Econ 1101
Summer 2013
Lecture 5

Section 005
6/24/2013

Announcements

- Homework 4 is due tonight at 11:45pm, CDT
  - Except for the part with price ceilings – moved to tomorrow night
- Midterm coming up – this Thursday!
  - Make sure to work through the practice problems posted on the website.

Agenda for today

- Positive and negative externalities
- Graphically depicting externalities
- A negative externality in Econland
- Government policy with externalities:
  - Taxes (Pigouvian Tax)
  - Command and Control
  - Tradable Allowances (also known as “cap and trade”)
- Theory of Public Goods

Externalities

"An externality arises when a person engages in an activity that influences the well-being of a bystander and yet neither pays nor receives any compensation for that effect."

We can therefore have a negative externality or a positive externality (could be both as well, but let's just consider one or the other in this class)

Negative Externalities

- cigarette smoking (second hand smoke)
- driving cars:
  - global warming from carbon
  - congestion (Drive on highway. Suppose make 1,000 other drivers go .6 seconds slower, so total external cost is 600 seconds or ten minutes)
- noise
  - cell phones
  - Planes
- Stinky tofu

Stinky Tofu

Positive Externalities

- Maintenance of exterior of one's home (landscaping,…)
- Research: (others can potentially imitate).
- Studying hard in Econ 1101?
  - Most of benefit is private
  - Maybe a little external social benefit if some of your knowledge spills over to your roommate

Which homeowner below is not providing positive externalities to the neighbors by watering the lawn?

Big Idea

- Since externalities are benefits or costs that are not directly considered (by definition, externalities are costs or benefits that are not paid or compensated for), we want to create a new idea of something that will depict externalities along with what we already have been depicting.
- What have we been depicting?
  - Private marginal cost (the COST to the people who are selling), which is just the supply curve
  - Private marginal benefit (the BENEFIT, or you can think reservation price, of the people who are buying), which is just the demand curve
- We want then to have:
  - Social marginal cost (the private marginal cost PLUS the cost the activity puts into society)
  - Social marginal benefit (the private marginal benefit PLUS the benefits the activity provides for the society)

Graphically…

How should we model externalities? We start with using our model for supply and demand.

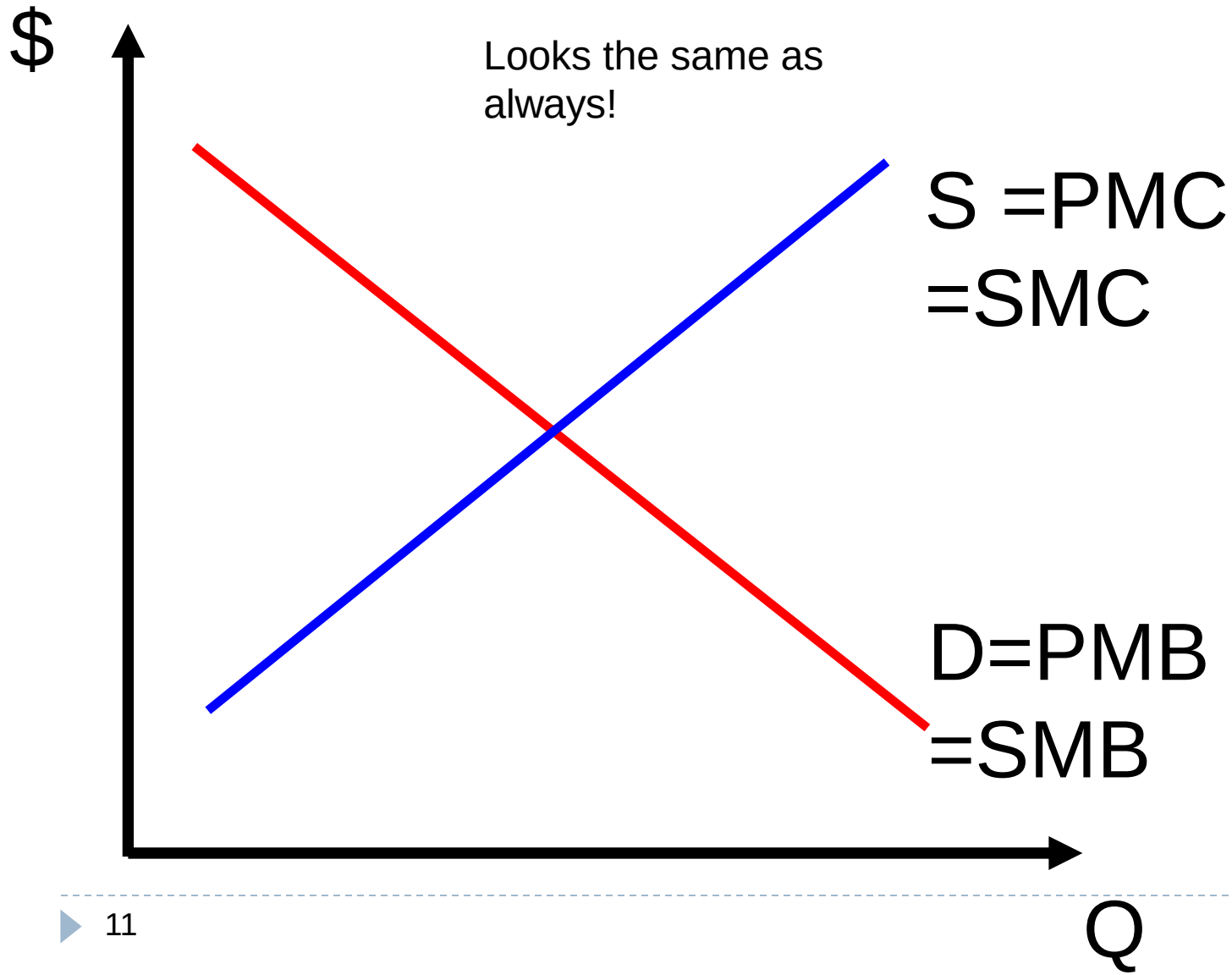
When there are NO externalities:

Social Marginal Cost (SMC) = Private Marginal Cost (PMC)
(just the supply curve)

Social Marginal Benefit (SMB) = Private Marginal Benefit (PMB)
(just the demand curve)

- also known as the marginal reservation price

No Externalities



With Externalities

When there is a negative externality:

Social Marginal Cost (SMC)

= Private Marginal Cost (PMC) + External Cost per unit (EC)

When there is a positive externality:

Social Marginal Benefit (SMB)

= Private Marginal Benefit (PMB) + External Benefit per unit (EB)

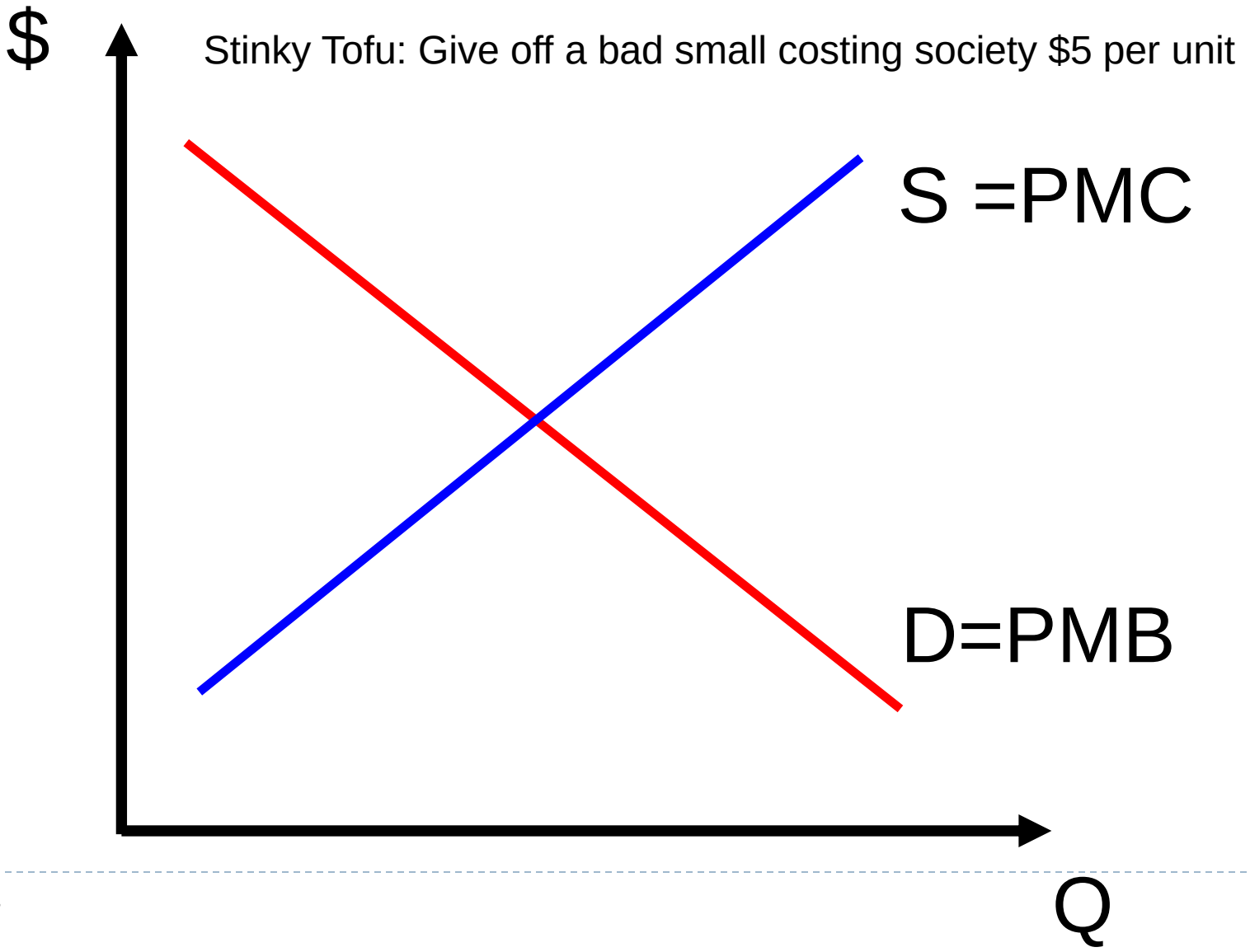
Negative Externalities

- Global warming from gasoline consumption (carbon use)
- Congestion from driving
- Stinky tofu production

- This means that External Cost (EC) > 0

- Let's say every unit of stink tofu gives off a terrible smell that costs society $5 per unit in the market

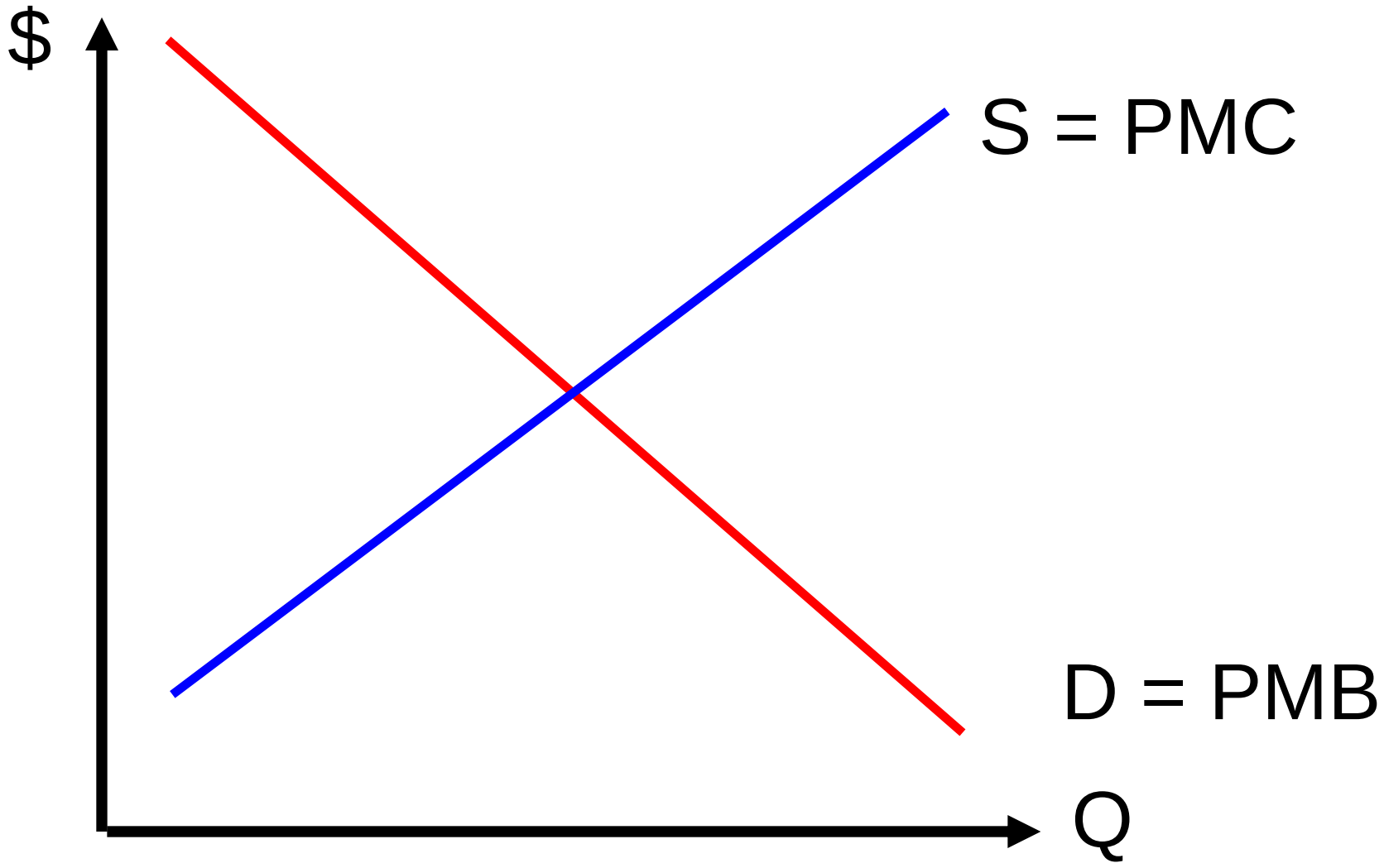
Negative Externality



Positive Externality

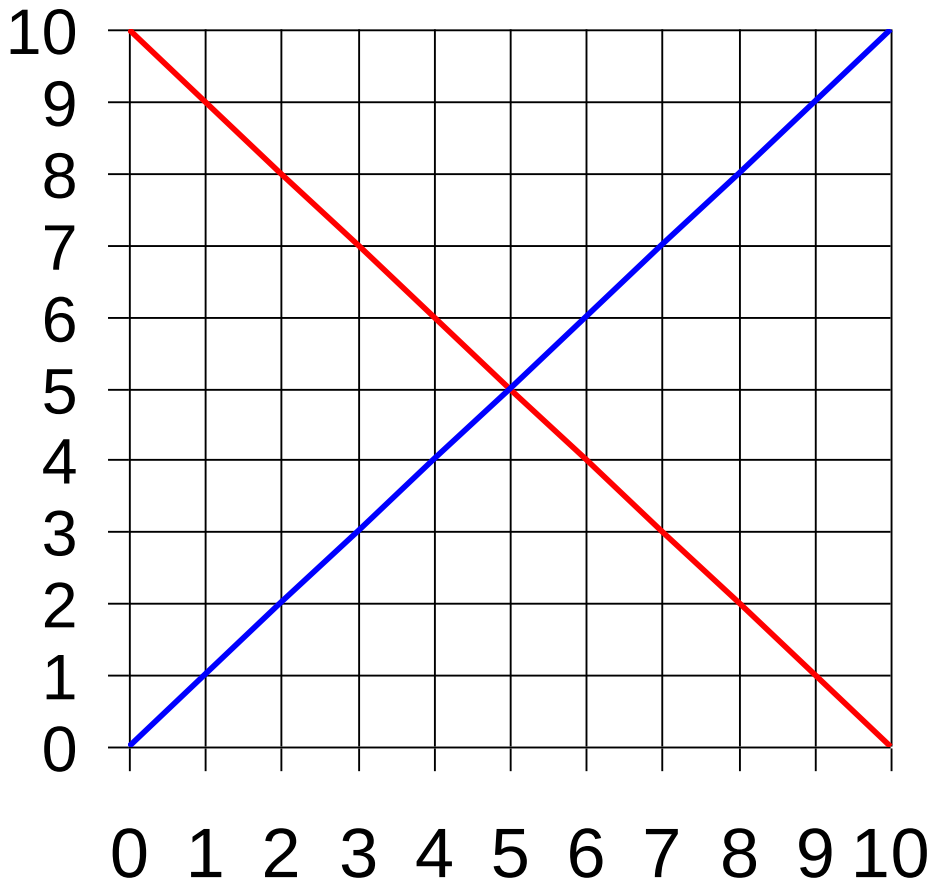
- Research
- Cologne
- Studying hard?

Positive Externality



Negative Externality in Econland

Production of 1 widget imposes an external cost of $4 per unit on others



Free-Market Quantity

Where S = D

PMB = PMC

→ Q=_____

Efficient Quantity

SMB = SMC (=PMC +EC)

Look on the graph where this point is:

→ Q=_____

Negative externality of $4

	Free Market
Q	5
P^D	5
P^S	5
CS	12.5
PS	12.5
GS	0
CS+PS+GS	25
Externality	-20
TS	5

Negative externality of $4

	Free Market
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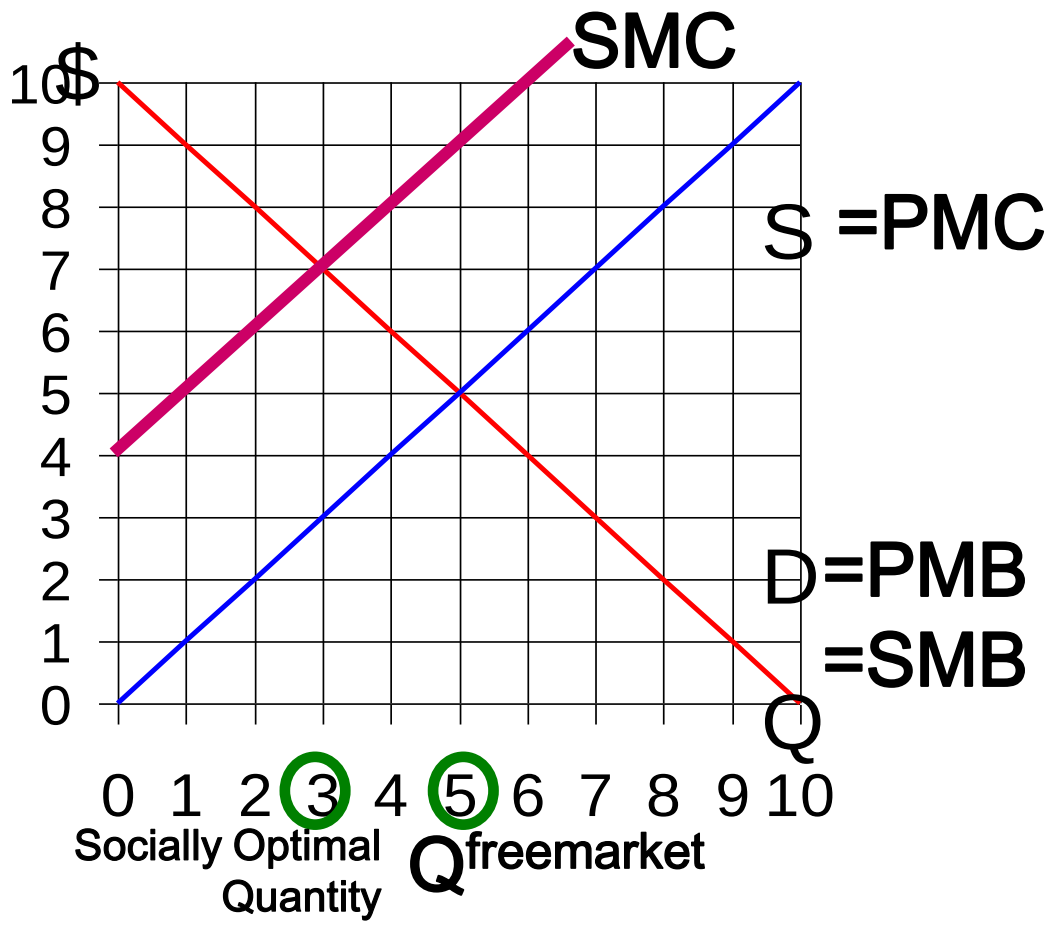
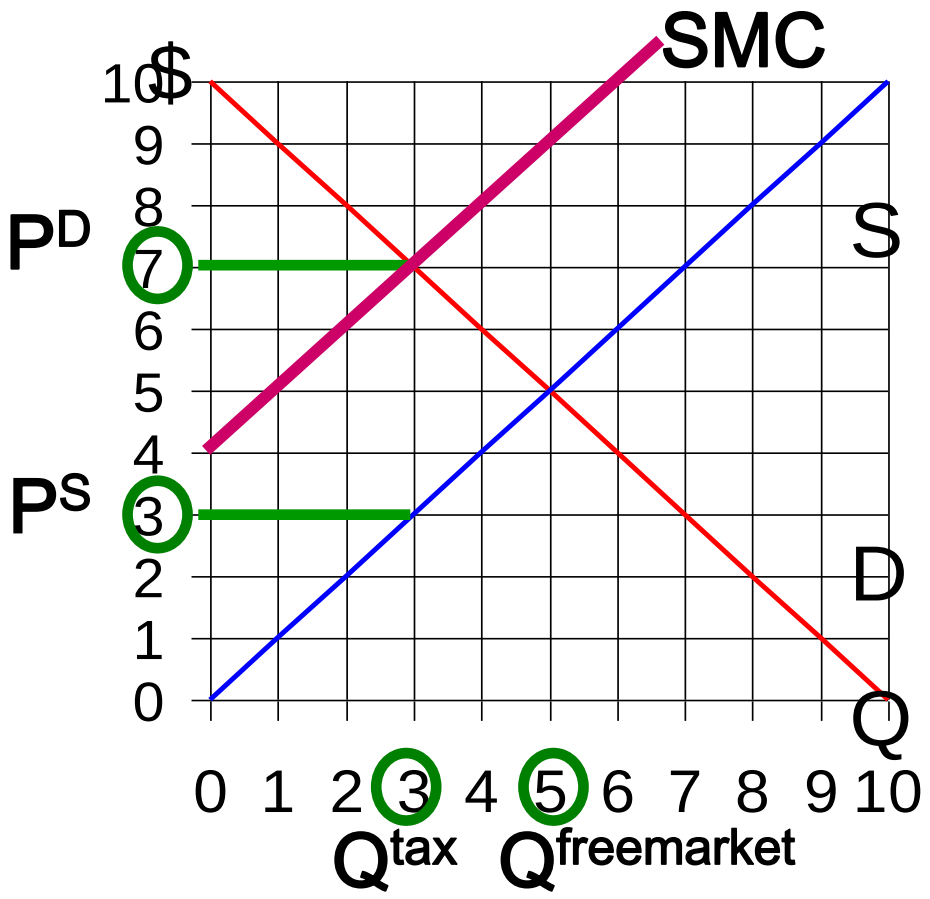


Note that with externalities, the free market equilibrium is no longer a Pareto efficient allocation.

Is there anything that can be done to increase the welfare of the economy, now that we have externalities? Something we can do that brings us to a quantity where SMB=SMC, which gives us the socially optimal quantity, or the Pareto efficient allocation?

To get to the socially optimal allocation (where SMC=SMB), the government could tax the market by an amount that's equal to the cost of the negative externality (in this case, $4)



	Free Market		Change
Q	5		
P^D	5		
P^S	5		
CS	12.5		
PS	12.5		
GS	0		
CS+PS+GS	25		
Externality	-20		
TS	5		

Negative Externality in Econland

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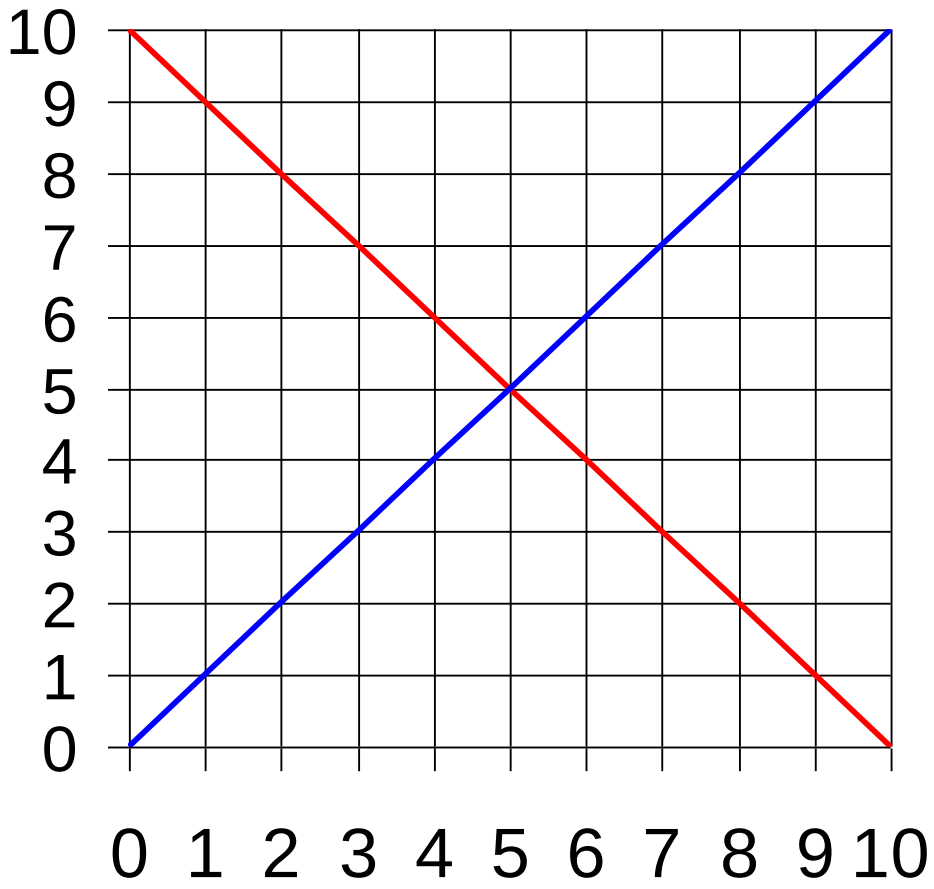


- Why are we better off with taxing than not taxing now in Econland? Isn’t there still a dead weight loss?

Relating back to FWT

Free Market: quantity is where

Private Marginal Benefit (PMB) = Private Marginal Cost (PMC)

Socially Efficient: quantity is where

Social Marginal Benefit (SMB) = Social Marginal Cost (SMC)

When EB=0 and EC=0 these are the same thing.

$Q^{\text{Free-Market}} = Q^{\text{Socially-Efficient}}$

- **First Welfare Theorem!**

If **negative** externality, then EC>0 and at free-market quantity,

- PMC < SMC
- $Q^{\text{Free-Market}} > Q^{\text{Socially-Efficient}}$

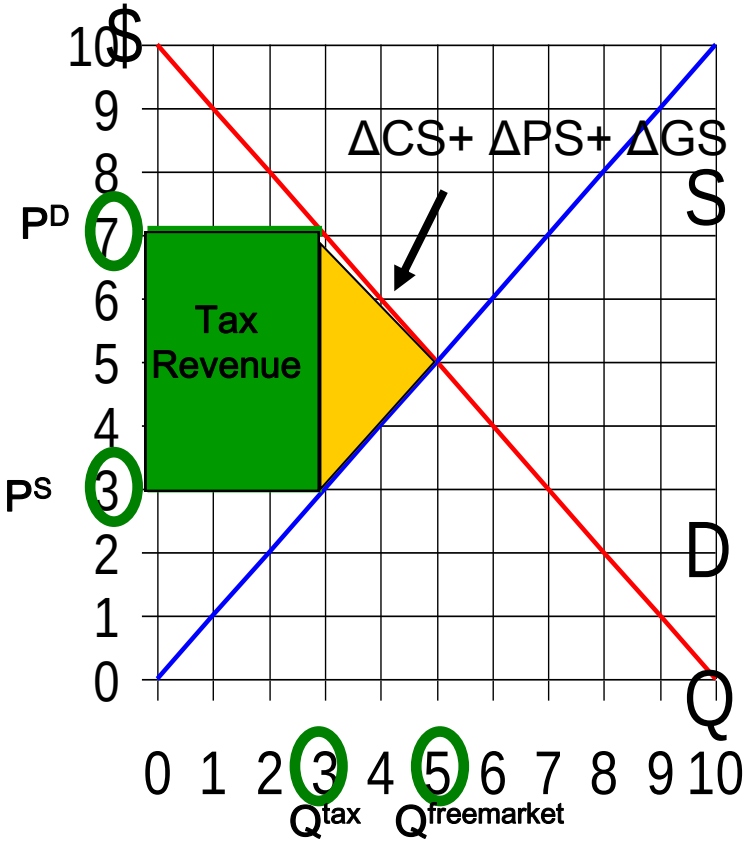
Output too big

If **positive** externality, then EB>0 and at free-market quantity,

- PMB < SMB
- $Q^{\text{Free-Market}} < Q^{\text{Socially-Efficient}}$

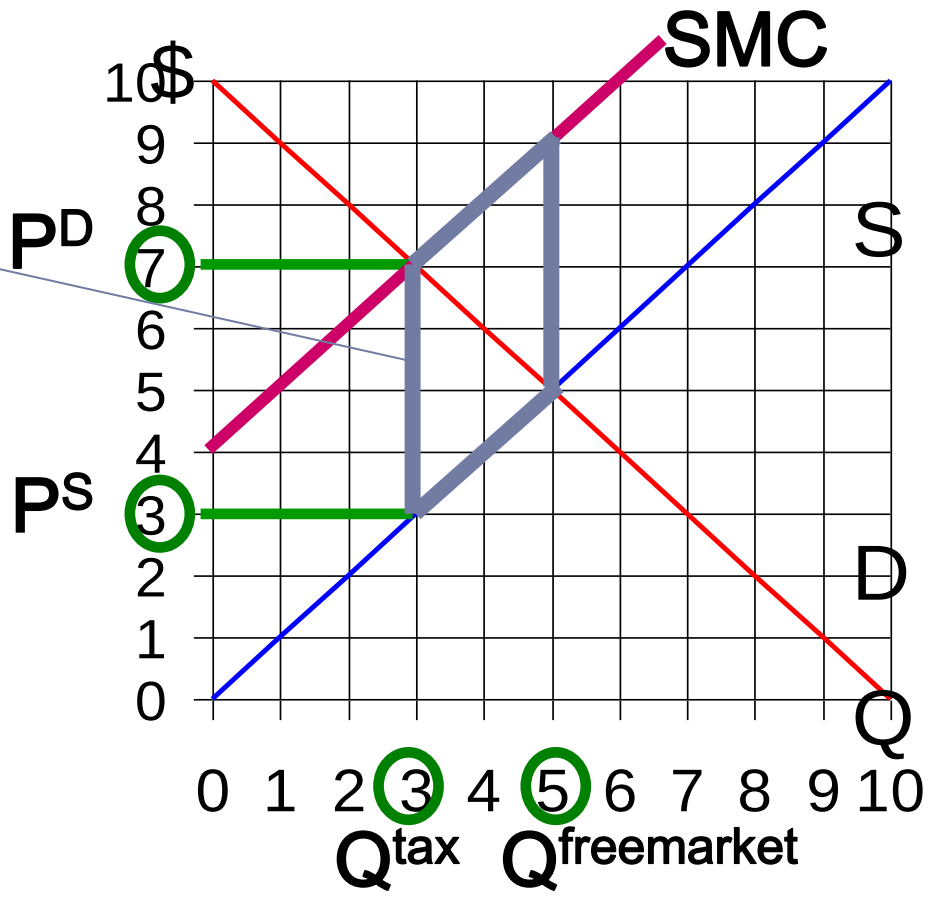
Output too small

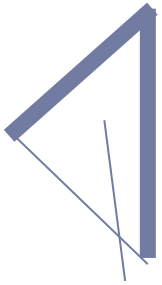
Remember the picture we had from before, which does not take into account the externality?



This parallelogram is the change in externality that was caused by the tax (the tax caused there to be two less units in Econland)

Remember this triangle is just the dead weight loss we get from taxing. So when we tax, we lose this area of surplus





We are left with this. This area is a gain in surplus compared to not taxing, when there is a negative externality.

Pigouvian Tax

With $4 tax, consumer is paying true social cost of another widget.

Pigouvian Tax

- **Internalize the externality**

Arthur Pigou, 1877-1959

- With a $4 tax, any firm making a decision to produce a widget pays the true social cost of the widget.

- Note that if instead we set a tax of $10, this would be more than the externality of $4. If the tax were $10, the entire market will be shut down. Total surplus would be 0, which is less than it would be with the free market (where it equals 5).

- What if that was a **positive externality**? What's the optimal policy then?

Alternatives

Command and Control

- Want to get from market quantity of 5 to 3? How about requiring each supplier (S1-S5) to cut back and make only .6 widget instead of 1 widget each.
- So total widget is 3 = .6×5

Real world equivalent:

- Fuel Efficiency standards on cars
- Mandatory scrubbers on power plants (to remove sulfur dioxide)
- Mandatory cutbacks at each plant

Command and Control

Problem with this policy in Econland:

- We don't have efficient production. S5 is producing while S1 still is not at capacity. We should shift production from S4 and S5 to S1,S2,S3 to be efficient.

Problems with Fuel Efficiency Standards (as compared to market solutions)

1. Does nothing about existing cars.

2. Different standards for different kinds of cars. No incentive to switch from SUV to small car.

Tax is more efficient.

But there’s one problem with the tax:
Politically not popular!

How to get same impact on efficiency as tax?

Cap and Trade

Solution: A market based method called Cap and Trade.

- Cap and Trade has been used in the U.S. to reduce sulfur dioxide emissions from power plants. (SO_2 causes "acid rain.")
- Graphically, same as tax, except the green box ($12) goes to the owners of the allowances.

For example, one possibility is:

- Suppose S1-S5 each initially allocated .6 allowances. (Are each capped at .6 in emissions. So total cap is 3 = 5*.6
  - Can think of this as a quota system. From our study of quotas in Econland, we know that if we set a quota of 3 units (max of 3 units in the market), a quota to sell one unit will be valued at $4.

Cap and Trade

- Remember that the last person to produce, S3 (since it is a quota of three units), will just break even (his cost to produce is $3, the quota he needs to sell his unit is worth $4, and he can sell his good for $7 in the market)
- So you can see that S4 and S5 will want to sell their quotas. Why?
  - S4 – has .6 quota, one unit of quota is worth $4, so: .6*$4 = $2.40
    - If S4 produces, she gets: .6*($7-$4)= .6*$3 = $1.80 (With P^d=$7 and a cost of $4, she makes $3 if she sells. She is only allowed to sell .6 units since she only was given a quota of .6).
    - S4 is better off selling her quota instead of producing.
  - Similarly, S5 will also do the same.

Cap and Trade

- To reiterate, the economics of the system that we just described for Cap and Trade works just like the supply management quota system that we went over in reading 3.
- However, in an environmental context, we usually use the term “allowances” instead of “quota”
  - An allowance is a permit to emit a particular amount of pollution, like one ton of sulfur dioxide.
- This kind of system is usually called a Cap and Trade system.
  - The total amount of emissions is “capped”
  - People are allowed to “trade” allowances to emit the pollution

Cap and Trade and the Climate Change

- There is a scientific question about the impact of human behavior on climate. Let's skip the science for this course.
- Let's take as given the consensus view of scientists that global carbon emissions must be cut (for the platform debates in recitation, let's not debate the science).
- Let's focus on policies that can potentially be pursued that impact carbon consumption.

Issue: Should policies be pursued at the global level through the United Nations and world-wide treaties?

- A key reason for doing this is that carbon is an externality that operates at the global level.
  - We don't need the UN to enact policies that make husbands put down toilet seats for their wives, as this is an externality that operates at the household level. (Big idea: Global externality)
  - Carbon emitted in the U.S. impacts China and vice versa.

- Kyoto Protocol is a Cap and Trade system that allows trades across countries.

U.S. did not sign the Kyoto Protocol

Main reason: a policy dispute between the U.S. and the big developing nations like China and India.

The U.S. argument: It won't do any good for the U.S. and Europe to cut back if it is completely offset by growth in emissions by China and India. U.S. wants limits on China and India. China is now the largest emitter of carbon in the world.

The China argument. Yes, China produces more carbon then U.S. But it has four times as many people.

Issue: Let's say we strike a deal and agree to cut back carbon emissions. Or we unilaterally decide as a country to do this.

How do we do it?

- Command and Control?
- Tax carbon (e.g. gas tax like in Europe?)
- Cap and Trade (raise energy prices but give green box to someone besides government)
- Subsidize innovation?

Public Goods

One more visit to Econland:

The Widget, a private good.

New words:
Rivalrous in consumption
I eat it, you can't.

Excludable
People can be prevented from consuming it.

These are the two characteristics of a private good.

Conversely

Nonrivalrous in consumption

One person consuming the good doesn't take anything away from another's ability to consume it.

- Tornado siren. I hear it, you can still hear it.
- Watching a TV show

Nonexcludable

- Can't prevent people from consuming the good.
- Tornado siren. Can't set it up so that only those paying for the service get to hear it. (Unless make it work through cell phones)
- TV programming? Once was not excludable (old fashioned over the air). But now can be excludable with pay-for-view, etc.

Public Goods:

- Nonrivalrous
- Nonexcludable

Examples:

- Tornado Sirens,
- Street lamp
- National Defense

- Research (if no patent system)

- Music and Film (if no intellectual property production)

Efficient Provision of Public Goods vs. Efficient Provision of Private Goods:

Private Good -> rule: should make another unit of output and give it to a person if that person's marginal willingness to pay exceeds the marginal cost.

- D1: values a widget $9
- S1: can produce at $1.

Make the widget!

Different story with public goods.

- I never told you this, but Econland has no sun! (So it's dark all the time)
- Proposal: Build an artificial sun, will light all of Econland.
- Cost of project is $20.
- What is willingness to pay?

If this were a private good, at a cost of $20 per unit, the efficient amount would be zero.

Name	would pay	Name	would pay
D1	9	S1	0
D2	8	S2	0
D3	7	S3	0
D4	6	S4	0
D5	5	S5	0
D6	4	S6	0
D7	3	S7	0
D8	2	S8	0
D9	1	S9	0
D10	0	S10	0

Public good: Add the willingness to pay of each together.

- If the artificial sun is built, all will get to enjoy it.
- Social Marginal Benefit from building the artificial sun is:

9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = $45.

Which is greater than $20.

So socially efficient to build the artificial sun.

What's the problem?

In the free market, there is a free rider problem.

- Worth it to do, but no one willing to put up the whole amount to do it themselves.

- Have a role for government.
  - If the government were to tax D1-D4 $5 each, there would be a Pareto improvement

- One last point: because of technological change things can become excludable that before were not excludable, and the other way.

Suppose we can build an artificial sun where you need a certain kind of sunglasses to see the light.

Entrepreneur build the artificial sun, sell sunglasses to people for $5.

D1-D5 buy, get $25 in revenue. Pays for the $20 investment.

The good is now excludable.

Key point: will need intellectual property protection.

- If someone can sell bootleg sunglasses, then the entrepreneur unlikely to be able to make a go of it.
- So won't get the investment in the first place.
- Economic logic of intellectual property protection like patents and copyrights

Common Resources

- Nonexcludable
- Rivalrous

Example: world fishing stocks

- Can be difficult to exclude people from fishing the oceans.
- Certainly rivalrous as overfishing has depleted important fish stocks.

- "Tragedy of the Commons"

- Way forward? Make fish excludable? (Through fish farming?)

Summary