LECTURE 8

COMMUNICATION AND SIGNALING

Introduction

- Aim of the lecture: explore how (pre-game) communication and information manipulation may alter the outcome of the game.
- **"Cheap talk":** Direct costless communication between players where by players announce which actions they will take.
- **Signaling/screening:** In game of incomplete information, agents may manipulate information by taking certain actions.

Communication: Perfectly aligned interests

- Coordination game: Entry game example

	market A	market B
market A	0,0	1,1
market B	1,1	0,0

- Without pre-game communication, there is a risk of coordination failure, where both firms enter the same market.
- We add a first stage, where communication is possible.

Communication: Perfectly aligned interests

- Suppose Firm 1 can announce at no cost its choice of action before Firm 2 gets to choose. The announcement is nonbinding, **"cheap talk."**
- "I will enter market A"
  - If Firm 2 believes Firm 1, it will choose B.
  - By sending a truthful message, Firm 1 can prevent coordination failure.
- Firm 1 will be truthful, and Firm 2 has no reason not to believe Firm 1.
- Coordination can be easily achieved. Pre-game communication benefits both players.

Communication: Partially aligned interests

	market A	market B
market A	0,0	2,1
market B	1,2	0,0

- Firm 1 is given the opportunity to say "I am going to market A". Firm 1 benefits from being truthful, and Firm 2 is likely to believe it.
- Cheap talk can enable a player to obtain his preferred outcome.

Communication: Conflicting interests

- Example: Employee/manager interactions

		Manager	
		Monitor	**No monitor**
Employee	Work	50,90	50,100
	Shirk	0, -10	100,-100

- The interests are conflicting.
- Suppose the manager has the opportunity to send a message to announce whether monitoring will take place today.

Communication: Conflicting interests

- If the manager says “I will monitor today”, then the employee will choose “Work” if he believes the manager.
- But then, the manager has no incentive to actually monitor, and is better off doing the opposite of what the signal said. The signal is not truthful.
- But if the manager always does the opposite of what he says, the employee will choose to shirk. Knowing this, the manager will monitor…etc.
- The employee should just disregard the signal. When players have conflicting interests, pre-game communication is uninformative. (babbling equilibrium)

Incomplete information

- So far we have considered games with **complete information**
  - players know all the rules of the game - all players, all possible strategies, and payoffs.

		Manager	
		Monitor	No monitor
Employee	Work	50,90	50,100
	Shirk	0, -10	100,-100

  - In complete information games, pre-game communication is limited to announcing the choice of future actions, i.e. cheap talk.

Incomplete information

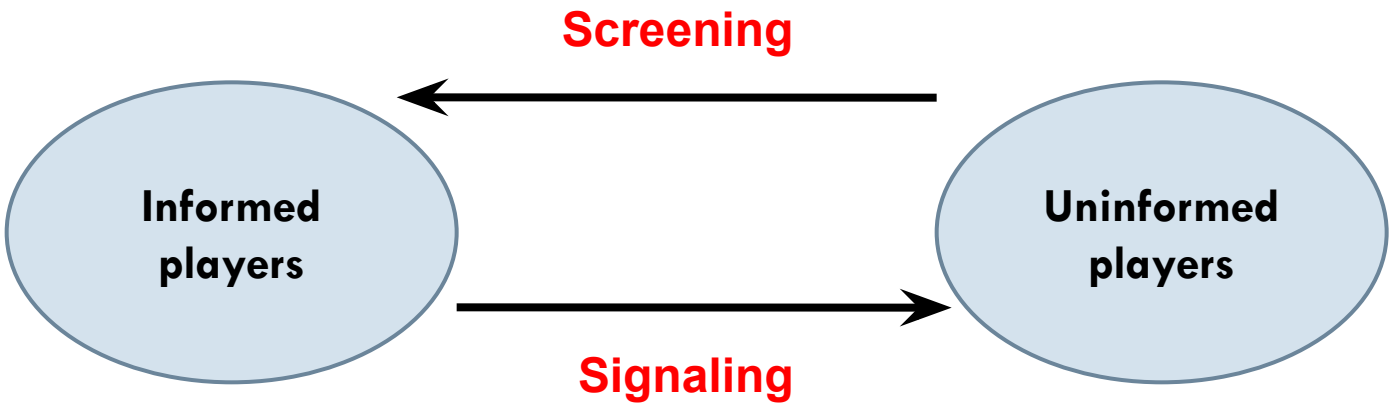
- In **incomplete information** games, players may not have some information about the other players, e.g. about their type and payoffs.
  - Producers may not know each others' costs functions.
  - An entrant may not know how costly if would be for the incumbent to fight a new entrant.
  - In a bargaining games, parties may not know each other's degree of impatience and outside option.
- Players know more about themselves than about other players.

Incomplete information

- Possessing superior information is often an advantage, and allows greater flexibility to adjust to the other player's profile
- Bargaining game: The optimal offer depends on the other player's degree of impatience and outside option.
- Entry game: the entrant may want to know how tough the incumbent is; the incumbent may want to know how committed the entrant is.

Information manipulation

- Because information can be so important, players may try to manipulate information, to alter the outcome. Manipulation of information becomes a strategy, a game within the game.



- Unlike cheap talk, signaling and screening is not costless.

Signaling/screening

- Signaling: The better-informed attempts to signal something about his type.
  - Reveal information truthfully, e.g. reveal that you are patient in a bargaining game.
  - Reveal misleading information, e.g. hide the fact that you are impatient.
- Screening: The less-informed player tries to elicit information and filter truth from falsehood
  - Employer wants to find out how hard-working its employees are.
  - Consumers wish to learn if a seller is trustable or not.

Adverse selection and signaling: the lemon problem

- Market for second-hand cars:
  - Two types of cars.
  - Good cars: valued at $12,500 by the seller
  - Bad cars: valued at $3,000 by the seller
- The potential buyer is willing to pay:
  - $16,000 for a good car
  - $6,000 for a bad car (the lemon)
- Depending on bargaining power of the two players, the price of the good car will between $12,500 and $16,000. The price of the bad car between $3,000 and $6,000.

The lemon problem: Asymmetric information

- Information is asymmetric: Sellers know the value of the car, but buyers don't.

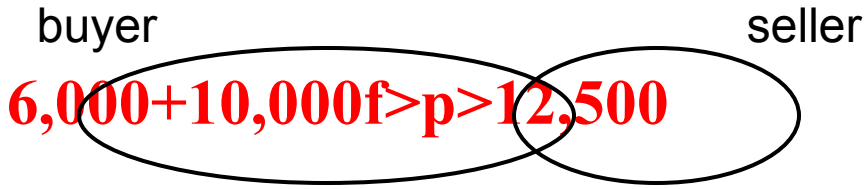
- Sellers of good car would like to indicate that their cars are good, but so do sellers of bad cars. Direct communication is not credible, and buyers remain uninformed.
- When quality is unobservable, there can only be one price p for both types of cars.

The lemon problem: Asymmetric information

- In the population of cars,
  - A fraction f is of good quality.
  - A fraction 1-f is of bad quality.
- For the buyer, the expected value of the car purchased is:
  - 16,000f+6,000(1-f)=6,000+10,000f
- He will buy the car if:
  - **6,000+10,000f>p**
- The seller of a bad car will sell if **p>3,000**. The seller of a good car will sell if **p>12,500**.

The lemon problem: Condition on f

- To meet the requirements of all sellers and buyers:



10,000f>12,500-6,000

- i.e **f>0.65,** more than 65% of cars are of good quality.
- If f>0.65, the expected value of a random car is more than 12,500. Buyers are willing to pay more than 12,500 for a random car, and sellers of good cars will agree to sell.
- If f<0.65, the expected value of a random car is less than 12,500. Buyers are not willing to pay more than 12,500 for a random car, and sellers of good cars will not agree to sell.

The lemon problem: adverse selection

- When f<0.65, there is an **adverse selection** problem. Sellers of good cars will drop out, and only low quality cars will remain on the market.
- Potential buyers will recognize this, and pay at most 6,000. Bad cars drive the good cars out.
- More generally, because of asymmetric information, producers of high quality products may not expect proper profit, so will not participate in the market.

Solving adverse selection: warranties

- Adverse selection originates from information asymmetry. Cheap talk is not going to work. Sellers of high quality cars may **signal** high quality using warranties.
- If the product is faulty of damaged, the seller will replace it.
- Suppose that buyers perceive any car with a warranty to be of good quality, and any car without a warranty to be of bad quality.
- Suppose that:
  - For sellers of good cars, the cost of offering warranties is $0. Good cars never fail.
  - For sellers of bad cars, the cost of offering warranties is $11,000. Low quality cars are more likely to fail.

Solving adverse selection: warranties

- Sellers of good cars will choose to offer a warranty:
  - Costs $0.
  - With warranty they can sell the car for $16,000, without warranty they can sell it for $6,000.
- Sellers of bad cars will choose not to offer a warranty:
  - Costs $11,000.
  - With warranty they can sell the car for $16,000, without warranty they can sell it for $6,000. (difference of $10,000)

Solving adverse selection: warranties

- Sellers of good cars can use warranties to credibly signal the quality of the car. **Signaling**
- Signaling works because good quality producers provide warranties which low quality producers cannot imitate.
- Warranties act as a “separating mechanism”. Whether warranty is offered depends on the quality of the car.

Solving adverse selection: advertising

- Sellers of high-quality products advertise to **signal** the quality of their products.
- For advertising to be worthwhile, consumers must buy the product repeatedly.
  - Low-quality sellers do not find it worthwhile to advertise
  - High-quality sellers find it worthwhile to advertise
- It is not the advertising message itself that is effective in convincing consumers. Rather, the simple fact of advertising signals that the product must be of high quality.

Solving adverse selection: value of the brand

- Over the long-term, high-quality sellers may be able to acquire a strong reputation and increase the value of their brand.
- Once reputation has been established, adverse selection is less of an issue, and the signaling motive for warranties and advertising may be less important.
- Over the long-term, the brand itself may act as a signal.

Signaling in the labor market:

Spence education model

- What credible signal can be used to convince employers that you are highly skilled and they should hire you?
- Spence argues that attending university, and taking tough courses can be used to signal skills.
- Consider an employer and two types of potential workers (students):
  - Able (A), Challenged (C).
  - Employers are willing to pay $160k for A type and $60k for a C type. The student's type is not observable to the employer.

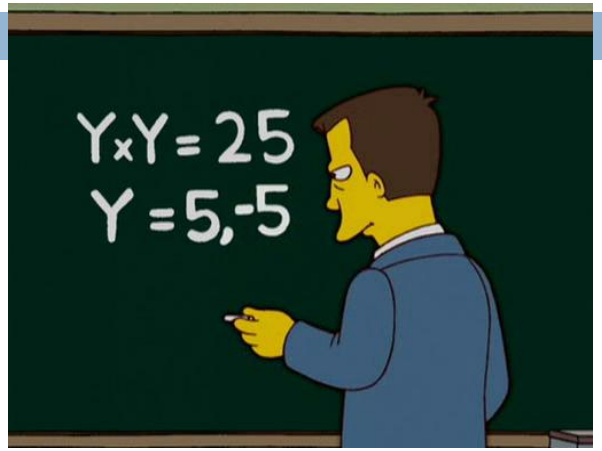
Spence education model

Setting

- What each player tries to achieve:
  - Employer: find out students' types.
  - Able students want to separate themselves from the challenged.
  - Challenged students want to mimic able students.
  - Cheap talk is not credible, all students will claim to be able.
  - Able students may use signaling strategies

Spence education model

Setting



- Key assumption: Able students are more willing to take difficult courses than challenged students
  - For A-type: cost of each tough course is $3,000 (low risk of failing the course)
  - For C-type: cost of each tough course is $15,000

Spence education model

Hiring policy

- Consider the following employer's policy:
  - Any student taking more than **n** tough courses is paid $160,000.
  - Any student taking less than **n** tough courses is paid $60,000.
- Assumption of the employer:
  - Any student taking at least n tough courses is assumed to be type A.
  - Any student taking less than n tough courses is assumed to be type C.
- Can this assumption be justified?

Spence education model

Hiring policy

- A-type will try to take many tough courses to signal their ability, but so will C-type. However, taking courses is more costly for C-type.
- The employer assumption that only A-type will select to take n course may be correct if it is too costly for C-type to take n tough courses.

Spence education model

Incentive compatibility

- C-type may "reveal their type" and take 0 tough course.
  - they are paid $60,000.
- C-type may take n tough courses are pretend to be A-type:
  - $160,000-$15,000n
- C-type prefer revealing their type to taking n tough courses if:

$$60{,}000 \geq 160{,}000 - 15{,}000n$$

$$\Rightarrow n \geq 6.67$$

Spence education model

Incentive compatibility

- A-type prefer take n tough courses and prove their type if:

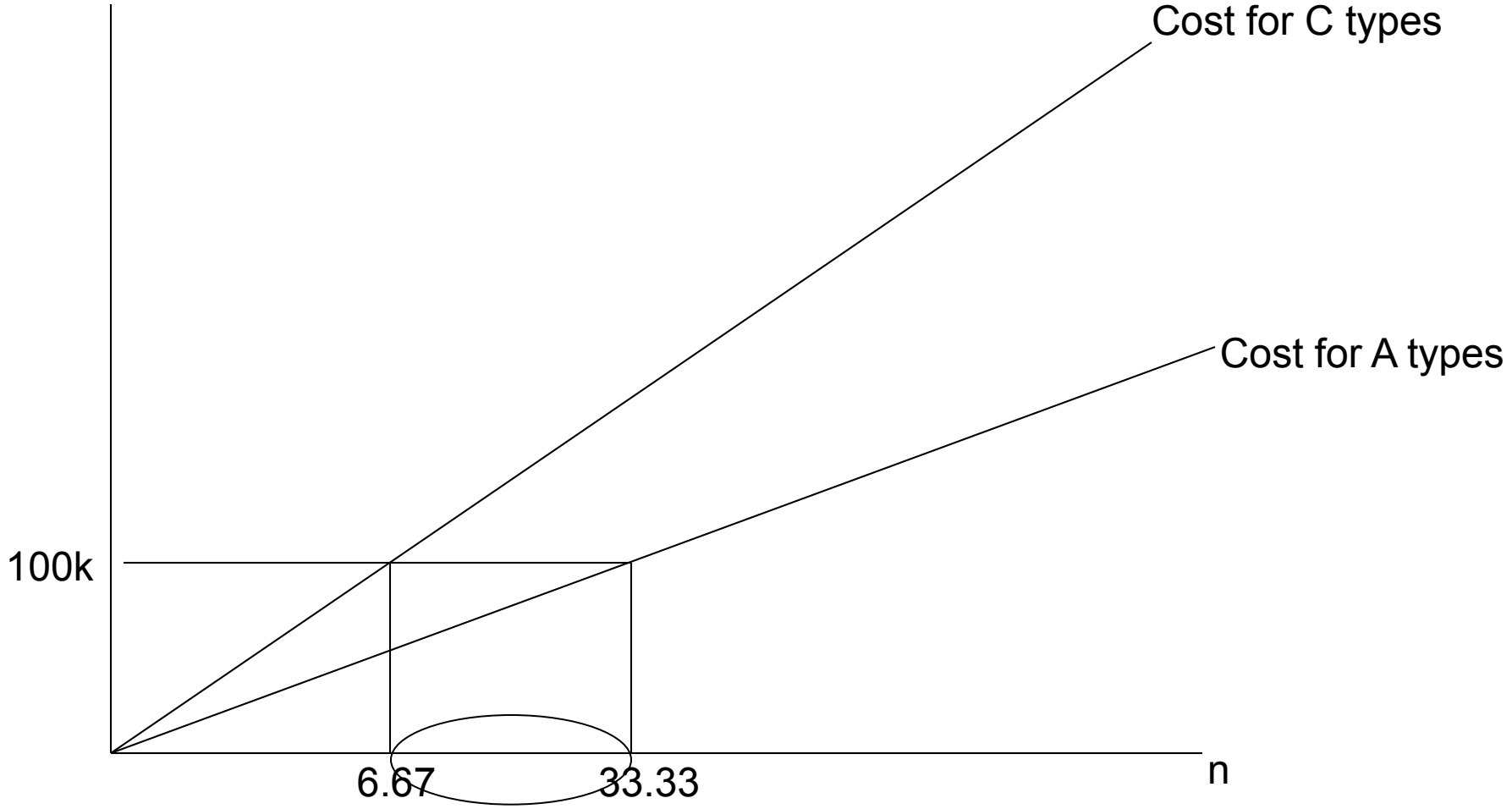
$$160{,}000 - 3{,}000n \geq 60{,}000$$

$$\Rightarrow n \leq 33.33$$

- In order to separate the two types:
  - The value of n must be set between 6.67 and 33.33.
  - A-type are willing to take more than n tough courses
  - C-type prefer taking less than n tough courses

Spence education model

Incentive compatibility



Spence education model

Payoffs

- Employers can set n=7.
  - A types choose n=7
  - C types choose n=0
- Intuition:
  - A-type can signal they type and separate themselves from C-type because the cost of tough courses is low to them.
  - C-type reveal their true types, because this is better than taking too many tough courses.
- Payoff for A= 160,000-7*3,000= $139,000
- Payoff for C= $60,000

Spence education model

Implications

- A positive relationship between years of education and wages does not necessarily show that education improve skills.
- Instead, education can act as a screening device used to identify the ability of job candidates.
- Go to university to signal your ability, go to the best universities to send an even stronger signal on your ability.

Summary

- Possibilities of manipulating information with cheap talk depend on whether players have aligned or conflicting interests.
- With incomplete information, players may manipulate information to obtain a favorable outcome: signaling.
- Signaling can be used to lessen the information asymmetries leading to adverse selection.
- Signaling can be used in the job market to signal your skills.