Taxes

1. The United States imposes an excise tax on the sale of domestic airline tickets. Let’s assume that in 2010 the total excise tax was $6.10 per airline ticket (consisting of the $3.60 flight segment tax plus the $2.50 September 11 fee). According to data from the Bureau of Transportation Statistics, in 2010, 630 million passengers traveled on domestic airline trips at an average price of $337 per trip. The accompanying table shows the supply and demand schedules for airline trips. The quantity demanded at the average price of $337 is actual data; the rest is hypothetical.

<table>
<thead>
<tr>
<th>Price of trip</th>
<th>Quantity of trips demanded (millions)</th>
<th>Quantity of trips supplied (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$337.02</td>
<td>629</td>
<td>686</td>
</tr>
<tr>
<td>337.00</td>
<td>630</td>
<td>685</td>
</tr>
<tr>
<td>335.00</td>
<td>680</td>
<td>680</td>
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<tr>
<td>330.90</td>
<td>780</td>
<td>630</td>
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<tr>
<td>330.82</td>
<td>900</td>
<td>629</td>
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</table>

   a. What is the government tax revenue in 2010 from the excise tax?
   b. On January 1, 2011, the total excise tax increased to $6.20 per ticket. What is the equilibrium quantity of tickets transacted now? What is the average ticket price now? What is the 2011 government tax revenue?
   c. Does this increase in the excise tax increase or decrease government tax revenue?

   1. a. Tax revenue is $6.10 per trip × 630 million trips = $3,843 million.
      b. The equilibrium quantity now falls to 629 million, with the price rising to $337.02. Tax revenue rises to $6.20 per trip × 629 million trips = $3,899.80 million.
      c. The increase in the excise tax increases government tax revenue.

2. The U.S. government would like to help the American auto industry compete against foreign automakers that sell trucks in the United States. It can do this by imposing an excise tax on each foreign truck sold in the United States. The hypothetical pre-tax demand and supply schedules for imported trucks are given in the accompanying table.

<table>
<thead>
<tr>
<th>Price of imported truck</th>
<th>Quantity of imported trucks (thousands)</th>
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<tbody>
<tr>
<td></td>
<td>Quantity demanded</td>
</tr>
<tr>
<td>$32,000</td>
<td>100</td>
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<tr>
<td>31,000</td>
<td>200</td>
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<tr>
<td>30,000</td>
<td>300</td>
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<tr>
<td>29,000</td>
<td>400</td>
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<tr>
<td>28,000</td>
<td>500</td>
</tr>
<tr>
<td>27,000</td>
<td>600</td>
</tr>
</tbody>
</table>
a. In the absence of government interference, what is the equilibrium price of an imported truck? The equilibrium quantity? Illustrate with a diagram.

b. Assume that the government imposes an excise tax of $3,000 per imported truck. Illustrate the effect of this excise tax in your diagram from part a. How many imported trucks are now purchased and at what price? How much does the foreign automaker receive per truck?

c. Calculate the government revenue raised by the excise tax in part b. Illustrate it on your diagram.

d. How does the excise tax on imported trucks benefit American automakers? Whom does it hurt? How does inefficiency arise from this government policy?

2. a. The equilibrium price without government interference is $30,000 and the equilibrium quantity is 300,000, as shown by point E in the accompanying diagram.

b. The effect of the excise tax is illustrated in the diagram: a tax of $3,000 per truck puts a wedge between the price paid by consumers, or the demand price ($31,000), and the price received by producers, or the supply price ($28,000). The quantity bought and sold is 200,000 trucks. The foreign automaker receives $28,000 per truck (after tax).

c. Since 200,000 trucks are sold, and the government earns a tax of $3,000 on each truck, the total tax revenue is 200,000 × $3,000 = $600 million. This is the shaded area in the diagram.

d. The excise tax leads to a rise in the price of imported trucks. Since American trucks are substitutes for imported trucks, the effect of the tax is to increase the demand for American-made trucks, which leads to a higher price for them. As a result, buyers of both domestic and foreign trucks pay higher prices because of the tax on foreign trucks. Inefficiency arises because some mutually beneficial transactions no longer occur due to the higher prices for trucks caused by the tax.
3. In 1990, the United States began to levy a tax on sales of luxury cars. For simplicity, assume that the tax was an excise tax of $6,000 per car. The accompanying figure shows hypothetical demand and supply curves for luxury cars.

![Demand and Supply Curves for Luxury Cars]

**a.** Under the tax, what is the price paid by consumers? What is the price received by producers? What is the government tax revenue from the excise tax?

Over time, the tax on luxury automobiles was slowly phased out (and completely eliminated in 2002). Suppose that the excise tax falls from $6,000 per car to $4,500 per car.

**b.** After the reduction in the excise tax from $6,000 to $4,500 per car, what is the price paid by consumers? What is the price received by producers? What is tax revenue now?

**c.** Compare the tax revenue created by the taxes in parts a and b. What accounts for the change in tax revenue from the reduction in the excise tax?

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**Solution**

3. **a.** The price paid by consumers is $54,000. The price received by producers is $48,000. The government’s tax revenue is $6,000 per car × 40,000 cars = $240 million.

3. **b.** The price paid by consumers is now $53,000. The price received by producers is $48,500. The government’s tax revenue is $4,500 per car × 60,000 cars = $270 million.

3. **c.** The government tax revenue rose as a result of the reduction in the excise tax. This occurs because the supply of and the demand for luxury automobiles are both highly elastic: a fall in the price paid by consumers leads to a large increase in the quantity demanded, and a rise in the price received by producers leads to a large increase in the quantity supplied. As a result, reducing the tax leads to a large increase in the quantity of luxury automobiles bought and sold—so large, in fact, that the increase in the quantity bought and sold more than makes up for the decrease in the tax per car.

4. All states impose excise taxes on gasoline. According to data from the Federal Highway Administration, the state of California imposes an excise tax of $0.18 per gallon of gasoline. In 2009, gasoline sales in California totaled 14.8 billion gallons. What was California’s tax revenue from the gasoline excise tax? If California doubled the excise tax, would tax revenue double? Why or why not?
4. Tax revenue is $0.18 per gallon × 14.8 billion gallons = $2.664 billion. Doubling the excise tax would reduce the amount of gasoline bought and sold, and tax revenue would less than double. The exception would be a case in which either demand or supply is perfectly inelastic; only in that special case would the quantity transacted not change as a result of the imposition of the excise tax, and tax revenue would—in this special case only—double as a result of a doubling in the excise tax rate.

5. In the United States, each state government can impose its own excise tax on the sale of cigarettes. Suppose that in the state of North Texarkana, the state government imposes a tax of $2.00 per pack sold within the state. In contrast, the neighboring state of South Texarkana imposes no excise tax on cigarettes. Assume that in both states the pre-tax price of a pack of cigarettes is $1.00. Assume that the total cost to a resident of North Texarkana to smuggle a pack of cigarettes from South Texarkana is $1.85 per pack. (This includes the cost of time, gasoline, and so on.) Assume that the supply curve for cigarettes is neither perfectly elastic nor perfectly inelastic.

a. Draw a diagram of the supply and demand curves for cigarettes in North Texarkana showing a situation in which it makes economic sense for a North Texarkanan to smuggle a pack of cigarettes from South Texarkana to North Texarkana. Explain your diagram.

b. Draw a corresponding diagram showing a situation in which it does not make economic sense for a North Texarkanan to smuggle a pack of cigarettes from South Texarkana to North Texarkana. Explain your diagram.

c. Suppose the demand for cigarettes in North Texarkana is perfectly inelastic. How high could the cost of smuggling a pack of cigarettes go until a North Texarkanan no longer found it profitable to smuggle?

d. Still assume that demand for cigarettes in North Texarkana is perfectly inelastic and that all smokers in North Texarkana are smuggling their cigarettes at a cost of $1.85 per pack, so no tax is paid. Is there any inefficiency in this situation? If so, how much per pack? Suppose chip-embedded cigarette packaging makes it impossible to smuggle cigarettes across the state border. Is there any inefficiency in this situation? If so, how much per pack?

5. a. In the accompanying figure, the demand for cigarettes in North Texarkana is relatively inelastic. So most of the $2.00 tax is borne by consumers, who pay an after-tax price of $2.95. Since it would cost $2.85 to purchase and smuggle a pack from South Texarkana ($1.00 price per pack + $1.85 smuggling cost per pack), this diagram illustrates a situation in which a North Texarkanan would be better off smuggling rather than purchasing cigarettes in North Texarkana.
b. In the accompanying diagram, the demand in North Texarkana is less inelastic. As a result, consumers pay an after-tax price of $2.50. In this case, it does not make economic sense to smuggle.

![Diagram showing demand and supply with after-tax price of $2.50]

**Excise tax = $2.00 per pack**

**Price of cigarettes (per pack)**

**Quantity of cigarettes (packs)**

\[ E \rightarrow S \]

b. As shown in the accompanying diagram, if the demand for cigarettes in North Texarkana is perfectly inelastic, the demand curve is a vertical line and all of the tax is borne by consumers. In that case, the after-tax price paid by North Texarkanans is $3.00. So the cost of smuggling could go as high as $1.99, and North Texarkanans would still be better off smuggling; at a cost of $2.00 to smuggle, they would be indifferent between smuggling and purchasing their cigarettes in their home state.

![Diagram showing demand and supply with after-tax price of $3.00]

**Excise tax = $2.00 per pack**

**Price of cigarettes (per pack)**

**Quantity of cigarettes (packs)**

\[ E \rightarrow A \rightarrow S \]

c. As shown in the accompanying diagram, if the demand for cigarettes in North Texarkana is perfectly inelastic, the demand curve is a vertical line and all of the tax is borne by consumers. In that case, the after-tax price paid by North Texarkanans is $3.00. So the cost of smuggling could go as high as $1.99, and North Texarkanans would still be better off smuggling; at a cost of $2.00 to smuggle, they would be indifferent between smuggling and purchasing their cigarettes in their home state.

d. Since demand is perfectly inelastic, the same number of cigarettes are transacted after the tax is imposed compared to before the tax is imposed. But there is still an inefficiency incurred in this situation despite the fact that no tax is paid and no transactions are discouraged: it is the $1.85 that is spent to smuggle a pack of cigarettes. This is the value of resources spent to evade the tax that consumers would have preferred to spend on other goods and activities. If technology eliminates smuggling altogether, there is no inefficiency. Because demand is perfectly inelastic, no transactions are discouraged by the tax, and all of the surplus lost by consumers is captured by the government as tax revenue.
6. In each of the following cases involving taxes, explain: (i) whether the incidence of the tax falls more heavily on consumers or producers, (ii) why government revenue raised from the tax is not a good indicator of the true cost of the tax, and (iii) how deadweight loss arises as a result of the tax.

a. The government imposes an excise tax on the sale of all college textbooks. Before the tax was imposed, 1 million textbooks were sold every year at a price of $50. After the tax is imposed, 600,000 books are sold yearly; students pay $55 per book, $30 of which publishers receive.

b. The government imposes an excise tax on the sale of all airline tickets. Before the tax was imposed, 3 million airline tickets were sold every year at a price of $500. After the tax is imposed, 1.5 million tickets are sold yearly; travelers pay $550 per ticket, $450 of which the airlines receive.

c. The government imposes an excise tax on the sale of all toothbrushes. Before the tax, 2 million toothbrushes were sold every year at a price of $1.50. After the tax is imposed, 800,000 toothbrushes are sold every year; consumers pay $2 per toothbrush, $1.25 of which producers receive.

Solution

6. a. After the imposition of the tax, consumers pay $5 more per book than before; publishers receive $20 less per book than before. Producers (publishers) bear more of the tax. The tax is $55 \( - \) $30 = $25 per book, and 600,000 books are bought and sold. So government revenue is $15 million. This, however, is a poor estimate of the cost of the tax, since it does not take into account the fact that, in addition to the higher price, there are now 400,000 potential consumers who would have bought the books without the tax but no longer will buy them. Deadweight loss arises because consumers and producers lose surplus that is not captured as government revenue. That loss in surplus is accounted for by the 400,000 potential consumers and publishers who would have made transactions without the tax but do not once the tax is levied.

b. After the imposition of the tax, travelers pay $50 more per ticket than before; airlines receive $50 less than before. The tax is split evenly between consumers and producers. The tax is $550 \( - \) $450 = $100 per ticket, and 1.5 million tickets are bought and sold. So government revenue is $150 million. This, however, is a poor estimate of the cost of the tax, since it does not take into account the fact that, in addition to 1.5 million travelers paying higher prices, there are now 1.5 million potential consumers who would have bought tickets without the tax but no longer buy tickets. Deadweight loss arises because consumers and producers lose surplus that is not captured as government revenue. That loss in surplus is represented by the 1.5 million tickets that would have been transacted at the pre-tax price but are not transacted once the tax is levied.

c. After the imposition of the tax, consumers pay $0.50 more per toothbrush than before; producers receive $0.25 less than before. The incidence of the tax falls mainly on consumers. The tax is $2.00 \( - \) $1.25 = $0.75 per toothbrush, and 800,000 toothbrushes are bought and sold. So government revenue is $600,000. This, however, is a poor estimate of the cost of the tax, since it does not take into account the fact that, in addition to 800,000 toothbrushes now being more expensive, there are 1.2 million toothbrushes that would have been transacted without the tax but are no longer transacted. Inefficiency arises because consumers and producers lose surplus that is not captured as government revenue. That loss in surplus is represented by the 1.2 million toothbrushes that would have been transacted at the pre-tax price but are not transacted once the tax is levied.
The accompanying diagram shows the market for cigarettes. The current equilibrium price per pack is $4, and every day 40 million packs of cigarettes are sold. In order to recover some of the health care costs associated with smoking, the government imposes a tax of $2 per pack. This will raise the equilibrium price to $5 per pack and reduce the equilibrium quantity to 30 million packs.

The economist working for the tobacco lobby claims that this tax will reduce consumer surplus for smokers by $40 million per day, since 40 million packs now cost $1 more per pack. The economist working for the lobby for sufferers of second-hand smoke argues that this is an enormous overestimate and that the reduction in consumer surplus will be only $30 million per day, since after the imposition of the tax only 30 million packs of cigarettes will be bought and each of these packs will now cost $1 more. They are both wrong. Why?

The economist working for the tobacco lobby is overestimating the change in consumer surplus. She is assuming that there will be no change in the quantity demanded and that consumers will continue to smoke 40 million packs of cigarettes per day even when the price has risen by $1 per pack. The economist working for the second-hand smoke lobby is underestimating the loss of consumer surplus. He expects that the quantity demanded will be reduced to 30 million packs per day. He is then looking at the loss of consumer surplus experienced by the consumers of those 30 million packs per day. The loss is $1 per pack, the increase in the price per pack. He is not counting the loss of consumer surplus experienced by those who are no longer smoking 10 million packs per day because consumption dropped from 40 million to 30 million packs per day.

The reduction in consumer surplus resulting from the new tax is the $30 million reduction experienced by the smokers of the 30 million packs plus the $5 million reduction in consumer surplus experienced by those smokers who are smoking 10 million fewer packs. The total reduction in consumer surplus is $35 million.

One way of calculating this answer is to look at the total consumer surplus before and after the new tax. Before the tax the consumer surplus was \( \frac{1}{2} \times (8 - 4) \times 40 \) million = $80 million. After the tax, the consumer surplus is \( \frac{1}{2} \times (8 - 5) \times 30 \) million = $45 million. The reduction in consumer surplus is $80 million – $45 million = $35 million. (Recall that the area of a triangle is \( \frac{1}{2} \times \) the base of the triangle \times the height of the triangle.)
8. Consider the original market for pizza in Collegetown, illustrated in the accompanying table. Collegetown officials decide to impose an excise tax on pizza of $4 per pizza.

<table>
<thead>
<tr>
<th>Price of pizza</th>
<th>Quantity of pizza demanded</th>
<th>Quantity of pizza supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
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<td>0</td>
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<td>1</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

a. What is the quantity of pizza bought and sold after the imposition of the tax? What is the price paid by consumers? What is the price received by producers?

b. Calculate the consumer surplus and the producer surplus after the imposition of the tax. By how much has the imposition of the tax reduced consumer surplus? By how much has it reduced producer surplus?

c. How much tax revenue does Collegetown earn from this tax?

d. Calculate the deadweight loss from this tax.

8.

a. The tax drives a wedge between the price paid by consumers and the price received by producers. Consumers now pay $9, and producers receive $5. So after the imposition of the tax, the quantity bought and sold will be one pizza.

b. Consumer surplus is now zero (the one consumer who still buys a pizza at $9 has a willingness to pay of just $9, so that the consumer surplus is $9 – $9 = $0). Compared to the situation before the imposition of the tax, where the equilibrium price was $7, consumer surplus has been reduced by $3. Similarly, the producer of the one pizza has a cost of $5, and this is the price he receives, so producer surplus is also zero: compared to the situation before, it has decreased by $3.

c. Collegetown earns a tax of $4 per pizza sold, which is a total tax revenue of $4.

d. Total surplus has been decreased by $6. Of that $6, the town earns $4 in revenue, but $2 of surplus is lost. That is the deadweight loss from this tax.

9. The state needs to raise money, and the governor has a choice of imposing an excise tax of the same amount on one of two previously untaxed goods: the state can tax sales of either restaurant meals or gasoline. Both the demand for and the supply of restaurant meals are more elastic than the demand for and the supply of gasoline. If the governor wants to minimize the deadweight loss caused by the tax, which good should be taxed? For each good, draw a diagram that illustrates the deadweight loss from taxation.
9. The tax should be imposed on sales of gasoline. Since both demand for and supply of gasoline are less elastic, changes in the price of gasoline will result in smaller reductions in the quantity demanded and quantity supplied. As a result, fewer transactions are discouraged by the tax—in other words, less total surplus (consumer and producer surplus) is lost. Panel (a) of the accompanying diagram illustrates a tax imposed on sales of gasoline, for which both demand and supply are less elastic; panel (b) illustrates a tax imposed on sales of restaurant meals, for which both demand and supply are more elastic. As you can see, deadweight loss, the shaded triangle, is larger in panel (b) than in panel (a).

10. Assume that the demand for gasoline is inelastic and supply is relatively elastic. The government imposes a sales tax on gasoline. The tax revenue is used to fund research into clean fuel alternatives to gasoline, which will improve the air we all breathe.

a. Who bears more of the burden of this tax, consumers or producers? Show in a diagram who bears how much of the excess burden.

b. Is this tax based on the benefits principle or the ability-to-pay principle? Explain.

Solution

10. a. The accompanying diagram shows an inelastic (relatively steep) demand curve for gasoline. The tax, whether imposed on consumers or producers, drives a wedge between the price paid by consumers, $P_C$, and the price received by producers, $P_P$. The burden of the tax is illustrated by the gray and light gray areas A and B. Area A is the loss of consumer surplus—the burden of the tax that falls on consumers. Area B is the loss of producer surplus—the burden of the tax that falls on producers. Here, the burden is borne predominantly by consumers.
b. Consumers who drive cars that use more gasoline pay most of the tax. If this tax were based on the benefits principle, the tax revenue would have to benefit those who pay most of the tax. However, everyone benefits equally from research into cleaner fuel, because of the improvement in air quality, so the tax is not based on the benefits principle. If this tax were based on the ability-to-pay principle, more of the tax would have to be paid by those who have a greater ability to pay. This would be true if cars that consume more gasoline were driven largely by higher-income individuals. To some extent this may be true: higher-income individuals drive larger cars, SUVs, and so on, and to the extent to which this is true, the tax is based on the ability-to-pay principle. However, a significant number of lower-income individuals drive old, fuel-inefficient cars. To the extent to which this is true, the tax is not based on the ability-to-pay principle.

11. Assess the following four tax policies in terms of the benefits principle versus the ability-to-pay principle.

a. A tax on gasoline that finances maintenance of state roads
b. An 8% tax on imported goods valued in excess of $800 per household brought in on passenger flights
c. Airline-flight landing fees that pay for air traffic control
d. A reduction in the amount of income tax paid based on the number of dependent children in the household

11. a. This tax is based on the benefits principle, since the people who use the state’s roads will be the ones paying the gasoline tax.
b. This tax is based on the ability-to-pay principle, since the people paying the tax will presumably be individuals who buy expensive items abroad and then import them on passenger flights.
c. This tax is based on the benefits principle, since the airlines pay the landing fee and are also the beneficiary of air traffic control services.
d. This deduction is based on the ability-to-pay principle. People who have more dependent children in their household will have higher expenses and so are less able to pay a given amount of income taxes, other things equal.

12. You are advising the government on how to pay for national defense. There are two proposals for a tax system to fund national defense. Under both proposals, the tax base is an individual’s income. Under proposal A, all citizens pay exactly the same lump-sum tax, regardless of income. Under proposal B, individuals with higher incomes pay a greater proportion of their income in taxes.

a. Is the tax in proposal A progressive, proportional, or regressive? What about the tax in proposal B?
b. Is the tax in proposal A based on the ability-to-pay principle or on the benefits principle? What about the tax in proposal B?
c. In terms of efficiency, which tax is better? Explain.
12. a. The tax in proposal A is regressive: since everyone pays the same dollar amount in taxes, higher-income individuals pay a lower percentage of their income in taxes. The tax in proposal B is progressive: higher-income individuals pay a higher percentage of their income in taxes.

b. Every citizen benefits equally from national defense. The tax in proposal A is based on the benefits principle: since everyone benefits equally, everyone pays equally. The tax in proposal B is based on the ability-to-pay principle: higher-income individuals are able to pay more taxes, and under this proposal they do pay more taxes.

c. In terms of efficiency, the lump-sum tax is better. The lump-sum tax creates a marginal tax rate of zero: once the tax is paid, every additional dollar earned is no longer taxed. Since it does not depend on people’s actions (how much income they choose to earn), it does not distort their incentives to earn income. The tax in proposal B has a higher marginal tax rate: each additional dollar of income earned is taxed. And the marginal tax rate is increasing: each additional dollar of income earned is taxed more than the previous dollar. This creates inefficiency, because it distorts the incentive to earn more income.

13. Each of the following tax proposals has income as the tax base. In each case, calculate the marginal tax rate for each level of income. Then calculate the percentage of income paid in taxes for an individual with a pre-tax income of $5,000 and for an individual with a pre-tax income of $40,000. Classify the tax as being proportional, progressive, or regressive. (Hint: You can calculate the marginal tax rate as the percentage of an additional $1 in income that is taxed away.)

a. All income is taxed at 20%.

b. All income up to $10,000 is tax-free. All income above $10,000 is taxed at a constant rate of 20%.

c. All income between $0 and $10,000 is taxed at 10%. All income between $10,000 and $20,000 is taxed at 20%. All income higher than $20,000 is taxed at 30%.

d. Each individual who earns more than $10,000 pays a lump-sum tax of $10,000. If the individual’s income is less than $10,000, that individual pays in taxes exactly what his or her income is.

e. Of the four tax policies, which is likely to cause the worst incentive problems? Explain.

13. a. The marginal tax rate is 20% regardless of the taxpayer’s income level: on each additional $1 in income, individuals pay $0.20 in taxes, which is 20%. An individual with a pre-tax income of $5,000 would pay $5,000 × 20% = $1,000 in taxes; this is 20% of his or her income. An individual with a pre-tax income of $40,000 would pay $40,000 × 20% = $8,000 in taxes; this is 20% of his or her income. Since each individual pays the same percentage of income in taxes, regardless of income level, this tax is proportional.

b. On income up to $10,000, there is a zero marginal tax rate: on each additional $1 of income in this tax bracket, individuals pay $0.00 in taxes, which is 0%. On income over $10,000, there is a 20% marginal tax rate: on each additional $1 of income in this tax bracket, individuals pay $0.20 in taxes, which is 20%. An individual with a pre-tax income of $5,000 would pay $5,000 × 0% = $0 in taxes; this is 0% of his or her income. An individual with a pre-tax income of $40,000 would pay $40,000 × 20% = $8,000 in taxes; this is 20% of his or her income. An individual with a pre-tax income of $40,000 would pay $10,000 × 0% + $30,000 × 20% = $6,000 in taxes; this is $6,000/$40,000 × 100 = 15% of his or her income. This tax is progressive because the percentage of income paid in taxes rises as income rises.
c. The marginal tax rate is 10% on the first $10,000 of income: on each additional $1 of income in this tax bracket, individuals pay $0.10 in taxes, which is 10%; it is 20% on the next $10,000 of income: on each additional $1 of income in this tax bracket, individuals pay $0.20 in taxes, which is 20%; it is 30% on all income above $20,000: on each additional $1 of income in this tax bracket, individuals pay $0.30 in taxes, which is 30%. An individual with a pre-tax income of $5,000 would pay $5,000 \times 10\% = $500 in taxes; this is 10% of his or her income. An individual with a pre-tax income of $40,000 would pay $10,000 \times 10\% + $10,000 \times 20\% + $20,000 \times 30\% = $9,000 in taxes; this is $9,000/$40,000 \times 100 = 22.5\%$ of his or her income. Again, this tax is progressive because the percentage of income paid in taxes rises as income rises.

d. For individuals who earn less than $10,000, the marginal tax rate is 100%, since all additional income is taxed away. For those who earn more than $10,000, the marginal tax rate is zero: they pay the same amount of tax—$10,000—regardless of how much they earn over $10,000. An individual with a pre-tax income of $5,000 would pay $5,000 \times 100\% = $5,000 in taxes; this is 100% of his or her income. An individual with a pre-tax income of $40,000 would pay $10,000 in taxes; this is $10,000/$40,000 \times 100 = 25\%$ of his or her income. This tax policy is regressive because those with higher incomes pay a smaller share of their income in taxes than those with lower incomes.

e. The tax policy in part d is likely to cause the worst incentive problems. People who make less than $10,000 if they work will receive zero income after taxes are paid, so there is zero incentive to work. For those making less than $10,000, part b has no incentive problems; and for those making more than $10,000, part d has no incentive problems. In both cases, the individuals in question get to keep 100% of an additional dollar earned.

14. In Transylvania the basic income tax system is fairly simple. The first 40,000 sylvers (the official currency of Transylvania) earned each year are free of income tax. Any additional income is taxed at a rate of 25%. In addition, every individual pays a social security tax, which is calculated as follows: all income up to 80,000 sylvers is taxed at an additional 20%, but there is no additional social security tax on income above 80,000 sylvers.

a. Calculate the marginal tax rates (including income tax and social security tax) for Transylvanians with the following levels of income: 20,000 sylvers, 40,000 sylvers, and 80,000 sylvers. (Hint: You can calculate the marginal tax rate as the percentage of an additional 1 sylver in income that is taxed away.)

b. Is the income tax in Transylvania progressive, regressive, or proportional? Is the social security tax progressive, regressive, or proportional?

c. Which income group’s incentives are most adversely affected by the combined income and social security tax systems?

### Solution

14. a. An individual who earns 20,000 sylvers pays no income tax but pays 20% of his or her income in social security tax. So the marginal tax rate is 20%.

An individual who earns 40,000 sylvers pays no income tax and pays 20% of his or her income in social security tax. But on an additional sylver (that is, on income above 40,000 sylvers) this individual pays a 45% tax (the basic income tax plus the social security tax). So the marginal tax rate is 45%.

An individual who earns 80,000 sylvers pays a marginal income tax rate of 25% and 20% in social security tax. But on an additional sylver (that is, on income above 80,000 sylvers), this individual pays only 25% (the income tax rate) because there is no social security tax on income over 80,000 sylvers. So this individual’s marginal tax rate is 25%.
b. The Transylvanian income tax system is progressive because the percentage of income paid in income taxes rises as income rises. But the social security tax system is a mix of proportional and regressive because the percentage of income paid in social security tax is constant at 20% up to an income of 80,000 sylvers, and then it falls to zero as income increases further. This makes the social security tax regressive overall.

c. In this system, incentive problems are worst for middle-income individuals (between 40,000 and 80,000 sylvers) because they have the highest marginal tax rate, 45%.

15. You work for the Council of Economic Advisers, providing economic advice to the White House. The president wants to overhaul the income tax system and asks your advice. Suppose that the current income tax system consists of a proportional tax of 10% on all income and that there is one person in the country who earns $110 million; everyone else earns less than $100 million. The president proposes a tax cut targeted at the very rich so that the new tax system would consist of a proportional tax of 10% on all income up to $100 million and a marginal tax rate of 0% (no tax) on income above $100 million. You are asked to evaluate this tax proposal.

a. For incomes of $100 million or less, is this tax system progressive, regressive, or proportional? For incomes of more than $100 million? Explain.

b. Would this tax system create more or less tax revenue, other things equal? Is this tax system more or less efficient than the current tax system? Explain.

Solution

a. This tax system is proportional up to an income of $100 million, but it is regressive for incomes higher than $100 million. Above $100 million, the tax is regressive, since higher-income taxpayers pay a smaller percentage of their income in taxes. For instance, the individual with income of $110 million pays $100 million \times 10\% = $10 million in taxes, which is $10 million/$110 million \times 100 = 9\% of his or her income in taxes. But an individual with an even higher income, say $200 million, would pay $100 million \times 10\% = $10 million in taxes, which is $10 million/$200 million \times 100 = 5\% of his or her income in taxes.

b. This tax system would raise almost the same amount of tax revenue, since for all individuals, except for the one richest individual, it is identical to the current tax system. The richest individual pays $10 million in taxes, except the new tax system now creates an incentive for that individual to work to raise his or her income: an additional dollar of income is now worth exactly one additional dollar. Under the current system, an additional dollar of income for the top earner would only be worth an additional 90 cents. So this tax system is more efficient than the current tax system.