1 Introduction

As a manager, you prefer that other firms not enter your markets. Sometimes you're lucky and you're protected by *natural* barriers to entry. Examples of these are legal protections on intellectual property (e.g., a patented product), government regulations limiting entry (e.g., restrictive zoning), and the amount of industry-specific capital investments needed to compete effectively. Many times, however, you don’t enjoy such protections. In these cases, the question is whether you can deter entry through strategic actions. These notes discuss what strategic actions you might take and the effect they’re likely to have. In particular, we’ll consider 6 methods:

1. Locking up customers.
2. Locking up suppliers.
3. Make entry unattractive (e.g., install “doomsday devices”).
4. Developing a reputation for toughness.
5. Signaling toughness (“beer drinking”).

To appreciate the problem you face in entry deterrence, consider Figure 1. [It’s similar to the game shown in lecture, but, given wordprocessing constraints, it’s drawn slightly differently here: It flows from top to bottom (rather than left to right) and the decision nodes are dots, not squares. As before payoffs of $E, I$ denote the entrant’s and incumbent’s payoffs respectively.] Observe that an entrant can enter or stay out. If it stays out, it earns nothing and the incumbent firm gets 10 (in whatever monetary units you like). If the entrant enters, the incumbent can acquiesce to this entry or fight it. They each get 5 if the incumbent acquiesces and -1 if the incumbent fights. Using backward induction, we see that the subgame perfect equilibrium is for the incumbent to acquiesce and the entrant to enter. From the incumbent’s view this is not desirable: The incumbent would do better if the entrant stayed out (10 > 5). The problem is that in this game there’s no way to make that happen.

But recall that game theory is like the ghost of Christmas future: It is a warning of what will happen if you don’t take strategic actions today to avoid
playing unpleasant games, like the one in Figure 1. The 6 strategies listed above are all ways to change this game. Strategies 1 and 2 are ways of changing the payoffs for the entrant—observe that if you can turn the entrant’s payoff of 5 into a negative number, then the entrant will prefer to stay out—entry is deterred. Strategy 3 is a way of “pruning” the acquiesce branch off the tree; that is, it is way to make a threat of fighting credible. If that threat’s credible, then the entrant will prefer to stay out. Entry is again deterred. Strategy 4 is a way to take advantage of repeated play to make the threat of fighting credible, which will again deter entry. Strategies 5 and 6 apply to situations of asymmetric information, when the entrant is not sure of the incumbent’s willingness or ability to fight.

2 Locking up Customers

An entrant won’t enter if it can’t get any customers. Hence, one strategy for deterring entry is to “lock up” the customers; that is make it difficult for the entrant to attract customers. Some ways to accomplish this are

- **Loyalty programs.** Loyalty programs, such as frequent-flier programs, are a good way to lock up customers. For instance, Detroit is one of Northwest Airline’s hubs and it doesn’t want another carrier to make extensive use of it. One thing that makes entry difficult into Detroit is that most of the heavy travelers in that area belong to Northwest’s WorldPerks program. Hence, a given passenger is more inclined to fly on Northwest even if an entrant offers a better fare: The cost of switching is having a longer wait to earn a free trip. For example, suppose that a passenger will earn a free trip worth $400 to her on her next trip. Suppose it would take her three years to earn a free trip on the entrant (since she would be new to its frequent flier program). Receiving something worth $400 in three years is worth $345.54 today (assuming a 5% annual interest rate). Hence, to steal this passenger the entrant would have to charge a price $54.46 less than Northwest to steal this customer from Northwest. In fact, it’s even harder than this to steal customers: Many travelers are traveling on business and, so, don’t pay the airfare themselves. Consequently, which frequent-flier program they have the most miles on could be the only...
criterion they use to choose with whom to fly. In short, it will either be expensive to lure customers (e.g., offer a discount of $54.46) or nearly impossible to do so. Either way, this makes entry less attractive and could, therefore, cause the entrant not to enter.

• **Brand loyalty & reputation.** As discussed in class, reputation can be a barrier to entry: Customers will naturally be reluctant to try the entrant’s product because they don’t have any experience with it. Consequently, to attract customers, the entrant may have to heavily discount or heavily advertise or both—all of which makes entry less attractive and will, thus, tend to deter entry. Although reputation can be a natural barrier, it is also one that can be built up strategically. For instance, most people wouldn’t know who made the CPU in their home computer and, hence, wouldn’t care unless the chip maker advertises the importance of its brand. Hence, we see the “Intel inside” campaign from Intel. A similar process takes place with medicines, such as Prozac, while they are under patent: To ward off generics, the brand name is pushed heavily so customers believe they care about who makes a given chemical compound.

• **Long-term contracts.** Another way to lock up customers is to sign them to long-term contracts, particularly ones with penalties for early termination. The contracts that the big computer-reservation systems, like Sabre, sign with travel agents are an example of this practice. Suppose it costs a travel agent $5000 to break its contract with Sabre. Then an entering computer reservation system would have to give the travel agent a price $5000 less than Sabre to steal this agent away. Again, this makes entry less attractive and, thus, will tend to deter entry. [Note: locking up customers via long-term contracts will likely invite antitrust scrutiny—you will need to be able to make a credible argument that there was another business reason for the long-term contracts (e.g., recouping set up costs).]

A variant on this is what Microsoft did to make it difficult for other operating systems, like IBM’s OS/2 to enter the market: Microsoft forced computer manufacturers to buy Windows under a contract where the manufacturer paid a royalty based on every computer it shipped whether or not that computer had Windows installed on it. Consequently, manufacturers had the choice of paying double for an installed operating system (e.g., installing OS/2 but paying for both OS/2 and Windows) or paying just once. Obviously, the latter was more attractive, which made it harder for OS/2 to compete. This practice was ended as part of Microsoft’s 1995 consent decree with the Justice Department.

• **Leasing.** Related to the last method is leasing. If you lease your product (e.g., a photocopier) rather than sell it, then you can deter two types of entrants. First, a long-term lease works to keep other firms entering the photocopier market for the reasons given above. Second, it keeps others from selling your used photocopiers. Remember that your used copiers are a substitute for your new copiers. You don’t want others, therefore, to
sell or lease them. You want to control the market for your used copiers. Leasing lets you do this. [Note: leasing of durable goods, like copiers, can invoke antitrust scrutiny (e.g., Xerox was forced to stop exclusively leasing its copiers by the antitrust authorities). Again its good to have another justification for the practice (e.g., its a way for customers to finance the good).]

- **Leveraging market power.** Suppose you sell two complementary goods (e.g., mainframe computers and their operating systems). Suppose you have considerable market power in one good (e.g., mainframe computers). You can leverage that to deter entry into the other market. For example, IBM used to sell its mainframes\(^1\) with a service contract that required IBM to dispatch a service technician within 24 hours of a breakdown. Now IBM would let customers know that it would dispatch the technician immediately if they were using an IBM operating system (e.g., CMS), but would dispatch the technician in 23 hours and 59 minutes if they were running a rival operating system (e.g., MTS). Because having your mainframe down is a major expense, customers had a strong incentive to go with an IBM operating system. This worked to block entry into the mainframe operating system market.

3 **Locking up Suppliers**

Firms can’t enter if they can’t acquire the necessary inputs at competitive prices. Hence, locking up suppliers will be a way to deter entry. This can be done by acquiring suppliers (a strategy known as *vertical foreclosure*). It can be done, as Alcoa did, by acquiring all patents for processes to extract aluminum from bauxite (including patents for processes that were *worse* than ones it already had).\(^2\) It can also be done by signing suppliers to long-term contracts. For example, extracting aluminum from bauxite requires a lot of electricity and Alcoa signed up the cheap electricity producers (those using hydro-power) to long-term contracts. A few years back, a drug manufacturer was accused of signing the producers of a key chemical to long-term contracts for the purposes of blocking entry into the manufacture of this drug.

4 **Make Entry Unattractive**

Both methods considered so far work by making entry less attractive. There are other ways to make entry unattractive. In particular, you can install “doomsday devices”.\(^3\) These are strategies that work to make the incumbent *committed* to not accommodating the entrant. Some examples of this:

\(^1\)After the antitrust authorities stopped it from leasing exclusively.

\(^2\)This will very likely trigger antitrust scrutiny.

\(^3\)The idea comes from Stanley Kubrick’s film *Dr. Strangelove*, where the Soviets build a device that will automatically destroy the world if they’re attacked with nuclear weapons.
• Build extra capacity to make it more likely that competition would resemble the Bertrand trap should an entrant enter. Given that competition will be more cutthroat, the entrant will perceive entry as less desirable.

• Advertise heavily that you’ll match any price in town. Recall from above that an entrant may need to discount to attract business because of the incumbent firm’s established reputation. This heavy advertising obliges the incumbent to match these discounted prices, meaning that it will be additionally difficult for the entrant to attract customers at a profitable price.

5 Develop a Reputation for Toughness

Recall the game of Figure 1. Imagine that, instead of being played once, the game is played repeatedly. In particular, suppose either it’s infinitely repeated or, equivalently, it has finite length but the end is unknown. Consider now the possibility that the incumbent seeks to develop a reputation for toughness. Specifically, the incumbent beats up an entrant foolish enough to enter against it in the hopes of convincing future entrants not to enter against it.

To make this somewhat more concrete, suppose that an entrant who is fought exits immediately. If the incumbent acquiesces, the entrant gets 5 and stays in to earn 5 every period. So if the incumbent fights, the incumbent gets −1 that period, but, assuming no further entry, it gets 10 every period thereafter. Suppose, further, that entrants won’t enter against a tough incumbent (clearly, it’s not in their interest if they think they’ll be fought), but will enter if they think the incumbent won’t fight. The question, then, is whether being tough (fighting) is credible in this repeated game. Let \( r \) be the interest rate and define

\[
\delta = \frac{1}{1 + r}
\]

as the discount factor. Then the present discounted value of fighting to establish a reputation is

\[
\text{PDV}_{\text{fight}} = -1 + \delta \cdot \frac{10}{1 - \delta},
\]

because if it fights it gets −1 today, but then 10 forever after, the present discounted value of which is \( 10 \delta / (1 - \delta) \). If the incumbent acquiesces, then the entrant’s in forever after, meaning the incumbent gets only 5. The present discounted value of acquiescing is, thus,

\[
\text{PDV}_{\text{acquiesce}} = \frac{5}{1 - \delta}.
\]

The incumbent will fight if \( \text{PDV}_{\text{acquiesce}} \leq \text{PDV}_{\text{fight}} \); that is, if

\[
-1 + \delta \cdot \frac{10}{1 - \delta} \geq \frac{5}{1 - \delta};
\]
or, rearranging, if

\[-(1 - \delta) + 10\delta \geq 5.\]

Hence, the incumbent will fight if \(\delta \geq \frac{6}{11}\). Consequently, if the incumbent is sufficiently patient, then it will fight to establish a reputation. Recognizing this, no entrant will ever enter. Entry is deterred.

In a more realistic model, we might expect that the incumbent would have to fight at least once to establish a reputation. Note, too, that we might imagine that if the incumbent doesn’t fight, then that might invite further entry. Its future payoffs from acquiescing might, therefore, be lower than 5. This doesn’t, however, change the logic of the model—in fact, it would make the incumbent even more willing to establish a reputation by beating up the first entrant since the alternative would now be even worse.

In summary, then, if you play myopically and acquiesce, then you can expect even more entry. On the other hand if you fight tooth and nail against every entrant, then you will deter entry against you.

6 Signaling Toughness

Consider the game in Figure 2. This is known as the beer and quiche game. [Note this is the same game as in the lecture notes, but due to wordprocessing constraints it looks a little different.] The story behind the game is that “nature” first decides whether the incumbent firm is tough or a wimp (not tough). That
is, the game starts in the middle at the node labeled nature. The probability that
the firm is tough is $\frac{1}{2}$ and the probability that it’s a wimp is $\frac{1}{2}$. The incumbent
knows whether it’s tough or a wimp. The incumbent then gets to choose its
breakfast, which it consumes publicly. Its choices are beer or quiche. Neither
type of incumbent likes drinking beer for breakfast, but the cost of this breakfast
differs between the two types: A tough incumbent incurs a cost of 1 (in whatever
monetary units you like) if it has beer for breakfast, while a wimpy incumbent
incurs a cost of 3 if it has beer for breakfast. After the incumbent has chosen
its breakfast, the entrant gets to move. Unfortunately for the entrant, it does
not know what nature decided; that is, it doesn’t know whether the incumbent
is tough or a wimp. To indicate this lack of knowledge, an information set (here
represented by a dashed line) is drawn between the entrant’s decision nodes
following beer drinking and an information set is drawn between the decision
nodes following quiche eating. That is, although the entrant knows what the
incumbent had for breakfast, the entrant doesn’t know whether the incumbent
is tough or a wimp. The entrant then decides whether to enter or stay out of the
market. If it enters against a tough incumbent, it gets $-1$. If it enters against a
wimpy incumbent, it gets 2. The payoff to the incumbent if entered against is 2
(regardless of type) and the payoff to it if the entrant stays out is 4 (regardless
of type). Of course if it’s had beer for breakfast, we must subtract the cost of
having done so. This gives the payoffs shown in Figure 2 (the convention is the
first number in the pair is the incumbent’s payoff and the second number is the
entrant’s).

What’s the equilibrium of this game? Well an equilibrium is for a tough
incumbent to drink beer for breakfast and a wimpy incumbent to eat quiche for
breakfast. The entrant believes that beer drinkers are tough and that quiche
eaters are wimps. Consequently, the entrant will enter against quiche eaters
and stay out against beer drinkers. To check that this all represents mutual
best responses, consider, first, a tough incumbent. If it were to deviate by
eating quiche, then it would be mistaken for a wimp. Consequently, it would
be entered against yielding it a payoff of 2. But if it drinks beer, it won’t be
entered against and, so, will get a payoff of 3. Three is greater than two, so beer
drinking is, indeed, a best response. Likewise consider a wimpy incumbent.
Suppose it deviated by drinking beer. It wouldn’t be entered against, but,
because beer is so costly to it, it would only earn 1. If, however, it ate quiche
and accepted being entered against, then it would earn 2. Two is greater than
one, so quiche eating is, indeed, a best response for a wimpy incumbent. How
about the entrant. In equilibrium, its beliefs are correct—wimps eat quiche and
tough incumbents drink beer—and given these beliefs the entrant is certainly
playing best responses: It doesn’t want to enter against a tough incumbent, but
it does want to enter against a wimpy incumbent.

Notice that this game is a signaling game. Like all signaling games the
“good” type (here, the tough type) signals by taking an action (here, beer
drinking) that the “bad” type (here, the wimp) would find too costly to take
even if it fooled the other player (here, the entrant) into believing it was good.
This, recall, is the essence of signaling.
Of course real-life firms don’t consume public breakfasts of beer or quiche. In this game, beer and quiche are colorful metaphors for real actions that firms can use to signal toughness. For instance, an incumbent can be tough because it has excess capacity. In this case, beer drinking would correspond to higher-than-monopoly output to signal this toughness. Alternatively, an incumbent could be tough because it has “deep pockets”—the financial resources to weather a fight. In this case, beer drinking would correspond to beating up rivals or other entrants. Or possibly it could signal its deep pockets through actions like paying high dividends. Finally, an incumbent could be tough because it has low costs. In this case, beer drinking would correspond to charging less than the monopoly price to signal this fact.

The last example, charging a low price, is known as limit pricing. Limit pricing is a particular good way of signaling toughness both to entrants and, even, to current rivals. A more complete analysis lies, unfortunately, outside the scope of these notes.