The homework is due noontime (between 12:40 and 13:30) 3 November, 2009 (Tuesday) in room MA 223 (the name on the office door is Fatma Taşkınc). Answers should be typed on the computer, stapled and should include either your section number or section discussion leader’s name. Late submissions, meaning after 13:30 Tuesday will not be accepted regardless of any excuse. Make sure you provide graphs when asked to so.

Part I: Problem solving

Solve the following problems.

1. The military has decided it is in need of a technology that allows it to better identify its targets from far away and is willing to spend money of research and development (R&D) efforts to develop this technology. The benefit to the military is that when attacking the probability that it will cause any civilian casualties falls. The cost to the military is that it has to spend money to hire engineers who will develop this technology. Start by assuming that the R&D activity of the military does not cause any benefits to anybody except the military. Similarly assume that the R&D activity of the military does not cause any costs to anybody except the military. The marginal cost and marginal benefit functions to the military are given by the following equations:

\[ MB = 80 - 0.4Q \]
\[ MC = 20 + 1.6Q \]

where \( Q \) stands for the quantity of R&D activities the military completes.

a. How many units of R&D activities will the military choose to complete? What will the price of this R&D activity be?

b. Should the government intervene in the R&D decision of the military? Why or why not?

c. Some engineers working for the military voluntarily leave their jobs and start working for medical companies who are developing new technologies to identify cancer cells at much earlier stages. This requires that the new technology identifies the “target cell” from far away, a technology similar to that developed by the military. The engineers who moved from the military can easily transfer their military knowledge and develop the medical equipment for cheaper, saving more patients from cancer through early detection. As such the R&D activities of the military creates an extra benefit to the society by improving their health, which is valued at 20 TL per R&D activity of the military.

Given this information: How many units of R&D activities will the military choose to complete? What will the price of this R&D activity be? How many units of R&D activities should the military choose to complete? Show these two points graphically.

d. In light of the new information in part (c) should the government intervene in the R&D decision of the military? Why or why not? What policy should the government use? Show the effects of this policy and the decisions of the military on a graph.
2. The government is thinking of building a new third bridge crossing the Bosphorus, over which individuals with very different valuations would travel. For simplicity there are three types of people who use the bridge and that there are 100,000 people from each type. The valuation of a typical type A is such that the benefit they get is 500 TL worth. The benefit type B gets is 250 TL worth, and the benefit C gets is 200 TL worth.
   a. What is the price the society is willing to pay to build this bridge?
   b. Suppose it costs 100 million TL to build this bridge, should the government build it or not? What is the net benefit to the society?
   c. The government is debating alternative ways to pay for this bridge. Discuss how the public would vote and whether the proposed financing plan would actually be accepted unanimously by every individual in Istanbul (the 300,000 people including all types A, B and C)
      i. The government proposes an equal tax of 300 TL for each of these 300,000 citizens, regardless of their type.
      ii. The government proposes a fee for use, where every person who accesses the bridge should pay a lump-sum amount of 500 TL.
      iii. The government proposes a fee for use, where every person who accesses the bridge should pay a lump-sum amount of 200 TL.
   d. Discuss the free-rider problem that could be evident in the following possibility: “The government decides to ask for voluntary donations, where individuals contribute to the financing by any amount they will to.”

3. Classify the following goods according to their excludability and rivalry criteria:
   a. Audio and video broadcasting with no-commercials
   b. Books at public libraries
   c. Hamburgers
   d. Internet services
   e. Dolmuş rides

Part II: Reading and discussion

Read the following article by Greg Mankiw from the New York Times and answer the questions at the end of the essay.

Economic View
One Answer to Global Warming: A New Tax
By N. GREGORY MANKIW
Published: September 16, 2007, New York Times

IN the debate over global climate change, there is a yawning gap that needs to be bridged. The gap is not between environmentalists and industrialists, or between Democrats and Republicans. It is between policy wonks and political consultants.

Among policy wonks like me, there is a broad consensus. The scientists tell us that world temperatures are rising because humans are emitting carbon into the atmosphere. Basic economics tells us that when you tax something, you normally get less of it. So if we want to reduce global emissions of carbon, we need a global carbon tax. Q.E.D.

The idea of using taxes to fix problems, rather than merely raise government revenue, has a long history. The British economist Arthur Pigou advocated such corrective taxes to deal with pollution in the early 20th century. In his honor, economics textbooks now call them “Pigovian taxes.”

Using a Pigovian tax to address global warming is also an old idea. It was proposed as far back as 1992 by Martin S. Feldstein on the editorial page of The Wall Street Journal. Once chief economist to Ronald Reagan, Mr. Feldstein has devoted much of his career to studying how high tax rates distort incentives and impede
economic growth. But like most other policy wonks, he appreciates that some taxes align private incentives with social costs and move us toward better outcomes.

Those vying for elected office, however, are reluctant to sign on to this agenda. Their political consultants are no fans of taxes, Pigovian or otherwise. Republican consultants advise using the word “tax” only if followed immediately by the word “cut.” Democratic consultants recommend the word “tax” be followed by “on the rich.”

Yet this natural aversion to carbon taxes can be overcome if the revenue from the tax is used to reduce other taxes. By itself, a carbon tax would raise the tax burden on anyone who drives a car or uses electricity produced with fossil fuels, which means just about everybody. Some might fear this would be particularly hard on the poor and middle class.

But Gilbert Metcalf, a professor of economics at Tufts, has shown how revenue from a carbon tax could be used to reduce payroll taxes in a way that would leave the distribution of total tax burden approximately unchanged. He proposes a tax of $15 per metric ton of carbon dioxide, together with a rebate of the federal payroll tax on the first $3,660 of earnings for each worker.

The case for a carbon tax looks even stronger after an examination of the other options on the table. Lawmakers in both political parties want to require carmakers to increase the fuel efficiency of the cars they sell. Passing the buck to auto companies has a lot of popular appeal.

Increased fuel efficiency, however, is not free. Like a tax, the cost of complying with more stringent regulation will be passed on to consumers in the form of higher car prices. But the government will not raise any revenue that it can use to cut other taxes to compensate for these higher prices. (And don’t expect savings on gas to compensate consumers in a meaningful way: Any truly cost-effective increase in fuel efficiency would already have been made.)

More important, enhancing fuel efficiency by itself is not the best way to reduce energy consumption. Fuel use depends not only on the efficiency of the car fleet but also on the daily decisions that people make — how far from work they choose to live and how often they carpool or use public transportation.

A carbon tax would provide incentives for people to use less fuel in a multitude of ways. By contrast, merely having more efficient cars encourages more driving. Increased driving not only produces more carbon, but also exacerbates other problems, like accidents and road congestion.

Another popular proposal to limit carbon emissions is a cap-and-trade system, under which carbon emissions are limited and allowances are bought and sold in the marketplace. The effect of such a system depends on how the carbon allowances are allocated. If the government auctions them off, then the price of a carbon allowance is effectively a carbon tax.

But the history of cap-and-trade systems suggests that the allowances would probably be handed out to power companies and other carbon emitters, which would then be free to use them or sell them at market prices. In this case, the prices of energy products would rise as they would under a carbon tax, but the government would collect no revenue to reduce other taxes and compensate consumers.

The international dimension of the problem also suggests the superiority of a carbon tax over cap-and-trade. Any long-term approach to global climate change will have to deal with the emerging economies of China and India. By some reports, China is now the world’s leading emitter of carbon, in large part simply because it has so many people. The failure of the Kyoto treaty to include these emerging economies is one reason that, in 1997, the United States Senate passed a resolution rejecting the Kyoto approach by a vote of 95 to zero.
Agreement on a truly global cap-and-trade system, however, is hard to imagine. China is unlikely to be persuaded to accept fewer carbon allowances per person than the United States. Using a historical baseline to allocate allowances, as is often proposed, would reward the United States for having been a leading cause of the problem.

But allocating carbon allowances based on population alone would create a system in which the United States, with its higher standard of living, would buy allowances from China. American voters are not going to embrace a system of higher energy prices, coupled with a large transfer of national income to the Chinese. It would amount to a massive foreign aid program to one of the world’s most rapidly growing economies.

A global carbon tax would be easier to negotiate. All governments require revenue for public purposes. The world’s nations could agree to use a carbon tax as one instrument to raise some of that revenue. No money needs to change hands across national borders. Each government could keep the revenue from its tax and use it to finance spending or whatever form of tax relief it considered best.

Convincing China of the virtues of a carbon tax, however, may prove to be the easy part. The first and more difficult step is to convince American voters, and therefore political consultants, that “tax” is not a four-letter word.

N. Gregory Mankiw is a professor of economics at Harvard. He was an adviser to President Bush and is advising Mitt Romney, the former governor of Massachusetts, in the campaign for the Republican presidential nomination.

Reading Questions:
1. Draw the supply and demand graph for a competitive market that produces pollution as a by-product.
2. Why is pollution an economic problem?
3. According to Mankiw, what is the simple solution to the problem of air pollution?