Uncertainty, Default, and Risk

(Welch, Chapter 06-2)

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Previous Slides

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

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.

Default

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

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.

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.

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?

Your Expected Dollar Return

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

Your Expected RoR

What RoR would you expect my bond to give you?

Would You Extend Credit?

Would you prefer to

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

Reduce Loan Amount

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

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?

Quoted = Expected Rates?

Are quoted interest rates on risky bonds expected rates?

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.

Risk-Neutral Interest Rate

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

[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.

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.”

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.

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!

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.

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%.

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.

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.

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.

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.

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%.

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.

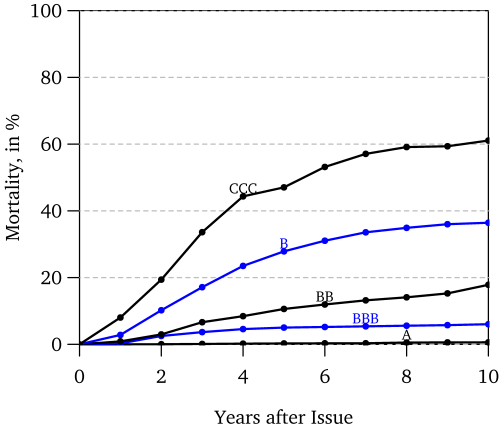
Implication of Risk-Neutrality

- 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.

Corporate Credit Ratings

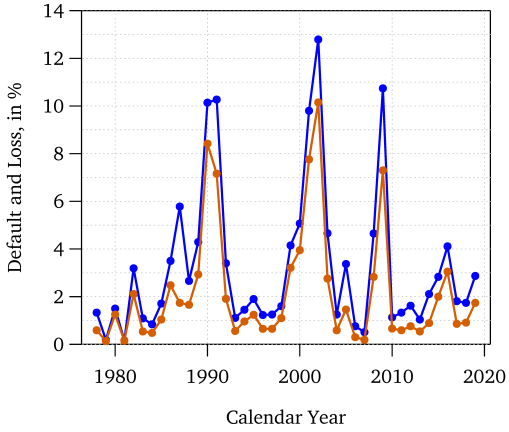
- Large corporations have credit ratings, too, ranging from AAA (best) to D.
- Default: failure to pay at least one payment on time.
  - Typical AAA firm does not default over 10 years ($\approx 0\%$).
  - Typical B firm has a 20% prob over 5 years.
  - Typical C firm has a 50% prob over 6–8 years.

Graph: U.S. Bond Mortality



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

Graph: U.S. Bond Death



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 $\approx$ 6.0%.

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

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.

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.

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.

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.

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.

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.

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.