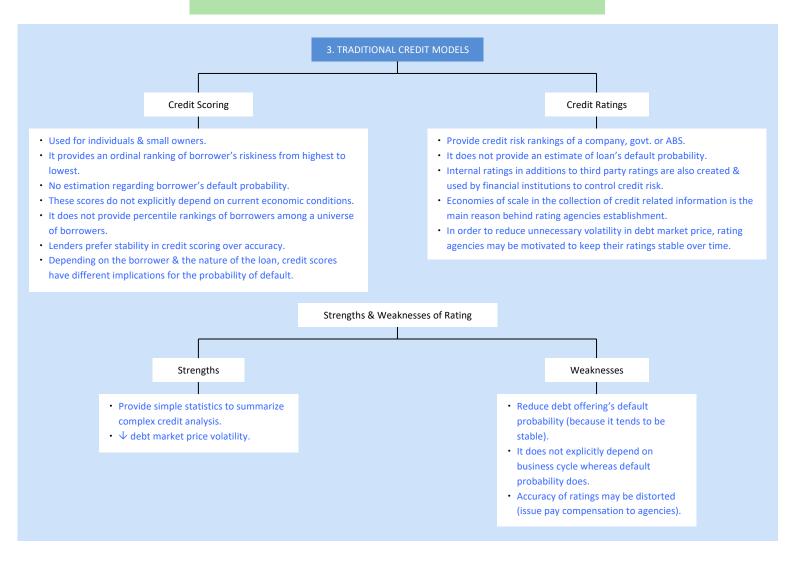


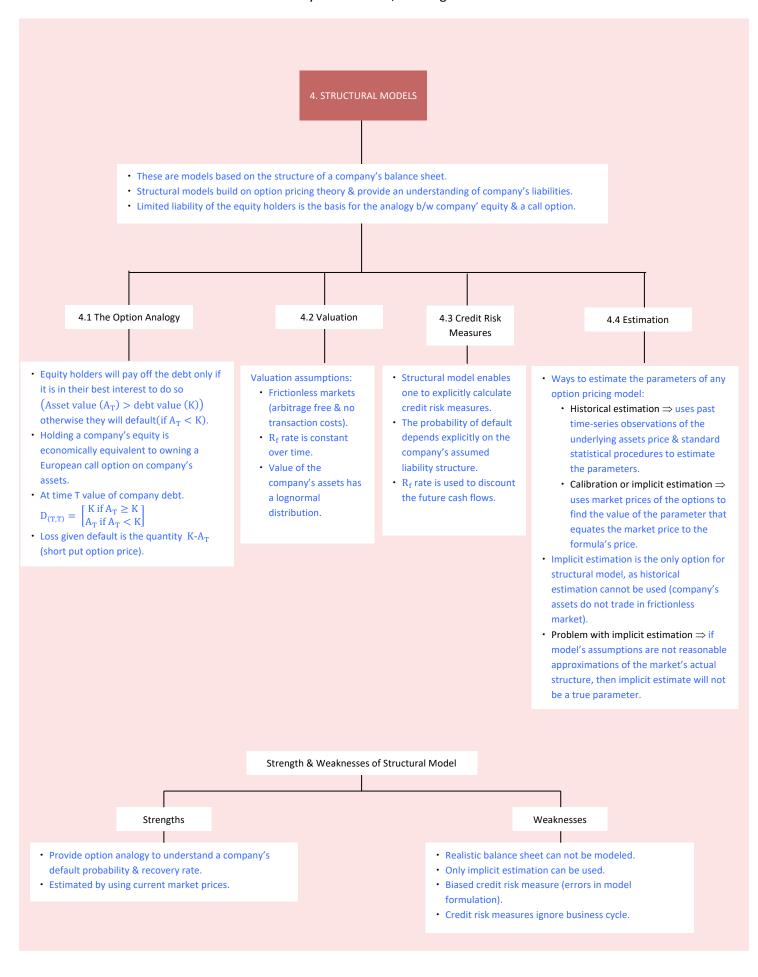
# Credit Analysis Model

RFM = Reduced Form Models CFs= Cash Flows ABS= Asset Backed Securities

## 2. MEASURES OF CREDIT RISK

- Credit risk ⇒ risk of omission of a coupon or principal payment.
- · Measures to quantify credit risk.
  - Default probability ⇒ probability that bond will default before maturity.
    - 1 the probability, riskier the bond (other factors constant).
  - Loss given default ⇒ outstanding amount of coupon & principal payments lost in the event of default.
    - Often expressed as % of exposure.
    - Recovery rate ⇒ % of position recovered in default.
  - Expected loss = probability of default × loss given default.
    - · Both factors depend on health of economy.
  - Present value of the expected loss ⇒ largest price one would be willing to pay to an insurer to entirely remove the credit risk of bond.
    - Most complex to calculate.
    - Two modifications to expected loss:
      - To explicitly adjust the probabilities to account for the risk of CFs.
      - To include the time value of money in calculation.
      - Most important measure as it provides the exact \$ difference one should pay or receive on the bond, relative to govt. bond.
    - Credit spread = YTM of risky bond YTM of govt. bond





#### 5. REDUCED FORM MODELS

- These models are developed to overcome a key weakness of structural models assumption that company's assets trade.
- RFM assumption ⇒ some of the company's debt trades.
- They are reduced form because they impose their assumptions on the output of a structural model.
- RFMs are flexible in matching actual market conditions.
- Assumptions of the reduced form models:
  - Company's zero coupon debt trade in frictionless markets.
  - R<sub>f</sub> rate is stochastic
  - State of the economy can be described by macroeconomic factors influencing the economy.
  - The company defaults at a random time 't'.
  - · Company's default represents idiosyncratic risk.
  - Given default, the % loss on the company's debt is  $0 < (X_t) \le 1$  (consider business cycle).
- Fourth, fifth & sixth assumptions are imposed on the output of structural model the probability of default & loss given default.

## 5.1 Valuation

- Option pricing methodology when applied to a reduced form model implies that risk neutral probabilities exist such that debt's price is equal to the expected payoff to the debt at maturity.
- Debt  $_{(t,T)}=\sum\limits_{E}^{\infty}\left[\frac{K}{(1+r_{t}\,\Delta)\left(1+r_{t}\Delta^{\Delta}\right)...\left(1+r_{t}-\Delta^{\Delta}\right)}\right]$

where

 $\frac{\sim}{E}$  = risk neutral probabilities

K = amount promised at time t

r = risk free rate

### 5.2 Credit Risk Measures

- Probability of default  $\operatorname{Prob}(\tau \leq T) = 1 E\left\{\frac{1}{[1 + \lambda(X_0)\Delta][1 + \lambda(X_\Delta)]...[1 + \lambda(X_T \Delta)\Delta]}\right\}$
- The expected loss:  $\sum_{i=0}^{T-A} E\left\{\frac{t(X_i)K}{[1+\lambda(X_0)\Delta][1+\lambda(X_0)]...[1+\lambda(X_i)\Delta]}\lambda(X_i)\Delta\right\}$
- The present value of the expected loss

$$KP(t,T) - D(t,T)$$

- Advantages of reduced form model:
  - The company's probability of default does not explicitly depend on the company's BS (as the case with structural model).
  - Reduced form models allow the company's different liabilities to have different loss rates if default happened.

### 5.3 Estimation

 Both implicit & historical estimations can be used for reduced form model (macroeconomic variables & company's debt prices are both observable).

## Estimation Approaches

Specify the inputs & the probability distribution for the

Problem 

if model is missspecified the resulting estimates will
be biased (not the case with historical estimation).

macroeconomic state variables.

5.3.1 Implicit Estimation

 Estimating parameters using this approach is an application of hazard rate estimation.

5.3.2 Historical Estimation

- Hazard rate estimation 

  technique for estimating the probability of a binary event.
- Preferred method because it incorporates past time series observations of company default macro variables & company BS characteristics.

### 6. THE TERM STRUCTURE OF CREDIT SPREADS

- Term structure of credit spread ⇒ diff. b/w yields on risky bonds v/s default free zero coupon bonds
- Market prices of traded coupon bonds of both types are used to estimate these yields.
- PV of the expected loss on any bond can be estimated using this term structure.

### 6.1 Coupon Bond Valuation

- Different seniority bonds from the same company can have different credit risk.
- Partition of bonds into equal seniority before starting any credit risk computation.

### 6.2 The Term Structure of Credit Spreads

- Under the frictionless market assumption, credit spread is entirely due to credit risk (under both structural & reduced form models).
- Credit spread is equal to the expected % loss per year on the risky zero-coupon bond.

### 6.3 Present Value of the Expected Loss

- PV of the expected loss = PV of riskless cash flows PV of CFs considering credit
- Assumption in decomposition of credit spread 

  no quantity impact of a purchase or sale on the
  price of the security mean no liquidity risk.
- Practical application 
   ⇒credit spreads consist of both the expected % & a positive liquidity risk premium.

### 7. ASSET-BACKED SECURITIES

- ABS differs from either corporate or sovereign debt in the structure of their future CFs.
- ABS are issued by SPVs against collection of assets called "collateral pool".
- Loans in the pool generate CFs from interest, principal repayments & prepayments.
- The structure of SPV debt is different from that of typical corporate bond and consists of bond tranches.
- The CFs first paid to most senior tranches, then to the next senior & so forth until all coupon payments are paid & any residual go to equity holders (reverse order in case of loss).
- Waterfall ⇒ allocation of CFs & losses.
- ABS are better characterized as credit derivative than simple bonds & they do not default
  when an interest payment is missed.
- Structural or reduced form model can be used to value ABS bond tranches.
- Monte Carlo simulation is often used to model ABS credit risk.
- Modeling the probability of loss, the loss given default, the expected loss & the PV of loss is a complex exercise.