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)

Stocks: Reserves & Other Assets (e.g. cars, buildings, technologies)

Flows: Primary Energy → Conversion → Energy Services

Supply: Diverse Govt. & Private Enterprises

Demand: Households, Firms, Governments, Others

Markets

Federal, State & Local Political & Regulatory Processes & Institutions

Suppliers of energy -supplying products

Suppliers of energy -using products

Social Norms, Customs, Values, Traditions, Institutions, Movements,…

Federal, State & Local Laws & Institutions

Suppliers of energy (services)

Users of energy (services)

Suppliers of energy (services)

Flow: Primary Energy → Conversion → Energy Services

Stocks: Reserves & Other Assets (e.g. cars, buildings, technologies)
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.

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

Discount rate

Revenues
Costs

Cash flows

Period

Total NPV = 0.96233×10^9 $
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: \( V = \sum_{t=1}^{\infty} \frac{C}{(1+r)^t} = \frac{C}{r} \)
  
  \[ V = \sum_{t=1}^{T} \frac{C}{(1+r)^t} = \sum_{t=1}^{\infty} \frac{C}{(1+r)^t} - \sum_{t=T+1}^{\infty} \frac{C}{(1+r)^t} = \frac{C}{r} - \frac{C}{r(1+r)^T} \]

  \( V = \) 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

<table>
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<th>PV of $1 at year:</th>
<th>7%</th>
<th>10%</th>
<th>Equivalent cash-flow haircut</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>.71</td>
<td>.62</td>
<td>-13%</td>
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<tr>
<td>10</td>
<td>.51</td>
<td>.39</td>
<td>-24%</td>
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<tr>
<td>15</td>
<td>.36</td>
<td>.24</td>
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<td>20</td>
<td>.26</td>
<td>.15</td>
<td>-42%</td>
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<tr>
<td>30</td>
<td>.13</td>
<td>.06</td>
<td>-56%</td>
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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):
  \[
  \text{Expected Return on Market Portfolio} = r_f + \text{Market Risk Premium}
  \]

• 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 \( \equiv 1.0 \); can use historic data to estimate beta for individual stocks

- BP and other oil majors less risky than average stock: 
  \[ \text{beta} = \beta \approx 0.80 \text{ vs. } 1.0 \]

- 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 \( \beta \) 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