Microeconomics with Ethics

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Chapter 24
Market Imperfections: Negative Externalities

One of the most important types of market imperfection is the case of externalities. Because externalities correspond to impacts that occur external to market activity itself, the standard perfect competition (PC) model assumes that market participants do not take these impacts into account when they make decisions. In essence, by not mentioning these potential effects, the PC model implicitly assumes the effects do not exist.

In this chapter and the next, we will begin with an otherwise perfectly competitive market and incorporate an externality effect. We will demonstrate how the inclusion of these effects will imply that the free market outcome is no longer economically efficient. This is the reason economists say that the market is imperfect, or that there is market failure.

We will also demonstrate how a government policy can be implemented to "correct" the market imperfection, thereby resulting in an improvement in economic efficiency. This means that government intervention can make the market better, or, make it succeed rather than fail. This represents another important justification for government economic policy (in addition to the provision of public goods (Chapter 22) and the regulation of common resources (Chapter 23)).

In this Chapter we will first give examples of the different types of externalities and then evaluate a market that contains a negative externality. We will also discuss government policies that can be used to improve economic efficiency. We will then highlight the importance of accurate measurement to assure effective government intervention by demonstrating what happens if policies are set at non-optimal levels. A compelling problem with government intervention arises because accurate measurement may be extremely difficult and require some unpleasant associations.

24.1 Externality Types

Learning Objectives

1. Learn the different types of externalities and why they are a market imperfection.
2. Learn the free market implications and the appropriate government response to different types of externalities.

An externality effect occurs whenever a production or consumption activity in a market spills over and has either a positive or negative impact on someone external to the market. Prime examples of externalities include air and water pollution, noise pollution, second-hand cigarette smoke, university research and education, and city architecture and landscaping.

Externalities can be classified into different types based, first, on whether the effect occurs because of production activities or consumption activities, and second based on whether the external effect is positive or negative. Table 24.1 below provides a few specific examples across these classifications.

Table 24.1 Externality Examples

Externalities	**Negative**	**Positive**
Production	Factory pollution Airport Noise	Pure research/education City Architecture
Consumption	Pollution by private cars Smoking in Public	Home landscaping Deodorant
Free Market Outcome	Over production/consumption	Under production/consumption
Corrective Policy	Tax	Subsidy

Negative production externalities include any production process that causes air or water pollution. This includes products like chemicals and steel, but also agricultural production that generates chemical runoff from fertilizer usage. Airplanes create noise in the vicinity of airports, which could be classified equally as a negative consumption externality because both production and consumption of travel services are occurring at airports.

Private motor vehicle use causing air pollution is a negative consumption externality, but the pollution caused by semi-trucks is a part of the production process and is therefore a production externality. Cigarette smoking in public places causes indoor air pollution in the process of consuming that good and is a negative consumption externality.

One of the best examples of a positive production externality is the scientific knowledge created in university research centers. These ideas are widely disseminated in academic journals and can provide insights for innovations in many different industries. Indeed, education services at many levels provide reading, writing, math and science skills, along with general knowledge about many other things which are useful for workers in a wide range of industries. Many jobs require a college education because businesses expect its skilled workers to have basic knowledge across a wide range of issues and more detailed knowledge in their major field of study.

Many city centers contain office buildings for workers that are designed by top architectural firms. Many of these buildings also have outdoor plazas containing artistic sculptures, fountains, and others attractive spaces. Since these production spaces are visited by tourists and enjoyed by city dwellers we can consider city architecture and design to be a positive production externality.

Perhaps the best example of a positive consumption externality is home landscaping. A home nicely adorned with trees, shrubs, and flowers can affect the property values of adjacent homes, thereby having a positive spillover effect for the neighbors. Deodorant usage is another consumption activity which we can all agree can have positive impacts for all those in the vicinity of its users, especially when in crowded places.

In the last two rows of Table 24.1 we show the key results when either negative or positive externalities prevail in a market. When the externality effect is negative, whether caused by production or consumption, the free market outcome will always be to overproduce, or overconsume, the product relative to what is ideal. To achieve the ideal, as we will demonstrate below, government can intervene by implementing a tax. When the externality effect is positive, whether caused by production or consumption, the free market outcome will always be to under-produce, or under-consume, the product relative to what is ideal. To achieve the ideal, as we will demonstrate in Chapter 25, government can intervene by implementing a subsidy.

Key Takeaways

1. There are four types of externality effects: negative production, negative consumption, positive production and positive consumption externalities.
2. A free market outcome will result in overproduction and overconsumption of goods with negative externalities.
3. A free market outcome will result in underproduction and underconsumption of goods with positive externalities.
4. Government intervention in the form of a tax can improve the market outcome when negative externalities are present.
5. Government intervention in the form of a subsidy can improve the market outcome when positive externalities are present.

24.2 Market Welfare with a Negative Externality

Learning Objectives

1. Learn to measure market welfare in the presence of a negative externality effect such as the pollution caused by gasoline consumption.

Consider the market for gasoline depicted in Figure 24.1. Assume that the market is perfectly competitive in that there are numerous suppliers of gasoline with market supply given by S and numerous consumers with market demand given by D. Recall that in a perfectly competitive market the supply function is derived from the marginal costs of the individual firms. As such, we can recognize that the vertical position of the supply curve represents the private costs borne by the firms to produce the product. This means that the intersection of supply and demand can be said to determine the private market price P_{pvt} and quantity Q_{pvt} which is what would arise in the market if we did not take account of the externality effect considered next.

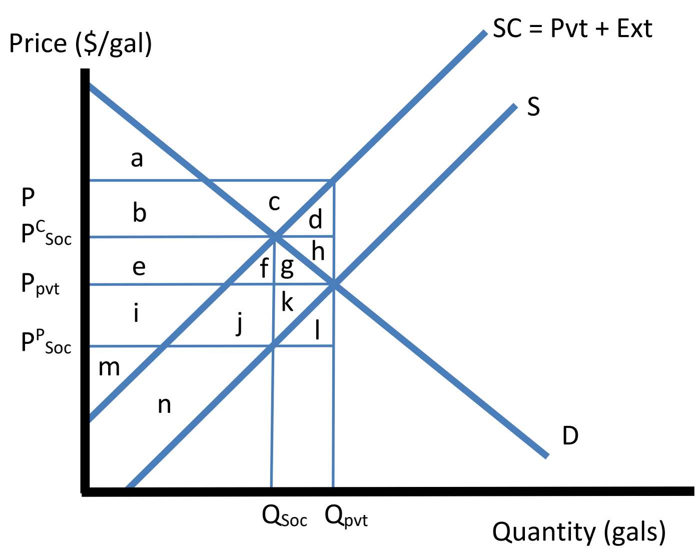
Let's suppose that the consumption of gasoline causes pollution which thereby generates negative health impacts on people in the community. These health impacts may include increases in respiratory illnesses resulting in more visits to doctors, greater usage of medications, greater hospitalizations, and even some early deaths due to complications. Air pollution can also cause reduced resistance to infections that may cause increases in some non-respiratory illnesses as well.

We will assume that these negative health effects are not experienced directly and noticeably by either producers or consumers of gasoline so that the effects are entirely external to the market. A counter-example may illustrate this point. Suppose instead the negative health effects directly impacted gasoline production workers, causing many to become seriously ill. In this example, the decline in worker productivity means the negative effects are assumed to be internal to the industry and thus profit seeking firms would have an incentive to find a resolution to the problem. However, when the negative effects are external to the market and do not affect either the producer and consumer decisions, then profit seeking firms and utility seeking consumers will be inclined to ignore these external effects. This is the reason a free market can fail to produce the best outcome.

Suppose these negative health effects, which we will call external costs, can be accurately measured and denominated in dollar terms per gallon of gasoline consumed in the market. For example, if the external costs were $0.50 per gallon and the quantity consumed were 10 million gallons, then the total external health costs would be $5 million. This makes the health costs a variable cost, because they increase as the total quantity consumed increases. This makes sense because we should expect health costs to rise with increases in pollution.

In Figure 24.1, we plot a Social Cost curve, SC, which is the vertical sum of the private costs incurred by firms in production, Pvt, (this is the market supply curve) and the external health costs, Ext. Thus, SC = Pvt + Ext.

Figure 24.1 Market Welfare with a Negative Externality



The Social Cost curve is not a supply function. Instead it is a curve intended to represent the total cost to the entire society of producing and consuming varying amounts of gasoline. We can use this curve to determine the optimal level of gasoline production. That quantity is found at the intersection of SC and the demand curve, because, at this quantity, Q_{Soc}, the marginal social cost is equal to the marginal social benefit.

Side Note: Although we are illustrating the effects of a negative consumption externality, this same analysis applies to a production externality. The social cost curve construction is merely a way to represent these external costs on the same diagram where the private consumption and production decisions are displayed. For this point to be true we also require that this be a closed market so that domestic production always equals domestic consumption. The analysis would differ between production and consumption externalities if the market were open to international trade.

This outcome comes from a mathematical exercise in which we maximize total social welfare while incorporating simultaneously all of the benefits that arise in consumption and production and all of the negative external health costs that are caused to others from this market activity.

The problem with negative externalities is that the free market outcome will generate an output level of gasoline that is excessive, namely $Q_{Pvt} > Q_{Soc}$. To see why, let's first use Figure 24.1 to determine total social welfare in the free market equilibrium and then show how intervention in the market can achieve the socially optimal outcome.

Market welfare in the free market equilibrium is the sum of consumer and producer surplus minus the negative health effects and is summarized in Table 24.2. The free market price and quantity is P_{Pvt} and Q_{Pvt}. Total consumer surplus is given by area a + b + e + f + g. Producer surplus is given by area i + j + k + m + n. The total external cost is found as the product of the per gallon externality cost and the quantity consumed in the market, Q_{Pvt}. The per gallon cost is the vertical distance between S and SC, which at Q_{Pvt} equals $P_H – P_{Pvt}$. Multiplied by Q_{Pvt} yields area - (b + c + d + e + f + g + h).

However to simplify the evaluation we will note that the per gallon cost at Q_{Soc} equals $P^C_{Soc} – P^P_{Soc}$. Thus, $P_H – P_{Pvt} = P^C_{Soc} – P^P_{Soc}$. Thus, the externality cost can also be written as area – (e + f + g + h + i+ j + k +l).

Market welfare equals the sum of these three effects. Notice that areas (e + f + g + i + j + k) cancel out yielding total market welfare of area + (a + b + m + n) – (h + l).

Table 24.2 Welfare in a Free Market Equilibrium with a Negative Externality
CS = a + b + e + f + g
PS = i + j + k + m + n
Externality Effect = - (e + f + g + h + i+ j + k +l)
MW = (a + b + m + n) – (h + l)

The sign for total market welfare is ambiguous because there are both positive values and negative vales included. In this particular diagram it is visually clear the positive areas are much larger in size than the negatives and that is certainly one plausible outcome. That means in this case, the benefits that accrue to the market participants outweigh the costs borne externally by others. In other words, it is overall better to produce and consume the product despite the negative effects.

However, as we'll see later, it is also possible for the reverse outcome to arise, where external costs exceed the benefits. In this latter situation, the external damages overwhelm any positive effects from the market activity.

Key Takeaways

1. Welfare in a market with a negative externality is measured as the sum of consumer and producer surplus minus the negative effects to others caused by the externality.
2. Market welfare has both positive and negative components and as such can take either a positive or negative value.
3. If market welfare is positive, then the advantages that accrue to consumers and producers of the product outweigh the costs borne by those who suffer the negative externality effects.
4. If market welfare is negative, then the advantages that accrue to consumers and producers of the product are outweighed by the costs borne by those who suffer the negative externality effects.

24.3 The Optimal Tax to Correct for a Negative Externality

Learning Objectives

1. Learn to evaluate the welfare effects of an optimal tax in the presence of a negative externality.

Next we'll consider a method to induce the optimal level of production and consumption. That optimal level occurs at the quantity Q_{Soc}. The easiest method to achieve that output level is with a tax on either production or consumption. Recall, that in a competitive market it won't matter on who the tax is assessed because the effects will be the same. Drawing on the results from Chapter 17, a tax set equal to the difference between P^C_{Soc} and P^P_{Soc}, that is a tax, $T = P^C_{Soc} - P^P_{Soc}$ will reduce the quantity produced and consumed to Q_{Soc}. The tax will raise the price to consumers to P^C_{Soc} and lower the price received by producers to P^P_{Soc}. Note that the tax is also equal to the size of the per gallon externality effect since was what caused the vertical shift establishing the social cost curve.

Table 24.3 Welfare Effects of an Optimal Tax Correcting a Negative Externality	
Surplus Levels after Tax	**Surplus Changes**
CS = a + b	ΔCS = - (e + f + g)
PS = m + n	ΔPS = - (i + j + k)
GR = e + f + i + j	ΔGR = + e + f + i + j
Externality Effect = - (e + f + i + j)	ΔEE = + g + h + k + l
MW = a + b + m + n	ΔMW = + h + l = h + d

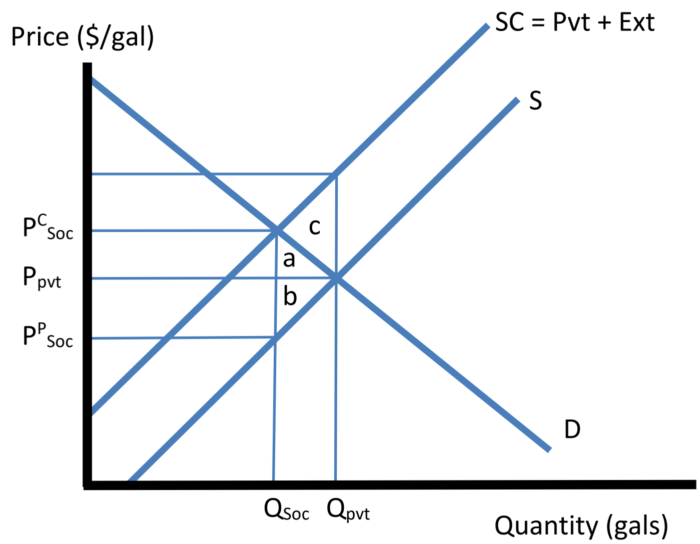
In Table 24.3 we summarize the after-tax surplus levels in the left-side column and the changes in surplus due to the tax in the right column. Keeping track of the effects is a bit cumbersome with so many areas, but the results narrow to a few important points.

First, note that since the optimal tax equals the per unit negative externality effect, government revenue from the tax equals the leftover negative effects of the pollution, shown in the first column. That means that the government could apply that revenue directly to cover the costs caused by pollution rather than spending it on general public goods. In this way, the government could directly compensate those negatively affected and pay their extra costs, implying there are no net damages from the pollution.

Second, note that if we add up the surplus changes in the first three rows on the right, we will be considering only the effects of the tax, which generates a net effect of area – (g + k). These are the deadweight losses, or market inefficiencies, caused by any tax in a competitive market. However, the tax now has the secondary effect of reducing the costs of pollution by area g + h + k + l. This is listed as a positive effect because reducing a cost is beneficial. The net effect is positive because the reduction in pollution is larger than the deadweight losses, leaving a net welfare benefit of area (h + l). This is unambiguously positive meaning that an optimal tax applied to correct for the negative externality actually raises market welfare. In other words, the tax improves economic efficiency by correcting for the negative externality.

There is one other small adjustment made in the net welfare effect. Because SC and S have identical slopes by assumption, area l equals area d in Figure 24.1, which enables us to denote the final net welfare effect as + (d + h). These net effects are summarized and simplified in Figure 24.2 with the areas relabeled. In this simpler version, areas a + b represent the deadweight losses caused by the tax and area c corresponds to the net positive improvement in market welfare. This simplified diagram is very helpful if asked to quickly identify the final impacts of an optimal tax in this situation.

Figure 24.2



Finally, the fact that the tax is optimal means that the net welfare effect, area c, is the largest obtainable with any size tax that might be applied. If the tax were set a little higher or lower, net welfare would remain positive, but the size of the welfare improvement would be slightly smaller than area c.

There is an important implication to consider here. We have shown that a tax can improve market efficiency and that opens up a role for government policy. In the presence of a negative externality, applying the optimal tax is better than allowing the private market to operate unhindered. In other words, government intervention is better than free markets. However, there is an important caveat that we consider next.

Key Takeaways

1. The optimal tax to correct for a negative externality is that tax which generates the optimal quantity that equalizes marginal social cost with marginal benefit.
2. The optimal tax that corrects for a negative externality redistributes income. Consumers and producers lose, the government collects more revenue helping taxpayers, and those injured due to the negative external effects and made better-off due to the reduction in these effects.
3. Market welfare, economic efficiency, improves when an optimal tax is set to correct for a negative externality.
4. An optimal tax to correct for a negative externality is an example of a welfare improving (efficiency improving) intervention by government.

24.4 Issues with Measuring the Externality Effects

Learning Objectives

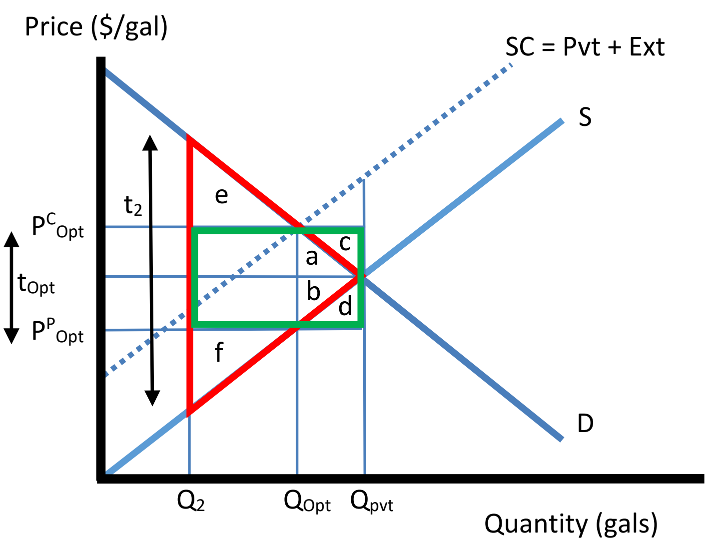
1. Learn why accurate measurement of the externality and market effects is important in determining the optimal tax to correct for a negative externality.
2. Learn the conditions necessary for a production or consumption ban to be optimal in the presence of a negative externality.
3. Learn why it is necessary to place an economic value on human life.

In order for government intervention to be the better outcome, government policymakers must be able to measure the market effects accurately. Our conclusion here isn't that government intervention is always better in the presence of a negative externality. Instead, the conclusion is that government intervention is better only if there exists an optimal tax (or something close), and if can be identified. But what if the optimal tax cannot be easily identified? One possible outcome is that efficiency is improved, only not by as much. Alternatively, if the tax widely misses the mark, it could actually makes things worse. We'll illustrate that outcome next.

Effects of a Non-Optimal Tax to Correct a Negative Externality

We use Figure 24.3 to compare the welfare effects of an optimal tax, t_{Opt}, versus a tax that is set at a much higher, non-optimal, level, t_2. The optimal tax would reduce output to the optimal level, Q_{Opt}, the level the equalizes the Social Cost and Market Demand.

Figure 24.3 Effects of a Tax Set Higher than the Optimal Tax



The welfare impact of the optimal tax is summarized in Table 24.4. The pure market net welfare effect establishes the deadweight losses, - (a + b), that accrue because of the tax. This is derived from the sum of changes in consumer surplus, producer surplus and government tax revenue. The externality effect, +(a + b + c + d), measures the benefits that accrue due to the reduction in pollution. The overall market efficiency effect adds these two together the get the positive area c + d.

Table 24.4 Comparing Net Welfare Effects: Optimal Tax vs. Non-Optimal Tax		
	Optimal Tax (t_{Opt})	**Non-Optimal Tax (t_2)**
Pure Market Net Welfare Effect	- (a + b)	- (Red Triangle)
Externality Effect	+ (a + b + c + d)	+ (Green Rectangle)
Overall Market Efficiency	+ c + d	c + d - e - f

However, when a non-optimal tax which is much larger is set, such as t_2, gasoline output is reduced to Q_2. The pure market net welfare effect, or deadweight losses, is now represented by the red triangular area in Figure 24.3. The externality effect, is now given by the green rectangular area. Notice that both of these impacts are much larger in overall magnitude. The larger tax does reduce pollution by much more than the optimal tax, but it also creates much larger deadweight losses. The overall market efficiency effect adds these two effects together to get the area (c + d) – (e + f). In general, this effect is ambiguous in sign because it will depend on the sizes of these areas. However, for the particular case depicted in Figure 24.3, clearly area (e + f) is larger than area (a + b) and therefore market efficiency is reduced. The particular case establishes a truth though, namely, that it is possible to overtax a product and leave the market participants worse off than they would be if the tax hadn't been implemented.

Now of course, those individuals who suffer the negative effects of pollution would prefer to have the higher, non-optimal, tax. Gasoline consumers and producers, on the other hand, would prefer to have no tax. Thus we have an issue rife with controversy with different interest groups preferring diametrically opposed policies.

What economic models offer is a way to balance these interests in order to achieve the best overall outcome while weighing the interests of opposing groups equally. One might ask how it is that this method weighs the interests equally. That's because we are converting all costs and benefits into dollar terms and in essence determining that policy that maximizes the number of dollars in circulation regardless of who receives them. That's another way to think about what it means to maximize economic efficiency.

However, in order to get this right, we have to be able to measure the costs and benefits accurately. We'll have a bit more to say about that later, but first, let's consider one other possible outcome that can arise in the presence of a negative externality; the case in which an outright market ban is optimal.

When is the Optimal Level of Pollution Zero?

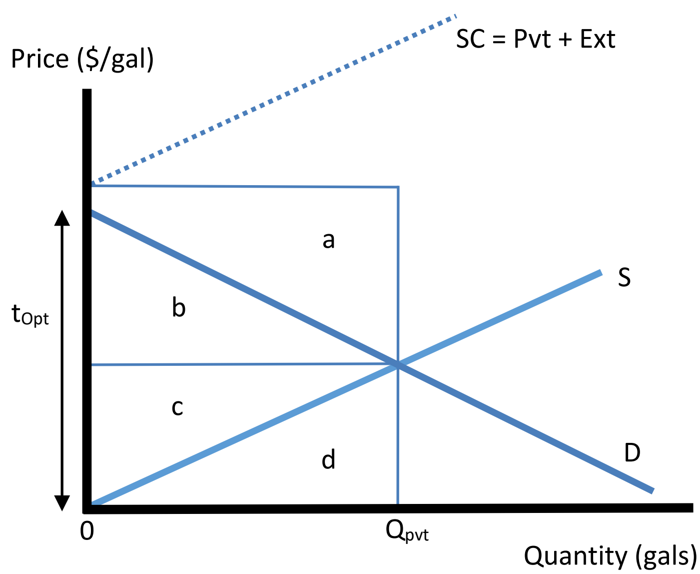
For those who are very concerned about environmental outcomes, it may seem obvious that because production and use of some products cause pollution and because pollution has damaging effects for some groups of people, the ideal solution may seem to be to eliminate the pollution. However, as the previous exercise suggested, it is important to recognize the positive effects the polluting product has on consumers and producers and to weigh that against the negative impacts of pollution. When that is done, the optimal outcome may not be to eliminate the polluting activity but rather to reduce it somewhat while allowing some pollution to continue. That is the solution described above. In that case, gasoline usage was reduced with the tax until the additional damaging effects to the market participants exactly balances the addition positive benefits occurring because of the reduction in pollution. Any increase in the tax beyond the optimal level will cause more harm than good. This means that the optimal level of pollution is not zero, but is positive instead.

However, this outcome depends critically on the nature of the costs and benefits accruing to the different parties at different tax rates. If we adjust these costs and benefits, it becomes possible to construct an alternative example where the optimal level of pollution is zero.

Consider the supply, demand and social costs curves presented in Figure 24.4. Suppose the product in question is *leaded* gasoline. Lead was once added to gasoline as an anti-knocking agent which improved engine efficiency. However, in the 1960s it was discovered that lead in the environment has very damaging effects, especially for children. Within a few decades countries began to ban leaded gasoline because of these damaging effects.

What's different in this situation is that the negative external effects of lead pollution is presumably very high. To reflect that, suppose the social cost curve is so high that it does not even intersect the market demand curve. As a consequence the optimal output becomes zero. To see why we can evaluate the welfare effect of a production ban given these circumstances. A production ban is a government restriction on all production or consumption of the product within the country. Not only are production and consumption of the good illegal, but there will typically be heavy penalties for violators who are caught and prosecuted.

Figure 24.4 Optimal Pollution is Zero



A production ban is a government restriction on all production and consumption of the product within the country. Although the ban eliminates all producer and consumer surplus for this particular product, the cost to the market participants is not likely to be too high in this case because there are alternative anti-knocking agents that can be used and the ban does not prevent the use of unleaded gasoline.

The changes in welfare are summarized in Table 24.5. Note the welfare impact for both consumers and producers is negative. However, the positive health impact from eliminating the harmful effects of lead in the environment are much larger than the losses to producers and consumers combined. The net market welfare effect is a positive a + d, which means the production ban unambiguously improves market efficiency.

Table 24.5 Effects of a Production Ban
ΔCS = - b
ΔPS = - c
ΔExternality Effect = + (a + b + c + d)
ΔMW = a + d

Because zero output is the optimal quantity in this case, this increase in market welfare is larger than any increase that would occur with, for example, a very large tax that allowed some leaded gasoline use to continue. Most importantly though, we have demonstrated a case where zero pollution is the best policy choice.

We have also illustrated further the need for accurate measurement. To know what the best policy is one must be able to measure the costs and benefits and weigh them against each other. Although it is often true that the measurement of complex relationships such as these are difficult to assess, making the best assessment possible with available data and knowledge has a better chance of success than mere guessing.

Here, it is important to point out that economic evaluations of market costs and benefits are always uncertain and are usually uncertain by an uncertain amount. The simple reason is that the economic system is very complex, constantly changing, and difficult to measure with precision. As a result, to get anywhere close to a reasonable economic estimate requires making many assumptions, the accuracy of which the researcher will never know for certain are correct. As a simple example, the cost/benefit calculations above will require knowledge of the slopes of the supply and demand curves so that surplus change calculations can be made. Usually this will involve estimating demand and supply elasticities in the market. The data to make these estimates, however, might be 10 – 20 years old. Thus, to make a surplus assessment today, the researcher will assume that the elasticities derived using earlier data continue to be valid today. This is a reasonable assumption because the researcher has no data from today to judge whether this is true or not and there is no better way to make the assessment.

In a typical cost/benefit calculation a researcher will have to make dozens of assumptions like these to conduct the evaluation. When it comes to monetizing the externality effects it will be even more difficult to measure these accurately and there will be typically be several different techniques that could reasonably be used to determine these values. Different researchers may have different opinions about which technique is best. This matters especially when the results differ widely across different techniques.

The point here is that one should never consider an empirical economic evaluation to be more than an educated, or informed, guess. Also, for especially contentious issues, as for example the minimum wage debate discussed in Chapter 20, there will often be multiple educated guesses about the expected effects, each with a different conclusion. Thus, the best course of action as an outside observer of these technical debates is to recognize that there is significant uncertainty and be careful not to proclaim any answer as the final truth of the matter.

Researchers should make different reasonable assumptions and debate what are the best empirical techniques to use to get closest to the correct answer. When that process leads to something close to agreement, or consensus, then conclude that the uncertainty is low for that issue. When there are widely different claims as to the best policy, though, one should recognize that there remains a considerably larger degree of uncertainty. A practical conclusion in this instance is that the likelihood that any policy proposal will work as intended, is directly related to the degree of uncertainty regarding the empirical measurements.

What if the Evaluation requires measuring the value of a human life?

For some social and economic policies, the negative external effects are not just inconveniences but instead are so severe that human lives may be jeopardized. Indeed, in both examples above the pollution effects involved human health which in some cases may involve loss of lives.

Many people believe that human life is invaluable; that you can't put a price, or dollar value, on human life. Indeed, many look skeptically at economic analyses that make estimates of how costly it is if human life is lost. And yet, many economic policy decisions today require calculations that do indeed put a value on human life. A quick internet search will reveal the value of a human life in the US today is estimated to beabout $10 million.

To convince you that this is a useful and even necessary calculation to make, consider the following story. Every year on US highways approximately 40,000 people are killed in traffic accidents. The main causes of these accidents include distracted driving, speeding, and intoxication. The losses of so many lives is a tragedy and it would certainly seem worth it to identify some government policy that could reduce or even prevent these deaths. If one believes that each one of these lives lost is truly invaluable, then it would make sense to consider anything and everything that could secure a notable reduction in highway fatalities.

Consider then the following policy proposal based on some empirical evidence. During the 1970s, the US Federal government implemented a national maximum speed limit of 55 miles per hours on all US highways. The purpose of the limit was to reduce gasoline consumption in the wake of the international oil shortages at the time. However, the speed limit had an unintended positive effect, it reduced annual traffic fatalities by approximately 7,000 per year. (See https://rosap.ntl.bts.gov/view/dot/16505/dot_16505_DS1.pdf). But 7,000 is only a fraction of the total lives lost each year so suppose the government implements a much more restrictive national maximum speed limit, say 20 miles per hour. The logic is simple; even if two cars crashed head on at 20MPH it is unlikely to cause a fatality, especially with today's airbag technology. Distracted drivers who veer off the road may cause some property damage, but the likelihood of lost lives would be near zero. Now of course, it is unlikely that the driving population would adhere to these strict limits. It is very common in the US for drivers to drive 10-20 miles per hour over the current limit. To prevent such an outcome this new legislation would require strict enforcement. Perhaps speed cameras could be placed on many roads and large increases in traffic police could be used to enforce this law. Very high penalties for violators could dissuade most everyone from driving over the limit. The result would be to save 40,000 lives per year. The solution seems so easy and obvious, so why not do it? The answer must be, because it's too costly.

Think of the costs of such a low speed limit. Transportation times and costs would rise considerably. Fruits and vegetables might not make it fresh to the market, or to assure its freshness many more refrigerated vehicles would be needed. The entire production process across the economy would slow down. Products would have to be made much further in advance to assure delivery to their final destinations. Recent innovative services, like next day delivery for online purchases, might revert to next month deliveries instead. And finally there are the enforcement costs. The speed cameras and extra traffic police would have to be paid out of government budgets and financed by taxpayers. Added up, these costs would be extremely high.

If people really and truly believed that life is invaluable, that no dollar value should ever be put on a human life, then that belief should be reflected in their actions. People should be petitioning government to act to make these low speed limit laws a reality. People should be holding rallies and sending their legislators emails insisting that something be done to save these lives of infinite value. The fact that people do not do this, means they have each determined that it is not individually worth it to do so. The cost to them is not worth the benefit to be obtained by their action. The implication must then be that the benefit, that is, the value of 40,000 human lives, is not infinite. These lives have some value that Americans are willing to sacrifice in order to achieve all of the benefits that result from rapid transportation.

Notice in this hypothetical example I have not suggested what that value of human life is, only that people behave as if it has some value. That value might be very high, but it is not high enough to induce people to action.

Hopefully this thought experiment convinces you that human life has a value. Hopefully the previous cost benefit analyses with negative externalities will convince you of the practical policy applications to determine the best policies to apply. What this exercise should not convince you of, is what precisely is the value of a human life? How to measure this is can be highly contentious and worthy of continuing evaluation and discussion. This is the area where there can be reasonable disagreements among researchers and policymakers. For example, should one consider the value of a young person to be higher than the value of an elderly person. In some areas we clearly make this distinction, as when younger patients are given higher priority for organ transplants. However, in most other economic analyses the value of a human life is considered the same regardless of how old the individual is. There are lots of interesting issues to consider but these are beyond the scope of this text. For a good overview of some of these kinds of measurement issues see this NPR Episode of Planet Money titled, Lives vs. the Economy. It features a discussion with several economists concerning the history of human life valuations in economic decision making and examines the appropriateness of government decisions to close down entire economies in the wake of the 2020-2022 Covid pandemic.

Key Takeaways

1. When there is a positive optimal tax to correct for a negative externality, a tax set too high may reduce market welfare.
2. When the negative externality effects are very large, the optimal quantity will be zero. In this case a production/consumption ban is the optimal policy.
3. Determining the optimal tax in the presence of negative externality effect requires accurate measurement of the externality effects and the market parameters.
4. Because many negative externality effects involve potential losses of human life, human life must be given an economic value to determine optimal policies.
5. Measurements of market and externality effects are only estimates that are often contentious. Different researchers can make different assumptions and derive different estimates. Due to the complex nature of these relationships, every estimate is uncertain, usually to an uncertain degree.