Uncertainty, Default, and Risk

(Welch, Chapter 06-2)

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1: Previous Slides

- Perfect Markets
- Uncertainty
  - Random Variables
  - Means and Standard Deviations
  - Risk Preferences

2: Default (“Credit”) Risk

- Most loans have credit risk
- The borrower can default (not pay).
- Loosely, credit risk = promised return that is lost on average when borrowers go belly-up.

3: Default

- Can the U.S. government / Treasury default?
- Do Treasury securities have default (credit) risk?

4: Working Example: Fair Default

- Henceforth, assume Treasury bond costs \$200 and promises to pay \$210.
  - $E(r_F)$ is known r_F, because Treasuries have no default risk.

$$\Rightarrow \quad E(r_F) = r_F = 5\% \ .$$

- In this chapter, we assume you are risk-neutral.
  - Every same-term investment should have 5% expected RoR.

5: Me and You

- I want to borrow $200 from you.
- I promise to repay $210.
- However, I may go bankrupt in 1 out of 100 cases, in which case I can repay only $50.
  - It does not matter whether it is my fault or not.
  - No ethics involved here.

6: What If I Promise?

- What is the “promised” RoR on my personal bond?
- Do I promise to give you the same RoR as the Treasury?

7: Your Expected Dollar Return

At the same promised 5%, what amount would you expect my bond to return?

8: Your Expected RoR

What RoR would you expect my bond to give you?

9: Would You Extend Credit?

Would you prefer to

1. make this loan to me; or
2. put your money into the 5% Treasury bond?

10: Reduce Loan Amount

How much money would you be willing to give me in exchange for *a* promise to pay you $210?

11: Claimed On Documents

- If Bloomberg (or the WSJ) were to print my bond's interest rate, what interest rate would they print?

- Which one would be more interesting?

12: Quoted = Expected Rates?

Are quoted interest rates on risky bonds expected rates?

13: Default (Credit) [vs Risk] Premium

- **Default Premium**: quoted compensation to make you break even on average (here, 0.81%).
  - It is required to get you to participate even if you are completely risk-neutral.
- If you repeat the investment infinitely many times, the *average default* ***payment*** is 0.
  - You get more payment if everything goes well, less otherwise.

14: Risk-Neutral Interest Rate

In the real world, would this interest rate really be high enough?

15: [Default vs] Risk Premium

- If you are risk-averse, you require a risk premium to not go U.S. Treasury.
- **Risk Premium**: extra compensation to give you *more* than the **time premium** *on average*.
- If you repeat the investment infinitely many times, the risk premium will allow you to earn more than an investor holding U.S. Treasuries will earn.

16: What Are They Today?

- Not Published!
- Quoted interest rates contain multiple premia.
- We need to estimate expected quantities to distinguish among premia,
- for which we typically use long historical data as a historical guide — our standard “Hail Mary.”

17: Risk Compensation?

- Never confuse the credit premium and the risk premium.
- In our risk-neutral perfect world, with a Treasury rate of 5.00% and a quoted bond of 5.81%, the risk premium was still zero.
  - the real world is neither risk-neutral nor perfectly perfect.

18: Important Reminder

- The Default/Credit-Risk Premium is *not* compensation for risk aversion.
  - The latter will be called the "risk premium" soon.
- **Warning**: You must be clear about the distinction between default premia and risk premia.
- Make sure you know what they are about, and know the difference between these premia!

19: Premium Decomposition I

- In a risk-neutral world:
- **Quoted (=Promised) Interest Rate $\geq$ Expected Interest Rate.**
- **Quoted Interest Rate = Time Premium + Default Premium**
- **Expected Interest Rate = Time Premium**
- In the real world, there are also risk premia, liquidity premia, tax premia, etc.

20: Premium Decomposition II (Here)

- The promised interest rate was 5.81%,
- the time premium 5.00%,
- the default premium 0.81%, and
- the risk premium 0.00%.

21: Typical Premium Magnitudes

- Risk premia for “fairly safe” bonds from “large, safe” companies can be as low as a few bps.
- Logically, if there is no default premium, there can be no risk premium.
  - there could be a default premium without a risk premium.
- The default premium is usually probably bigger in magnitude than the risk premium.

22: Combined Premia over US Treasuries, 2021

AAA	A	BAA	B1
0.7%	1.0%	1.4%	2.3%

Short	Long
0.5%	1.3%

- US Treasuries were about 2.0% for top panel, and 0.9%/1.8% for bottom.

23: Promised IRR?

- IRR from promised cash flows is *a* promised IRR.
  - It is what everyone quotes.
- Never use the promised IRR for capital budgeting:
  - you must use an IRR computed from **expected** cash flows, not from promised cash flows,
  - just as you must use **expected** and not promised cash flows in the NPV rule.

24: Default (Credit) in NPV

- **In PV applications, you have to use**

$$PV = \frac{E(\text{Cash Flow})}{1 + E(\text{Discount Rate})} .$$

- You must use **expected** values in both the numerator.
  - Actually, the appropriate discount rate should be known today, so you can drop the E() in the denominator. Don't use **promised** from other projects, though.
  - In the real world, stupid users often mix up the difference between promised and expected quantities.

25: Default (Credit) in NPV

- The expected payoff is in the numerator, and it takes care of the default risk of our project.
- The correct PV of the risky loan promising only \$210 would be

$$PV = \frac{E(\text{Cash Flow})}{1 + E(\text{Disc Rate})} = \frac{\$208.40}{(1 + 5\%)} \approx \$198.47 \ .$$

- No one would give us \$200 upfront for this loan, because the economy-wide cost of capital is 5%.

26: Using *Promised* in NPV?

- The expected discount rate—*not the promised RoR*—is in the denominator.
  - It is the opportunity cost of capital on other projects, quoted in terms of their expected RoRs, not in terms of their promised RoRs.
  - You can't use the **promised** RoR of opportunities (elsewhere) as your cost of capital.
  - They are just promised, too.

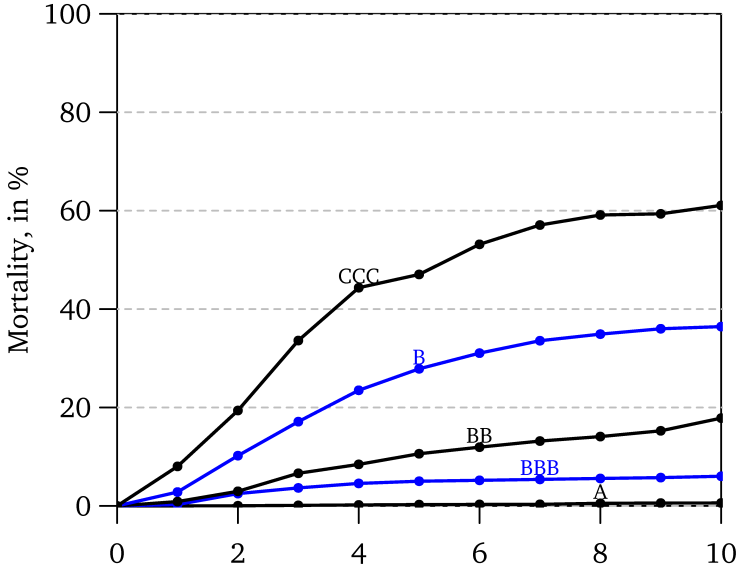
27: Implication of Risk-Neutrality

- In our risk-neutral PCM, every project has the same cost of capital (here 5%)
- . . . regardless of how likely the project or bond is to pay what it promises.
  - which is also why we don't believe the real world is actually risk-neutral.

28: Corporate Credit Ratings

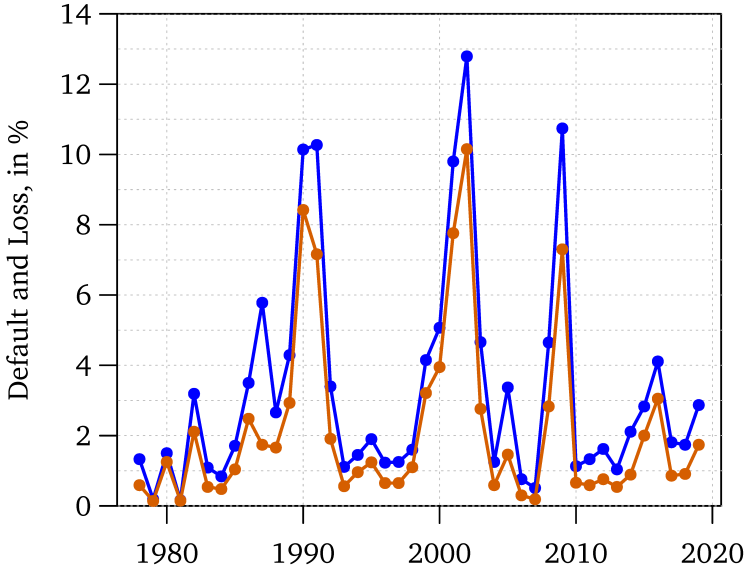
- Large corporations have credit ratings, too, ranging from AAA (best) to D.
- Default: failure to pay at least one payment on time.
  - Typical AAA firm does not default over 10 years ($\approx$ 0%).
  - Typical B firm has a 20% prob over 5 years.
  - Typical C firm has a 50% prob over 6–8 years.

29: Graph: U.S. Bond Mortality



but not similar probabilities over time. they happen a lot more in recessions and tough times. . .

30: Graph: U.S. Bond Death



31: More Default or Risk Premium?

- Most yield spread of corporate bonds is due to the chance of default (i.e., the credit spread).

Example: if a Boston Celtics = 9.4%, whereas a similar Treasury = 5.6%, then I would guesstimate that Celtics bond pays off ≈ 6.0%.

- 3.4% would be the default risk, and
- 0.4% would be the risk (and other) premium.

32: Crucial Uncertainty Lesson

- **Never ever confuse expected rates with (higher) promised rates.**

- The 9.4% from the Boston Celtics is not expected!
- Newspapers and websites virtually never report expected rates.

33: Critical Mistake

- If you use *a* promised or quoted *cash* flow where you *have* to use *an* expected *cash* flow (i.e., you mix up these two), do not mention **under *any* circumstances** *that* you took this finance course with me *as* your instructor.
  - Just *say* you went to HBS instead.

34: Credit (Default) Swaps (CDS)

- You can buy insurance against default, called credit (default) swaps.
  - The financial crisis of 2008 has made them famous, because they played a central role. They quasi-defaulted themselves!
- Most CDS are now centrally cleared.
  - Sellers: hedge funds who want to speculate on default.
  - Buyers: mutual funds or pension funds who want to reduce their risk exposure.

35: CDS Contract Basics

- In the event of default, the CDS seller may either:
  - pay the CDS buyer a fixed amount, or
  - allow the CDS buyer to sell the bond for a pre-agreed price to the CDS seller upfront.
- Most CDS are standardized now.
  - A few unusual ones are negotiated up-front.

36: CDS Market Size

- In 2021, there was about $10 trillion of single-name credit swaps outstanding.
- However, market-size is hard to assess.
  - Someone with $10m long and $10m short may or may not be counted as 0.

37: CDS Market Background I

- The risk of credit divorces from the holders of the corporate debt.
  - Risk is somewhat similar to the housing derivative risk — an obscure bank in Germany may blow up over housing trouble in Kansas.
  - A fund can buy the bonds, insure itself many times over against default with a CDS, and then vote to try to drive the firm itself into bankruptcy.

38: CDS Market Background II

- However, as a buyer of a CDS, you will also have to worry about whether the issuer of the CDS will go bankrupt itself.
- Much less of a worry with a central clearing house.
- And whether the clearing house board deciding what is a default is also conflicted.