

Recitation #6 – Week 02/15/2009 to 02/21/2009

Chapter 7 - Taxes

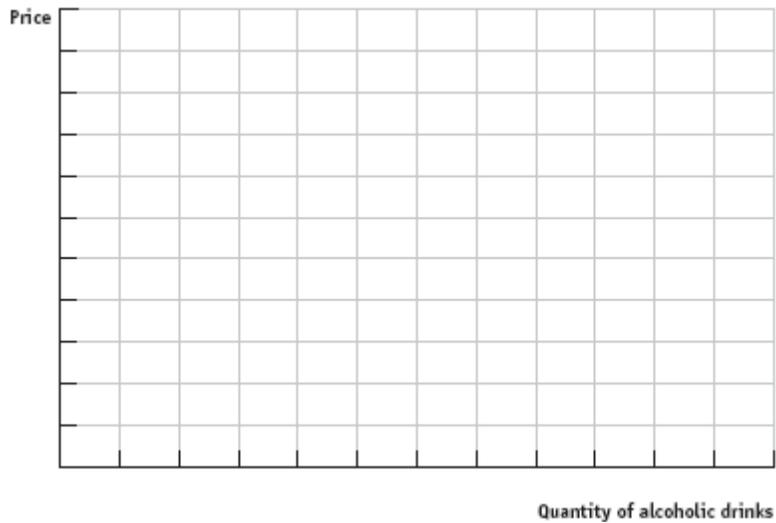
Exercise 1. The government wishes to limit the quantity of alcoholic beverages sold and therefore is considering the imposition of an excise tax on the market for alcoholic drinks. Suppose the market for alcoholic drinks can be described by the following demand and supply equations:

$$\text{Demand: } Q = 10,000 - 2,000P$$

$$\text{Supply: } Q = 2,000P$$

where P is the price of an alcoholic drink and Q is the quantity of alcoholic drinks sold and consumed during the time period. The proposed excise tax is \$2 per alcoholic drink.

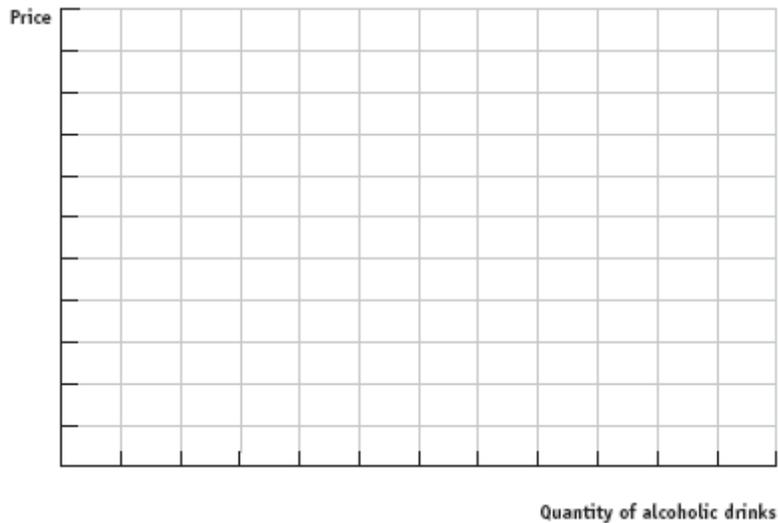
a. Draw a graph representing the initial market for alcoholic drinks. Label the equilibrium price P_1 , and the equilibrium quantity Q_1 .



b. Compute the numeric value of P_1 and Q_1 in this market.

c. What is the value of consumer and producer surplus (CS and PS) in this market prior to the imposition of the tax? Shade in these two areas on your graph in part (a) and label these areas clearly. What is the value of total surplus before the tax?

d. Suppose the excise tax is implemented and producers are legally responsible for paying the tax. Draw a new graph representing this market now that the excise tax has been implemented. Label the new equilibrium price with the tax (P_t), the new equilibrium quantity with the tax (Q_t), and the net price received by producers after they pay the tax to the government (P_n).



e. Calculate the numeric values of P_t , Q_t , and P_n that you marked on your graph in part (d).

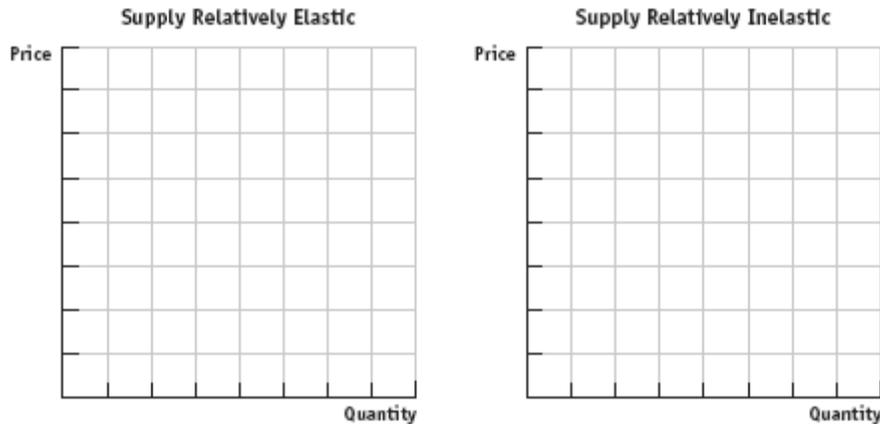
f. On your graph from part (d), label the areas that correspond to consumer surplus with the tax (CSt), producer surplus with the tax (PSt), CTI, PTI, and DWL.

g. Calculate the value of CSt , PSt , CTI, PTI, tax revenue, and DWL once the tax is implemented. Is the sum of $(CSt) + (PSt) + (\text{tax revenue}) + \text{DWL}$ equal to the original value of total surplus before the tax was implemented?

h. Suppose the excise tax is raised to \$3 per alcoholic drink. What is the effect of this price increase on tax revenue? Provide a qualitative answer as well as a quantitative answer.

Exercise 2. The textbook emphasizes that the effect of an excise tax depends on the price elasticities of demand and supply. This question and question 4 explore the relationship between elasticity and the excise tax.

a. Draw two graphs side by side, and draw a demand curve that is the same in both graphs. (Hint: this means that the y-intercept and the x-intercept for these two demand curves are the same in the two graphs.) Label this curve D in both graphs.



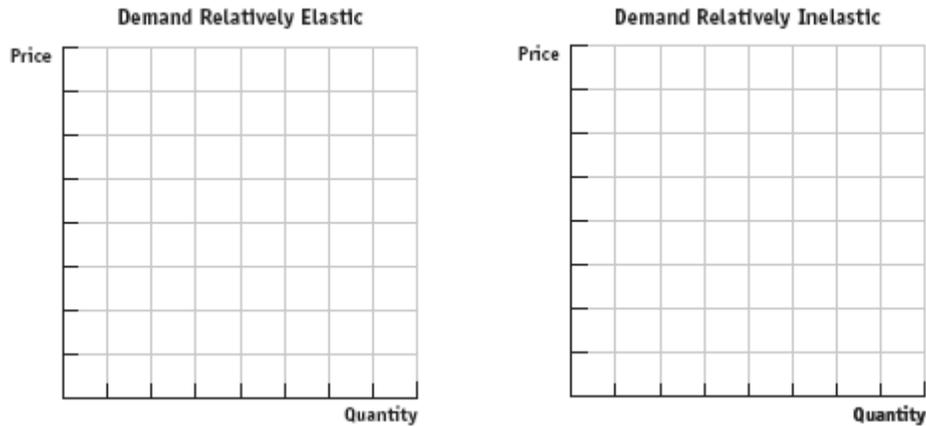
b. In the first graph, draw a relatively elastic supply curve and label the initial equilibrium price P_1 and the initial equilibrium quantity Q_1 . In the second graph, mark P_1 and Q_1 (the same P_1 and Q_1 as you found in the first graph) and then draw a relatively inelastic supply curve that goes through this equilibrium point. Label the supply curve in both graphs S_1 .

c. In the first graph, draw a second supply curve that shows the effect of an excise tax. This second supply curve should be drawn parallel to the first supply curve. Label the equilibrium price with the tax P_t , the equilibrium quantity with the tax Q_t , and the net price firms receive after they pay the tax P_n . In addition, on this graph, label consumer surplus with the tax (CS_t), producer surplus with the tax (PS_t), CTI , PTI , and DWL .

d. In the second graph, draw a second supply curve that shows the effect of an excise tax which is exactly the same excise tax as in the first graph. (Hint: the y-intercept of the new supply curve for each graph is equal to the y-intercept of the original supply curve plus the excise tax.) Label all the same items for this graph that you labeled in the first graph. **e.** Compare the two graphs and comment on the effect of price elasticity of supply on your results.

Exercise 3.

a. Draw two graphs side by side. In both graphs, draw a supply curve that is identical. Label this curve S_1 .



b. In the first graph, draw a demand curve (D) that is relatively elastic. Label the initial equilibrium price P_1 and the initial equilibrium quantity Q_1 . In the second graph, mark P_1 and Q_1 (the same P_1 and Q_1 as in the first graph) and then draw a relatively inelastic demand curve through this equilibrium point. Label this curve D .

c. In both graphs, draw a second supply curve that illustrates an excise tax. The two supply curves should be identical and should be labeled S_t . On both graphs, label the equilibrium price with the tax P_t ; the equilibrium quantity with the tax Q_t ; and the net price firms receive after they pay the tax P_n . In addition, on both graphs, label consumer surplus with the tax (CSt), producer surplus with the tax (PSt), CTI , PTI , and DWL .

d. In which graph is the DWL greater?

e. In which graph is the CTI greater?

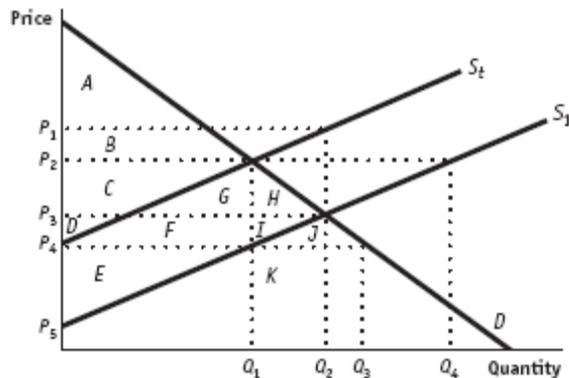
f. In which graph is the PTI greater?

Multiple choice questions

1. The cost of a tax is equal to

- the tax revenue raised by the tax.
- the tax revenue raised by the tax, plus the deadweight loss associated with the tax, plus whatever administrative costs that compliance with the tax incurs.
- the tax revenue raised by the tax plus the deadweight loss associated with the tax.
- the deadweight loss associated with the tax and the administrative costs that compliance with the tax entails.

Answer the **next seven questions** (2-8) based on the following information. The graph below represents the market for cigarettes in Tinseltown. D is the demand curve, S_1 is the supply curve, and S_t is the supply curve after an excise tax has been imposed on cigarettes. Letters A through K represent areas in the graph. Prices are denoted as P_1 , P_2 , P_3 , P_4 , and P_5 . Quantities are denoted as Q_1 , Q_2 , Q_3 , and Q_4 .



2. The excise tax in the graph is equal to

- $P_1 - P_4$.
- $P_2 - P_4$.
- $P_4 - P_5$.
- Answers (a) and (c) both measure the excise tax.
- Answers (b) and (c) both measure the excise tax.

3. The consumer surplus before the tax is equal to the sum of areas

- a. *A, B, C, G, and H.*
- b. *A and B.*
- c. *A, B, C, D, E, F, G, H, and I.*
- d. *D, E, F, and I.*

4. The producer surplus before the tax is equal to the areas

- a. *A, B, C, G, and H.*
- b. *A and B.*
- c. *A, B, C, D, E, F, G, H, and I.*
- d. *D, E, F, and I.*

5. The tax revenue collected by the government when this excise tax is imposed is equal to

- a. $(P_1 - P_3)(Q_2)$.
- b. $(P_2 - P_4)(Q_1)$.
- c. $(P_2 - P_4)(Q_2)$.
- d. $(P_2 - P_3)(Q_1)$.

6. The deadweight loss from a consumer's perspective is equal to area(s)

- a. *H.*
- b. *I.*
- c. *H and I.*
- d. *C, G, and H.*

7. The efficiency cost of this excise tax can be measured as area(s)

- a. *G and H.*
- c. *I and J.*

- b. H and I . d. H , I , and J .

8. A mathematical expression for the deadweight loss caused by this excise tax is

- a. $(P_2 - P_4)(Q_2)$.
- b. $(P_2 - P_4)(Q_2 - Q_1)$.
- c. $(1/2)(P_2 - P_4)(Q_2 - Q_1)$.
- d. $(1/2)(P_2 - P_3)(Q_2 - Q_1)$.

9. The income tax in Tinseltown is a flat tax that requires everyone to pay 10% of their income to the government no matter what their level of income. This tax is

- a. efficient.
- b. proportional.
- c. regressive.
- d. based on the ability-to-pay principle.
- e. based on the benefit principle.

10. The highways in Tinseltown are financed through toll taxes that are collected from people driving on these highways. This tax is

- a. efficient.
- b. proportional.
- c. based on the ability-to-pay principle.
- d. based on the benefit principle.

11. In this year's presidential election in Tinseltown, one of the candidates is running on a platform that advocates a change in the income tax. This candidate proposes that individuals in the bottom half of the income distribution should pay 50% of their income to the government, while individuals in the top half

of the income distribution should pay 30% of their income. This candidate reasons that the higher-income individuals will still end up paying a lot of money to the government. The tax structure advocated by this candidate is

- a. regressive.
- b. progressive.
- c. proportional.
- d. efficient.

Answer the **next six questions** (12-17) based on the following information. The market for soft drinks in Tinseltown is given by the following demand and supply equations:

$$\text{Demand: } P = 100 - 2Q$$

$$\text{Supply: } P = 2Q$$

Where P is the market price measured in cents and Q is the market quantity measured in bottles of soft drink. Tinseltown is considering imposing an excise tax on soft drink producers of 20 cents a bottle.

12. If this excise tax is imposed, the new supply curve with the excise tax will be

- a. $P = 2Q + 20$.
- b. $P = 2Q - 20$.
- c. $P = 2(Q + 20)$.
- d. $P = 2(Q - 20)$.

13. If this excise tax is imposed, the price of soft drinks in Tinseltown will increase by cents.

- a. 20
- b. 30
- c. 10
- d. 0

14. If this excise tax is imposed, the tax revenue collected by the government will equal

- a. \$1.
- b. \$2.
- c. \$3.
- d. \$4.

15. If this excise tax is imposed, the deadweight loss associated with the tax will equal

- a. \$5.
- b. \$4.
- c. \$1.
- d. \$0.50.

16. The loss in consumer surplus due to the imposition of this excise tax equals

- a. \$6.25.
- b. \$4.
- c. \$2.25.
- d. \$0.25.

17. If this excise tax is imposed, the producer tax incidence is equal to

- a. \$1.
- b. \$2.
- c. \$2.25.
- d. \$4.

18. An excise tax is imposed on producers of a good. For a given supply curve, the more price elastic the demand for the product, the greater the tax incidence on

- a. consumers.
- b. producers.

19. An excise tax is imposed on producers of a good. For a given demand curve, the more inelastic the supply of the product, the greater the tax incidence on

- a. consumers.
- b. producers.

20. When the price elasticity of demand is low and the price elasticity of supply is high, the burden of an excise tax falls primarily on

a. sellers of the product.

b. buyers of the product.

21. When the price elasticity of demand is high and the price elasticity of supply is low, the burden of an excise tax falls primarily on

a. sellers of the product.

b. buyers of the product.

22. You are told that the initial supply curve in a market is $P = Q$ and the initial demand curve in the market is $P = 100 - Q$. An excise tax is imposed in this market and it results in the government collecting \$1,250 in tax revenue. The excise tax in this market is equal to

a. \$10. c. \$25.

b. \$20. d. \$50.

23. Excise taxes cause deadweight loss when the excise tax

a. raises the price of the good being taxed.

b. decreases the quantity of the good supplied and demanded in the market.

c. creates an incentive for mutually beneficial exchanges to take place.

d. Answers (a), (b), and (c) are all true.

24. The deadweight loss due to the imposition of an excise tax is lowest when

- a. demand is relatively inelastic and supply is relatively elastic.
- b. demand is relatively inelastic and supply is relatively inelastic.
- c. demand is relatively elastic and supply is relatively elastic.
- d. demand is relatively elastic and supply is relatively inelastic.

25. Policymakers wishing to dramatically decrease the consumption of a good by using an excise tax will find that the success of this policy depends on

- a. the price elasticity of demand.
- b. the price elasticity of supply.
- c. the price elasticities of either demand or supply.
- d. the size of the excise tax. The price elasticities of supply and demand have no impact on how successful the policy is with regard to decreasing the consumption of the good.

26. Which of the following statements is true?

- I. The ability-to-pay principle of taxation says that all individuals have the ability to pay tax and should therefore not be exempt from paying taxes.
- II. The ability-to-pay principle of taxation when applied in the design of a tax system results in all individuals paying their fair share of taxes.
- III. The ability-to-pay principle of taxation and the benefits principle of taxation result in the same outcome with regard to designing tax systems.

- a. Statement I is true.

- b. Statement II is true.
- c. Statement III is true.
- d. Statements I and III are true.
- e. Statements II and III are true.
- f. None of the above statements are true.

Use the following table to answer the **next three questions (27-29)**. The table provides information about pre-tax income and then gives after-tax income for three different tax structure proposals.

| Pre-tax income | Proposal 1: After-tax income | Proposal 2: After-tax income | Proposal 3: After-tax income |
|----------------|---------------------------------|---------------------------------|---------------------------------|
| \$ 20,000 | \$ 15,000 | \$ 15,000 | \$ 15,000 |
| 32,000 | 24,000 | 27,000 | 22,400 |
| 40,000 | 30,000 | 35,000 | 27,200 |
| 80,000 | 60,000 | 75,000 | 52,000 |
| 200,000 | 150,000 | 195,000 | 120,000 |

27. Policymakers wish to impose a proportional, or flat, tax based on income. Which proposed tax structure represents this choice?

- a. Proposal 1
- b. Proposal 2
- c. Proposal 3

28. Policymakers wish to impose a regressive tax based on income. Which proposed tax structure represents this choice?

- a. Proposal 1

b. Proposal 2

c. Proposal 3

29. What percentage of income does an individual pay in taxes under proposal 2 if that individual's pre-tax income is \$40,000?

a. 0.125%

b. 1.25%

c. 12.5%

d. 125%

30. The marginal tax rate is

a. the total number of dollars paid as a tax divided by the taxpayer's income.

b. the total amount of tax revenue collected by the government divided by the economy's total income.

c. the percentage of an increase in income that is taxed away.

d. the percentage of income paid as taxes by the lowest quintile of income in the economy.

31. In contrast to taxes at the federal level, taxes at the state and local level of government in the United States

a. apply the ability-to-pay principle more frequently.

b. tend to be more proportional.

c. tend to be more regressive.

d. tend to be more progressive.

Answers to the Multiple choice questions

1. Answer b. When the government imposes a tax, this clearly results in the government receiving tax revenue which is a cost to the taxpayer, but the imposition of a tax imposes greater costs than just the tax revenue collected. The tax also imposes an efficiency cost (the DWL) as the tax causes a distortion in consumer behavior. The tax also imposes an administrative cost associated with complying with the tax.

2. Answer e. The excise tax is equal to the vertical distance between the original supply curve and the supply curve with the tax. At quantity Q_2 , the vertical distance is equal to $P_1 - P_3$: this is the same distance as $P_2 - P_4$ or $P_4 - P_5$.

3. Answer a. The area of consumer surplus is the area above the equilibrium price and below the demand curve. Before the tax is implemented, the equilibrium price is P_3 and thus the area of consumer surplus is equal to the areas A , B , C , G , and H .

4. Answer d. The area of producer surplus is the area that lies beneath the equilibrium price and above the supply curve. Before the imposition of the tax, the equilibrium price is P_3 and the area of producer surplus is the sum of areas D , E , F , and I .

5. Answer b. The tax revenue collected by the government is equal to the product of the tax per unit and the number of units of the good sold when the tax is implemented. In this example, the tax per unit is $(P_2 - P_4)$ and the number of units sold is Q_1 , so the tax revenue is equal to $(P_2 - P_4)(Q_1)$.

6. Answer a. When the excise tax is imposed, the consumer reduces consumption of the good. Some of the consumer's original consumer surplus is captured by the government: the consumer's tax incidence measures the economic burden of the tax borne by consumers. The consumer also loses a part of the original consumer surplus due to the efficiency cost of the tax: in this graph, this is represented as area H .

7. Answer b. The excise tax imposes an efficiency cost equal to the deadweight loss. This deadweight loss is represented by the areas H and I in the graph. Prior to the imposition of the excise tax, total surplus is equal to the

sum of consumer and producer surplus. When the tax is imposed on this market, part of this total surplus is captured by the government as tax revenue, but part of the total surplus is lost to consumers and producers due to the distortion the tax causes with respect to the level of consumption of the good. This distortion is measured by areas H and I .

8. Answer c. The area of deadweight loss can be calculated as an area of a triangle: thus, this area is equal to one-half times the product of the excise tax per unit and the change in quantity due to the imposition of the tax. In this example, the excise tax per unit is equal to $(P2 - P4)$ and the change in quantity is $(Q2 - Q1)$.

9. Answer b. This is an example of a proportional tax, since the tax is the same proportion of everyone's income. High-income people pay 10% of their income as do low-income people. This tax is not based on the benefits principle, since the amount of tax you pay is not tied to the level of government services you receive, nor is the tax based on the ability-to-pay principle, since the government does not take into account the individual's ability to pay when collecting the tax.

10. Answer d. Those individuals who make use of the highways in Tinseltown pay the tax that provides these highways. These individuals benefit from the highways and they pay the tax to support the construction of these highways. No distinction is made with regard to the individual taxpayer's ability to pay: if the individual uses the highway then they pay the toll.

11. Answer a. Since lower-income individuals will pay a larger percentage of their income to the government with this tax structure, this tax structure is regressive.

12. Answer a. The new supply curve will be parallel to the original supply curve but will have a y-intercept that is 20 cents greater than the original supply curve's y-intercept. Since the original supply curve intercepts the y-axis at zero, this means that the new supply curve with the excise tax will intercept the y-axis at 20.

13. Answer c. To answer this question, you must know the original price of soft drinks in Tinseltown before the excise tax and the price of soft drinks in Tinseltown after the imposition of the excise tax. The original price of soft

drinks is 50 cents, and when the tax is implemented the price will rise to 60 cents. The increase in the price equals 10 cents.

14. Answer d. The tax revenue is equal to the tax per unit times the number of units sold. When the excise tax is implemented, 20 bottles of soft drinks will be sold at a price of 60 cents each. But 20 cents of that price represents the excise tax, so the government will collect 20 cents per bottle sold, or a total of \$4.

15. Answer d. The deadweight loss can be calculated as the area of a triangle. The deadweight loss is equal to $(1/2)(\text{excise tax per unit})(\text{the original equilibrium quantity} - \text{the equilibrium quantity with the excise tax})$, or $(1/2)(20 \text{ cents per unit})(25 \text{ units} - 20 \text{ units})$, which equals \$0.50.

16. Answer c. The original consumer surplus is equal to \$6.25 and the new consumer surplus after the imposition of the excise tax is equal to \$4.00, which means the loss in consumer surplus due to the tax is equal to \$2.25.

17. Answer b. The producer tax incidence is a measure of the economic burden of the excise tax on producers. Producers prior to the excise tax sold their good for 50 cents a bottle. With the excise tax the price of soft drinks increases to 60 cents a bottle, but the government receives 20 cents of that price. The producer therefore keeps only 40 cents for every soft drink the producer sells. From the producer's perspective, the excise tax results in a decrease in the price of soft drinks from 50 cents a bottle to 40 cents a bottle. The producer sells 20 bottles of soft drinks once the excise tax is imposed, and the producer tax incidence is therefore equal to 10 cents a bottle times the 20 bottles, or \$2.

18. Answer b. When demand is more elastic, this implies that consumers are price sensitive and that a small change in price will result in a large change in the quantity demanded. Hence, an excise tax places a greater economic burden on suppliers in this case.

19. Answer b. When supply is inelastic, this implies that a small increase in price will cause a relatively large change in the quantity demanded; when supply is elastic, a small increase in price will cause a relatively small

change in the quantity demanded. For a given demand curve, an excise tax results in greater tax incidence on producers when supply is inelastic.

20. Answer b. When price elasticity of demand is low (implying a relatively steep demand curve) while price elasticity of supply is high (implying a relatively flat supply curve), the economic burden of an excise tax falls primarily on consumers since the excise tax causes a relatively large increase in price and a relatively small decrease in the quantity demanded.

21. Answer a. When price elasticity of demand is high (implying a relatively flat demand curve) while price elasticity of supply is low (implying a relatively steep supply curve), the economic burden of an excise tax falls primarily on producers since the excise tax causes a relatively small increase in price and a relatively large decrease in the quantity demanded.

22. Answer d. One way to solve this problem is to draw a graph with the initial supply and demand curves and then calculate what the tax revenue would equal for each of the excise tax rates. For each level of the excise tax, the supply curve with the tax could be written as $P_s = Q_s + (\text{the amount of the excise tax})$, where P_s is the supply price and Q_s is the quantity supplied at that price. Then, use this equation plus the demand equation and each level of the excise tax to calculate the equilibrium quantity, the equilibrium price with the tax, and then the tax revenue generated by the tax. Thus, if the excise tax is equal to \$50 per unit, then the equilibrium quantity in the market once the tax is imposed is 25 units, the equilibrium price with the tax is \$75, and the tax revenue is equal to $(\$50/\text{unit})(25 \text{ units}) = \$1,250$.

23. Answer b. An excise tax creates a deadweight loss because it discourages mutually beneficial exchanges from taking place. The excise tax creates a deadweight loss by altering the amount of the good supplied and demanded in the market. An increase in price due to the excise tax is not sufficient to create a deadweight loss, because if the demand curve is perfectly inelastic, there is no deadweight loss due to the tax.

24. Answer b. The deadweight loss from an excise tax is smallest when both the demand and supply curves are relatively inelastic, since this implies that the percentage increase in the price is relatively greater than the percentage decrease in the quantity supplied and demanded in the market.

25. Answer c. A policy to reduce consumption of a good through the imposition of an excise tax is more successful when the activity being discouraged is elastically demanded or supplied.

26. Answer f. The ability-to-pay principle is based on the principle that those with greater ability to pay a tax should pay more than those with less ability to pay the tax. The benefits principle is based on the principle that those who benefit from public spending should bear the burden of the tax that pays for that spending. In the first statement, it is possible to think of individuals who lack the ability to pay a tax (the unemployed, the disabled, the retired, children, etc.). In the second statement, the ability-to-pay principle results in those with higher incomes paying higher taxes: some of these individuals may not feel that the resultant tax system and its economic distribution are fair. In the third statement, the two principles distribute tax burden quite differently: the benefits principle considers the connection between the recipients of the government's spending programs and the level of taxes these individuals pay, while the ability-to-pay principle does not consider who receives the benefits of government spending programs, but instead focuses on sheer ability to pay the tax.

27. Answer a. A flat tax collects the same percentage of the base regardless of the taxpayer's income or wealth. Proposal 1 represents a flat tax, since this tax is 25% of the pre-tax income regardless of the level of pretax income.

28. Answer b. A regressive tax structure is one in which the tax rises less than in proportion to income so that high-income taxpayers pay a smaller percentage of their income than do low-income taxpayers. Proposal 2 taxes individuals with income of \$20,000 at a rate of 25% of their income, while individuals with income of \$200,000 are taxed at a rate of 2.5% of their income.

29. Answer c. An individual earning a pre-tax income of \$40,000 pays \$5,000 in taxes under proposal 2. To convert this to a percentage, divide $(5,000/40,000)$ and then multiply this value by 100.

30. Answer c. The marginal tax rate is a measure of the change in tax divided by the change in income. Answer (a) measures the average tax rate for a taxpayer, since it computes the value of $(\text{taxes paid}/\text{income})$. Answer (b) measures the ratio of total taxes paid to total income. Answer (d) measures the average tax rate paid by taxpayers in the lowest quintile in a society.

31. Answer c. State and local taxes are more regressive than federal taxes, which are overall quite progressive. State and local governments recognize that a decision to tax high income individuals more heavily than low-income individuals may result in the high income individuals moving to other localities where taxes are lower.