

# G5212: Game Theory

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# Signalling

- We are now going to move on to our second formulation of the asymmetric information problem: Signalling
- Key difference is now the informed party moves first
- Classic example: Education
  - Student decides what schooling to get
  - On the basis of this firms decide who to hire
- This is again a huge literature in micro theory
- Can be differentiated by the technology that governs the way that information can be sent
  - i.e. how can we ensure that some information can be communicated

## An Example: The Market for Lemons

- In order to illustrate the problem, consider the following classic example from Akerlof [1970]
  - There is a seller of a car
  - The car can either be of good quality (with probability  $p$ ) or be a lemon (with probability  $1 - p$ )
  - If the car is of good quality it is worth  $G$  to a potential buyer and  $g$  to the seller
  - If it is of poor quality it is worth  $L$  to a potential buyer and  $l$  to the seller
  - Assume

$$G > g$$

$$L > l$$

$$G > L$$

$$g > l$$

- Assume also that there are multiple buyers so that the seller has all the market power

## An Example: The Market for Lemons

- If the quality of the car is observable, what is the first best outcome?
- Both types of car get sold
- Price of good quality cars is  $G$
- Price of lemons is  $L$
- Market is efficient: both types of can end up with the person that values them most

## An Example: The Market for Lemons

- What will happen if the quality of the car is only observable to the seller?
- Can it be the case that both types of car are traded?
- If the buyer can't observe the quality, then the most they will be prepared to pay is the expected value
  - Given the strategy of the seller
  - i.e. what cars they sell
- So if both types of car are to be sold, the price must be

$$pG + (1 - p)L$$

## An Example: The Market for Lemons

- Will the seller sell at this price?
- Only if

$$pG + (1 - p)L > g$$

- If not then this price will not be enough to encourage the seller to sell high quality cars
- Only equilibrium is one in which only low quality cars are sold at price  $L$
- Market is inefficient because high quality cars cannot be traded

## An Example: The Market for Lemons

- What went wrong in this example?
- Seller has no credible way to signal that the car is in fact of good quality
  - They could promise that this was a high quality car, but why would the buyer believe them?
  - They could set different prices for the different types of car, but what is to stop them selling the low quality car at a high price?
- Need to add some additional ingredient to allow communication to take place

# Three Possibilities

- ① Costly Signalling
- ② Cheap Talk
- ③ Verifiable Information

# Costly Signalling

- Perhaps the most obvious way to ensure that information can be transmitted is to make it **costly**
- The key thing here is not that signals cost money, but the **costs are different for different types**
  - In our example, imagine that  $G = \$1000$  and  $L = \$800$
  - It is possible for the seller to get a 'certificate' saying that this is a good quality car
  - It is possible to get the certificate even if the car is of low quality - it just costs more
    - To get the certificate when the car is of high quality costs \$50
    - When it is of low quality it costs \$250

# Costly Signalling

- It is an equilibrium of this game for
  - Sellers with high quality cars get a certificate and sell the car for \$1000
  - Sellers with low quality cars do not, and sell the car for \$800
- Buyers know what type of car they are getting
- There is no incentive for the low quality car seller to mimic the high quality type by getting the certificate
- This is because of the difference in costs of the certificate of the two different types

# Cheap Talk

- In the example above, the incentives of the two parties are perfectly unaligned
  - Seller always prefers higher prices
  - Buyer always prefers lower prices
- If, instead, incentives were perfectly aligned, communication could take place
  - For example if the seller and the buyer were part of the same family
  - Should be able to communicate its quality
- What about intermediate cases?
  - You are buying a car from your third cousin
  - They care about your welfare, but also about how much money they get

# Cheap Talk

- One might expect that some communication might take place
  - Your cousin would not sell you the worst possible car for the highest possible price
  - But they might be interested in making you pay a bit over the odds
- It turns out that this is formally correct
  - If incentives are partially aligned then some communication can take place
  - The more aligned are the incentives, the more information can be communicated
- This is the model of cheap talk (Crawford and Sobel 1982)

# Verifiable Information

- Another case (which we may not get the chance to discuss in depth) is that of **verifiable information**
- The informed party can credibly reveal their type - only question is whether they choose to do so.
- For example, maybe every car has a certificate that reveals its quality
- The only choice is whether the seller chooses to show the buyer the certificate
- What would you expect to happen in this case?

# Verifiable Information

- As long as the buyer was aware of the existence of the certificate, we would expect to get **full disclosure**
- Imagine that neither type showed their certificate
- Then the high type either cannot sell their product at all, or they sell it at

$$pG + (1 - p)L$$

- If they show their certificate then they will be revealed as the high type for sure
- Can sell for price  $G$

# Verifiable Information

- This type of unravelling result is standard in the disclosure/verifiable information literature
- High types will always have the desire to reveal their type, reducing the average quality of those that do not reveal
- This means the next highest will want to reveal their type
- And so on....
- The basis of a lot of regulation meaning that firms should not be forced to reveal information (!)