Lecture 16: Commitment and Brinkmanship

Primary references:
Besanko et al, Economics of Strategy, Ch. 9
Dixit and Nalebuff, Thinking Strategically, Ch. 8.
Commitment: An Example

Two armies wish to occupy an island located between their countries. A bridge connects each country to the island.

- Each army prefers to let the opponent occupy the island rather than fight.
Commitment: An Example

1. Suppose army 1 occupies the island and burns its own bridge.
2. Now army 1 has no choice but to fight.
3. If it did not burn its bridge, it could always retreat.
4. Army 2 is best off letting army 1 have the island.
5. By *reducing* its set of choices, army 1 wins the island.
Burning Bridges

- We typically think of more options as a good thing and “burning bridges” as a bad thing.
- In strategic environments, it often pays to credibly commit to restrict yourself to a set of strategies.
- In 1066, William the Conqueror burned his ships after crossing the English Channel, committing to fight for England.
- Cortés emulated this strategy in conquering Mexico.
Cortés in Mexico

- Cortés sunk all but one of his ships upon arrival in Cempoalla in 1519.
- “Had [Cortés] failed, it might well seem an act of madness...Yet it was the fruit of deliberate calculation...There was no alternative in his mind but to succeed or perish.” W.H. Prescott, *Conquest of Mexico* (1842).
- This united the soldiers. All knew that the others had no choice but to fight.
Credibility

- For commitment to have strategic value, it must be visible, understandable and credible.
- We saw in the analysis of limit pricing that a threat to engage in a price war with an entrant may not be credible.
- Burning ships, on the other hand, is a credible commitment to fight.
- What are things we can do to credibly indicate we are “all in,” and how can we use this to our advantage?
Capacities and the Stackelberg Leader-Follower Game

- Recall that in the Cournot model of quantity competition, quantities may be interpreted as *capacities*.
- Let’s return to our original example. Conditional on the total capacity built by all sellers, the price that emerges is the one that just clears the market. If, for example, inverse demand is given by

  \[ P = 100 - Q, \]

where \( Q \) is total cases, and there are two firms who build \( q_1 \) and \( q_2 \) units of capacity, the price will be

  \[ P = 100 - q_1 - q_2. \]

Let marginal cost be $10 per unit of capacity.
- Let’s change one thing. Now, firm 1 gets to choose its capacity first and sink that cost. Firm 2 observes firm 1’s move perfectly.
Recapitulating the Original Example

First, let’s remind ourselves how the original game played out.

Recall that firm 1’s marginal revenue, conditional on firm 2 building $q_2$, satisfies

$$MR_1 = 100 - 2q_1 - q_2,$$

and its $MC = 10$. Setting these equal and rearranging a bit, we find

$$q_1 = 45 - .5q_2.$$

The function $q_1 = 45 - .5q_2$ characterizes firm 1’s best response to firm 2’s capacity choice. Similarly, $q_2 = 45 - .5q_1$ characterizes firm 2’s best response.

If the firms move simultaneously, the Nash equilibrium capacities satisfy both best-response functions.
Now, imagine that firm 1 moves first.
The intersection of these best-response functions does *not* give the equilibrium any more.
What do you think will happen? What will firm 1 want to do?
Firm 1 as First Mover

- Now, firm 1 anticipates that firm 2 will choose \( q_2 = 45 - .5q_1 \) after firm 1 chooses \( q_1 \).
- Firm 1 incorporates that into its thinking. It thinks forward and reasons backward.
- The price it receives is
  
  \[
  P = 100 - q_1 - q_2 \\
  P = 100 - q_1 - (45 - .5q_1) \\
  P = 55 - .5q_1,
  \]

  so that its marginal revenue is \( MR = 55 - q_1 \).
- Then, setting \( MR = MC \) yields \( q_1 = 45 \).
- Firm 2’s optimal response is \( q_2 = 22.5 \).
The Stackelberg Equilibrium

The leader knows that the follower will respond according to its best-response function. Thus, it chooses the point on that function that maximizes its (the leader’s) profit.

Intuitively, it commits to a high capacity, shrinking the follower’s market and causing it to respond weakly.
The Stackelberg Equilibrium

- Recall that in the simultaneous move game, the price is $40, so each firm earns $900 in profit (net of fixed costs).
- In the leader-follower game, the price is $100 - $45 - $22.5 = $32.50, for a price-cost margin of $22.50.
- The leader earns $1,012.50, while the follower earns $506.25, net of fixed costs.
This type of commitment has two distinct advantages.

- It *directly* increases the leader’s payoff, relative to what it would earn in a simultaneous-move setting.
- It *indirectly* increases the likelihood the leader drives out the follower, by reducing the follower's payoff to a level where it is more likely to suffer a loss (once fixed costs are included).

If the follower is deciding whether to pay fixed costs and compete, it may be profitable for the leader to build *more* capacity than 45.

This would lower the follower’s payoff even more. If it makes the follower exit, then the leader is a monopolist.
Strategic Commitment

- Capacity investment is a commitment that is bad for competitors (a *tough* commitment). In contrast, some commitments may be good for competitors (*soft* commitments).

- The key to understanding why a tough commitment works here is that capacities are **strategic substitutes**.
  - If by increasing my choice of an action, the best-response of my rival is to decrease her choice, then the actions are strategic substitutes.
  - By committing, I gain a tactical advantage by weakening my opponent.

- With competition in capacities, I would not want to make a soft commitment. For example, an action that raises my marginal cost of capacity weakens me.
  - If I were to start selling in a different market as a monopolist and this caused my marginal cost to go up in this market, that would weaken me in this market.
Strategic Commitment

- Things are different when the action choices are \textit{strategic complements}.
  - If by increasing my choice of an action, the best-response of my rival is to increase her choice, then the actions are strategic complements.
  - Prices are the classic example of strategic complements.

- With strategic complements, a tough commitment \textit{could} backfire. For example, suppose I sink an investment that lowers my marginal cost of production, which causes me to want to lower my price. This will cause my rival to lower her price.
  - If my action does not drive the entrant out of the market, then because of fiercer price competition it hurts me to take it.
  - If my action does drive the entrant out of the market, then it helps me.
With strategic complements, it is better to make soft commitments if you know your action will not drive out your rivals. For example, investing in switching costs for your products helps you both lock in existing customers for the future and softens your willingness to engage in a price war.

We thus have two possibilities for action choices, strategic complements and strategic substitutes, two choices for types of commitments, tough and soft, and two possible post-investment scenarios, accommodation and deterrence.

Let’s summarize the taxonomy of business strategies.
D denotes deterrence. The listed strategy is best if the investment drives rivals out.

A denotes accommodate. The listed strategy is best if there will be post-investment competition.
Strategic Commitment: Business Examples

- Airbus vs. Boeing in large passenger jets.
- Nucor vs. USX in thin-slab casting.
- Philips vs. Sony in compact disc production.
- What were the successful strategies in these cases, in the context of the taxonomy?
On October 14 1962, United States reconnaissance planes discovered the Soviet Union had begun to install nuclear missiles in Cuba.

After a week of discussions, President Kennedy announced a naval quarantine of Cuba on October 22.

Kennedy estimated the probability of escalation to nuclear war to be between $1/3$ and $1/2$.

After several days of posturing, the Soviet Union backed down.
Brinkmanship

- This describes the strategy of taking your opponent to the brink of disaster and compelling him to pull back.

- Brinkmanship occurs in many business/political situations.
  - Labor and management negotiate a contract in the shadow of a strike/lockout, à la the NFL.
  - Democrats and Republicans negotiate a budget in the shadow of a government shutdown.
  - Two firms contemplate merging, while fighting a “war of attrition” for a market big enough for only one firm.

- Brinkmanship also occurs in other parts of life, like marriage partners pursuing change and compromise in the shadow of divorce.
Brinkmanship

- Brinkmanship is subtle and dangerous and difficult to execute properly.
- A key part of brinkmanship is the degree to which risks are beyond the control of the negotiating parties.
- To make it work, intuitively, you want to move the risk of a bad outcome into a range that you find acceptable but your opponent does not.
Let’s revisit the Cuban Missile Crisis. Kennedy had a wide range of options:

- Do nothing.
- Launch a strike on the missiles.
- Impose a quarantine or blockade.
- Launch a nuclear strike on the Soviet Union.

After Kennedy chose the blockade, the Soviet Union had a wide range of options:

- Back down.
- Stop missile-carrying ships.
- Try to run the blockade.
- Launch a nuclear strike on the United States.

Where is the brink?
Why not just threaten to annihilate the Soviet Union unless the missiles are removed by a particular day?
  - Would such a threat be believed?
  - What would be the likely outcome if such a threat were issued?

One option is to remove human decision-making, à la the “Doomsday machine” from Dr. Strangelove.
  - This makes the threat credible, but also raises the possibility that error leads to unnecessary annihilation.

The basic problem is this threat is just too costly to execute.

Far better is the threat of nuclear war *with some probability*. 
Brinkmanship: The Importance of Uncertainty

- Ideally, brinkmanship escalates the probability of a bad outcome in small steps. If Kennedy can move the probability to the point where Khruschev is uncomfortable continuing, he can win.
- How can you credibly establish some risk, though? You can’t just say you’ll flip a coin and decide on that basis.
- The “fog of war” formed a useful commitment device. How can Kennedy control the naval blockade? What should standard operating procedure be for the first Soviet ship to refuse to be boarded?
- By surrendering some control of how things might escalate (e.g. the US sinks a Soviet ship), Kennedy set in motion a chain of events that he could not be guaranteed to control or stop.
- Intuitively, optimal brinkmanship moves the (credible) probability of war to a range that Kennedy is comfortable with but Khruschev is not. Then Khruschev will quit.