FRANKFURT UNIVERSITY OF APPLIED SCIENCES

Environmental Assessment

Fachbereich 2 Informatik und Ingenieurwissenschaften

Coase and transaction cost

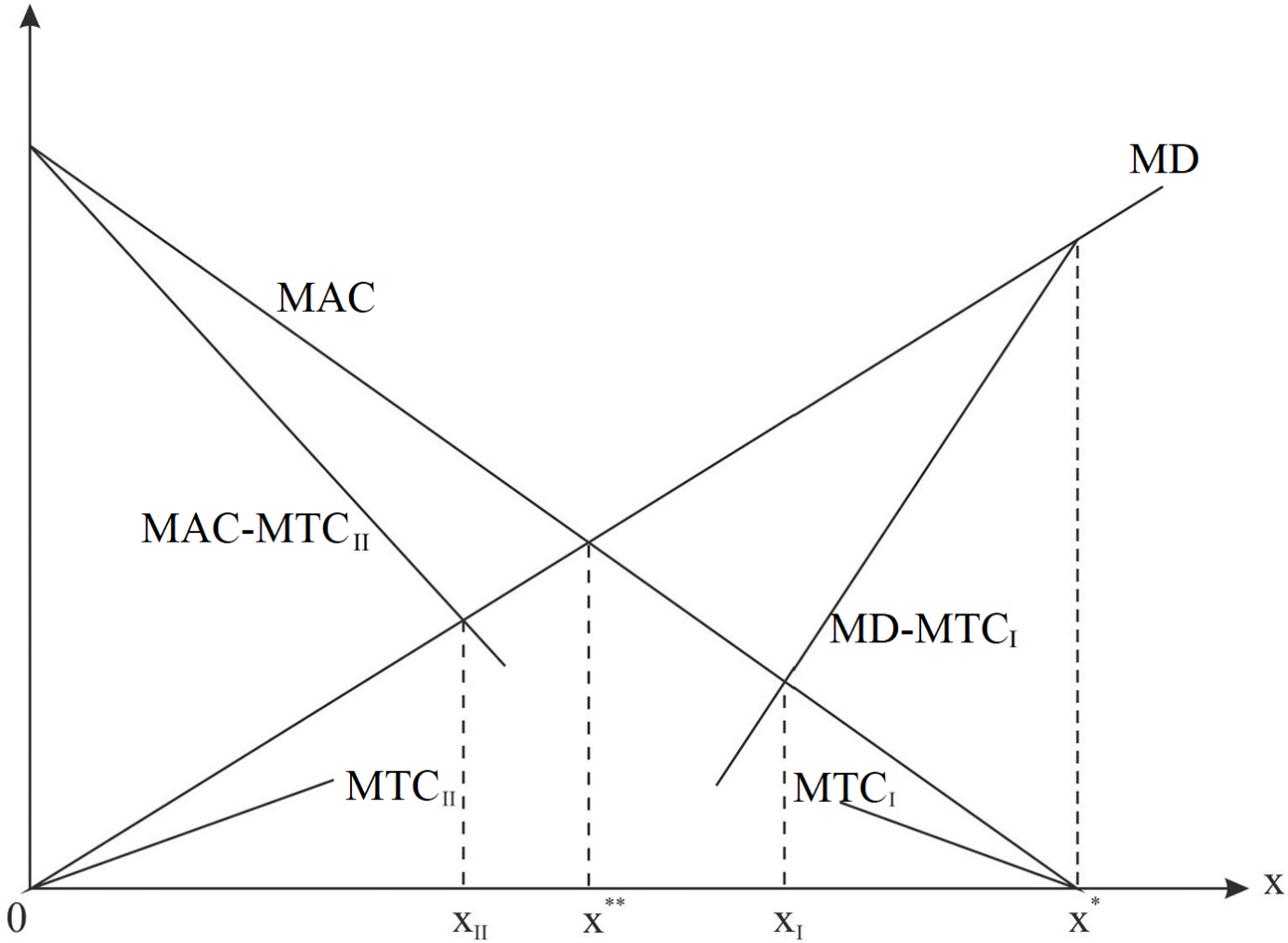

Figure: With adjustments taken from Endres (2022)

Coase and transaction cost

- more intuitive than MD-MTC$_I$ in the previous picture:

$\rightarrow$ MC=MTC$_I$+MAC (total marginal cost)

$\Rightarrow$ delivers same intersection point x^{**}

- example: MD=x, MAC=10-x, MTC$_I$=1-0.1x

$\Rightarrow$ $x^{**} = \frac{11}{2.1}$

Distortion from transaction cost

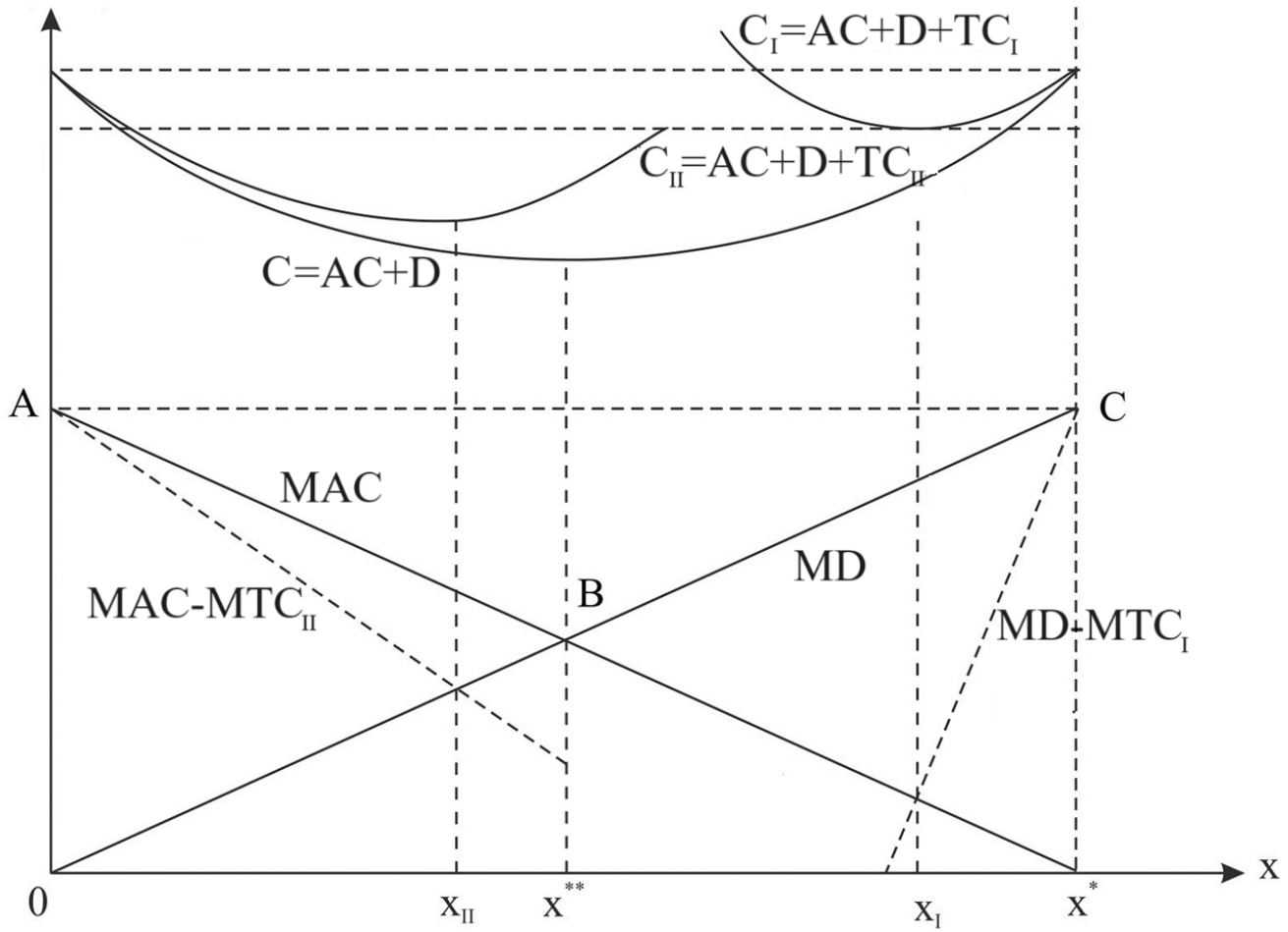

Figure: With adjustments taken from Endres (2022)

Coase theorem – exercise

Assume there is a country C_N negotiating with another country C_F about keeping or cutting a large forest. Country C_N profits from **keeping the forest** (emission sink) according to

$$U_N = q^2$$

while country C_F, which is the owner of the forest, generates a utility from **cutting the forest** corresponding to

$$U_F = 21q - \frac{q^2}{2}$$

with q corresponding to quantity units of the forest.

a) Use the information above to derive the damage function D_N and the abatement cost function AC_F?

b) Calculate the global optimum.

c) Calculate the abatement cost AC_F for the global optimum.

Coase theorem – exercise

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with q corresponding to quantity units of the forest.

d) Calculate the utility surplus induced by the global optimum when compared to cutting the forest.

e) Assume an equal distribution of the utility surplus. What is the payment for C_F?

Coase theorem – exercise

Assume there are countries $C_{N1}, C_{N2}, ..., C_{N10}$ negotiating with one other country C_F about keeping or cutting a large forest forest. Countries C_N profit from **keeping the forest** (emission sink) according to

$$U_{agg.} = q^2$$

while country C_F, which is the owner of the forest, generates a utility from **cutting the forest** corresponding to

$$U_F = 21q - \frac{q^2}{2}$$

with q corresponding to quantity units of the forest.

f) Assume there are 10 countries profiting from keeping the forest with an aggregated utility function $U_{agg.}$. How negotiations might change?

Coase theorem – solution

a) U_N reflects the utility from **keeping** the forest. The utility from **cutting** the forest corresponds to a disutility (negative utility) leading to $U_N = -q^2$ with q reflecting the amount of cut forest instead of kept forest. However, the question is not about the utility for cutting the forest but about the damage for cutting the forest which again means change of the sign eventually leading to $D_N = q^2$. For the other country we find $AC_F = U_F$ since utility corresponds to welfare and thus abatement cost.

MAC and MD – summary

MAC depends on

- individual preferences
- abatement technology

Both MAC and MD depend on

- income

$\Rightarrow$ MAC and MD are not constant but change over time

Pigouvian tax

Figure: Arthur Cecil Pigou (1877 – 1959); source: Wikipedia

Pigou suggested the introduction of a tax leading to a socially optimal output level

$\Rightarrow$ internalization of externalities

Pigouvian tax

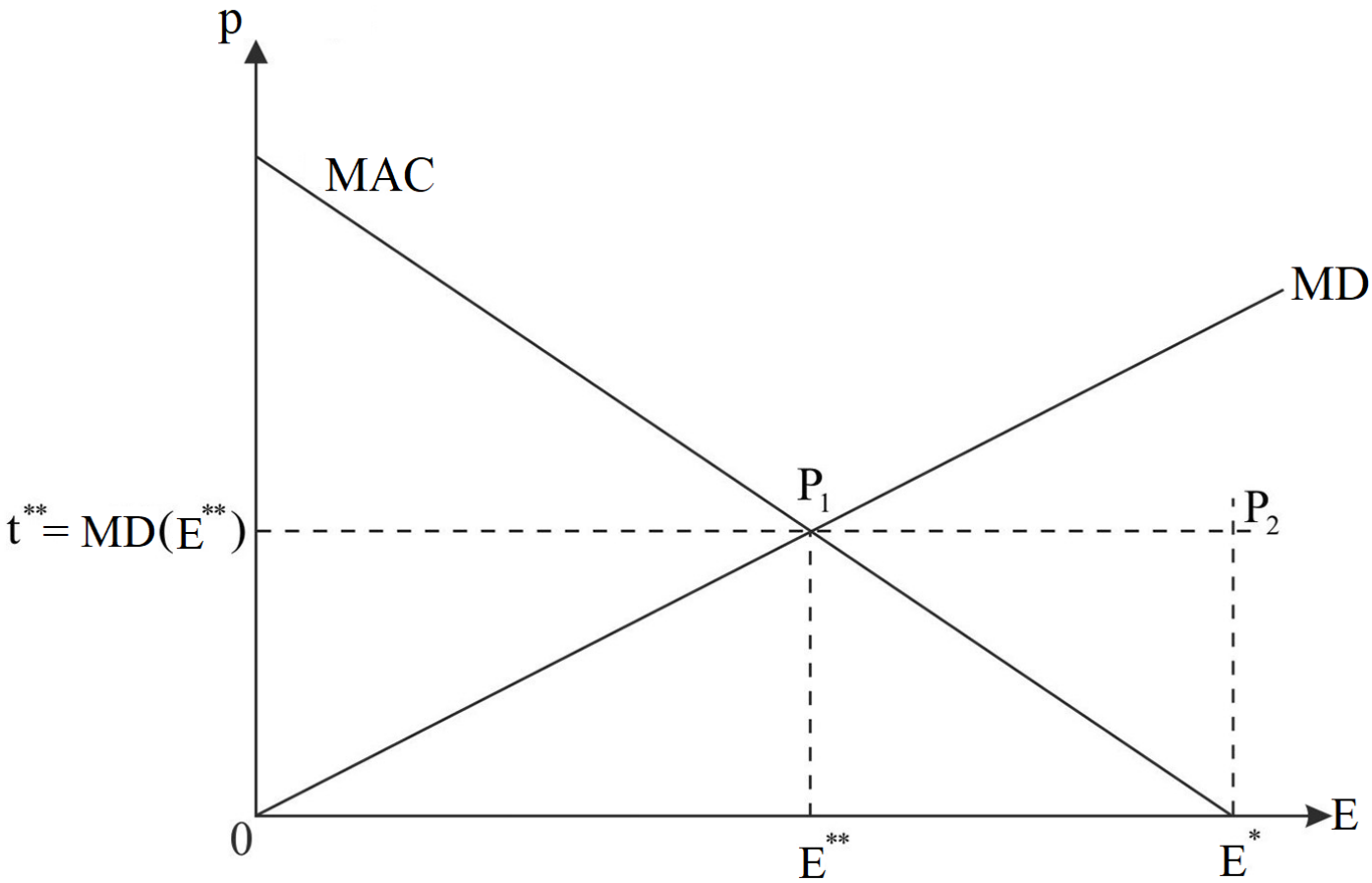

Figure: With adjustments taken from Endres (2022)

Pigouvian tax

- tax rate $t > \text{MAC}$

$\rightarrow$ emission reduction advantageous

- tax rate $t < \text{MAC}$

$\rightarrow$ emission (production) increase advantageous

$\Rightarrow$ for $t = \text{MD}(E^{**})$ emissions will reduce to the social optimum

Pigouvian tax and subsidy

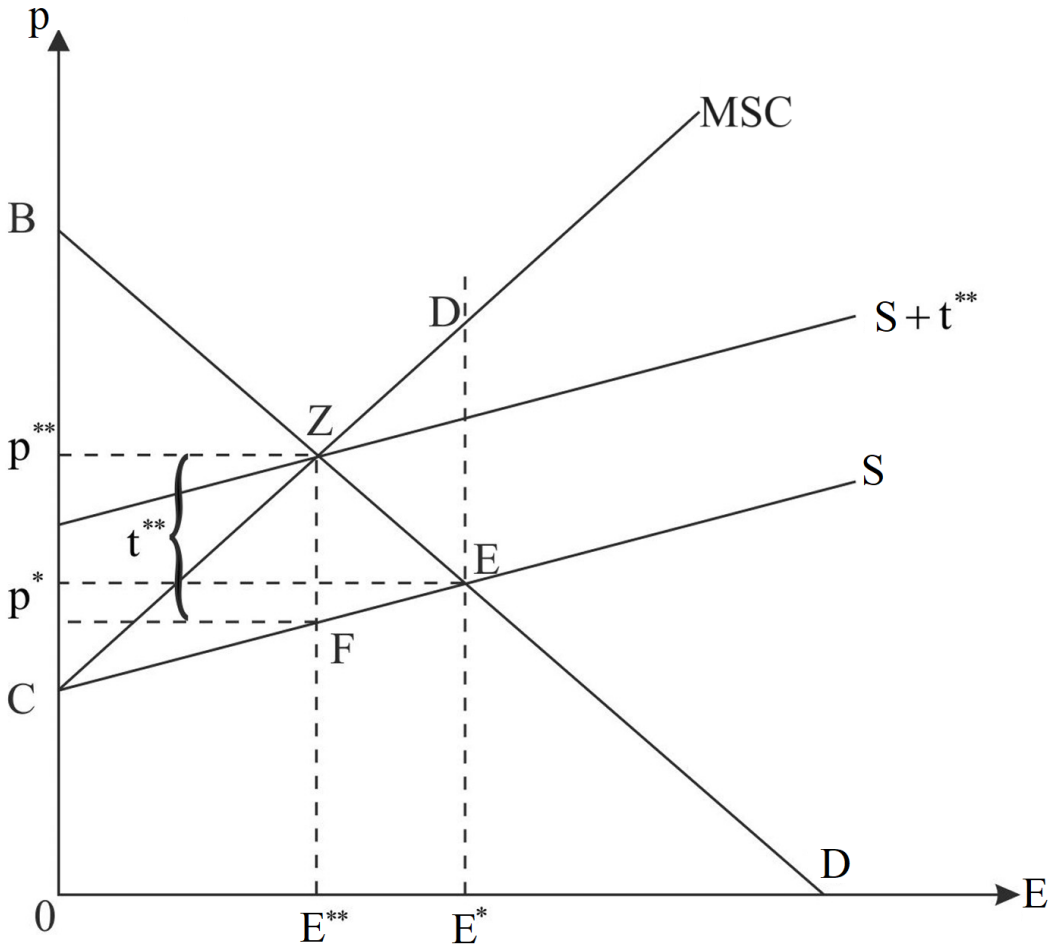

Figure: With adjustments taken from Endres (2022)

References

Endres, A. (2022). *Umweltökonomie*. Kohlhammer.