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Environmental and Health Economics
ECON/ENVR/SOSC 2310

Guojun He

2019 Spring

Private Solutions to Externalities

- Moral codes and social sanctions
  - most people don't litter
- Charitable organizations
  - Alumni donations
- Integrating different types of businesses

Property Rights

- Property rights
  - Define how a resource is owned and used
  - It is a legal definition
- Property rights can be viewed as an attribute of an economics good:
  - The right to use the good
  - The right to earn income from the good
  - The right to transfer the good to others
  - The right to enforce of of property rights

1991 Nobel Prize Laureate:

Ronald Coase

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1991

Ronald H. Coase

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Ronald H. Coase - Facts

Ronald H. Coase

Born: 29 December 1910, Willesden, United Kingdom

Died: 2 September 2013, Chicago, IL, USA

Affiliation at the time of the award: University of Chicago, Chicago, IL, USA

Prize motivation: "for his discovery and clarification of the significance of transaction costs and property rights for the institutional structure and functioning of the economy"

http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1991/coase-lecture.html

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The Coase Theorem

- The Coase Theorem states that if property rights are well defined and privates parties can bargain without cost over the allocation of resources, then the private market will always solve the problem of externalities on its own and allocate resources efficiently.

- Transaction costs are the costs that parties incur in the process of agreeing to and following through on a bargain.

Property Rights

- Example of complete property rights:
  - You have an apple, you can eat it,sell it, give it to your friend, or throw it away.
  - No one is allowed to use/own it unless you permit.
- Example of incomplete property rights:
  - Rural land in Chinese villages: the farmers can use it,get rents from it, but cannot sell it.
  - Land in HK: owns by the government, but leases to the public for ownership for a limited period of time

Transaction Costs

- The costs of negotiating, monitoring, and governing exchanges between people.
  - Communication charges, legal fees, informational cost of finding the price, quality, and durability, etc.

Externality and Property Rights

- When we suffer from negative externality or see the natural environment being harmed *we may tend to assume that the one causing the damage does not have the right to do so.*
- Yet we all pollute *and assume that we have the right to do so*:
  - Ride in an internal combustion engine vehicle
  - Flush the toilet
  - Put something on our building's trash shut
  - When we cool our homes or cook food

Smoking

- Today no one is allowed to smoke on campus – but 20 years ago you can smoke in this classroom
  - If you watch old movies on TV notice how many of the characters smoke;
  - Today only the ‘bad guys’ are seen smoking.

Ads in the old days…

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- In general, in most places and IN MOST OF HISTORY it is probably fair to say that environmental property rights lie mostly with the polluter -- *until* the cumulative effect of their impacts became intolerable.

- That also implies, the right of polluting can be transferred.

Coase Theorem Discussion

- See handout.

Coase Theorem: Smoking

- Two students live in the same dorm:
  - one smoker
  - one non-smoker

The Deep Insights in Coase Theorem

- Coase Theorem is an Irrelevance Theorem:
  - Even though externalities exist, as long as property rights are clearly defined and the transaction costs are zero, no matter how the initial property rights are allocated, private bargaining will always achieve the social optimum.
  - The parties involved in a transaction can achieve efficiency by (Coasian) bargaining

How to Understand Coase Theorem

- How the property rights are allocated among different parties will not affect the market outcome.
- But the party who receives the right is better off.
- In other words, rights are valuable.

Wolves

- Ecology + Economics

- Wolves:
  - Cool looking
  - Scary, eat sheep, little children, etc.
  - Top of the food chain predator

Wolves

- Wolves threaten livestock and personal safety, ranchers and government agencies kill them.
  - Aggressive campaigns to eliminate wolves
  - The US government offered money to kill a wolves, 20-50 dollars per wolf
  - In the1970s, almost no wolves in U.S.

No Wolves:

- Elk population grow
- Elks eat streamside willows, cotton-woods, shrubs that prevent erosion
- Affected Habitat of fish and other aquatic species
- Aspen trees cannot grow... Because all the sprouts were eaten by elks.
- Number of coyotes increased because of no wolf, which eat squirrels and rabbits.
- The food available to foxes and raptors decreased…

To restore biodiversity, in 1994, 14 wolves in two packs from Canada were transported to Yellowstone National Park

Today in the Yellowstone

- https://youtu.be/ysa5OBhXz-Q
  - More than 170 wolves in 14 packs have claimed Yellowstone as their home.
  - A more balanced ecosystem is returning to the area.
  - Elk numbers have declined due to hunting by wolves.
- …

Before & After Wolves

Restoring wolves to Yellowstone after a 70-year absence as a top predator—especially of elk—set off a cascade of changes that is restoring the park's habitat as well.

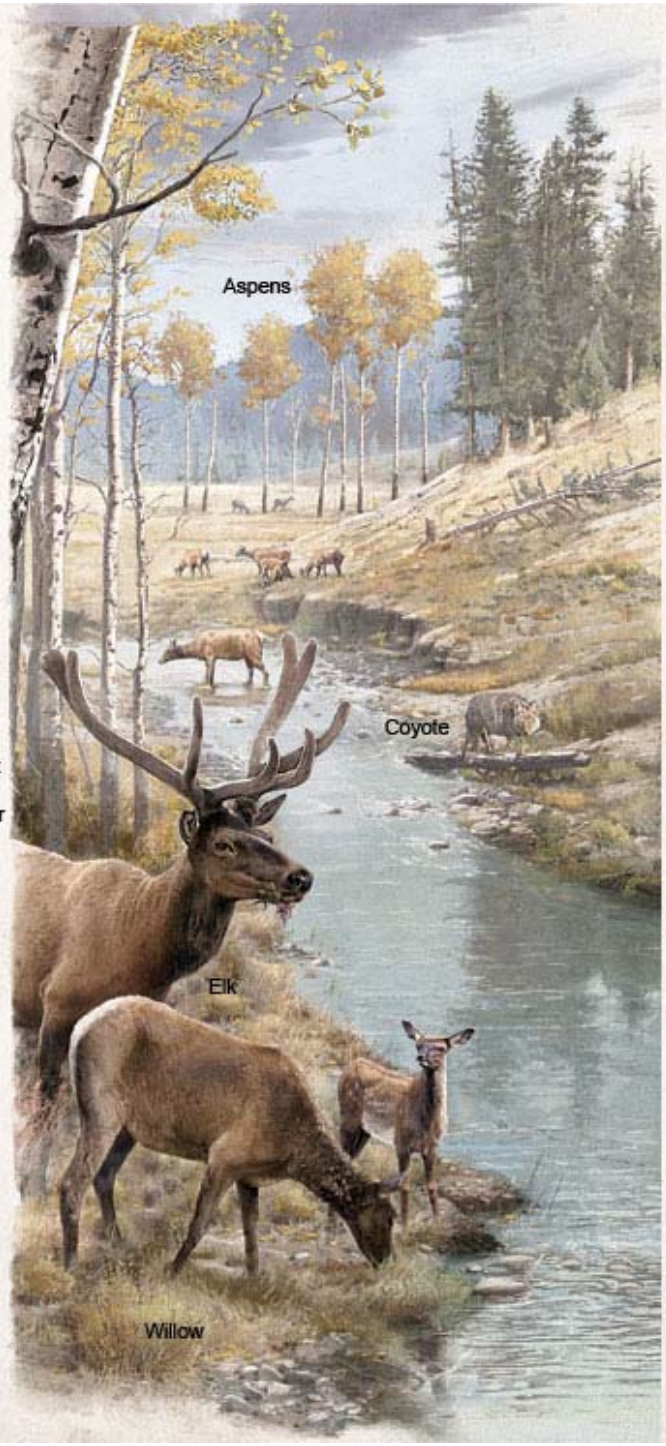
YELLOWSTONE WITHOUT WOLVES 1926-1995

ELK overbrowsed the stream side willows, cotton-woods, and shrubs that prevent erosion. Birds lost nesting space. Habitat for fish and other aquatic species declined as waters becam broader and shallower and, without shade from streamside vegetation, warmer.

ASPEN trees in Yellowstone's northern valleys, where elk winter, were seldom able to reach full height. Elk ate nearly all the new sprouts.

COYOTE numbers climbed. Though they often kill elk calves, they prey mainly on small mammals like ground squirrels and voles, reducing the food available for foxes, badgers, and raptors.

ART BY FERNANDO G. BAPTISTA, NG STAFF; AMANDA HOBBS, NG STAFF
SOURCES: ROBERT L. BESCHTA AND WILLIAM J. RIPPLE, OREGON STATE UNIVERSITY; DOUGLAS W. SMITH, YELLOWSTONE NATIONAL PARK



YELLOWSTONE WITH WOLVES 1995-PRESENT

ELK population has been halved. Severe winters early in the reintroduction and drought contributed to the decline. A healthy fear of wolves also keeps elk from lingering at streamsides, where it can be harder to escape attack.

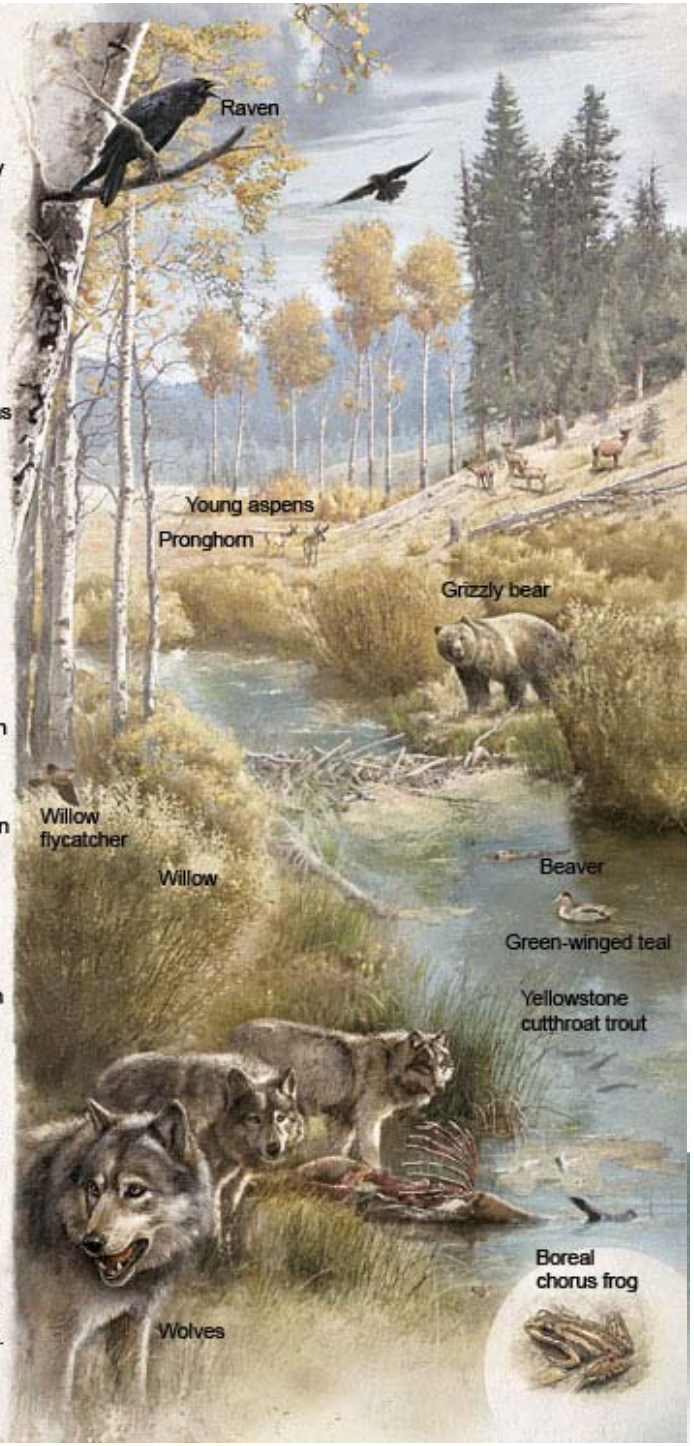
ASPENS The number of new sprouts eaten by elk has dropped dramatcally. New groves in some areas now reach 10 to 15 feet tall.

COYOTES Wolf predation has reduced their num bers. Fewer coyote attacks may be a factor in the resurgence of the park's pronghorn.

WILLOWS, cottonwoods, and other riparian vegetation have begun to sta bilize stream banks, helping restore natural water flow. Overhanging branches again shade the water and welcome birds.

BEAVER colonies in north Yellowstone have risen from one to 12, now that some stream banks are lush with vegetation, especially willows (a key beaver food). Beaver dams create ponds and marshes, supporting fish, amphiians, birds, small mammals, and a rich insect population to feed them.

CARRION Wolves don't cover their kill, so they've boosted the food supply for scavengers, notably bald and golden eagles, coyotes, ravens, magpies, and bears.



Wolves

- Wolves kill livestock
- Ranchers kill wolves
- But non-ranchers want wolves
- A typical externality

Market Based Solution

- Set up a fund to transfer $$ from non ranchers to ranchers to compensate them for the livestock loss
- Economists love when a market can be introduced to correct a problem
- Either:
  - Everyone is better off
  - No-one is worse off

  (Pareto improvement)

Defenders of Wildlife

Wolf Compensation Trust

Our goal is to shift economic responsibility for wolf recovery away from the individual rancher and toward the millions of people who want to see wolf populations restored. When ranchers alone are forced to bear the cost of wolf recovery, it creates animosity and ill will toward the wolf. Such negative attitudes can result in illegal killing.

TOTAL PAYMENTS FROM 1987 TO OCTOBER 2009*		$1,368,043
TOTAL NUMBER OF PAYMENTS TO LIVESTOCK PRODUCERS		893
TOTAL NUMBER OF DEPREDATION INCIDENTS:	CATTLE	1,306
	SHEEP	2,421
	OTHER**	105

SUMMARY BY YEAR

2009	$143,387*	59 Payments	81 Cattle, 213 Sheep, 5 Other
2008	$226,891*	131 Payments	195 Cattle, 238 Sheep, 22 Other
2007	$239,862	152 Payments	235 Cattle, 309 Sheep, 6 Other
2006	$181,765	101 Payments	195 Cattle, 205 Sheep, 8 Other
2005	$101,086	75 payments	102 Cattle, 83 Sheep, 6 Other
2004	$138,091	94 Payments	108 Cattle, 452 Sheep, 9 Other
2003	$63,145	53 Payments	52 Cattle, 210 Sheep, 14 Other
2002	$64,174	46 Payments	75 Cattle, 133 Sheep, 8 Other
2001	$53,297	34 Payments	67 Cattle, 149 Sheep, 2 Other
2000	$50,446	38 Payments	36 Cattle, 105 Sheep,13 Other
1999	$35,937	40 Payments	51 Cattle, 108 Sheep, 6 Other
1998	$17,483	17 Payments	27 Cattle, 13 Sheep, 5 Other
1997	$26,065	21 Payments	24 Cattle, 152 Sheep

A More General Framework

- In practice, both the benefits and costs of pollution (think about the smoking example) are not constant.
  - The marginal benefit of pollution decreases as more pollution is created, but the marginal cost of pollution increases.
  - Need to figure out what is the equilibrium after Coasian bargaining.

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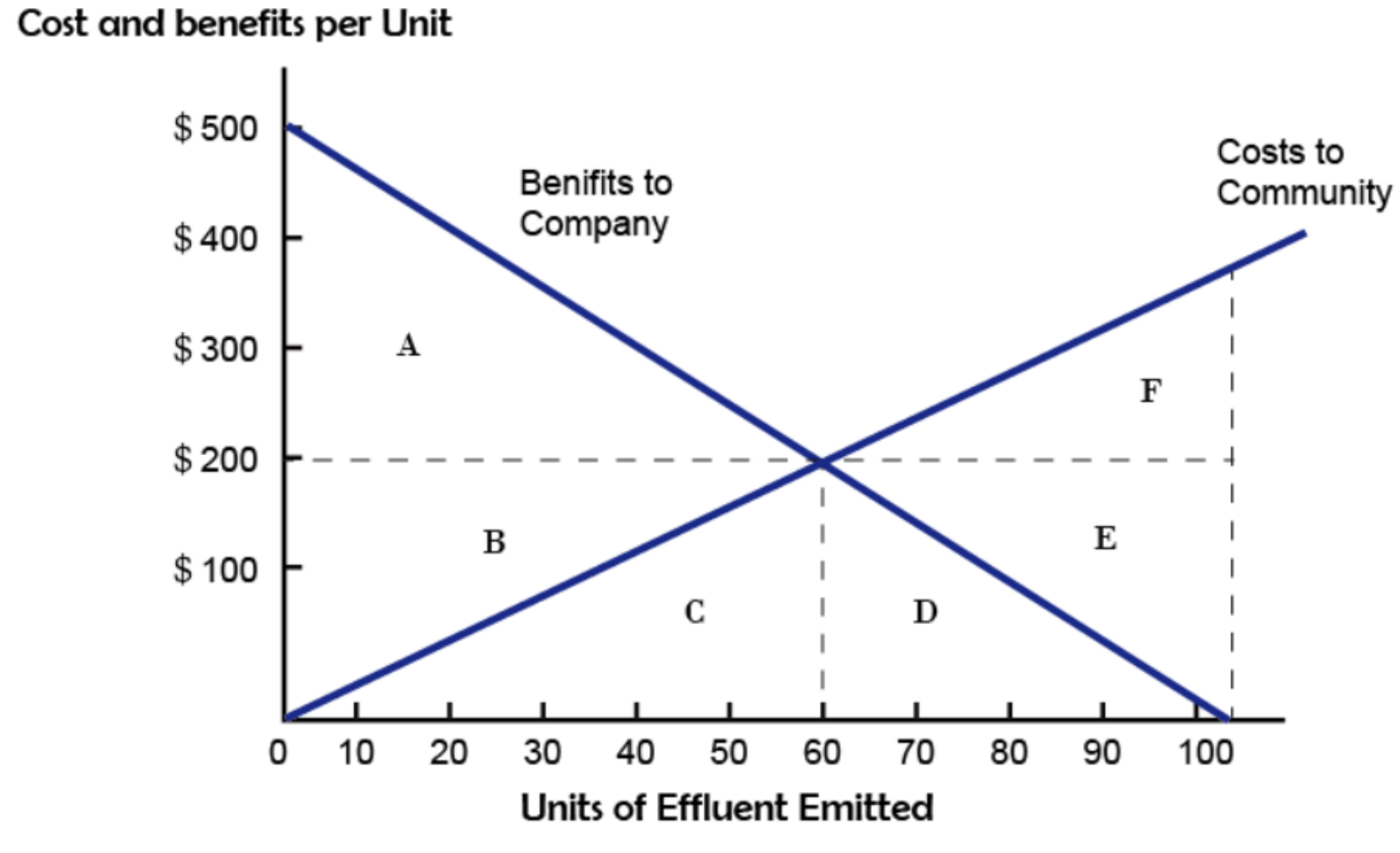
Coase Theorem



Building the graph

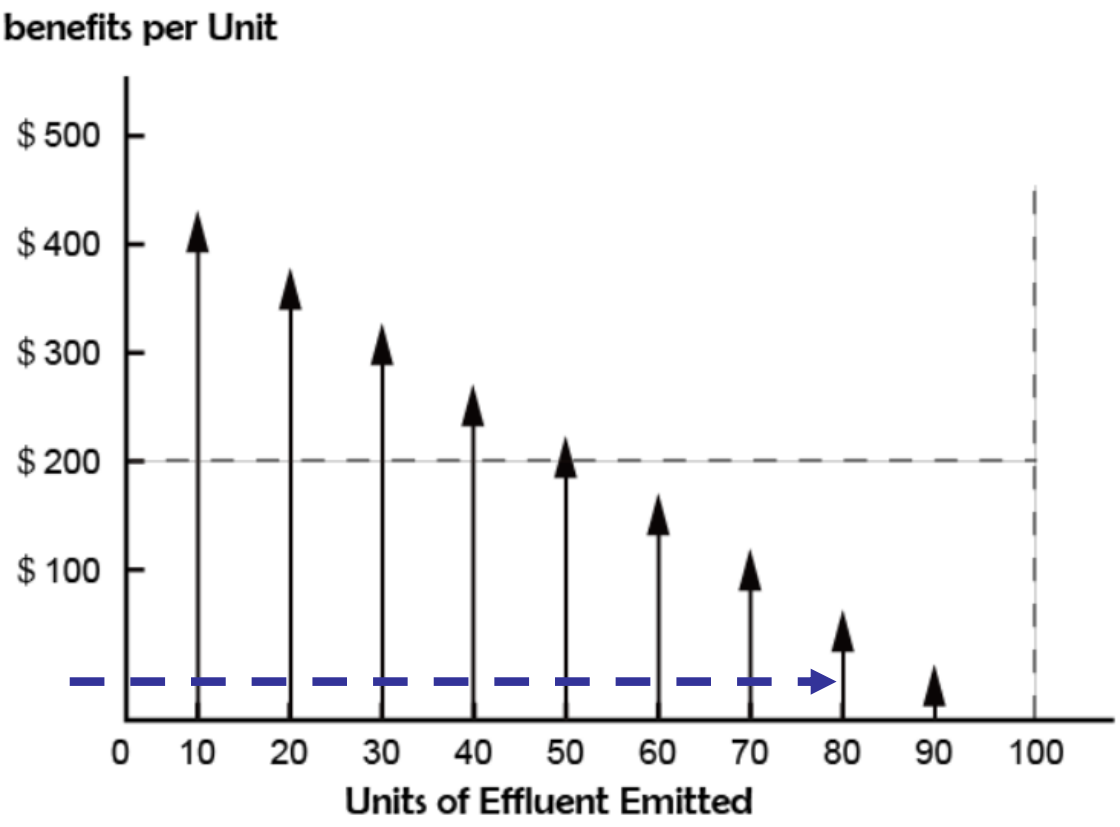
Producer: Output ⇧

↓

Creates benefits "marginal" benefits **(diminishing)**

↓

Pollution ⇧



Building the graph

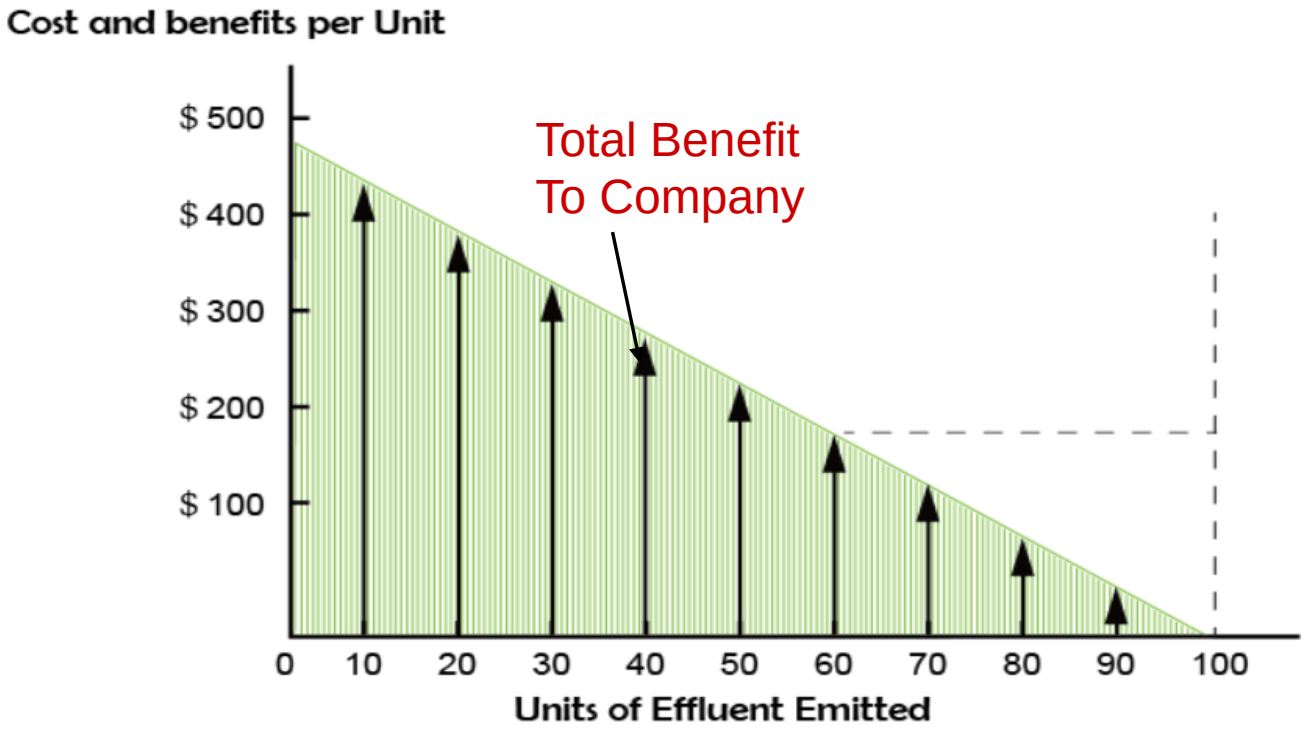
Producer: Output ⇧

↓

Creates benefits "marginal" benefits **(diminishing)**

↓

Pollution ⇧



Building the graph

⇧ With pollution

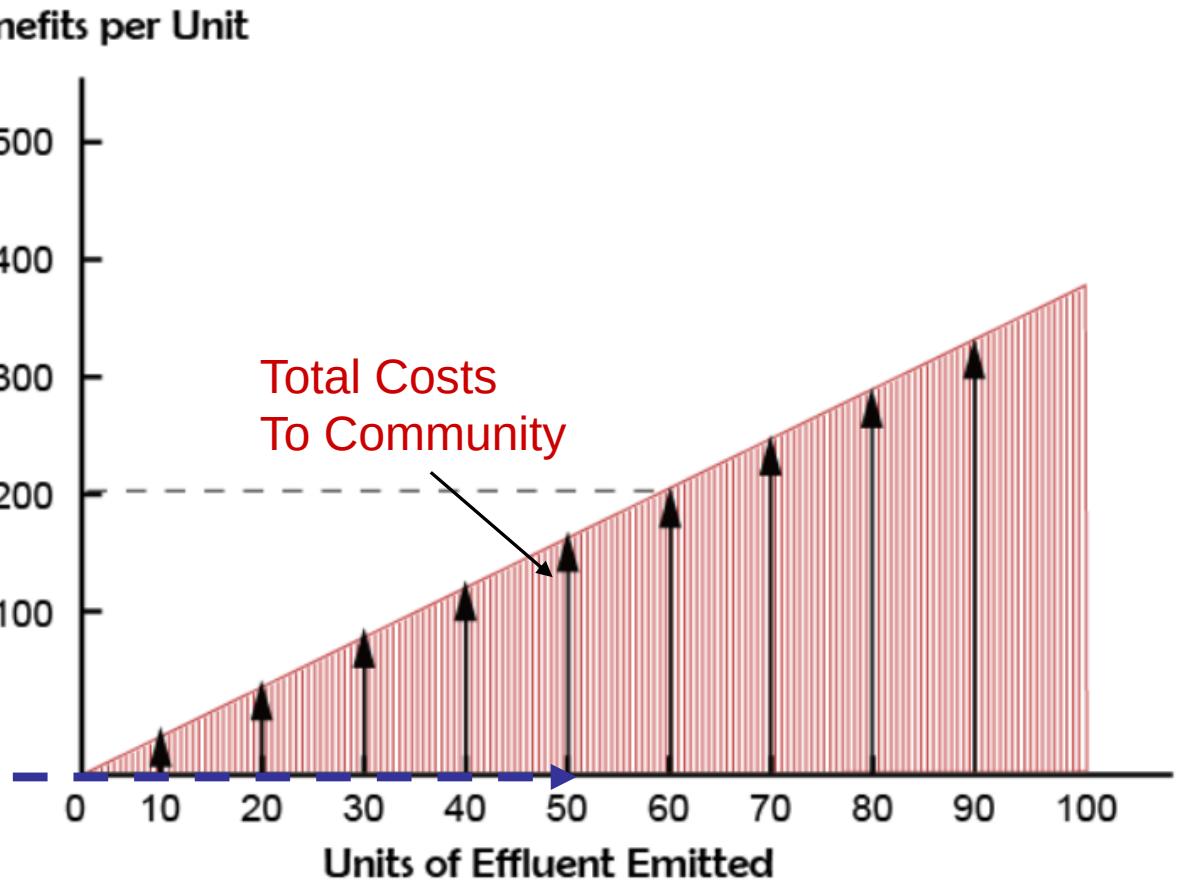
↓

Community experiences

↓

⇧ Costs

clean up
health care
lost tourism



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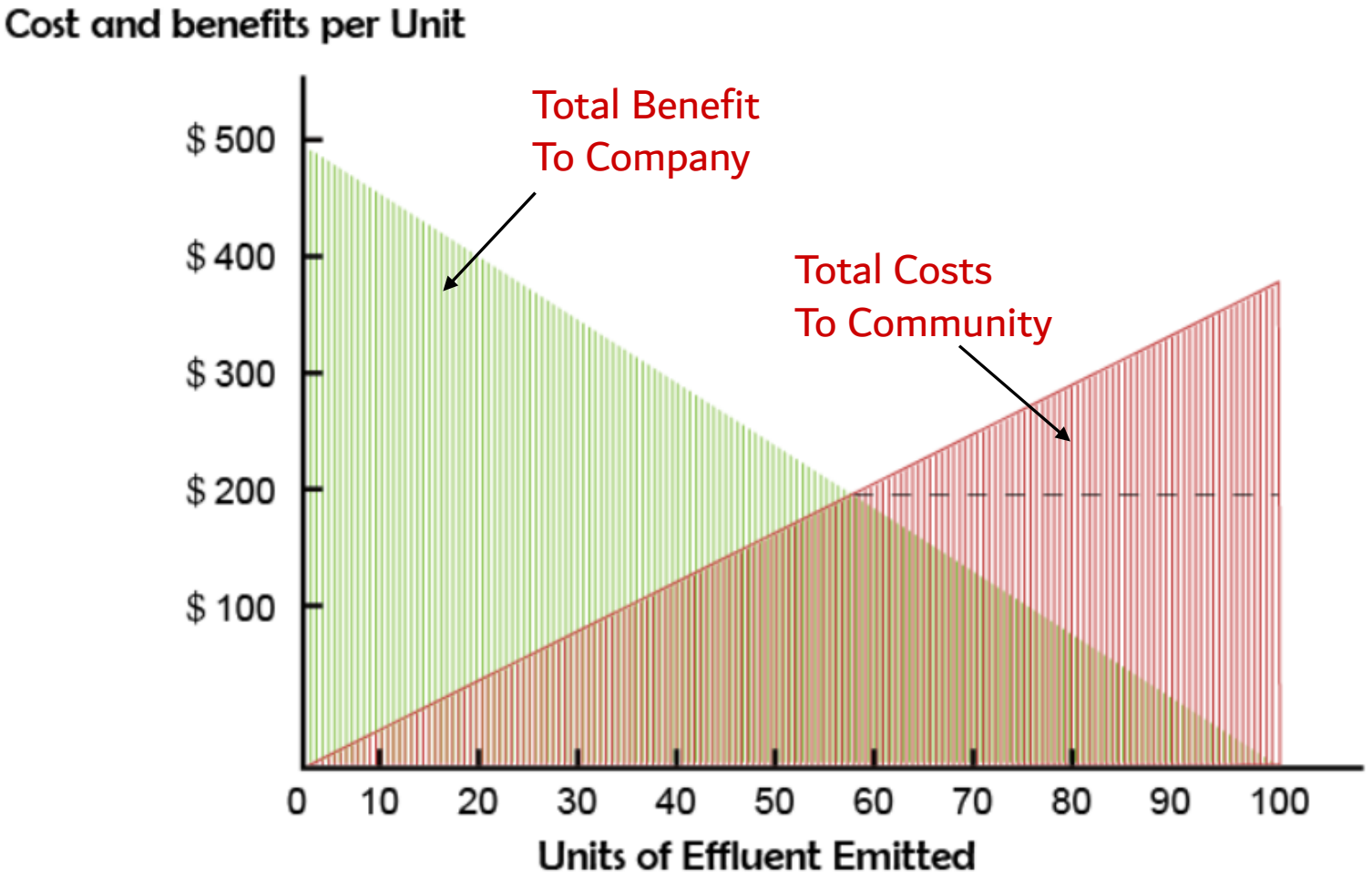
"Optimal" solution (max social benefit) without actual transactions??

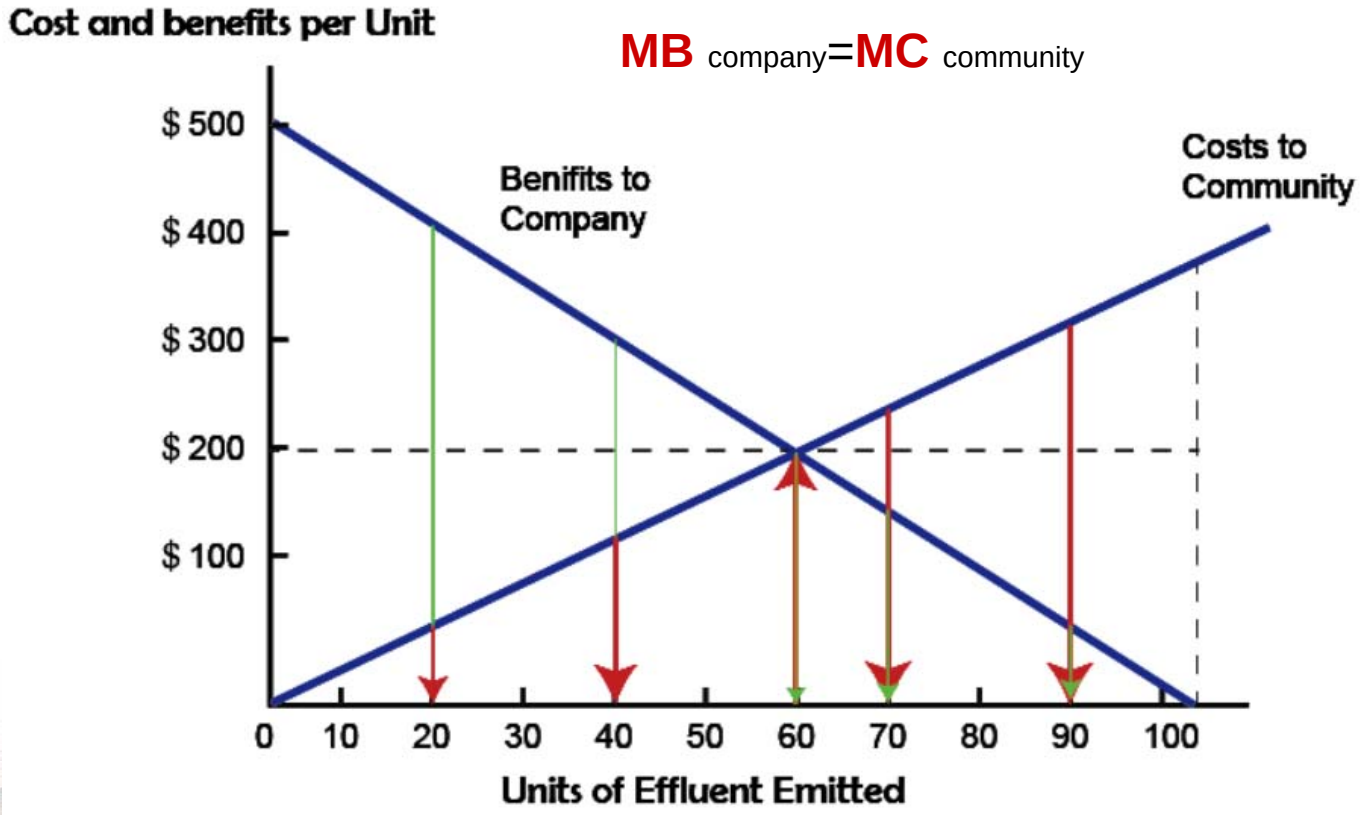


"Optimal" solution (max social benefit) without actual transactions??

@100 units pollution

@ 0 units pollution

"optimal"@ output producing 60 units of pollution



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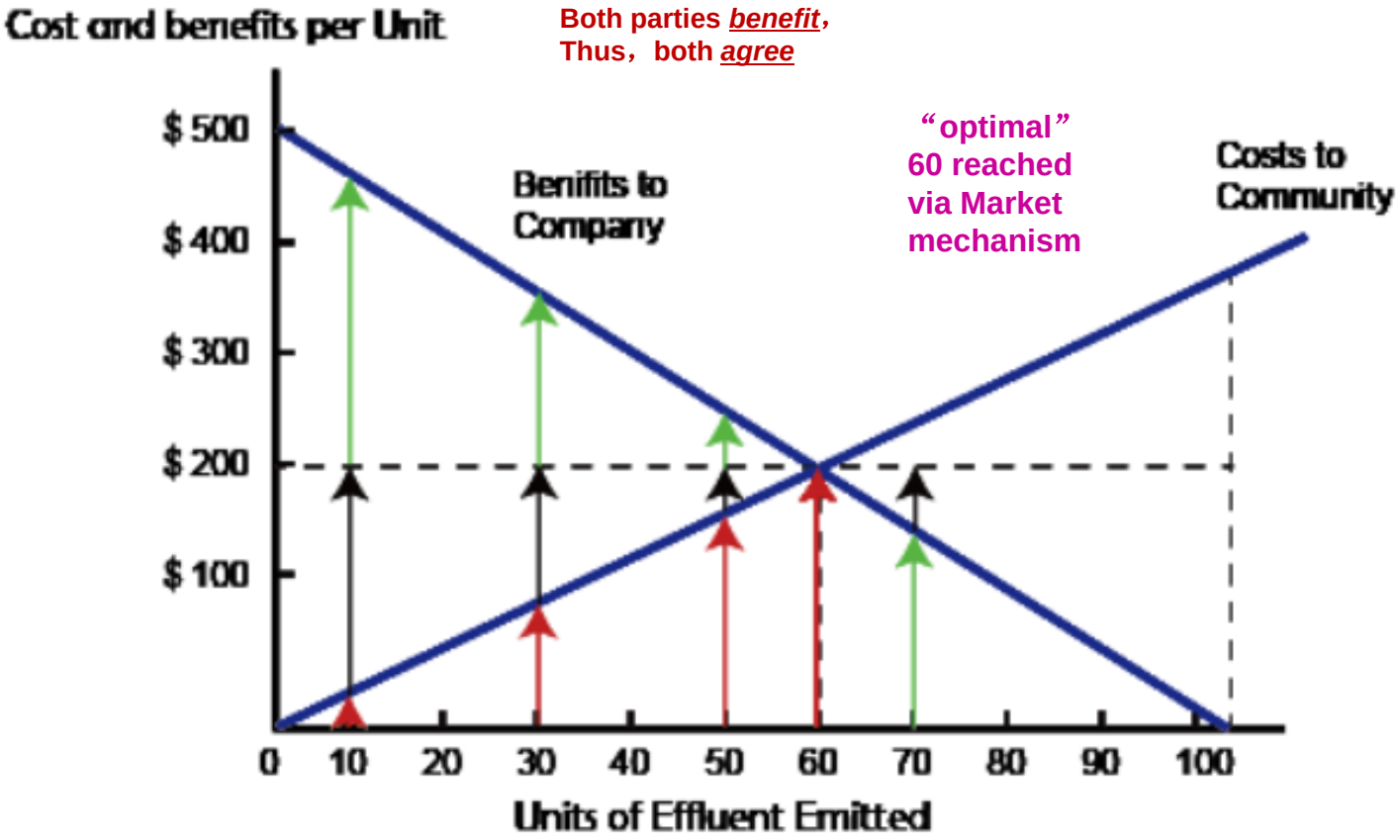
Coase Theorem says same "optimal" Outcome obtained via market transactions

Case 1

Community owns
"right" to determine
How much pollution is
Permissible

Begin with zero
Pollution

Company would
Like to produce
output & gain benefit.
But, creates Pollution



Both parties ***benefit***,
Thus, both ***agree***

"optimal"
60 reached
via Market
mechanism

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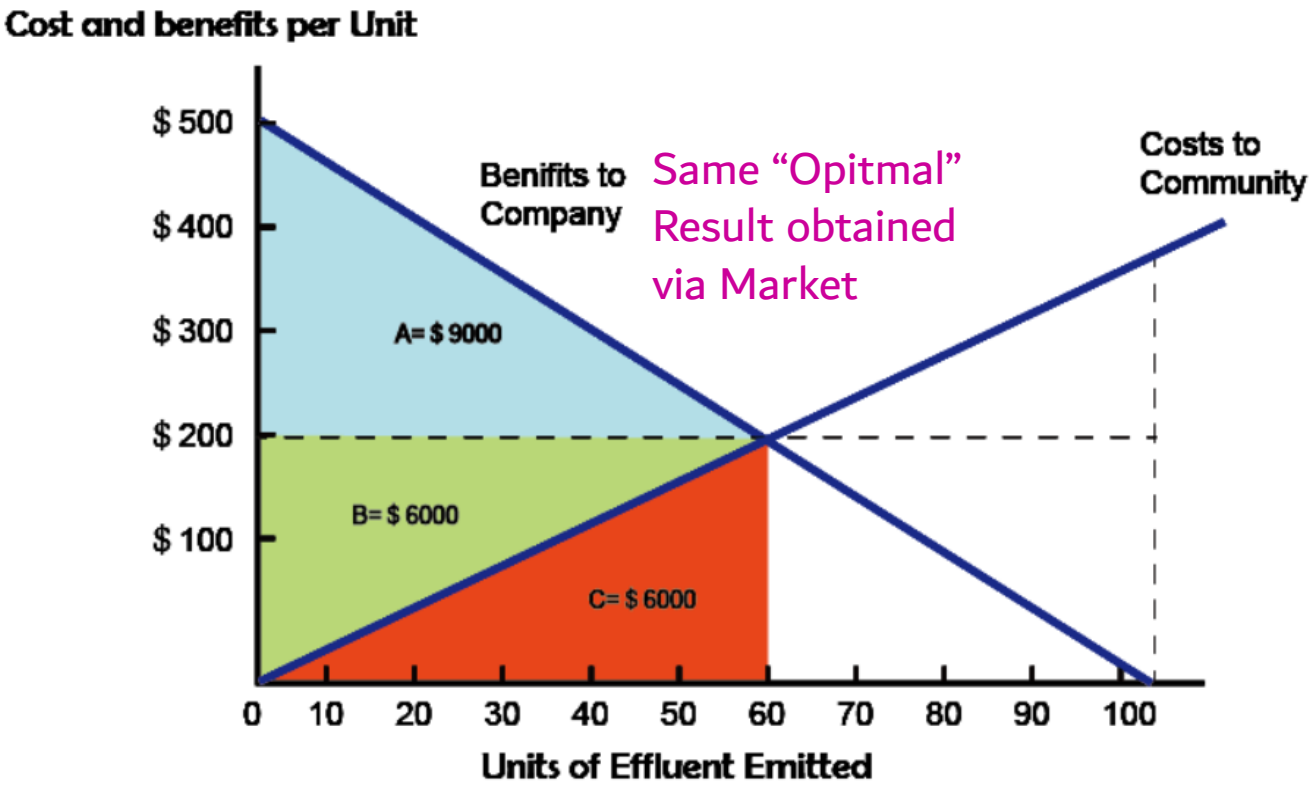
What has been achieved?

Community **has**

1. **Pollution costing $6000 (C)**
2. **$12000 new income (B+C)**
3. **Net Gain $6000**

Company **has**

1. **Paid $12000 (B+C)**
2. **Gained benefits of $21000 (A+B+C)**
3. **Net profit of $9000 (A)**



Same "Opitmal" Result obtained via Market

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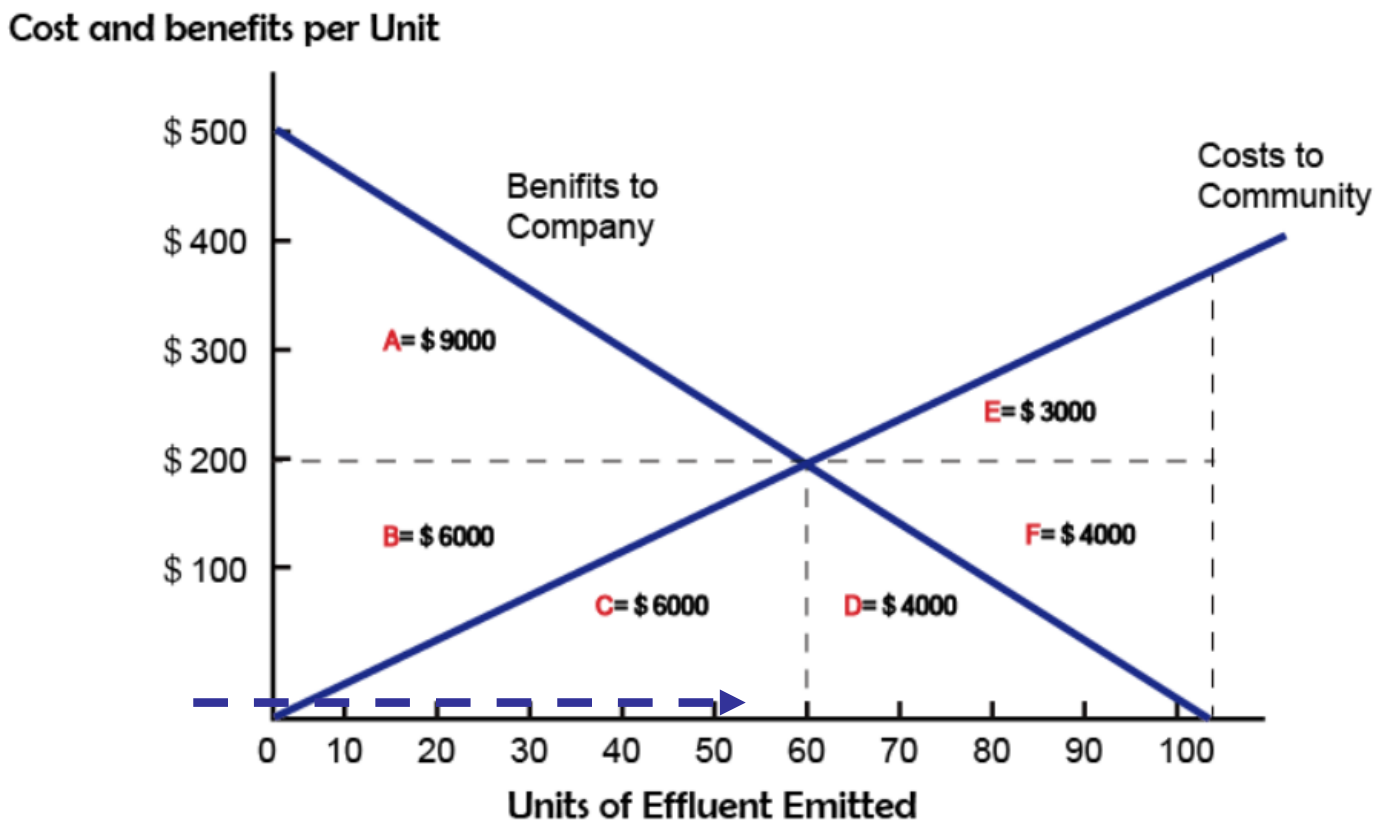
Case 2

Company owns "right" to determine how much pollution they make

Begin with output that creates maximum benefit of $25000
(A+B+C+D)

and creating 100 unit pollution

Community incurring cost of $17000
(C+D+E+F)



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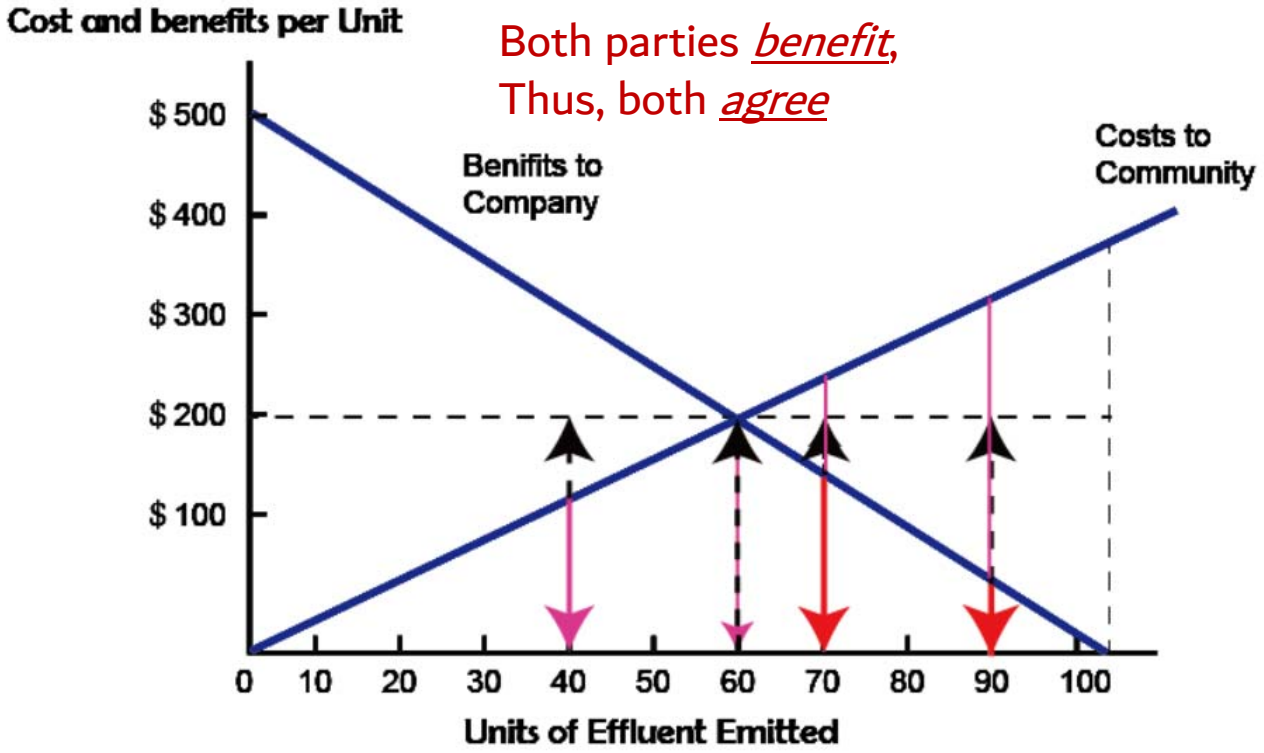
Case 2

Company owns "right" to determine how much pollution they make

Community

wants to reduce pollution

Offers to make payment of $200 per unit to cutback output



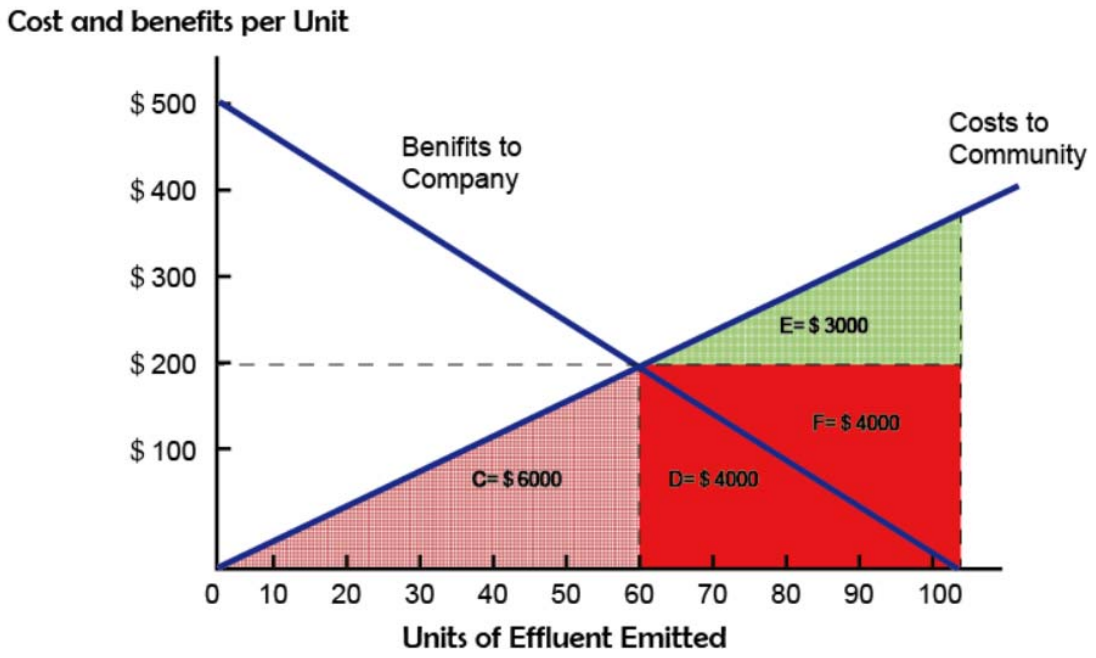
Both parties *benefit*,
Thus, both *agree*

What has been achieved for *community*

Community **has**

1. **Eliminated $11,000 in pollution costs (D+E+F)**
2. **Made pmts of $8,000 (D+F)**
3. **Left with pollution cost of $6000**
4. **Incurring cost: $14,000 (C+D+F)**

vs, $17000



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What has been achieved for *company*

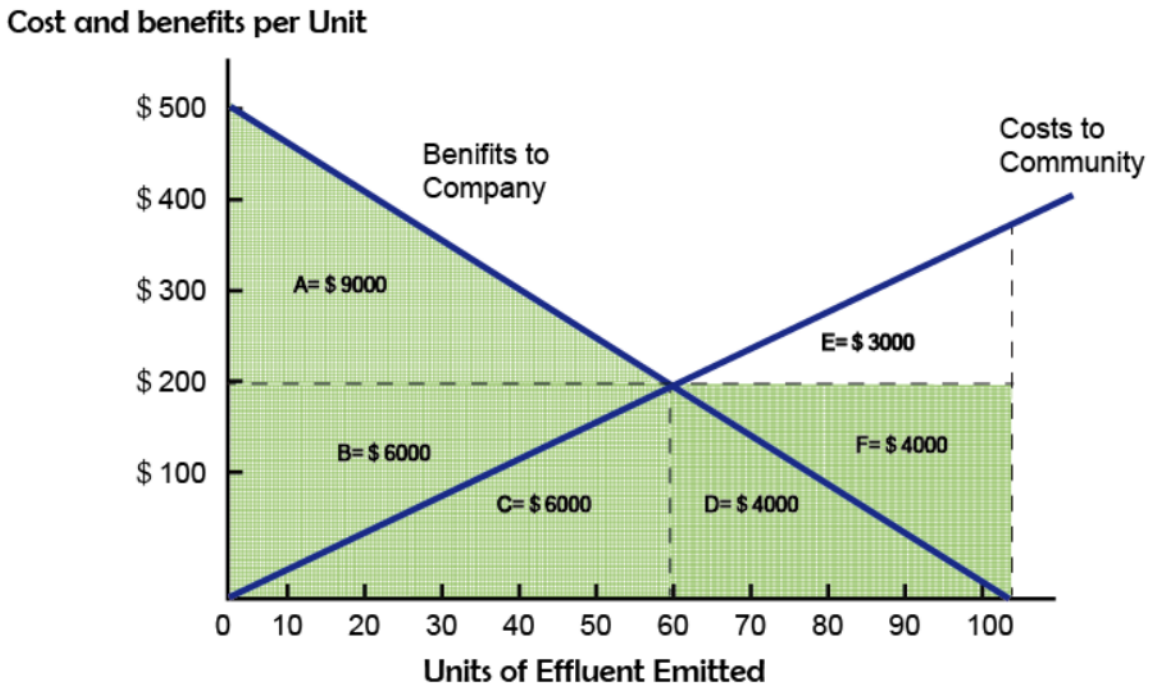
Company **has**

1. **Reduced pollution, giving up benefit of $4,000 (D)**

2. **Received pmts of $8,000 (D+F)**

3. **Retains existing benefit of $21,000 (A+B+C)**

4. **Total Benefit $29,000 （A+B+C+D+F） vs. $25,000**



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Company Holds Rights

	Community		Company	
Beginning position	**$17,000**	Pollution costs	$25,000	Benefits
	8,000	Pmts made	$8,000	Pmts rec'd
	11,000	⇓ **Pollution costs**	4,000	⇓ **Lost benefits from ⇓ output & pollution**
	6,000	Remain Costs	21,000	Remain benefits
Ending position	**$14,000**	Total pmts made & remain costs	$29,000	Total pmts rec'd & remain benefit
	$3,000	Improvement	**$4,000**	Improvement
Change in Pollution	***40 unit Reduction*** ***(60 units remain)***			

Community Holds Rights

	Community		*Company*	
Begin position	0 units	Pollution	$0	Benefits
	$12,000	Pmt rec'd	$12,000	Pmt made
	6,000	Pollution permitted	21,000	Benefit from new output & pollution
End position	**$6,000**	Remain after pmts used to clean up pollution	**$9,000**	Remain benefit after pmts
Improvement	**$6,000**		**$9,000**	
Change in pollution	**60 units of pollution produced**			

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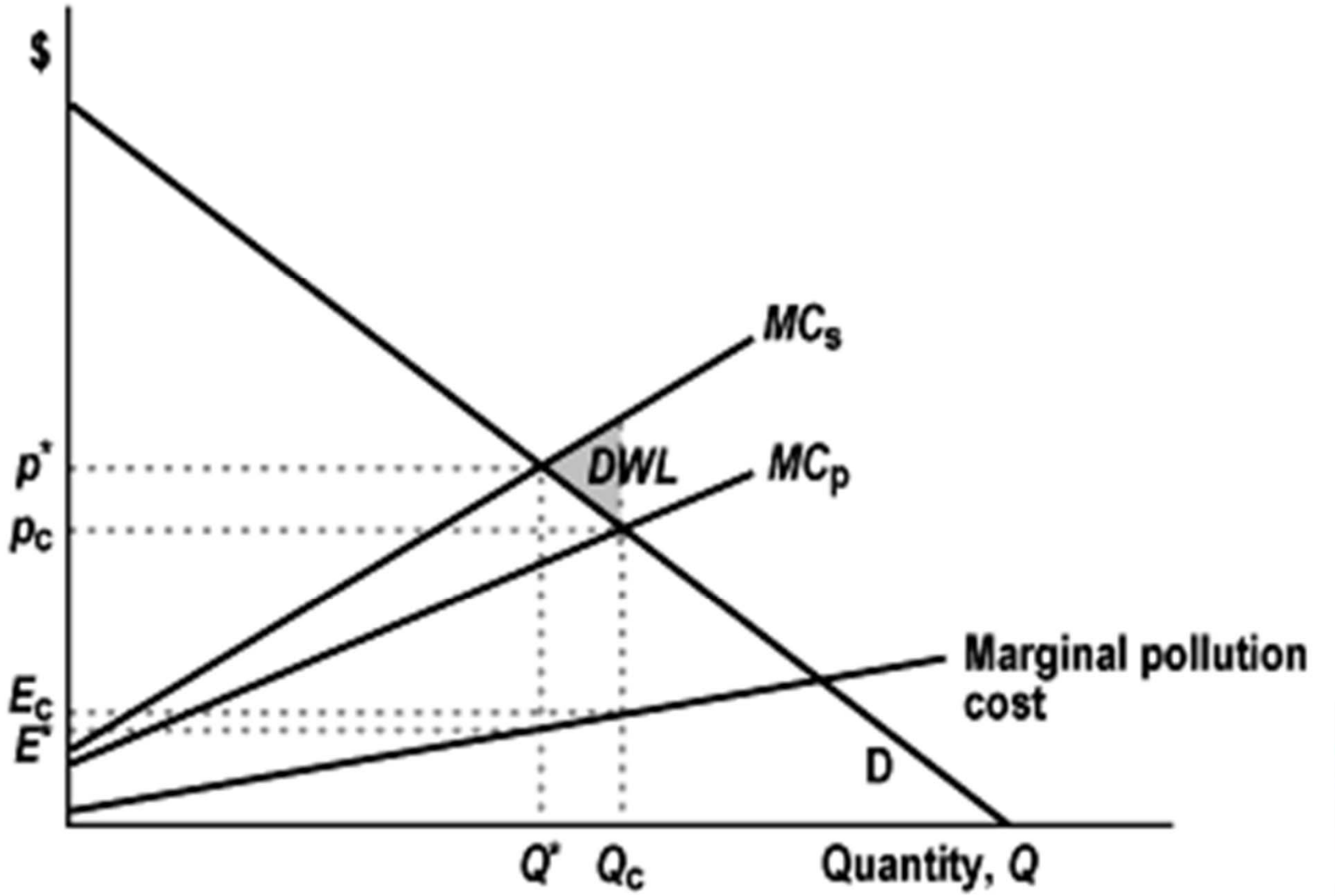
How to Relate Products Markets with Pollution Markets

- Social Welfare
  = Producer Surplus + Consumer Surplus

- Pollution is an externality, it imposes costs that are external to the private production process.

- Social marginal costs are higher than private marginal costs.

Pollution and Social Optimum



- The Coase Theorem basically says we should develop a market for externality (pollution).

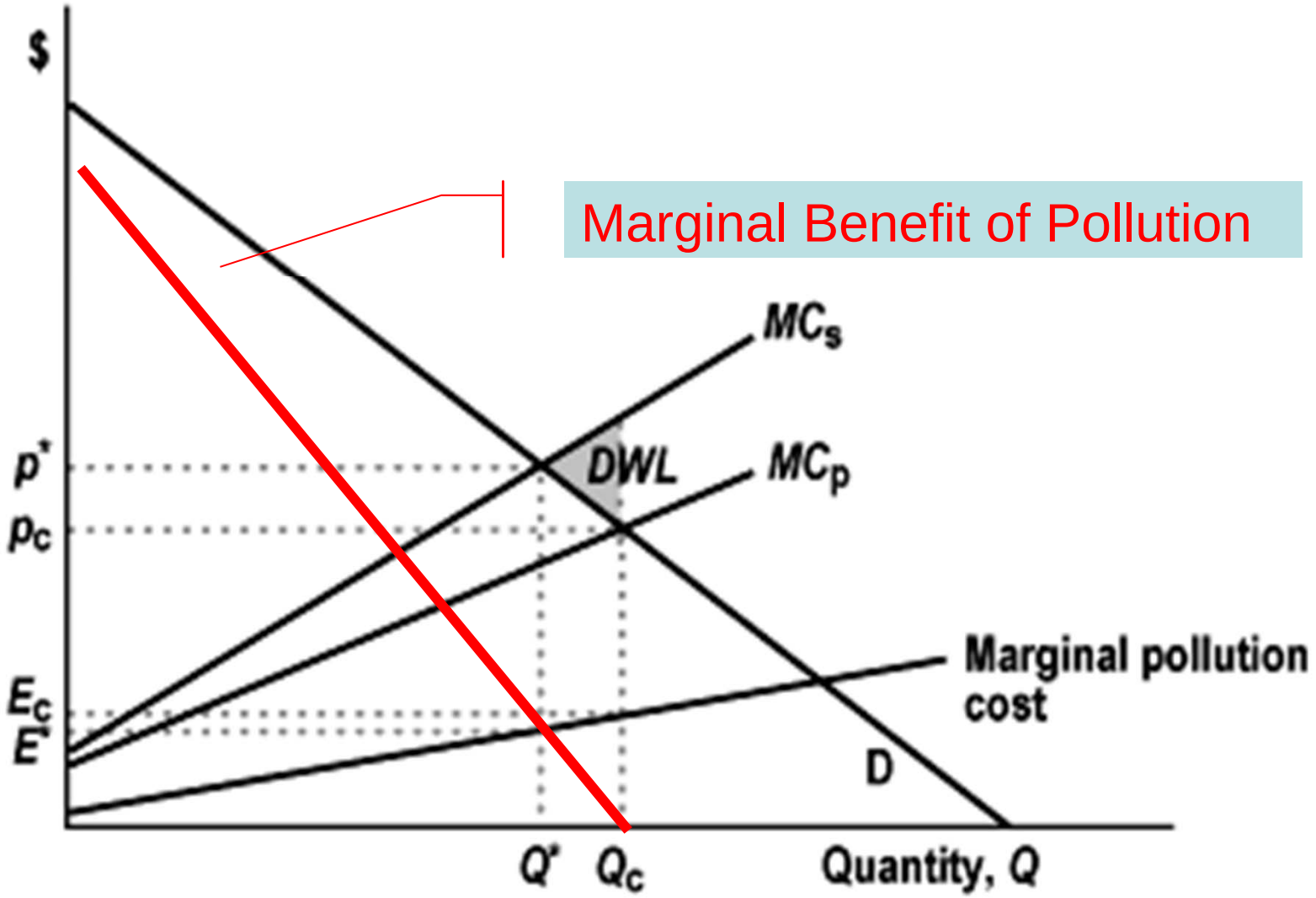
- Another way to arrange this information:

- Identify the marginal private benefits of pollution to both producers and consumers, and compare them to the external costs of pollution.

Marginal Benefits and Costs of Pollution

- Marginal benefits of pollution: the benefits to consumers less the private costs to producers of one more unit of pollution.
- Subtract the private marginal cost curve from the demand curve.
- The marginal benefits of pollution line summarizes the private market solution for gasoline.

Marginal Benefit and Cost of Pollution (MBP, MCP)



* Why Coase Theorem Does Not always Work

- There are almost always transaction costs
- Transaction costs can be so high that private agreement is not possible:
  - Thousands of polluters and millions of affected people
- Defining right is very difficult
  - We cannot divide air up into individual portions

* Why Coase Theorem Does Not always Work

- Initial allocations often do matter
  - Because rights are valuable, the interested parties will spend large amount of time and money to get the rights; those investments in lobbying could serve other social purpose.
- Imperfect information and Imperfect enforcement
- Market Power

* Why Coase Theorem Does Not always Work

- Imperfect information regarding environmental Benefits and Costs
  - Pollutees know that pollution is detrimental to their health, but they may not be fully aware of the consequences.
  - Environmental damages typically occur infrequently (i.e., illness) and over long periods of time (i.e., morbidity).
  - Similarly, the benefits firms receive from polluting, or the costs of controlling pollution, might depend on alternative technologies or methods of production. Difficult to find the “price” on units of pollution to reflect the MB.

*Why Coase Theorem Does Not always Work

- **Inalienability**
  - While many property rights can be bought or sold, some rights are inalienable.
  - Inalienable rights are rights which cannot be sold or transferred
  - Example: rights to freedom and to life itself

- **Why law-makers impose inalienable rights?**
  - Morality: many countries prohibit individuals from selling themselves or others into slavery
  - Other reasons?

- Short < 5 min. video on internalizaing externalities & the Coase theorem
- http://www.youtube.com/watch?v=zcPRmh5AIrI

*case study + questions (http://www.aw-bc.com/info/bruce/ch04_bruce.pdf)

A CASE IN POINT

4.1 Coase Goes to Hollywood

A news item on how filmmakers on location pay residents thousands of dollars to keep quiet while they are shooting a scene illustrates the Coase theorem in action, and its shortcomings.

> In his seven years as a location manager in the film industry, Patrick McIntire has rented noisy chain saws just so he could turn them off and paid lawn crews to stop clacking their shears and revving their leaf-blowers. Loud radios, barking dogs and immovable people have cost him a bundle.
>
> Mr. McIntire is not alone. In Los Angeles and other California areas popular for filming, residents are sometimes making thousands of dollars from movie crews by promising to vacate outdoor sets, tone down noise or otherwise stop harassing them. The problem has become so acute that the state legislature has stepped in, drafting laws to make harassing film crews for profit a criminal offense.
>
> "It's gotten to the point where at almost every shoot, somebody has their hand out," said State Senator Herschel Rosenthal, Democrat of Van Nuys, the sponsor of one such bill. "People blow horns, walk through shots, make their dogs bark or crank their stereos. And they all demand money to stop." (*New York Times*, July 27, 1995.)

The noise and disturbance of activities by residents are a cost to filmmakers on location, but keeping quiet is a cost to the residents. (Note the reciprocal nature of the externality.) The residents effectively have the property rights and can make whatever noise they want within the law. Filmmakers adopt the Coasian solution of paying them to keep quiet near the set. If the value of quiet to filmmakers is more than the cost to the residents, an efficient outcome is reached. But filmmakers claim that people are manipulating the system by creating noise or causing disturbance on purpose, simply to elicit a payment from the filmmakers. Such "attracting the nuisance" is a form of bargaining cost.

Critically analyze the following:

- If passed, how would Senator Rosenthal's bill alter the distribution of property rights? Do you think the amount of on-location filming would be affected by the change in property rights?
- If Rosenthal's bill passed, is it likely that residents would bribe filmmakers not to shoot in their neighborhoods? Why or why not?
- Suppose that, before shooting, filmmakers must report to a third party (such as the local government) how much it is worth to them to shoot, and that residents must report how much it is worth to them to avoid the disruption. The assignment of property rights will be determined afterwards by the flip of a coin. As a result, none of the parties knows, at the time they report their valuations, whether they will receive payment or be required to pay. Would this lead to a more efficient outcome? Why or why not?