

# Alternative Derivation of Firm 1's Willingness to Pay

$P_p$  = Price of permit

$$\Pi_1(Q_1) = 60 \cdot Q_1 - 300 - 2Q_1^2 - P_p Q_1$$

$$P_p = 12, \quad 0 = 60 - 4Q_1 - 12 \Rightarrow Q_1 = 12$$

$$\Pi_1(12) = 60 \cdot 12 - 300 - 2(144) - 12 \cdot 12 = -12$$

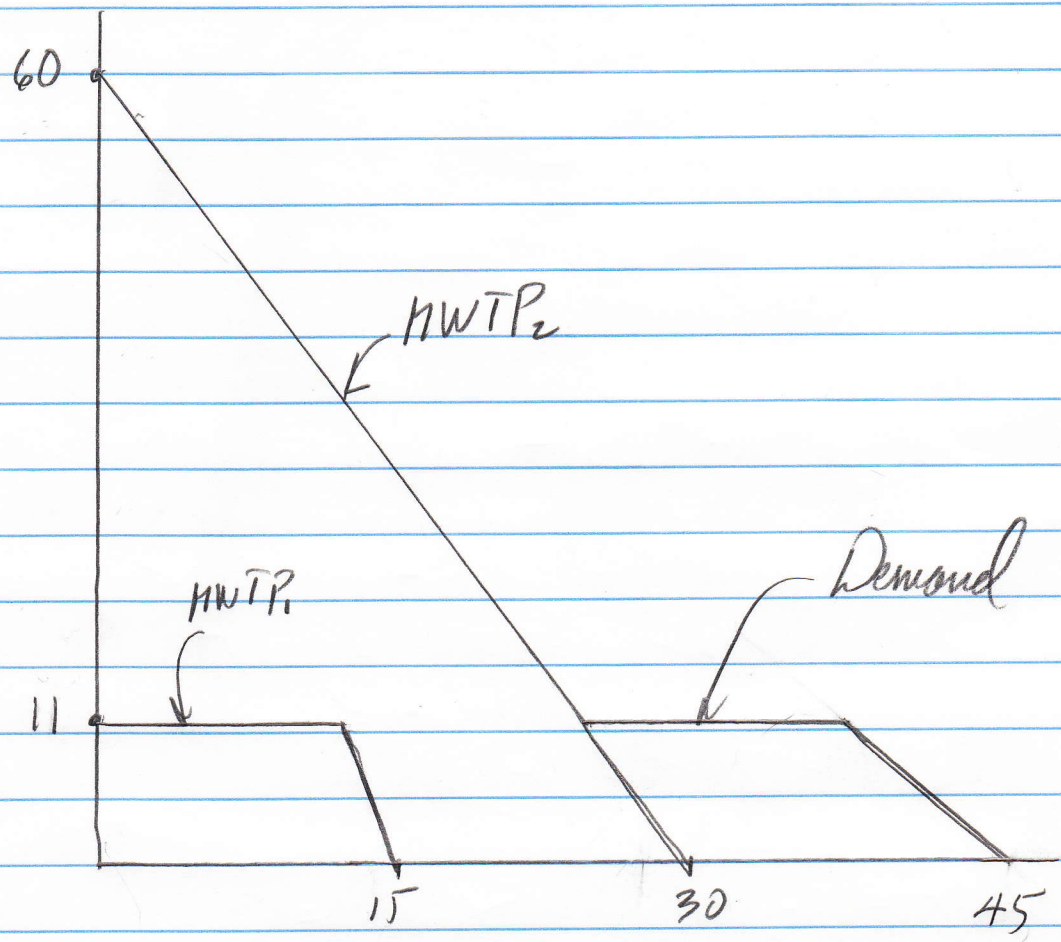
$$P_p = 11, \quad 0 = 60 - 4Q_1 - 11 \Rightarrow Q_1 = \frac{49}{4} = 12,25$$

$$\begin{aligned} \Pi_1\left(\frac{49}{4}\right) &= 60 \cdot \frac{49}{4} - 300 - 2\left(\frac{49}{4}\right)^2 - 11\left(\frac{49}{4}\right) = \\ &= 735 - 300 - 300,125 - 134,75 = 0,125 \end{aligned}$$

Thus

$$\begin{aligned} \text{WWT}P_1 &= 60 - 4Q_1 & P_p &\leq 11 \\ &= 0 & P_p &> 11 \end{aligned}$$

Firm 2 @  $P_p = 11$  solves  $11 = 60 - 2Q_2 \Rightarrow Q_2 = \frac{49}{2} = 24,5$



Firm 1 will bid 12 at  $P_p = 11$  } after rounding  
 Firm 2 will bid 24 at  $P_p = 11$  } down

37

if round up  
 in which case  
 some allocation  
 scheme is needed