Normative Frameworks for Business Decisions

Lecture 10

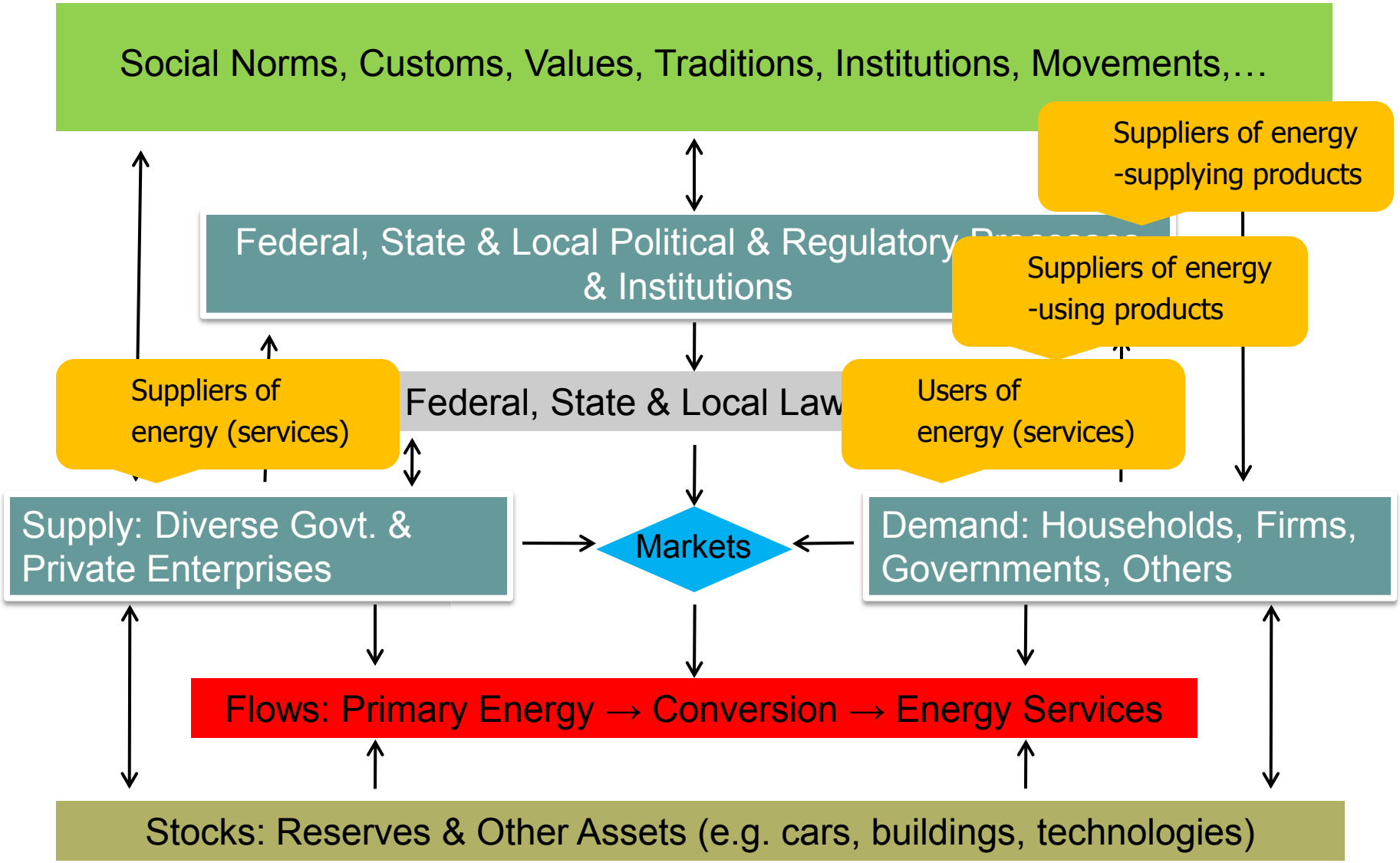
A Bit of Way-Finding:

- Last two sessions: energy demand by individuals/households
  - Basic rational actor model: max U(energy services, etc.), with preferences fixed, depending only on own consumption
  - But preferences are learned to an important extent; depend on others; not fixed – so demand curves can change
  - And "economic-style" maximization is a special behavioral case:
    - Cog Sci: automatic v. deliberate cognition (Kahneman: *Thinking Fast and Slow*)
    - Weber: rational pursuit of ends (economic) v. rational pursuit of a value v. feels good v. tradition/habit
- Next three sessions: energy demand by firms/organizations
  - Today, the rational actor model: firm maximizing *something*
  - Then two sessions on behavioral complications
    - Organizations are full of people, who are complicated enough
    - Being in organizations adds another layer of complexity!
- After vacation, two *normative* sessions on supply-side strategy

When firms rationally pursue some objective, what should it be? What is "utility" for a firm?

- Issue is sharpest for corporations v. proprietorships, partnerships
- Friedman (1971 Nixon price controls debated) says…?
  - Executives are legally the employees of owners
  - Cutting profits for good works is taxing owners without representation
  - How to decide what good works to pursue?
  - So, corporate executives should maximize profits/value
- Handy (Post dot-com bust) says…?
  - Lots of criticisms of short-term focus, stock options, etc.
  - Profits are a means not an end
  - A good firm is "a community with a purpose"
  - Treat employees (others) as stakeholders, like owners
  - Go beyond legal requirements for environment, safety, etc.
- Some other points:
  - Merck free river-blindness cure (1988+) – charity or value maximization?
  - Merck hiding adverse effects of Vioxx (1999-2004 – value maximization?
  - When is it OK to close an unprofitable plant or company?

The many roles of firms (& other organizations)



What's common among all of these?

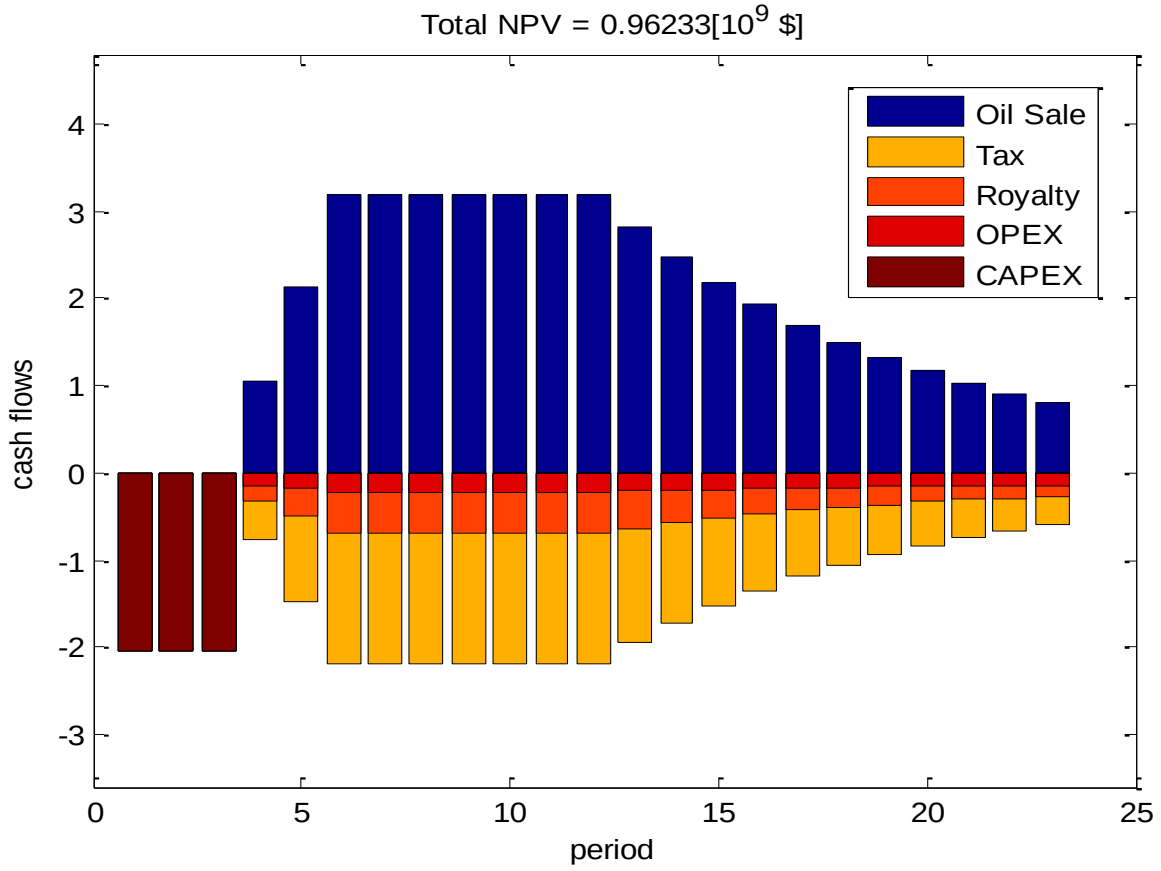
- Suppliers of energy (services)
- Users of energy services
- Producers of energy using products
- Producers of energy supplying services

- Typically require decisions involving:
  - costs and benefits spread out over many years
  - substantial uncertainty

- Will assume maximization of the value of the firm = BMA's "honest share price", may not = share price..

If not constrained on the capital market, just make all positive NPV investments

NPV = discounted value of all *cash flows*, net of up-front costs, using the opportunity cost of capital



revenues **costs**

$$NPV = \sum_{j=1}^{N} \frac{R_j - C_j}{(1+r)^j}$$

discount rate

Some basics in computing NPVs

- Use cash flows, *not* accounting profits. Depreciation affects taxes but does not affect available cash.
- Simple NPV formulas from sums of geometric series:
  - Perpetuity: $V = \sum_{t=1}^{\infty} \frac{c}{(1+r)^t} = \frac{c}{r}$
  - c per year for T years = perpetuity – perpetuity starting in T+1:

$$V = \sum_{t=1}^{T} \frac{c}{(1+r)^t} = \sum_{t=1}^{\infty} \frac{c}{(1+r)^t} - \sum_{t=T+1}^{\infty} \frac{c}{(1+r)^t} = \frac{c}{r} - \frac{c}{r(1+r)^T}$$

    - V = value of T-month mortgage, r=monthly rate, c=monthly payment
- Market interest rate is R, inflation rate is i. What is the real interest rate, r – increase in purchasing power?

$$\frac{1+R}{1+i} = 1+r; \quad R = i + r + ir; \quad r = R - i - ir \approx R - i$$

Real v. nominal analysis

- Almost all market interest rates are *nominal*; they relate $ today to $ tomorrow regardless of inflation
  - They embody inflation expectations, of course: higher when inflation expected to be higher, ceteris paribus
  - Historic data yield past real interest rates…
  - Treasury Inflation Protected Securities (TIPS) pay in real $; can use for "market" inflation expectations – but thin market
    - 3/9/2012: 20-year R = 2.83%, r = 0.52%; i = 2.31%
- **Most common error** in NPV calculations: mixing real and nominal quantities
  - If use today's prices to compute cash flows (common), must use REAL discount rates
  - If use nominal rates, from the market, must adjust cash flows for expected inflation

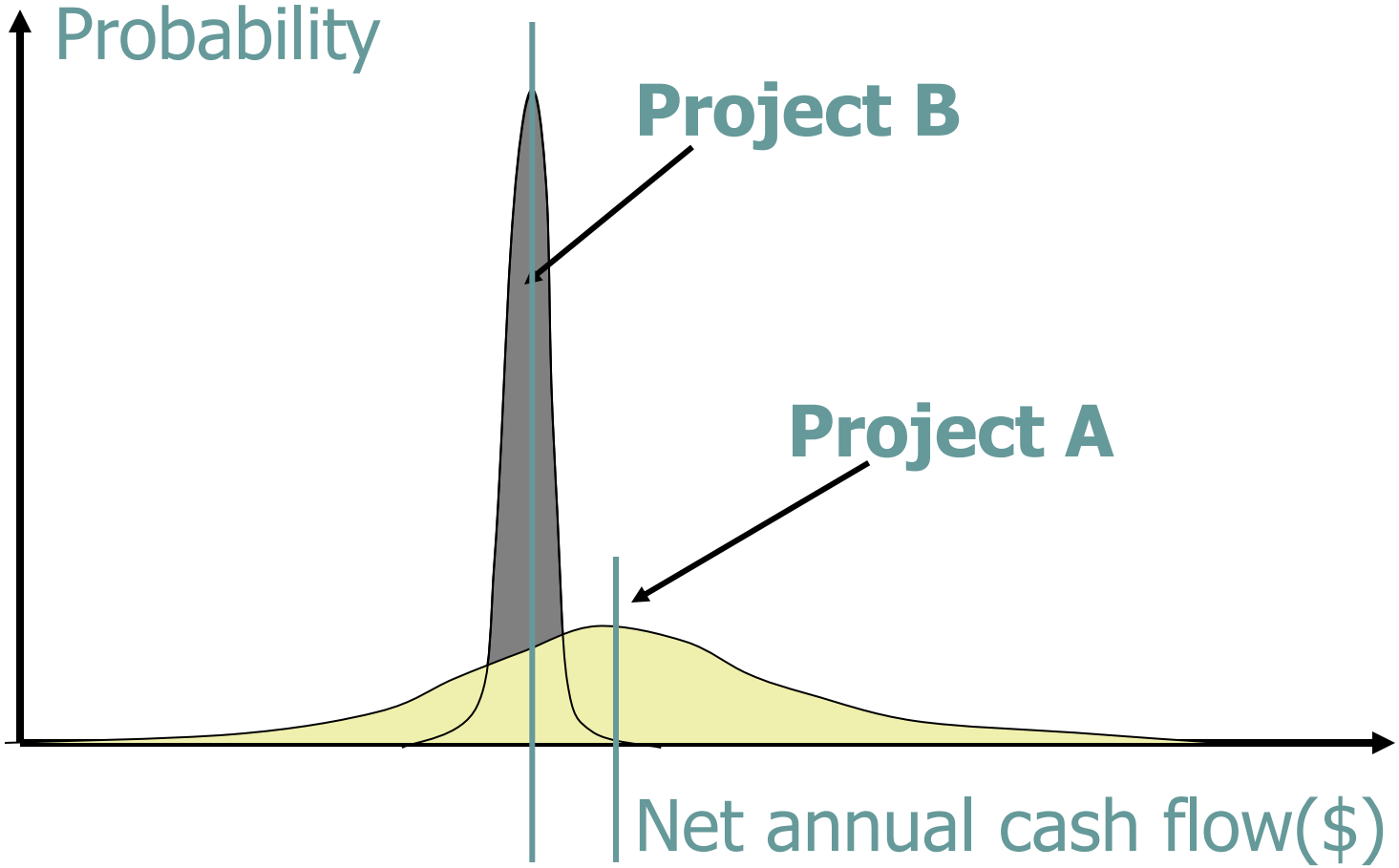
Where do discount rates come from?

- If there is no risk, can use nominal rate for riskless securities – typically US government debt
- More generally, the discount rate should be an *opportunity cost* – an expected rate of return on an investment of comparable riskiness that shareholders can get in the market
  - Higher risk → Higher EXPECTED return
- Typically, discount expected (i.e., mean of pdf) cash flows at risk-adjusted discount rates
  - If components of cash flow differ in riskiness, it is appropriate to use different discount rates
- But, how do we define risk & adjust discount rates?

Small differences in the discount rate matter

PV of $1 at year:	7%	10%	Equivalent cash-flow haircut
5	.71	.62	-13%
10	.51	.39	-24%
15	.36	.24	-34%
20	.26	.15	-42%
30	.13	.06	-56%

Project Choices



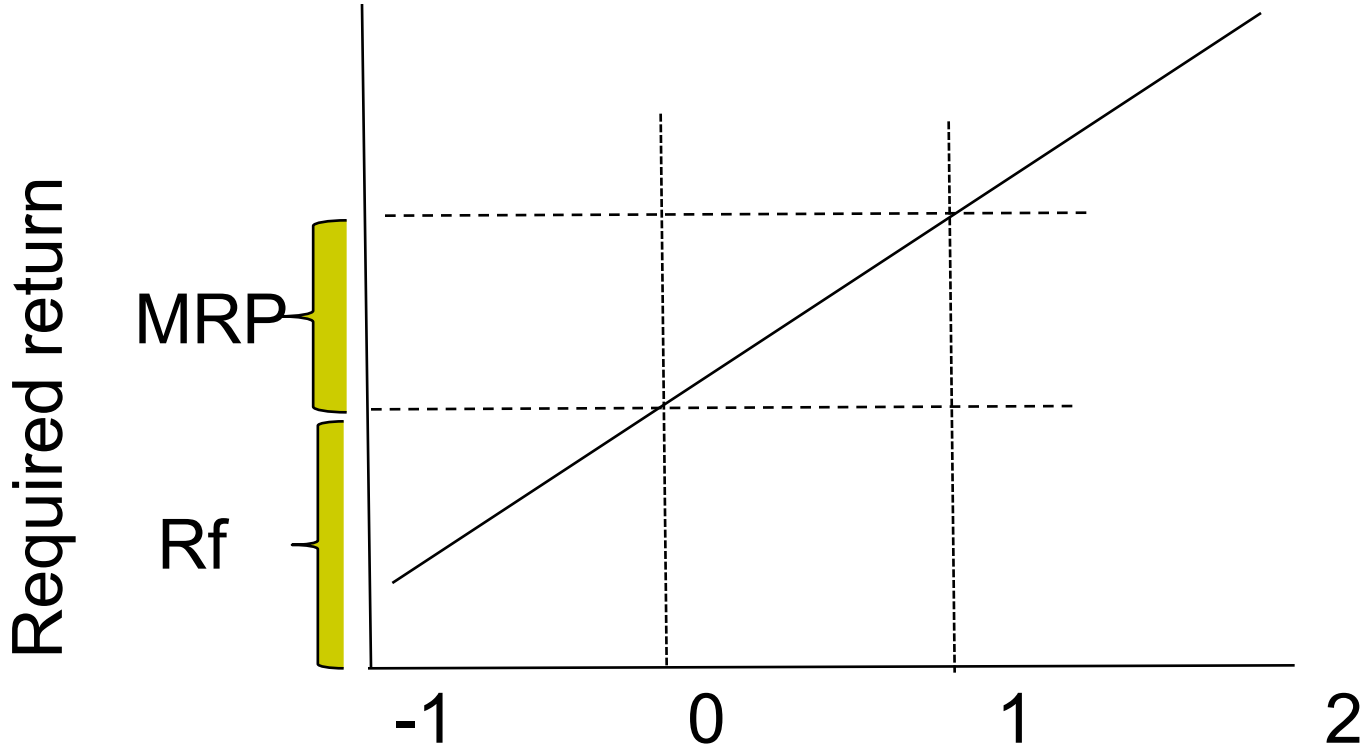
Which project would you choose?

Investor's Perspective on Risk

- Basic investment theory (*Markowitz 1950s*) says that investors should hold diversified portfolios
- "Two Fund Separation" (*Tobin 1960s*)
  - Investors should hold a mix of the "market portfolio" (index funds) and safe short-term bonds.
  - The less risk-averse investors are the more wealth they will put in the market portfolio and the less they will put in short-term bonds.
- To hold the market portfolio, investors need to earn a "risk premium" over safe bonds on average. (*Sharpe 1960s):*

  Expected Return on Market Portfolio = r_f + Market Risk Premium
- Implies that the riskiness of any particular investment is measured by what owning it would do to the riskiness (variance, say) of the portfolio of a well-diversified investor, not by the riskiness of its return considered in isolation
  - A stock that always moves against the market can be a great thing to own, no matter how big those moves are on average
  - Risk uncorrelated with the market can be diversified, no premium

General Risk-Return Relationship: The Capital Asst Pricing Model (Sharpe)



Beta risk (correlation with market * relative volatility)

BP cost of equity—example

- Beta for the market as a whole ≡ 1.0; can use historic data to estimate beta for individual stocks
- BP and other oil majors less risky than average stock:

  beta = $\beta \approx 0.80$ vs. 1.0
- BP cost of equity over forecasted short-term interest rates, from CAPM:

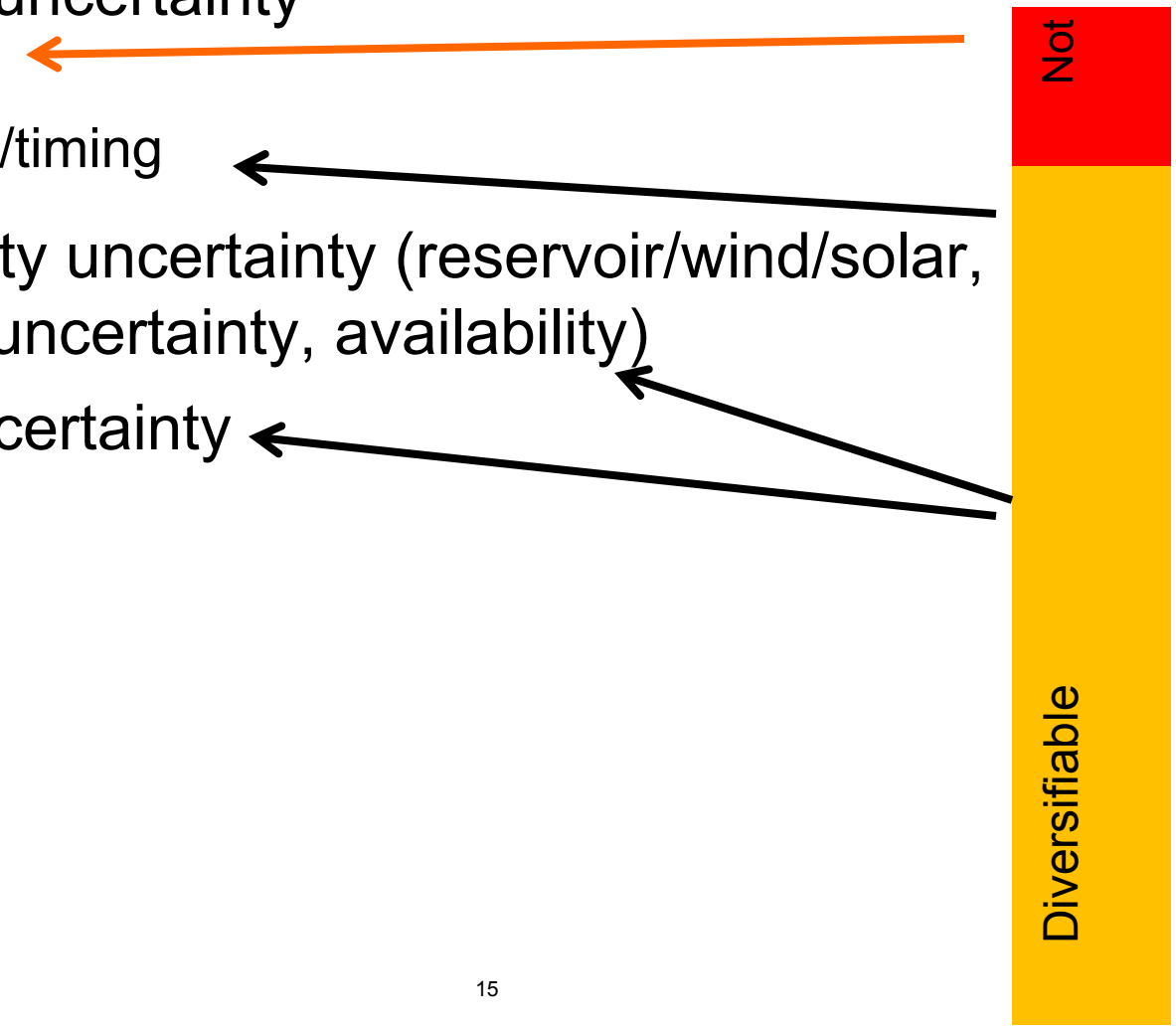
  Forecasted short rate = 3%

  Forecasted market risk premium = 5.4%

  $r_E = 3.0 + 0.8 \times 5.4 = 7.3\%$
- Given those forecasts, this would be an estimate of the opportunity cost of investing in projects as risky as BP is on average – i.e., projects with a β of 0.8

Diversifiable ($\beta \approx 0$) v. Non-diversifiable ($\beta > 0$) Risk

- Revenue uncertainty
  - Price
  - Quantity/timing
- Productivity uncertainty (reservoir/wind/solar, technical uncertainty, availability)
- Capex uncertainty



Degrees of analytical (and strategic) difficulty

- Cost-saving projects can just focus on cost conditional on level of activity; e.g. Wednesday
- Projects that deliver contractual/regulated revenues; e.g. a wind farm with a power purchase agreement
  - Revenue model is fairly simple; cost risks diversifiable(?)
- Projects whose revenues are determined in “the market”; e.g. a new gas-fired generating plant
  - Revenue model involves non-diversifiable risk
- Projects that involve innovation; e.g., new battery design
  - Revenue model must focus on creation and capture of value
- Small businesses with limited capital market access
  - **CIMITYM!**
  - Zero-beta risks may be existential – and so?

For Wednesday:

- Hexion decision re combined heat and power (CHP)
- An opportunity to do NPV: Is CHP a good investment for Hexion?
- An opportunity to think about how firms actually make decisions: How should Darren address the naysayers concerns?
- An opportunity to think about how to get firms to make “better” decisions
  - Communication/framing
  - Policies and incentives

15.031J / 14.43J / 21A.341J / 11.161J Energy Decisions, Markets, and Policies
Spring 2012