FRANKFURT UNIVERSITY OF APPLIED SCIENCES

Environmental Assessment

Fachbereich 2 Informatik und Ingenieurwissenschaften

Market and fairness

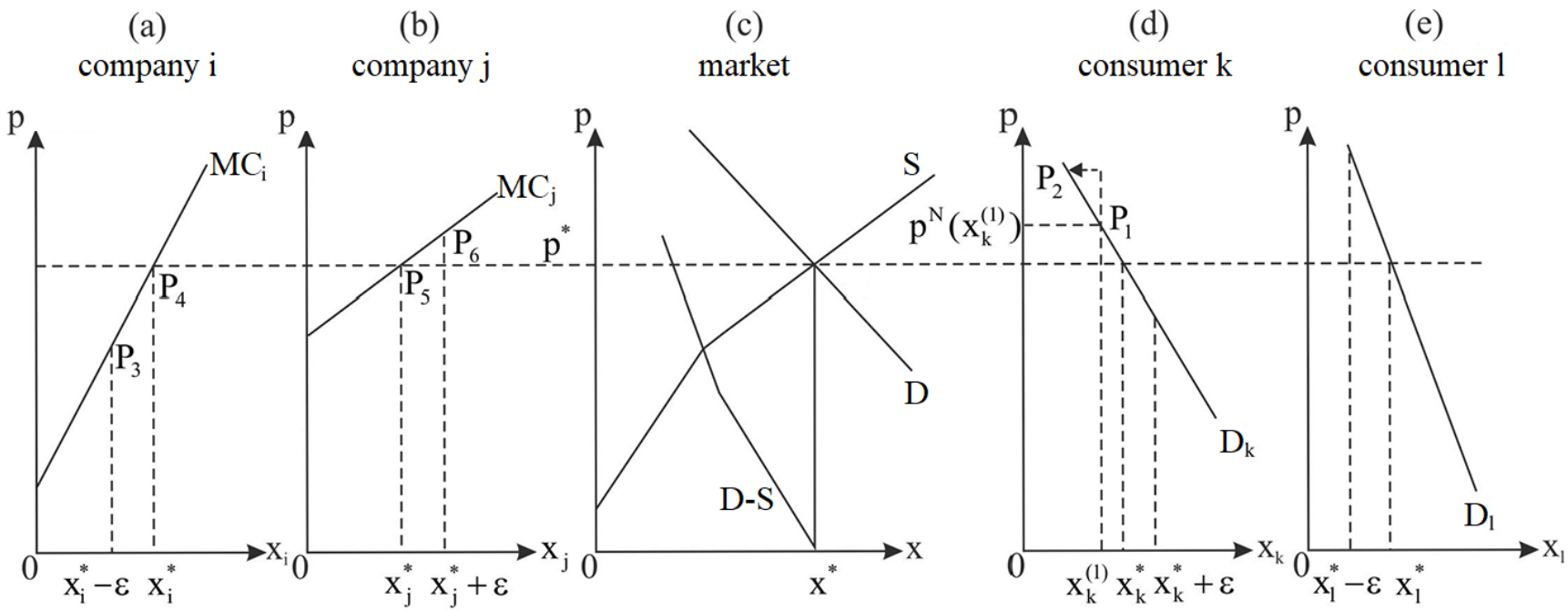


Figure: With adjustments taken from Endres (2022)

External effects

The described market mechanism is based on

- individual preferences
- income
- prices
- production technology
- market organization (e.g. perfect competition)
- rational behavior (utility and profit maximization)

Still, the impact of the market outcome on a third parties' (outside the market) utility or profit is not considered.
$\Rightarrow$ external effects

Market failure

Example

Assume a river with a factory upstream and a fisher downstream.

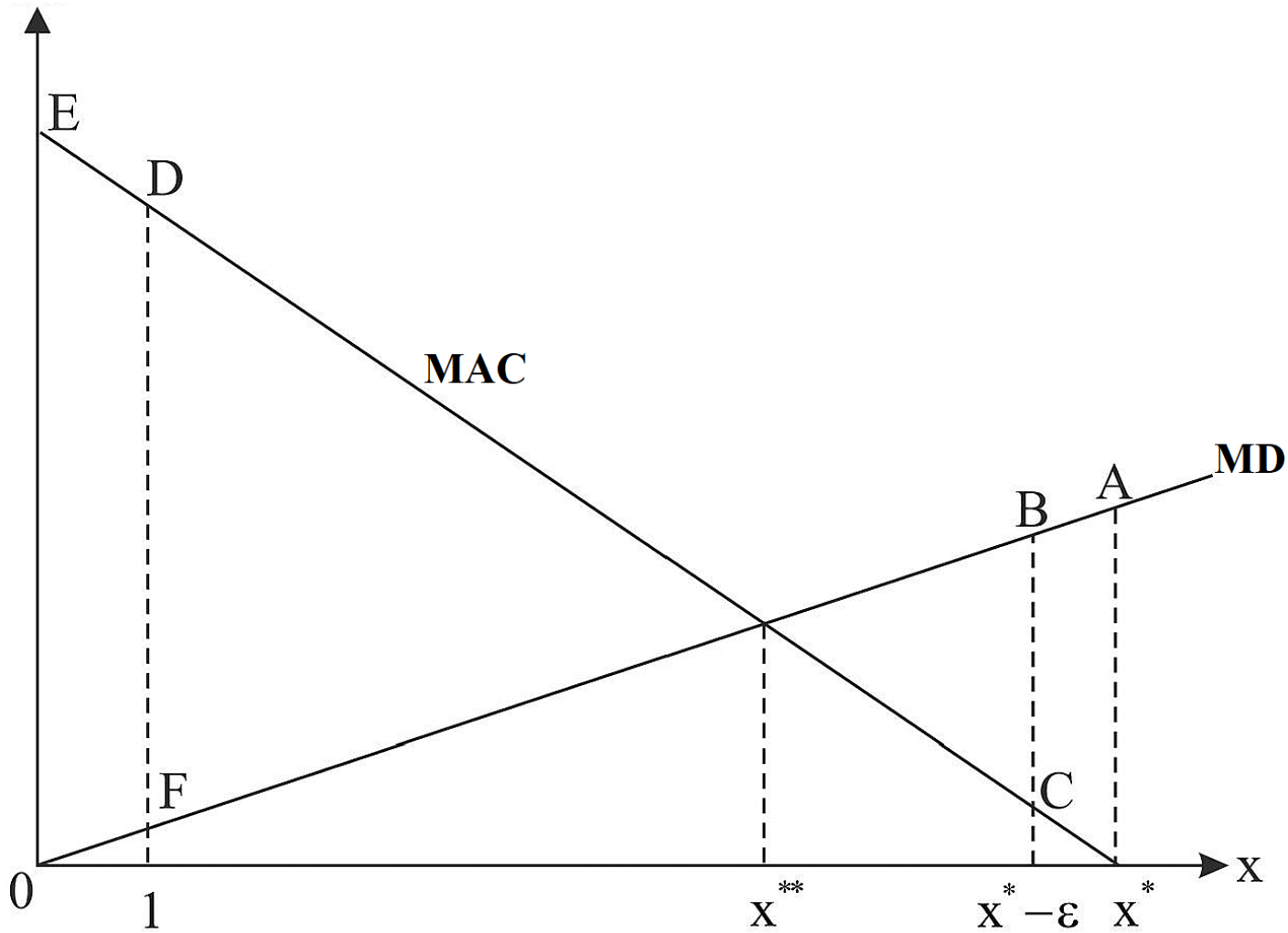
- waste water of the factory
- shrinking fish population

$\Rightarrow$ market failure

What does a reduction of the factory output cost (society)?

What does the emission of the factory cost?

Marginal abatement cost and marginal damage



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Marginal abatement cost and marginal damage

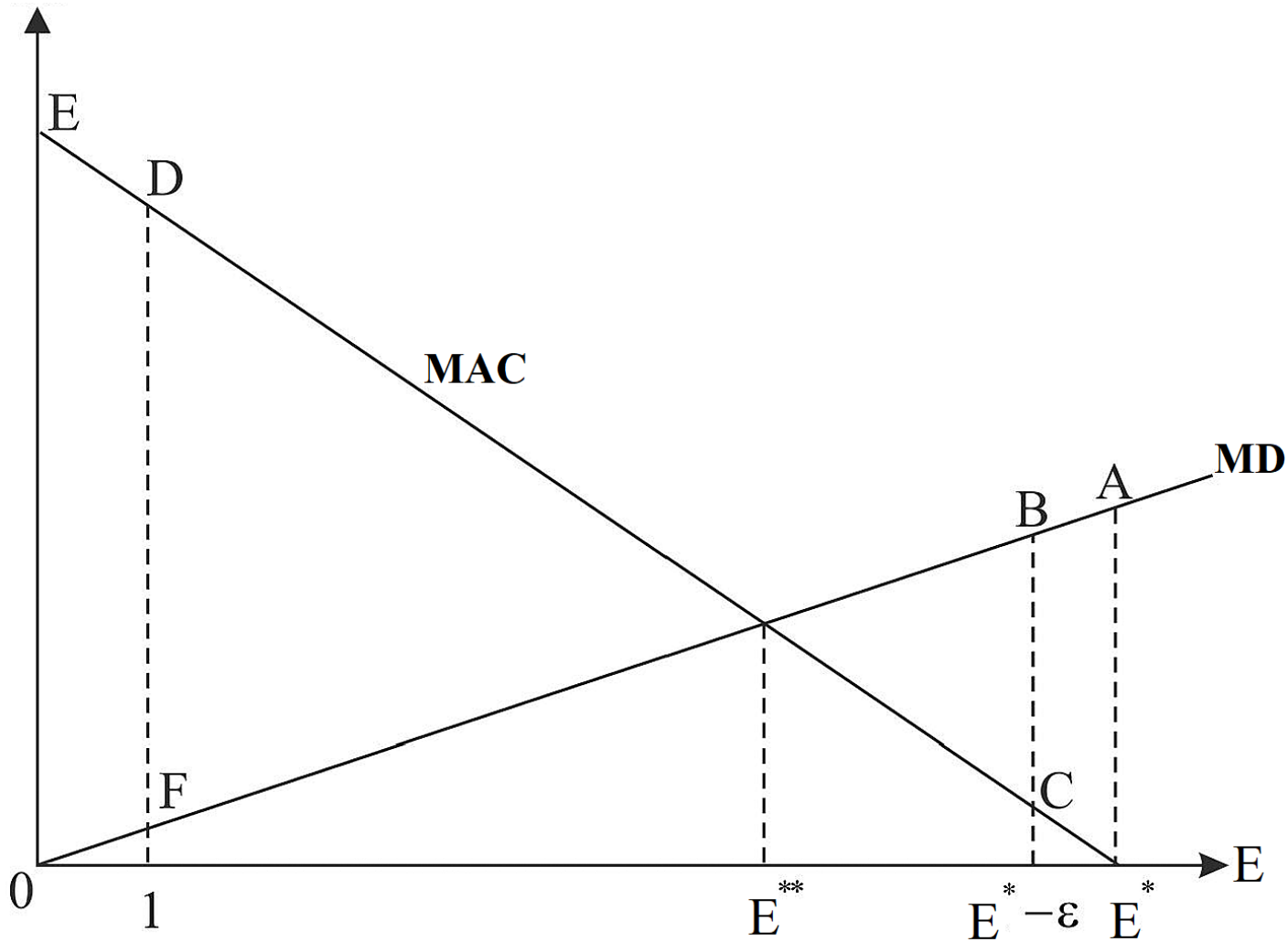

Figure: With adjustments taken from Endres (2022)

The bargaining solution

Figure: Ronald Coase (1910 – 2013) at the University of Chicago Law School in 2003. Winner of the "Nobel Memorial Price" in 1991; source: Wikipedia

The basis for a bargaining solution are

- clearly defined property rights
- no transaction costs
- two parties for negotiation

The bargaining solution – exercise

Let us have a look again at the factory upstream and the fisher downstream. Assume that the factory's profit depends on emissions E as follows

$$\Pi_U = b\left(aE - \frac{E^2}{2}\right)$$

while the fisher faces the profit

$$\Pi_D = d - \frac{cE^2}{2}$$

with a=10, b=c=2 and d=200

a) Calculate the emission level E^* which is optimal for the factory.

b) Calculate the socially optimal emission level E^{**}

c) Assume the factory owns the property rights of the river. What is the maximum the fisher is willing to pay for a change from E^* to E^{**}? What is the minimum the factory will ask for?

The bargaining solution – exercise

Let us have a look again at the factory upstream and the fisher downstream. Assume that the factory's profit depends on emissions E as follows

$$\Pi_U = b\left(aE - \frac{E^2}{2}\right)$$

while the fisher faces the profit

$$\Pi_D = d - \frac{cE^2}{2}$$

with a=10, b=c=2 and d=200

d) Assume the fisher owns the property rights of the river. What is the maximum the factory is able to pay for a change from E^{**} to E^{*}? What is the minimum the fisher will ask for?

The Coase theorem

Summary

*"Let **exclusive property titles** to the environment be defined, and let them be **transferable**. Let there be **no transaction costs**. Let individuals **maximize their utilities**, and let them be **nonaltruistic**. Then a bargaining solution among different users of the environment will result in a **Pareto-optimal** allocation of the environment. The resulting allocation is **independent of the initial distribution** of property titles."* (Siebert, 2008).

Coase – the solution?

- Why are there still environmental problems?

$\rightarrow$ free rider problem

$\rightarrow$ impact of initial distribution

$\rightarrow$ transaction cost

Strategic behavior

Assume you are a lawyer and you defend a client who robbed a bank together with an accomplice. So far, the police "only" found your client and his accomplice each with a pistol which means 3 years in prison for each of them. The states lawyer suggest the following deal:

a) no prison if your client confesses the robbery for him and his accomplice while his accomplice denies it
b) 3 years in prison if your client and his accomplice confesses
c) 10 years in prison if your client denies but the robbery is proved by his accomplice
d) 1 hour time!

Free rider problem

The prisoners' dilemma as rationale for the free rider problem

		accomplice	
		deny	confess
client	deny	(-3; -3)	(-10; 0)
	confess	(0; -10)	(**-8**; **-8**)

payoffs Π in years: $(\Pi_{client};\Pi_{accomplice})$

$\Rightarrow$ rational decision eventually harms the decider

Strategic behavior

Assume two countries C_1, C_2 which are suffering from emissions of country C_E. Country C_E offers to reduce emissions for a payment of 4 units. This emission reduction will increase the utility of countries C_1 and C_2 by 4 units each. Both countries C_1 and C_2 or one of the countiries can make a contract with country C_E

a) Calculate the payouts for all situations (contract, no contract).

b) Illustrate the game in the matrix form.

c) Is there a dominant strategy?

Free rider problem

A variant of the prisoners' dilemma

		country 1	
		contract	no contract
country 2	contract	(2; 2)	(0; 4)
	no contract	(4; 0)	**(0; 0)**

payoffs Π in money units: $(\Pi(C_1);\Pi(C_2))$

$\Rightarrow$ rational decision is **not** Pareto-optimal!

Income effect

- intuition:

$\rightarrow$ income affects consumption

$\Rightarrow$ impact on acceptance of environmental damage

Income effect

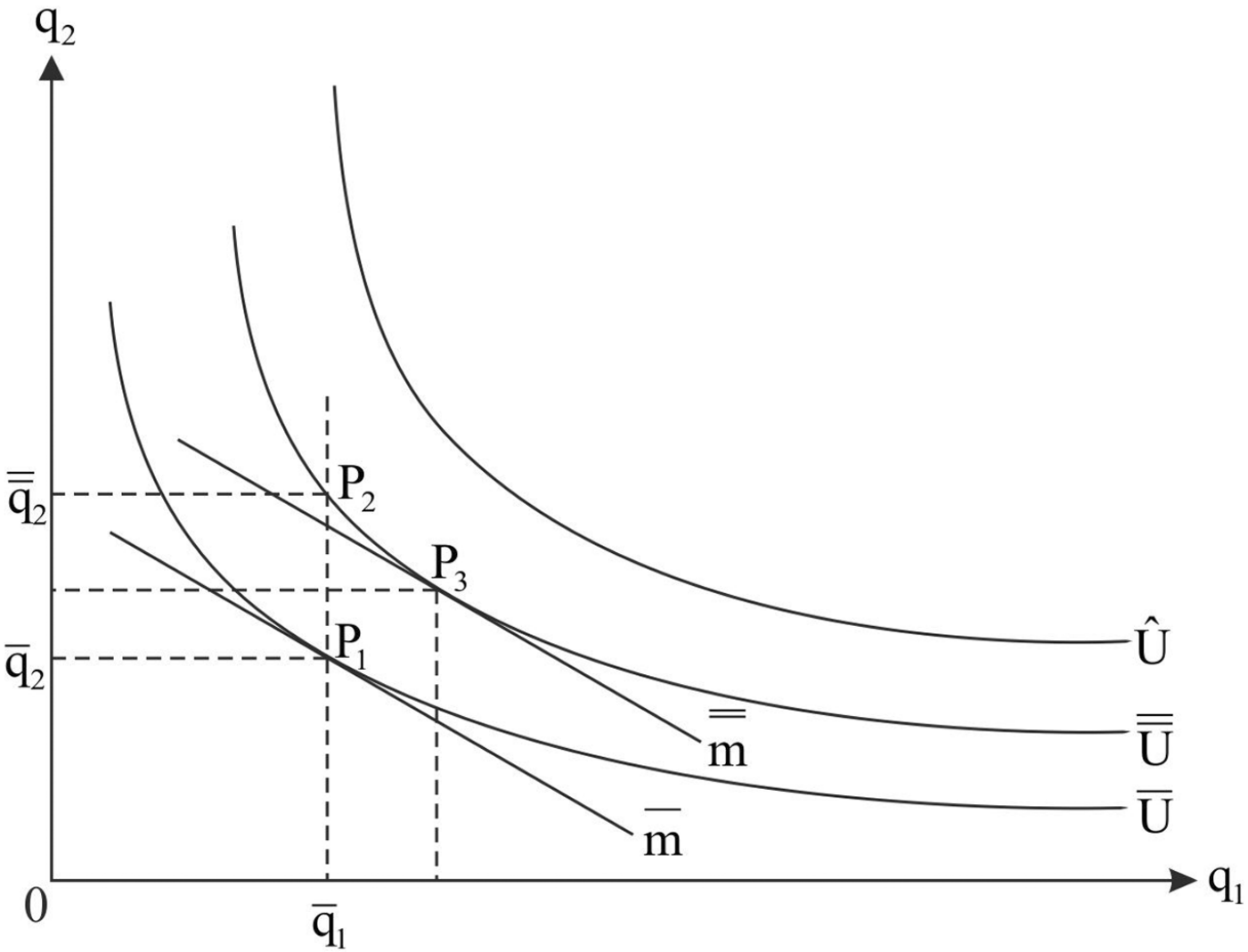

Figure: With adjustments taken from Endres (2022)

Impact of property rights assignment

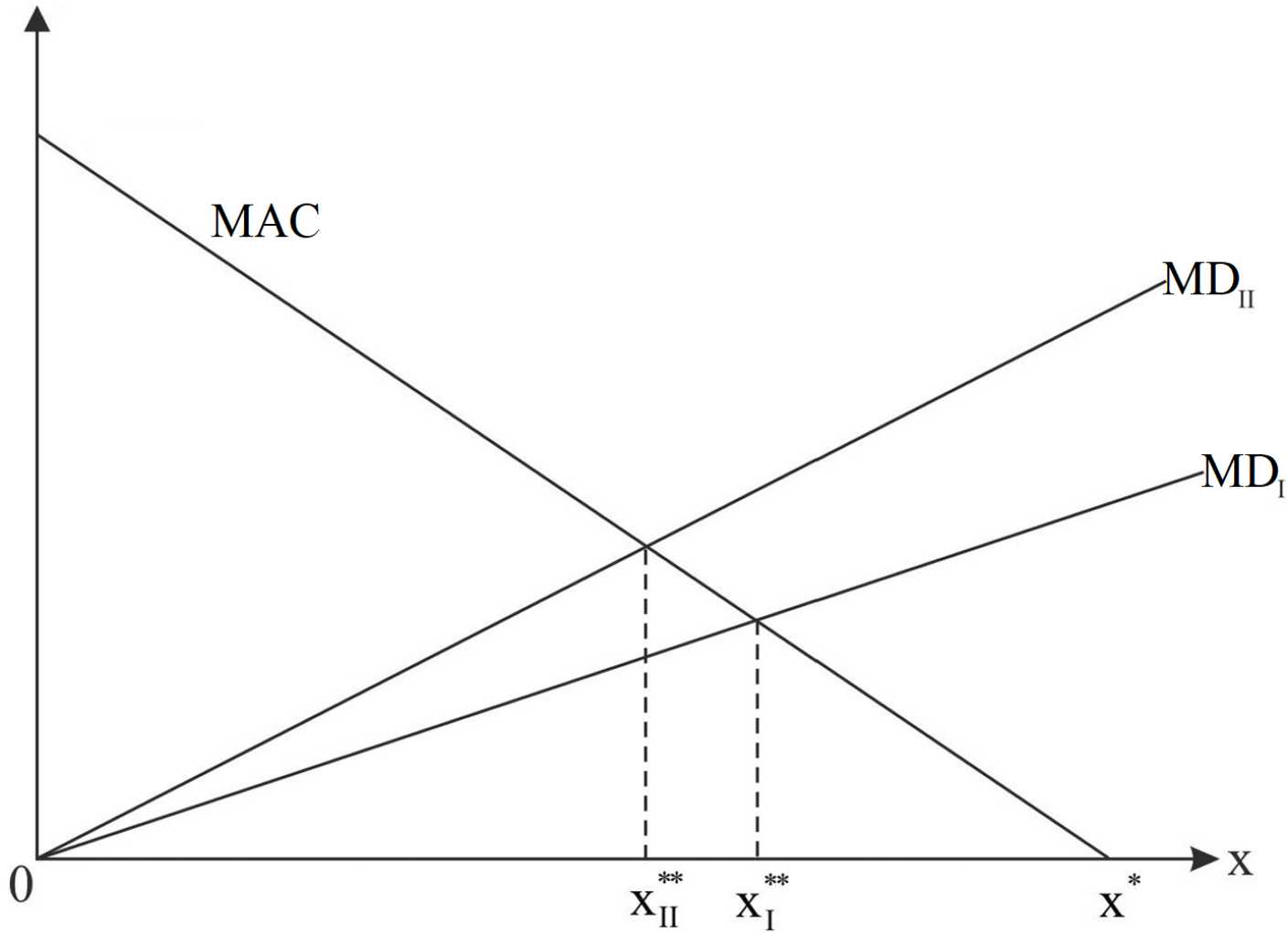

Figure: Marginal damage MD "nominally" increases when property rights are assigned to the pollutee (MD_I) instead of the polluter (MD_{II});source: with adjustments taken from Endres (2022)

Transaction cost

- bargaining is costy
- uncertainty can be interpreted as transaction cost

$\rightarrow$ the higher the uncertainty, the higher are transaction cost

Coase and transaction cost

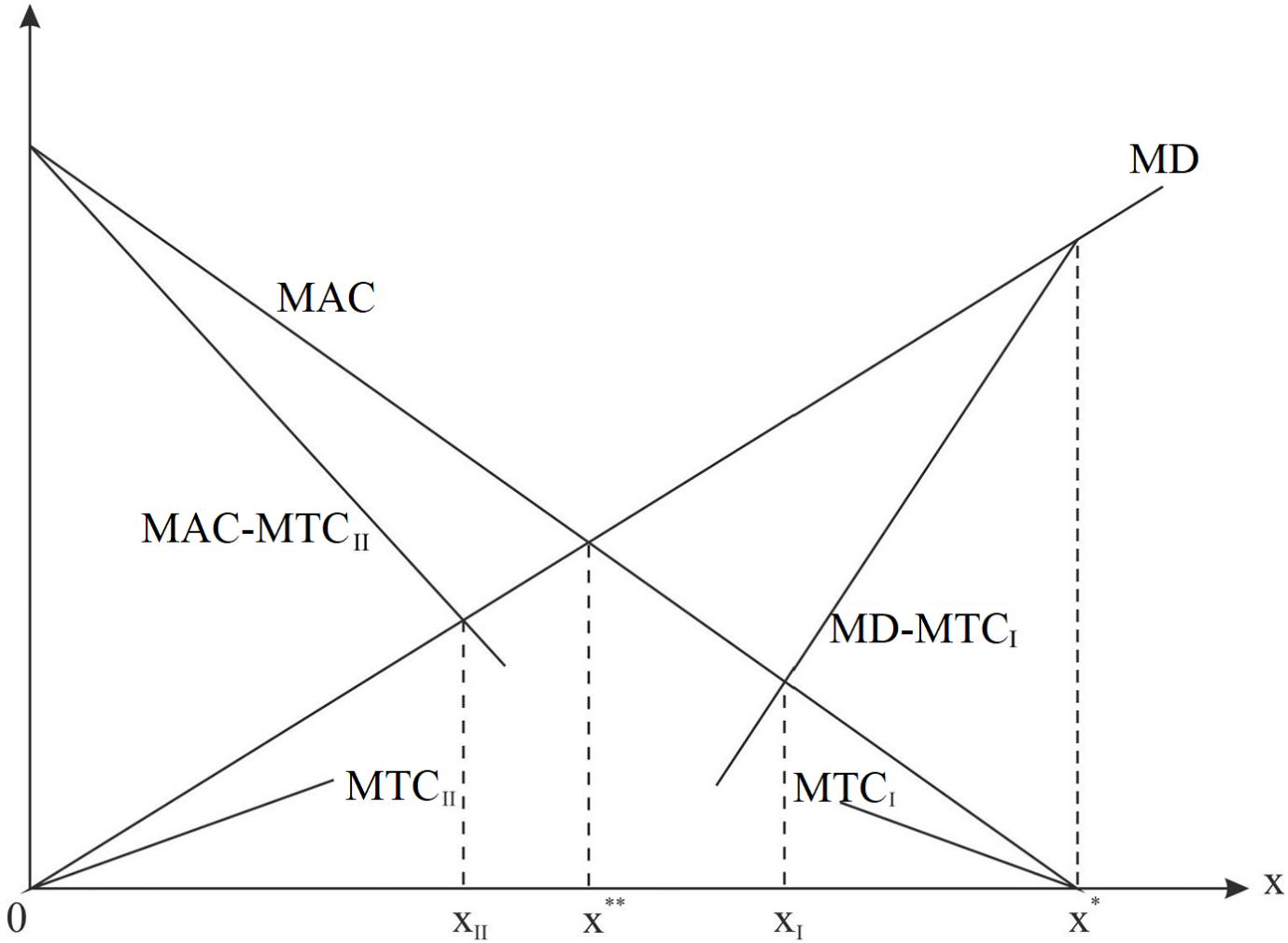

Figure: With adjustments taken from Endres (2022)

References

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

Siebert, H. (2008). *Economics of the Environment: Theory and Policy*. Springer.