Anderson, PUBLIC FINANCE
Chapter 12
End-of-chapter problems with solutions

1. Suppose that the demand for a good is given by the inverse demand function: \( p = 0 - 3q \).
   a. Plot the demand curve on a graph.
   b. Compute the price at which 2 units of the good will be demanded.
   c. Suppose that a unit tax of 1 is introduced. Plot the new demand curve.
   d. What is the price at which 2 units will be demanded after the tax is imposed?
   e. If supply is perfectly elastic at the price of 5, what is the equilibrium quantity of the good before the tax is imposed? What is the effect of the tax on price and quantity? Explain.
   f. How much revenue is generated by this tax?
   g. Who bears the burden of this tax?

   Answers:
   a. Plot graph with intercept 10 and slope -3.
   b. At \( q = 2 \), \( p = 10 - 3(2) = 10 - 6 = 4 \).
   c. Plot graph, shifting demand curve down with new intercept 9 and same slope -3.
   d. At \( q = 2 \), \( p = 9 - 3(2) = 9 - 6 = 3 \).
   e. Before tax set \( S = D \): \( 10 - 3q = 5 \). Solution: \( q = 5/3 \).
      After tax set \( S = D \): \( 9 - 3q = 5 \). Solution: \( q = 4/3 \).
   f. Revenue = \( 4/3 \)(1) = 4/3.
   g. Consumers bear the entire burden due to the horizontal supply curve.

2. Suppose that the demand for a good is given by the inverse demand function \( p = 10 - 3q \) while the supply of the good is given by the inverse supply function \( p = 2 + 2q \).
   a. Plot the demand and supply functions on a graph.
   b. Set the two price equations equal and solve for the equilibrium quantity.
   c. Using the equilibrium quantity, determine the equilibrium price.
   d. Now suppose that a unit tax of 1 is imposed, shifting the supply curve upward, increasing the intercept by 1 unit.
   e. Re-compute the equilibrium quantity and price and determine the incidence of the tax. Explain who bears what shares of the tax.
   f. Calculate the elasticities of demand and supply at the original equilibrium point (before the tax) and describe the relative elasticities. [Recall that the elasticities are given as: \( (1/\text{slope}) (p/q) \).]

   Answer:
   a. Plot
   b. Set demand equal to supply: \( 10 - 3q = 2 + 2q \). Solution for \( q \) gives \( q = 8/5 \).
   c. \( p = 10 - 3(8/5) = 10 - 24/5 = 26/5 \).
   d. New supply: \( p = 3 + 2q \).
   e. Set demand equal to supply: \( 10 - 3q = 3 + 2q \). New equilibrium quantity is \( 7/5 \).
      New equilibrium price is \( 29/5 \). Revenue generated by the tax is \( (7/5)(1) = 7/5 \).
Consumer share of the tax burden is the difference in price times quantity: \((29/5 - 26/5)(7/5) = 21/25\). Producer share of the tax burden: \((2/5)(7/5) = 14/25\). Adding these two gives \(35/25\) or \(7/5\).

f. At \(q = 7/5\) the price elasticity of demand is \((1/3)[(29/5)/(7/5)] = 29/21\). At \(q = 7/5\) the price elasticity of supply is \((1/2)[(29/5)/(7/5)] = 29/14\). Notice that demand is relatively more elastic than supply, hence the consumer bears a larger share of the burden of the tax than does the producer.

3. The food stamp program in the United States provides monthly allotments of food stamps to families of various sizes, based on their income. The following table lists the gross monthly income standards (130% of poverty level in the year 2002) and the maximum monthly food stamp allotment.

<table>
<thead>
<tr>
<th>Household size (persons)</th>
<th>Gross monthly income eligibility standard (130% of poverty level) ($)</th>
<th>Maximum monthly food stamp allotment ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>931</td>
<td>135</td>
</tr>
<tr>
<td>2</td>
<td>1,258</td>
<td>248</td>
</tr>
<tr>
<td>3</td>
<td>1,585</td>
<td>356</td>
</tr>
<tr>
<td>4</td>
<td>1,913</td>
<td>452</td>
</tr>
<tr>
<td>5</td>
<td>2,240</td>
<td>537</td>
</tr>
<tr>
<td>6</td>
<td>2,567</td>
<td>644</td>
</tr>
<tr>
<td>7</td>
<td>2,894</td>
<td>712</td>
</tr>
<tr>
<td>8</td>
<td>3,221</td>
<td>814</td>
</tr>
<tr>
<td>each additional member</td>
<td>+328</td>
<td>+102</td>
</tr>
</tbody>
</table>

Source: www.frac.org.html

a. Compute the maximum monthly food stamp allotment as a fraction of the gross monthly income eligibility standard for households of various sizes listed in the above table.

b. Explain the pattern of food stamp program benefit incidence across households of various sizes revealed in the fractions computed in part a.

c. Compute the change in maximum allotment with a change in gross income for households of various sizes listed in the above table.

d. Explain the pattern of marginal food stamp benefit incidence across households using the ratios computed in part c.
**Answer:**

<table>
<thead>
<tr>
<th>Household size (persons)</th>
<th>Gross monthly income eligibility standard (130% of poverty level) ($)</th>
<th>Maximum monthly food stamp allotment ($)</th>
<th>Ratio of allotment to gross income</th>
<th>Change in maximum allotment with change in gross income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>931</td>
<td>135</td>
<td>0.1450</td>
<td>na</td>
</tr>
<tr>
<td>2</td>
<td>1,258</td>
<td>248</td>
<td>0.1971</td>
<td>0.3456</td>
</tr>
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<td>1,585</td>
<td>356</td>
<td>0.2246</td>
<td>0.3303</td>
</tr>
<tr>
<td>4</td>
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<td>452</td>
<td>0.2363</td>
<td>0.2927</td>
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<td>0.2397</td>
<td>0.2599</td>
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<td>2,567</td>
<td>644</td>
<td>0.2509</td>
<td>0.3272</td>
</tr>
<tr>
<td>7</td>
<td>2,894</td>
<td>712</td>
<td>0.2460</td>
<td>0.2080</td>
</tr>
<tr>
<td>8</td>
<td>3,221</td>
<td>814</td>
<td>0.2527</td>
<td>0.3119</td>
</tr>
<tr>
<td>each additional member</td>
<td>+328</td>
<td>+102</td>
<td></td>
<td>0.3110</td>
</tr>
</tbody>
</table>

http://www.frac.org.html/

**a.** See fourth column in above table.

**b.** The ratio of maximal allotment to gross income rises with household size from 1 to 6, but falls for households of 7 persons, then rises for households of 8 persons. Thus, the general pattern is that food stamp allotments rise with income over the range of gross income eligibility standards for households of various sizes. The pattern is not rising throughout, however.

**c.** See right-hand column in above table.

**d.** The change in maximum allotment with change in gross income varies across household sizes. The ratio is falling over the range of 2-5 person households, but jumps up for 6-person households, falls dramatically for 7-person households, and rises again for 8-person households, and finally holds steady for additional persons (beyond 8).

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**4.** Use a labor-leisure choice model such as that developed in Chapter 11 to analyze the incentive effect of government program targeted at low-income households. Suppose, in particular, that the government provides a grant $g_0$ for households with income less than some threshold $y_0$. Once household income reaches the threshold $y_0$, however, the household is no longer eligible for the grant and receives nothing.

**a.** Draw the household budget line and analyze the work incentive effect of the government grant program.

**b.** Suppose, instead, that the lump-sum grant of $g_0$ is reduced as household income rises, with the grant formula: $g = g_0 - g_y y$. The term $g_y$ is the marginal rate at which the grant is reduced as income increases. Once income reaches the level $y = g_0 / g_y$, the household no longer qualifies for the grant and receives nothing. Draw the budget line under this grant program and explain the work incentive effects of the grant program.
Panel A. of the following figure illustrates the case where the grant $g = g_0$ is simply withdrawn when the household income rises to the level $y = g_0 + w(T - l^*)$. Since the grant is withdrawn at that point, the household budget line drops by the amount $g_0$ and the slope of the budget line remains at $-w$. Panel B. illustrates the case where the grant is phased-out. The phase-out rate $g_y$ acts as a tax, flattening the slope of the budget line until the household is no longer eligible. Then, the budget line is steeper with additional work with slope $-w$.

5. True, False, or Uncertain? Explain.
   a. A tax imposed on a good with relatively inelastic demand is borne primarily by the consumer.
   b. A tax imposed on a good with relatively elastic supply is borne primarily by the producer.
   c. A tax imposed on a good with zero elasticity of demand is borne entirely by the producer.
   d. A tax imposed on a good with zero elasticity of supply is borne entirely by the producer.
   e. A tax imposed on a monopolist is borne entirely by the consumers of the product.
f. A tax imposed on a good with relatively inelastic demand will be effective in reducing the quantity of the good produced and consumed.
g. A tax imposed on a good with relatively elastic supply will be opposed more vigorously by industry lobbyists than by consumer advocates.

Answer:
a. True, the incidence of a tax is borne to a greater extent by the economic agent with relatively less elastic response.
b. False, since supply is relatively elastic, the burden of the tax will fall more on the consumers.
c. False, the tax is borne by the unresponsive economic agent, in this case the consumers.
d. True.
e. False. Draw a graph of a monopoly firm and demonstrate that the firm itself bears some of the burden of the tax.
f. False, the inelasticity of demand means that quantity will not be greatly affected.
g. False, since the burden of the tax is borne more by the economic agent with the relatively smaller elasticity, we would expect consumer groups to be more reactive than producer groups in this case.

6. The State of Aksarben has a problem. The State Supreme Court has just ruled that the state’s method of taxing property is unconstitutional. Rather than suffer the revenue shortfall that would occur in the absence of legislative action, Senator Wahoo reacts by introducing legislation which would provide a new tax surcharge to be applied to capital used in the agricultural sector, while leaving capital taxation unchanged in the rest of the economy. Set up a diagram like Figure 12.10 in which you can analyze the effect of an increase in the rate of taxation on capital in the agricultural sector and explain the effects of the tax increase.
7. Senator Beatrice is concerned that one of the state’s major industries, food processing, is hampered by a high rate of taxation applied to capital. She has introduced legislation which would provide a substantial tax reduction for capital used in the food processing industry, while leaving capital taxation unchanged in the rest of the economy. Set up a diagram like Figure 12.10 in which you can analyze the effect of a reduction in the rate of taxation on capital in the food processing sector and explain the effects of the tax reduction.

8. Iona is a retired school teacher whose pension income is $18,000 per year. She also receives social security income of $12,000 per year. Jay is a young man who does not choose to work. He inherited $600,000 from his Aunt Midge which he invested in a bond fund that provides a 5% return, generating $30,000 income per year. If we are concerned about the horizontal equity of taxation, should consider these two people equals and tax them equally? Explain why or why not.

Answer:
While both individuals have income of $30,000 per year, their income sources differ. If we apply a Haig-Simons definition of taxable income (as described in Chapter 9--all accretions to wealth) we should consider the two individuals equals
and tax them equally. Answers to this question depend on one’s definition of equals. Alternative definitions are possible, but require economic justification.