Leverage

Effect on investment performance

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UCONN

1 Introduction

What are we going to do during this class:

- There are trillions in mortgage debt in the US alone.
- We will focus on leverage, and its effect on investment performance of the equity. (There might also be other considerations, like tax treatment, which we will skip for now.)
- Note that in normal corporate finance, this section would most likely be skipped.
  - Stockholders can lever up or down on their own account.
  - Borrow money, or by investing in bonds. (Or anything that is highly collinear with interest rates.)
- This is obviously not the case for direct real estate investment.

2 What is leverage

- You can use debt to “lever” up your property.
- Say you purchase a $10M property, and you take up a $6M loan. (I.e. you use $4M of your own money.)
- We have two ways to measure leverage;
  - **Leverage ratio (LR):** V/E = (L + E)/E. Which is $10M/$4M = 2.5.
  - **Loan to Value (LTV):** L/V = L/(L + E). Which is $6M/$10M = 0.6.
    - V = value of property.
    - L = loan amount.
    - E = equity, i.e. own money in the property.

2 What is leverage

- Equity is your ownership share. However, it gives you (normally) full control over the property. (As long as you meet the requirements of the debt obligations.)
- Debt, on the other hand, receives a senior claim on the cash flows and value. In other words, the debtor is always paid first.
- However, equity gets the **residual claim** on cash flow and value. Meaning that whatever is left after the debtor is paid, is for the equity holders.
  - The residual claim ensures that property managers are sufficiently incentivized to maximize profit.

3 Effect of leverage on risk and return on equity

- Note that as an investor, you only really care about the return (and risk) of your own money, aka equity.
- Previously, we have only focused on risk/return of properties, treating them as if there is no leverage on them.
- This is extra interesting, as this means that **heterogeneous investors**, have yet another way to match their risk/return preference on a property.
- Next, we will discuss what the effect of leverage is on return, followed by the effect of leverage on risk.

3 Effect of leverage on return on equity

- Take the following numbers:
  - Value in t: $10,000,000.
  - Value in t+1: $10,200,000, or a 2% capital gain / appreciation.
  - 8% income return at t, or $800,000.
  - Thus, total return was (8% + 2% =) 10% on the property, free and clear of debt. (PBTCF)
- However, now assume that the investor takes a $6M loan to fund this property (thus equity is $4M), and the interest rate is 8%.
  - **LR = 2.5** ($10M / $4M), **LTV = 0.6** ($6M / $10M).
  - **What is the return on equity in this case?**
  - Note that the return on the property remains 10%.
- Small (but important!) technical note, the loan is assumed to be interest rate only and risk free.

3 Effect of leverage on return on equity

- There are multiple ways on calculating the return on equity. One way;
  - Lender gets the first claim on the cash flow. Interest rate is 8%, and the loan amount is $6M, thus total **interest paid is $480,000**.
  - Subtract that amount from the free cash flow of the property of $800,000, and you – as an investor – can keep ($800,000 - $480,000 =) **$320,000**.
    - Expressed as a yield, this gives us $320,000/$4,000,000 = **8%**. This remains the same, because the interest rate is a similar % as the income yield.
  - You can keep the entire capital gain of $200,000.
    - Expressed as a yield, this is $200,000/$4,000,000 = **5%**.
- Thus the total return on equity is (8% + 5% =) **13%**.

3 Effect of leverage on return on equity

	Property	Levered equity	Debt
Initial value	$ 10,000,000	$ 4,000,000	$ 6,000,000
Cash flow	$ 800,000	$ 560,000	$ 240,000
Ending value	$ 10,200,000	$ 4,200,000	$ 6,000,000
Income return	8%	14%	8%
Appreciation return	2%	5%	0%
Total return	10%	19%	4%

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Now we lowered the interest rate to 4%.

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Income return	8%	14%	4%
Appreciation return	2%	5%	0%
Total return	10%	19%	4%

Note that the total return even increases more.

But now let's go back to the original example of 8%.

3 Effect of leverage on return on equity

- Great! We increased our return by *30%*! (Difference between the 10% and 13%.)
- What the market really cares about is the return over the risk-free rate.
  - In that case the difference is even larger. Note that we called the loan risk-free? This means we can assume the risk-free rate is 8% in the previous example.
  - Thus, the comparison should be between (10% - 8% =) 2% and (13% - 8% =) 5%.
  - Which is **2.5 times** as much!
- Unfortunately, as we know, there is no such thing as a free lunch. And this **increase in expected return**, comes with an **increase in expected risk**.
  - Note again that it is very important to distinguish between realized risk/return and expectations.

4 Effect of leverage on risk of equity

- Risk in investment is related to **uncertainty and unpredictability**. We do not know the cash flow growth. We do not know the price / rent appreciation for sure.
  - With our NPV investment reports, this is reflected in the return requirement (r).
  - In this case we are talking about the same property, with the same return requirement, but an “extra” layer of risk for the investor.

4 Effect of leverage on risk of equity

- We have two scenarios;
  - **Optimistic**;
    - Value at t + 1: $11,200,000, or 12% increase.
    - 9% net income yield, or $900,000.
  - **Pessimistic**;
    - Value at t + 1: $9,200,000, or -8% appreciation.
    - 7% net income yield, or $700,000.

- The loan amount and interest rate stays the same ($6M at 8%), and does not care about whether or not an optimistic or pessimistic scenario unfolds.
- We quantify risk, as the range in total return between the good and bad scenario. So what is the risk?

4 Unlevered (LR = 1, LTV = 0)

	Optimistic	Pessimistic
Initial value	$ 10,000,000	$ 10,000,000
Cash flow	$ 900,000	$ 700,000
Ending value	$ 11,200,000	$ 9,200,000
Income return	9%	7%
Appreciation return	12%	-8%
Total return	21%	-1%

The risk is essentially the difference in total return (obviously minus the risk-free rate), which has a range of 11% around the mean (the 10% total return of the unlevered property).

4 Effect of leverage on risk of equity

- We have two scenarios;
  - **Optimistic**;
    - Exit value on Equity is $11.2M - $6M = $5.2M.
    - Cash on Equity is $900,000 – $480,000 = $420,000.
  - **Pessimistic**;
    - Exit value on Equity is $9.2M - $6M = $3.2M.
    - Cash on Equity is $700,000 – $480,000 = $220,000.

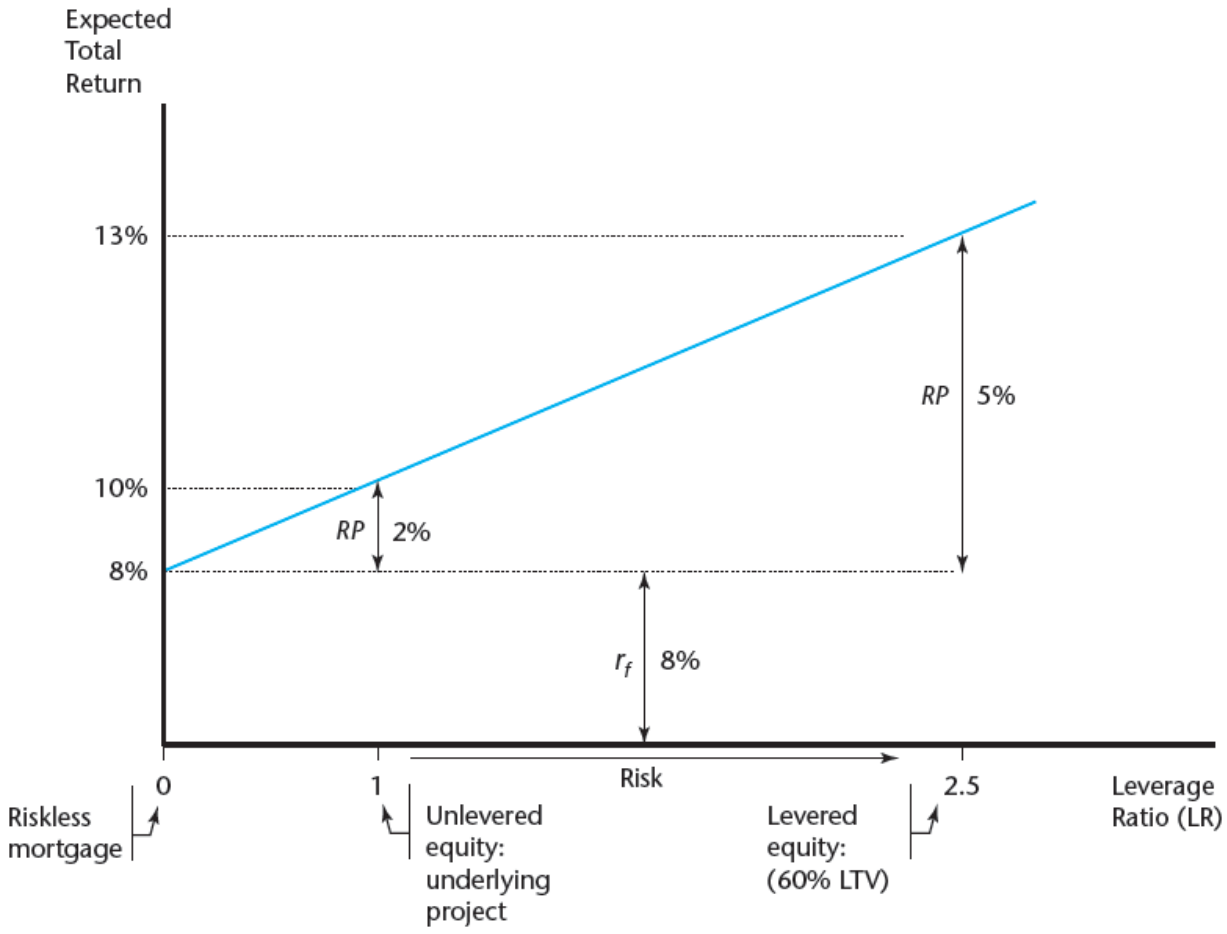
- The in initial investment of Equity was $4M.
- What are the returns in both scenarios?

4 Levered (LR = 2.5, LTV = 0.6)

	Optimistic	Pessimistic
Initial value	$ 4,000,000	$ 4,000,000
Cash flow	$ 420,000	$ 220,000
Ending value	$ 5,200,000	$ 3,200,000
Income return	10.5%	5.5%
Appreciation return	30.0%	-20.0%
Total return	40.5%	-14.5%

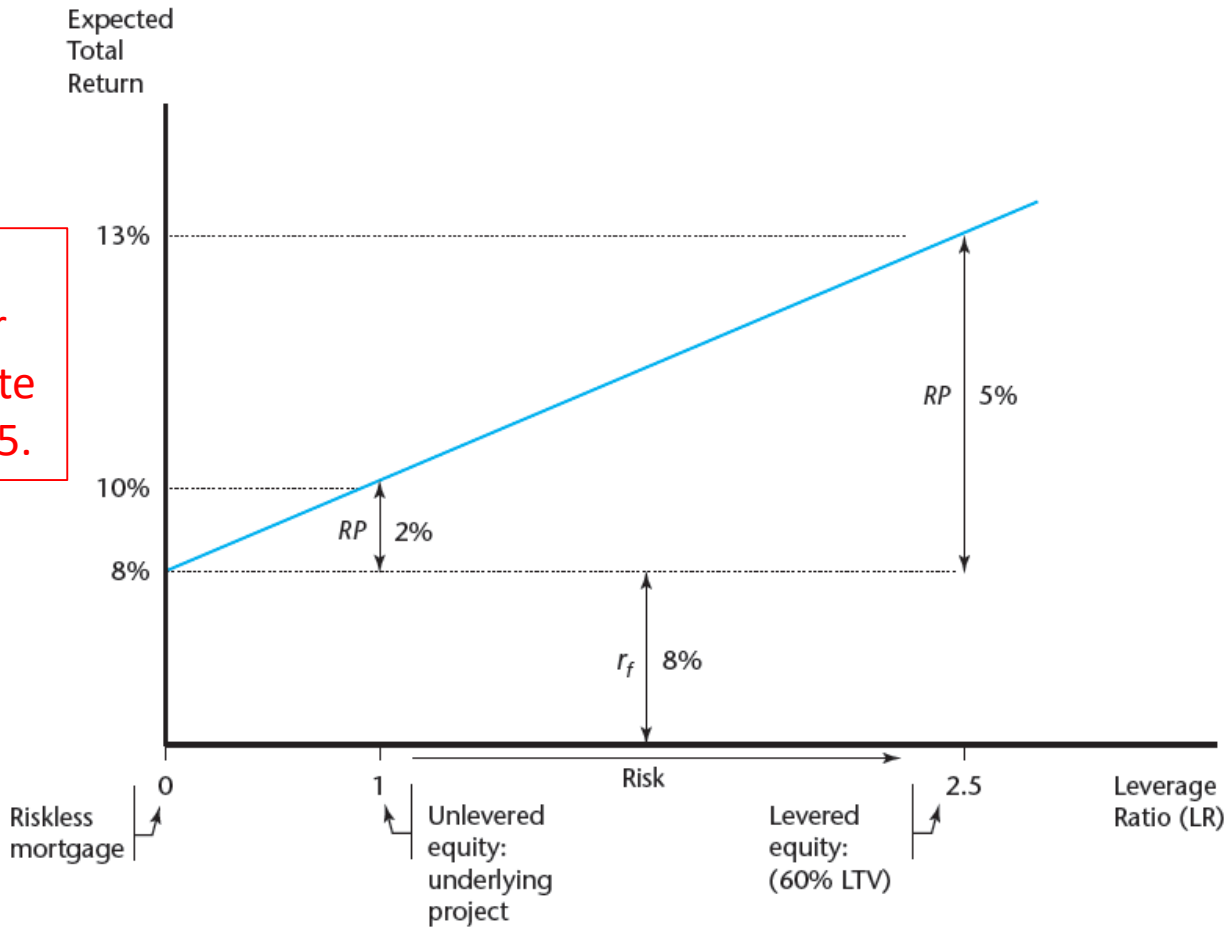
Unlevered the "risk" was 11%. When the same property is being levered, the "risk" increases to (40.5 – 13 =) 27.5%. Note we use the mean total return of the levered property. If we divide the 27.5% / 11% = 2.5. Where did we hear that number before? Even real estate abides by the **security market line**!

4 Security Market Line

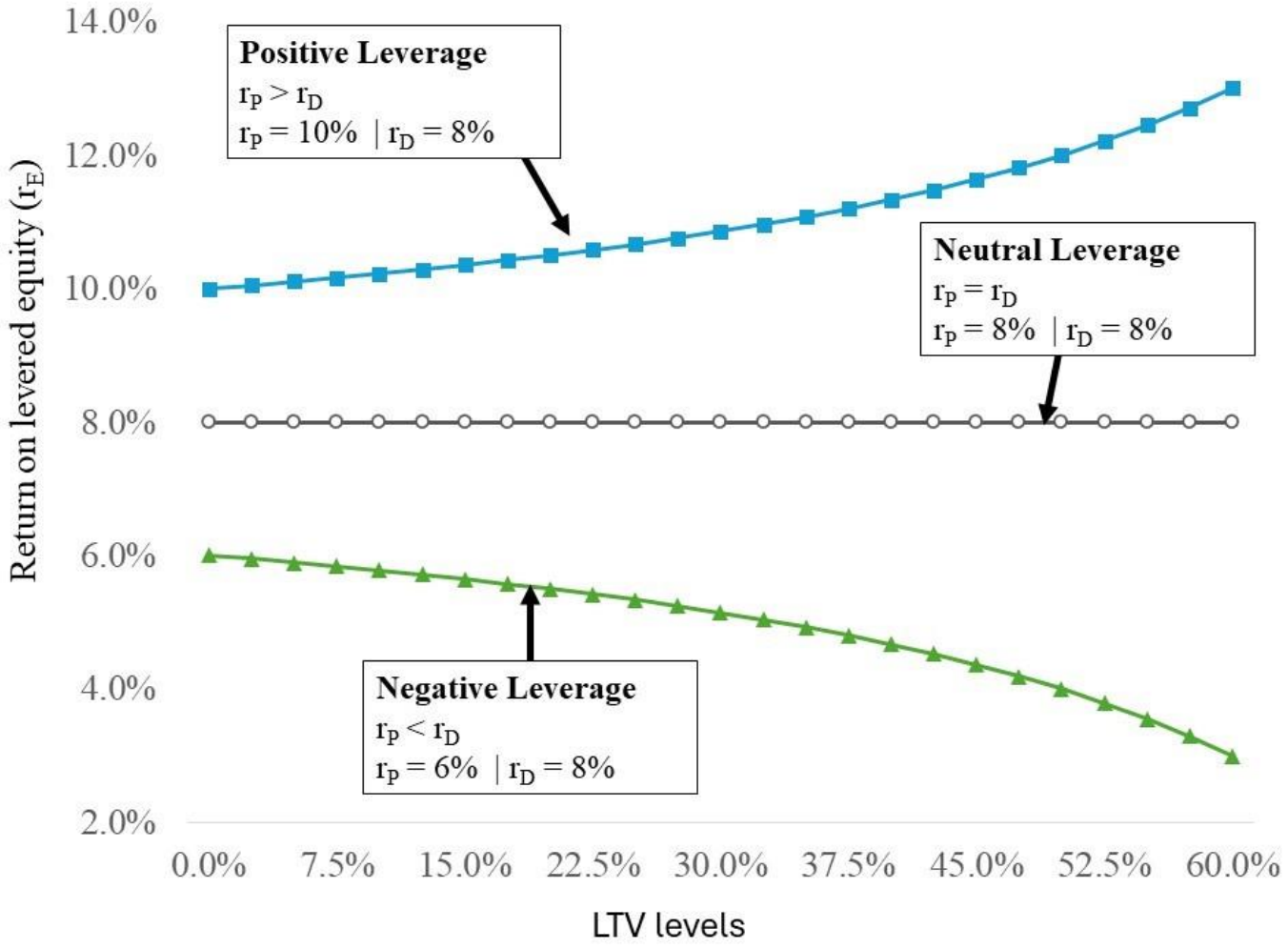


4 Security Market Line

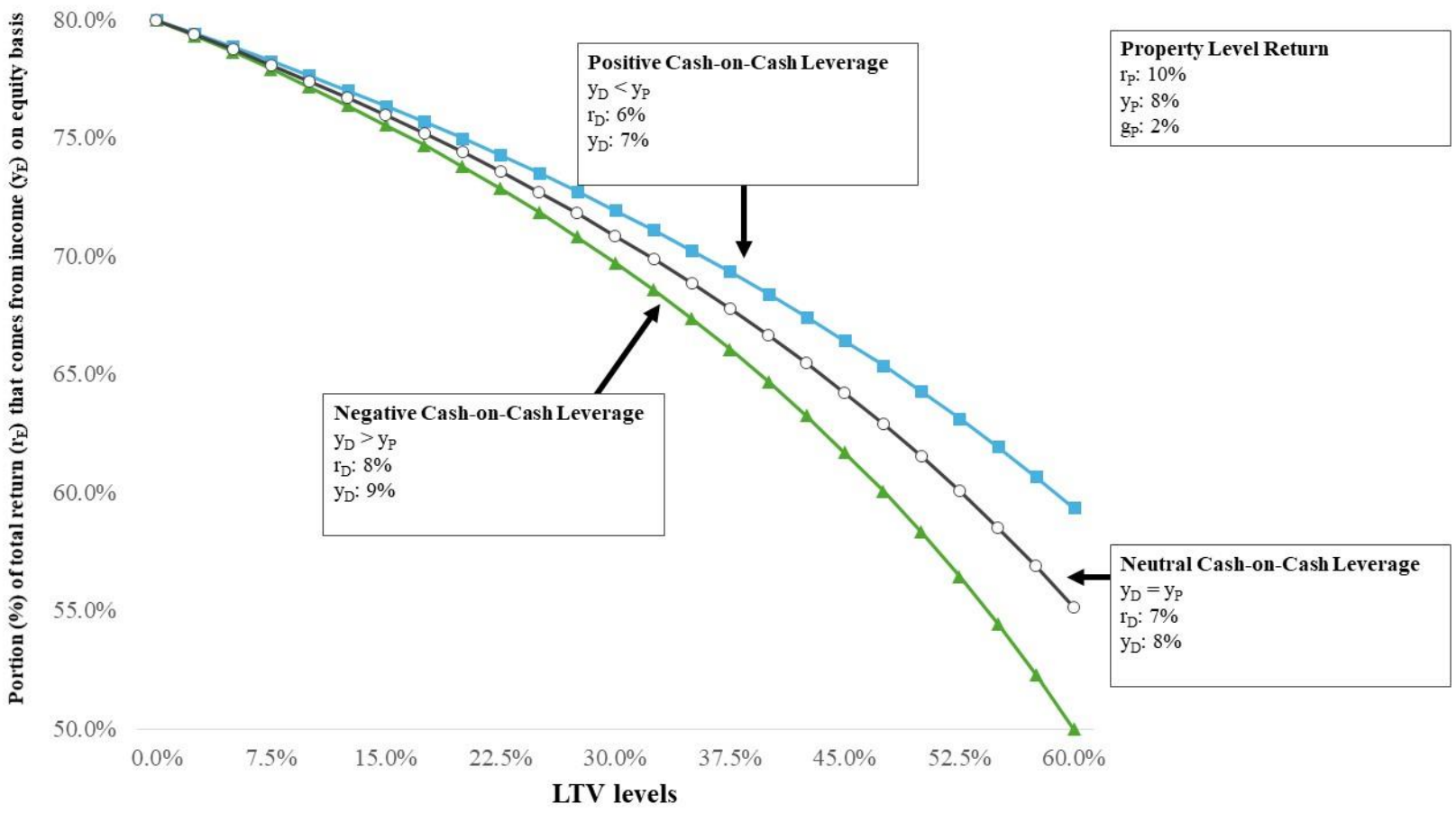
Note that only the return over the risk-free rate increases by 2.5.



4 Positive Leverage



4 Income Component

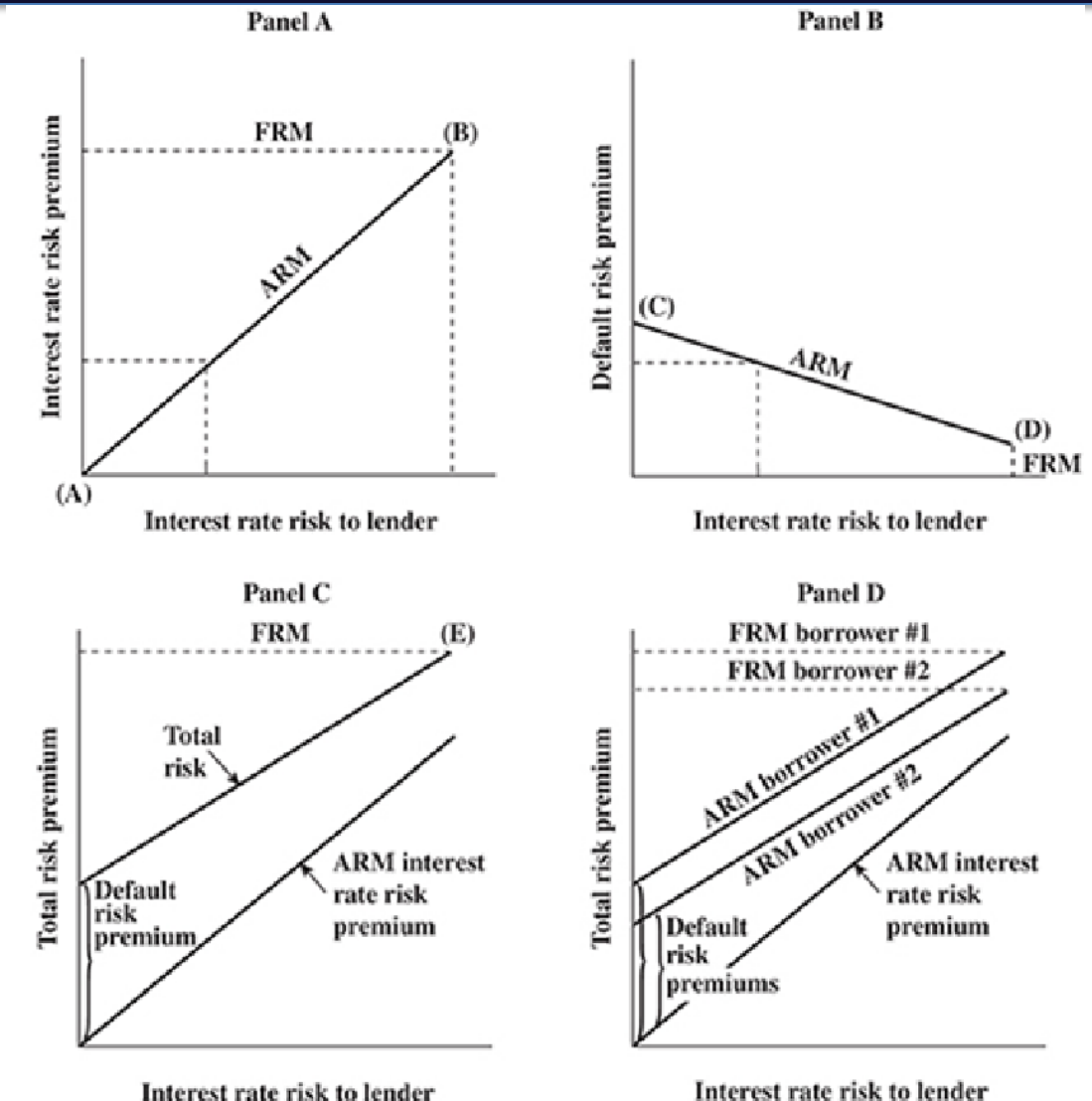


5 Short note on debt

- In reality, debt is not riskless.
- There are two/three main sources of risk when in the market for mortgage lending.
  - **Default risk**. Meaning the lender may repossess the property to run it or sell it.
  - **Interest rate risk**. Mortgages are fixed for a long time, whereas deposits are short-run.
    - **Refinance risk**. Investors refinance when interest rates go down, but not vice verse.

- To get a sense of these risks and how to mitigate them, think of the following extreme mortgage products;
  - **ARM**. Adjustable Rate Mortgage. The interest rate floats every year to reflect current market prices.
  - **FRM**. Fixed Rate Mortgage. The interest rate stays fixed for the entire time of maturity. (Which in an extreme would be 30 years.)

5 Short note on debt



5 Housing Market

- In housing markets, mortgages are **securitized**. Meaning the mortgages are pooled in a SPV (essentially a separate LLC), and bonds are sold (backed by the SPV) to ultimate investors.
- The government guarantees the bond payments.

- This way, the banks do not run the interest rate risk anymore, but also, it is safer for homeowners as they can get 30-year FRM.

- This does not work for CRE for several reasons;
  - No political incentive
  - CRE is way more heterogeneous, meaning we cannot accurately price what is in the SPV.

5 CRE debt in Reality

- How is the mortgage market organized in CRE?
  - Properties are put in an SPV (SPV) or something similar (like a private REIT) or LLC.
    - As a result, when the mortgage cannot be paid anymore, only the property is affected, not the firm.
    - Unless you want to talk about **mezzanine** debt…
  - Unlike the residential market, CRE is a mix of ARM and FRM, with a **maturity** of less than (or equal to) 10 years.
    - Typically, it **amortizes** in 20/25 years, with a **balloon payment** at 10/7/5 years.
    - A **2/10 structure** means a mortgage with a FRM for 2 years, after which it becomes ARM for the remaining 8 years.
    - A **3/7 structure** and **1/5 structure** are also popular.
  - Typical LTV levels are 20% (low risk), 40% (medium risk), and 60% (high risk).
    - Higher LTV levels also mean higher interest rates!

5 CRE debt in Reality

- Mortgages (nowadays) are always **Constant Payment Mortgages** (CPM) for the FRM part of the contract.
- Note that the **debt payment** (or debt service) consists of two components;
  - **Interest payment**: the contract rate you often see advertised. This is to compensate the lender for the risk she is running.
  - **Principal payment**: This is the amount you use every month to pay off the debt. It is based on the amortization table.

- With CPM you ensure that the total payments remain the same every month. Which makes it easier to predict.

5 CRE debt in reality

- Assuming the CPM, we can calculate the total payments (PMT) as such;

$$PMT = \frac{L \times r \times (1+r)^N}{(1+r)^N - 1}$$

- Where:
  - L = total initial loan amount
  - r = monthly interest rate (so i/12)
  - N = is the total amount of months to amortization

5 CRE debt in reality

- Once you know your payments, you can subdivide payments into interest and principal payments, by calculating the interest payments first.
- The interest payment is simply r times the outstanding balance (not the original amount!).
- The principal payment is subsequently the total debt service minus the interest payment.

- But what do we do after the mortgage becomes an ARM?
- Well… we can’t predict interest rates well, and we can purchase a hedge/insurance against interest rate hikes.