

KELLOGG SCHOOL OF MANAGEMENT
Strategic Decision-Making

DECS-452
Week #10

Professor Bob Weber

Attached are short model answers to all of the “project” questions.

Recommended readings:

Conveniently, amazon.com responds to a search for "game theory books" with a list spanning several pages. As well, my personal list of not-too-technical favorites includes:

Games, Strategies, and Managers, John McMillan, Oxford, 1992.
Thinking Strategically, 1993 and *The Art of Strategy*, 2008, Dixit and Nalebuff, Norton.
Getting to Yes, Fisher and Ury, Houghton-Mifflin, 1981.
The Art and Science of Negotiation, Raiffa, Harvard, 1982.
The Manager as Negotiator, Lax and Sebenius, 1987.
The Strategy of Conflict, Thomas Schelling, Harvard, 1973.
Passions within Reason, Robert H. Frank, Norton, 1988.
Auctions and Auctioneering, Cassady, 1967.
Gaming the Vote: Why Elections Aren't Fair, William Poundstone, Macmillan, 2008.

The military-strategy classics by Sun Tzu (*The Art of War*) and von Clausewitz (*On War*, 1832) are worthwhile readings, as is Machiavelli's *The Prince*. All three can be found online at <https://www.marxists.org/archive/index.htm>. You might enjoy subscribing to *The International Journal of Intelligence and Counterintelligence* (<http://www.tandfonline.com/toc/ujic20/current>), which publishes a variety of fascinating articles (and has several available online as examples).

The FCC Spectrum Auctions

After our discussion, and a reading of the paper on the class webpage, you might want to ask yourself a couple of questions. First, recall the situation which arose Friday afternoon, on what turned out to be the next-to-last day of the auction. WirelessCo attacked TDS in Houston, and TDS responded in the bid-withdrawal round by freeing up enough eligibility to hit San Francisco the very next round.

As it happened, WirelessCo had second thoughts about its attack, and withdraw its bid for Houston immediately, i.e., in the same withdrawal round that TDS prepared its response. But what might TDS have done the following Monday morning, had WirelessCo's withdrawal not occurred?

This is where activity "waivers" could come into play. Rather than bidding on San Francisco immediately, TDS had the option of exercising one of its remaining waivers. In this manner, they could wait and see if WirelessCo would respond to the threat at the earliest moment it possibly could after *seeing* it, i.e., after Monday's first round of bidding. While one sometimes is forced to carry out threats, it is always better to give competitors time to see them and respond. The true value of a threat is realized when it *doesn't* have to be carried out.

What if waivers hadn't existed? Under the rules of the auction, nothing would prevent TDS from replacing its withdrawn bids Monday morning, while purposefully placing its Houston eligibility on a split of smaller licenses in which it had never expressed interest. Following this with immediate withdrawal of those bids and the replaced ones (if WirelessCo failed to respond with a Houston withdrawal) would intensify the threat to attack San Francisco, a threat which most likely would be carried out in the next round. All of this would have been somewhat more costly to TDS than using the waivers which were available.

And what might the FCC do to deter the various types of tacit cooperation between firms which arose during the A- and B-block auction? I'll leave that question to your speculation, or out-of-class discussion. However, you might find the attached article from *The Economist* to be of interest.

As a side note: In the early stages of the auction, an interesting strategy was available. With most firms submitting new bids each round at the minimum accepted increase, a firm could have bid a bit more than the minimum for a license, then withdrawn its (presumably high) bid immediately. The FCC re-offering price would then be no higher than the withdrawn bid. This strategy could be repeated round after round, in order to keep the price on a license a firm truly desired from rising round after round at the minimum bid increment. This time-buying strategy was indeed apparently followed in the early stages of the C-band auction (by a firm I happened to be consulting for). It also irritated the FCC to no end. <grin>

Learning to Play the Game

American economists said that auctions would be the most efficient way to allocate the radio spectrum. But was the bidding rigged?

ECONOMISTS are forever theorizing about how the world might be run more efficiently. Three years ago, the American government finally let them put their theories to the test. Congress directed the Federal Communications Commission (FCC), America's telecoms agency, to scrap its practice of weighing who most deserves to use a given piece of the radio spectrum. Instead, the FCC was told to auction frequencies for services such as mobile phones. This was expected to achieve two goals at once. First, the government would get money for the right to use a scarce public resource. Second, each frequency would be used in the most productive way, because the company that could best employ it would offer the highest bid. The concept is so compelling that Britain's new government this week proposed spectrum auctions too.

Spectrum auctions have provided full employment for America's microeconomists and game theorists. The FCC's consultants carefully designed auction rules that would maximize the government's revenue. Telecommunications companies hired teams of experts to map out bidding strategies. The procedure seemed to be a roaring success. In 14 different auctions since 1994, the FCC has attracted winning bids worth \$23 billion. But suddenly it has all gone wrong. An auction last month of frequencies suitable for wireless data transmission, which was expected to raise \$1.8 billion, produced only \$13.6m. Worse, the Department of Justice is investigating whether bidding has been rigged.

How could a bidding procedure crafted by leading experts in game theory lead to bid-rigging? The answer is not at all clear. But it appears that some decisions made in designing the auctions may have made them susceptible to manipulation. In short, bidders may have turned out to be better game theorists than the FCC.

The sales technique adopted by the FCC involves what is known as simultaneous multiple-round auctioning. A given sale might involve, say, frequencies suitable for paging systems. Frequencies for various cities are sold simultaneously. Bidders must register in advance, stating which frequencies they may wish to bid for. Bidders are strictly prohibited from "cooperating, collaborating, discussing or disclosing the substance of their bids or bidding strategies".

Each sale involves multiple rounds of bidding. Bids, which are made by computer, are sealed during each round, and the identity of bidders is concealed to prevent -- in theory at least -- collusion. At the end of each round all bids for all frequencies are revealed, so that participants can plot their move in the following round. If a bidder judges that the prices offered for a frequency in, say, Denver have become too high, in the following round it is free to bid for Atlanta and ignore Denver altogether. The bidding continues, round after round, until there are no new bids for any of the frequencies on offer.

Game theorists thought this complex process perfect for an industry in which collaboration among bidders (enabling each, for example, to win a block of licenses for contiguous areas rather than a less valuable scattering of licenses across the country) might be a temptation. The only snag is that this auction method had never been tested except in laboratory experiments. Just as game theorists would expect, bidders seem to have learned how to use the rules to their advantage.

In a complaint to the FCC, High Plains Wireless, a Texan firm, claims that Mercury PCS, a rival for licenses in Texas, "warned off" High Plains from bidding against it in a January 1997 auction. Mercury allegedly "signaled" its intention to go after specific licenses in subsequent rounds by bidding odd amounts ending with the area codes of the cities it coveted. Mercury says that this was a "prudent application of bidding strategy, rather than collusion".

Signaling is apparently not a new problem. The FCC was informed that it was taking place shortly after the second spectrum auction, in July 1994. At the time, the FCC was advised by game theorists that it could prevent signaling by rounding the values of all bids before they are announced (so a bid of \$1,100,415, signaling that a participant was intent on winning a San Francisco license, would be reported as \$1.1m). The commission ignored this advice. Why? One reason may be that attempts to warn off rivals by signaling can backfire, leading to more intense bidding that could drive up the government's take. Now, the FCC says that in the future reported bids will be rounded.

Sending a message

That may not stop signaling altogether, however. In one early auction, a big bidder apparently signaled its aggressive intent by entering two bids for a particular region's licenses in the first round. Its competitors got the message, and it won the licenses without much of a battle.

Were the low bids achieved in the FCC's April auction, in which licenses for cities such as Minneapolis-St. Paul and Des Moines, Iowa, went for \$1 each, the result of collusion? The FCC, with some justification, says that the auction flopped because a cash-hungry Congress ordered it rushed. Some game theorists, however, claim that collusion has occurred in several spectrum auctions, and has proved especially effective where few bidders took part. That description fits the April sale, in which a mere 17 bidders snapped up the 126 licenses on offer.

The surest way to end bid-signaling would be to scrap the simultaneous multiple-round auction and go to an old-fashioned sealed-bid auction instead. But a switch to closed bidding might well make bidders more cautious: to avoid "winner's curse" -- the tendency to bid too high in order to be sure of winning -- bidders in sealed-bid auctions normally discount their estimates of the object's worth. That might, in the end, leave the government with less revenue than the multiple-round auctions have delivered. The game theorists may not have devised the perfect way of allocating the radio spectrum, but for all its flaws, it may still be the best one.

Strategic Decision-Making (DECS-452 Course Outline)

The RCA transponder lease auction

- 1) Agent-instruction errors, and the inevitable result
 - a) Cyclical-consistency of strategies: If it makes sense for me to act like this, then it should make sense for others to do the same. If they indeed do act this way, does it make sense for me? If the answer is "No," I should re-examine my assumptions and plans.
- 2) The FCC error
- 3) The RCA error

Ethics

- 1) The responsibilities of a competitor vs. the responsibilities of a rule-setter (game designer)
 - a) The Steelers' coach's problem: Losing a football game to enter the playoffs
 - b) The 1981 MLPA strike, the "second season", and the White Sox's response
- 2) Recognizing your constituencies
- 3) Anticipating ethical challenges
- 4) Recognizing that others might not feel the same constraints as you do

"Law" as a combination of stated rules, enforcement effort, and penalization: Ethical, moral, and economic justifications for obeying (or violating) the law

- 1) The moral imperative.
- 2) Economic constraints.

Final project model answers: Distributed in class.