

Micro-Macro Link of Eco-efficiency

Expert Group Meeting on Eco-Efficiency in North-East Asia
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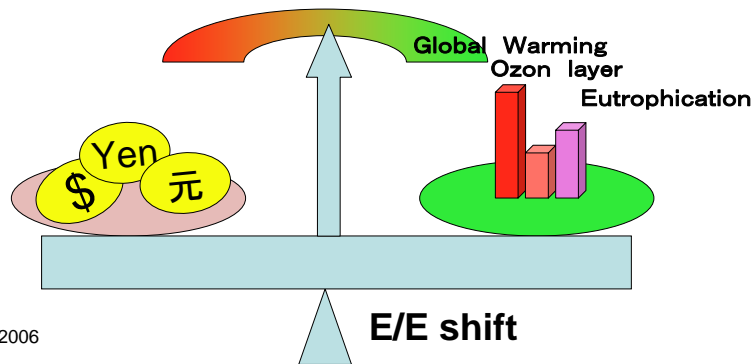
Masanobu Ishikawa
Professor
Graduate School of Economics
Kobe University

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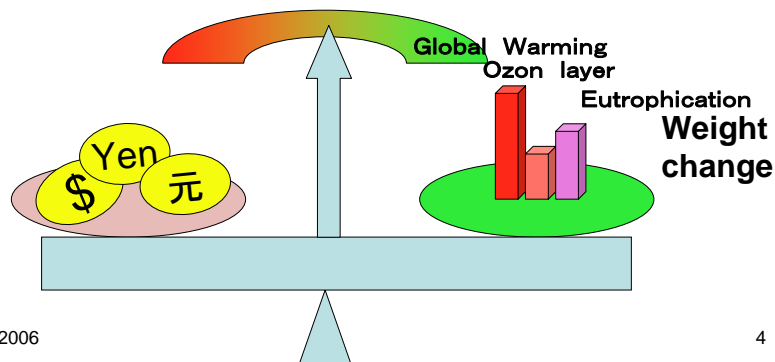
What is Eco-efficiency (E/E)?

- An instrument for sustainability analysis
- Trade-off : environment and economic welfare
- When we choose E/E to be more green
- Match against normative considerations



What is Eco-efficiency (E/E)?

- Match against normative considerations
- When weight to produce single score change



Economy vs. Environment

Integration of non-economic values of goods over society is not an easy task.

– Aggregation of value over people

- | | |
|--------------------|---|
| • Economy | • Environment |
| • 100RMB+100RMB | • A dog + a cat |
| – Always 200RMB | – How to get aggregated value of a dog and a cat? |
| – Nobody complains | |

Sorry for very primary topic, but very important

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Eco-efficiency (E/E) and Sustainability

- Sustainability:
 - reconciling environmental, economic and social concerns
 - both from current and long term perspective



Too big a question: our position is

- no predetermined harmonized solution
- piecemeal solutions with stepwise approach

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E/E as a sensing rod

- Pursue sustainability:
 - like walk through a dark tunnel with only very faint light
 - E/E can be an useful sensing rod to make sure if there is no obstacles ahead

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Terminology of E/E

- A wide variety of terminology depending on
 - application
 - background of the researchers
 - views how to treat negative signs

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Terminology of E/E

	<i>product or production</i> <i>prime</i>	<i>environmental improvement</i> <i>prime</i>
<i>economy</i> <i>divided by</i> <i>environment</i>	production value per unit of environmental impact, or: environmental productivity	cost per unit of environmental improvement or: environmental improvement cost
<i>environment</i> <i>divided by</i> <i>economy</i>	environmental impact per unit of production value, or: environmental intensity	environmental improvement per unit of cost, or: environmental cost-effectiveness

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Micro-Macro Link of E/E

- E/E can be applicable to both:
 - micro level; technologies or firms
 - macro level; regions, national economy or global economy
- However, there is no link between micro level and macro level practices

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Problems of linkage: economic impacts

- **Combination of micro and macro level**
 - **Competitiveness is important, but it is a pity that it might not be relevant to sustainability.**
 - **Likely to cause policy differences with sustainability.**
 - **Not sustainable.**

Target-micro	Micro	Macro	Interpretation
Firm	Added value	GDP	Crude index of wealth
	turnover	Gross corporate turnover	Crude size of market economy (note: double count)
	Profit	Gross corporate income	Wealth allocated to capital owner
Product	price	GDC	Crude index of wealth
	Cost	-	Competitiveness, productivity
Technology	Abatement cost	Gross abatement cost	Gross expenditure for pollution abatement
	Production cost	-	Competitiveness, productivity

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Problems of linkage: environmental impacts

- **Weighting: how to construct social utility?**
 - Emission to environmental impacts: global warming, ozone layer depletion, eutrophication etc.
 - Environmental Impacts to single score: wide variety of methods and no agreement.

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Get around utility aggregation

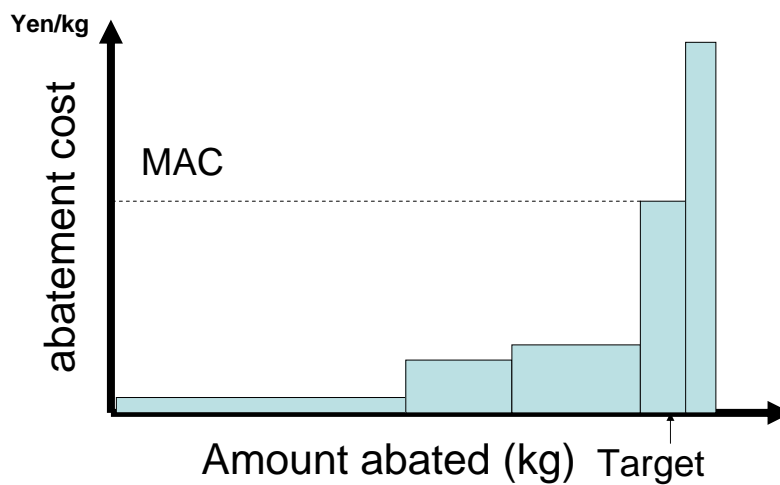
- Avoid utility aggregation: cost minimization approach
 - Maximum Abatement Cost method (MAC)
 - Minimum cost with reference to the same combination of emissions
- However, the applications are limited to:
 - green purchasing, optimization with the given amount of budget
 - not for policy assessment

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Maximum Abatement Cost method (MAC)



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Maximum Abatement Cost method (MAC)

MAC by Oka et al. (2005)

Substance	MAC(yen/kg)
CO ₂	7.0
NO _x	2,500
SO ₂	43
TOD*	1,700
Particulate matter	6,700
Dioxins	1.9X10 ¹⁰
Heavy metals	20,000

*: TOD: theoretical oxygen demand which represents the load of pollutants causing eutrophication in closed water areas, taking into account endogenous production, and is defined as $TOD=3COD+(19.7TN+143TP)/2$

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Maximum Abatement Cost method (MAC)

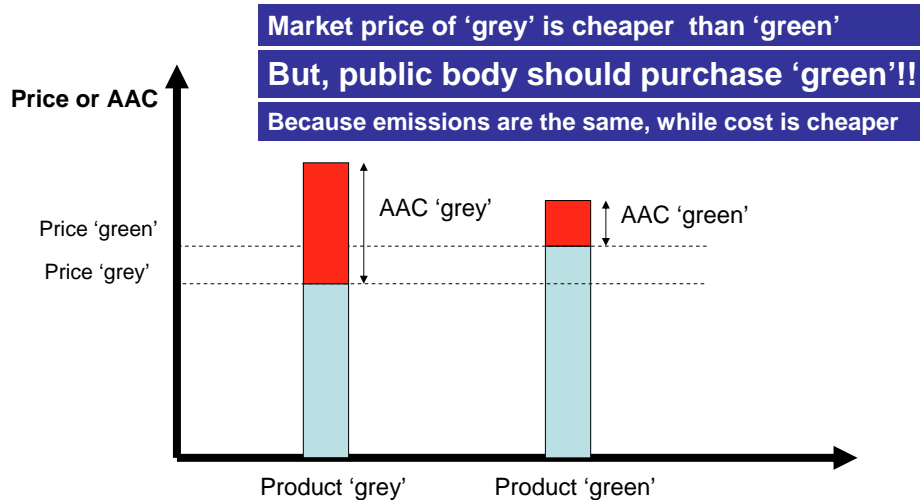
- Procedure
 - LCI analysis of target products
 - Determination of MAC data
 - Calculation of AAC from the sum of MAC*emissions over all pollutants considered
 - Comparison of the market price added with AAC

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Maximum Abatement Cost method (MAC)



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Conclusions

- E/E can be an useful sensing rod to make sure if there is no obstacles ahead
- The variation of E/E is very wide. Maybe too wide if we regard micro level choices to be aligned with macro level requirements, We need to clarify competence of specific E/E and it's consistency of micro-macro link.
- E/E inherits problems of value aggregation from LCA and fallacy of composition from economics. More effort is needed to avoid or overcome these problems. An example is MAC for green procurement.

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End

Thank you for your attention!!

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Reference

- MAC method: Oka et al. (2005) The maximum-abatement-cost method for assessing environmental cost effectiveness, *Journal of Industrial Ecology* 9(4), 22-23

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