THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

ECON2030 - Microeconomic Policy

Tutorial 3: Environmental Policy

Tutor: Francisco Tavares Garcia

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Assessments

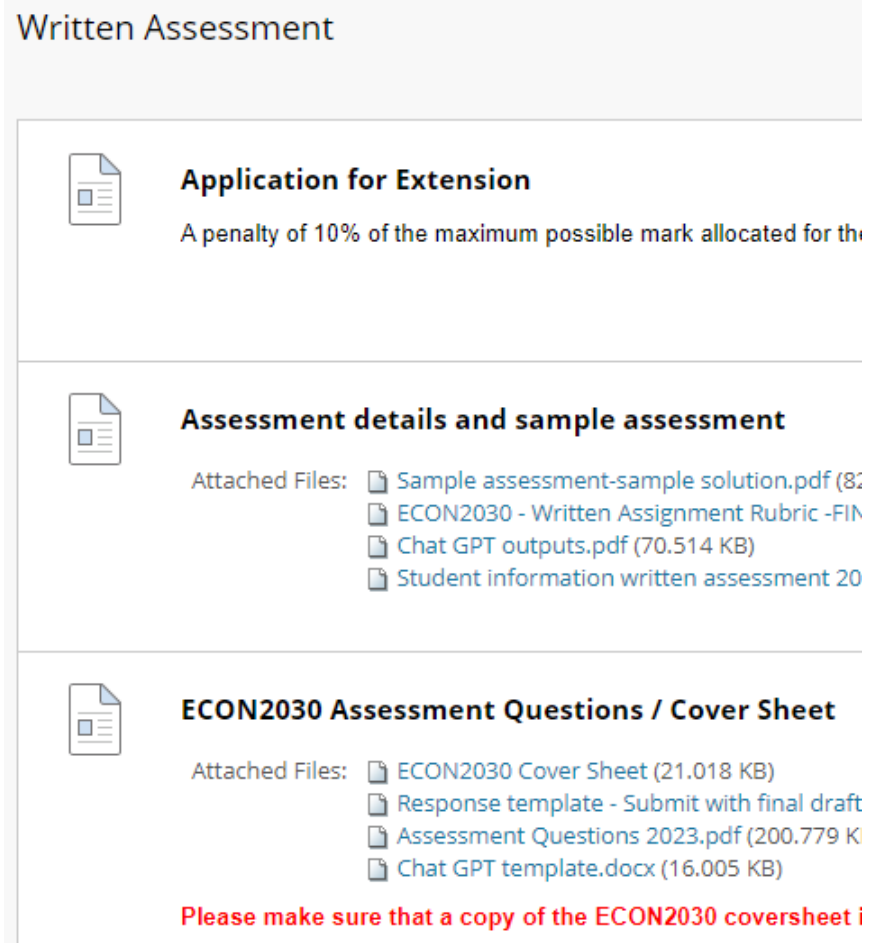
Assessment Task	Due Date	Weighting	Learning Objectives
Report Written assessment	TBC. 22 Aug 13:00:00; 12 Sep 13:00:00; 3 Oct 13:00:00; 17 Oct 13:00:00; 7 Nov 13:00:00	100% 4 Assessments	1, 2, 3

Due next Tuesday @ 1pm !!!

R1.1/R1.2: *"Climate deal struck after Labor and the Greens reach safeguard mechanism agreement"* (ABC, 2023). Provide the economic background of the Safeguard Mechanism. Provide a critical economic appraisal of the mechanism on reaching Australia's climate goals. What would you propose as a better economic policy?

Deadline R1.1: 22nd August 2023; before 13:00

Deadline R1.2: 12th September 2023; before 13:00



THE UNIVERSITY OF QUEENSLAND, SCHOOL OF ECONOMICS

ECON 2030: Tutorial 3

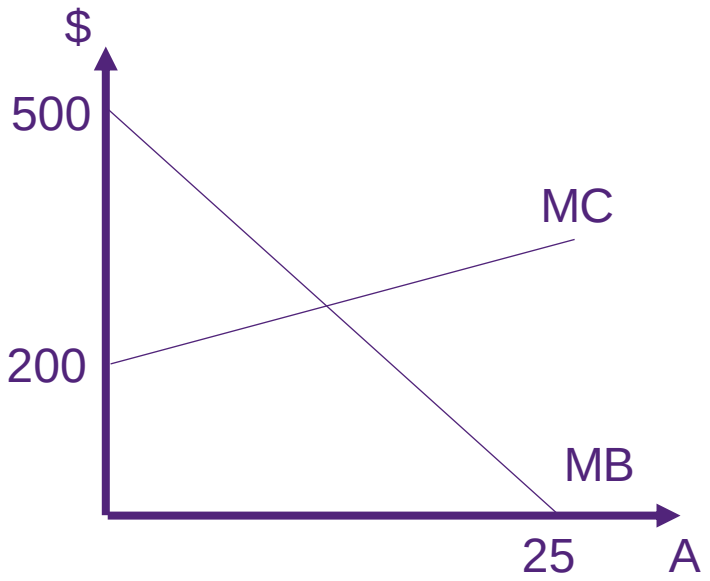
Environmental Policy

1 Market for Pollution Abatement

Assume that scientific studies provide you with the following information concerning the benefits and costs of sulphur dioxide emissions:

- Benefits of abating (reducing) emissions: $MB = 500 - 20A$
- Costs of abating emissions: $MC = 200 + 5A$

where A is the quantity abated in millions of tonnes and the benefits and costs are given in dollars per tonne. Use a graph to illustrate your answers.



- Benefits of abating (reducing) emissions: $MB = 500 - 20A$
- Costs of abating emissions: $MC = 200 + 5A$

a) What is the socially efficient level of emissions abatement?

MB = MC

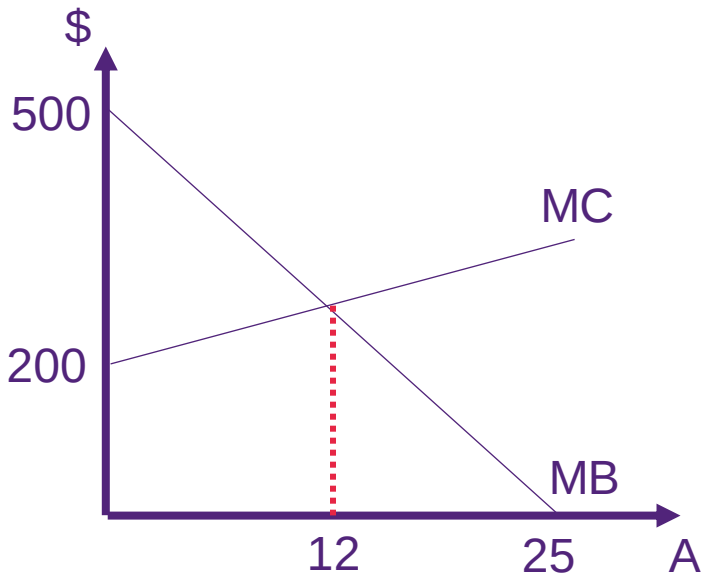
500 – 20A = 200 + 5A

500 – 200 = 5A + 20A

300 = 25 A

A* = 300/25

A* = 12



- Benefits of abating (reducing) emissions: $MB = 500 - 20A$
- Costs of abating emissions: $MC = 200 + 5A$

b) What are the marginal benefit and marginal cost of abatement at the socially efficient level of abatement? What is the net social benefit (benefit minus cost) at the efficient level?

MB = 500 – 20A

= 500 – 20*12

= 500 – 240

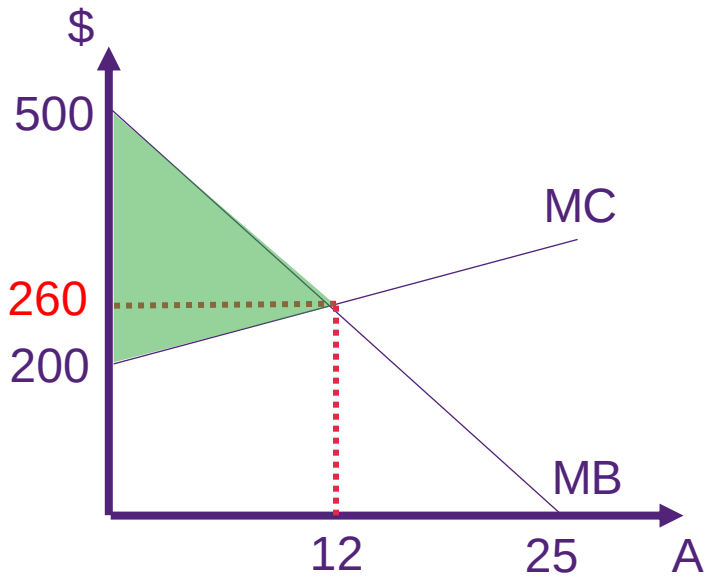
= 260

Net Benefit = (500 – 200) * 12 / 2

= 300 * 6

= 1800

MB = MC = 260. Net benefit = 1800



- Benefits of abating (reducing) emissions: $MB = 500 - 20A$
- Costs of abating emissions: $MC = 200 + 5A$

c) What happens to net social benefits (benefits minus costs) if you abate one million more tonnes than the efficient level? One million fewer?

A = 13

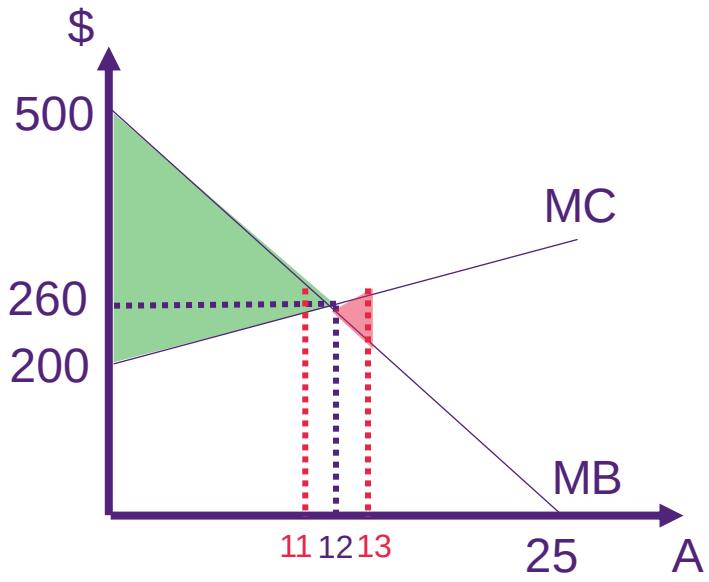
MB = 500 – 20*13 = 240
MC = 200 + 5*13 = 265

Net benefit diff = little triangle
= (13 – 12) * (265 - 240) / 2
= 1 * 25 / 2
= 12.5

A = 11

MB = 500 – 20*11 = 280
MC = 200 + 5*11 = 255

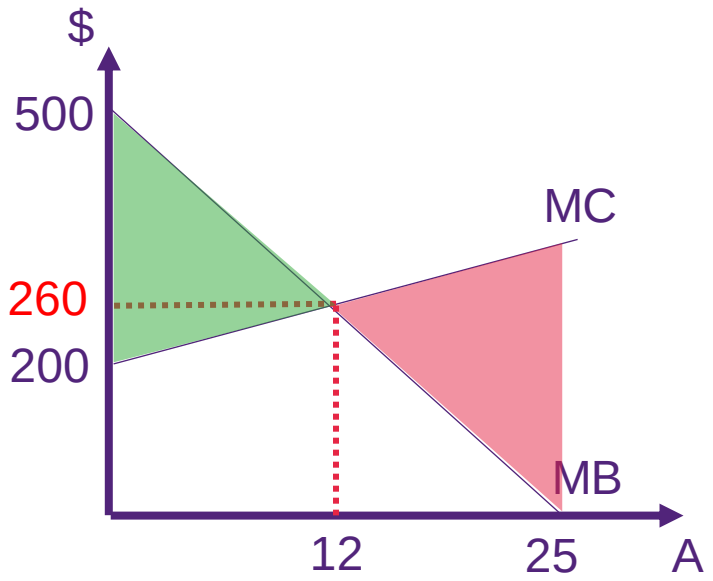
Net benefit diff = little triangle
= (12 – 11) * (280 - 255) / 2
= 1 * 25 / 2
= 12.5



- Benefits of abating (reducing) emissions: $MB = 500 - 20A$
- Costs of abating emissions: $MC = 200 + 5A$

d) Why is it socially efficient to set marginal benefits equal to marginal costs rather than abating until total benefits equal total costs?

When MB=MC, net social benefit is maximised, whereas when TB=TC, net social benefit equals zero.



2 COST-EFFECTIVENESS, EMISSIONS FEE, CAP-AND-TRADE

Suppose that two firms emit a certain pollutant. The marginal cost of reducing pollution for each firm is as follows: $MC_1 = 300e_1$ and $MC_2 = 100e_2$, where e_1 and e_2 are the amounts (in tonnes) of emissions reduced by the first and second firms, respectively. Assume that in the absence of government intervention, Firm 1 generates 100 units of emissions and Firm 2 generates 80 units of emissions.

a) Suppose regulators decide to reduce total pollution by 40 units. In order to be cost effective, how much should each firm cut its pollution?

$$40 = e_1 + e_2$$

$$MC_1 = 300e_1$$
$$MC_2 = 100e_2$$

$$MC_1 = MC_2$$
$$300e_1 = 100e_2$$
$$3e_1 = e_2$$

$$40 = e_1 + e_2$$
$$40 = e_1 + 3e_1$$
$$40 = 4e_1$$
$$e_1 = 10$$
$$e_2 = 3*10 = 30$$

$e_1^* = 10$ and $e_2^* = 30$

2 COST-EFFECTIVENESS, EMISSIONS FEE, CAP-AND-TRADE

Suppose that two firms emit a certain pollutant. The marginal cost of reducing pollution for each firm is as follows: $MC_1 = 300e_1$ and $MC_2 = 100e_2$, where e_1 and e_2 are the amounts (in tonnes) of emissions reduced by the first and second firms, respectively. Assume that in the absence of government intervention, Firm 1 generates 100 units of emissions and Firm 2 generates 80 units of emissions.

b) What emissions fee should be imposed to achieve the cost-effective outcome? How much would each firm pay in taxes?

Tax = Marginal Cost

$MC_1 = 300e_1$
= 300 * 10
= $3,000

Firm 1 = $3,000 * (100 - e_1)
= $3,000 * (100 - 10)
= $3,000 * 90
= $270,000

Firm 2 = $3,000 * (80 - e_2)
= $3,000 * (80 - 30)
= $3,000 * 50
= $150,000

Firm 1 tax bill = $270,000.
Firm 2 tax bill = $150,000.

c) Suppose that instead of an emissions fee, the regulatory agency introduces a tradable permit system and issues 140 permits, each of which allows the emission of one tonne of pollution. Firm 1 uses it political influence to convince the regulatory agency to issue 100 permits to itself and only 40 permits to Firm 2. You can assume the permit market is competitive.

i) How many, if any, permits are traded between the firms?

ii) What is the minimum amount of money that must be paid (total) for these permits?

iii) By how many tonnes does each firm end up reducing its pollution?

Firm 1 = 100 permits
Firm 2 = 40 permits

$MC_1 = MC_2$

Equilibrium
Firm 1 = 90 permits
Firm 2 = 50 permits

Firm 2 will purchase 10 permits from Firm 1

10 permits
#3,000 each

$30,000 total.

Firm 1 = (90 – 100) = -10 tonnes
Firm 2 (50 – 80) = -30 tonnes

Firm 1 reduces 10 tonnes and
Firm 2 reduces 30 tonnes.

d) Transform firm 1's marginal abatement cost function to be dependent on *emissions* instead of emissions reduction. Verify that at the chosen tax rate in question (b), Firm 1 has the same equilibrium emissions level you found in question (b).

Firm 1 abatement = e_1

Firm 1 emission E_1 = 100 - e_1

e_1 = 100 - E_1

MC_1 = 300e_1

= 300 * (100 - E_1)

= 30,000 – 300 E_1

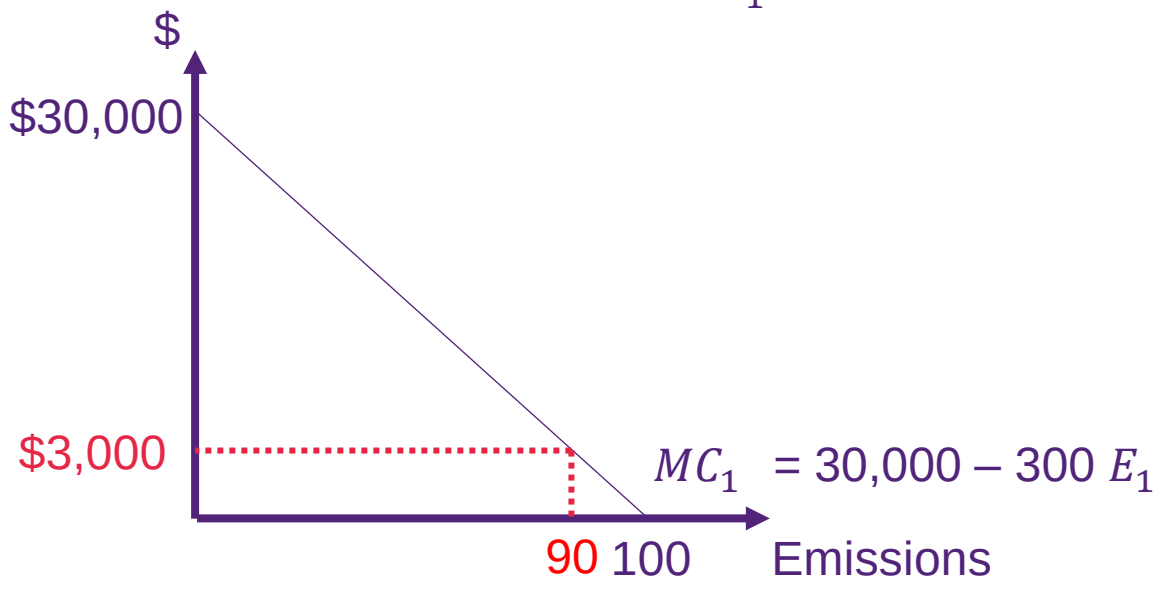
MC (b) = \$3,000

3,000 = 30,000 – 300 E_1

300 E_1 = 30,000 – 3,000

E_1 = 27,000 / 300

E_1 = 90



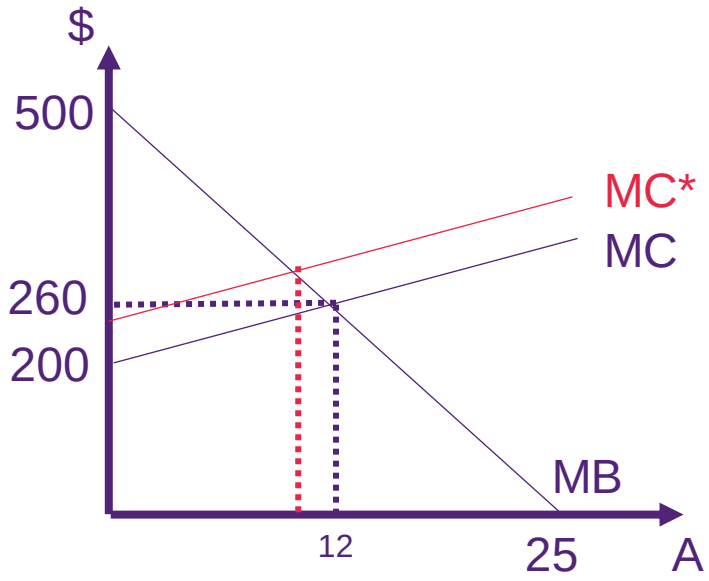
3 Uncertainty

The following curves desribe the abatement of carbon dioxide.

- Benefits of abating (reducing) emissions: $MB = 500 - 20A$
- Costs of abating emissions: $MC = 200 + 5A + \theta$

where A is abatement and θ is a normally distributed random variable. Should the government choose a price or quantity mechanism to control carbon dioxide? Does this depend on theta? What is the social losses for a price mechanism when $\theta = 2$?

MB is steeper than MC, so a quantity mechanism should be used.



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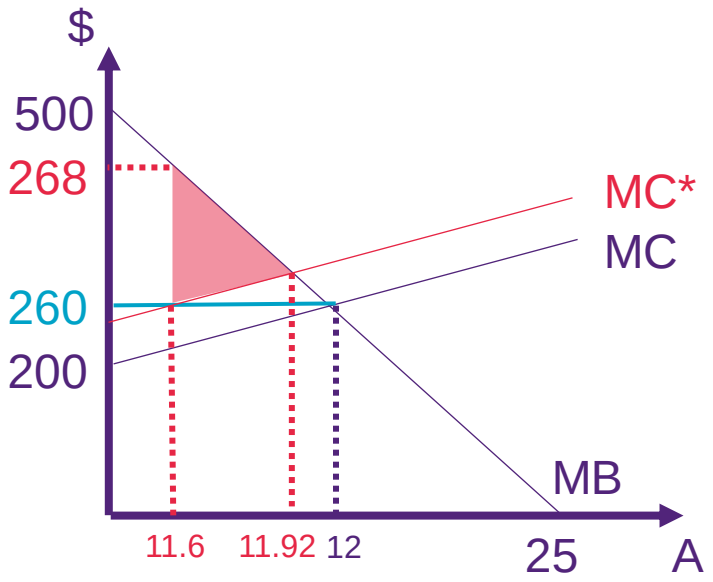
MB = MC*
500 – 20A = 200 + 5A + θ
500 – 200 - 2 = 5A + 20A
298 = 25A
A = 11.92

MC* = 260
200 + 5A + θ = 260
5A = 260 – 200 - 2
5A = 58
A = 11.6

MB = 500 – 20A
= 500 – 20*11.6
= 500 – 232
= 268

Social loss = triangle
(268 - 260) * (11.92 – 11.6) / 2
= 8 * 0.32 / 2
= 1.28



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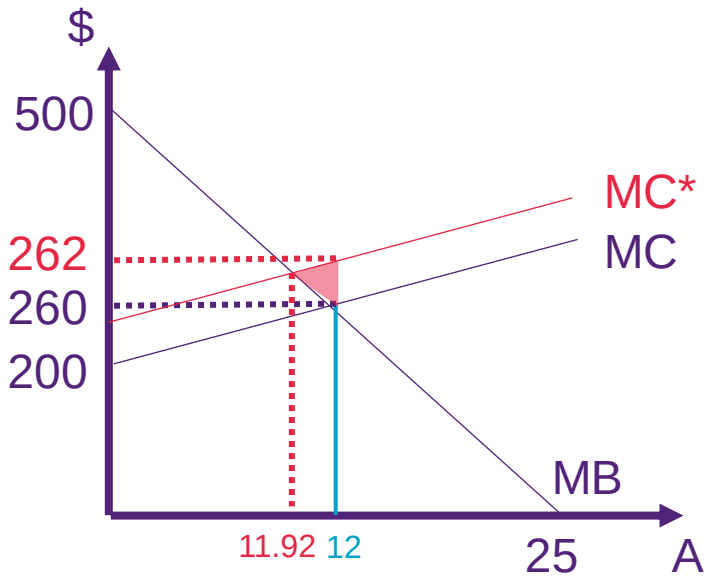
MB = MC*
500 – 20A = 200 + 5A + θ
500 – 200 - 2 = 5A + 20A
298 = 25A
A = 11.92

MC* = 200 + 5*12 +2
= 200 + 60 + 2
= 262

Social loss = triangle
(262 - 260) * (12 – 11.92) / 2
= 2 * 0.08 / 2
= 0.08

The social loss is 0.08



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Thank you

Francisco Tavares Garcia | Tutor
School of Economics

Reference

Harvey, R., & Gayer, T. (2013). *Public finance*. McGraw-Hill Higher Education.