Chapter 1 - Introduction

3. From 1960 to 1980, Spain’s share increased from 1.5% to 5.3%, an increase of 253%, the largest percentage increase. Canada’s share increased from 5.4% to 7.0%, an increase of 30%, the smallest percentage increase.

From 1980 to 2009, Korea’s share increased from 3.4% to 6.9%, an increase of 102.9%, the largest percentage increase. Sweden’s share (from 1980 to 2009) increased from 8.9% to 10.0%, an increase of 12.4%, the smallest percentage increase.

5. From 1960 to 2009, the CPI grew from 82.4 to 214.5 or by 160.3%. From 1980 to 2009, the Hospital and Related Services index grew from 69.2 to 567.9 or by 720.7%. From 1960 to 2006 the Physician Services index grew from 76.5 to 320.8 or by 319.3%.

6. From 1970 to 2009, Private Health Insurance grew by a multiple of 50.87 or 4,987%; Medicare by 64.56 or 6,356% ; and Medicaid by 69.14 or 6,814%.
Chapter 2 - Microeconomic Tools for Health Economics

1. An improvement in the technology of producing health would increase the health intercept. An increase in available productive resources would increase both intercepts (i.e. the entire curve would shift outward).

2. Inefficiency will be shown by an interior point (A) in a production-possibility diagram (Figure E2-1).

Two efficient combinations are shown by B and C.

The cost is the decrease in production of other goods (opportunity cost), moving from point B to point C. The amount of other goods given up is shown by BD.

3. a. Increase in supply leads to lower equilibrium price and higher equilibrium quantity.

b. Same as (a).

c. Decrease in demand leads to lower equilibrium price and lower equilibrium quantity.

d. No effect on equilibrium price and quantity, but if the ceiling price is below the equilibrium price there will be excess demand.

4. a. This curve is linear.

b. This curve is curvilinear.
5. The Food axis (horizontal) shows the maximum quantity of Food if all income is spent on food (i.e. none on health services). The reverse holds for the OG axis (vertical).

The budget constraint will be unaffected if the income level and both prices double.

6. Elasticity is \(-1.5 \times \frac{(300)}{1050} = -0.43\). The parameter \(-1.5\) is the coefficient of the demand relationship.

7. This problem should refer to the Table 2-5. The slope is \(-17.2\), i.e. the reduction in the amount of capital.

8. As noted in the Figure E2-2, the equilibrium price does not rise by as much as the tax. A firm will move up the MR curve by the amount of the tax, but this does not lead to an equal price increase. With a linear demand, the slope \(\frac{\Delta P}{\Delta Q}\) of the MR curve is twice the numerical value of the slope of the demand curve. Thus the price increase will be 50% of the tax.

\[ Q_d = 1810 - 10p_s. \]

\[ Q_d = 1910 - 10p_s. \]
Chapter 3 - Statistical Tools for Health Economics

1. Age 35 or less; mean = 2.39
   Over age 35; mean = 4.83

2. Age 30 or less; mean = 2.00
   Age 30 - 45; mean = 3.14
   Over age 45; mean = 8.25

3. \( Q = 5.32 - 0.92P \)
   \( R^2 = 0.189 \)

   \( Q = 1.54 + 0.08Y \)
   \( R^2 = 0.095 \)

   \( Q = -2.80 + 0.17A \)
   \( R^2 = 0.536 \)

4. \( Q = -1.63 - 0.55P + 0.03Y + 0.15A \)
   \( (2.04) \quad (1.01) \quad (5.04) \)
   \( R^2 = 0.620 \)
   \( (t\text{-statistics in parentheses}) \)

   \( P \) and \( A \) are significant at 5% level; \( Y \) is not.

<table>
<thead>
<tr>
<th>Elasticity at means</th>
<th>Mean</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ( P )</td>
<td>2.116666</td>
<td>-0.332</td>
</tr>
<tr>
<td>Mean ( Y )</td>
<td>21.75862</td>
<td>0.217</td>
</tr>
<tr>
<td>Mean ( A )</td>
<td>36.60714</td>
<td>1.592</td>
</tr>
<tr>
<td>Mean ( Q )</td>
<td>3.48148</td>
<td></td>
</tr>
</tbody>
</table>

5. Assuming \( G = 0 \),

<table>
<thead>
<tr>
<th></th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P ) 2</td>
<td>-5.86</td>
</tr>
<tr>
<td>( Y ) 20</td>
<td>3.57</td>
</tr>
<tr>
<td>( P_0 ) 3</td>
<td>6.86</td>
</tr>
<tr>
<td>( Q ) 1.4</td>
<td></td>
</tr>
</tbody>
</table>
6. \begin{align*}
Q_a & \quad 19 \quad -0.263 \quad 0.211 \\
Q_b & \quad 29 \quad -0.172 \quad 0.138
\end{align*}

Elasticities for group (b) are smaller, because 1 unit increase is a smaller pct of a larger amount.

7. If price rises by $1, demand decreases by 3.3.

Initial Q is 350
Percent Change -0.94%

If income rises by $1, demand increases by 0.001.

Percent Change 0.0003%

8. Good Z is a substitute. An increase in the price of Z leads to an increase in the quantity demanded of X.

We cannot be confident about good X as a normal good, because the income coefficient is statistically insignificant.

9. a. Cigarette consumption decreases as income rises, although the impact does not differ significantly from zero. By this criterion cigarettes are a “necessity” and might be considered as an “inferior good.”

b. Multiply the coefficient -0.67 by 3, that is (12 – 9). This indicates that college graduates consume 2.01 cigarettes less than high school graduates.

10. The answer to this question depends critically on what seems to be an outlying, but apparently correct, value for Luxembourg, with a PPP-adjusted income of 91,377 and PPP-adjusted expenditures of 4,808.

Including Luxembourg in the regression gives,
Mean GDP per capita 35248.93
Mean expenditure per capita 3361.356

Regression

Expenditure = 607.2947 + 0.078 * GDP per capita

Elasticity = 0.078 * (35248.93/3361.356) = 0.82

This would show health expenditures as a “necessity,” because the elasticity is less than 1.0. An increased income would imply a reduced share.

Excluding Luxembourg,

Mean GDP per capita 33244.35
Mean expenditure per capita 3309.698

Regression

Expenditure = -1483.81 + 0.144 * GDP per capita

Elasticity = 0.144 * (33244.35/3309.65) = 1.45

This would show health expenditures as a luxury, because the elasticity exceeds 1.0, with an increased income implying an increased share.

Instructors can use this example, if they wish to explain to students the importance of outliers.
Chapter 4 – Economic Efficiency and Cost Benefit Analysis

1. At that point, the marginal social cost exceeds the marginal social benefit.

2. Assume that all costs and benefits are incurred at the end of the period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Project 1 Costs</th>
<th>Project 1 Benefits</th>
<th>Net@6%</th>
<th>Net@12%</th>
<th>Year</th>
<th>Project 2 Costs</th>
<th>Project 2 Benefits</th>
<th>Net@6%</th>
<th>Net@12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5000</td>
<td>2000</td>
<td>-2830.19</td>
<td>-2678.57</td>
<td>1</td>
<td>5000</td>
<td>0</td>
<td>-4716.98</td>
<td>-4464.29</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>2000</td>
<td>1779.99</td>
<td>1594.39</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2000</td>
<td>1679.24</td>
<td>1423.56</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>2000</td>
<td>1584.19</td>
<td>1271.04</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>6</td>
<td>0</td>
<td>2000</td>
<td>1409.92</td>
<td>1013.26</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>7</td>
<td>0</td>
<td>2000</td>
<td>1330.11</td>
<td>904.70</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>8</td>
<td>0</td>
<td>2000</td>
<td>1254.82</td>
<td>807.77</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>9</td>
<td>0</td>
<td>2000</td>
<td>1183.80</td>
<td>721.22</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>10</td>
<td>0</td>
<td>2000</td>
<td>1116.79</td>
<td>643.95</td>
</tr>
<tr>
<td>Sum</td>
<td>2213.23</td>
<td>1610.41</td>
<td></td>
<td></td>
<td>Sum</td>
<td>1578.47</td>
<td>-373.39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Project 1 is preferable in each case.
The project with the later returns is more competitive the lower the discount rate.

3. a. Using the criterion of marginal benefit equaling marginal cost, the efficient level of abatement is 50. The marginal benefit (40) of going from level 50 to level 60, is exceeded by the marginal cost, which is 45.

   b. Yes, because total benefits exceed total costs. It is not efficient.

   c. Even the total costs exceed the total benefits. Moreover, any level above 50% is not economically efficient.

4. Project

<table>
<thead>
<tr>
<th>Year</th>
<th>Costs</th>
<th>Benefits</th>
<th>Net@6%</th>
<th>Net@5%</th>
<th>Net@4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10000</td>
<td>0</td>
<td>-10000.00</td>
<td>-10000.00</td>
<td>-10000.00</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>4000</td>
<td>3773.58</td>
<td>3809.52</td>
<td>3846.15</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>3500</td>
<td>3114.99</td>
<td>3174.60</td>
<td>3235.95</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>3500</td>
<td>2938.67</td>
<td>3023.43</td>
<td>3111.49</td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td>-172.76</td>
<td>7.56</td>
<td>193.59</td>
</tr>
</tbody>
</table>

Not approved at 6% discount rate.
Approved at 5% discount rate.
Approved at 4% discount rate.
5. Average Cost/Cancer

  Stage 1 - $2,000  
  Stage 2 - $2,476  
  Stage 3 - $2,830

Marginal Cost/Cancer

  Stage 1 - $2,000  
  Stage 2 - $12,000  
  Stage 3 - $40,000

Stage 1 is the optimal level of screening.

6.

  a. $1000  
  b. $600  
  c. $750  
  d. $400  
  e. $1150

7.

a. CS = ½ x 15 x 100 = 750; PS = ½ x 8 x 100 = 400; Total surplus = 1150

b. You're looking at the loss of CS. If Q is limited to 90, the WTP (inverse demand) is 11.5 (90% of the linear distance between 25 and 10). So, the loss of surplus is ½ x (11.5 - 10) x 10 = 7.5. CS falls from 750 to 742.5.

  Total loss in surplus includes loss of PS as well. Loss of PS (calculated similarly) is ½ x (10 - 9.2) x 10 = 4, so PS falls from 400 to 396.

  Total surplus falls from 1150 to 1138.5.
Chapter 5 - The Production of Health

1. | E=10 |   | E=15 |   |
   | HC  | HS | MP | HC | HS | MP |
   | 0   | 0.000 | 0 | 0.000 | 1 | 63.305 | 63.305 |
   | 1   | 56.054 | 56.054 | 1 | 63.305 | 63.305 |
   | 2   | 79.273 | 23.218 | 2 | 89.526 | 26.222 |
   | 3   | 97.089 | 17.816 | 3 | 109.647 | 20.121 |
   | 4   | 112.108 | 15.020 | 4 | 126.609 | 16.962 |
   | 5   | 125.341 | 13.233 | 5 | 141.553 | 14.944 |
   | 6   | 137.304 | 11.963 | 6 | 155.064 | 13.511 |
   | 7   | 148.305 | 11.001 | 7 | 167.488 | 12.424 |
   | 8   | 158.545 | 10.240 | 8 | 179.052 | 11.564 |
   | 9   | 168.162 | 9.617 | 9 | 189.914 | 10.861 |
   | 10  | 177.259 | 9.096 | 10 | 200.187 | 10.273 |
   | 11  | 185.911 | 8.652 | 11 | 209.957 | 9.771 |
   | 12  | 194.177 | 8.267 | 12 | 219.293 | 9.336 |
   | 13  | 202.106 | 7.929 | 13 | 228.248 | 8.954 |
   | 14  | 209.735 | 7.629 | 14 | 236.864 | 8.616 |
   | 15  | 217.097 | 7.361 | 15 | 245.178 | 8.314 |

![Health Production Graph](attachment:image.png)
2. For blacks, every factor except BCHS.
   For whites, WIC, abortion, and prenatal care.

   These may reflect lower incomes and educations.

5. The plot confirms the Prichett and Summers finding.
Chapter 7 - Demand for Health Capital

1. Figure E7-1 shows the limiting cases of perfect substitution (negatively sloped straight line) and no substitution (right angle).

2. Figure E7-2 shows how the individual would spend all of his or her income on health (that is, a corner solution at E).

3. Refer to Figure 7-65 (text), with an increase in demand, due to higher wage. The cost of capital must be lowered due to the decreased depreciation rate.
4. We have a straight line, with the X intercept of 365 and the Y intercept of 73000. The slope is -200.

5. Indifference curve is tangent at Leisure = 165, income = 40000.

6. Vertical intercept increases to 76650. The equilibrium will show both increased leisure and increased income, although these depend on the shapes of the indifference curves. Instructors may wish to address income and substitution effects.

7. This shifts the leisure-income possibilities curve in. The X-axis is now 355 and the Y intercept is 71000. It is likely that both leisure and income will fall, although these again will depend on the shapes of the indifference curves.

8. a. Referring to Figure 7-6 (text), the optimal health stock will rise with an increase in wage rate. Her increased education would also increase the demand for health capital.

b. Again referring to Figure 7-6 (text) we see an outward shift in the MEI curve. Increased education also shifts out the MEI curve.

c. With the increase in the cost of capital, the optimal stock decreases.

9. a. Components of capital costs are forgone interest, depreciation. One gives them up to get capital.

b. \( I^* = 500 - 1000 \times 0.10 = 400. \)

   Equilibrium expenditure = 400 x 0.10 = 40.

c. Equilibrium level of health investment falls to 300. Equilibrium health expenditures will rise from 40 to 60, because the MEI is seen to be inelastic.
10. According to equation (7.7), Ed will be ingesting 1000 more calories per week. With each exercise session burning 300 calories, Ed will have to exercise 3.33 more times per week to avoid increasing $S$. 