

### Introduction

- ▶ Last time, saw that if all interaction between agents happened in a market, would obtain Pareto efficient outcome
- ▶ However, in general we have *externalities*, where agents have preferences for things that are not sold on the market
- ▶ Question for today: Will we still get Pareto efficient outcomes if there are goods with no market?

### Types of Externalities

- ▶ *Consumption externality*: when a consumer cares directly about the consumption or production of others
  - ▶ Positive consumption externalities:
  - ▶ Negative consumption externalities:
- ▶ *Production externality*: when production possibilities of one firm influenced by choices of other firms or consumers
  - ▶ Positive production externalities:
  - ▶ Negative production externalities:

## Consumption Externality Example: Smoking Roommate

- ▶ Let A and B be two people sharing a room
- ▶ A prefers to smoke while B prefers clean air
- ▶ A and B each endowed with some money:  $m_A, m_B$
- ▶ Note that we can represent this situation with Edgeworth box:
  - ▶ Money on horizontal dimension, eg
  - ▶ Then vertical axis represents percent of smoky air for A, or conversely clean air for B
  - ▶ Total amount of air is fixed
  - ▶ Preferences for A increasing in money and in smoky air
  - ▶ Preferences for B increasing in money and in clean air

5 / 20

## Smoking Roommate: Endowments

- ▶ Only one thing left to specify for Edgeworth analysis: endowments
- ▶ First, suppose A has the right to smoke; where will endowment be?
- ▶ Next, suppose B has the right to clean air; where will endowment be?
- ▶ These are just two extremes; a whole continuum of possible property rights
- ▶ As long as property rights are clear and agreed upon, Pareto efficient allocation will be obtained

6 / 20

## Smoking Roommate Edgeworth Box

## The Coase Theorem

- ▶ Suppose preferences of both agents are quasilinear in money
- ▶ What does this imply about indifference curves of each consumer?
- ▶ What does this imply about contract curve?
- ▶ Whatever the initial endowment, agents end up consuming same amount of clean air
  - ▶ This is called *The Coase Theorem*
  - ▶ Big implication (if assumptions hold): initial property rights do not affect final allocations of clean/smoky air

7 / 20

8 / 20





## Property Rights Reversed

- ▶ If fishery has the property right, we get the socially optimal solution
- ▶ What if the steel mill has the right to pollute?
- ▶ In particular, steel mill can pollute up to  $\bar{x}$  and fishery can pay price  $q$  to lower this amount
- ▶ Steel mill's problem: ▶ Fishery's problem:

17 / 20

## Tragedy of the Commons

- ▶ Suppose some villagers are grazing cows on the village green
- ▶ If  $c$  cows are grazing, total value of milk produced is  $f(c)$ , which is concave
- ▶ Each cow costs  $a$  to buy and maintain
- ▶ Village's socially optimal number of cows?
  
- ▶ Villagers' individual decisions
  - ▶ Suppose each villager can choose to buy a cow or not
  - ▶ Since number of villagers is relatively small, Nash Equilibrium is an appropriate tool here

18 / 20

## Tragedy of the Commons (cont)

- ▶ Suppose  $c$  villagers choose to buy a cow, and the rest stay out
- ▶ When is this a Nash Equilibrium?

- ▶ Is this social optimum?

- ▶ What happened?

19 / 20

## Tragedy of the Commons Graphically

20 / 20