Economics 3250 Dr. Lozada
Spring 2009 Exam 2

**Do Not Turn This Page Over Until You Are So Instructed!**

This exam has 25 points. There are six questions on the exam. The questions are worth four points each, except for Question 1, which is worth five points.

Put your answers to the exam in a blue book.

You have **one hour** (that is, until **2:25pm**) to take this test. After the test is over, I'll lecture until the regular class period ends.

Answer the questions using as much precision and detail as the time allows. Correct answers which are unsupported by explanations will not be awarded points.

**Answer all of the following six questions.**

1. **[5 points]** Page 179 of your textbook is attached to this exam. Read its first paragraph (which is part before the "Conclusions" title). Then, use a graph such as Figure 1 to explain what the authors are saying in that paragraph.

2. **[4 points]** What is the relationship between tradeable pollution permits and "hot spots"?

3. **[4 points]** Figure 2 is one of the graphs we used in studying fishery economics. How does this graph generate information about steady-state yield? What is steady-state yield?

4. **[4 points]** According to neoclassical economic theory, an exhaustible resource traces what sort of path through time on a graph such as Figure 3? Why? What is the name of the basic principle underlying this result? (Hint: It's named after the neoclassical economist who first derived the principle.)

5. **[4 points]** Attached to this exam is a copy of page 251 of your textbook. In class, I disagreed with its last paragraph.

   (a) Explain why people who agree with that paragraph will think that government regulation of pollution is less needed than people who disagree with that paragraph.

   (b) Do you agree or disagree with that paragraph? Why? (Even though I lean towards disagreeing with it, you can still get full credit on this question by agreeing with it; your answer will be graded on the strength of your argument, not on whether you agree with my position or not.)

6. **[4 points]** In class, we discussed five economic instruments which could be used (or are being used) to manage municipal solid waste. Discuss one of these instruments. (Just one of them.)

' to be much lower where the changes and/or there are few rs ago the previously quoted opriate here. However, new ucts, such as unleaded petrol, work in this case (Opschoor, s, the power of a tax to reduce igness to carry on purchasing ie face of higher prices. Carbon is and Barrett (1991) concludes ssions very substantially would inly, than the taxes already posals'.

## lems

s perceived by critics to be one ition of pollution taxes, their imposing such taxes upon its ition tax on its own industries ared to foreign competitors so ie less attractive to consumers hat a carbon tax 'is likely to be s introduced by a number of

n of international agreement or s. First, it will always be in the ntries, except itself, sign such m their reductions in global ased production costs, thereby gn countries whose firms now effect is a very strong incentive m is that, even if such an practice this treaty would be of all countries abiding by a d be different. This is because mage based upon the size and ause of the differences in the h country would also face a ocess of achieving its specific efore be extreme difficulty in evel of pollution tax per unit of



A further international complication arises due to those countries which inevitably do not sign any such international pollution tax treaty. Suppose that we consider again a carbon tax placed upon fuel prices. If a carbon tax treaty were signed then this would have the effect of reducing fuel demand in signatory nations. This depressed world fuel demand would lead the oil exporting nations to lower their prices in an effort to protect their falling profits. However, this falling fuel price would have two effects; first, it would offset some of the effects of the tax in signatory nations so that the slump in demand would be somewhat countered; second, it would be taken advantage of by non-signatory nations who would expand their demand for this cheaper fuel. The net impacts of such a carbon tax treaty, in terms of emissions reductions, could therefore be significantly smaller than we might initially expect (Barrett, 1991).

## Conclusions

In theory, pollution taxes provide an important route for internalizing the external pollution damage costs caused by companies and restricting their pollution emissions to a sustainable optimal level. They also have several desirable side-effects in that they can also send signals to consumers regarding the pollution consequences of their purchases. Furthermore, the regressive impacts of these taxes upon the poorer sections of society can be adequately compensated for by a system of tax redistribution. Because of these factors, taxes deserve consideration as an economic incentive tool for the reduction of pollution. However, in practice there are some formidable problems to be addressed. The accurate determination of an appropriate pollution tax level is dependent upon accurate information regarding the damage costs of that pollution and the benefits of its associated production of goods. Furthermore, in order that pollution taxes can be adopted on any significant scale, a previously unknown level of international agreement is likely to be necessary. The feasibility of such agreement remains uncertain.

## Further reading

T. Barker and R. Lewney, 'Macroeconomic modelling of environmental policies: The carbon tax and regulation of water quality', Department of Applied Economics, University of Cambridge, 1990; mimeo referenced in Barrett (1991).

S. Barrett, 'Global warming: Economics of a carbon tax', in D. W. Pearce (ed.), *Blueprint 2: Greening the World Economy*, Earthscan, London, 1991.

J. M. Buchanan and G. Tullock, 'Polluters profits and political response: Direct control versus taxes', *American Economic Review* **65**: 130–47, 1975.

B. Bye, T. Bye and L. Lorentsen, 'SIMEN: Studies of industry, environment and energy towards 2000', Discussion Paper No. 44, Central Bureau of Statistics, Oslo, 1989.

make profit. We have argued that this need not be inconsistent with improving the environment. What is required is careful management to decouple the legitimate pursuit of profit from its impact on the environment. Freely functioning markets will not do that without aid. Wholesale government intervention will almost certainly not achieve it either: governments may set out to be benign but they frequently manage economies and environments no better than free markets.

It is conceivable that the pursuit of self-interest within a regulatory framework will secure sustainable development. But the moral case for the environment remains, and it shows through in business approaches to the environment. It shows as *commitment* – which we might define as a concern for the environment which cannot be explained in terms of the self-interested motives discussed previously. *Proving* and *measuring* commitment are difficult, maybe impossible. But it isn't easy to understand some corporate approaches to the environment unless commitment exists.

## Further reading

D. W. Pearce, *Employment and Environmental Policy*, Economic Report, The Employment Institute, London, 1991.

Most large companies issue statements about commitment to environmental policy. Useful illustrations are given in:

T. Burke and J. Hill, *Ethics, Environment and the Company*, Institute of Business Ethics, London, 1990.

Many case studies and useful illustrations are to be found in:

Business International Ltd, *Managing the Environment: The Greening of European Business*, Business International Ltd, London, 1990.

Some sections of this chapter have been taken from:

F. Cairncross, *Costing the Earth: What Governments Must Do; What Consumers Need to Know; How Businesses Can Profit*, The Economist Business Books, London, 1991.

D. W. Pearce, *Corporate Responsibility and the Environment*, British Gas, London, 1991.

The reference to the study on costs and benefits of environmental policy is:

P. Portney, *Public Policies for Environmental Protection*, Resources for the Future, Washington, DC, 1990.

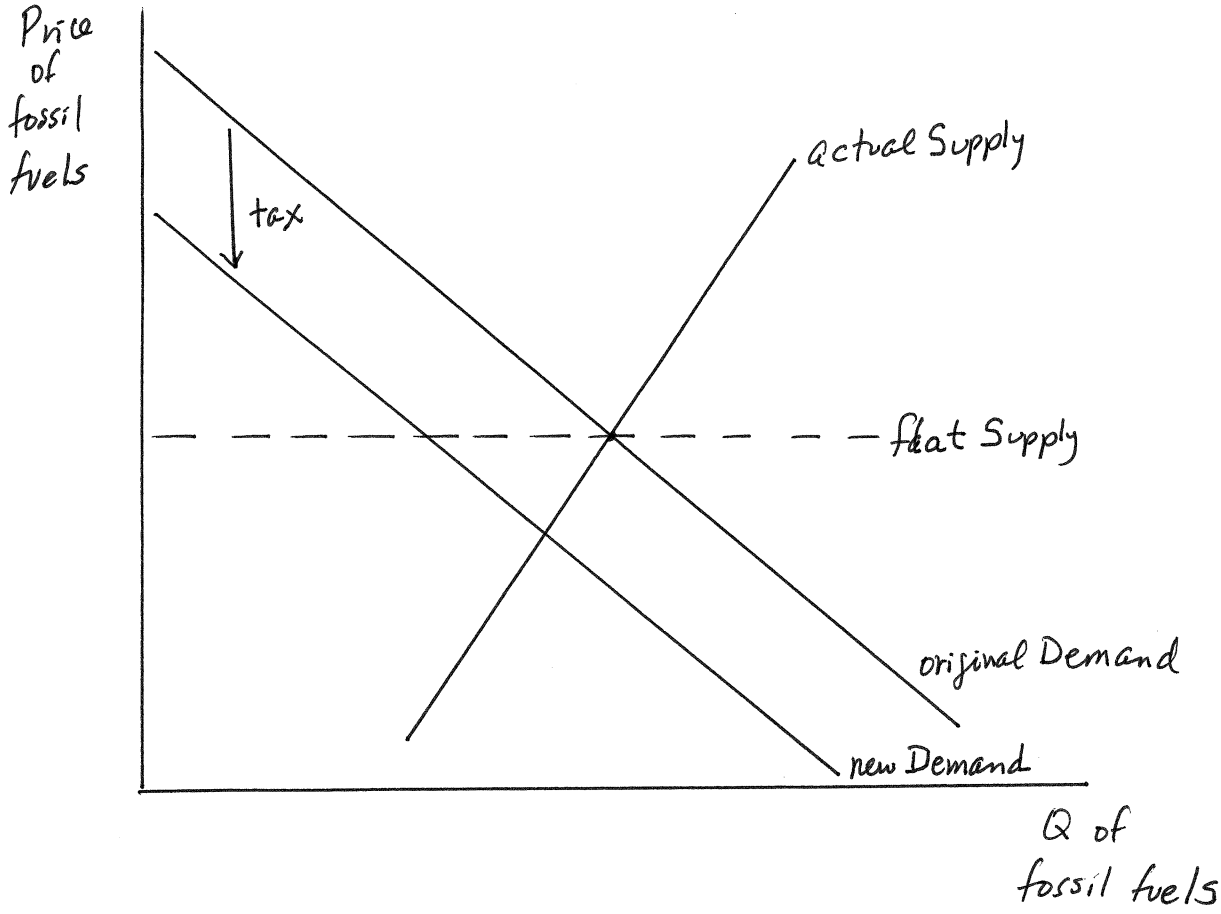

Price of fossil fuels
tax
actual Supply
flat Supply
original Demand
new Demand
Q of fossil fuels

Fig. 1

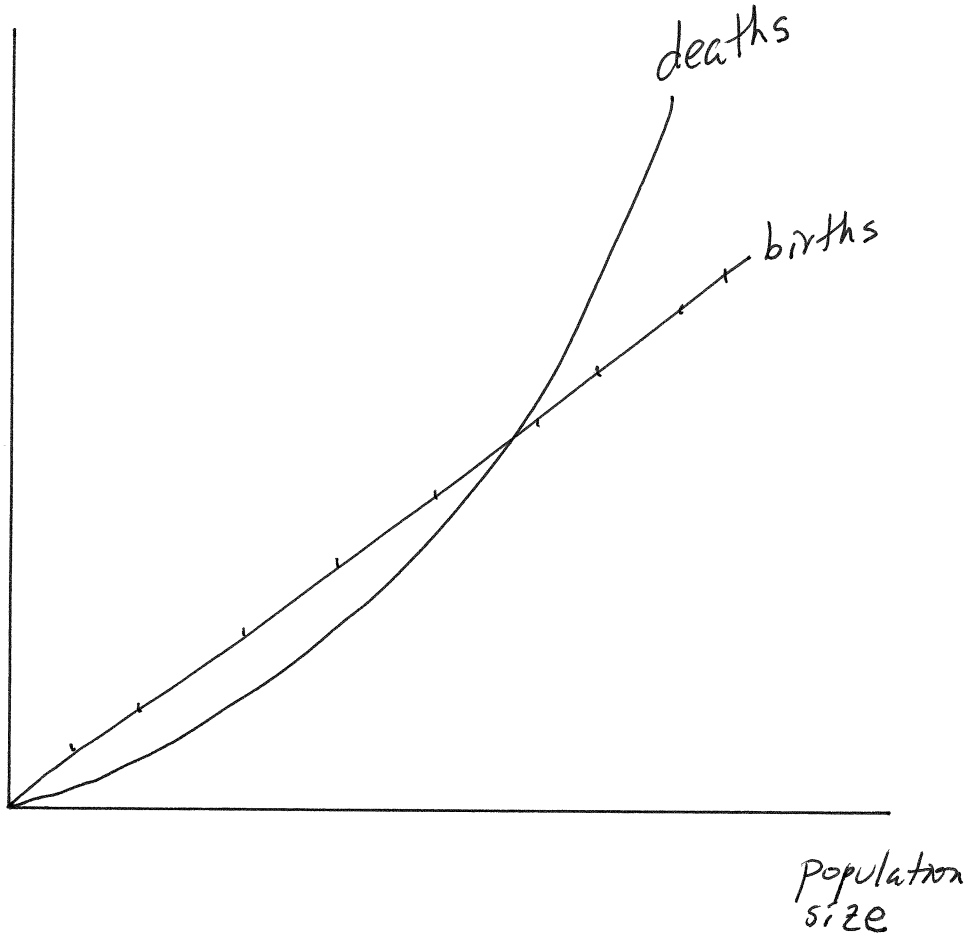



Fig. 2

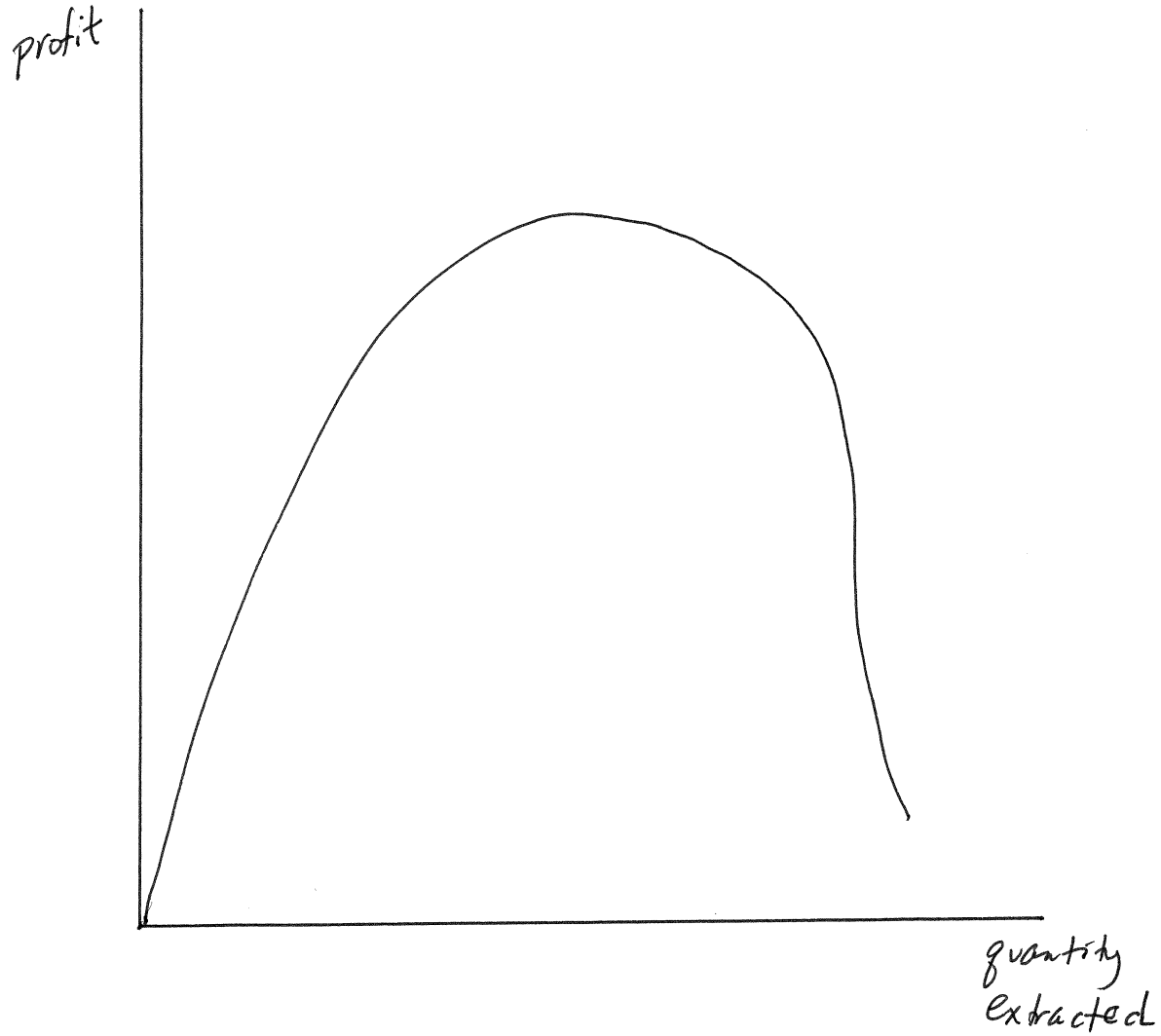
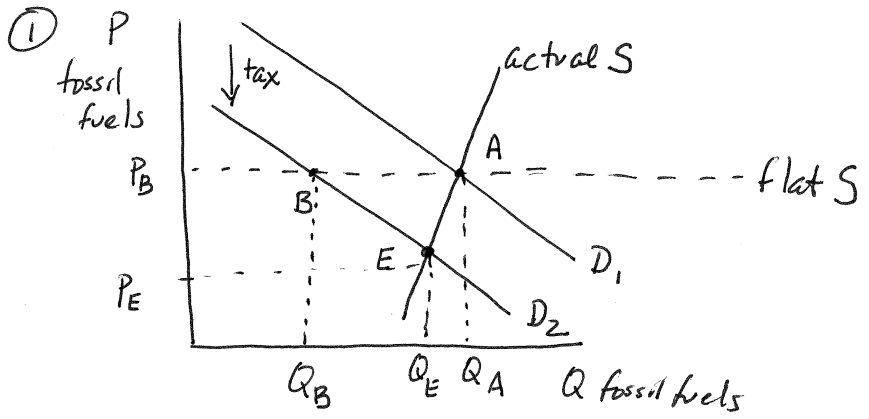



Fig. 3

# Answers to Econ. 3250, Exam 2, Spring 2009

① 


Demand is reduced from $D_1$ to $D_2$ by the carbon tax.

If supply were flat, the tax would cause Quantity to fall to $Q_B$.

However, supply is not actually flat, so equilibrium quantity will not fall as far as $Q_B$. It will only fall to $Q_E$. This is because price will fall to $P_E$. As the book says, "this falling fuel price... would offset some of the effects of the tax... so that the slump in demand would be somewhat countered..."

If you thought price would stay at $P_B$, you'd predict that the tax would lower fossil fuel use to $Q_B$, but actually price will fall and fossil fuel use will not be lessened all to way to $Q_B$, but only to $Q_E$.

(2) "Hot spots" are highly polluted small areas.

A national tradeable pollution permit scheme, to take one example, limits ("caps") pollution nation-wide. This allows — that is, it permits — pollution to be high in some parts of the nation if it is correspondingly low in other parts of the nation. Thus one would get hot spots.

The remedy would be to "cap" pollution over smaller geographical areas. The more localized the pollutant, the smaller the areas would have to be. For example, $CO_2$ is not a localized pollutant at all, so a global system for it is fine, but small particulate pollution is quite localized, so a tradeable permit scheme for it might have to be done on a county-by-county basis, or even using smaller areas.

(3)

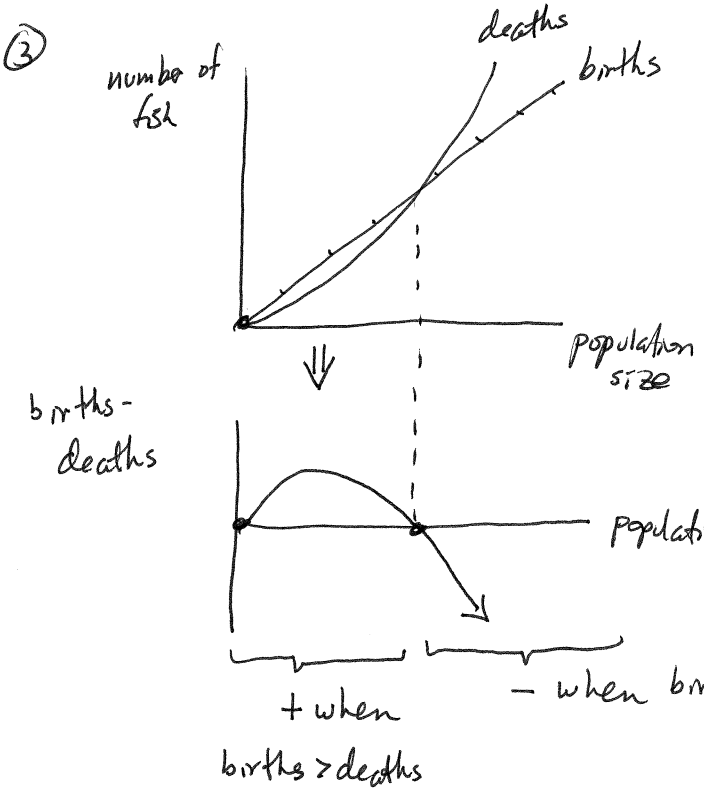



Fig. 2

Fig. 2a

Fig. 2a graphs "births - deaths." ("Deaths" means "natural deaths," not caused by fishing.) We have:

$$\text{Population at end of year} = \text{Population at start of year} + \text{births} - \text{deaths} - \text{harvest}.$$

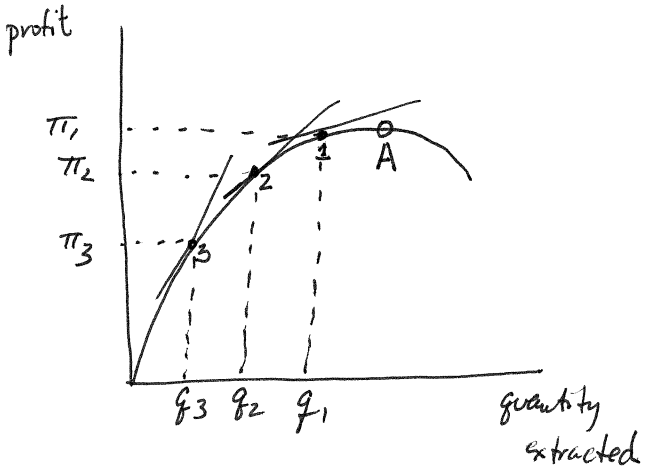
In a <u>steady state</u>, population at the end of the year equals population at the beginning of the year. So in a steady state, from the above equation,

$$\text{harvest} = \text{births} - \text{deaths}.$$

↑ steady state

So steady-state harvest, which is "steady state yield," is equal to births − (natural) deaths, so it is equal to Fig. 2a.

(4)




According to the Hotelling Rule, quantity extracted slowly falls over time, for example from $q_1$ to $q_2$ to $q_3$ and gradually to zero. Profit falls as well, from $\pi_1$ to $\pi_2$ to $\pi_3$ and gradually to zero. Marginal profit rises at the rate of interest (which is the Hotelling Rule). This is shown in my graph above by the ever-steeper tangent lines as you go from $q_1$ to $q_2$ to $q_3$.

Why? Well, quantity and profit cannot be at point A forever, because the resource is exhaustible. (The firm wishes it could be at point A forever.) Quantity has to fall. Falling suddenly is not an equilibrium (it'd cause price to rise suddenly, and in equilibrium, the perfect-foresight firms would know this & they'd want to produce more, not less, after the price rise). So quantity falls slowly.

Optional: MΠ rising at the rate of interest gives the firm no incentives to shift its extraction to an earlier or later date.

(5) a)

The paragraph asserts that some firms protect the environment even though that reduces their profit. (Reduces their long-term profit — because reducing short-term profit in order to gain long-term profit does not show "commitment" to the environment, but rather commitment to long-term profit.) Firms who act this way will reduce pollution without government regulation. So government regulation would be unnecessary, or less necessary, if firms acted this way. (to reduce pollution)

People who disagree with the paragraph think firms just maximize (maybe long-term) profit. These firms have no separate "commitment" to the environment. Hence the profit-maximizing amount of pollution is often more than the socially-optimal amount of pollution, and to achieve the social optimum, government regulation is required.

b) Disagree: Firms solely pursue profit-maximization. If they didn't, they'd be taken over or out-competed by their rivals who did maximize profit.

Agree: Firms are complicated social structures made up of different individuals and groups (upper management, middle management, shareholders, blue-collar workers, etc.) with different goals. So firms do not monolithically maximize profit. Some decision-makers in the firm may desire to protect the environment even if the firm (or even they themselves) would earn less money doing that.

(6) The answer is one of:

i) materials levy: an input tax; that is, a tax on the inputs used to manufacture packaging and other items which will be discarded

ii) product charge: an output tax; that is, a tax on finished products (or parts thereof) which will be discarded

iii) waste disposal charge: a fee to dispose of municipal solid waste. (Such fees usually exist but often don't give strong incentives to reduce waste.)

iv) deposit-refund system: A tax on a finished product (a "product charge") combined with a subsidy for delivering the waste that's left over to the appropriate recycling point.

v) marketable permits: For example, newspapers could be limited to 90% (or less) virgin paper ("virgin" = "not recycled"). They'd get permits for 90%. Firms who wanted to use more than 90% virgin paper would have to buy permits from other firms which want to use less than 90% virgin paper.