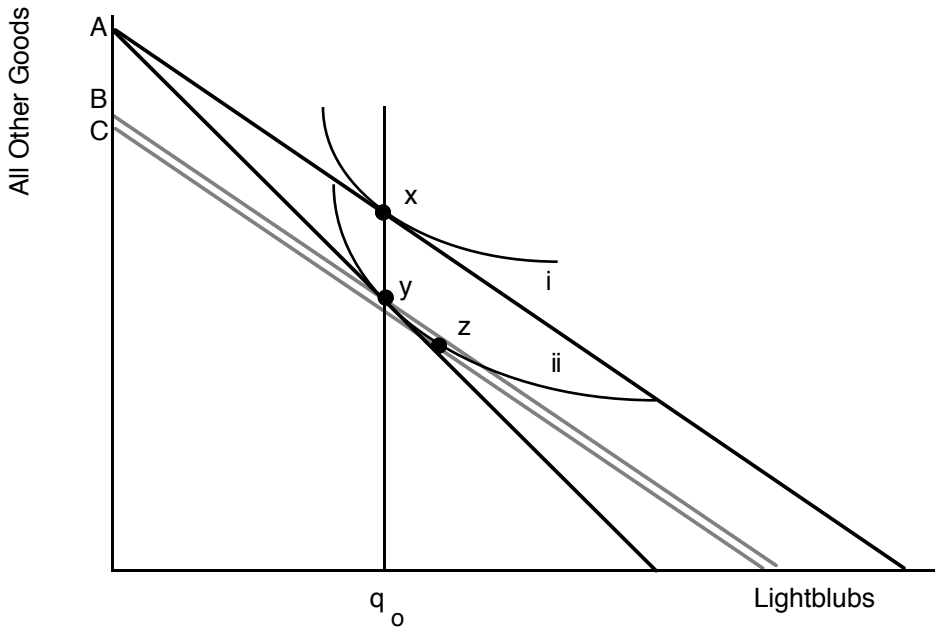
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ECONOMICS 131

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Answers to Problem Set #3

1. Excess Burden of a Tax on an Inelastically Demanded Good

a. When the market demand curve is vertical the imposition of a tax steepens the budget line but happens to keep the demand for bulbs unchanged at q_o. The equivalent variation measure of the welfare loss to the consumer is AC — the amount by which his or her income could be reduced while maintaining utility at the level ii. Subtracting the amount of tax raised (AB) gives the excess burden (BC).



b. Consumers consume to the point where their marginal rate of substitution of light bulbs for all other goods (AOG) is equal to the price ratio (including the tax):

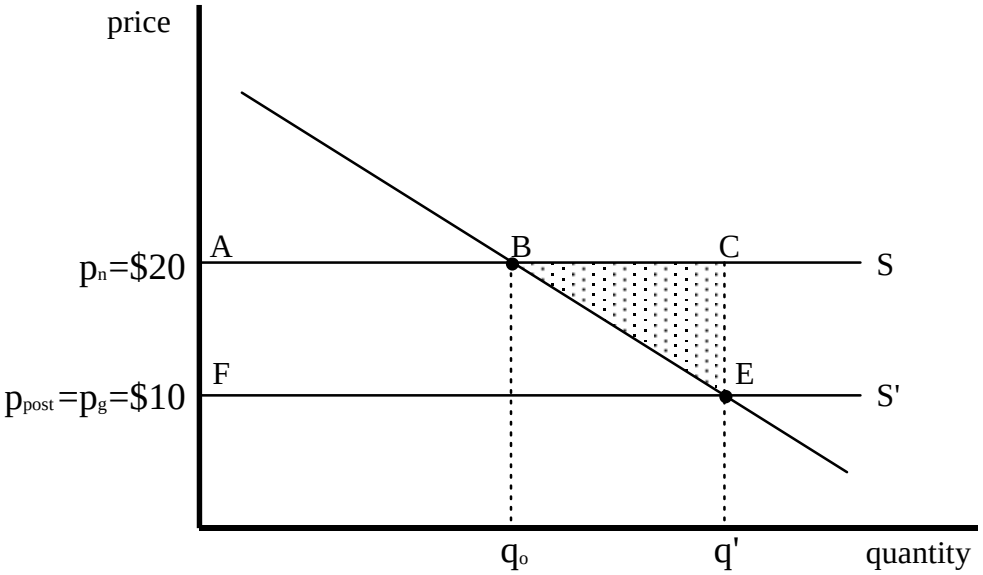
$$MRS_{bulbs,AOG} = (P_{bulbs} + T) / P_{AOG}.$$

Producers set production where the marginal rate of transformation between light bulbs and AOG is equal to the prices they face,

$$MRT_{bulbs,AOG} = P_{bulbs} / P_{AOG}.$$

Economic efficiency requires MRS = MRT, but there is a "tax wedge" that prevents this condition from being met. Thus, at the margin, the cost of producing one more light bulb, P_{bulbs}/P_{AOG}, is less than their value to the consumer, $(P_{bulbs}+T)/P_{AOG}$), and so both could be made better off by an increase in quantity at any intermediate price. The tax wedge, and not the shift in market demand per se, generates excess burden.

2. The Incidence and Excess Burden of a Subsidy



a. The original equilibrium is at point B with a price of $20 per book. After the $10 subsidy to the sellers the supply curve shifts down by the amount of the subsidy to S'. The demand curve is unchanged. The new equilibrium is at point E with a new posted price of $p_g = p_{post}$=$10. The entire economic incidence of the subsidy is enjoyed by the buyers. The sellers receive the $10 price plus the $10 subsidy, for a total of $p_n=p_{post}+S$=$20, which is unchanged from the pre-subsidy situation. (With a subsidy $p_n>p_g$.)

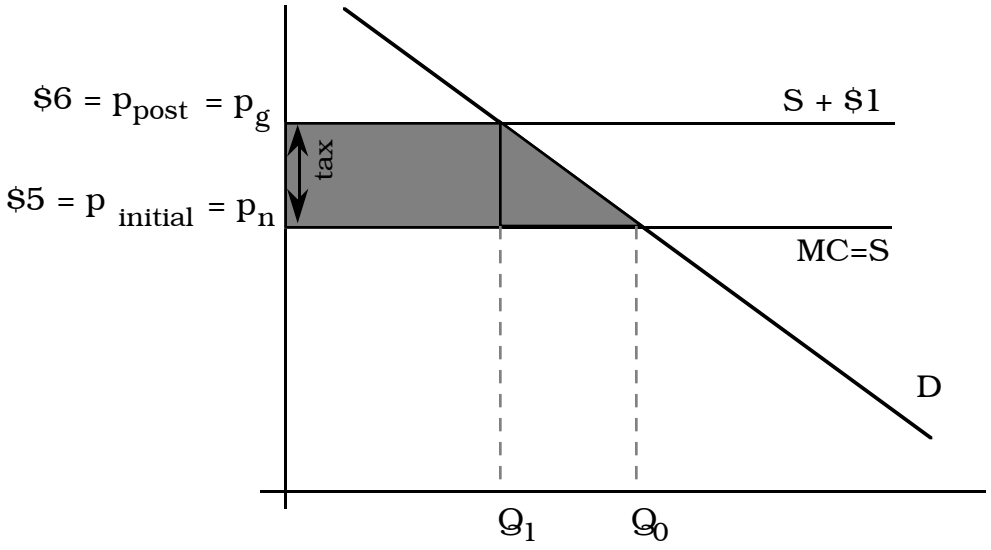
b. The burden to the consumers from this subsidy is the (negative) area -ABEF. (This is the increase in consumer's surplus which they enjoy.) The tax revenue raised (also negative) is -ACEF. The difference is

-ABEF
- (-ACEF)
= BCE

So the shaded triangle BCE is the deadweight loss. This is the true cost of producing the extra q_O-q' books sold (at \$20 each) minus the consumers' willingness to pay for these books (given by the demand curve).

3. Excess Burden and Marginal Excess Burden

a. The supply curve shifts up by the amount of the tax which the supplier must pay. The equilibrium posted price goes up from the intersection of the original supply and demand curves to the intersection of the demand curve with the new supply curve (at $p_g = p_{post} = \$6.00$). This is what the buyer pays (since the tax is not levied on the buyer). The seller receives p_n, the posted price less the tax, or \$5.00.



b. The quantity sold in equilibrium is Q_1. The tax is \$1.00. Thus the revenue is the shaded rectangle.

c. Excess burden is the welfare loss to the consumer *minus* the revenue raised.

d. The welfare loss to the consumer is the taxes paid on the Q_1 units actually purchased (the shaded rectangle) *plus* the loss in the consumer surplus on the (Q_0-Q_1) units which were formerly purchased (the difference between the demand—or "willingness-to-pay"—curve and the old price), which is the shaded triangle. Subtracting the revenue (again, the shaded rectangle) gives the triangle as the excess burden.

e. The marginal excess burden when a tax is imposed which reduces demand by one unit is the thin rectangle shown. This is the increment to the excess burden triangle. This is more than the average excess burden, which is the average height of the triangle.

