BEM 103

Class 2:
Value to Issuers
10-03-2013

10-02 Class 2: Value for Issuers

Raising capital allows

- Acceleration and Evaluation of projects.
- Varying cost of Capital and capital budgeting.

But you need value

- So Deciding value

Modigliani Miller

- capital structure does not matter

Risk and taxes. (capital structure matters)

Fallacy of sunk costs

Finance today

- Mr. Icahn said on Tuesday that he “pushed hard” during a “cordial dinner with Tim [Cook CEO of Apple] last night” for Apple to do a $150 billion stock buyback.
  - NY Times October 1 2013
- Why?
- Apple has more than 57 billion dollars of Cah on hand
- Doing the stock buy back would entail borrowing substantially
- Why

Why issue financial claims at all

- "why not live in capital autarky?
  - Question for firms
  - Question for individuals
  - Question for governments
- Oldest problem is clearly individuals (because firms were family firms and thus family finance is firm finance)
- But the real innovators were governments

Focus on the problem for a firm

- **Acceleration**
- **Firms have two sources of investment resources**
  - Retained earnings
  - Issuing New claims
- **If investment is limited to retained earnings it is constrained by profits.**
  - Problems for firms with indivisible investment (it may take such a long time to accumulate the needed resources, investment never takes place)
  - Problem for firms where market share matters for long term strategic growth (imitation is easy but customers are loyal)
  - You get pro-cyclical investment and that may not maximize profits—in particular in industries where there are time-to-build delays.

Example aviation: it takes a decade to design and test a new jet liner. And you want to be ready when demand is forecast to be large.

Project Evaluation

- **Project:**
  - **An investment opportunity**
    - **It can lead you to start a firm**
    - **Or a firm to start a new investment proces**
- **Finance Definition :**
- **Project is vector of payments (negative if you invest (costs), positive if you get a payment).**
- $C=\{c_1, c_2,..,c_t \ldots c_T\}$…Note some of these may be zero
- $Y=\{y_1, y_2,..,y_t \ldots y_T\}$. Some of these may be zero
- $X=\{x_1, x_2,..,x_t \ldots x_T\}$. Each of these positive or negative

N projects

- Let the firm contemplate n projects
- The longest lived ends at time T
- For each we can define
- $X^i=\{x^i_1, x^i_2,..,x^i_t \ldots x^i_T\}$.
- Question is which one should we undertake?
  - Are early positive x^i good or bad? Are large negative followed by large positive x^i
  - One needs a mechanism for inter-temporal accounting
- One exercise the firm should undertake is to ask:
  - Are any of these projects profitable enough that the market would want to fund them?
  - IF not then the firm should return its investment resources to shareholders or bondholders.
- But that means we must measure value

Deciding value

- Suppose we have a claim that pays x_t in each period from 1 to T, then nothing.
- The net income stream is $X=\{x_1, x_2,..,x_t \ldots x_T\}$
- Recal the definition of discount rate

$$d=1/(1+r)$$

- Its value is the discounted sum of those payoffs:

$$V = \sum_{t=1}^{T} x_t d^t$$

- And that is what you would want to pay for it

Net Present value (2)

- Suppose you borrow Y today to buy a claim that pays x in every period and X^T at the last period.
- The interest is r Every period you owe rY and at T you have to pay Y
- So net present value is $$NPV = \sum_{t=1}^{T} (x - rY)d^t + (X - Y)d^T$$
- If NPV is positive you should do the project. If it is negative not
- Project, canal, Railroad, stadium….
- Notice there is no “price” of the asset here

Cost benefit ratio, Internal rate of Return

- Project has revenues $X=\{x_1, x_2,..,x_t \ldots x_T\}$ and costs $C=\{c_1, c_2,..,c_t \ldots c_T\}$.
- The cost benefit ratio is : $CB = \frac{\sum_{t=1}^{T} x_t d^t}{\sum_{t=1}^{T} c_t d^t}$
- Recall $NPV = \sum_{t=1}^{T} (x_t - c_t) d^t$
- So CB>1 iff NPV>0
- Internal rate of return find smallest real r such that $\sum_{t=1}^{T} (x_t - c_t) d^t = 0 = \sum_{t=1}^{T} \frac{(x_t - c_t)}{(1+r)^t}$
- In general if IRR>r then CB evaluated at d=1/1+r>1 and NPB>0
  - Problem generically T-1 roots (some imaginary) and if the late payoff negative cause pbs

The problem of value (wrap up)

- Given an interest rate and a set of *expected* payoffs revenues $Y=\{y_1, y_2,..,y_t \ldots y_T\}$ you can compute a net present value. That is the value of that security to someone who is risk neutral.
- Issuer might use that to see if project worth starting
- Intermediary might use that to set price of equity in a project
- Buyer should use to that (in part) to decide whether to buy the security.
- Is that the most anyone would pay for this?

Side bar Heterogeneity

- If there is a market interest rate then

$$NPV_X^M = P_X = \sum_{t=1}^{T} \frac{(x_t - c_t)}{(1+r)^t} \quad \forall X$$

- So all people with discount rate $d^*=1/(1+r)$ are indifferent between holding securities and not.
- Anyone with a discount rate greater than d^* will want to hold some of securities and anyone discount rate less than d^* will not.
- (1) that means that market wealth just involves the 'patient' individuals
- (2) those people with $d<d^*$ save in non market investments or not at all.
- Does this make sense?
- What happens when the aggregate demand for funds increases?

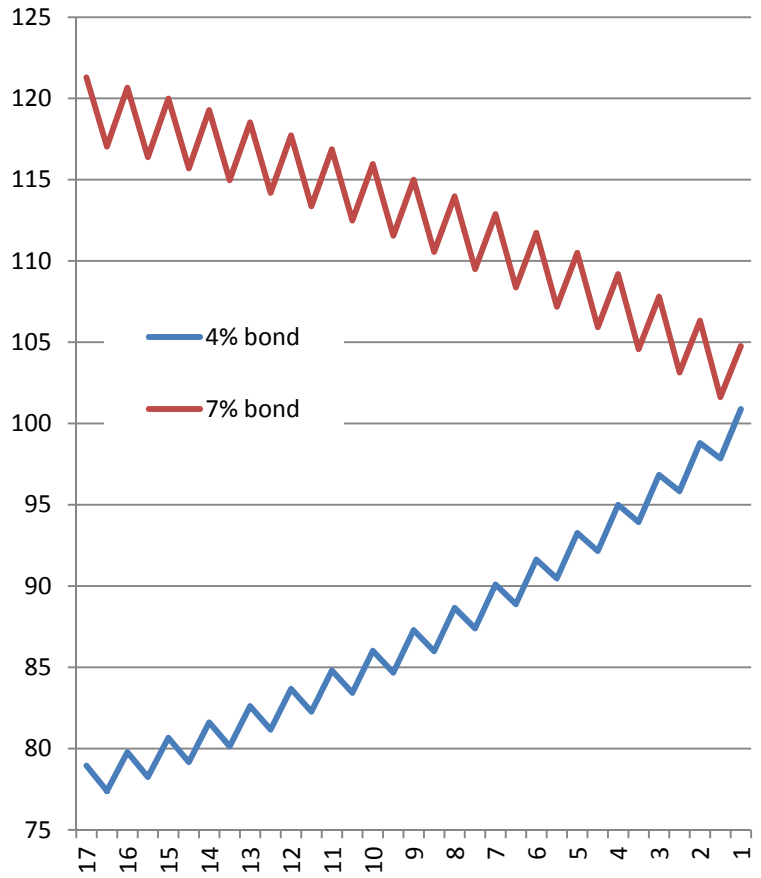
Valuation is forward looking

- What is the value of a project with a million dollar investment 1 million dollars?
- Ex ante?
  - You compare 1,000,000 to $V = \sum_{t=1}^{T} x_t \, d^t$
- Ex post?
  - You have made the investment so when you sell the project say at period t' what is left is : $V = \sum_{t=t'}^{T} x_t \, d^t$
- Sunk costs.
  - Finance does not care about sunk costs.

Valuing bonds

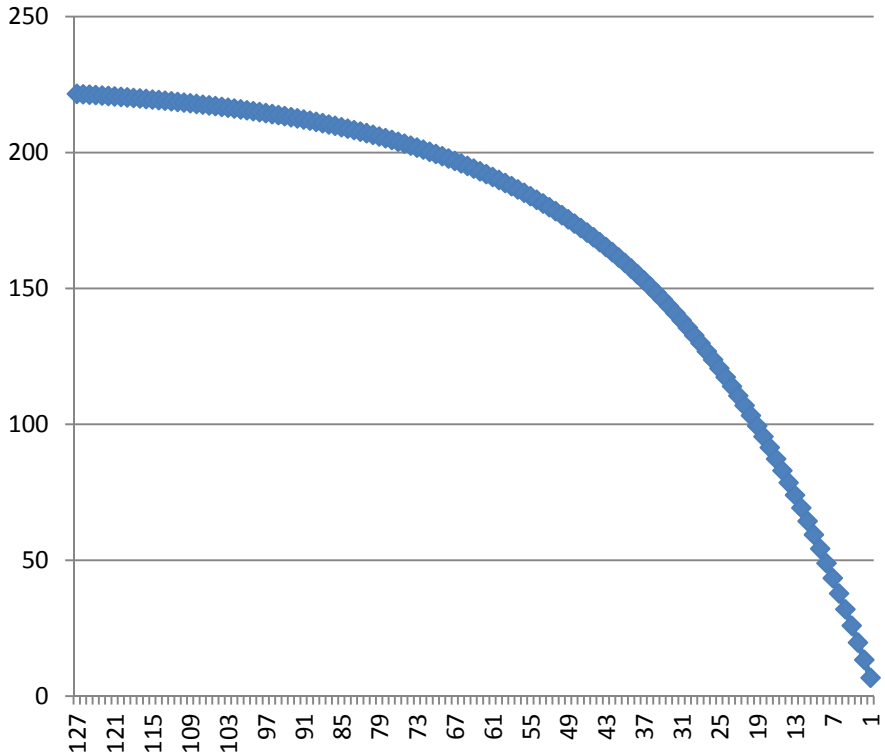
$$V_{t\prime} = \sum_{t=t\prime}^{T} x\, d^t + B d^T$$

- Compare two $100 bonds with that mature T periods hence. Discount rate is 0.97
- one pays a 4% coupon ever other period, the other 8% every other period
- Right after an interest payment price falls,
- But over time prices converge to par value



Valuing Equity

- A project that delivers X=7 every period for T Periods and then nothing.
  - say a patent



Back to Icahn

- How to use project Valuation to rationalize the request for a large stock buy back (returning cash to shareholders)
- Apple has 57 Billion dollars of Cash on hand
- Icahn may have decided that the rate of return of additional investment by Apple is lower than that of the market…
- Maybe he does not know about the I-Dog and the I-Cat projects.

Bonds and Stock

- Do they matter?
- Why do we differentiate between different types of claim?
- Efficiency
  - Affect the value of the firms
- Because issuers care
  - Affect the risk exposure of principals
- Because investors care
  - Affect the risk exposure of investors

Modigliani Miller

- Capital structure does not affect the value of the firm.
  - Unless markets are imperfect
  - And capital structure affects fundamental returns (incentives of individuals in the firm
- The proof is in two steps and involves an arbitrage argument.
- Start with two firms with the same return vector X ={x…x}.
- The first issues only stock so the total value of the firm V_1 must equal the value of the stock S_1 .
- The second firm issues some bonds its value is V_2

Step 1

- The first firm is all stock so $V_1 = S_1$.
- The second firm issues some bonds its value is V_2
- Suppose $V_2 > V_1$.
- Now consider an investor who owns α of firm 2's stock. His investment is worth $Y_2 = \alpha(X - rD_2)$.
- Suppose he sells that stock and borrows αD_2 he can then buy $s_1/S_1 = \alpha(S_2 + D_2)$.
- His income is then

$$Y_1 = (\alpha(S_2 + D_2)/S_1)X - r\alpha D_2$$

$$\text{or } \alpha(V_2/V_1)X - r\alpha D_2$$

- IF $V_2 > V_1$ then $\alpha(V_2/V_1)X - r\alpha D_2 > Y_2 = \alpha(X - rD_2) = \alpha X - \alpha r D_2$
- So investor would always sell the levered company 2. (unless both values were the same).

Step 2

- Now Suppose $V_2<V_1$.
- Consider investor who owns s_1 of firm 1 has a return
$$Y_1=(s_1/S_1)X= \alpha X.$$
- Now he sell that investment and buys s_2 of firm 2 and d bonds
$$\text{where } s_2= (S_2/V_2)s_1 \text{ and } d=(D_2/V_2)s_1$$
- So he is buying proportionally into the stock and bonds of firm 2
- Now $Y_2= (s_2/S_2)(X-rD_2)+rd=(s_1/V_2)(X-rD_2)+r(D_2/V_2)s_1$
$$=(s_1/V_2)X = \alpha(S_1/V_2)X$$
- Recall that we assumed $V_2<V_1$ .Firm 1 is all stock so $V_1 =S_1$
- So $V_2<V_1 \Rightarrow (S_1/V_2)$ thus $Y_2> \alpha X= Y_1$ but then the investor prefers to sell his all share of the all stock firm (firm 1).
- The only way that two firms with a return X can have different leverage is if financial structure does not matter.

Implications

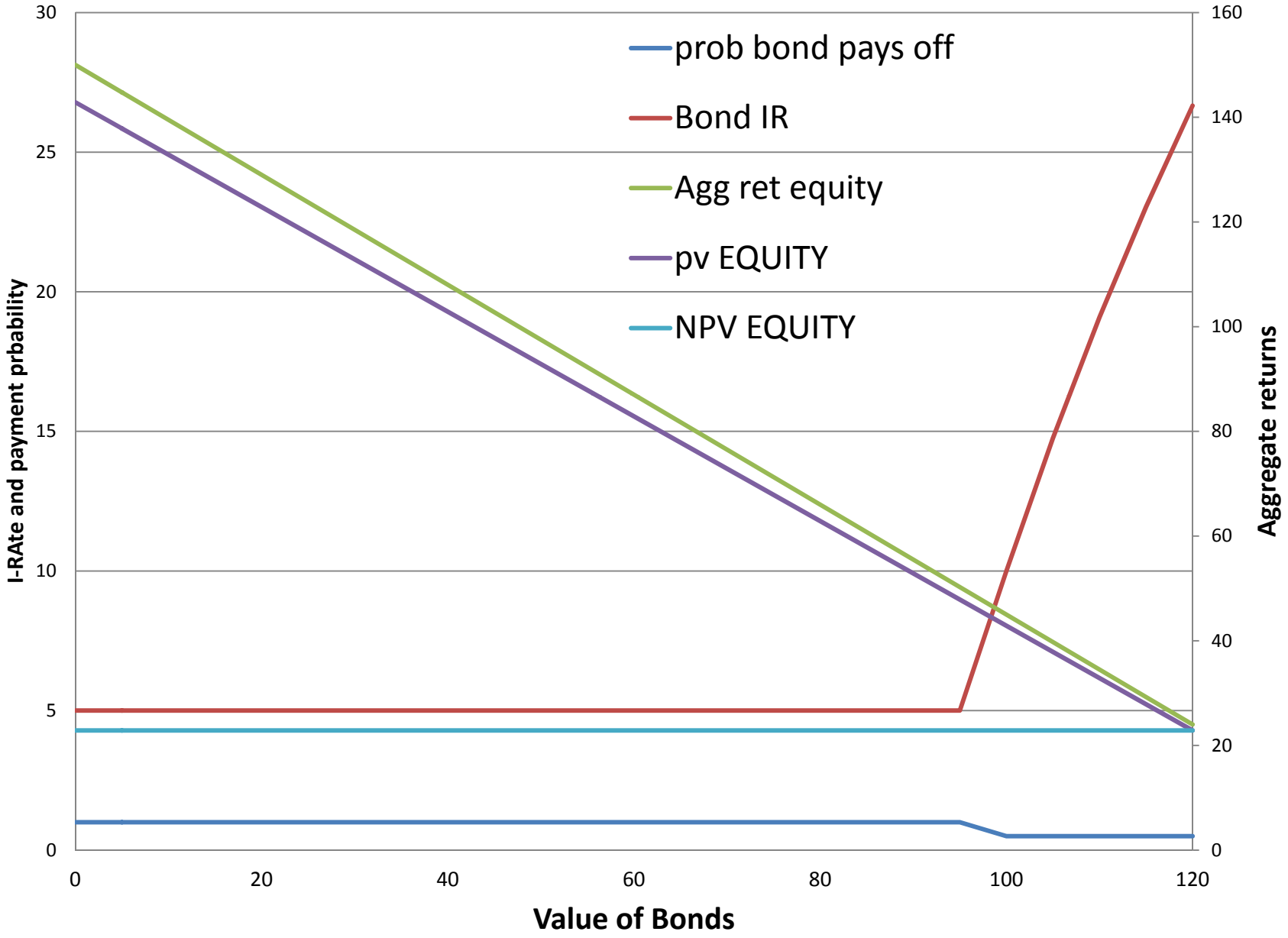
- If markets are efficient
- Prices adjust and keep things in equilibrium
  - Arbitrage
  - Not trade result
- Fundamentals (X) matter not financial structure (S or B)

An example

- Project upfront cost is 120 . Returns either 100 or 200 with probability 1/2
- Rate of interest is r=5% Discount rate is d= 1/(1+r)=.9524
- Suppose the firm just issues equity.
  - Aggregate return 150 (0.5*100+0.5*200)
  - Discounted present value PV=d(150) = 142.8
  - Net present value NPV= PV-120 =*d150-120*= 22.8
- Suppose now the firm issues some bonds B.
- Case 1. B< 95. it makes all payments even if the project does not work very well. So no risk and r=5%.
- AR=150-(1+r)B,
- PV=d(AR)= d150-d(1+r)B =d150-B
- Equity has to put in S=B-120
  - NPV=PV-S= d150-B-(120-B)=*d150-120*. **Same as before**

Example Pt 2

- Case 2 If B> 95, it can only make full payment if the project is good. So now the interest rate has to take that into account. It will be set so that the expected return on bonds is 1+r
- 0.5 (100)+0.5(B(1+r')=(1+r)B =>
- 0.5Br'=(1+r)B-0.5 (100)- 0.5B =>
- r'= (B-100)/B +2r.
- The aggregate return is now. AR=0.5(0)+0.5(200-(1+r')B) and so on and so forth
- you can do the algebra to see that PV is falling but NPV stays the same
- Picture of 1000 words


prob bond pays off
Bond IR
Agg ret equity
pv EQUITY
NPV EQUITY
I-RAte and payment prbability
Aggregate returns
Value of Bonds
0
5
10
15
20
25
30
0
20
40
60
80
100
120
140
160

Back to Icahn

- If Modigliani and Miller are right
- 150 billion dollar stock buy back makes no sense
- You would have to turn a firm with 123 Billion in equity and 19 billion dollars in debt into a firm with 23 billion dollars in equity and 119 billion dollars in debt
- So we have a puzzle

Beyond Modigliani Miller

- Two lessons
  - (1) Arbitrage is a powerful force
    - More so in theory where there are always agents who step in immediately to 'fix' and eliminate arbitrage opportunities
    - But also in practice
  - (2) MM is right in theory and wrong in practice
    - Financial structure matters
      - Because there are transactions costs
      - Because it affects incentives
      - Because it matters to managing risk
    - Financial markets are imperfect

Next time

- **<u>10-07 Class 3: Exchange mechanisms</u>**
- **Exchange as measure of value**
- **Secondary markets and the double auction**
- **Primary markets and underwriting**
- **Rapid changes in the structure of global finance**