

## 4. Taxation—Who Pays?

We hear many assertions about taxation, some of them mutually contradictory. “Taxes hinder economic growth.” “Income taxes discourage people from working.” “Taxes on business are passed on to consumers.” “Taxes on business penalize investment and job-creation.” “Property taxes drive poor people out of their homes.” “Property taxes cause prime agricultural land to be developed for housing.” “Sales taxes fall hardest on the poor.” “The fairest tax system is one that taxes a little bit of everything.” “We need to tax consumption in order to encourage saving.”

What’s the real story?

### 4.1 All Taxes Come Out of Rent or the “ATCOR Principle”

All taxes come out of rent. A tax cannot take interest or wages without destroying them.

It is obvious a tax on land values comes out of rent, since land value is the capitalized present value of expected rent. If  $a$  is a level stream of rent,  $i$  is the interest rate and  $V$  is value, then:

$$V = \frac{a}{i}$$

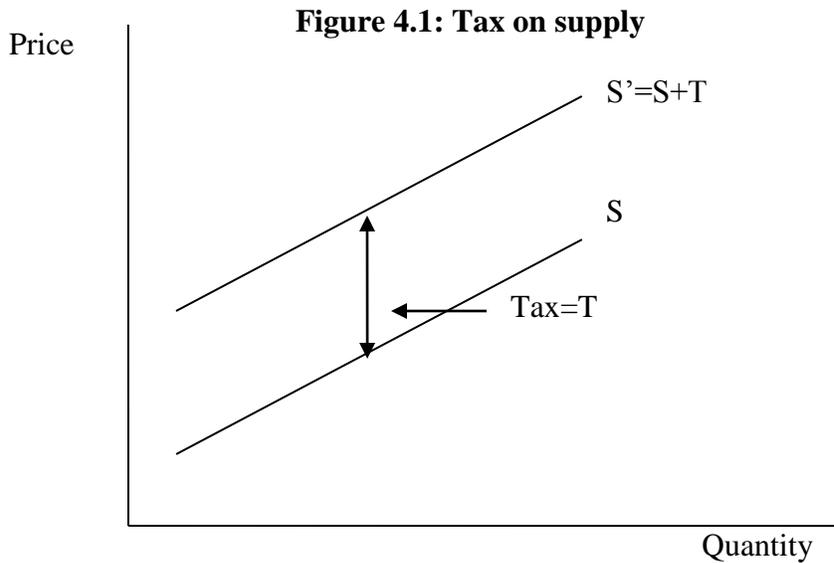
If we impose a tax  $T=tV$ , where  $t$  is the tax rate, then solving for  $V'$ , the after-tax land value, we get:

$$V' = \frac{a-T}{i} = \frac{a-tV'}{i} = \frac{a}{i+t}$$

The expected tax on expected rent is capitalized back into the land value.

But what about a tax on production?

Consider an ordinary supply curve. Remember that it represents the rising marginal cost of production as volume increases. Let’s add a per unit excise tax,  $T$ , to that supply curve, as in **Figure 4.1**. (The tax on gasoline, of so many cents per gallon, is an excise tax.) The producers must now cover not only their marginal cost at each volume, but their marginal cost plus the tax. The effect of the tax is to *reduce the quantity supplied at every price!*



**Figure 4.2** shows how this tax  $T$  affects price and quantity sold.  $P_1$  and  $Q_1$  are pre-tax price and quantity. The blue triangle is consumer rent, while the green triangle is producer rent. Tax  $T$  puts a wedge between the consumers and producers. The consumers pay price  $P_2$  for quantity  $Q_2$ , the post-tax quantity, which is less than  $Q_1$ . The producers get price  $P_3$  for their sales of  $Q_2$ . The government gets tax revenue of  $T \times Q_2 = (P_2 - P_3) \times Q_2$ .

As the diagram makes clear, the tax is paid out of producers' and consumers' rent. Demand and supply where the rent is less than  $T$  are now submarginal—the grayed out triangle of deadweight loss. To put it another way, the tax collects rent,  $T \times Q_2$ , where there is at least  $T$  available, and kills potential transactions which offer less than  $T$ .

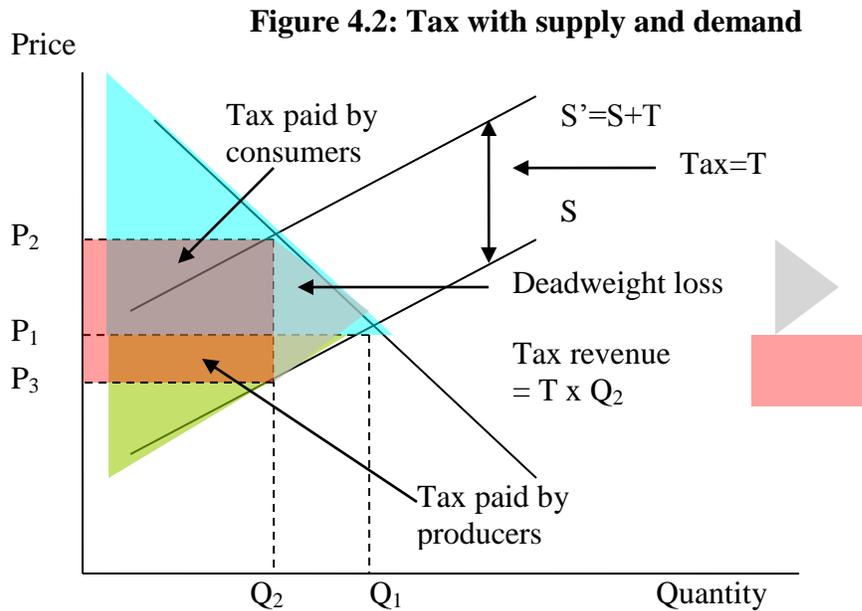
#### 4.2 Taxes fall on consumers and producers in inverse proportion to demand and supply elasticity, or the “Inverse Elasticity Principle”

Notice that even though tax  $T$  is nominally paid by the producers, in fact part is paid by the consumers. In the illustration, the consumers pay a larger share than the producers. The consumers pay  $(P_2 - P_1) \times Q_2$ , while the producers pay  $(P_1 - P_3) \times Q_2$ . So the producers have “passed on” part of the tax to the consumers.

In fact, it's obvious from the geometry of Figure 4.2 that consumers and producers pay in the same ratio as the slopes of the demand and supply curves at  $P_1$  and  $Q_1$ . But as shown in section 3.3, the ratio of the slopes is also the inverse ratio of the elasticities of demand and supply,

$$\frac{E_D}{E_S} = \frac{\text{Slope}_S}{|\text{Slope}_D|}$$

So as a generalization: *A tax is shared between consumers and producers in inverse proportion to their elasticities of demand and supply.* This result makes sense. Elasticity measures responsiveness. The consumers or producers with the more elastic curve can better “pass on” the tax to the other.



The Inverse Elasticity Principle obviously applies to any kind of sales or output tax. Contrary to the popular notion that such taxes are entirely “passed on” to consumers, the taxes are in fact shared between producers and consumers, depending on relative elasticity. Since demand for basic foods is fairly inelastic compared to demand for luxuries like boats, we would expect more of a tax on food to fall on consumers than a tax on boats.

Here’s an environmental application of the “Inverse Elasticity Principle”: Suppose we want to put a heavy tax on gas, say \$2 per gallon, as part of an effort to cut greenhouse gas releases. Politically, that seems impossible. The public wouldn’t stand for a \$2 increase. But would gas really increase by \$2? In fact it wouldn’t. Demand for gas is inelastic, but supply is much more inelastic. So most of the tax would be “shifted back” onto oil companies. Of course they don’t want us to know that!

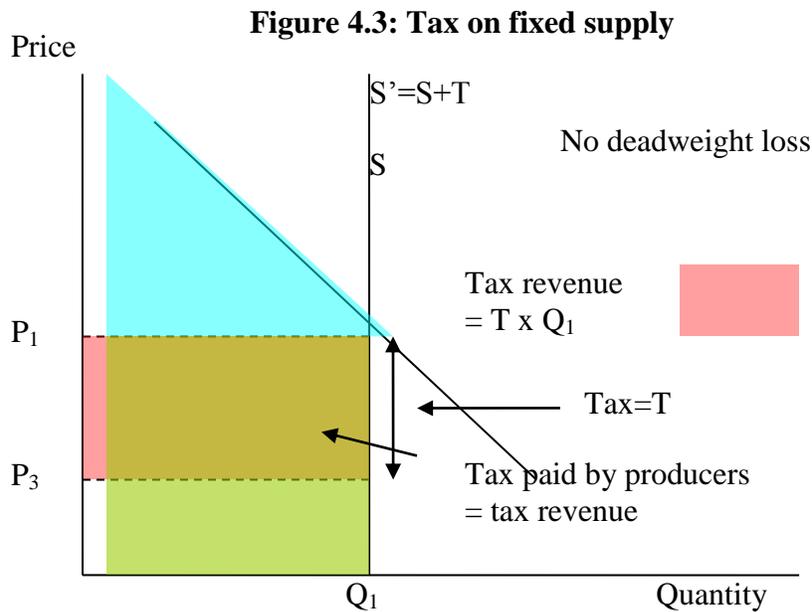
The Inverse Elasticity Principle lies behind something known as the “Ramsey Rule” of taxation, named after economist Frank Ramsey (1903-1930). The Ramsey Rule holds that taxes should be applied in inverse proportion to price elasticity of demand.

### 4.3 Taxes on land and other natural resource titles are paid entirely by the producers

Land and other natural resource titles, such as spectrum, are entirely fixed in supply. There is only one parcel of land between 33<sup>rd</sup> and 34<sup>th</sup> on the west side of 5<sup>th</sup> Avenue in Manhattan—and the Empire State Building sits on that parcel. The building and the parcel actually have separate owners. 12 TV stations and 19 FM radio stations broadcast from the Empire State Tower. Each has a unique license to broadcast at a particular frequency and particular power, which determines the range of the signal.

Any tax on land or other resource title must be paid entirely by the producer (who of course doesn’t actually “produce” the resource, but merely acquires it). In Figure 4.3, the tax comes

entirely out of the producers' rent. There is no deadweight loss. The producer cannot shift any of the tax onto the consumer.



#### 4.4 Taxes on labor income fall hardest on low income and part-time workers

In the US, Federal taxes on labor income fall into two categories: payroll taxes financing Social Security, and the progressive income tax. Many states and localities also collect income taxes, piggybacked onto Federal taxes.

A generic labor supply curve looks like a J; flat in the low-wage region and very steep in the high-wage region. Workers in the low-wage region have a “low labor-force attachment.” That means they change jobs frequently, work part time, and are often unemployed. These people are very sensitive to small changes in compensation, that is, their labor supply is very elastic.

**Figure 4.4** shows how an income tax affects low wage workers: It reduces their take-home wage from  $W_1$  to  $W_3$ , while the employer pays  $W_2$ . Employment is reduced from  $H_1$  to  $H_2$ . There is substantial deadweight loss. That is many people who could work productively are not hired. The tax is shared between employer and employee depending on relative elasticity.

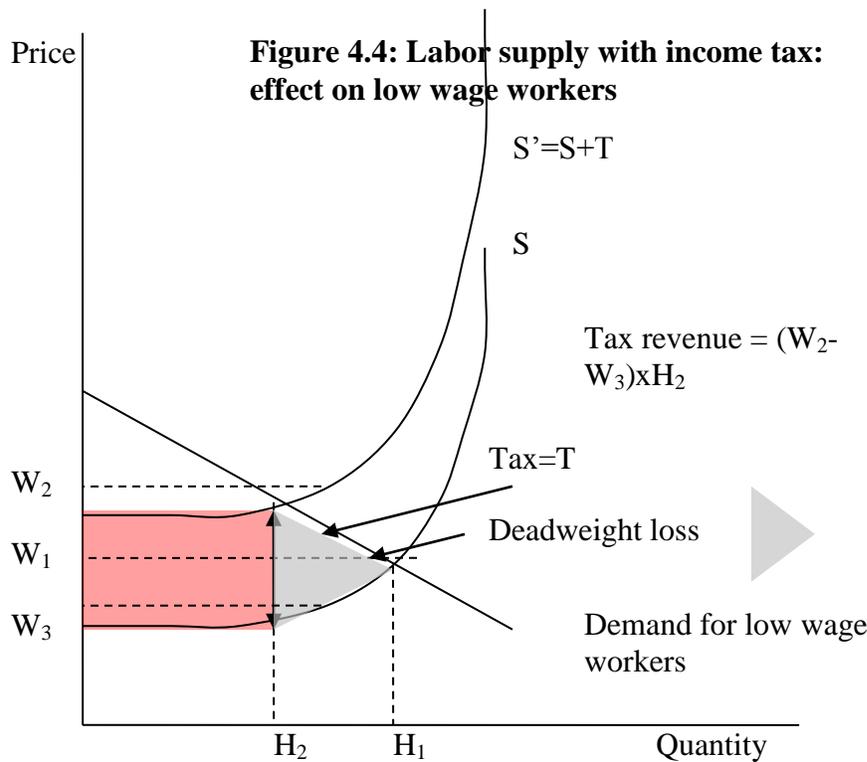
Employers of low-wage workers have a relatively high demand elasticity, for two reasons: Labor is an important part of their budget, and they are often marginal operations themselves. See Table 3.1 in the section on Elasticity.

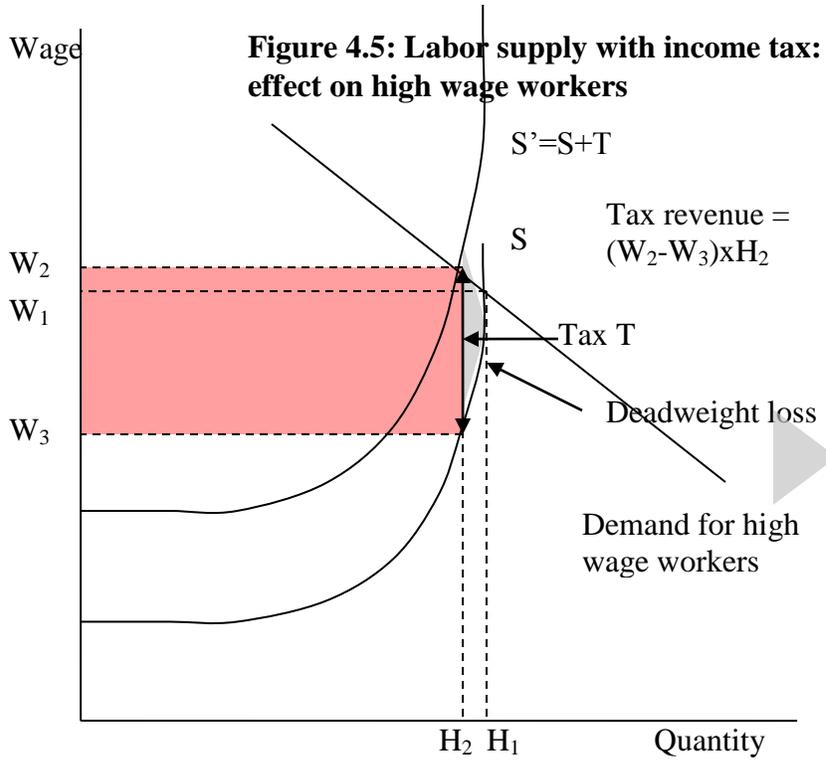
Workers in the high wage region of the labor supply curve have strong labor force attachment. They will work full time over a large range of wages. Their labor supply is highly wage-inelastic.

Employers of high-wage workers often have a relatively low demand elasticity, because such workers form only a small part of their budgets.

**Figure 4.5** shows how an income tax affects high wage workers: It reduces their take-home wage from  $W_1$  to  $W_3$ , while the employer pays  $W_2$ . Employment is slightly reduced from  $H_1$  to  $H_2$ . There is little deadweight loss. The tax falls primarily on the high-wage employee.

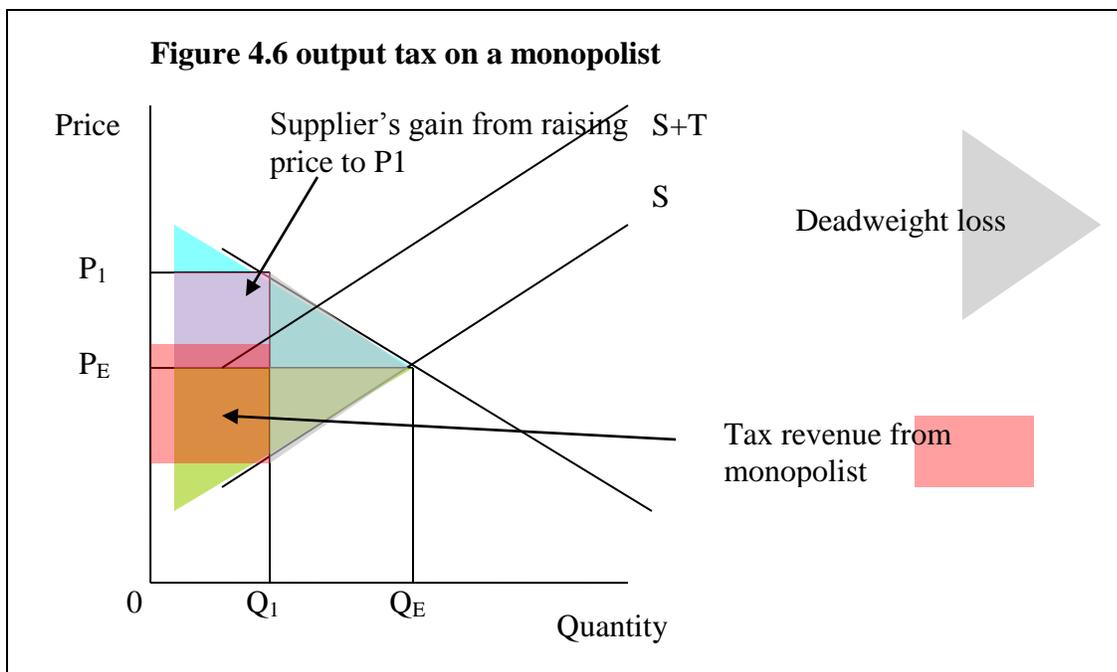
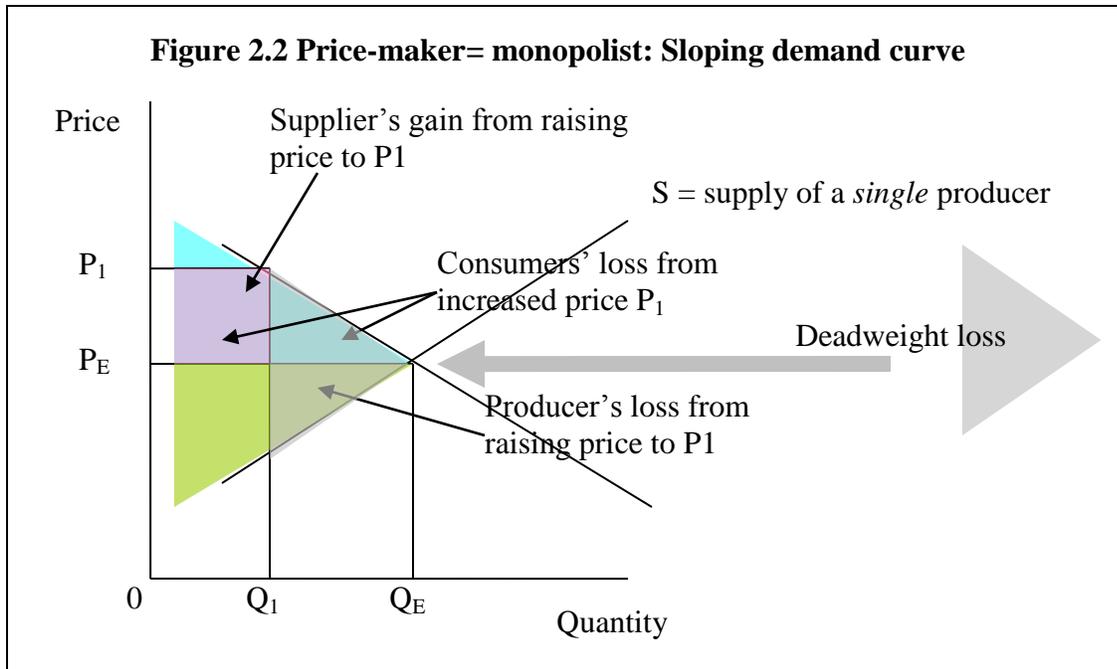
There's a policy moral to this story: an income tax (including payroll tax) on low wage workers is very destructive to employment. An income tax on high wage workers does very little damage, as their labor supply is very inelastic. Unfortunately, over the years the US income and payroll tax system has degenerated from a tax on the rich, to a tax on low and middle income workers. At the rich end, the tax has become filled with loopholes for property income, and the marginal rates have fallen. At the poor end, the Social Security payroll tax, now at 17%, plus worker's comp, unemployment compensation, Medicare and disability—add a large burden on low-wage workers. The proposed health insurance mandate will add a further burden.





#### 4.5 Impact of Taxes on Monopolists

Figure 2.2 shows how a monopolist takes rent from consumers by raising prices and restricting output, causing deadweight loss in the process. As **Figure 4.6** shows, if we put an output or sales tax on a monopolist, the tax will capture part or all of the monopolist's economic rent. In other words, a monopolist cannot significantly "pass on" such a tax, because it is already operating in the elastic portion of the demand curve, and cannot raise prices much further.



#### 4.6 Income and Marginal Effects of Taxes

Taxes affect behavior in two different ways: marginal and income. A tax that adds to the cost of an activity has a *marginal* effect if a decision-maker can partially avoid the tax by doing less. A tax has an income effect, if by making a decision-maker a little poorer, it encourages him or her to greater effort or investment. All taxes have some degree of income effect. Only taxes on rent do *not* have a marginal effect.

A store can partially avoid a sales tax by selling goods at a higher price and lower volume—thus partially “passing on” the tax to its customers. Low wage workers may work less, or not at all, thus avoiding the Social Security tax and passing it on to employers. A tax on imported steel leads manufacturers to use less, substitute other metals, and charge more for their products—again, “passing on” part of the tax. A tax on apartment buildings leads their owners to build fewer of them, partially “passing on” the tax in the form of higher rentals.

A tax on land—or other natural resource like spectrum—has a pure income effect. It presses the owner to put the land to use to pay the tax, or sell to someone who will. Marginal taxes raise the cost of activity; land taxes raise the cost of inactivity.

#### **4.7 Impact of Taxes on the Economy**

According to popular assertions, all taxes damage the economy and are passed on to consumers. In reality, taxes have widely varying effects, depending on elasticity. The supply of land and other natural resources is totally inelastic, so taxes on these are not passed on at all. It follows that taxes on natural resource-based corporations are not much passed on to consumers. Sales and excise taxes are not just “passed on” but are shared between producers and consumers in inverse proportion to relative elasticity. Income taxes on high-wage individuals—like corporate executives—fall almost entirely on these individuals rather than on their employers, with little deadweight loss to the economy. Income, payroll and related taxes on low-wage individuals are shared between them and their employers. These taxes kill jobs and put small labor-intensive businesses at a disadvantage..