Peter J. Wilcoxen   Department of Public Administration
PPA 723, Managerial Economics   The Maxwell School, Syracuse University

Solution to Exam 1
Fall 2006

Here are notes on the solution. Some of the graphs may be omitted and the explanations are a bit terse. If you have any questions, please don't hesitate to stop by during office hours or the lab session to talk over things in detail.

Part 1

The proposed tax would raise the price of cigarettes from $5 (the $4 W2A plus the $1 tax) to $7. In doing so, it would reduce the quantity consumed. The effects are shown in the diagram.
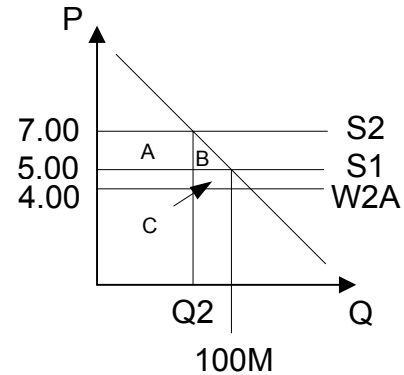
Computing Q2 using the elasticity of demand:

$\%\Delta P = (7-5)/5 = 40\%$

$\%\Delta Q = (-0.5)*(40\%) = -20\%$

$\Delta Q = 100*(-0.2) = -20$

$Q2 = 100 - 20 = 80$

The change in consumer surplus is a loss of areas A+B:

$A = \$2*80M = \$160M$

$B = 0.5*\$2*20M = \$20M$

$\Delta CS = -(A+B) = -\$180M$

The change in PS is 0: before and after the change, suppliers get to keep $4, which is exactly their W2A. They get no PS in either situation.

The change in government revenue is straightforward to calculate. Before the tax increase, it was $1*100M = $100M. After the increase, it is $3*80M = $240M. The increase, therefore, is $140M. In terms of the diagram above, the change in revenue is A-C (additional new revenue less lost revenue on packs no longer purchased.

The increase in deadweight loss is the net of the changes in CS and government revenue, which is equal to -$180M + $140M = - $40M. In the diagram, it is equal to -(A+B) + (A-C) = -B-C.

Part 2

2(a) Initial equilibrium

$W2P = 5500 - 0.5*Q$

$W2A = 5*Q$

$W2P = W2A$

$5500 - 0.5*Q = 5*Q$
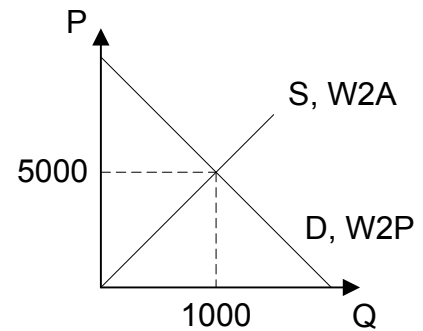
$5500 = 5.5*Q$

$1000 = Q$

$W2P = 5500 - 0.5*1000 = 5000$

$W2A = 5*1000 = 5000$

$P = 5000$

2(b) Equilibrium with $550 tax

$W2P = 5500 - 0.5*Q$

$W2A = 5*Q$

Buyers will choose Q where $W2P = P$

Sellers will choose Q where $P = W2A + \$550$

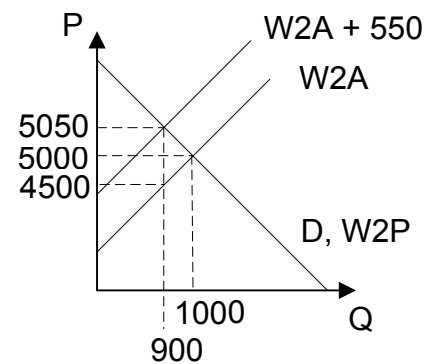Equilibrium: $W2P = W2A + \$550$

$5500 - 0.5*Q = 5*Q + \$550$

$4950 = 5.5*Q$

$900 = Q$

$W2P = 5500 - 0.5*900 = 5050$

$W2A = 5*900 = 4500$

Purchaser price: 5050

Producer price: 4500

Quantity: 900

2(c) Changes in surplus

$\Delta CS = -(\$50*900 + 0.5*\$50*(1000-900)) = -\$47,500$

$\Delta PS = -(\$500*900 + 0.5*\$500*(1000-900)) = -\$475,000$

$\Delta Rev = \$550*900 = \$495,000$

$DWL = (\$47,500 + \$475,000) - \$495,000 = 27,500$

Check by calculating the area of the triangle to the right of the new Q:

$DWL = 0.5*\$550*100 = \$27,500$

Producers bear most of the tax: the price they receive falls by $500 while the price paid by consumers rises by only $50. Equivalently, of the total tax revenue of $495,000, the producers pay $450,000 while consumers pay only $45,000.

The difference is due to the difference in the demand and supply elasticities. Demand is much more elastic than supply, so buyers bear little of the burden. Calculating the elasticities:

Demand: $\eta = \%\Delta Q/\%\Delta P = ((900-1000)/1000) / ((5050-5000)/5000) = -10\%/1\% = -10$

Supply: $\eta s = \%\Delta Q/\%\Delta P = ((900-1000)/1000) / ((4500-5000)/5000) = -10\%/-10\% = 1$

Part 3

For both goods, the subsidy lowers the price paid by buyers from $100 to $80, or by 20%. The changes in Q's can be calculated using the demand elasticities:

$\eta = \%\Delta Q/\%\Delta P$

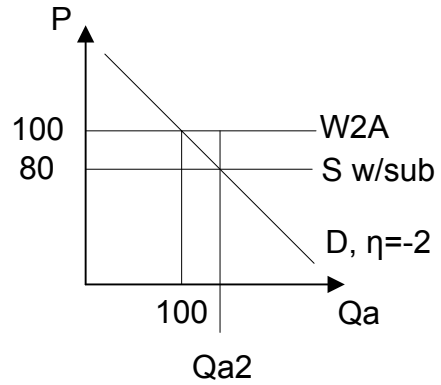$\%\Delta Q = \eta*\%\Delta P$

Good A:

$$\%\Delta Qa = (-2)*(-20\%) = 40\%$$

$$\Delta Qa = 0.4*100 = 40$$

$$Qa2 = 100 + \Delta Qa = 100+40 = 140$$
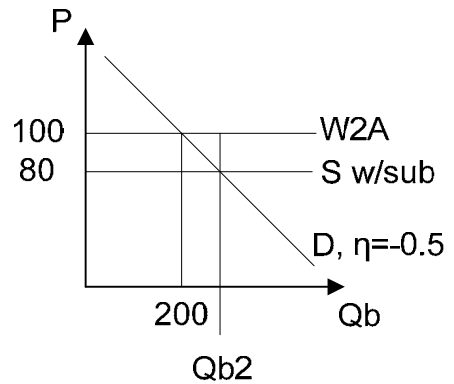

Good B:

$$\%\Delta Qb = (-0.5)*(-20\%) = 10\%$$

$$\Delta Qb = 0.1*200 = 20$$

$$Qb2 = 200 + \Delta Qb = 200+20 = 220$$

The total amount spent on the subsidy will be $20*140 + $20*220 = $7,200. It's substantially larger than $6,000. The consultant failed to take into account the fact that people will consume more of each service when the prices fall.

Part 4

Initially, 100 units are consumed. Of those, 60 units are supplied by domestic producers since their supply is perfectly inelastic. The remaining 40 units are imported and the price in the market is equal to $50.
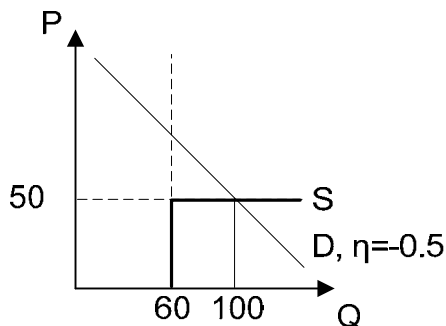
Imposing a tariff will raise the equilibrium price and reduce consumption. The tariff needs to be large enough to cut imports to $40/2 = 20$ units. Domestic producers will still produce 60 units (since their supply is perfectly inelastic), so when the tariff is in place total consumption must fall to $60+20 = 80$ units. The final equilibrium will have to look like this:
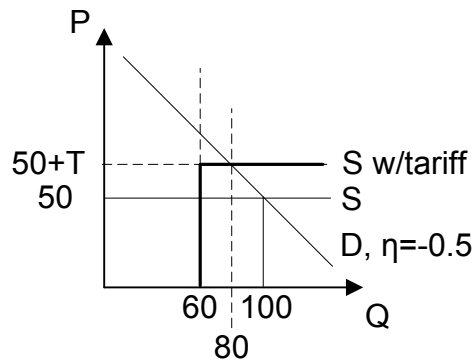
To find the amount that the price must rise in order to reduce consumption to 80, use the demand elasticity:

$$\eta = \%\Delta Q/\%\Delta P$$

$$\%\Delta P = \%\Delta Q/\eta$$

$$\%\Delta P = ((80-100)/100)/ (-0.5) = (-20\%)/(-0.5) = 40\%$$

$$P = \$50 + 0.4*\$50 = \$70$$

Since the equilibrium price will be the price of imports ($50) plus the tariff, the tariff must be $70 - $50 = $20.