods to cross verify range
      - Then complete 2XX-2
  - Considerations for Loss Curve Development
    - How much history is relevant
      - Do issuers stay the same or go “down market”
    - Composite for several issuers

Elements of Credit Assessment

- The Empirical Loss Curve – Cloning Data
  - Additive Method
    - Base Curve: \( y_{i}, i = 1, 2, ..., N \)
    - Target Curve: \( g_{i}, i = 1, 2, ..., n < N \)
    - To Complete: \( g_{i} = g_{i} + (y_{i} - y_{i}), i = n + 1, n + 2, ..., N \)
    - Cumulative Expected Loss Estimate for the Pool:
      \[
      E(L) = g_{i} + (y_{i} - y_{i}) \]
  - Multiplicative Method (similar nomenclature to above)
    - Base Curve: \( y_{i}, i = 1, 2, ..., N \)
    - Target Curve: \( g_{i}, i = 1, 2, ..., n < N \)
    - To Complete: \( g_{i} = g_{i} \cdot \frac{y_{i}}{y_{i}}, i = n + 1, n + 2, ..., N \)
    - Cumulative Expected Loss Estimate for the Pool:
      \[
      E(L) = g_{i} \cdot \frac{y_{i}}{y_{i}} \]

Elements of Credit Assessment

- The Empirical Loss Curve – Cloning Data

Issuer’s (hypothetical) Loss Curve History
Elements of Credit Assessment

- The Empirical Loss Curve – Cloning Data

**Projecting or Cloning the (hypothetical) Loss Curve**

<table>
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<tr>
<th>Multiplication Method (%)</th>
<th>Estimated Method (%)</th>
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</tbody>
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- Elements of Credit Assessment
- The Empirical Loss Curve – Cloning Data

1.67

- Elements of Credit Assessment
- Payment Certainty vs. Value

1.68

- Elements of Credit Assessment
- The Empirical Loss Curve

1.69
Elements of Credit Assessment

- Payment Certainty vs. Value
  - Structured-Finance Valuation Methods use direct value inputs: interest, loss, default, recovery, delinquency, principal balance, time-to-maturity, yield, time, etc.
    - The main variations in valuation methods explore 3 dimensions
      - Time/Timeless
      - Probabilistic/Certain
      - Aggregated/Granular
  - As an Aside – An alternative paradigm embodies Merton’s Model for explicit default probability estimation
  - A taxonomy for method comparison is shown following

Elements of Credit Assessment

- Payment Certainty vs. Value
  - Structured-Finance Valuation Methods
    - Time (1 & 3): Do not have time as a variable and focus on collateral liquidation and so don’t consider the funding question over term
      - BOTE, for example (of 1)
    - Within Time, we see that methods are refined by the choice of point methods or incorporate risk/uncertainty into the value analysis
      - Stress Testing (2) uses a specified scenario and not the ensemble of probability weighted outcomes to assess value – S&P ratings, for example
      - Analysis using the Loss Distribution in a simple way exemplify (3) where standard deviation of losses modify the result
      - More generally, (4) and (6) incorporate timing of uncertain events – either on “average” or with more granularity (loan-by-loan)
    - With Aggregation/Granularity we consider average loan or loan-level data – which may likely not be always possible