

CHAPTER 4

MARKETS AND GOVERNMENT



What's in It for You?

So far, we've discussed freely functioning competitive markets where prices and quantities of goods produced and consumed are determined only by the forces of demand and supply. The reality is, however, that in all modern economies governments intervene in markets. The ways and degree of that intervention and the economic role of government in general is the subject of hot political debates. Different schools of economic thought have different views on these issues too. But there are certain things about government economic policies on which most economists agree.

In this learning module, we examine how government interventions affect market outcomes and economic efficiency. We start with a discussion of price controls, which are legal restrictions on how high or low the price of a good may go. A maximum price that sellers can legally charge is called a price ceiling, and a minimum price below which exchange between buyers and sellers is illegal is called a price floor.

For instance, a price ceiling that is perhaps most well-known is rent control, i.e. when a local government puts a cap on monthly rent for apartments. The intention is to make rental housing more affordable, a rent ceiling may sound like a good idea. But will it really benefit tenants? How will it affect the availability of affordable housing? The economic efficiency of the market? The most hotly debated price floor is the minimum wage, which is essentially the lowest price of labor that employers must pay. The intention here is to help the working poor make ends meet and decrease income inequality. But do the minimum wage laws really make workers better off? We address these questions.

Then we turn to a government intervention that does not directly sets prices but influence the market equilibrium through shifting either the demand or the supply curve. Specifically, we discuss excise taxes, i.e. taxes imposed on a particular good or service. We examine how an excise tax on sellers or buyers of a good influences its equilibrium price and quantity. An important question here is, who actually pay the tax? The buyers or the sellers? For example, the gasoline tax is levied on sellers of gas (i.e. gas stations are responsible for sending the tax money to the government). Does this mean gas sellers pay the whole tax? Or do they pass it on to buyers by charging a higher price? You will learn how to figure out who actually pays the tax. You will also see how taxes affect economic efficiency of competitive markets.

Finally, as we've noted in Chapter 2, competitive markets can only be economically efficient if no externalities are generated by production or consumption of the good. Recall that an externality is a cost or benefit resulting from production or consumption of a good that is imposed on someone other than its buyers or sellers. An example is a paper mill that pollutes

the nearby river with toxic chemicals, imposing costs—such as health problems, contaminated drinking water, and dead fish—on people and businesses downstream. Free markets fail to account for these external costs. We show how government intervention can help reduce the adverse effects of market failures due to externalities.



Learning Objectives

At completion of this learning module you are expected to be able to:

- Explain the concepts of price ceiling and price floor and show the effects of price controls on the market outcomes and economic efficiency
- Explain the concept and purposes of excise taxes, show the effects of an excise tax on the equilibrium price and quantity of the good and on economic efficiency, determine the tax incidence and explain the factors that influence it
- Explain the concepts of negative and positive externalities and show how external costs and benefits make unregulated competitive markets inefficient
- Show how in the presence of external costs, an excise tax can make the market more efficient

4.1 Price Controls

As we mentioned above, price controls are government regulations that restrict market prices. There two kinds of price controls: a price ceiling, a maximum price sellers can legally charge for a good or service and a price floor, a minimum price buyers are required to pay for a good or service. Let's start with price ceilings.

Price Ceilings

A **price ceiling** is a *maximum* legal price in a market: the highest price that sellers can legally charge. For a price ceiling to be effective, the government agency that establishes it must also have the authority to take action, such as fines or jail time, against sellers who charge a price that's higher than the price ceiling.

In the United States, price ceilings have been proposed for a number of goods and services, for example, prescription drugs, doctor and hospital fees, the charges made by automatic teller bank machines, and auto insurance rates. And they could be relatively easily implemented in those and other markets, but it's rarely done. One exception is **rent controls**, which are price ceilings imposed on the markets for rental housing. Rent controls exist in large cities, such as New York City, San Francisco, and Washington DC. They could, however, be applied to any local housing market.

Note that for a price ceiling to affect the market outcome, it must be set *below* the market equilibrium price. Since sellers are allowed to charge a price that is lower than the price ceiling, when the price ceiling is set above the equilibrium price, market forces will drive the

price down to the equilibrium price and the price that is actually charged will be the market equilibrium price. That is, the price ceiling will not affect the market outcome.

Consider the market for rental housing in the imaginary city of Mountain View shown in Figure 1-a. To keep our analysis simple, let's assume that all apartments are exactly the same and therefore would rent for the same price. Initially, the equilibrium rent is \$600 per month, and the quantity of apartments rented at this price is 50,000 units (point E_1). Then, local businesses expand rapidly, bringing more people into the city, so the demand for rental housing shifts from D_1 to D_2 . As a result, with the current rent of \$600 per month, the quantity of apartments demanded is 130,000 units now, while the quantity supplied remains at 50,000 units. That is, there is an excess demand of 70,000 units. As we could see in Chapter 2, in an unregulated market, as buyers bid up the price, it will keep rising until the quantity demanded equals the quantity supplied so that the excess demand disappears and the market is in equilibrium again. In Figure 1-a, this happens at point E_2 , where the rent is \$800 per month and $Q_D = Q_S = 90$ thousand units.

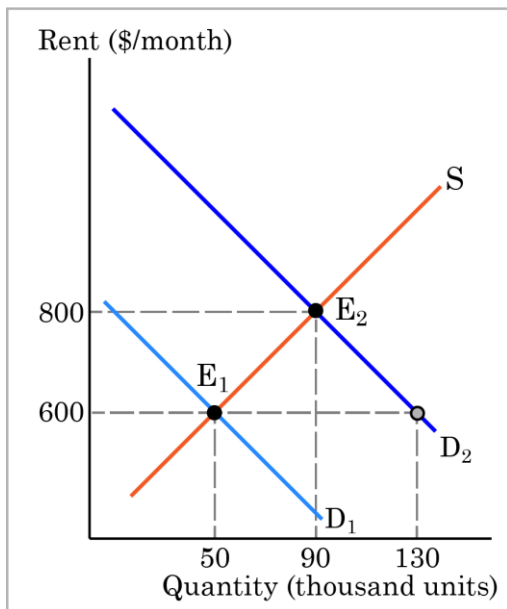


Figure 1-a An increase in the demand for housing

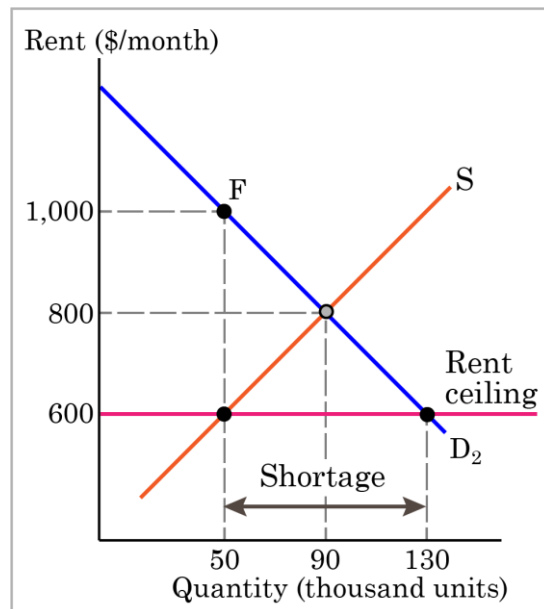


Figure 1-b A rent ceiling

But suppose that the city council decides that a rent of \$800 per month is unaffordable to many people who would like to live and work in the city. So the city government implements a rent ceiling at \$600 per month. The results are shown in Figure 1-b. Since the rent is no longer allowed to adjust to the equilibrium level, it remains at \$600, so the quantity of apartments demanded stays at 130,000 units, while the landlords are willing to supply only 50,000 units at this price. That is, the excess demand of 80,000 units now becomes a persistent shortage of rental housing.

Does the rent control accomplish its purpose to make housing more accessible to lower-income tenants? Note first that although some tenants are able to rent an apartment at a lower price (\$600 per month instead of \$800 per month), the quantity of units available is less than it would be if the market were in equilibrium (50,000 units compared to 90,000 units).

Second, since the desires of buyers and sellers are not synchronized at the rent ceiling, if the government succeeds in enforcing it, some *nonprice rationing* scheme must be used to determine who gets an apartment and who doesn't. Apartment owners could make the units available on a first-come, first-served basis, in which case long waiting lists would form. Other possibilities would be for government to establish priority structures, with some potential tenants being permitted to rent and others being denied that opportunity.

The irony here is that government imposed the rent ceiling to protect consumers from the hardship of high prices, but the result is that many of them have to deal with the hardships that result from the shortage of housing: wasting time and money on long commutes to work from places where housing is available, filling out forms in an attempt to meet some arbitrary government criteria required to get an apartment, or simply giving up the opportunity to and work in the city. Frustrated housing seekers will spend considerable amounts of time on networking, web searches, scanning the local newspaper ads, etc., desperately trying to find ways to get an apartment closer to the area and then racing to be first when hearing any breaking news of such an opportunity. If we include the opportunity cost of the time spent on all these activities (which, as we showed in Chapter 1 we should), the actual cost of rental housing in Mountain View to consumers is likely to be well above the rent ceiling and even above the free-market rent.

As shown in Figure 1-b, with the rent ceiling in effect, only 50,000 units are available. This quantity corresponds to point F on the demand curve, which means consumers are willing to pay \$1,000 per month to rent an apartment. This amount can be viewed as the **full economic price** paid by consumers, which equals the amount explicitly paid for the apartment (the rent ceiling of \$600) plus the implicit amount paid through the opportunity cost (\$400), which can be called the **nonpecuniary price**. As you can see in Figure 1-b, the full economic price of an apartment in Mountain View (\$1,000) exceeds the free-market equilibrium rent (\$800).

Since in the presence of a binding rent ceiling the potential tenants are willing to pay higher prices than the controlled rate, if the government fails to strictly enforce the rent ceiling, black markets may develop where the price could be as high as the full economic price. A **black market** is a market where goods or services are sold illegally. For example, illegal side payments to landlords, known as “key money” (exorbitant prices that tenants pay “for new locks and keys”) are common in rent-controlled cities. Another form of a black market is informal (i.e. unregistered) subletting for a price above the rent ceiling.

To quantify the effects of a price ceiling on buyers, sellers, and society as a whole, as well as on the market efficiency, let's use the concepts of consumer surplus, producer surplus, total social surplus, and deadweight loss that we presented in Chapter 2. Figure 1-c shows the effects of the rent ceiling in Mountain View. With no rent ceiling—i.e. when the market is in equilibrium with the rent of \$800 per month and 90,000 units rented—the consumer surplus (CS) is the triangular area A+B+C, which equals

$$CS = (\$1,250 - \$800) \times 90,000 / 2 = \$20.25 \text{ million}$$

the producer surplus is the triangular area E+D+G, which equals

$$PS = (\$800 - \$350) \times 90,000 / 2 = \$20.25 \text{ million}$$

and the total society surplus generated in the market for rental housing is

$$TS = PS + CS = \$20.25 \text{ million} + \$20.25 \text{ million} = \$40.5 \text{ million}$$

With the rent ceiling in effect—i.e. when the rent is \$600 per month and 50,000 units are rented, the consumer surplus is the trapezoid area A+B+E, which equals

$$CS_C = [(\$1,250 - \$600) + (\$1,000 - \$600)] \times 50,000 / 2 = \$26.25 \text{ million}$$

and the producer surplus is the triangular area G, which equals

$$PS_C = (\$600 - \$350) \times 50,000 / 2 = \$6.25 \text{ million}$$

and the total society surplus is

$$TSC = PS_C + CS_C = \$26.25 \text{ million} + \$6.25 \text{ million} = \$32.5 \text{ million}$$

As you can see, the rent ceiling transfers part of the producer surplus (area E = $\$200 \times 50,000 = \10 million) to consumers, but the overall consumers' gain ($\$26.25$ million – $\$20.25$ million = $\$6$ million) is less than the overall producers' loss ($\$20.25$ million – $\$6.25$ million = $\$14$ million) because parts of both consumer and producer surpluses (area C and D) are lost because of the under-consumption and under-supply of housing due to the rent ceiling. That is, the rent ceiling reduces the total society surplus by the amount of the deadweight loss, i.e. area C+D, which is

$$DWL = (\$1,000 - \$600) \times (90,000 - 50,000) / 2 = \$8 \text{ million}$$

You might say, “OK, I can see that the rent ceiling in Mountain View causes an overall economic efficiency loss, reducing the total society surplus by \$8 million. But tenants, the poor, still benefit, and they benefit at the expense of landlords, the rich, as the consumer surplus increases by \$6 million.” This, however, is not correct for several reasons.

First, note that we calculated the consumer surplus with the rent ceiling based only on the explicit legal price that tenants pay. However, as we discussed above, consumers also pay the opportunity costs of time wasted on search activities and of troubles associated with the shortage of housing. And some of them may end up paying the higher black-market price. In Figure 1-c, the potential loss of consumer surplus due to these circumstances is shown by area B+E. That is, if we took into account the full economic price of an apartment given the quantity of units available when the rent ceiling is in effect, the consumer surplus would be reduced to just area A, that is to

$$CS_{CF} = (\$1,250 - \$1,000) \times 50,000 / 2 = \$3.125 \text{ million}$$

Second, the enforcement of the rent ceiling may be costly to the government, so the renters' surplus is likely to be further reduced because of higher local taxes they would probably have to pay to cover those costs.

Third, we have assumed in the foregoing discussion that the quality of goods and services produced remains the same when price controls are established. This is not generally the

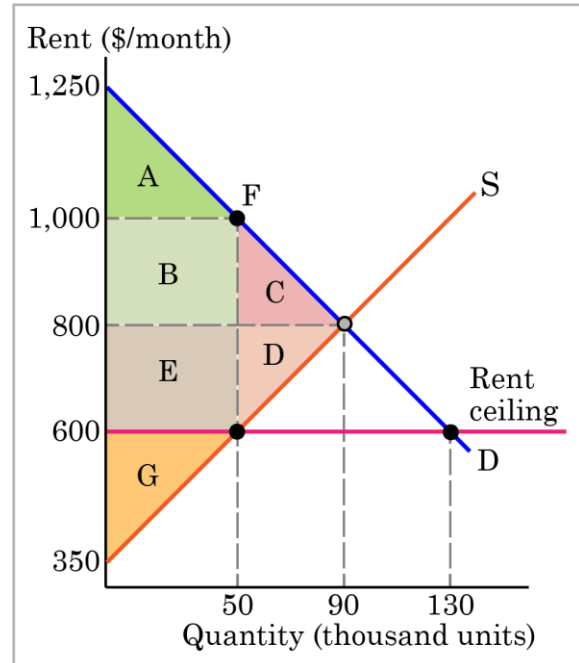


Figure 1-c The welfare effects of a rent ceiling

case, as landlords have little incentive to maintain rental property. Excess demand for apartments at the controlled price makes it possible to obtain tenants even if the unit deteriorates. Thus, regulations that prevent prices from adjusting to equilibrium levels cause predictable changes in quality. Landlords tend to spend less on maintenance and on essentials like heating, cooling, hot water, and lighting. So, when renters get “cheaper” housing than the market requires, they tend to also end up with lower quality housing. Markets can clear at lower prices if quality is reduced to a sufficiently low level. In addition, renters (or potential renters) lose their housing as landlords convert apartments to co-ops and condos.

Finally, as experience with rent controls in cities as diverse as New York City; Lisbon, Portugal; and Berkeley, California shows that rent ceilings tend to allocate low-priced apartments to the well-connected and well-to-do rather than provide better housing to low-income renters. The tenants who occupy rent-control housing are usually those who have lived in a the city for a long time, which often includes the rich and famous.

Price Floors

A **price floor** is a legally established minimum price that can be paid for a good or service. As with the price ceiling, for this established price to be effective it must have the force of the law, i.e. the government or some other agency with enforcement power must be behind it. The government agency that establishes the price floor must also have the authority to take action, such as fines or jail time, against buyers who pay a price that’s lower than the price floor. A price floor is sometimes referred to as a price support.

Unlike a price ceiling, for a price floor to have an effect on the market outcome, it must be set *above* the market equilibrium price. Buyers are allowed to pay a price that’s higher than the price floor, so if the price floor is set below the equilibrium price, it will not affect the market outcome.

Price floors are common in the markets for agricultural commodities. Around the world, many countries, including the United States, have passed laws to create agricultural price supports. Farm prices and thus farm incomes fluctuate, sometimes widely, from year to year. A change in the demand or supply of a particular commodity will cause its price to either rise or fall. So even if farm incomes are adequate on average, in some years they can be quite low. The purpose of price supports in agriculture is to prevent these swings.

Perhaps the best-known example of a price floor is the minimum wage, which is based on the belief that someone working full time ought to be able to afford a basic standard of living. In other words, it’s argued that the minimum wage can be used as a poverty-fighting tool. The federal minimum wage was raised to its current level of \$7.25 per hour on July 24, 2009. Congress periodically raises the federal minimum wage, but historically the increases have been irregular. Table 1 shows the history of the federal minimum wage back to 1978. As can be seen in the table, there’ve been some fairly long gaps between increases in the federal minimum wage. There was a gap of just over nine years from January 1, 1981 to April 1, 1990, and there was a gap of just under ten years from September 1, 1997 to July 24, 2007. As this is being written, it’s been nearly eight years since the last increase. Long gaps between increases are not historically unusual then.

In addition to the federal minimum wage, numerous states and some municipalities (i.e., counties, cities, and towns) have established their own minimum wage that exceeds the federal minimum wage. If a worker has a job in such a state or city, then his/her minimum wage would be the one established by the state or city, rather than the federal minimum wage. Currently (March 2017) the states with the highest minimum wage are the District of Columbia, at \$11.50 per hour, followed by Massachusetts and Washington (state), tied at \$11.00 per hour. A number of municipalities also have higher than the federal minimum wages. For example, San Francisco's and Santa Fe Counties had minimum wages of \$14 per hour and \$11.09 per hour, respectively, and Seattle, Washington had a minimum wage of \$11 per hour in 2017.¹

To examine the effects of a minimum wage law on the market outcome, let's consider a hypothetical market for unskilled labor in a city shown in Figure 2-a. Note first that in labor markets, unlike the product markets we've examined so far, people are the sellers and firms are the buyers. In other words, workers supply their labor services and firms demand labor services. Nonetheless, the labor demand and supply model works the same way as that for goods and services. We should also keep in mind that the minimum wage applies to unskilled and low-skill workers only. Skilled workers, such as doctors, lawyers, accountants, and airline pilots earn much more than the minimum wage and are not competing with unskilled and low-skilled workers for the same jobs.

As you can see in Figure 2-a, the market equilibrium wage of unskilled workers is \$5.25 per hour and the market equilibrium quantity of unskilled labor is 8 million hours per year. But suppose that the minimum wage is set at \$7.25 per hour. Since the minimum wage is above the market equilibrium wage, it will affect the market outcome. Although at a wage of \$7.25 per hour workers are willing to supply 12 million hours of labor, employers are willing to hire only 4 million hours. Therefore, the number of labor hours that is actually hired is 4 million. That is, the minimum wage creates a surplus of 8 million hours of labor, which is

Table 1 Recent History of the Federal Minimum Wage

Date wage was increased	Federal minimum wage
January 1, 1978	\$2.65
January 1, 1979	\$2.90
January 1, 1980	\$3.10
January 1, 1981	\$3.35
April 1, 1990	\$3.80
April 1, 1991	\$4.25
October 1, 1996	\$4.75
September 1, 1997	\$5.15
July 24, 2007	\$5.85
July 24, 2008	\$6.55
July 24, 2009	\$7.25

Source: U.S. Department of Labor, Wage and Hour Division, "History of Federal Minimum Wage Rates Under the Fair Labor Standards Act, 1938–2009," accessed at <https://www.dol.gov/whd/minimum-wage/chart.htm>

¹ Sources: U.S. Department of Labor, Wage and Hour Division, "Minimum Wage Laws in the States—January 1, 2017," <https://www.dol.gov/whd/minwage/america.htm>. San Francisco Office of Labor Standards Enforcement, "Minimum Wage Ordinance (MWO)," <https://sfgov.org/olse/minimum-wage-ordinance-mwo>. Santa Fe County, "Living Wage Ordinance," <https://www.santafecountynm.gov/livingwage>. Seattle Office of Labor Standards, "Information for Small Employers," <https://www.seattle.gov/laborstandards/ordinances/minimum-wage/small-employers>.

referred to as **unemployment** (or underemployment). Note also that the minimum wage decreases employment of unskilled labor by 4 million hours as compared with the labor market where there is no minimum wage.

To address the question of whether the minimum wage laws effectively serve their purposes, let's first examine the effects of the minimum wage using the concepts of use the concepts of consumer surplus (in this case employer surplus), producer surplus (i.e. worker surplus), total social surplus, and society's deadweight loss.

As shown in Figure 2-b, with no rent ceiling—i.e. when the labor market is in equilibrium with the wage of \$5.25 per hour and 8 million hours of labor employed—the employer surplus is the triangular area A+B+C, which equals

$$ES = (\$9.25 - \$5.25) \times 8 \text{ million} / 2 = \$16 \text{ million}$$

the worker surplus is the triangular area E+D+F, which equals

$$WS = (\$5.25 - \$1.25) \times 8 \text{ million} / 2 = \$16 \text{ million}$$

and the total society surplus generated in the market for unskilled labor is

$$TS = ES + WS = \$16 \text{ million} + \$16 \text{ million} = \$32 \text{ million}$$

With the minimum wage in effect—i.e. when the wage is \$7.25 per hour and 4 million hours of labor are employed—the employer surplus shrinks to the triangular area A, which equals

$$ES_M = (\$9.25 - \$7.25) \times 4 \text{ million} / 2 = \$4 \text{ million}$$

the worker surplus is the trapezoid area B+D+F, which equals

$$WS_M = [(\$7.25 - \$1.25) + (\$7.25 - \$3.25)] \times 4 \text{ million} / 2 = \$20 \text{ million}$$

and the total society surplus is

$$TS_M = ES_M + WS_M = \$4 \text{ million} + \$20 \text{ million} = \$24 \text{ million}$$

As you can see, the minimum wage transfers part of the employer surplus (area B = \$4 × 4 million = \$16 million) to workers, but the overall workers' gain (\$20 million – \$16 million = \$4 million) is less than the overall employers' loss (\$16 million – \$4 million = \$12 million) since parts of both employer and worker surpluses (area C and E) are lost because of the unemployment due to the minimum wage. That is, the

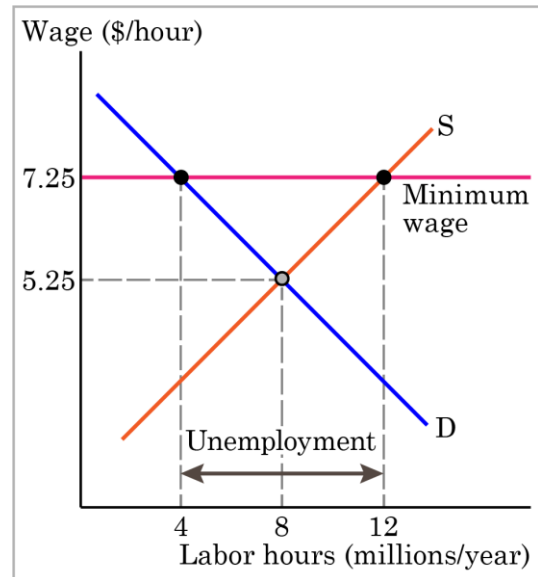


Figure 2-a Minimum wage in a market for unskilled labor

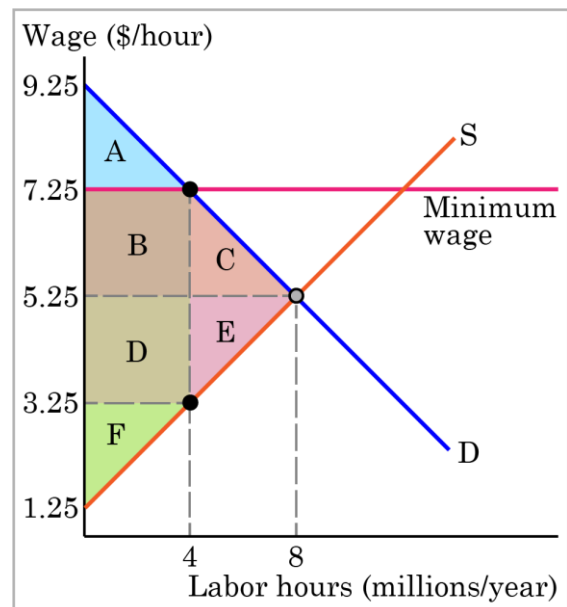


Figure 2-b The welfare effects of a minimum wage

minimum wage reduces the total society surplus by the amount of the deadweight loss, i.e. area C+E, which is

$$DWL = (\$7.25 - \$3.25) \times (8 \text{ million} - 4 \text{ million}) / 2 = \$8 \text{ million}$$

So, again, it looks like a price control—the price of labor in this case—works as intended, increasing the workers’ surplus. But does it really? Note first, that in our example, although workers who are employed get higher wages, 4 million hours of labor are unemployed, i.e. many workers who are willing to work for that wage can’t find a job or are underemployed.

Second, as in the case of a rent ceiling, we should consider the opportunity cost of time and troubles to unskilled or low-skilled workers are desperately trying to find a job. If we account for these opportunity costs, the actual economic pay that workers receive may potentially fall to \$3.25, and the actual worker surplus may potentially shrink to area F, that is to

$$WS_{MF} = (\$3.25 - \$1.25) \times 4 \text{ million} / 2 = \$4 \text{ million}$$

Proponents of minimum wage increases claim they are just trying to help out the working poor. To be sure, an individual who works 2,000 hours during a year, will earn an annual gross income of only \$10,300—a figure well below the poverty line. Supporters claim that increases in the minimum wage are necessary to achieve “basic fairness” (a nebulous concept at best). Opponents of the minimum wage recognize that like all effective price floors, it often results in an increased unemployment rate, with unskilled workers, particularly minorities, most detrimentally effected.² In addition, some researchers have found no evidence that minimum wage laws reduce poverty, material hardship, or the receipt of public benefits.³ If the minimum wage is increased, the argument goes, a surplus of workers will be the result. However, a closer look at the minimum wage reveals that the debate may be much ado about nothing.

Firms compensate workers for their toil in more ways than one. The level of “full compensation” that firms pay workers comes in three main forms: wages, fringe benefits, and training opportunities. Consider the following equation:

$$\text{Full Compensation} = \text{Wages} + \text{Fringe benefits} + \text{Training opportunities}$$

If government imposes a higher minimum wage, firms can keep the level of full compensation constant simply by lowering fringe benefits and/or training opportunities. One method of lowering fringe benefits involves the ratio of part-time workers to full-time workers that the firm employs. Because of union contracts and federal laws, part-timers generally receive fewer fringe benefits than full-timers. That being the case, a firm facing a higher minimum wage can keep the average level of full compensation constant by replacing full-time workers with part-time ones. Economic research has demonstrated that increases in the minimum wage are often accompanied by increases in the prominence of part-time employment. The laws of demand and supply matter because they have repeatedly been shown to be more powerful and effective than the laws of government. Although governments often interfere with the workings of the market, markets will adjust and prevail, in time.

² Neumark, D., and W. Wascher. “Minimum wages and employment.” *Foundations and Trends in Microeconomics* 3:1–2 (2007): 1–186.

³ Sabia, Joseph J., and Robert B. Nielsen. “Minimum wages, poverty, and material hardship: new evidence from the SIPP.” *Review of Economics of the Household* 13.1 (2015): 95–134.

4.2 Excise Taxes

An **excise tax** is a tax that's levied on the purchase or sale of a particular good or service. Unlike a general sales tax that's levied on virtually any good or service that's bought or sold, an excise tax is imposed on a specific good or service. For example, in the United States, excise taxes are levied on gasoline, cigarettes, alcoholic beverages, and tanning services. Excise taxes can be implemented by governments at the federal, state, or even local level. When, for instance, you purchase a gallon of gasoline in Georgia, \$0.18 of the amount collected by the gas station goes to the federal government and \$0.31 goes to the state government.

There three main reasons why governments levy taxes, whether it's an excise tax or some other form of tax, such as an income tax or a property tax. The primary purpose, is to obtain revenue to support government operations, including providing national defense, police and fire protection, financing education and social programs, road repairs and maintenance, and parks and recreation. The second purpose is to correct inequities in the distribution of income and wealth, given the fact that letting market forces play freely may result in extreme income and wealth inequalities. The third purpose, particularly relevant to excise taxes, is reduce the production of socially undesirable goods or byproducts, such as cigarettes, alcohol, air and water pollutants, and carbon dioxide—a byproduct of burning fossil fuels, such as gasoline, that traps heat in the atmosphere causing global climate change.

How an Excise Tax Affects the Market

To see how an excise tax affects the market for the good it is imposed on, let's consider a competitive market for pizza in the city of Raspboro shown in Figure 3-a. With no excise tax, the equilibrium price is \$12 per pizza and the equilibrium quantity is 40,000 pizzas. Now suppose the city council imposes an excise tax on sellers of pizza, requiring them to pay \$4 per pizza to the government. How will the tax affect the market equilibrium?

Let's note first that pizza producers perceive the tax as a \$4 per-pizza increase in their costs. As we know from Chapter 2, this raises the price that sellers are willing to accept to offer a given quantity of pizza by the amount of that additional cost. For example, to supply 40,000 pizzas, sellers now ask \$16 per pizza instead of \$12 pizza. This means the supply curve shifts upward by the amount of the per-unit tax (\$4), from S to S_T .

As you can see in Figure 3-a, after the supply curve shifts, the market is no longer in equilibrium at 40,000 pizzas. Although sellers would accept the price of \$16 per pizza to supply that quantity, buyers are willing to buy 13,000 pizzas at this price. After the market price adjusts to eliminate that excess supply, the equilibrium price is \$15 per pizza and the equilibrium quantity is 20,000 pizzas.

Notice that the shift of the supply curve resulting from the tax works in a different way than do supply-

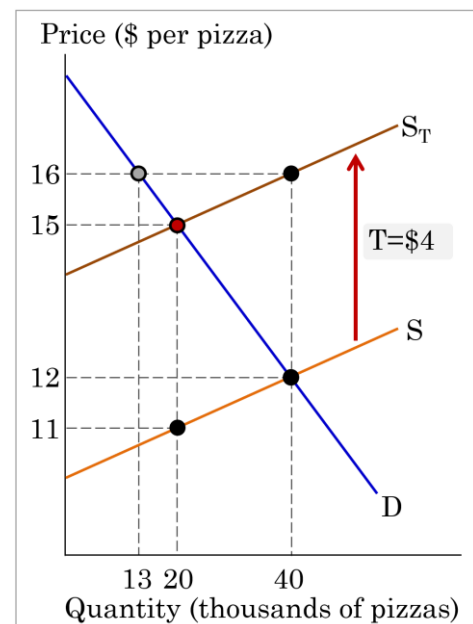


Figure 3-a An excise tax on sellers

curve shifts we studied in Chapter 2. The tax drives a wedge between the price buyers pay (the market price) and the price that sellers actually get (the market price minus the tax). In the example in Figure 3-a, with the tax in effect, in equilibrium, buyers pay \$15 per pizza, but sellers actually only get $\$15 - \$4 = \$11$, as they have to send \$4 to the government per each pizza sold.

Two important conclusions follow from this analysis. First, an excise tax reduces the equilibrium quantity of the good on which it imposed. Second, the tax raises the market price of the good, but the price rises by less than the amount of the per-unit tax. In our example, as a result of a \$4 per pizza tax, the market price rises by \$3 per pizza, not by \$4 per pizza.

Who Is Paying the Tax?

Let's continue our pizza example. Recall that the tax is collected from pizza sellers. But who really bears the burden of it? Do sellers pass it on to buyers altogether? The distribution of the tax burden between buyers and sellers is called **tax incidence**. We can determine the tax incidence by comparing the prices that buyers pay and sellers receive before and after the tax is imposed.

As shown in Figure 3-b, with no tax, buyers pay \$12 per pizza and with the tax in effect, they pay \$15. So, the tax incidence that fall on buyers is $\$15 - \$12 = \$3$ per pizza. What about sellers? With no tax, they receive \$12 per pizza, the same price as buyers pay. With the tax, however, sellers collect \$15 per pizza from buyers but \$4 of that goes to the government, so sellers end up keeping $\$15 - \$4 = \$11$ per pizza sold. Note that the price that sellers actually get after the tax (\$11) is shown by the point on the no-tax supply curve (S) that corresponds to the equilibrium quantity with the tax in effect (20,000 pizzas). So, the tax incidence that falls on sellers is $\$12 - \$11 = \$1$ per pizza.

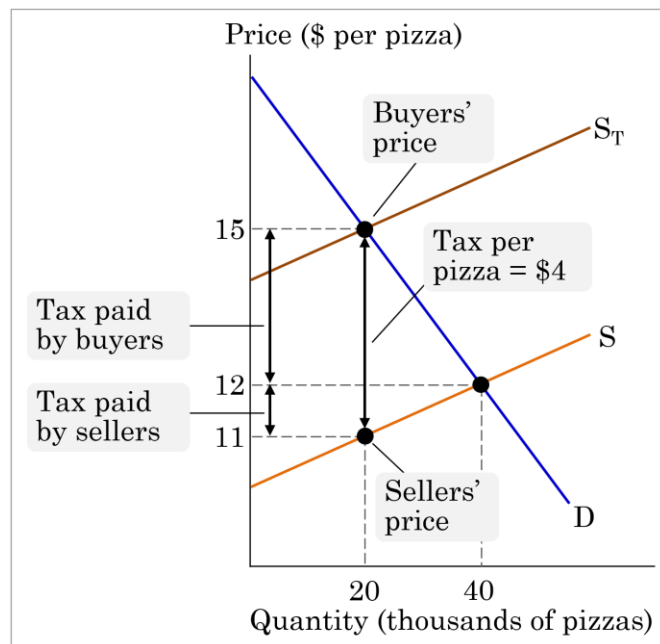


Figure 3-b The incidence of a tax collected from sellers

Thus, our example shows—and it is generally the case—that the incidence of an excise tax falls on both sides of the market. With the tax, buyers pay more and sellers receive less per each unit of the good bought and sold.

But what if instead of sellers, the government collects the tax from buyers? Will this increase the tax incidence that falls on buyers? Or maybe buyers then will pay the whole tax? Let's change the scenario in our example. Suppose now that the \$4 per pizza tax is collected

from buyers, i.e. for each pizza bought, buyers are obligated to pay \$4 as a tax.⁴ Figure 3-c shows the effects on the market.

We start with the same no-tax equilibrium, where price is \$12 per pizza and the quantity is 40,000 pizzas. Now, buyers realize that at each given quantity of pizza, the value that they receive from consuming a pizza is reduced by the amount of the tax they have to pay per each pizza bought, i.e. by \$4. As a result, the demand curve—which as we learned in Chapter 2 reflects consumers’ willingness to pay—shifts downward by the amount of the per-unit tax, from D to D^T in Figure 3-c.

As you can see, after the demand curve shifts, the market is no longer in equilibrium at 40,000 pizzas. Although sellers would accept the price of \$12 per pizza to supply that quantity, buyers are willing to buy only 13,000 pizzas at this price. After the market price adjusts to eliminate that excess supply, the equilibrium price is \$11 per pizza and the equilibrium quantity is 20,000 pizzas.

Again, the tax drives a wedge between the price buyers actually pay (the market price plus the tax) and the price that sellers actually get (the market price). That is, the buyers’ price is $\$11 + \$4 = \$15$ per pizza while the sellers price is \$11.

Now we can determine the tax incidence the same way we did when the tax was imposed on sellers, i.e. by comparing the prices that buyers pay and sellers receive before and after the tax is imposed. As shown in Figure 3-d, with no tax, buyers pay \$12 per pizza and with the tax in effect, they pay \$15. So, the tax incidence that fall on buyers is $\$15 - \$12 = \$3$ per pizza. With no tax, sellers receive \$12 per pizza and with the tax they get \$11 per pizza. So, the tax incidence that fall on sellers is $\$12 - \$11 = \$1$ per pizza. As you can see, the incidence of an excise tax collected from buyers is exactly the same as of that collected from sellers!

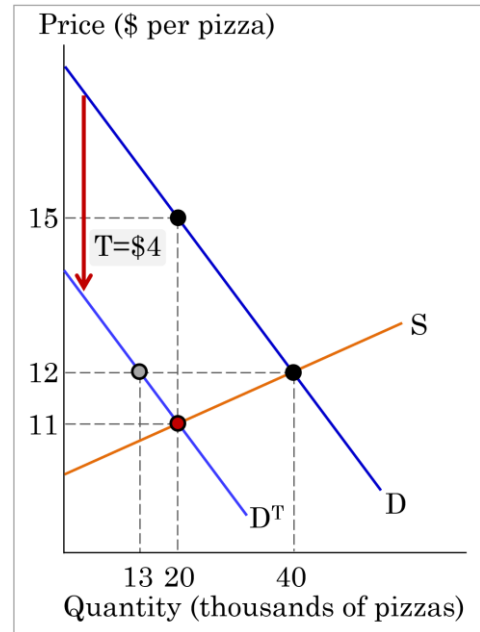


Figure 3-c An excise tax on buyers

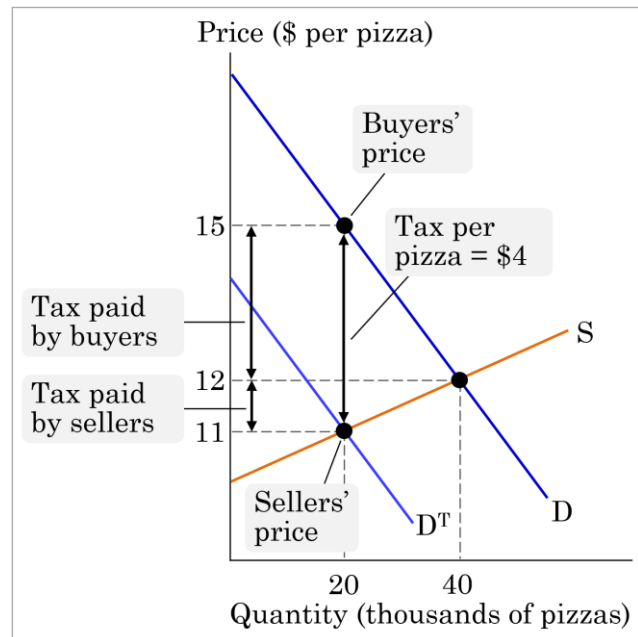


Figure 3-d The incidence of a tax collected from buyers

⁴ For the sake of argument, let’s not worry here about the fact that collecting a tax from consumers for each pizza bought would be impractical.

This leads us to an important general conclusion:

The incidence of an excise tax is the same no matter whether it is collected from buyers or sellers.

Tax Incidence and Elasticity

If an excise tax incidence does not depend on whether the tax is collected from sellers or buyers, then what does it depend on? The answer is, the price elasticity of demand and supply. To see how, let's consider another example of an excise tax, the so called "luxury tax".

In 1990, Congress enacted an excise tax on luxury goods, such as private jets, yachts, fur coats, diamonds, and luxury cars. Because only wealthy consumers could afford these goods, the purpose was to reduce income inequality and raise revenue for the government by taxing the rich. Do you think the tax effectively served its purpose?

To see how a luxury tax works, consider a (hypothetical) market for natural fur coats shown in Figure 4. First, recall from Chapter 3 that the demand for luxury goods tends to be elastic, and with the market defined to include just fur coats, it is likely to be very price elastic. If the price of fur coats rises, instead of a fur coat for his trophy wife, a millionaire can easily decide to use his money to buy a race horse or a bigger house or take an exotic vacation. This is reflected by a rather flat demand curve (D) in Figure 4. The supply of fur coats, on the other hand, is much less price elastic, at least in the short run. Resources used to produce natural fur coats are rather rare and it is not easy for natural fur producers to switch to an alternative product or find an alternative market. Therefore, in the same quantity range, the supply curve (S) in Figure 4 is much steeper than the demand curve.⁵

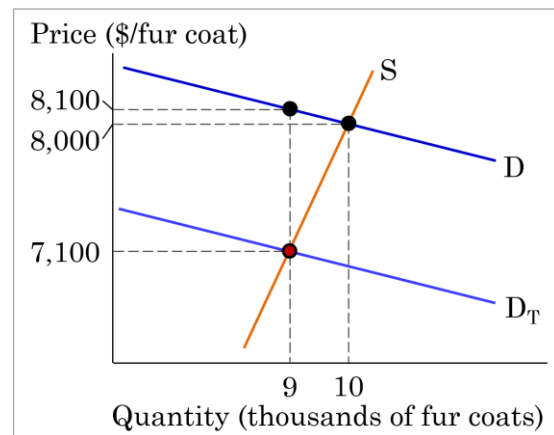


Figure 4 A tax on buyers of fur coats

With no tax, the market is in equilibrium when the price of a fur coat is \$8,000, and 10,000 fur coats are sold. Now, suppose that the luxury tax imposed on buyers of fur coats is \$1,000 per coat. As we know from previous analysis, an excise tax collected from buyers shifts the demand curve downward by the amount of the tax. Thus, the demand curve in Figure 4 shifts down by \$1,000, from D to D_T. After the market adjusts, the equilibrium price of a fur coat is \$7,100 and the equilibrium quantity is 9,000 coats.

Let's see now what the fur coat tax incidence is. With no tax, buyers pay \$8,000 per coat, while with the tax in effect they pay \$7,100 + \$1,000 = \$8,100 per coat. So, the tax incidence that fall on buyers is \$8,100 - \$8,000 = \$100 per coat. With no tax, sellers receive \$8,000 per coat, while with the tax they get \$7,100 per coat. So, the tax incidence that falls on sellers is \$8,000 - \$7,100 = \$900 per coat. In other words, the wealthy buyers of fur coats pay only 10%

⁵ It can be calculated that in the relevant price and quantity ranges, the price elasticity of demand (absolute value) is about 8.5, while the price elasticity of supply is about 0.9.

of the tax, while the rest of it is paid by sellers—i.e. firms and workers who produce fur coats—which is not what was intended when the tax was enacted.

This example shows once again that tax incidence does not depend on whether the tax is collected from buyers or sellers. It also illustrates how tax incidence depends on the price elasticities of demand and supply. With highly elastic demand and much less elastic supply, the burden of the luxury tax collected from buyers falls mostly on sellers. This became apparent shortly after the tax was enacted. Since the tax did not serve its purpose, Congress mostly repealed it in 1993. In general:

The incidence of an excise tax falls more heavily on the side of the market that is less elastic.

The intuition behind this conclusion is as follows. A low elasticity of demand means that buyers are not willing to give up much of the good when its price rises. And a low elasticity of supply means that sellers are not willing to give up much of the production of the good when the price they receive falls, perhaps because they can't find suitable alternatives. When a tax is imposed on the good, the side of the market that is willing to give up less has to bear more of the tax burden.

Excise Taxes and Efficiency

To see how an excise tax affects the efficiency of competitive markets, let's return to our example of a tax imposed on sellers of pizza (Figure 3-a). The effects of the tax on consumer surplus, producer surplus, and total social surplus are shown in Figure 5.

With no tax—i.e. when the market is in equilibrium with the price of \$12 per pizza and 40,000 pizzas sold—the consumer surplus is the triangular area A+B+C, which equals

$$\begin{aligned} CS &= (\$18 - \$12) \times 40,000 / 2 \\ &= \$120,000 \end{aligned}$$

the producer surplus is the triangular area E+D+F, which equals

$$\begin{aligned} PS &= (\$12 - \$10) \times 40,000 / 2 \\ &= \$40,000 \end{aligned}$$

and the total society surplus generated in the market is

$$TS = CS + PS = \$120,000 + \$40,000 = \$160,000$$

With the tax in effect—i.e. when the market price is \$15 per pizza and 20,000 pizzas are sold, the consumer surplus shrinks to the triangular area A, which equals

$$CS_T = (\$18 - \$15) \times 20,000 / 2 = \$30,000$$

and the producer surplus reduces to area F, which equals

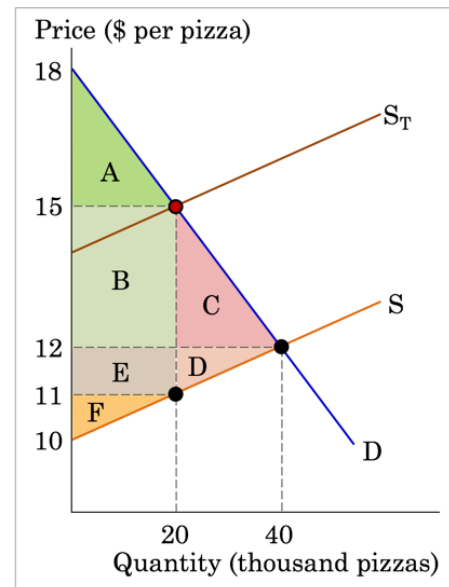


Figure 5 The effect of an excise tax on the efficiency of the market

$$PS_T = (\$11 - \$10) \times 20,000 / 2 = \$10,000$$

The government collects a tax revenue equal to the per unit tax (\$4) times the quantity of pizza sold (area B+E):

$$GR = \$4 \times 20,000 = \$80,000$$

which can be viewed as government surplus. Then, the total society surplus is

$$TS_T = CS_T + PS_T + GR = \$30,000 + \$10,000 + \$80,000 = \$120,000$$

As you can see, the tax transfers part of the consumer surplus (area B = $\$3 \times 20,000 = \$60,000$) and part of the producer surplus (area E = $\$1 \times 20,000 = \$20,000$) to the government. But part of the consumer surplus (area C) and part of the producer surplus (area D) go to a deadweight loss. That is, the tax reduces the total society surplus by the amount of the deadweight loss (area C+E), which is

$$DWL = (\$15 - \$11) \times (40,000 - 20,000) / 2 = \$40,000$$

The main conclusion from our example is that excise taxes create deadweight losses and reduce society total surplus. This happens because an excise tax raises the price paid by buyers, so they choose to buy less than they would with no tax, and lowers the price received by sellers, so they choose to supply less than they would with no tax. As a result, the market equilibrium quantity falls below the efficient level.

4.3 Correcting for Externalities

From our discussions in the previous sections you might get the impression that any government intervention in competitive markets causes inefficiencies, i.e. results in deadweight losses. This impression, however, is wrong.

Recall from Chapter 2 that competitive markets can only be efficient if *no* externalities are generated by production or consumption of the good. An **externality** is a cost or benefit resulting from production or consumption of a good that is imposed on someone other than its buyers or sellers. Costs imposed on a third party are **negative externalities**. Benefits received by a third party are **positive externalities**. Free markets fail to account for externalities, which results in deadweight losses for society. In such situations, government interventions can make market outcomes more efficient.

Consider, for example, an unregulated competitive market for gasoline. For the market outcome to be efficient, the price of gas must include all the costs associated with its production and consumption. This, however, is not the case because when we drive, we impose substantial *external* costs on others, which the market fails to account for.

Economists have identified three main categories of external costs associated with the use of gasoline. First, burning gas emits carbon dioxide, the main contributor to the global climate change, which is expected to impose large economic costs on certain businesses, cause health problems for many people, and even threaten national security. Second, air pollution by automobile fumes causes health problems—such as asthma attacks—increasing health care costs and leading to premature deaths. Third, cheaper gas results in more driving, leading to traffic congestion, which imposes external costs in the forms of higher opportunity costs of time spent on traveling and higher accident-related costs.

To illustrate a market failure due to external costs, let's consider a (hypothetical) unregulated competitive market for gasoline shown in Figure 6-a. Suppose that the external costs of gasoline are \$1 per gallon. The market, however, ignores these costs. Consumers make their decision based on their private benefits reflected by the demand curve (D). And producers decide how much gas to sell based on their private opportunity costs reflected by the supply curve (S). Producers are willing to sell 400 million gallons of gas at \$2 because this price covers their opportunity cost of producing the 400 millionth gallon (i.e. their marginal cost of it). And consumers are willing to pay \$2 to get that quantity of gas. Thus, the market is in equilibrium where the price of gas is \$2.00 and the quantity of gas bought is 400 million gallons.

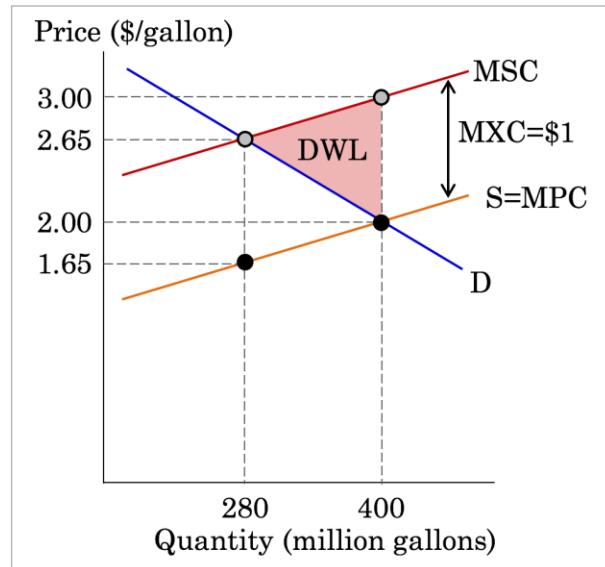


Figure 6-a Market inefficiency due to external costs

The problem here is that the market price does not cover all the **social costs (SC)**—i.e. the true costs—of gasoline, which equal the producers' **private costs (PC)** plus the **external costs (XC)**:

$$SC = PC + XC$$

In Figure 6-a, to find the true social cost of an additional gallon of gas, we add the external cost of gas ($MXC = \$1$ per gallon) to its marginal private cost (MPC) shown by the supply curve at each quantity of gas supplied. So, graphically, the marginal social cost curve (MSC) lies \$1 above the market supply curve ($S = MPC$). Now we can see that when the market is in equilibrium at 400 million gallons, the true cost of the last gallon sold is \$3, while its value to consumers is only \$2. This means the market does not produce the efficient quantity of gas.

What quantity of gas is efficient then? As you can see in Figure 6-a, the marginal social cost of gas equals its marginal benefit to consumers at the point where the price is \$2.65 per gallon and the quantity of gas sold is 280 million gallons. For each additional gallon above this quantity, the marginal social cost exceeds the marginal benefit, which means those additional gallons should not be produced. That is, in the presence of the external costs, the market overproduces $400 \text{ million} - 280 \text{ million} = 120 \text{ million}$ gallons of gas.

The total efficiency loss (i.e. deadweight loss) due to the fact that the market does not take external costs into account is shown by the triangular area DWL in Figure 6-a, which equals

$$DWL = (\$3 - \$2) \times (400 \text{ million} - 280 \text{ million}) / 2 = \$60 \text{ million}$$

Thus, a free competitive market fails to achieve the efficient outcome in the presence of externalities. Can government interventions help make it more efficient? One way to *internalize* external costs, i.e. make producers and consumers of the good whose production or consumption causes them, is to impose an excise tax on that good.

Continuing our example of a market for gasoline, suppose the government levies a tax on sellers of gas that is equal to the external costs, \$1 per gallon (Figure 6-b). As we know, an excise tax on sellers shifts the supply upward by the amount of the per unit tax. So the gas tax of \$1 per gallon will shift the supply curve (S) in Figure 6-b up by \$1. As a result, the market equilibrium with the tax occurs where the price of gas is \$2.65 and the quantity of gas sold is 280 million gallons.

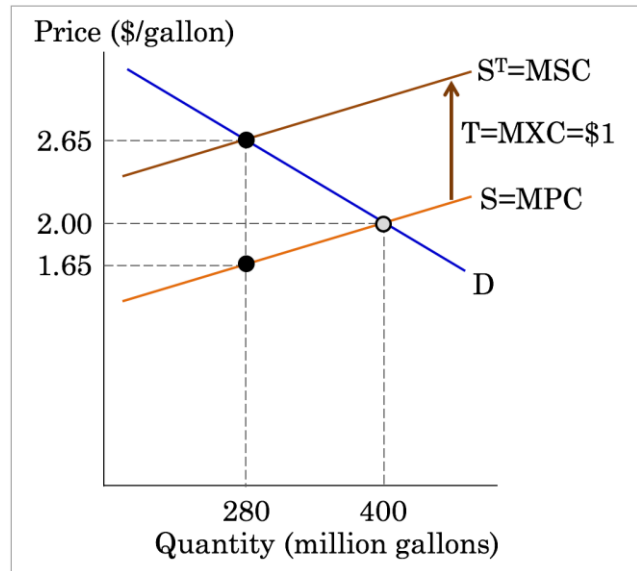


Figure 6-b An excise tax internalizing external costs

Since the supply curve with the tax (S^T) coincides with the marginal social cost curve (MSC), this is also where the marginal social cost equals the marginal benefit. This means the market price of gasoline now accounts for all of its costs, including the external costs, so the market outcome is efficient.

In reality, however, dealing with externalities is not that simple. The main problem is that external costs are very hard to quantify. For example, economists have been trying to estimate the external costs of gasoline for a long time, with different studies producing different results ranging from \$1.00 to \$2.00 per gallon. A recent study by the International Monetary Fund has found that for the United States, the external costs of gasoline amount to \$1.60 per gallon.⁶ If this estimate is correct, then the tax on gasoline in the United States that would result in the efficient market outcome is \$1.60 per gallon, which is much higher than the current average \$0.52 per gallon.⁷

⁶ Ian Parry, et al. *Getting Energy Prices Right : From Principle to Practice*. International Monetary Fund, 2014. DOI:<http://dx.doi.org/10.5089/9781484388570.07>.

⁷ Including federal, state, and local taxes and fees. Click [here](#) for detailed information about the U.S. gasoline tax from the American Petroleum Institute.