

Professional Career Program

Environmental Economic Theory

No. 6

(6 November 2018)

Benefits and costs analysis: how to measure costs.

Instructor: Eiji HOSODA

Textbook: Barry .C. Field & Martha K. Fields (2009)

Environmental Economics - an introduction,

McGraw-Hill, International Edition

PCP Environmental Economic Theory (Hosoda)

Homework 7

6 November 2018

1. Theme: Explain how “command and control” works for protecting environment. Why is it adopted in many countries for protecting environment, instead of incentive-based policies? Explain the reasons, based upon experiences in your own country.
2. Language: English.
3. Volume: A4 two pages. Single space. 12 points.
4. Submission period: 9 a.m. 12 November 2018- 9 a.m. 13 December 2018.
5. Submission: Submit your paper in a pdf. file. A file name must be “**HW7.xxx.pdf**” (xxx=your name). Send your file to hosoda@econ.keio.ac.jp.
6. Remark: Sources other than internet documents are recommendable. If you use internet information, check plural sources and compare them. List references you have used.

Reliability of benefit-cost analysis

- It is indispensable to estimate costs as well as benefits accurately so that the benefit-cost analysis works well and fulfills the purpose.
- Yet, costs are sometimes underestimated although benefits are sometimes overestimated. (Consider why.)
- These biases damage the reliability of the benefit-cost analysis as well as environment.
- Hence, some people oppose the idea and results of the benefit-cost analysis.

Domain setting and accuracy of benefit-cost analysis

- On p. 21 of lecture note 4, I wrote “define the environmental, economic, and geographic *domain*” at the first step of a benefit-cost analysis.
- Namely (Next slide.)

4-3-1. Benefit-cost analysis

- The basic procedure of the analysis is as follows:
 - (1) Specify the project or program. Also, **define the environmental, economic, and geographic domain.**
 - (2) Specify the inputs required and the outputs which are supposed to be obtained.
 - (3) Estimate the social costs and benefits of the inputs and outputs in the domain.
 - (4) Compare these benefits and costs.

See the details in pp. 119-122 of the textbook (The Basic Framework and Scope of the Program).

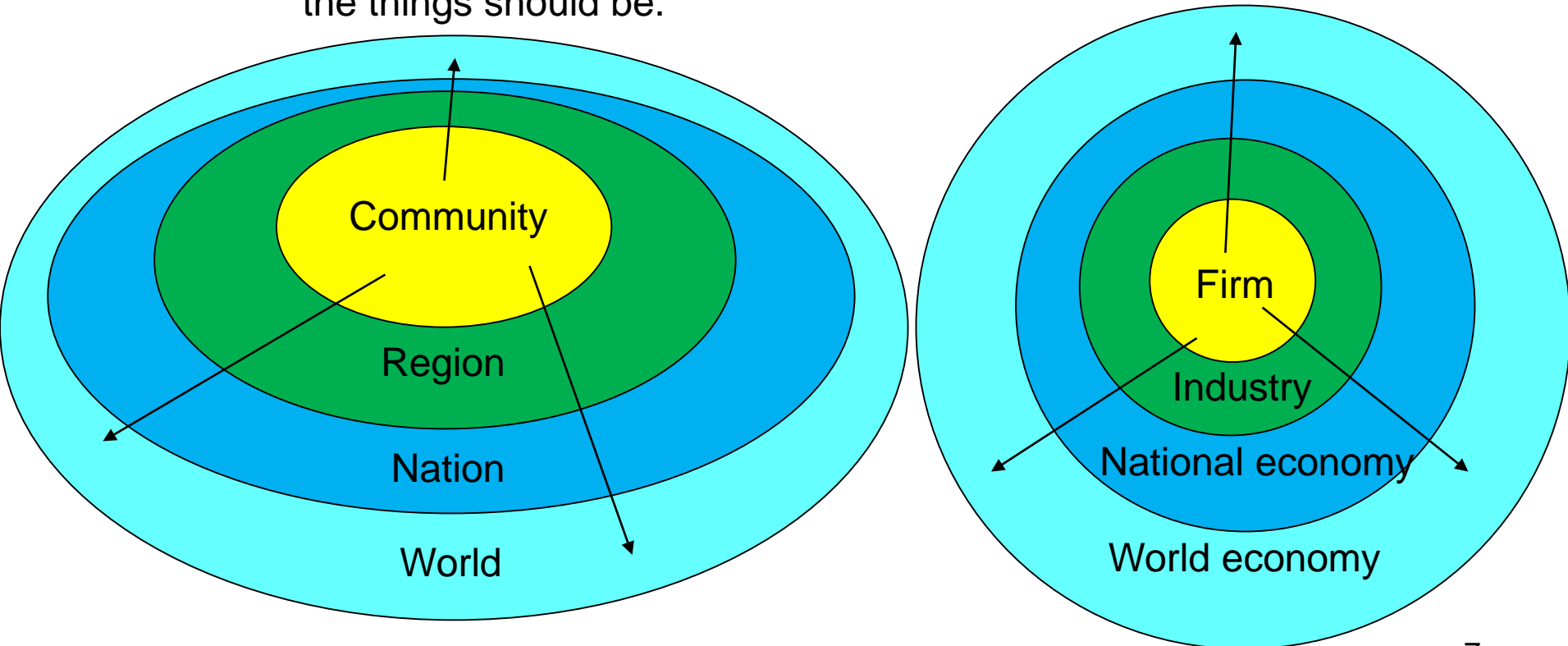
Domain setting and accuracy of benefit-cost analysis (cont.)

- Thus, the domain setting is very important for the analysis.
- Clearly, domains affect accuracy of the benefit-cost analysis.

The domains of benefit-cost analysis

Domains affect accuracy of the benefit-cost analysis.

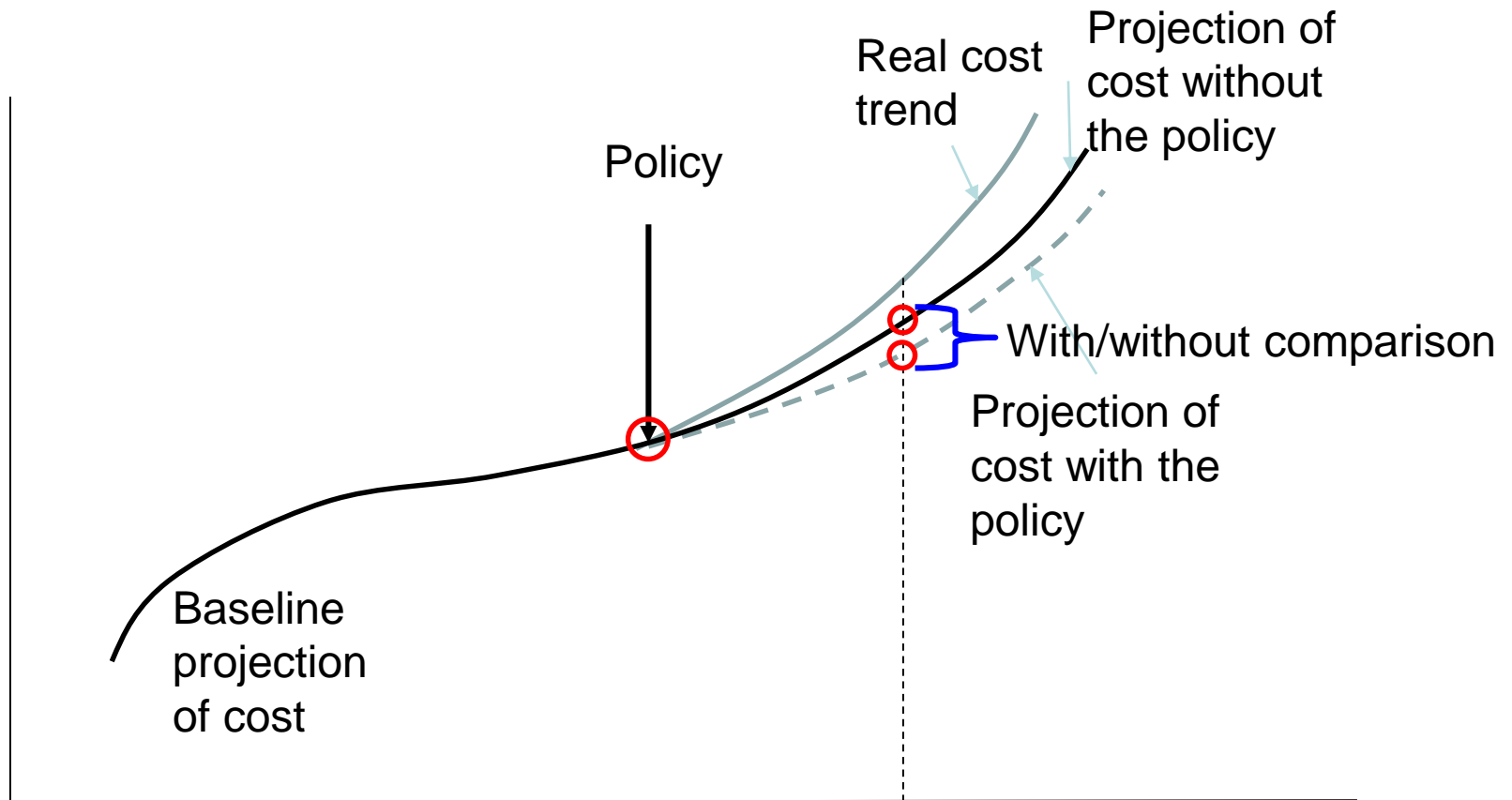
The wider the domain, the tougher the accurate estimation of costs becomes, and the more complicated the things should be.



What should be compared?

- The with/without comparison should be adopted, instead of before/after comparison (Thus, the comparison should not be a matter of chronological order).
- When technical progress, change of weather condition and so on occur, the costs without the regulation may change, and not the same as before.
- *Ceteris paribus* comparison must be adopted.
- In other words, baseline analysis is required: the estimation of what future costs will be when no regulation is introduced. \Rightarrow Cf. Global warming problems.

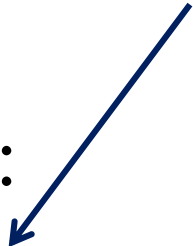
Explanation by means of a figure



An example

See the textbook (p. 161).

The business as usual



(a) Before the regulation:	\$ 100
(b) In the future <i>without</i> the regulation	\$ 120
(c) In the future <i>with</i> the regulation	\$ 150

What should be compared is (b) and (c), instead of (a) and (c).

Remarks

- There may be a gap between the real cost and the projection of cost without the policy (business as usual) as you see in the figure of p. 9.
- This is because the real cost may possibly be affected not only by the policy but also by other factors such as a foreign exchange rate, climate, and so on.

Remarks (cont.)

- When we make projection of costs, benefits, and so on, we may not be able to take all the factors which affect the projection into account.
- Thus, it is quite possible that there is a gap between the real costs or benefits and the projected ones.

The status quo in which biases exist

- There may exist biased regulations, subsidies and so on, for benefits of some specific groups.
- These make the environmental costs higher than when there is no such bias.
- If such biases are removed, the environmental quality should be enhanced without any further social costs.
- From political consideration, such biased policies have sometimes been introduced.

An example

- Some energy industries may possibly be subsidized or given a special consideration by governments: A coal industry in Germany, U.S.A., China and so on.
- Then, the amount of the product is surely larger than the optimal one, so that the environmental burden is also larger than the optimal level.
- It may be said that CO₂ emission is encouraged indirectly by such a consideration.

The distribution of costs

- The social costs are distributed among different actors.
- If some regulation is introduced into an industry, there may be cost increase, which triggers increase in the output price.
- This price increase should affect other industries or consumers.
- Since economic actors affect one another in a very complicated way, it is hard to identify the cost distribution.

The distribution of costs (cont.)

- How the costs would be distributed among actors depends upon the supply-demand conditions.
- Costs may be easily shifted from one industry to another industry in some cases, but not in other cases.
- The elasticity of supply and demand curves affects shift and incidence of the cost increase.

An example

- Suppose that carbon tax is imposed on plants which burn fossil fuels.
- Then, there should be increases in prices of the products of those plants, if a demand curve is elastic. (Cf. slides pp. 30, 32)
- These price increases affect costs of firms which use the products of those plants.
- The effects ripple through industries.

Opportunity costs

- We have learned about opportunity costs.
- Social opportunity costs are appropriate as costs in the benefit-cost analysis.
- Mere expenditure does not mean real opportunity costs.
- For example, community expenditure sometimes includes *transfer payment*, which should not be counted as the additional social cost.

Environmental costs

- Environmental control may create new environmental costs.
- If environmental control is introduced, actors' behavior should be changed.
- Then, say, media which carry pollutants may also be affected, and possibly switched from one to another.
- *Eg.* Some municipalities have introduced waste charge. But this may encourage illegal dumping, which is another type of social costs.

An example

- Sometimes, we were encouraged not to use disposable chopsticks in restaurants, since they were considered wasteful.
- Yet, if we use non-disposable chopsticks in restaurants, this means that used chopsticks must be washed with detergent.
- Waste from the use of disposable chopsticks may be reduced, while the discharge of waste water may be increased.

An example (cont.)

- It is not so easy to determine which alternative is environmentally friendly.
- People often jump to the conclusion.
- Thus, plastic straw is replaced with paper straw.
- But is this really environmentally friendly?

Enforcement costs

- To implement environmental regulations, enforcement costs are required.
- Sometimes, quite a large amount of resources must be allocated to enforcement activities.
- Yet, enforcement costs become prohibitively high when perfect implementation of regulations is pursued.
- It is impossible to make perfect implementation of a regulation, since it is too costly.

A remark

- *Remark.* Some radical environmentalists often insist that much tougher regulation should be implemented for environmental protection.
- Yet, too strict regulation may possibly cause the other type of distortion, such as black-market activities, which should be worse than the former situation.
- The next example clearly shows that such things could happen.

An example: transaction of ivory

- Quite a few NGOs oppose the transaction of ivory, and insist on banning it.
- Yet, it is impossible to implement the ban perfectly, since it costs too much.
- Moreover, there may presumably be a black-market created, which should distort allocation of costs tremendously.
- For indigenous people, elephants are nothing but hazardous a creature.

Costs of single facilities

- It is not so hard to estimate costs in a single facility.
- Capital costs and operation costs may be easily calculated.
- Yet, it is not easy to estimate environmental costs.
- Then, trouble with communities often occur, since those costs are often ignored or underestimated.
- Thus, the real opportunity costs are often higher than the monetary costs.

Local regulation

- Local regulations may affect actors in the community in a complicated way.
- Some may lose profits, and others employment.
- Those possible losers may protest against the introduction of the regulation.
- Yet, if a sort of social adjustment is fully made, the social opportunity costs may be smaller than the initially counted ones.
- But notice that the adjustment costs exist.

Industry regulation

- If we consider costs of regulation within an industry, we can say that the adjustment costs are internalized in the industry.
- Hence, the higher production costs are possibly true social opportunity costs.
- Yet, inter-industry interaction is so complicated that it may be hard to predict exactly what the social costs will be. \Rightarrow There are always entry and exit!

How can we get cost data?

- We can collect cost data by means of surveys.
- Cost data are often based upon the past data, not upon the future data.
- There is rather small amount of information on the future costs.
- It is necessary to supplement survey data with technical engineering data.
- Firms may overestimate the costs, sometimes hoping to promulgate weaker regulations.

Minimum control costs

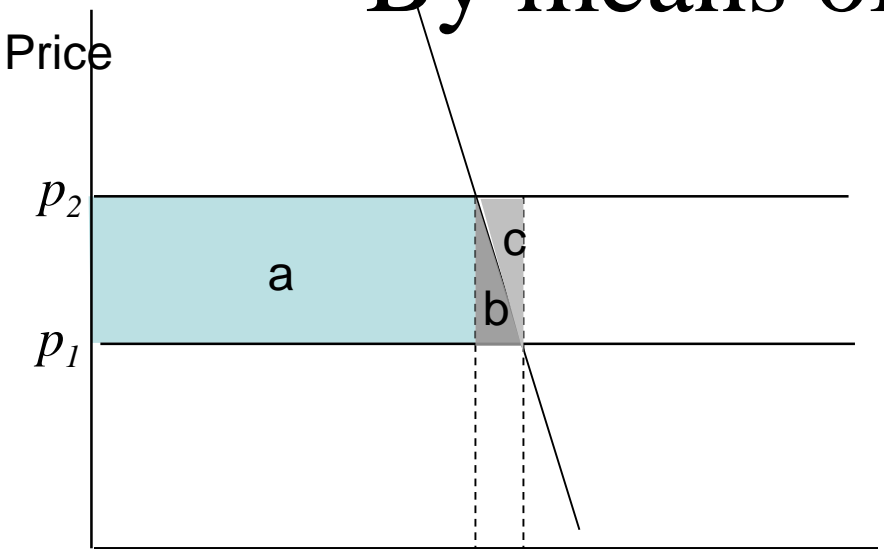
- It is sometimes hard to know the minimum pollution control costs in an industry level.
- If there is no information on the minimum costs, the efficient policy cannot be adopted.
- If the equi-marginal principle is not satisfied, it is difficult to get accurate information on the minimum costs in a industry level.
- Environmental regulation often ignores the equi-marginal principle.

Adjustment of output and its effect on costs

- Suppose that production costs of a commodity increase.
- The welfare loss is often calculated the price increase times the amount of transaction of the commodity.
- But the transaction is affected by the price increase, so that the calculation of the welfare loss may be wrong.

Adjustment of output and its effect on costs

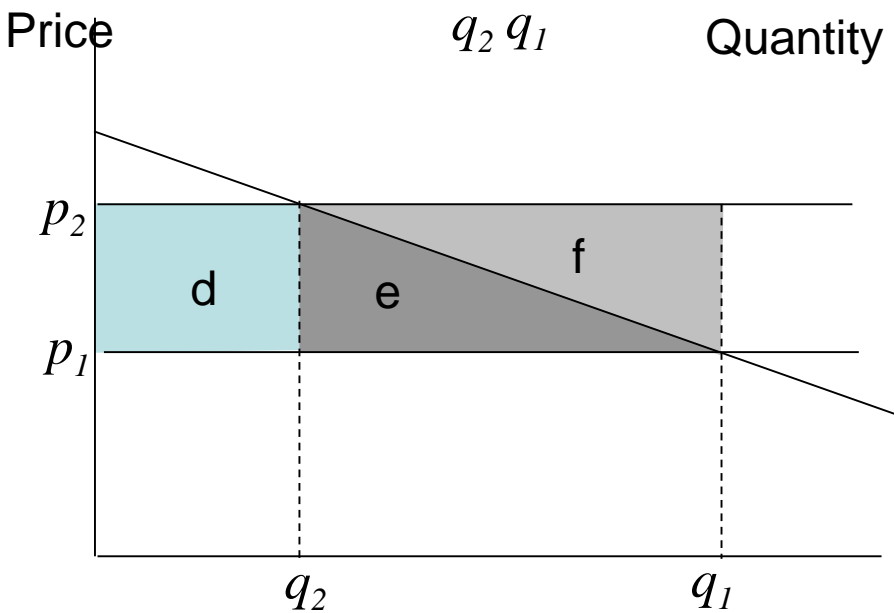
By means of figures



C_2 If adjustment of output is not taken into account, the opportunity cost is misrepresented.

C_1

The correct measure of the cost to society is $(a + b)$ in the upper panel, and $(d + e)$ in the lower panel, not $(a + b + c)$ and $(d + e + f)$ respectively, since the output level changes after the introduction of regulation.



C_2

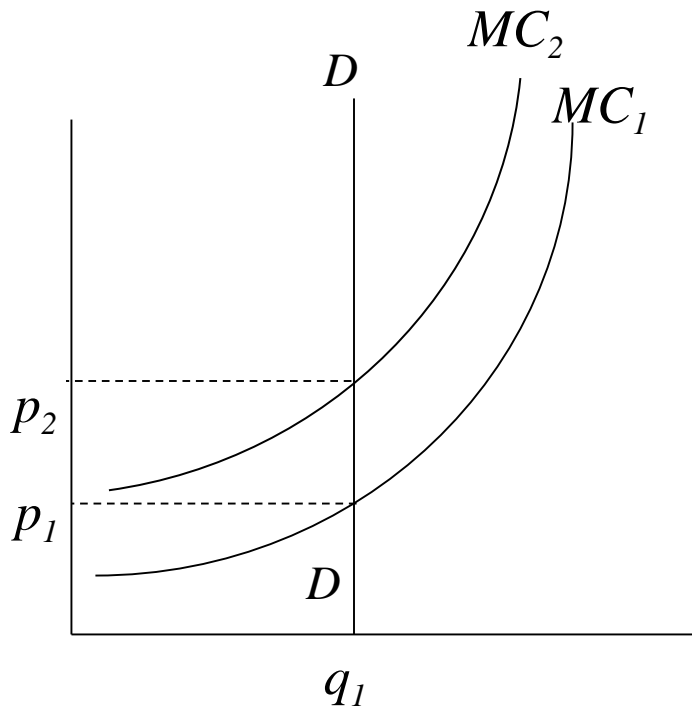
C_1 The larger the elasticity of demand to price, the bigger the misrepresentation would be.

Quantity

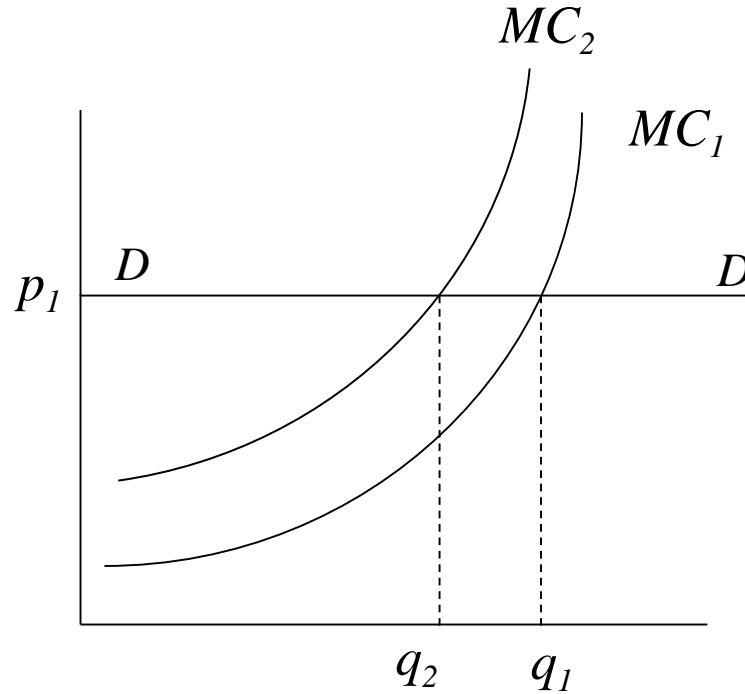
How is cost burden distributed?

- How cost burden is distributed among actors depends upon many factors.
- One of the most important factors is elasticity of a demand curve (also a supply curve).
- If it is very inelastic, an increase in costs is shifted to consumers. If it is elastic, producers cannot shift the cost increase to consumers, and owe it.

Explanation by means of a figure



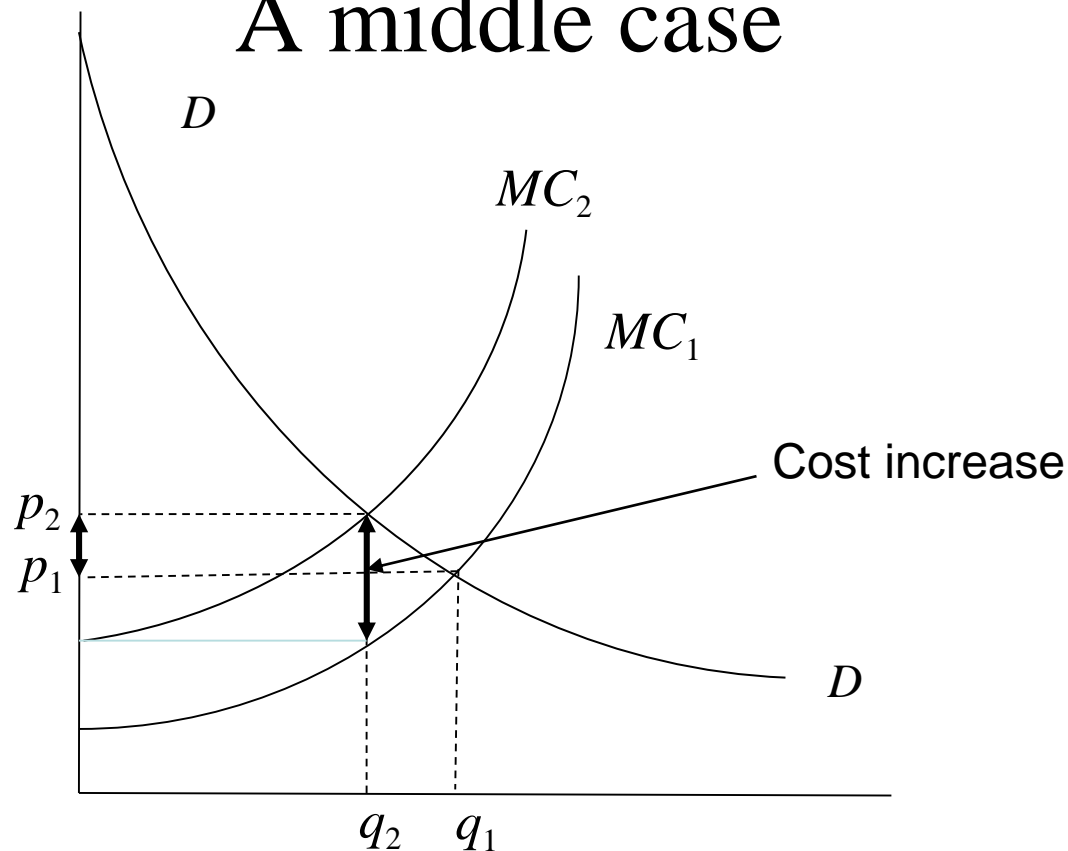
Cost burden is completely shifted to consumers, since the price increases just by an increase in costs.



Cost burden is completely on producers, since the price does not increase despite the cost increase.

Explanation by means of a figure

A middle case



Cost burden is shared by producers and consumers, since the price increases but less than the cost increase.

The long-run effects

- Cost increase in the short-run is different from that in the long-run.
- Firms allocate resources for research and development (R & D).
- Then, technical progress may possibly soften the initial increase in the opportunity costs.
- Furthermore, some firms or industries may make profits by adopting new technology, *i.e.*, eco-technology.
- Actually, an eco-industry is developing and getting more profits than before.

Difference of costs among nations

- The social opportunity costs differ among countries even if the same regulation is introduced.
- This is because the industrial structure, the market structure, the political structure and so on are different among countries.
- Some countries may have already implemented the similar regulation, so that the baseline may have to be reconsidered.

Bottom-up approach

- There are mainly two methods to count the social opportunity costs in a national level; bottom-up approach and top-down approach.
- The former counts all the costs in a firm level and an industry level, and add those costs.
- But, when some regulations are introduced, the industrial structure is changed, so that the cost-counting misrepresents the real costs.
- There may be entry as well as exit, which makes the calculation harder.

Top-down approach

- In a top-down approach, a macroeconomic model which includes environmental factors is constructed.
- Thus, an aggregated model is assumed.
- Using the model, one can calculate several values of the macroeconomic performances.
- Iteration is done until reasonable results are obtained.

Technical progress

- Technical progress changes the future costs of reduction of environmental burden.
- If the time span of the estimation is short, the cost estimation is rather accurate.
- It is very hard to estimate the costs in the far future, since no one can correctly expect how technical progress changes the economic structure.
- Pessimists tend to overestimate the future costs, while optimists tend to underestimate them.

An example

- When the Japanese government tried to introduce a regulation against air pollution caused by automobile exhaust gas in 1978, a think-tank estimated the costs caused by the regulation.
- It said that the costs would be so huge that Japanese automobile manufacturers would lose the competitiveness and so the world market share.
- Yet, the opposite happened. Japanese automobile manufacturers gained more competitive power in the world market of automobiles.

An example (cont.)

- This example shows that a think-tank, a government, and whatever they may be, could easily make biased estimation, when they are not neutral.
- The same things could happen in any field.
- When Japan opened the orange market to the world, some scholars had said that Japanese orange farming would disappear.
- Such thing did not, however, happen.

Remarks

- When we consider increases or decreases in costs, it is important to take system innovation as well as technical progress into account.
- Changes of a socio-economic system affect cost structures of firms, industries, communities, nations and so on.
- Thus, even if there is no technical progress, costs may decrease thanks to system innovation.

Remarks (cont.)

- System innovation means an improvement of socio-economic structure in some cases.
- It sometimes means removing barriers which hinder an economy from increasing social welfare.
- For example, if vested interest is removed, social welfare should increase.