Environmental Economics in the Central European Context

Time: Tuesday 4pm – 7pm
Location: at CERGE-EI, Room # 11

Instructor: Jana Krajcova
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Reading materials: http://home.cerge-ei.cz/richmanova/Teaching.html

OUTLINE OF THE COURSE:
The aim of this course is to introduce students to some basic economic principles and theories explaining environmental issues and problems today and to explore existing policies at the national and international level. Students will learn about basic theoretical concepts of environmental economics such as externalities, the tragedy of the commons, enforcement as a public good, interventionist solutions to the externality problem, such as taxes and marketable pollution permits, as well as non-interventionist solutions to the externality problem, such as the Coasian solution and self-regulation. We will also review the debate over the environmental Kuznets curve. In the second half of the course, we will discuss the field data and environmental policies of the Czech Republic and place them into international context. Finally, if time allows, we will discuss current topics such as renewable resources and the controversy about their support schemes. Because experimental evidence complements theoretic insights, field data and simulating models nicely, we will review some research articles that draw on the experimental methodology. This course will help students 1) to see the environmental problems from the economic/behavioral perspective in order to understand how environmental protection is question of local policy design but at the same time a very complex international coordination game; 2) to learn about and understand local environmental burdens in broader context.

GRADING POLICY:
Class participation and activity (10%),
Quick quizzes (20%)
Presentation (30%)
Final exam (40%)

More detailed description of grading policy

a) **Class participation and activity:** This is to reward the students that actively participate in class, ask or answer questions, participate in discussions. Unexcused absences (for other than medical reasons) are strongly discouraged, more than one absence will affect the final grade for the course. Please if you know you cannot make it to the class, it is always best to communicate with the instructor (send a short email explaining the reason) and agree on how to make up for the missed class.

b) **Quick quizzes:** After each class (by the end of the day) the instructor will upload (check the course webpage) a so-called Worksheet for the current lecture. Worksheet is a list of questions or problems that should help you to review the material discussed in class and thereby prepare for the final exam. You are not expected to submit your answers regularly. Instead, the following class (unless informed otherwise in advance) will start with a quick quiz. In the quiz, the students will be asked to answer one of the questions from the worksheet in writing and submit to the instructor. You are allowed to use notes prepared before the class but everyone has to use their

own notes and produce an original answer to the question asked. In case there is too much of similarities in answers from different students, all involved will receive zero points from the quiz.

c) **Presentation:** Instead of a midterm exam, we will have students' presentations. Each student (or a group, (we will agree on this based on the final size of the class) will chose an environmental topic by March 21 (midnight) and inform the instructor via email. If needed, the instructor will discuss the topic with the student/group. **All the topics need to be approved by the instructor by the end of week 5 of the semester!!!** This is to avoid any disappointments on either side. You can choose any environmental topic that you find interesting and relevant. Topics from environmental economics or policy design are preferred. Examples: unusual/innovative environmental policies; comparison of two policies in different countries/cities to deal with environmental problems such as e.g. transportation, waste management, renewable support schemes etc.; evaluation of real-world environmental measures based on what we covered (incentive-compatibility, efficiency, implementation); international environmental issues/coordination/cooperation etc; a review of interesting academic article which is somehow connected to what we discuss in classes… Each presentation needs to include (apart from the obvious: introduction, motivation, explanation of your topic and conclusion) 1) your own contribution such as critical evaluation/assessment/comparison of various policies and link to the theory that we discuss and 2) references to all the sources that you use. For further inspiration you can also check the course webpage, some of the older semesters also include sample student presentations. The slides that you will use should be emailed to the instructor no later than at the end of the presentations' day.

d) **Final exam:** At the end of the semester we will have a cumulative final exam (that is everything that was discussed during the semester is relevant). It will be a 90-minute exam. The questions will be selected from worksheets. Also the questions that had previously appeared in quick quizzes can appear on the final exam. You can use one sheet of paper (A4 size), with notes on both sides, handwritten or printed (but remember that sometimes less is more ☺**). It is crucial that everyone prepares their own notes!!!** Every sharing of notes will be regarded as cheating. Similarly as for the quizzes, if there is too much of similarities in answers of different students, all involved will receive zero and it will, too, be regarded as cheating.

Some general information and guidelines:

Use of notebooks or mobile phones in classes is not allowed. All the materials for classes will be uploaded before the class to the course web page – students are encouraged to print out the lecture notes and take notes on margins during the class. Take deadlines are given, not subject to bargaining. All the deadlines are announced well in advance and late submissions will not be accepted without penalization. Students who come after the quiz has started will not be allowed to take the quiz (unless there is a serious verifiable reason). Make-up quizzes can be allowed for excused absences; proper form and date have to be agreed on with the instructor. Plagiarism and cheating are serious academic offences and will not be tolerated. Random House Unabridged Dictionary defines plagiarism as "the unauthorized use or close imitation of the language and thoughts of another author and the representation of them as one's own original work." (Random House Unabridged Dictionary, 2nd Edition, Random House, New York, 1993) – make sure to avoid that ☺.

In case you have any problems (related to the course), questions or you feel like you need a consultation feel free to contact your instructor at krajcova.janka@gmail.com. Keep in mind that communication with your instructor (written or personal) can help to avoid problems or difficulties!

(Tentative) Course Outline:
[Check the online version for changes]

WEEK:	TOPICS:
1 - Feb 21	Introduction, Market failures - externalities, tragedy of the commons, environment as public good, "An Inconvenient Truth"
2 - Feb 28	Interventionist solutions to the Externality problem – Pigouvian taxes and standards and charges
3 - Mar 7	Interventionist solutions to the Externality problem – Marketable pollution permits
4 - Mar 14	Non-interventionist solutions to the Externality problem - Environmental labelling; Environmental Kuznets curve
5 - Mar 21	Non-interventionist solutions to the Externality problem – The Coasian solution **Presentation topics to be submitted**
6 - Mar 28	**MIDTERM WEEK: Student's presentations**
7 - Apr 4	Non-interventionist solutions to the Externality problem – Voluntary programs and self-regulation
8 - Apr 11	Environmental Policy in the Czech Republic – History and current issues I
9 - Apr 18	**SPRING BREAK**
10 - Apr 25	Environmental Policy in the Czech Republic – History and current issues II
11 - May 2	Environmental Policy in the EU – History and Current problems
12 - May 9	Environmental Policy in the world context – History and Current problems, Renewable Resources
13 - May 16	**FINAL EXAM**

Some useful links

- CENIA (www.cenia.cz) – website of the Czech Ministry of the Environment's information agency.
- Environment Center of Charles University (http://www.cuni.cz/COZPENG-5.html)
- European Environment Agency (http://www.eea.europa.eu/) - environment agency of the EU
- http://ec.europa.eu/environment/enveco/index.htm - web site of the EC

READINGS

- all reading materials are available for download at the instructor's web-page
- the first part of the course follows: **Schotter, Andrew (1997), Microeconomics. A Modern Approach.** Second Edition. Addison-Wesley; there are several editions of that book, when I refer to page/problem numbers it will always be consistent with the scanned version which can be downloaded from the course web page
- **REQUIRED readings are expected to be read prior to the class for which they are relevant**

- OPTIONAL readings provide specific information, methodological tools, particular economic models etc. for students that have deeper interest in environmental economics, are not required

Screening of "An Inconvenient Truth" Discussion

Introduction

Why do we care about the environment?

- life supporting function (location and the basic conditions for the existence of life)
- natural resources (inputs for consumption and production)
- amenity values (natural beauty)

Natural resources:

- flow resources (solar radiation, wind or water energy – the current use does not affect future availability)
- stock resources (the current use affects future availability)
- renewable resources (forests, stock of fish, etc…)
- non-renewable (fossil fuels, mineral ores)

The problem is that with increasing human activity, industrial production, unclean technologies, there are adverse and often permanent impacts on biophysical environment.

Different types of resources and interactions => different types of environmental problems

- nature degradation due human activity (deforestation, pollution)
- conflicting usage of the natural resource (e.g. amenity vs. production)
- distribution of usage over time (this or future generation? concept of sustainability)
- distribution among agents (problem of too many fishermen)

=> need for VARIOUS TOOLS to remedy them => Environmental Economics

Current issues in the US?

Current issues in Europe and the CR

- water and air pollution, greenhouse effect (how to manage with growing industrial production, transportation)
- soil pollution (industrial fertilizers), state of forests
- energy intensity (especially in post-communist countries)

- noise (transportation air/road/railway)
- waste management
- decrease in biological diversity and ecological stability (due agricultural production and fragmentation of the landscape due transportation and urbanization)

Instruments of environmental protection

- regulations,
- economic and financial (standards and charges, marketable pollution permits, taxes, fines, tax reliefs and subsidies, property rights),
- voluntary programs (environmental labeling),
- environmental education and public awareness

PRINCIPAL QUESTION – which tools are the most efficient for particular environmental situations/types of problems...

➔

ENVIRONMENTAL ECONOMICS

- a subfield of economics concerned with environmental issues
- undertakes theoretical or empirical studies (in search for effective environmental measures)
    - of the economic effects of environmental policies
    - impacts of economic instruments on decision-making when environmental impact is a concern
- e.g. costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming…

EXPERIMENTAL ECONOMICS

- a tool frequently used by environmental economists
- why? b/c they (not only) provide an important insight on environmental measures employed by governments and NGOs
- we will review couple of experimental articles throughout this course,
- for use of experimental methods see e.g.
    - **(G&G)** Greenstone, Gayer, (2007), Quasi-Experimental and Experimental Approaches to Environmental Economics.
    - **(L&L)** Levitt, List, (2009), Field experiments in economics: The past, the present, and the future.

Q: What comes to your mind when you hear "(economic) experiment"?

Merriam-Webster Dictionary:

"Experiment is a tentative procedure or policy; an operation or procedure carried out under controlled conditions in order to discover an unknown effect or law, to test or establish a hypothesis, or to illustrate a known law."

Benefits of employing Experimental Methods

- **The effect of planned policy change** can be tested at relatively low cost (compared to allocation of much larger resources to an inefficient program; e.g. training program for the unemployed, new pricing scheme for electricity,…)
    - A new drug is tested to make sure that it has the expected effect which is not outweighed by possible side-effects → to minimize potential cost on public health
- **Explaining or predicting non-experimental outcomes** (e.g. Barr and Serneels 2004: correlation of wage outcomes of employees with their behavior in a trust game experiment) – again, relevant policy/strategy implications at relatively low cost
- **Testing theoretical predictions at relatively low cost** (economic theory, game/behavioral theory)
- Help to **generate the data** which are difficult to be obtained from "the field"
    - Estimation of a cost that the firm which produces pollution should internalize so that the (socially) more efficient outcome can be achieved

➔ **ENVIRONMENTAL ECONOMICS**

Externalities -> correction? -> (G&G)

- Imagine an example of air or water pollution as a byproduct of the production of marketable good
- created pollution imposes health costs on inhabitants and/or costs on the down-the-river company not internalized by the firm which is responsible for producing the pollution
- government intervention might help to maximize net (social) benefits/welfare – require reliable estimates of the costs and benefits (how to set the tax? will the market participants react in expected way?) => ENVIRONMENTAL ECONOMICS
- **EE** addresses the inefficiencies resulting from production of externalities –> experimental and quasi-experimental methods
- hinge upon proper design, implementation, appropriate approach to the data analysis

Market failure

- one of the key concepts
- situations when markets alone (without any intervention) fail to allocate resources efficiently
- Hanley, Shogren, and White (2007) in their textbook Environmental Economics:

  "A market failure occurs when the market does not allocate scarce resources to generate the greatest social welfare. A wedge exists between what a private person does given market prices and what society might want him or her to do to protect the environment. Such a wedge implies wastefulness or economic inefficiency; resources can be reallocated to make at least one person better off without making anyone else worse off."

- scenarios where individuals' pursuit of pure self-interest leads to results that are not efficient, i.e. can be improved upon from the societal point-of-view.

Externality

- one of the common causes of market failure -> another key concept of EnviEcon
- **an impact on a party that is not directly involved in the (economic) transaction**
- exists when a person makes a choice that affects other people that are not accounted for in the market price and thus the prices do not reflect the full costs or benefits in production or consumption of a product or service [➔ market failure].
- **Positive externality -** an action that imposes a positive side effect on a third party
- **Negative externality -** an action that imposes a negative side effect on a third party; many negative externalities are related to the environmental consequences of production and use.

Q: Can you think of couple of examples on positive or negative externalities?

Examples of positive externalities:

- A **beekeeper** => honey + pollination
- An **attractive garden** => amenity values, increased property values for all owners.
- **Home ownership** => owners more likely to be actively involved in the local community.
- **Education** => lower criminality

Examples of Negative Externalities

- **Transportation** => congestion cost + pollution
- **Industrial Production** => GHG emissions from burning oil/gas/coal => climate change
- **Water pollution** => poisons in the water ➔ plants, animals, and humans harmed
- **Industrial farm animal production** => increase in the pool of antibiotic-resistant bacteria + air quality problems + the contamination of rivers, streams, and coastal waters with concentrated animal waste + animal welfare problems
- **Fishing** => depletion of the stock of available fish => **Tragedy of the commons**.
- **Consumption of alcohol** => drinking and driving accidents

marginal social benefit of consumption	<	the marginal private benefit of consumption

⇓

MARKET FAILURE

(over-consumption of the good; the price is too low)

FIGURE 17.1 Dolan's water-paper society.

The paper mill imposes an external cost on the water treatment plant by dumping its wastes into the river. These wastes increase the treatment plant's cost of cleaning the water.

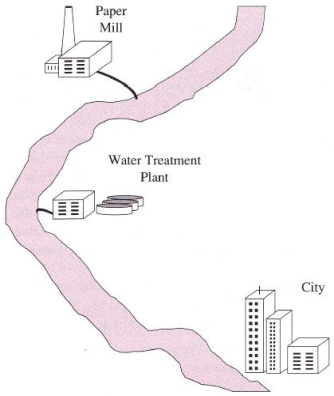
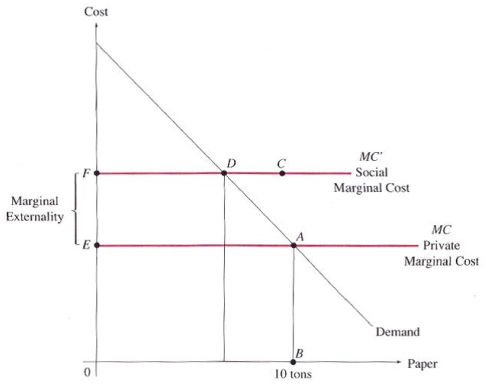


FIGURE 17.2 Pigouvian taxes.

The imposition of a tax equal to the marginal externality (distance *EF*) equates the private marginal cost *MC* faced by the paper mill with the social marginal cost *MC'* and thereby induces the mill to produce at the optimal level for society (point *D*).



Pareto efficiency (= Pareto optimality)

- a concept in economics; named after Vilfredo Pareto (an Italian economist who studied economic efficiency and income distribution)
- Situations in which it is **impossible to make one person better off without necessarily making someone else worse off**.

⇨ **Pareto improvement**

- given a set of alternative allocations of goods for a set of individuals: a change from one allocation to another that **can make at least one individual better off without making any other individual worse off**
- an allocation is defined as **"Pareto efficient"** or **"Pareto optimal"** (or "Allocative efficiency") when **no further Pareto improvements can be made**.
- **on consumption side:** resources cannot be re-allocated to make one consumer better off (in terms of utility) without making another worse off; or
- **on production side:** production inputs (capital and labor) cannot be re-allocated such that production of at least one good in the economy increases without decreasing the production of some other good.

A simple illustrative example:

- Imagine that Robinson Crusoe has invented a machine that can
  - make two mangoes out of one coconut, or
  - make one coconut out of two mangoes.
- Crusoe's utility is U(c,m)=c*m
- thus marginal utilities are U'_m=c and U'_c=m
- (➔the more of mangoes he consumes the happier he is from each additional piece of coconut and vice versa)
- Initial allocation: 4 mangoes + 4 coconuts
- **Is that Pareto-optimal allocation? If not, what would Crusoe have to do to get a P-O allocation?**

	he'll end up with	Robinson's final utility (c*m)
doing nothing	4 coconuts + 4 mangoes	16
converting 1 coconut into 2 mangoes	3 coconuts + 6 mangoes	18
converting 2 coconuts into 4 mangoes	2 coconuts + 8 mangoes	16
converting 2 mangoes into 1 coconut	5 coconuts + 2 mangoes	10
converting 4 mangoes into 2 coconuts	6 coconuts + 0 mangoes	0

- You can work through all the alternative allocations but it is easy to see in which case his utility function will be the highest…

⇨ in the P-E allocation, Robinson will end up with 3 coconuts + 6 mangoes.

- Note that more formally, you can solve the problem using the concepts of **Marginal rate of transformation**… those interested can find the solution in Schotter's textbook, Chapter 15, Solved Problem 15.1 (p. 581 in the 3rd edition)
  - ⇨ This is just a simplest case, with just one individual, Robinson Crusoe.
  - ⇨ What if we take into account also his "Man Friday", whose utility over coconuts and mangoes might be different?
  - ⇨ Or even a larger economy with number of consumers and producers…. with potential externalities…
  - ⇨ **Social efficiency** – efficient allocation from the social point of view when the total social (including external) costs are accounted for

Typical causes of market failures:

i. **externalities**
ii. **public goods or common goods ("the tragedy of the common")**
iii. market power (imperfect/no competition) – not relevant for us now

Public good

- is a good that is **non-rivalrous** and **non-excludable**.
- **Non-rivalrous** means that consumption of the good by one individual **does not reduce availability of the good for consumption by others**;
- **Non-excludable** means that **no one can be effectively excluded from using the good**.
- Non-rivalness and non-excludability may cause problems for the production of such goods
- markets alone might fail to produce optimal (or desired, for that matter) amount of public goods => market failure.
- environment is an example of public good

In the real world, there may be no such thing as an absolutely non-rivaled and non-excludable good; but we can get close enough… also, some goods might be mixed…

Examples of public goods (can you think of any?):

Here come some….

- light houses (cannot exclude ships from using it)
- defense and law enforcement
- fireworks
- streetlights
- roads
- informational goods (software development, authorship, invention)
- **environmental goods (clean air, clean water….environmental protection in general)**

Some goods are **"mixed"** in the sense that they have the properties of both, private and public goods

- excludable but non-rival (like cable TV)
- non-excludable but rival (like public park)

The free-rider problem

- **is a central problem and a reason why public goods often lead to an instance of market failure…**
- individually-rational and self-interested behavior on the market might result in an inefficient outcome
    - typically in underproduction, or no production at all
    - non-excludability +self-interest => individuals can take advantage of public goods without contributing sufficiently to their production
    - if private organizations don't reap all the benefits of a public good which they have produced, their incentives to produce it voluntarily might be insufficient.
- this is called the **free rider problem**

- relies on assumption of individual rationality and self-interest maximization
- if in unregulated market an individual cannot be excluded from consumption of public good (breathing clean air, riding good roads…etc) and there is no mechanism to ensure his contribution to creation of that good, why should a self –interested rational individual pay for something s/he would get to consume anyway?
- that is why the government often has to step-in regulating, collecting taxes, etc… to correct the market failure and ensure the production of public good

Example

- consider national defense, a standard example of pure public good.
- suppose an individual thinks about exerting some extra effort to defend the nation.
- benefits to that particular individual might be very low (especially if the "defending activity" is not geographically close to our individual and he/she might not face immediate threat of being affected by the war)
- on the other hand, there is a high possibility that he or she could get injured or killed during the course of his or her military service.
- importantly, a free rider knows that he or she cannot be excluded from the benefits of national defense, regardless of whether he or she contributes to it (as long as the army exists, it does not matter too much whether there is one more soldier or not).
- thus a rational individual would not voluntarily exert any extra effort, unless there is some inherent pleasure or material reward for doing so (for example, money paid by the government, as with all-volunteer army or mercenaries).

Now, **to establish a national defense system**, the government needs to

- determine how much money to spend on it – small vs. huge military complex
- needs to know the cost of each alternative
- and know the maximum willingness of each member of the society to pay these costs

⇨ How to find out? Well, the government could try to ask…
⇨ It is not so simple…

…Suppose you know that everyone is reporting their true willingness to pay. You also know that there are so many people in the society that your response, however small, will not affect the level of national defense => no incentive to report truthfully => "economically rational" response would be to say that you are not willing to pay for national defense.

⇨ But if everyone would do so…..

Questions for an economist? (Schotter, Chapter 18)

- what is the optimal amount of public good to produce, and what conditions must be satisfied at such optimum?
- How can economy achieve that optimum?
- Will free markets be able to achieve that optimum, or must the government help the economy to coordinate its activities?

Q: Think about how environmental protection can be conceptualized as a public-good-provision problem. Solutions?

Solutions:

1. **Lindahl "free market solution"**
   - relies on everyone truthfully revealing their preferences for public good;
   - the government serves as a "coordinator" (no intervention)
   - the coordinator sets everyone's' share on the total cost if the good is provided
   - people face prices and the market will take care of the rest: people will maximize their utility and state their demand for the public (as well as the private) good.
   - In the equilibrium, prices of private goods and shares on cost of public good are set such that no one wishes to change his/her demand for private and for public goods + supply of private good equals the demand + everyone consumes the same amount of public good (due to non-excludability + non-rivalry).

     Problem: incentives not to be truthful in revealing one's preferences.

⇨ **Another proposed solution(s):**

2. **A demand-revealing mechanism**
   - imagine a dark street and three equally costly plans to install streetlights (one very bright streetlight or combinations of less bright streetlights)
   - ask inhabitants, how much they are willing to pay for each of the proposed plans and implement the one that maximizes the total willingness to pay)

     → still there is no guarantee that collected contributions will cover the total cost of implementing the streetlight plan.

3. **An auction election mechanism:**
   - people submit their bids (bidding the money one is willing to pay + the quantity demanded);
   - then if the public good is produced, everyone pays the difference between the cost and sum of the bids made by other people multiplied by average quantity demanded
   - Everyone has a right to refuse his or her cost share
   - If all people agree to pay their costs share the demanded quantity is produced.
   - If no agreement is reached, public good is not produced – the experimental evidence suggests that people in general do not seem to be truth-telling (Smith, 1977)

4. **Coase argument**:
   - with no transaction cost and unilateral property rights, most conflicts could be resolved by private bargaining [more on that later]

5. **Government provision** (public good financed by tax revenues)
   - it might be difficult to ensure the government has an incentive to provide the optimum amount even if it were possible for the government to determine precisely what amount would be optimal
   - A government may **subsidize production of a public good in the private sector;**
   - unlike government provision, subsidies may result in some form of competitive market.

- Principal-agent problems can still arise between the citizens and the government or between the government and the subsidized producers.

6. **An exclusion mechanism (club goods)**
   - developed for information goods,
   - introduction of exclusion mechanisms which turn public goods into club goods.
   - Example: copyright and patent laws (intellectual property laws) that attempt to remove the natural non-excludability by prohibiting reproduction of the good.
   - Although they can address the free rider problem, the downside is that they imply private monopoly power and thus are not Pareto-optimal.
7. support public mindedness by **tradition** and **social norms** (a non-market solution)

Tragedy of the commons (Hardin, 1968)

- a dilemma in which **multiple individuals acting independently and solely** and rationally consulting their **own self-interest** will **ultimately destroy a shared limited resource** even when it is clear that it is not in anyone's long term interest for this to happen.
- Hardin uses an example, of herders sharing a common parcel of land (the commons), on which they are each entitled to let their cows graze.
- it is in each herder's interest to put the next (and succeeding) cows he acquires onto the land, even if the carrying capacity of the commons is exceeded
- if this goes on and on the land is eventually damaged for all as a result.
- This is because
  - **The herder receives all of the benefits from an additional cow,**
  - **the damage to the commons is shared by the entire group.**
- If all herders make this individually rational economic decision, the commons will be destroyed to the detriment of all.
- the problem arises when **property rights are not well defined** (the “commons”)
- private property then provides a mechanism to avoid externalities
- the owner cares about the property and controls its use + can exclude others from overusing it (see the discussion in Hardin as well)
- private property is not the only available mechanism – regulations work as well (with legal system to enforce them)

Examples (**can you think of any?**):

- **over-herding** cows (see Hardin)
- **over-fishing** (each fisherman has a negligible impact on the total fish stock… but too many fisherman might result in serious depletion)
- **automobile pollution** – each automobile lowers the air quality and it is not likely that the free market would result in the optimal amount of pollution → emission standards for automobiles

  → **Possible solutions** (practical example)**:**

  - 1963 Clean Air Act and its amendments set automobile emission standards for the manufacturers of vehicles in the US and Lawrence White examined the costs and benefits of this program
  - cost per car is estimated at
    - $600 for emission control equipment
    - $180 for extra maintenance
    - $670 due to reduced gasoline mileage and the necessity of unleaded gasoline

  => **total cost of $1450** (in 1981 dollars) per car

Any Problem?

How does this policy affect incentives of consumers/drivers? Mileage?

Does the pollution in the area matter for everyday driving decision?

- White identifies following problems:
  - everyone who buys a car must pay extra $1450, whether they live in highly polluted area or not
  - most of the responsibility falls on the manufacturer, only little on the user

    => car owners have little incentives to keep the pollution control equipment in working order unless they are inspected
  - no incentive to economize driving – people who drive 2000 miles in less polluted areas pay exactly the same amount of money as people who drive 500,000 miles in heavily polluted areas → it would make sense to encourage people to drive less (at least in heavily polluted areas)

- **Can you think of alternative solution that would address White's criticism?**
- Alternative solution that White offers: **effluent fees**
- annual inspection of all vehicles estimating the car's likely emissions during the past year
- different communities (areas) could levy different fees => people face the true cost of generating pollution => encouraged to generate "socially optimal amount of pollution" (or, well, at least closer to it)
- **Why do you think it should work better?**
- the system would encourage the owners to search for low-cost ways of reducing their emissions, including changing their driving habits and the type of vehicle (more eco)