

Handout 5b: Taxes and Deadweight Loss

Mankiw Ch 7–8

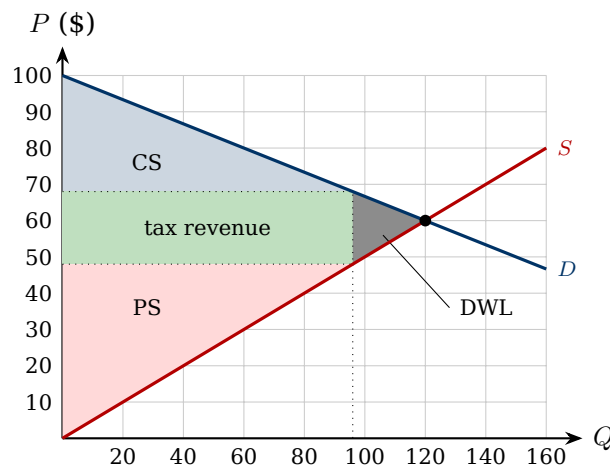
Answer key

A tax on kayak rentals

The daily market for kayak rentals on the Charles River (Handout 5, Problem 2) is

$$Q_d = 300 - 3P \quad Q_s = 2P$$

Without a tax: \$60 a rental, 120 rentals a day, total surplus \$6,000. The city puts a **\$20 tax** on each rental, paid by the renter.



- a) What price do renters pay, what do owners keep, and how many kayaks are rented? Who bears more of the tax, and why?

Renters pay P_B , owners keep $P_B - 20$: $300 - 3P_B = 2(P_B - 20)$, so $5P_B = 340$. Renters pay **\$68**, owners keep **\$48**, and $Q = 300 - 204 = 96$.

Renters pay \$8 more; owners get \$12 less. **Owners bear more**: at \$60 supply is less elastic than demand ($E_s = 2 \times 60/120 = 1$, $E_d = 3 \times 60/120 = 1.5$), and the less elastic side bears more of a tax.

- b) Shade consumer surplus, producer surplus, tax revenue and the deadweight loss on the grid. Compute each, and total surplus.

$CS = \frac{1}{2} \times 96 \times (100 - 68) = \$1,536$. $PS = \frac{1}{2} \times 96 \times 48 = \$2,304$. Revenue = $20 \times 96 = \$1,920$.

Total surplus = $1,536 + 2,304 + 1,920 = \$5,760$. **Deadweight loss = \$240** = $\frac{1}{2} \times 20 \times (120 - 96)$: the 24 rentals the tax stops were each worth more to a renter than they cost an owner. The revenue is not lost; the city spends it.

- c) The city doubles the tax to \$40. Find the new quantity, revenue and deadweight loss. Did revenue double? By how much did the deadweight loss grow, and why?

$300 - 3P_B = 2(P_B - 40)$: $P_B = \$76$, owners keep \$36, $Q = 72$.

Revenue = $40 \times 72 = \$2,880$, not \$3,840: the market shrinks as the tax rises.

DWL = $\frac{1}{2} \times 40 \times (120 - 72) = \$960$, **four times** \$240. Doubling the tax doubles both the height (the tax) and the base (the rentals lost) of the triangle.

- d) Suppose instead there are exactly 120 kayaks, and owners rent them all at any price (supply is vertical at 120). Who bears the \$20 tax, and what is the deadweight loss?

The quantity stays at 120, so renters still pay \$60 (that is what clears 120 rentals on the demand curve) and **owners bear the whole tax**: they keep \$40. **No deadweight loss**: the tax stops no rentals. Revenue = $20 \times 120 = \$2,400$. The less elastic the market, the smaller the loss.