

An Introduction to market failures

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A *market failure* is something that is **inherent** to the market that causes the market equilibrium allocation to be inefficient.

There is a famous theorem in welfare economics that shows that under certain conditions the allocation of resources in long-run competitive equilibrium is efficient.

This result is both amazing and fantastic: somehow, everyone doing their selfish best, ignoring the effects they have on others, results in an efficient allocation from society's perspective. Wow – Adam Smith's invisible hand at work.

When this theorem is presented, often the details are passed over and the presenter does not emphasize that the result only holds *under certain conditions*.

Markets, in equilibrium, are not always efficient.¹ When the allocation in an unregulated market in equilibrium is inefficient, the market is said to fail, *market failure*. Market failures are numerous in the resource and environmental sector of the economy. The market fails in the allocation of many environmental and natural resources, making the overall allocation of resources inefficient: Adam Smith's *invisible foot* tripping up the allocation of resources.

¹ Could a market in disequilibrium ever be efficient? Something to think about. Disequilibriums can be efficient but can a market disequilibrium be efficient.

We now need to examine the different sorts of market failures and see how they prevent the market from achieving efficiency.

I identify six categories of market failure (common property, externalities, public commodities, excess market power, lack of markets, and distortions in capital markets).

My classification is somewhat arbitrary, and there is overlap between some of my categories

Common property resources are one category of market failure. The market (or lack of) puts a zero price on common-property resources

A resource is common property if access to it is not controlled. That is, a resource is common property if no one **effectively** owns the resource.²

(The term *common-property* is somewhat misleading, but it is the historical term. *Not-effectively owned* would probably be a better term)

While few resources in this world are pure common-property resources (resources where access to them is completely uncontrolled), access to many environmental resources is largely uncontrolled, or controlled to only a limited extent.

Are the contents of your fridge a common property resource?

What features would your fridge and its content have if the contents were cp? You probably wouldn't be able to keep beer in stock—the stock size of its contents would be driven down to inefficient levels, maybe to extinction.

² Aficionados of inadequate property rights make many subtle distinctions between different degrees of property rights. Hopefully they will excuse me for lumping them all together; one needs to start simple.

A common-property fishery causes the market to fail, so will a common-property oil field, a common-property wilderness area, a common-property air space, a common-property aquifer and a common-property rain forest.

The common-property nature of many wild animals is a significant contributor to many species being endangered (too few from an efficiency perspective).

The common-property nature of the air in many places is a major reason for excessive air pollution from an efficiency perspective.

Consider a commercial fisherman. They produce caught fish, which they sell. Inputs into the production of caught fish include labor, capital, and fish swimming around in water. The capital and labor are used to get the fish out of the water and onto the dock. Labor and capital are not common-property resources, so must be paid for. If the fish stock is owned, the fisherman will have to pay the owner for each fish harvested, and the owner will charge an amount sufficient to cover the decreased value of the stock because it is reduced in size by the harvest.³ Put simply, the fisherman will have to pay the opportunity costs of all of the inputs its uses to produce docked fish.

³ Like the meat-packing company that must pay the rancher to harvest his cattle. The rancher controls access to his herd, so won't give them up for free.

Alternatively, if the stock is common property with no owner who charges for harvesting from the stock, the commercial fisherman will not consider the opportunity cost to the rest of society of her reducing the stock because she will not have to pay this cost. That is, when an input is free, people will overuse it—not surprising. Many of the ocean’s fisheries are or have been common-property resources.

For some, maybe me, driving country roads, drinking beer, and shooting cows is fun. But, unfortunately, I don’t do it very often; there is a risk involved; it is a felony.

Property rights for cows are well-defined and have a long history of enforcement; in the old west, cattle rustlers were executed at the end of a rope.

It was a capital offense, probably still is in Texas, many things are.

If I started shooting cows, the police would likely catch me, I would confess (I get nervous and confess, even at Customs), and straight to jail I would go: a place with big guys who might find me cute, or, at least, a new face.

So, if I want to shoot cows, I need to make prior arrangements with the rancher: knock on the door, offer him a couple grand for each cow I want to shoot, and pay in advance (unless we have already set up a PayPal account). Ranchers will be happy to oblige me if my willingness-to-pay to shoot is high enough. While my willingness-to-pay to shoot is positive, it is not high enough to entice the rancher, so I don't harvest many cows.

But, **what if** all the ranchers lost control of their cows ([“Cows Gone Wild”](#)—the movie) and there was no sheriff to chase and hang criminals like me. I would get to shoot cows for free; I would still have to buy gas, beer and bullets, but would **not** have to pay the opportunity cost associated with the loss to society because the world has one less cow. Cows would be over harvested from society's perspective, a market failure.

Buffaloes used to be common-property resources and there were millions of them. What happened to them all?⁴ Dudes like Buffalo Bill could buy a box of bullets and a train ticket from St. Louis to Denver; then knock off a few hundred Buffalos to help pass the time on the train. (How do you think he got his nickname?) There was a loss to society but not to Bill, Bill was maximizing his utility subject to his constraints (cost of bullets, etc.)

⁴Ted Turner (former owner of CNN and former husband of Barbarella, aka Jane Fonda) owns most of the ones that are left.

Why are some resources common property but many others not?



“In the beginning”

There was little need to control access to resources

Most resources are now scarce, but when man first arrived on the scene, scarcity was not a big issue—big garden with only two residents and a talkative snake.⁵⁶

⁵ Assuming Adam and Eve are the only members of society.

⁶ Define scarcity.



All resources started off as common property but now access is controlled for many of them.⁷ However, even now, after years of private-property capitalism, there remain resources that are both terribly scarce and effectively common property.

This has happened, in part, because the characteristics of some natural resources make them expensive for either a private agent or the government to define and enforce property rights. Sometimes there are cultural reasons (it is considered “wrong” for some things to be ownable)

Think about why cows are not common property, but many ocean fish are?

⁷ Contrary to popular belief, private property and the market system were not created by God.

Cows were bred to minimize the cost of controlling them: bred to be stupid, can't jump over fences, easy to spot, cheap to brand, kids stand next to mom, and willing to wait in line to be slaughtered—how convenient.



Wild fish, on the other hand, are very difficult to keep track of. Maybe we need to breed domestic fish who don't like to run around. (We are doing this: farmed salmon and catfish. Soon wild fish will have gone the way of wild buffaloes. Farmed fish currently account for more than way more than 50% of fish consumption)

There are cultural and historical reasons that some resources remain common property. People who exploit common-property resources get very upset when someone suggests

they should pay to use the resource. “My father hunted here, my grandfather hunted here, my great-grandfather It is my God-given right.” I have had guys with guns say that to me while they were standing in the middle of my driveway.

Selling stuff like clean air to the highest bidder makes many people queasy, not economists, but maybe economists are a different species. That is, some people think some things should not be for sale.⁸

⁸ If it is illegal (or wrong) to own X, X is more likely to be C.P.

John Wayne, then barbed wire, reduced the cost of enforcing property rights in the old west.



Thelma before John and before barbed wire, standing near a crummy wooden fence

You've seen the movie. The widowed farmer and his beautiful daughter, Thelma, struggle to grow corn on their Kansas homestead, their crops unfenced. The local ranchers, a selfish, profit-maximizing bunch, drive their cattle to Kansas City right through the corn fields (it's the shortest route), destroying most of the crop and dooming our heroine, and her father, to poverty.

An old dad with a rusty gun is not enough to get the ranchers to lengthen their journey and take a detour around the farm. Dad can't enforce his property rights.



In the spring, John Wayne appears; he falls for the daughter; takes sympathy on the father, and, with his gun, muscles, and swagger, scares off the cowboys and cattle.



The farmer pays for this in terms of grandchildren that look like John Wayne. But over the years, Thelma's love for John **wanes**. But what can she do? If she dumps him, back will come the cattle drive and the kids will starve.

[Then barb wire is invented](#), greatly decreasing the cost of controlling access to the farm.

Thelma dumps John after he puts up the fence; she runs the farm, and grandpa lives out his golden years watching his corn and grandchildren grow. Barb wire changed the west.

Can you think of other inventions (technological advances) that significantly decreased the cost of enforcing property rights? Branding cows? (now chips or tags)

What sorts of technologies does the U.S. use to control access to the U.S.? Have there been major advances in those technologies? What about the “WALL”?

How has the technology for protecting your iPhone from thieves changed over the last few years? Car stereos?

Externalities are another class of market failure

To define externalities, I first need to define external effects.

External Effects: An external effect exists if the actions of one or more economic agents enter as direct arguments in the utility or production functions of other economic agents. That is, an external effect exists if the actions of one economic agent directly affect one or more other economic agents.⁹

My grading of your quizzes will likely directly affect you, so will the smile of someone you like.

Externalities: There is an externality if an economic agent(s) does something that directly influences (not indirectly through market prices) some other economic agent(s) and there is the potential, by adjusting the level of the external effect, to make one of the parties better off without making some of the others involved worse off.

It is important to get the wording just right.

Or, equivalently, there is an externality if an external effect is produced at an inefficient level.

⁹ Contrast direct effects with indirect effects. My polluting you with my cigarette smoke is a direct effect; I moving to Boulder and driving up housing prices affects you, but not directly – it is an indirect effect, felt through a price change. Effects felt through the market place are indirect effects, and examples of the market working.

Examples of external effects that might, or might not, be externalities

Lake Wungabunga: Firm located on river dumps pollution in the river. The river flows into the lake where there is a resort with a swimming beach. The pollution makes swimmers sick.

Second-hand smoke from cigarettes

The effect of your weight gain on your friends ([Kolata NYT 07/26/2007](#))

A [former Governor of N.Y.](#) and prostitutes. Assume he got a STD and passes it along to his wife – she did not know he was infected, neither did he.

Consider the recent, and large, flood on the Front Range—five years ago, almost to the day. Many people put up barriers (sand bags, bags of dirt, pieces of wood, whatever they could find) to divert flowing water away from their homes or businesses. Did this cause external effects?

The above are all negative external effects

What are some examples of positive external effects?

Honey producers and orchards?

You wear sexy cloths because you like to, and your appearance turns on another individual and he or she likes the feeling but turning them on was not your intent.¹⁰

Wanda sends you a dozen roses and a love letter, which affects you. It could be a positive or a negative effect.

Give me an example of a good whose consumption produces no external effects.

Tell me why it is a good example.

Assess your argument.

¹⁰ What if it was your intent?

The existence of a negative or positive non-price impact on others (external effects) is necessary but not sufficient for the existence of an externality. If the provision of the external effect is at the efficient level there is no externality, even though there are external effects.¹¹

¹¹ After class, a student asked an interesting question that I had not previously thought about. If the external effect affects someone or something that is not a member of society, is it still an external effect? My sense is that the level of this external effect is not a factor in determining whether society is operating efficiently or a factor in determining whether a particular reallocation is efficiency increasing (for the society in question). But, it is still an external effect.

For example, if I shoot a moose for food, and that moose is not a member of society, the WB of the moose is not a factor in determining whether the shooting increased efficiency, but the moose was directly affected (it was shot and killed).

Consider my examples of negative and positive external effects. We could speculate on how likely they are produced at inefficient levels.

What might cause an external effect to be produced at the efficient level? Or not produced at the efficient level?

Consider smoking:

If smokers can smoke wherever and however much they want (with no regulation or incentive to cut back) there is **likely** to be an inefficient level of smoking—too much.

Why? Because the private cost to the individual of smoking another cigarette is less than the cost to society (cost to him plus the cost to others) of him smoking another cigarette, so she smokes too many from society's perspective –too much second-hand smoke is produced.¹²

If the smoke is taxed¹³ such that the efficient amount of secondhand smoke is produced, the efficient amount of smoke will be produced, likely a positive amount (some members of society will still smoke; they enjoy smoking, and these are benefits to society).

¹² The inefficiency is in terms of the effects of the second-hand smoke, not specifically a function of the amount I smoke, unless there is a fixed relationship between the amount I smoke, and the amount of second-hand smoke produced.

¹³ Ideally, one would want to tax me on the basis of the amount of my smoke others experience rather than the number of cigarettes I consume.

There is no externality even though some individuals continue to be injured by the secondhand smoke (there is still a negative external effect, but it's at its efficient level).

Consider a second example. If the efficient amount of secondhand smoke is achieved through a regulation, there is no externality, and some people are still adversely affected by the remaining second-hand smoke.

Consider a world with two individuals: you and I, where smokers have the right to smoke, I smoke, and you hate secondhand smoke. If you bribe me to reduce the amount I smoke to an efficient amount, there is no externality, even though you are made sick by the remaining smoke. This is an example where efficiency could be achieved even if smokers have the right to smoke. How likely are such efficiency increasing bribes?

Elaborating on the definition of an externality:

When the external effect is **positive** and the economic agents who produced the effect are required to take full account of their actions – by being compensated to produce the efficient amount of positive effects or by being mandated to produce the efficient amount of positive effects, there is no externality.

For efficiency, it does not matter whether the funds for that compensation are collected from the agents who benefited from the action or from some other source. That is, whether the funds to compensate the producers of the positive external effect are collected from those who are the beneficiaries of the positive external effects, or from somewhere else, is an equity issue.

And, when the effect is **negative** and the economic agents who produced the negative external effect are required to fully incorporate the damages produced – through fine, tax, or mandate, such that they produce the efficient amount of damages, there is no externality.

If the negative externality is internalized with a Pigouvian tax (a per-unit tax on pollution), it does not matter whether the funds collected are paid to

the damaged agents. Whether they should be is an issue of equity, not efficiency

In summary, if the producer of the external effect has the correct incentive to take the external effect into account, there is no externality.

Note that if a tax (subsidy) internalizes an externality, the tax revenues collected (total subsidy paid) will not necessarily equal the total damages to the injured (value of the benefits received). Efficient taxes/subsidies are, in general, based on marginal effects rather than total effects.

At first, some of you might not like my definition of an externality because it admits the definite possibility that in the absence of externalities there will be remaining external effects on economic agents that make them strictly better off or strictly worse off.

However, it is important to distinguish between inefficiencies and perceived inequities, and between external effects and externalities.

Being repetitive, there can be external effects when there are no externalities.

In addition, when the efficient amount of an external effect is produced, but those who are affected by the external effect are not compensated if the effect is damaging or forced to pay compensation if the effect is beneficial, the allocation of resources might be perceived as unfair, but there is no externality.

To repeat this point, consider the following thought experiment. Smoking is taxed such that the efficient amount of secondhand smoke is produced, and the tax revenues raised are given to those damaged by the secondhand smoke. There is no externality. Now take those tax revenues away from those damaged and give them to a third party. Does taking the money away from the damaged cause the externality to re-emerge? No.

Blowing cigarette smoke at your neighbor is an external effect that might or might not be an externality, the same with pollution from a factory.

Externalities result when property rights are not well defined. Therefore, one should conclude that common property and externalities are closely linked. Could externalities exist if all property rights for stuff like the air and your person were well defined and enforced?¹⁴

We can talk about

Producer-producer external effects

Producer-consumer external effects

Consumer-consumer external effects

Consumer-producer external effects

And

Spillovers (if everyone is affecting everyone else (e.g., car pollution and CO2 emissions)).

¹⁴ If, for example, you effectively owned your body and the air space around it, no one would be able to put a pollutant in your space, or anything else, without your approval. They also could not punch you or take your wallet unless you gave them your permission (because you like them, or they pay you). Neither sexual harassment nor rape would exist, but prostitution could.

Examples and review questions

(note that there are review questions online for each section of the course. There are also old exams.)

Smoking is a good example of an external effect. Suppose individual A's utility function is $U^A = U^A(X^A, Y^A)$, where Y^A is the consumption of cigarettes by individual A, X^A is the consumption of other stuff by individual A, and $U^B = U^B(X^B, Y^B, Y^A)$ such that individual B is adversely affected by A's smoking. (This could be the case even if individual B enjoys his own smoking.) Note that I assumed that A does not care about how much B smokes. If individual B cannot control the amount of smoke he or she receives from individual A (that is, she lacks certain property rights), then a competitive market will typically not result in an efficient allocation of resources; in which case there is a negative externality—individual B gets too much second-hand smoke from an efficiency point of view.¹⁵

¹⁵ I added the modifier “typically” because there could, in theory, be bargaining between the parties.

QUESTION: Consider a crowded park such as Yellowstone, Disneyland, or Boulder Mountain Parks. There is congestion; that is, individuals are getting in each other's way (crowding each other, increasing the lines, etc.). Are these interpersonal negative impacts (spillover-type external effects) necessarily externalities?

There are definitely external effects; whether there are externalities depends on whether the level of congestion is or is not efficient. (We will often talk about the efficient vs. the inefficient level of congestion, mostly in terms of parks and roads)

Note that sometimes the presence of other people can make us better off (a positive external effect). Teenagers typically want to be where the crowd is. They want to go to the party or beach where the popular kids are. So, if you are popular, going to a party makes that party more attractive to others (you produce a positive external effects). Alternatively, if you are unpopular, your being there makes the place less cool (a negative external effect).

Looking ahead (for later in the term) if congestion makes people worse off, then if a narrow road or urban park is open-access (common property) there will be too much congestion (an inefficient amount). But if the road or park is privately owned and managed to maximize profits one would expect the efficient amount of congestion, so no externalities, only external effects.

What if the primary purpose of your action was to affect someone else? Does that intent make the level of the external affect efficient (so there is no externality).

Some definitions of an externality state that the effect **must be unintentional** for there to be an externality. For example, by this definition if one intentionally harms another party there is no externality. **This definition is misguided/wrong.**

In explanation: making the harm intentional does not guarantee the external effect will be produced at its efficient level.

The issue is not solely whether the action that created the external effect is intentional – motivation is only part of the issue. The critical issue is whether the agent producing the effect fully **internalizes** the costs or benefits he is imposing on others.

Consider a situation where my actions make you worse off (a negative external effect) but this effect on you was simply a consequence of my pursuing my own selfish interests. And, my goal was not to harm you; it is simply a side-effect. Contrast that with a situation where I do something to intentionally make you worse off because I take pleasure from making you miserable (we all know people like that, including, sometimes, ourselves).

In that second case, I am taking account of the effect of my actions on you, so, to some extent, internalize my effect on you, so the amount of my sadistic behavior **might** be efficient.

Or, it might **not** be the efficient amount, maybe because I can't tell how much my behavior is affecting your WB (can't tell how much you are suffering). That is, the WB I get from hurting is not necessarily one-to-one with the hurt your experience.

Or, maybe there is a bribe the potential victim could pay the sadist to reduce his amount of sadism, making them both better off, so the current condition is inefficient, even though the sadist is getting pleasure from inflicting the pain.¹⁶

So, the amount of sadistic behavior might not be efficient, even though the intent of the sadist is to inflict pain.

If the potential victim is poor, maybe there is no bribe that would be accepted, making the amount of sadistic behavior efficient, assuming the sadist can correctly assess how much the victim is suffering, and its one-to-one with the with his pleasure.

Of course, torturing people is, in the eyes of many (not everyone), unfair. And the level is often inefficient. It is also, in the eyes of many, simply wrong.¹⁷

You might want to check out the NYT article

[Everyday Sadists Among Us](#)

Read about the bug murderers.

¹⁶ Or maybe, you can make the sadist think you are suffering more than you are. This could be efficiency increasing. She continues to think she is inflicting pain so here WB remains the same, while your WB declines (you suffer less)

¹⁷ Then again, our President is for water-boarding terrorists, so are a lot of other people. Note that labelling someone a terrorist, is a way to say that they are not a member of society.

My current favorite example of a negative, external effect is not washing one's hands after using the toilet.

I used to use *ax murdering for pleasure* as an example, but finally realized, after many years of using it as an example, that it not a simple example because there is an intent to harm. (See the previous discussion of intent.)

For a more detailed discussion of ax murdering and washing one's hands after using the toilet see my paper, [Ax murdering and wash your hands after using the toilet: a contrite/confused economist](#)

Some economists argue that the market system will, with no outside interference, correct all potential externalities such that the efficient amount of the external effects is produced from society's perspective.

The following is an example of this type of argument: I smoke cigarettes and blow smoke in your face producing both an external effect and an externality. Then you bribe me to either smoke less or to blow the smoke in another direction. That is, you exchange money for less pollution and I give up some of my pleasure from smoking in exchange for more money. That is, we trade until there are no further gains from trade.

At which point, even though I continue to smoke some, the allocation between the two of us is efficient: the only way to make one of us better off requires that the other be made worse off. This is a logically sound argument and was first put forward by [Ron Coase](#); the argument helped him to win the Nobel Prize in Economics.



If you don't have enough money to bribe me to smoke less, too bad for you; whatever amount of smoke I choose to blow, it's efficient.

Click [here](#) to link to Coase's original article and some of the other classic literature on externality theory.

[Ron Coase](#) recently died (September 2, 2013). He was almost 103.

Put simply, the Coasian theory says something we already know: if property rights for a resource are well-defined and well-enforced, the market is more likely to efficiently allocate it.

While the Coase argument is sound in theory there are a lot of reasons why it does not work for all natural and environmental resources.

Consider my smoking example; it is restrictive in many ways. There are only two parties involved and they are aware of each other. **Property rights are well established** in that the smoker assumes she has the right to smoke and the recipient of the smoke accepts that he has no power to reduce the smoke, other than by paying the bribe. And, negotiation between two parties is relatively easy.

The real world is typically more complicated: many parties are often involved (consider car pollution). The damaged parties often do not accept the notion that they have no rights other than the right to bribe.¹⁸ In addition, negotiations between multiple parties are typically difficult and expensive: it is difficult for everyone affected to find each other and to negotiate.

So, while some externalities are internalized by legal bribes, many are not.

Mergers can be a way that the market internalizes producer-producer externalities. Imagine that one firm produces pollution that affects one and only one other firm. The pollution increases production costs for the second firm, so decreases its profits. The externality could be corrected by the one firm bribing the other to reduce its pollution, but the efficient amount of pollution could also be achieved if the two firms merge. The

¹⁸ Remember, I noted earlier that externalities are due to lack of well-defined property rights.

merged firm will correctly account for the external effect. That is, the external effect will become internal to the new entity. Mergers sometimes occur for this reason.¹⁹

Also, be aware that I have glazed over the issue of the cost of correcting the inefficiency, implicitly assuming it to be zero. For many small external effects, the efficient thing to do is nothing when one considers the cost of internalizing the inefficiency—it simply does not make sense to tax or regulate the effect. Consider a tax on ugly socks.

You might want to look at my [micro principles notes](#) on external effect and externalities. There are some pictures of **bad tattoos**. Should we tax or regulate ugly tattoos that are visible to others?

One last, uncomfortable thing about externalities and efficiency: imagine, for example, that my preferences are such that I am made worse off when straight-white couples display signs of affection in public. In that case, if you and your opposite-gender partner display affection in my presence, a negative external affect is produced, and one must ask whether you will produce public displays of affection in the efficient amount?

In other words, if economists take my preferences as given (no matter whether society thinks them appropriate) my bigoted preferences determine whether your behavior produces external affects. A lot of people would have a big problem with this.

The efficient amount of racial discrimination? Ugh. Economists solely concerned with efficiency would not talk, for example, about the “right to free speech” but rather the efficient amount of free speech and the efficient amount of axe-murdering.

One more example, what if people care about their position relative to others such that if you get a raise I am worse off because, relatively speaking, I am now poorer. Such relative effects are important and greatly complicate the issue of efficiency and achieving efficiency.

You drive a new Chevy SUV. I live next door at drive a beat-up old Dodge Dart. I the replace it with a Porsche SUV.

¹⁹ Most mergers occur for other reasons.

***Public Commodities* possess the property that multiple agents can and must consume the same units of the commodity.²⁰**

A necessary condition for this is that the commodity must be *noncongestible*. A public commodity is noncongestible in the sense that one agent's consumption of a unit does not preclude or impinge on another agent's consumption of that same unit.

Another term for non-congestible is *non-rivalrous*.

All economists would agree that non-congestible is a necessary condition for a commodity to be a public commodity, but most economists would conclude it is not a sufficient condition.

All would add the property of *non-excludable*; non-excludable meaning that once units of the commodity are provided to one agent, no other agent can be excluded from consuming those same units.

²⁰A commodity is a private commodity if one agent's consumption of a unit of the commodity precludes another agent's consumption of those same units – we can't both eat the same ice cream cone. Note that paying for a commodity is not a necessary condition for the commodity to be a private commodity. If it was, a commodity would not be a private commodity if someone received it as a gift.

The definition of a public commodity is then further restricted by assuming, in addition to non-congestible and non-excludible, that everyone is forced to consume all units of the public commodity produced. Note that this last condition does not require that all are affected the same but does imply non-excludible.

I define public commodities as those commodities with the property that everyone consumes every unit of the commodity that is produced.

Note, a commodity is a public commodity because of its nature and our preferences, **not** on how economic activity is or is not organized. We both can't physically eat the same scoop of ice-cream, but we both experience the effects of the U.S. arming "moderate" rebels in Syria.

Goods that are provided by the government are not necessarily public commodities. For example, roads and public schools are **not** public goods in the economic sense of the word. So, we need to distinguish between public goods and goods provided by the government.

The air is not a public good. It is definitely congestible, and no two individuals can consume the same unit of air. If air was noncongestible, air pollution would not be a problem, and everyone could breathe the same liter of air.

There are no pure public goods (I used to wonder about Santa Claus), and no pure private goods: consumption always has some effect, often small, on others. Even though my basement has no windows and is soundproof, the neighbor gets upset when I sit down there watching porn movies (somehow, he just knows).

It is better to use the word *commodity* than the word *good* when discussing public commodities because many public commodities are goods for some member of society and bads for other members, attacking Iraq being one such example, Obama and Trump being additional examples.

Can you think of an example of a commodity, besides Santa, that is non-congestible but where people can be excluded? Cable TV shows?

Where people cannot be excluded but where individuals can choose to not consume/experience the commodity.

So, my friend Mark the other day asked me whether weather forecast was a public commodity (actually he asked a related question)

For purpose of the question, define a weather forecast as the prediction of a scientific model.

What properties does a weather forecast have?

Is it congestible? Is it excludable. Can you exclude yourself?

The market is incapable of producing public goods at their efficient levels. This is the heart of Public Economics. Why?

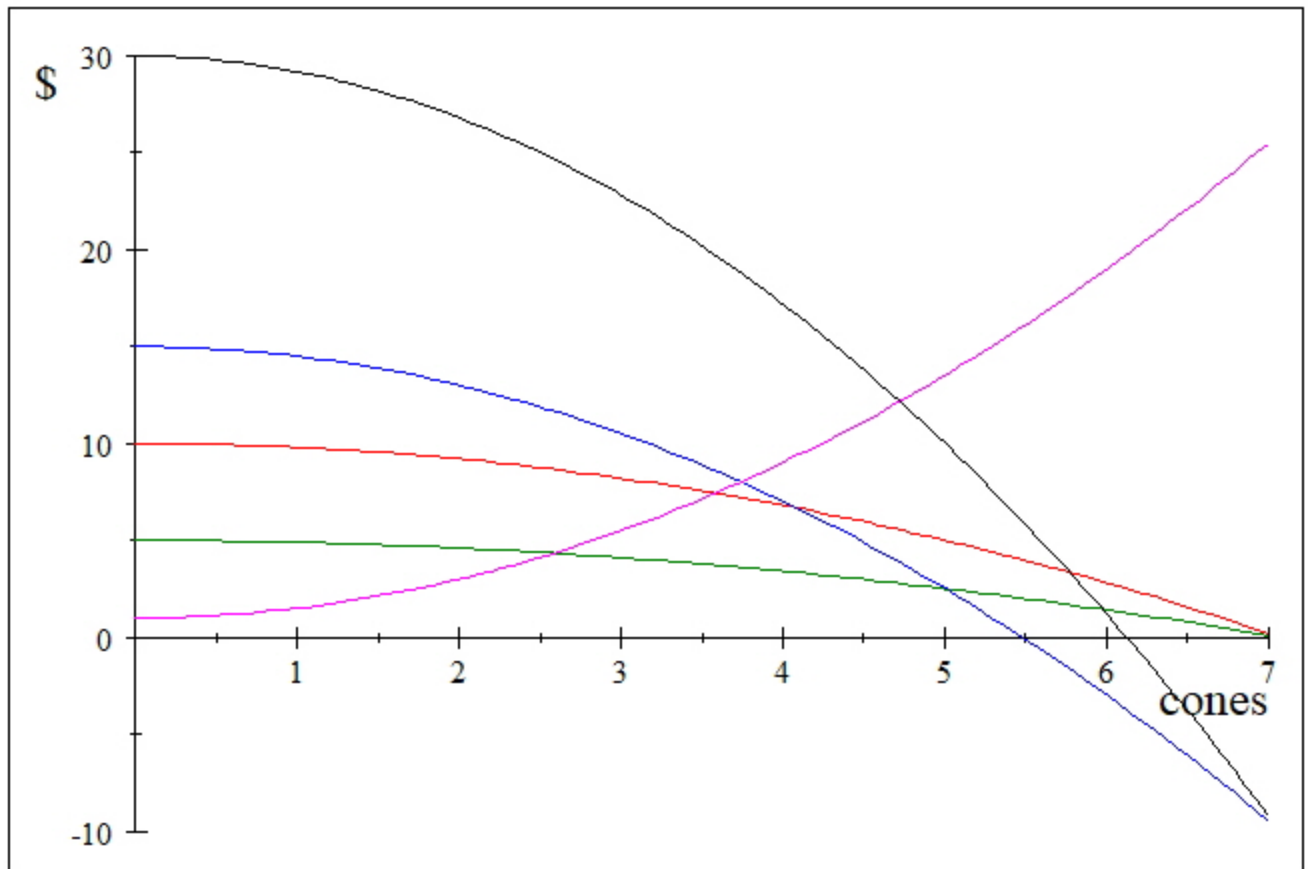
The main reason is that a producer of a public good can't make **all** those who benefit from its availability pay for it. A private firm does not have the ability to "tax", and people typically won't pay for something if they automatically get it for free when someone else pays the cost of production.

In more detail, society wants public commodities produced up to the point where the cost to society of the last unit produced (marginal **social** cost) is just equal to the benefits to society from the last unit produced (the **marginal** social benefits). (This is also what society wants for private goods.)

Marginal social benefits are the sum of all the benefits all members of society get from the last unit produced. (This is also the rule for private goods, but in that case only one individual is affected by the consumption of each unit, so for a purely private good $MSB = MPB$)

For a public commodity, draw a graph of marginal private benefits for each of three people. If society consists of these three individuals, marginal social benefit is the vertical sum of marginal private benefits across all individuals. (Put dollars on the vertical axis and units produced on the horizontal axis.)

Need to change the name of the graph from cones to "public good"



Fred blue, Alexa green, George red

A profit-maximizing private firm will produce units of the public commodity up to the point where marginal private cost of production equals marginal revenue, but for public commodities marginal revenue will be way less than marginal social benefits so less than the efficient amount will be produced

: there is no way the firm can get all member of society to pay the amount that they value the last unit produced because once a unit is produced everybody consumes it regardless of whether they pay—the *free-rider problem*.

Only an entity with the power to tax (the government) can produce public commodities in the efficient quantities.

Imagine if ice-cream cones were public commodities; every time you buy and eat a cone I, and everyone else, consumes the same cone. No way am I going to pay you or Hagan Daaz for my enjoyment of the cone, and Hagan Daaz is not going to produce the efficient number of cones from society's perspective. Assuming ice-cream cones are liked by all, the market will grossly under-produce them.

If you want to have resources efficiently allocated and if some commodities have public properties, you will need a government (an institution with the power to tax).

Besides the ability to tax it will also need the ability to determine the efficient levels of public commodities.

One might view the consumption of a public commodity as a special type of externality. When I consume another unit of "national defense", you are forced to as well, whether you like it or not.

Environmental resources such as animal species and ecological systems can have a public-commodities aspect to them.

Consider wolves. If wolves are reintroduced in Colorado, their presence will be experienced by all of us. My enjoyment from knowing that wolves roam Colorado does not preclude you from enjoying or hating the existence of those same wolves; we all are stuck with them. Reintroducing wolves is like attacking Iraq; one citizen's loving it does not preclude others from loving or hating it, but we all live with it.

There are some environmental resources whose existence affects us even if we do not "use" or "consume" them in the traditional senses of these words. I value the wilderness of Alaska even though I have never been there and have no desire to go – too cold and too scary, besides I might run into Sarah P. I feel the same about wetlands. I would value the presence of wolves in Colorado but have not desire to hang out with them.

Different names for these types of values are *non-use values* and *passive-use values*. Such values can be positive or negative—I hate knowing snakes exist and that people in the Sudan are starving, and the people in Africa are dying of Ebola. And, my hating does not preclude you from hating, or liking, or whatever.

Many environmental resources have a public-commodity aspect in that they produce non-use values which need to be summed across individuals to get the social benefit of the

resource. My being damaged by the BP spill in the Gulf of Mexico or the destruction of the World Trade Towers did not preclude you from being damaged.

If BP was sued for the damages to the American people from the Gulf spill (BP recently settled for approx. \$18B), total damage would be the sum of the damages to all of us, even if most of us had never seen the place. **Cite Mobil ad in non-market readings**²¹

<http://edwardmorey.org//4545/mobil.pdf>

One last thing about public commodities, make sure you understand the distinction between public resources and common-property resources.

Take a look at my [micro principles notes on public commodities](#), particularly the numerical and graphical example.

²¹ Mobil is now Exxon Mobil

Excess Market power (monopoly and oligopoly) in resource and goods markets are another category of market failure. Monopoly power typically prevents the market from achieving efficiency.

Excess market power means one or more firms have the ability to influence the market price by changing their level of output.

How does excess market power cause inefficiency?

Typically (the text-book examples), but not always, excess market power causes the producer (or small number of producers) to produce and sell an inefficient amount, too little.

Under-producing from society's perspective is how a monopolist makes excess profits. The monopolist can control total production of the product, so can produce less than would have been produced by a competitive industry, and the competitive amount is the efficient amount in the absence of external affects.

The monopolist does this because the resulting price increases more than makes up for producing and selling fewer units—restricting output, up to a point, increases its profits.

There is a lot of monopoly and oligopoly power in the resources sector, e.g., big oil companies, big mineral companies, OPEC, etc. Firms that harvest natural resources are often large.

Note that monopolistic holders of scarce natural and environmental resources tend to be the conservationist's friend, and this is typically **not** a good thing from an efficiency perspective.

Why? If, for example, only competitive firms owned oil reserves, every year more of each year's reserves would be extracted than if the oil reserves were owned by only one or only a few agents (firms, governments, etc.).

Lack of markets: The market cannot efficiently allocate resources if markets do not exist for some of those resources.

If there is no market for beer (places where beer is bought and sold), the market economy won't efficiently produce or allocate beer.

There is only a very limited market for the use of air.²² Water markets are imperfect, at best, and often non-existent, the same is true for many other environmental resources and amenities.

²² In the U.S., there are tradable permits for SO₂ emissions

Many potentially important futures markets don't exist.

A futures market for commodity x is a market where one can buy and sell x today for delivery at some specified future date, with payment either now or at some specified future date.

Limited futures markets (30, 60, 90 days) exist for many natural resources. See the NY Times or the Wall Street Journal financial pages for current prices.

Society wants to achieve intertemporal efficiency in the use of its scarce natural and environmental resources, but the market cannot do it if markets for the future delivery of these resources do not exist.

Assuming three generations (now, the near future, and the distant future) define intertemporal efficiency in terms of the welfare of each generation. This would be a good quiz question. Let's have a quiz right now.

If you don't have a clue write 5/10 on a piece of paper with your name on it, and hand it to me.

The intertemporally allocation is efficient if the only way to make one generation better off requires that another generation or generations be made worse off. That is, if the allocation can be changed such that one or more generations are made better off without any other generations being made worse off, the current intertemporally allocation is inefficient.

Grading 10 points if close, 5 points for all other answers.

Write your name (the grader) on the top of the quiz. I will grade a subsample of the quizzes. If, in my opinion, your grade is substantially wrong, I will change the grade and reduce the grader's grade by 2 points.

If we want the **market** to efficiently allocate oil between now and 2050, a market has to exist where one can buy and sell oil now for delivery in 2050 with payment either now or in 2050.

If there are no long-run futures markets for oil, producers are more likely to leave too little in the ground for the future.²³

Markets require well-defined property rights, including enforcement, and low transactions costs for trades. Lack of these will result in a lack of markets. This suggests that one way to reduce the inefficiencies associated with market failures is to create markets, future or otherwise, where they do not currently exist.

How?

Clear up ambiguities wrt property rights; that is, make sure property rights are well defined. (This is what, for example, pollution permits are designed to accomplish.)

Develop technologies, for example, that can inexpensively monitor how much how much pollution a firm or consumer is emitting by type. E.g. a device that monitors how much your car is polluting in real time.²⁴

²³ The effect could, in theory, go the other direction, but this is unlikely.

²⁴ Such devices exist.

Create institutions and policies that will decrease the cost of trades

Examples of new markets – the U.S. market for SO₂ emissions – eBay, and other web sites where things can be bought and sold (e.g. Etsy).

Distortions in capital markets: That is, the market rate of interest is either too high or too low from an efficiency perspective.²⁵

Note that lending money is a type of saving—you lend rather than putting it in your mattress, so you can earn a rate of return on your savings.

Capital markets determine market rates of interest, the rate at which the **market-place** discounts the future.²⁶

Draw a graph with amount borrowed and lent on the horizontal axis and interest rate on the vertical with the demand for capital being downward sloping (as interest rate falls investors will want to borrow more money) and the supply of capital being upward sloping (suppliers will want to lend more as the higher the interest rate (their return on the amount they lend))

If his market distorted, so that the market rate of interest is too high or too low from an efficiency perspective, the market will inefficiently allocate between now and the future.

What sorts of factors would cause such distortions?

Any restriction imposed on the interest rate would distort, for example a government mandated ceiling or floor on the market rate of interest.

Lack of access to capital markets by some of the players in the market place

²⁵ Note that a market rate of interest can also be too high or low from an equity perspective.

²⁶ Contrast this with how you personally discount the future (your personal rate of discount) and the rate society would choose to discount the future (the social rate of discount).

For example, poor farmers in poor countries often have no place they can go to borrow money for seeds and fertilizer.

Micro-credit, a recently new phenomenon, is a program that partially fills this gap in credit markets; it provides small loans (a few hundred dollars at most) to small businesses in developing countries. But micro-credit has not solved the problem.

In the U.S., racial minorities often have less access to credit than others. Racial minorities have better access now than in the past but there are still barriers, for example, lack of banks in poor neighborhoods.

For ethical reasons, one cannot use human capital as collateral for a loan. While this is good from an ethical perspective, it likely causes inefficiency in the capital market. Explaining: If human capital was collateral on a loan and one defaulted on a loan, the lender would then own your capital – this is called slavery, and it is frowned upon. But bans against slavery can be efficiency decreasing if people want to use themselves as collateral.

There can be lack of access on the savings side as well: limited places to save. In poor countries, there are often few financial institutions for the rural poor—no place to save.²⁷

One must distinguish between market failure in capital markets and a divergence between the market rates of interest and the social rate of discount due to intergenerational equity issues.

That is the market rate of interest might be correct from an efficiency perspective, but not from an equity/fairness perspective.

²⁷ One way to save for the future is to have a cow or goat. Or have a bunch of kids and hope they will take care of you when you are old.

This ends our list of types of market failures

When thinking about the real world, get hung about, but not too hung about, the exact differences between the different categories of market failures. The important issue is whether the current unregulated allocation is or is not efficient.

If the current allocation is efficient, we don't need to worry about policies to make it efficient.

If it is inefficient, we typically want to consider policies that might make the allocation more efficient.

Worrying about whether the inefficiency is caused by a guber market failure or a gomer market failure is of second-order importance for policy makers, but of test-importance for students of environmental economics.

In this course, we will study environmental resource use within the general framework of allocating society's scare resource.

We will conclude that there is a lot of potential for market failures/inefficiencies wrt to natural and environmental resources. We have already mentioned many.

If we identify market/failure/inefficiency, we should then ask whether government intervention can improve things.

Market failure **does not imply** that government intervention will make things more efficient. That is, market failure is not sufficient to warrant intervention by the government.

If the government intervenes in the market, or usurps the market, and causes the allocation to become more inefficient, we call this **nonmarket** failure. It happens.

If the government intervention will make the allocation more inefficient (worse), it is not warranted.

However, government intervention often improves the allocation of resources.²⁸

We have to figure out the appropriate government policy to correct the market failure.

²⁸ There are many people who do not believe this: people who take on faith that the government can do no good in terms of efficiency. Consider the modern “Tea Party”. Some members of the Tea Party believe this. Other members believe government intervention could increase efficiency but that the increase in efficiency is not worth it in terms of lost freedom (their objective is freedom, not efficiency)

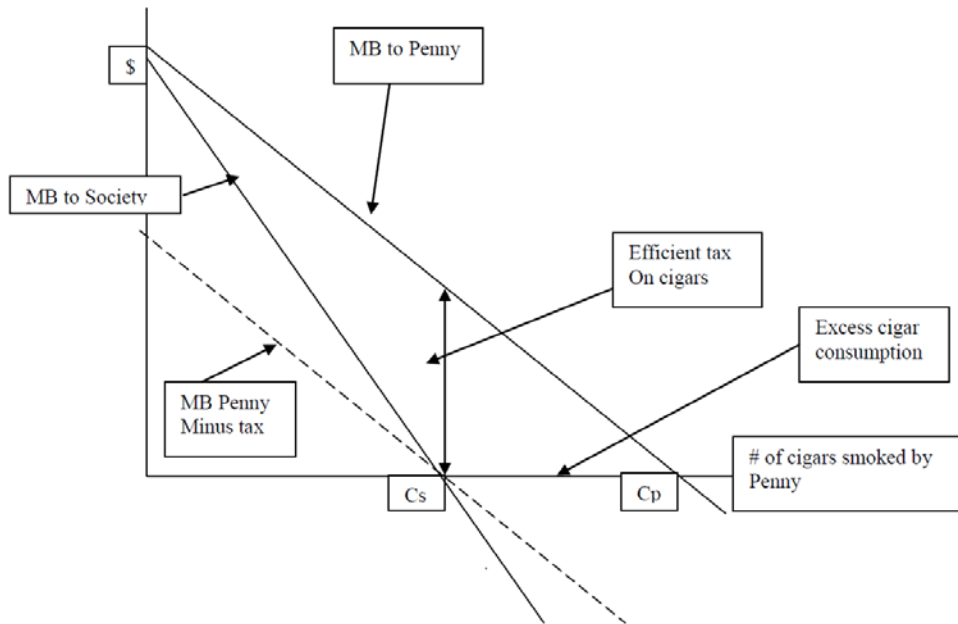
Clearing up some loose ends wrt market failures:

A graphical look at Fred, Penny and cigar smoke

Assume a two-person society. Penny is a smoker, Fred is not, and Penny's smoke makes Fred sick. Cigars are provided for free by God, so the marginal cost of cigars is zero for both Penny and Fred, so free for society.

Assume that for the only way for Fred to experience less second-hand smoke is for Penny to smoke less. (As we will see this is a critical assumption.)

Graph this situation with \$ on the vertical axis and cigars smoked by Penny on the horizontal axis. Include, the MC to society (and Penny) of providing cigars for Penny to smoke. Include examples of the Penny's MB curve for cigars smoked and society MB curve for cigars smoked by Penny. Identify how many cigars Penny will choose to smoke. Identify the efficient number of cigars smoked from society's perspective.



If the property rights for smoking are not well-defined and the government does not intervene, the market fails because the benefits to Penny of an additional cigar smoked are greater than the MB to society

Vertical distance between the MB to Penny line and MB to society line is? The damage to Fred caused by Penny smoking another cigar.

How to correct the inefficiency?

Ban cigar smoking? NO

Pass a law saying Penny must smoke C_s cigars per day, no more, no less? Yes

Or, put a tax on each cigar smoked? Yes. What should the tax be?

In this example, would Penny prefer the tax or the regulation?

How about permits to smoke cigars? How many permits should be issued? How to allocate the permits between Penny and Fred is a matter of equity, not efficiency.²⁹ (Note that if Fred gets some permits in the initial allocation, Penny will buy them from him.)

If property rights are well defined (e.g., Penny has the right to smoke), does the government have to do anything to correct the market failure? As we discussed earlier, without government intervention, Fred has an incentive to bribe Penny to smoke less. If she is smoking more than C_s cigars the benefits to her (in\$) from the last cigar smoked is less than what Fred would pay to stop her from smoking it. So, if they can get together and bargain, efficiency can be achieved. Ron Coase (a Nobel laureate) argued this is likely to work?

²⁹ This statement is not quite true. It's complicated.

Now re-graph the example but instead of assuming the second-hand smoke drives a wedge between marginal private benefits and marginal social benefit, recast the second-hand smoke as driving a wedge between the marginal private cost of cigars and the marginal social cost of cigars.

In this graphical representation of the problem $MB_p - MB_s$ (there is gap between the marginal benefits to society and the marginal benefits to society).

But in this representation, $0 = MC_p$ is less than MC_s (that is the marginal private cost to Penny of each cigar is zero but the marginal social cost is this zero plus the damage to Fred from each additional cigar).

Now draw a new set of lines assuming the marginal cost of producing joints is positive and increasing (both from a private and social perspective). Assume Penny, but not Fred, likes to smoke weed, but Fred enjoys the second-hand smoke from Penny. Given your graph, identify the number of joints Penny will choose to smoke and the efficient number for her to smoke.

A graphical look at the pollution in Lake Wungabunga from a factory

Draw lake, river, factory and public swimming beach on the lake

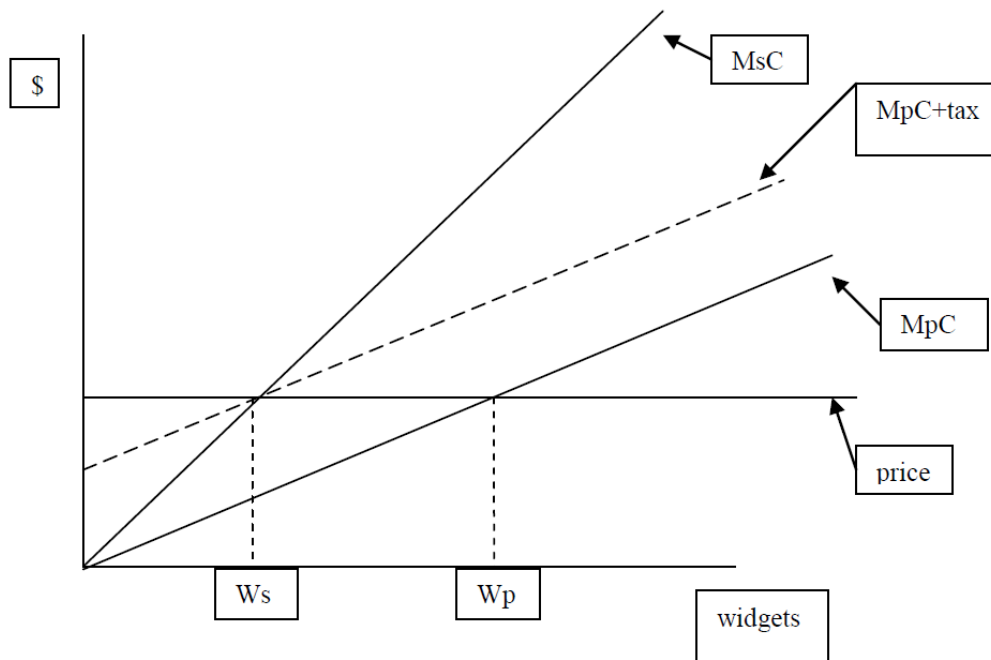
Assume a competitive widget firm and assume $P = MB$ to society from widgets (there are no external effects associated with widget **consumption**).

The firm has an upward sloping marginal cost curve for producing widgets. Draw the graph

Assume the river and lake are both common-property resources so the firm is not charged to dump its pollution in the river. The pollution negatively affects the recreators who stay at the resort.

So, the firm's MC curve for producing widgets lies below society's MC curve for it producing widgets.

Assume there is a one-to-one relationship between widget production and the amount of waste the producer dumps in the river. (This last assumption is important.)³⁰



The firm's output of widgets and amount of waste produced are both too high from society's perspective (inefficient) but efficient from the perspective of the firm.

Possible ways to correct the market failure:

- Require the firm to produce W_s widgets

³⁰ This assumption is equivalent to the assumption that the only way Fred could experience less second-hand smoke is for Penny to smoke less.

- Tax the firm on either each unit of output or each unit of pollution. The tax on widget production should be the vertical distance between MpC and MsC at W_s .
- Since, by assumption, there is a one-to one relationship between output and pollution it doesn't matter whether the tax is on the output or the pollution. If, for example, each widget produced generates 2 units (1/2 unit) of pollution then the tax in terms of units of pollution would be $\frac{1}{2}$ (twice) the tax in terms of widgets.
- As explained below, if there was **not** a one-to-one relationship between output and pollution, **efficiency could not be achieved by taxing widget production but could be by directly taxing the amount of pollution produced**
- One could imagine the resort bribing the factory if the factory had the right to pollute, or the factory paying the resort if the resort owned the river and lake.

- Draw a graph where the efficient amount of pollution from widget production is zero. This is the case where society banning the activity (e.g. banning the dumping radioactive waste out the door) is the efficient thing to do.³¹

Have them do this.

³¹ We have to be careful, the efficient amount of waste going out the door might be positive, if it is very expensive to keep the amount emitted to zero, and/or the radiation does not affect a lot of people or does not affect people until many years in the future.

Could we also achieve efficiency by paying (subsidizing) Penny and the firm to pollute less?

YES

But it would have to be structured as follows. The government agrees to give the polluter some amount of money if they pollute zero, but reduce this amount for each unit the firm pollutes.

The amount less per unit would be the tax that achieved efficiency.

So, this is effectively a pollution tax, after a lump subsidy is paid.

I made a very restrictive assumption in the Wungabunga example (and the cigar example)

I assumed a one-to-one relationship between widget production and the effect on the resort.

I made the same restrictive assumption when I assumed that the only way to reduce the amount of second-hand smoke Fred experiences is for Penny to smoke less.

That is, I assumed no *abatement technology*. I assumed pollution could only be affected by increasing or decreasing widget production.

That is the production function of pollution from widget production has only one input,³²

W

$P=P(W)$ the amount of pollution emitted depends only on the number widgets produced.

Note that this does not mean the production function is a straight line, it only means there is nothing that could change that would shift the line. It could look like

³² For Penny and Fred if there is no abatement potential in terms of the amount of second-hand smoke Fred experiences, S_F , the production function for S_F is $S_F=S_F(C)$ where C is the number of cigars that Penny smokes.

Alternatively, one might, more realistically, assume pollution is a function of widget production, W , and the amount of L and K allocated to *abatement technology*.

$P=P(W, K_a, L_a)$ where P is pollution and K_a is the amount of capital allocated to abating pollution.

Make sure you understand that K_a and L_a are in addition to the amounts of L and K used to produce W .

In this case, a tax on the amount of pollution, set at the correct amount, would still achieve an efficient outcome, but a tax on widget production will not generate the efficient outcome (the efficient amount of pollution, achieved efficiently). A tax on widget production gives the firm **no** incentive to hire L and K to abate the pollution. And when abatement is possible, efficiency typically requires that a positive amount of L and K be allocated to abatement.

Efficiency requires that there be the efficient amount of pollution and the reduction to the efficient amount be achieved in the minimum-cost way. The firm therefore needs two incentives: reduce their pollution to the efficient level and do so in the minimum cost way. If widgets are taxed instead of pollution, there is a widget tax that will cause the firm to reduce pollution to the efficient level, but the firm will do this only by decreasing W because that is the only way the firm can affect their tax bill.³³ The flaw is that reducing W might not be the cheapest way for the firm to reduce pollution. (It will be the cheapest if it is the only way.) But a per-unit tax on pollution rather than widgets

³³ Taxing widgets give the firm no incentive to hire L or K to abate pollution because they are not being taxed on the amount of pollution they produce.

can achieve both goals because it gives the firm the incentive to reduce pollution and it gives the firm the incentive to reduce the pollution in the minimum-cost way.

Did I make the same restrictive assumption in the Penny and Fred example? That is, did I assume that the amount of second-hand smoke that Fred consumes is only a function of the number of cigarettes that Penny smokes? What are the implications? (Would make a good exam question? Yes, it would)

For example, if Penny (or Fred) could reduce the amount of second-hand cigarette smoke Fred experiences by walking away (the amount of pollution Fred experiences can be reduced holding constant the amount Penny smokes, so there is the potential for abatement).

Consider the case where Penny could costlessly stay away from Fred.

A question: We have been talking a lot about market failures. List a set of conditions (maybe not feasible) under which there would be no market failures; that is, conditions under which the competitive equilibrium will be efficient.

1. Well-defined property rights for all scarce resources, including environmental and natural resources
2. Well-developed markets for all scarce resources
3. Complete sets of futures markets
4. All markets competitive as possible
5. Absence of external effects (hard to imagine)
6. Absence of public commodities (hard to imagine)

The first four on my list can be influenced by policy. With respect to the 5th, in theory if one could completely control, through property rights, the effects people have on each other, external inefficient external effects would be eliminated, but not external effects.

We cannot create a world where we do not affect one another.

Wrt the 6th, we can't make non-congestible goods congestible, and, even if we could, we would not want to. Could we solve the free-rider problem by figuring out ways to exclude

people from consuming the noncongestible good? Could doing this lead to more efficient levels of non-congestible goods?³⁴

In explanation, society can internalize externalities but cannot eliminate external effects, nor can it assume away public commodities.

And, as the planet becomes more populated (crowded) one would expect more and more external effects, for example, congestion effects.

³⁴ This is a tough question. Cable companies have figured out a way to make exclude people from watching non-congestible TV shows, you need the box that unscrambles the signal. However, while this caused the private company to produce a non-congestible commodity, it is inefficient to exclude those people who would value watching the show but have a WTP to watch that is less than the cost of cable. This implies that if we want the un-congestible good produced at the efficient level, the government needs to be involved if exclusion is possible.

Consider my experiences with Satellite radio in my car.

Note that efficiency does not imply happiness or well-being

We have talked a lot about how the market does or doesn't do a good job of efficiently allocating resources

We need to keep in mind what markets are. The market system is an institution that developed to allocate resources and allocate goods and service.

There are other institutions that have also evolved to allocate resources and distribute goods.

The government

The family

Centrally planned economies

Tribes

Dictators

The Church

They all have their advantages and disadvantages. Sometimes these other allocational mechanisms allocate efficiently, sometimes they do not; sometimes they do a better job of it than markets would.

Note that some of the largest centrally-planned economies are big corporations such as Google and Amazon. The market does not operate within a firm; within a firm, resources are allocated by command and control.³⁵

³⁵ Ronald Coase wrote a famous article about this.

How are resources allocated by the U.S. Federal government? Allocations are determined by the Executive Branch, the Legislative Branch, and the Courts, sometimes in agreement and sometimes in conflict.

While, ceteris paribus, more efficient is often better

If society **had to** choose between a specific efficient allocation that was very unfair and a specific inefficient allocation that was fairer, a welfare maximizing society might choose the inefficient allocation over the efficient allocation.

Demonstrate with a utility possibilities frontier.

And, sometimes more efficient just seems wrong

Consider a situation where polluting factories are uniformly distributed across rich and poor neighborhoods. It is likely the case that relocating all the ones in rich neighborhoods to poor neighborhoods would be efficiency increasing, but absent compensation for the poor neighborhoods many people would find this wrong.

End of the introductory stuff on market failures