Mechanism design
Recitation IX

Agenda

- Basic idea behind mechanism design
  - Permits vs. taxes
  - Price floors and safety valves (price ceilings)

Be sure to take good notes & ask questions!

Recap: Uncertainty

- Two or more outcomes: e.g. ε, payoffs, MAC
- Known probabilities

- Expected values (aka weighted average)

  =Prob(Outcome1)*Value(Outcome1)

  + Prob(Outcome 2)*Value (Outcome 2)

  + etc

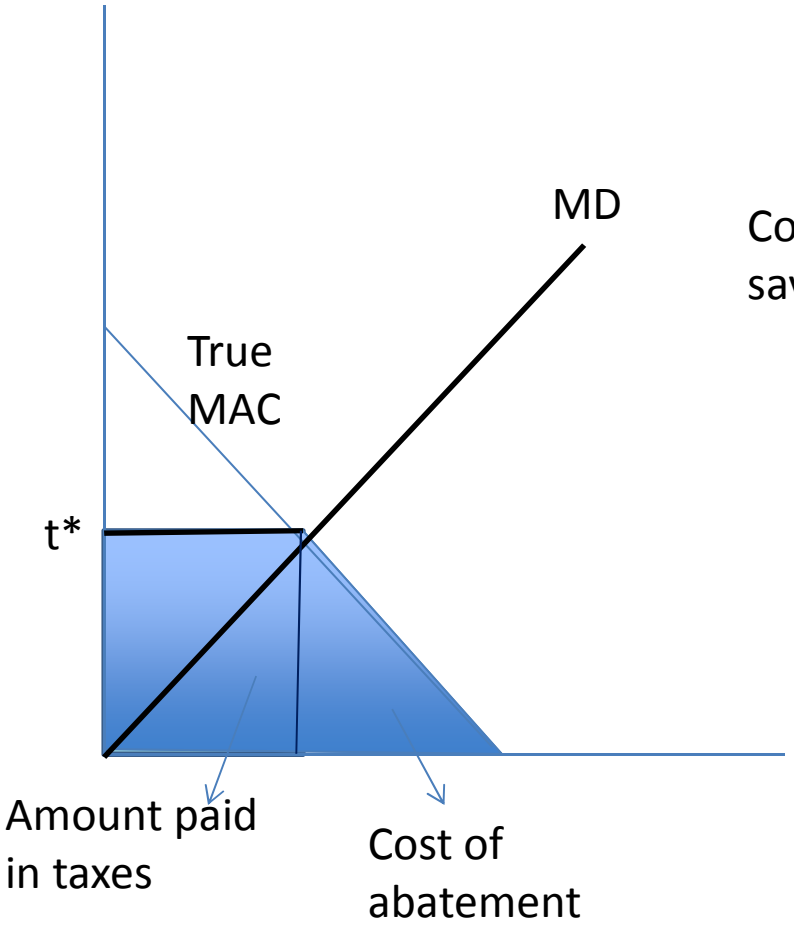
Basics: Forecasting behaviors with taxes

Regulator ask firms to report MAC and sets tax s.t. $MAC_{reported}$ =MD

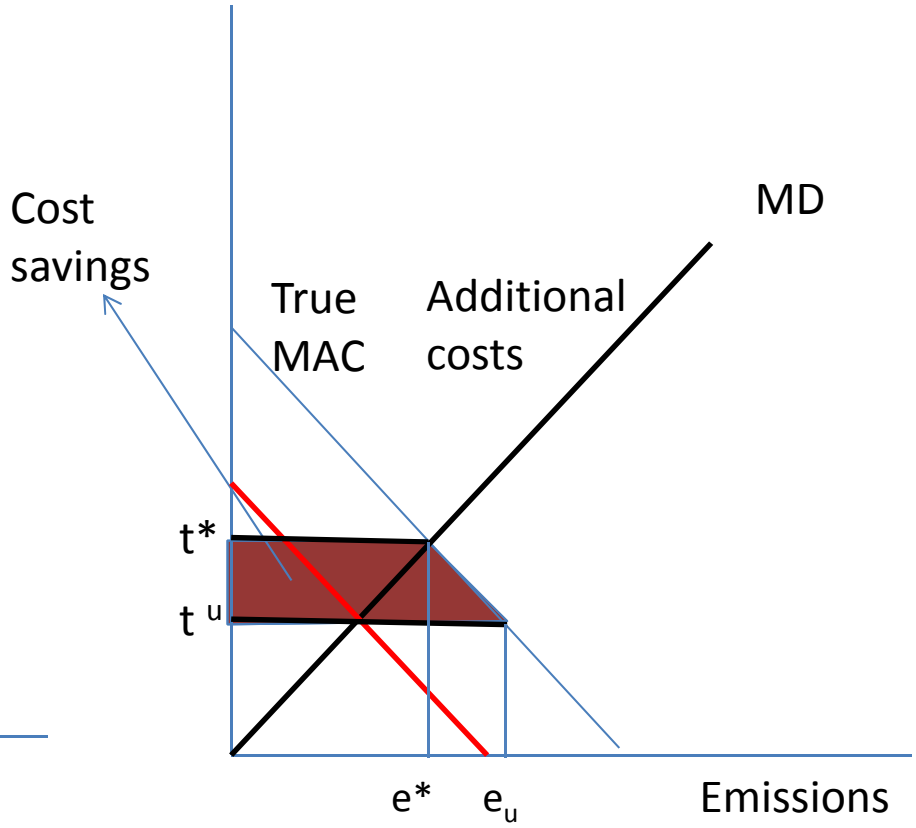
Will the firm report its MAC truthfully?

With taxes firms are better off *under*stating

Costs with true MAC



Costs with
understated MAC



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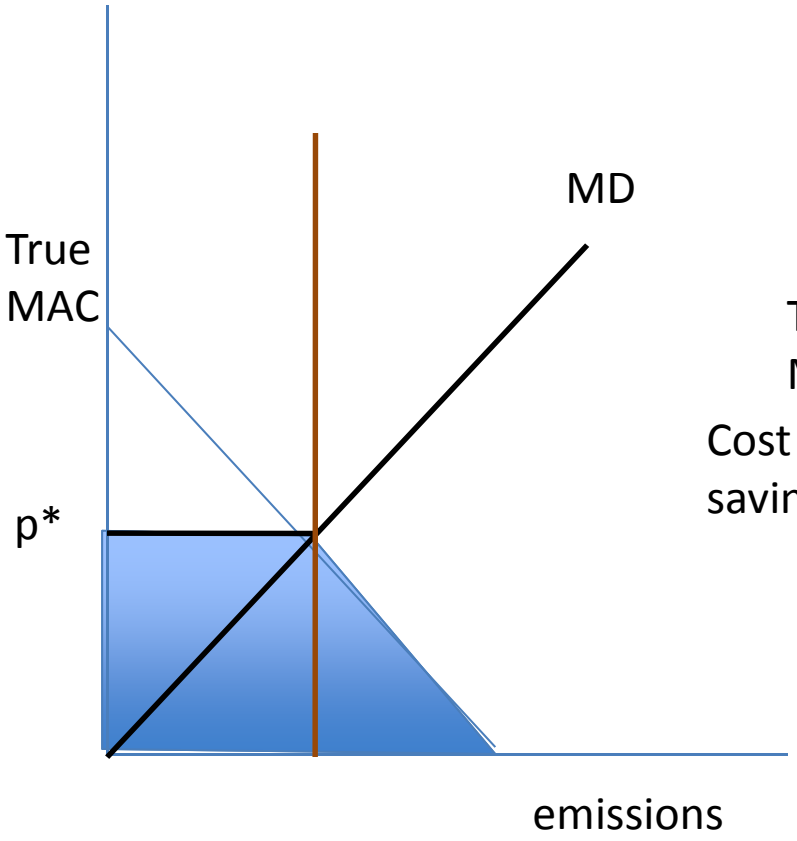
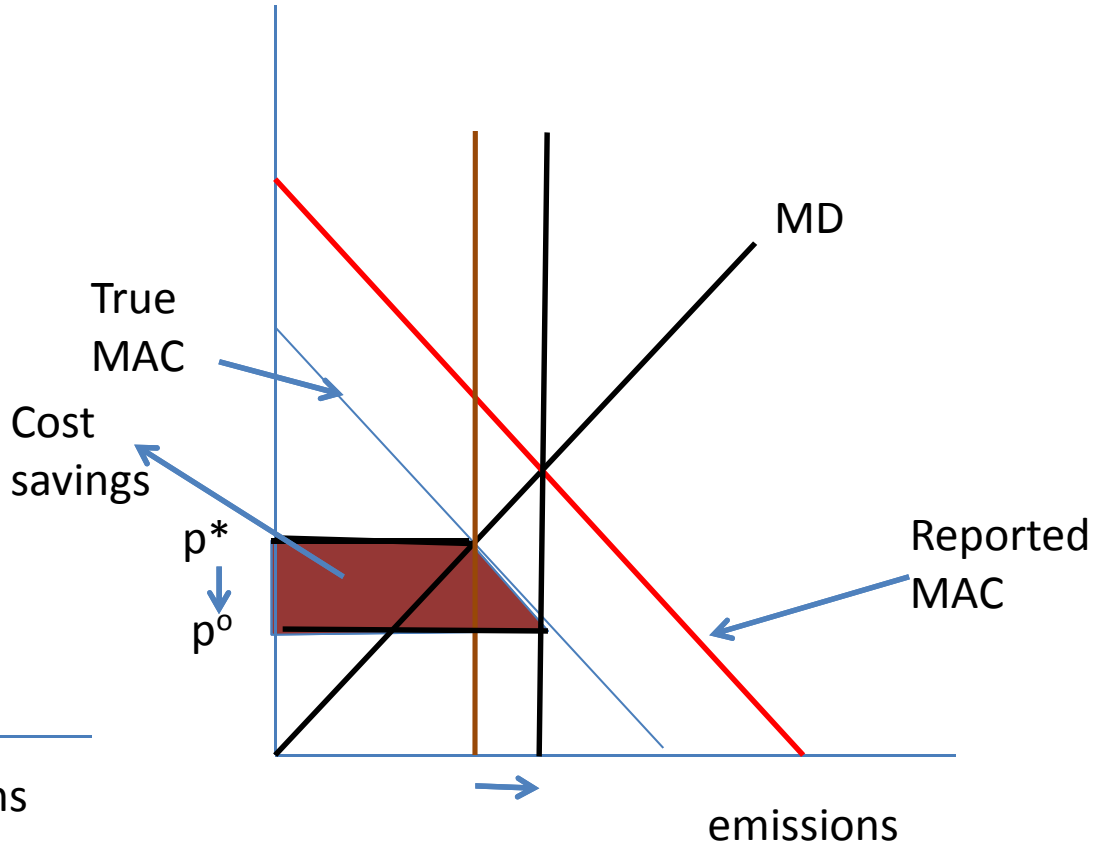


Costs with overstated MAC



Problem 1

- Uncertain abatement costs. Two equally likely outcomes:

$$C_h(e) = \frac{1}{2}(6-e)^2$$

$$C_l(e) = \frac{1}{2}(4-e)^2$$

- Damages function: $d(e) = \frac{1}{2}e^2$

Solutions: Problem 1 a & b

$$\min_e E(TC) = E(AC) + D = \frac{1}{2}\left(\frac{1}{2}(6-e)^2\right) + \frac{1}{2}\left(\frac{1}{2}(4-e)^2\right) + \frac{1}{2}e^2$$

$$\frac{dE(TC)}{de} = -\frac{1}{2}(6-e) - \frac{1}{2}(4-e) + e = 0$$

$$= -3 + \frac{e}{2} - 2 + \frac{e}{2} + e = 0$$

$$= -5 + 2e = 0$$

$$e^* = 5/2$$

Solutions: Problem 1 a & b (Cont'd)

- Expected total costs

  E(TC) = E(TAC) + TD

$$E(TC) = \frac{1}{2}\frac{1}{2}(6 - e^*)^2 + \frac{1}{2}\frac{1}{2}(4 - e^*)^2 + \frac{1}{2}(e^*)^2$$

$$E(TC) = \frac{1}{2}\frac{1}{2}\left(6 - \frac{5}{2}\right)^2 + \frac{1}{2}\frac{1}{2}\left(4 - \frac{5}{2}\right)^2 + \frac{1}{2}\left(\frac{5}{2}\right)^2$$

$$E(TC) = 6.75$$

Detour: Definitions for efficiency

- The sum of pollution costs is minimized

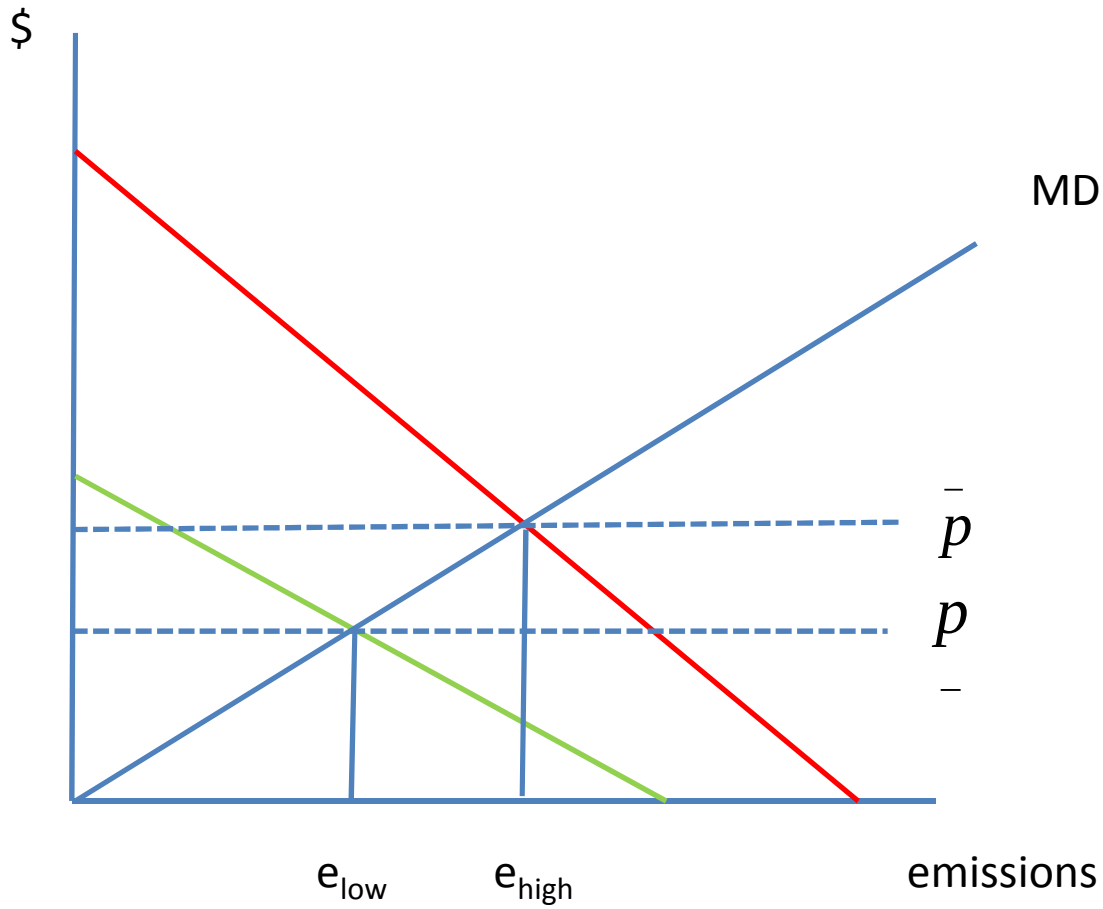
  Min (TC of abatement + Damages)
- MAC=MD
- No DWL

Q: Are we likely to get an efficient outcome when the MAC are uncertain?

Price floors & Safety valves

- Minimum price comes into play when costs are low
- Maximum price when the costs are high
- Efficiency rules:
  - Optimal price floor : point at which true MAC_{low} =MD
  - Optimal safety valve: point at which true MAC_{high} =MD
- Outcomes: truthful reporting

Intuition behind the mechanism

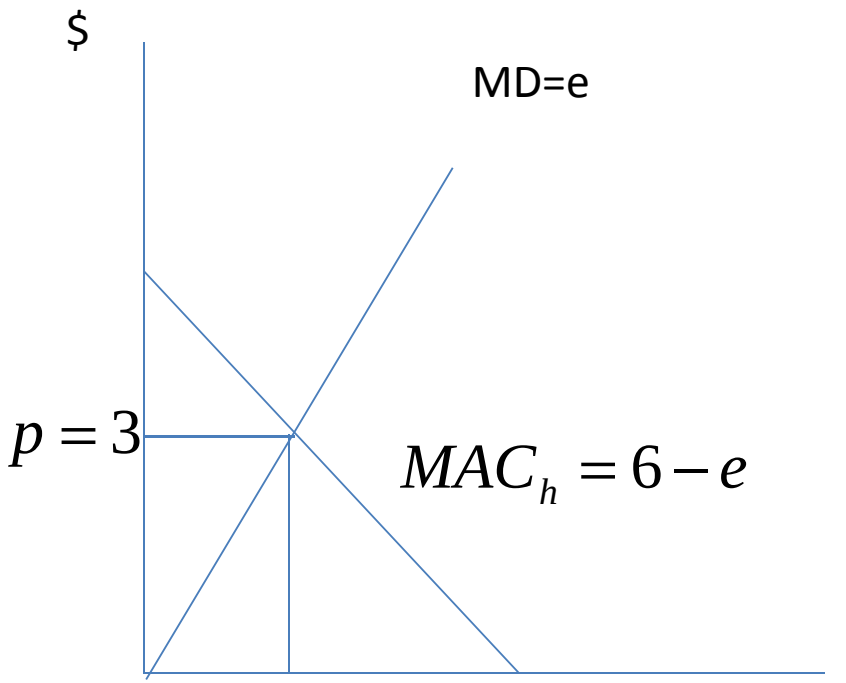


Solutions: Problem 1c (safety valves)

$$MD = MAC_h$$

$$e = 6 - e$$

$$e = 3$$



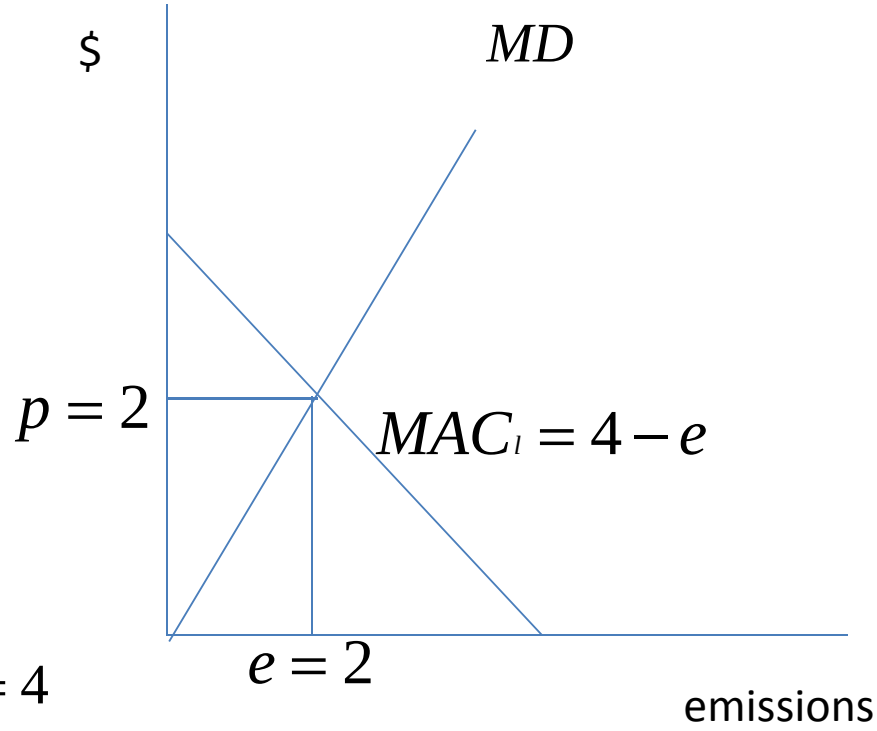
$$Costs = TC + D = \frac{1}{2}(6-e)^2 + \frac{1}{2}e^2 = 9$$

Solutions: Problem 1c (price floors)

$$MD = MAC_l$$

$$e = 4 - e$$

$$e = 2$$



$$Costs = TC + D = \frac{1}{2}(4-e)^2 + \frac{1}{2}e^2 = 4$$

$$Expected \quad Costs = \frac{1}{2} * 4 + \frac{1}{2} * 9 = 6.5$$

Take home message

- Asymmetric information results in DWL
- Mechanisms exist for truthful reporting
- Cost-effectiveness & efficiency