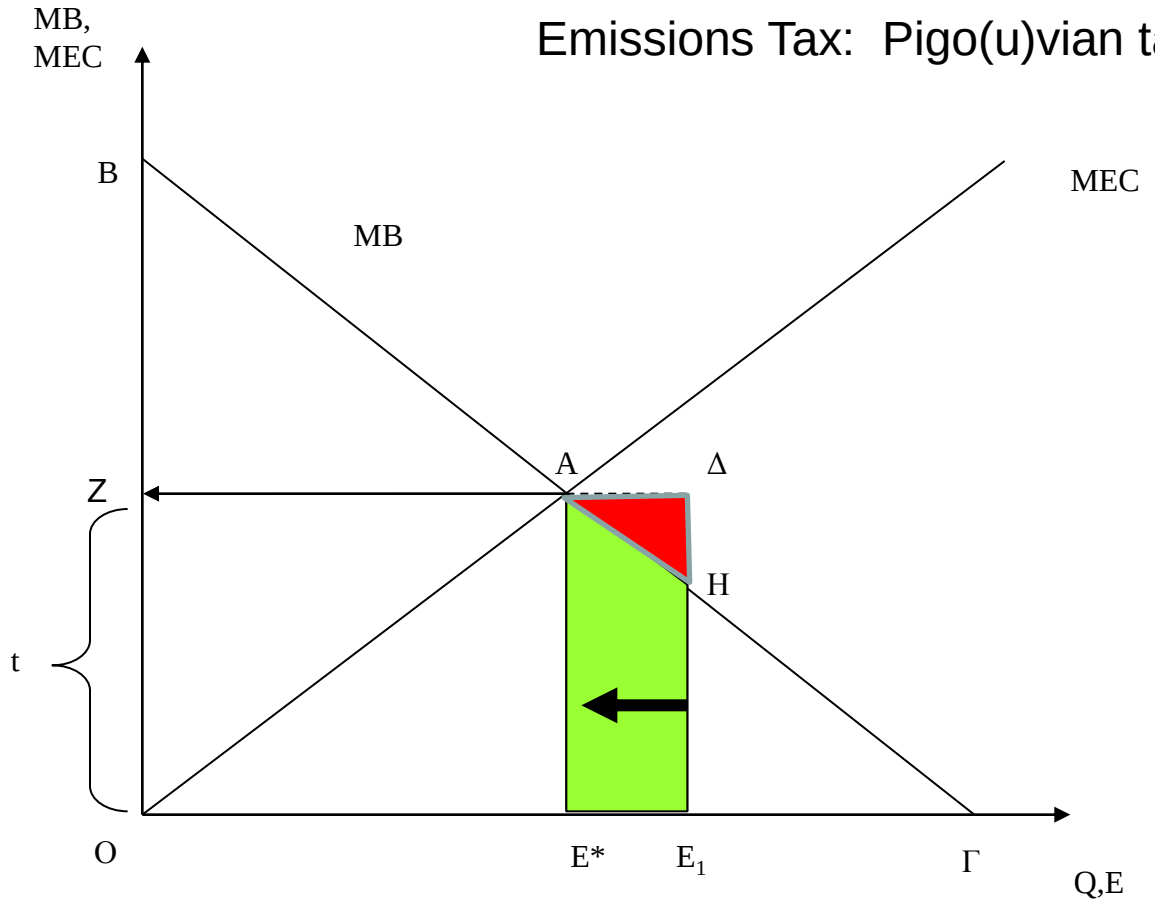
Emissions Tax: Pigo(u)vian tax



definition

$$t = D'\left(\sum_i e_i^*\right)$$

$$AE^*E_1H < A\Delta E_1E^* \Rightarrow E_1 \rightarrow E^*$$

Additional Private benefit

Additional Tax payments

Pigouvian taxes achieve Optimal pollution level E*

Optimal solution

Society's problem: maximization of social surplus

$$\max\left[\sum_i\left(B_i(e_i)-te_i\right)-D\left(\sum_i e_i\right)+\underbrace{t\sum_i e_i}_{\substack{lump-sum\\ refund}}\right]\equiv\max\left[\sum_i B_i(e_i)-D\left(\sum_i e_i\right)\right] \quad (1)$$

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$$\frac{\partial\left\{\sum_i B_i(e_i)\right\}}{\partial e_i}-\frac{\partial\left\{D\left(\sum_i e_i\right)\right\}}{\partial e_i}=0\Rightarrow B_i'(e_i^*)-\underbrace{D'\left(\sum_i e_i^*\right)\frac{\partial\overbrace{\left\{\left(\sum_i e_i\right)\right\}}}{\partial e_i}}_{chain\ rule}=0$$

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$$B_i'(e_i^*)=D'\left(\sum_i e_i^*\right) \quad (2)$$

Each and every firm equates MB with $D'\left(\sum_i e_i^*\right)$

Producer's problem : maximization of private benefit after Pigouvian taxation

$$\max B_i\left(e_i\right)-te_i \qquad \forall i \qquad (3)$$

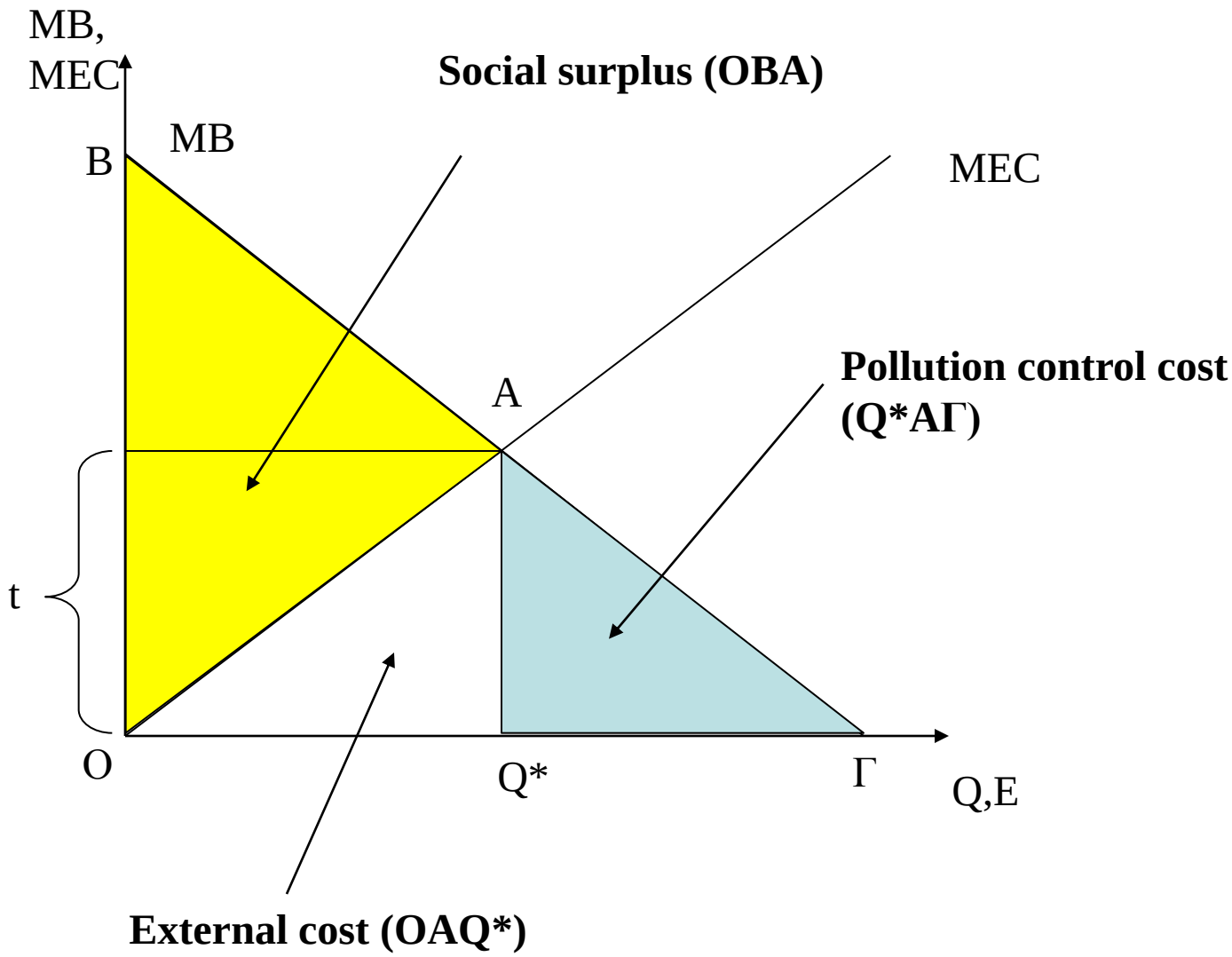
then $$B_i'\left(e_i^*\right)-t=0 \qquad \forall i \qquad (4)$$

Combining (2) και (4) we derive the definition of Pigouvian taxation

$$t=D'\left(\sum_i e_i^*\right)\equiv D'\Big|_{\sum_i e_i^*}$$

→ Pigouvian tax
Equals with the value of MEC
Evaluated at the optimal level

Welfare analysis when taxes are transfer payments



Double Dividend Hypothesis

The revenues from Pigouvian taxation may reduce the magnitude of pre-existing taxation and may also reduce the overall tax distortions.

when? When green taxation is less distortive **compared to** other taxes and There is a **balanced budget**

$$\max \sum_i \left(B_i(e_i) - t_1 e_i \right) - D\left(\sum_i e_i \right) + (1+\lambda) t_1 \left(\sum_i e_i \right) \quad (5)$$

Social value of tax revenues

$t\left(\sum_i e_i \right)$ Accounting value of tax revenues

$(1+\lambda)$

Shadow price of public funds

then

$$\underbrace{B_i'\left(e_i^*\right)-t_1}_{\downarrow\ 0}-D'\left(\sum_i e_i^*\right)+(1+\lambda)t_1=0 \qquad (6)$$

combining (2) και (6) we have

$$t_1=\frac{D'\left(\sum_i e_i^*\right)}{(1+\lambda)} \qquad (7)$$

$$\lambda>0\Rightarrow t_1<t$$

meaning?

Result: when the environmental policy design takes into account the social value of green Taxation, then $t_1<t$

Lower tax induces more emissions, more emissions means higher damage which is cancel off, at the margin, by the increased tax revenues.