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Credit Risk on Corporate Debt

0. Overview

- Global Debt Markets
- Yield Spreads
- Default and Recovery Rates
- Valuation
- Bond Ratings
- Registration Basics
- Credit Derivatives
- Interest Sensitivity Revisited

1. Global Debt Markets

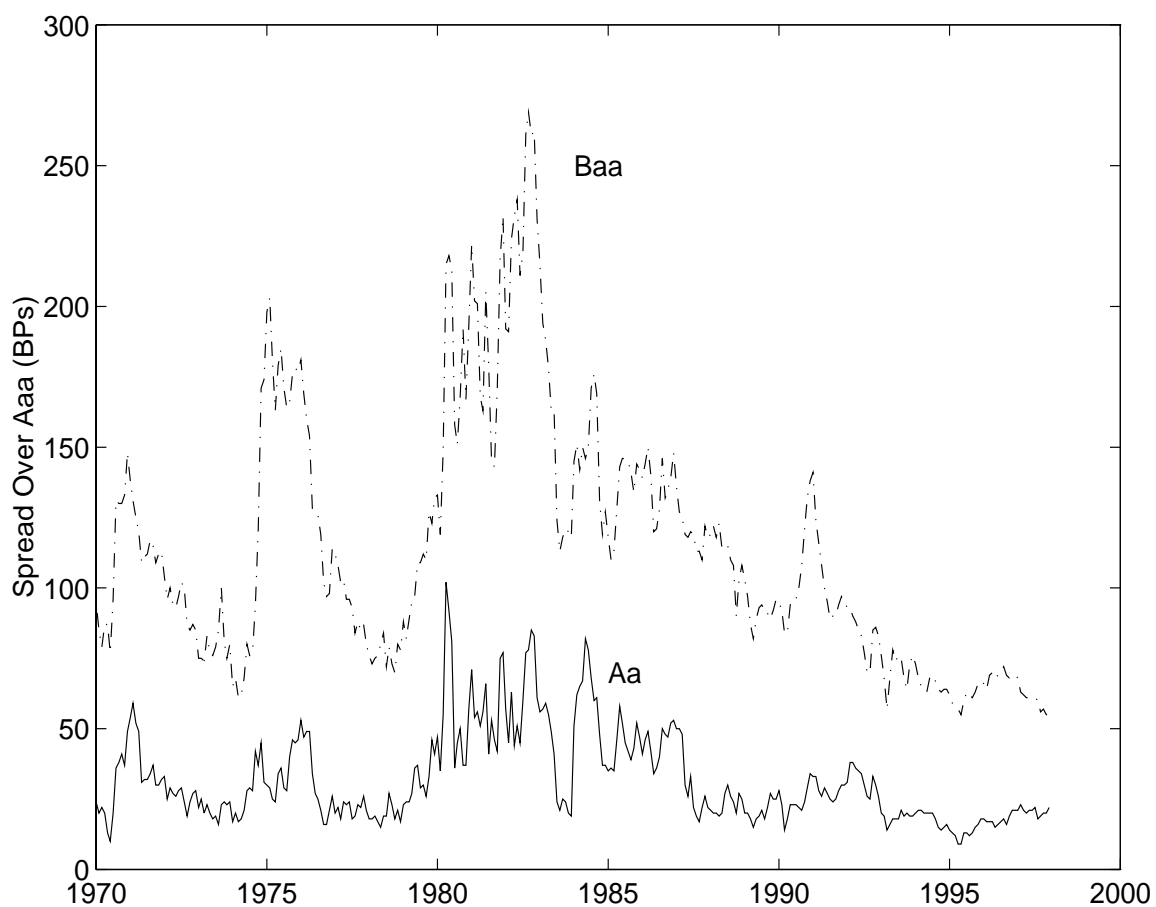
Amounts outstanding, billions of US dollars, 1996:

Public Domestic Issues	
US	7.102
Japan	3.299
Germany	0.854
Total	16.205
Private Domestic Issues	
US	4.513
Japan	1.469
Germany	1.024
Total	9.625
International Issues	
US	0.403
Japan	0.357
Germany	0.342
Emerging Markets	0.276
Total	3.226
International Issues by Currency	
Dollars	1.246
Yen	0.518
Deutschemarks	0.347
Pounds	0.237
Swiss Francs	0.166

Source: IMF.

2. Yield Spreads for US Corporates

Aa and Baa spreads over Aaa, 1970-1997:



Source: Moody's, yields on generic corporates.

2. Yield Spreads for US Corporates (continued)

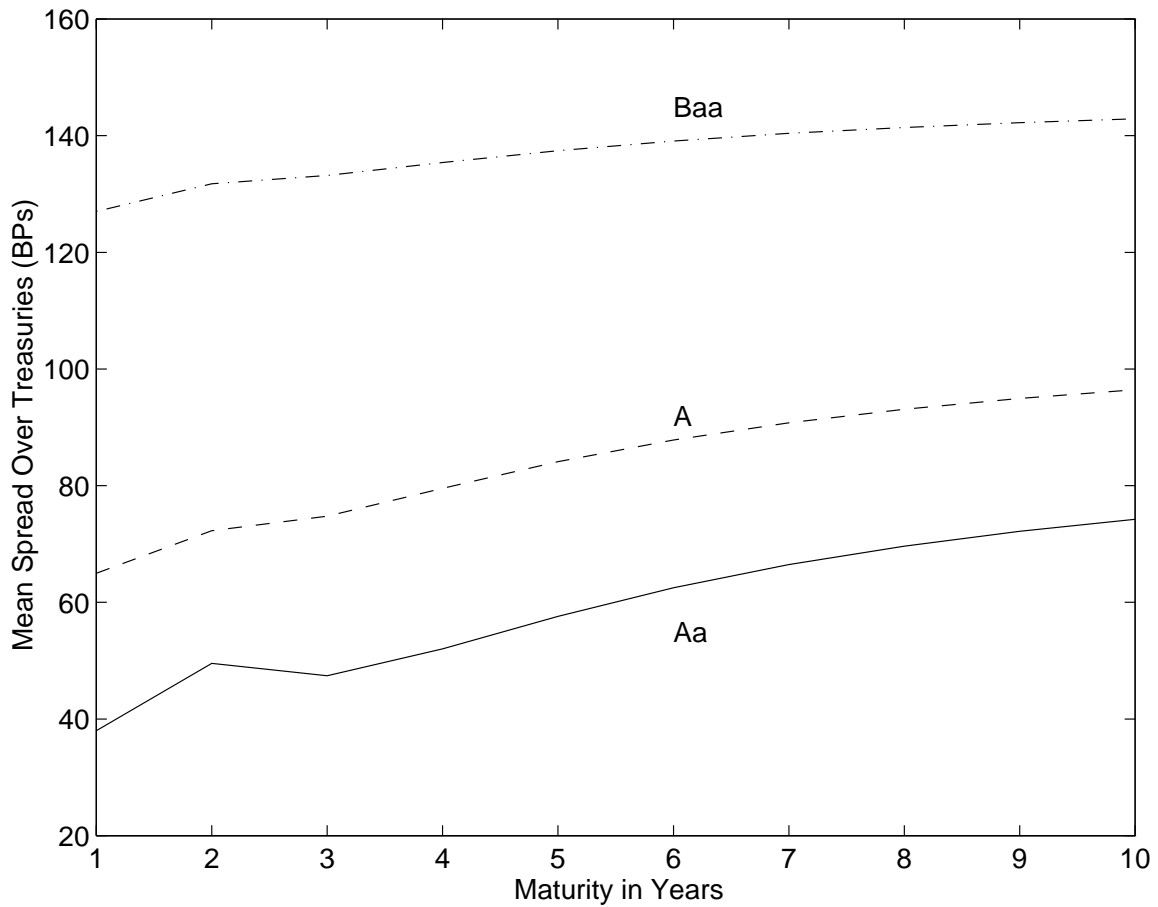
- Yield spreads over Aaa (BPs):

Rating	Mean	Std Dev
Aa	32	16
A	64	35
Baa	114	45

- Remarks:
 - Credit risk is apparently the major factor
 - Liquidity plays a role, too
 - Spreads highly variable

3. Spot Rate Spreads

- Reminder: yields depend on maturity and coupon
- Spreads for spot rates (1986-97):



3. Spot Rate Spreads (continued)

Average spreads over treasuries (1986-97, BPs):

Maturity (Yrs)	Aa	A	Baa
1	38	65	127
2	50	72	132
3	47	75	133
4	52	80	135
5	58	84	137
6	62	88	139
7	66	91	140
8	70	93	141
9	72	95	142
10	74	96	143

Source: Elton, Gruber, and Mann (preliminary!)

4. Default and Recovery Rates

- Default rates (%), 1970-96:

Rating	1-Year	5-year	10-year
Aaa	0.00	0.13	0.74
Aa	0.03	0.40	1.13
A	0.01	0.57	1.73
Baa	0.12	1.71	4.61
Ba	1.36	11.57	20.94
B	7.27	29.45	44.31

Source: Moody's.

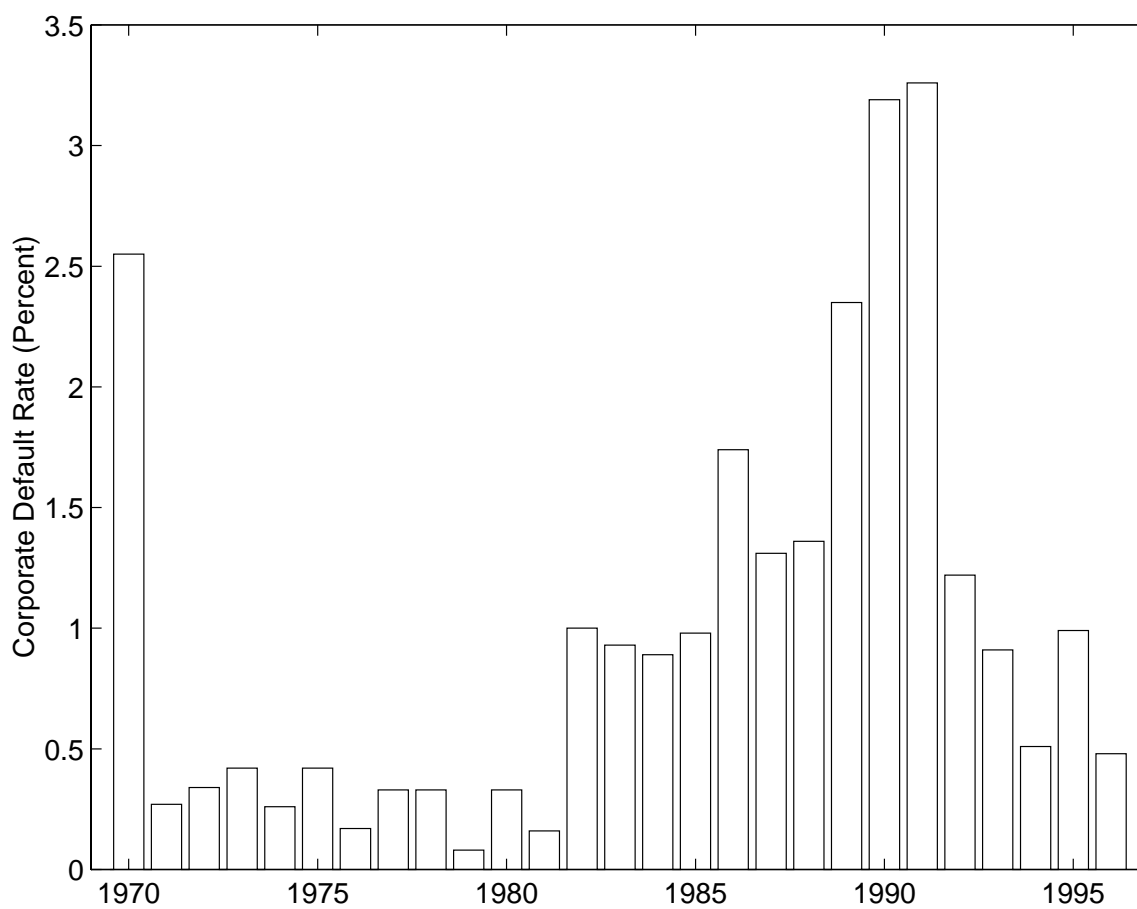
- Recovery rates (%), 1989-96:

Security	Average Recovery
Senior Secured Debt	63
Senior Unsecured Debt	48
Senior Subordinated Debt	38
Subordinated Debt	28
All Public Debt	41

Source: Moody's.

4. Default and Recovery Rates (continued)

Annual US corporate default rates:



5. Rating Drift

- Summary: ratings typically drift down
- 1-year rating changes (%), 1970-93:

Current Rating	Future Rating				
	Aaa	Aa	A	Baa	Other
Aaa	89.6	7.2	0.7	0.1	0.1
Aa	1.1	88.8	6.9	0.3	0.2
A	0.1	2.5	89.0	5.2	0.8
Baa	0.0	0.2	5.2	85.3	6.4

- 5-year rating changes (%), 1970-93:

Current Rating	Future Rating				
	Aaa	Aa	A	Baa	Other
Aaa	62.5	21.8	4.9	0.5	1.2
Aa	5.5	52.9	22.3	3.9	2.7
A	0.3	9.9	59.6	15.0	5.8
Baa	0.2	1.9	18.8	49.7	17.8

Source: Altman.

NB: Totals don't sum to one (some ratings are withdrawn).

6. Evidence Wrap-Up

- Observations:
 - Spreads large and variable
 - Spreads increase with maturity
 - Ratings drift down (on average)
 - Defaults bunched in time (not diversifiable?)

- Inference: spreads reflect
 - Default probabilities
 - Recovery rates
 - Risk premiums

7. Risk and Return (CAPM Review)

- Returns: r_f is the riskfree return, r_m the return on the market, and r_i the return on an arbitrary asset

- Expected returns:

$$\begin{aligned} E(r_i) &= r_f + \beta_i [E(r_m) - r_f] \\ &= r_f + \pi_i \end{aligned}$$

(think of π_i as the risk premium on asset i)

- Valuation of asset i :

$$\text{Price} = \frac{\text{Expected Cash Flow}}{1 + r_f + \pi_i}$$

(one-period example, but you get the idea)

- Summary: value based on expected cash flow, but the discount rate is adjusted for risk (π_i)
- Remark: similar result applies in more general settings (ie, beyond the CAPM, including our state-contingent claims models)

8. Corporate Bond Analytics

- Impact of default, recovery, and risk on yield spreads
- One period bonds (practice)
- Notation:

$$\begin{aligned}\alpha &= \text{Prob}(\text{Solvency}) \\ &= 1 - \text{Prob}(\text{Default}) \\ \beta &= \text{Recovery Rate}\end{aligned}$$

- Expected cash flow from one dollar face value:

$$E(\text{Cash Flow}) = 1 \times [\alpha + (1 - \alpha)\beta]$$

- Valuation:

$$\begin{aligned}\text{Corp Disc Factor} &= \frac{1}{1 + (y + \pi)/2} \times [\alpha + (1 - \alpha)\beta] \\ &= \frac{1}{1 + (y + s)/2}\end{aligned}$$

where y is the riskfree (treasury) spot rate, π the risk premium, and s the appropriate corporate spread

- Remark: the spread s captures the effects of default (α), recovery (β), and risk (π)

8. Corporate Bond Analytics (continued)

- Example:

$$\alpha = 0.99$$

$$\beta = 0.50$$

$$\pi = 0.01$$

$$y = 6\%$$

- Calculations:

$$E(\text{Cash Flow}) = 0.995$$

$$\text{Treas Disc Factor} = 0.9709$$

$$\text{Corp Disc Factor} = 0.9614$$

$$s = 2.04\%$$

9. Interest Sensitivity of Corporates

- Yield is sum of two components:
 - Yield y on comparable treasury
 - Spread s over treasuries

- Sensitivity:

- Duration (sensitivity to y):

$$D = -\frac{dp/dy}{p} \quad (\text{the usual calculation})$$

- Spread duration (sensitivity to s):

$$D_s = -\frac{dp/ds}{p} \quad (\text{the same number})$$

- Price changes:

$$\Delta p \cong -Dp\Delta y - D_s p \Delta s$$

- Value-at-Risk (VAR) analyses include both components

9. Interest Sensitivity of Corporates (continued)

- Statistical properties of the spread
(monthly changes, 1986-97):

Std dev of 5-year treas spot	0.33%
Std dev of 5-year corp spread	0.19%
Correlation	-0.31

Source: Elton, Gruber, and Mann.

- Statistical approaches (CreditMetrics, CreditRisk⁺, etc)
 - Model spreads for each rating class
 - Allow for changes in rating, too
 - Subtle issue: correlation across bonds

10. Bond Rating Overview

- Rating agencies: Moody's, Standard and Poors, Fitch, Duff and Phelps
- Ratings based on
 - Industry: how risky?
 - Firm's status in industry
 - Financial situation
 - Management and accounting quality
 - Legal status: senior or subordinated, covenants
- Statistical approaches
 - Compute ratings from ratios of:
 - * pretax earnings to interest payments (coverage)
 - * working capital to total assets
 - * retained earnings to total assets
 - * operating income to total assets
 - * book value of equity to total assets (leverage)
 - Estimation by a variety of statistical methods
 - Modifications dictated by data availability (eg, private firms and emerging markets)

11. SEC Registration Basics

- Public issues in the US must be registered with the SEC under the 1933 Act:
 - Clear registration statement with SEC
 - File and distribute prospectus
- Failure to register when called for gives the buyer a put
- Shelf registration: Rule 415 allows a firm to register a security once, then issue or reissue within two years at its convenience (medium term notes are a good example)
- Exemptions from registration:
 - Reg 144A: sales to Qualified Institutional Buyers (QIBs)
 - Reg S: ditto off-shore sales to non-US buyers
 - Private placements: some debt is placed directly
 - Issues with maturities under 180 days (paper)
- Disclosure applies to all: even when registration isn't required, fraud laws and investor due diligence generally require borrowers to disclose relevant information

12. Structured Financing Overview

- Securitization:
 - Issuer sells loans (or other assets) to “single-purpose vehicle (SPV),” typically a trust, legally separate from the issuer
 - SPV issues securities using the loans as collateral
 - Examples: mortgages, credit card debts, auto loans
 - Simplest version is a passthrough: owners of securities get cash flows of loans (net of a servicing fee)
 - Advantages:
 - * Issuer (a bank, say) unloads the capital charges associated with holding the loans
 - * Securities generally more liquid than the loans
 - * Allows specialization: originator, servicer, and investor can be different
 - * Structuring: SPV can issue different classes of securities that appeal to different investors (“tranches”)
 - * Overcollateralization can support higher rating on security than on the underlying loans

12. Structured Financing Overview (continued)

- Collateralized Bond Obligations (CBOs)
 - SPV buys bonds, typically with low average rating
 - SPV finances bonds by issuing securities

Illustrative example:

- * 70% (say) Aa-rated notes at Treas + 35 BPs
 - * 15% Baa-rated notes at Treas + 200 BPs
 - * 15% equity (residuals)
- Advantages:
 - * Diversification: portfolio less risky than pieces
 - * Transforms junk into investment grade
 - * Allows junk issuers to tap investment grade market
 - * Sharp discount on junk makes this profitable
 - * Leverage: equity investors (the issuer?) have highly-levered position in underlying bonds
(moreover, often treated better by regulators than equivalent positions in underlying assets)

13. Credit Derivatives

- Market forces:
 - Institutions want to diversify credit exposure
 - * Example: bank has large exposure to important client, wants to reduce credit exposure (and capital requirements) without jeopardizing relationship
 - Investors want direct access to credit risk
 - * Example: Pension fund wants exposure to credit risk on Brady bonds without additional exposure to interest rates
 - Problems:
 - * Underlying assets hard to trade
 - * ... and contain other risks
 - Possible solution: credit derivatives

13. Credit Derivatives (continued)

Examples

- Default swap or put
 - Investor pays (say) fixed annual premium
 - Dealer pays difference between par and market price if default occurs (investor has a put option)
 - Remark: similar to bond insurance
- Total return swap
 - Counterparty 1 pays LIBOR + spread
 - Counterparty 2 pays total return on loan pool
 - Result: 1 has assumed 2's credit exposure
 - Variants: replace loan pool with corporate bonds, Brady bonds, municipals, or sovereigns, either individually or in “baskets” (hence the various bond indexes)
- Credit spread swap
 - Investor pays yield on a specific corporate bond
 - Dealer pays treasury yield + spread
 - Result: Investor gains exposure to corporate credit risk

13. Credit Derivatives (continued)

ABC Corp in the mid-80s (several mergers ago)

- Situation:
 - Rumors of hostile takeover triggered increase in spread on ABC debt
 - ABC regarded rumors unfounded
- Plan:
 - ABC and an investment partner purchased ABC's debt
 - Partnership agreement assessed changes in value due to credit risk to ABC, changes due to market yields to partner
- Result:
 - ABC's credit spread tightened, earning ABC several million dollars

13. Credit Derivatives (continued)

- Outstanding issues:
 - Documentation: no ISDA standard agreement yet
 - * Greater legal burdens in writing contracts
 - * Uncertain treatment by courts
 - Lack of standardization hurts liquidity
 - Uncertain verification of credit events
 - Regulatory treatment: when is a hedge counted?
 - International differences in default/bankruptcy law

Summary

- Corporate debt trades at lower prices (higher yields) than treasuries with comparable cash flows
- Standard interpretation: credit risk
- Valuation has three components: default rates, recovery rates, and risk premiums
- Bond ratings are professional assessments of credit risk
- Credit risk is an extra ingredient in fixed income portfolios and is generally modeled as an extra factor (the spread)
- CBOs and credit derivatives are useful tools for managing credit risk