INSTRUCTOR'S MANUAL

ENVIRONMENTAL ECONOMICS & MANAGEMENT

Theory, Policy, and Applications

6th Edition

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CONTENTS

Notes

N1-N4

ANSWERS TO REVIEW QUESTIONS

(*Guidelines to instructors given in brackets*.)

Chapter 1

THE ROLE OF ECONOMICS IN ENVIRONMENTAL MANAGEMENT

1a. State how each of the following factors affects the materials balance model: (i) population growth; (ii) income growth; (iii) increased consumer recycling actions; (iv) increased industrial recycling; (v) increased use of pollution prevention technologies.

[In answering each part of this question, the student should make it clear that the *ceteris paribus* condition is being assumed.]

(i) Population growth is expected to increase the materials flow. An increased population implies a larger consumer group and hence an increase in the demand for goods and services. As production is expanded to meet that demand, more resources are called forth from nature. The flow of residuals from economic activity back to nature also increases, both from production in the form of industrial wastes and from the consumption of goods and services.

(ii) Income growth should increase the materials flow, since higher income promotes higher consumption levels, which will lead to the same chain of events discussed in part (i).

(iii) Increased consumer recycling will divert some amount of household residuals away from the flow back to nature. It should be noted, however, that this activity reduces the residual flow only in the short-run, since recyclables eventually become residuals as well. (The laws of thermodynamics confirm this assertion.)

(iv) Increased industrial recycling will have an effect analogous to what is described in part (iii), except that the diversion of residuals arises from changes in producer behavior rather than consumer behavior. It is also true that increased industrial recycling may provide producers with alternative inputs that will slow the demand for raw materials drawn from nature.

(v) Increased use of pollution prevention technologies will reduce the flow of residuals to the environment in both the short-run and the long-run, assuming such practices are sustained.

b. Assume that stringent pollution controls are placed on the flow of residuals released into the atmosphere. According to the materials balance model, what

does this imply about the residual flows to the other environmental media and/or the flow of inputs into the economy?

Based on the first law of thermodynamics, the flow of residuals released to other media (i.e. water and land) should increase, *assuming all else held constant.*

2a. Why is design for recycling, as practiced by BMW Group and discussed in Application 1.1, important to the environment?

According to the Materials Balance Model, recycling is a way to delay the flow of residuals back to nature. Therefore, it is important that some manufacturers have instituted the sustainable practice of designing products to facilitate recycling when the product reaches the end of its useful life.

b. Explore the design for recycling approach employed by another automobile manufacturer, such as Toyota or another manufacturer, and compare it to that of BMW Group.

[Obviously, student responses will vary with the manufacturer selected and the specifics of the design for recycling program implemented by that firm. Overall, students should focus on the firm's design decisions that are specifically targeted at facilitating recovery and recycling, any dismantling or sorting processes, along with any established plan to help consumers return end-of-life vehicles. Students should then compare the selected firm's overall recycling efforts to those of BMW Group, comparing recycling or recovery targets, any measures of program accomplishments relative to objectives, and any other data to support the comparison.]

3. Faced with the oil crisis of the mid-1970s, the U.S. Congress instituted Corporate Average Fuel Economy (CAFE) standards.These have been increased over time, most recently in 2010 for the 2012-2016 model years. (For detail on the CAFE standards, visit the Web site of the National Highway Traffic Safety Administration, **www.nhtsa.dot.gov/fuel-economy.**) These standards are aimed at increasing the fuel economy, or miles per gallon (MPG), of automobiles. These standards are aimed at increasing the fuel economy, or miles per gallon (MPG), of automobiles.

a. Briefly describe the expected environmental effect of increasing the MPG of automobiles, holding all else constant.

By increasing the MPG achieved by automobiles, gasoline consumption should decline. Lower consumption should bring about *some* improvements in environmental quality. For example, greater fuel efficiency means fewer trips to the gas pump, which in turn

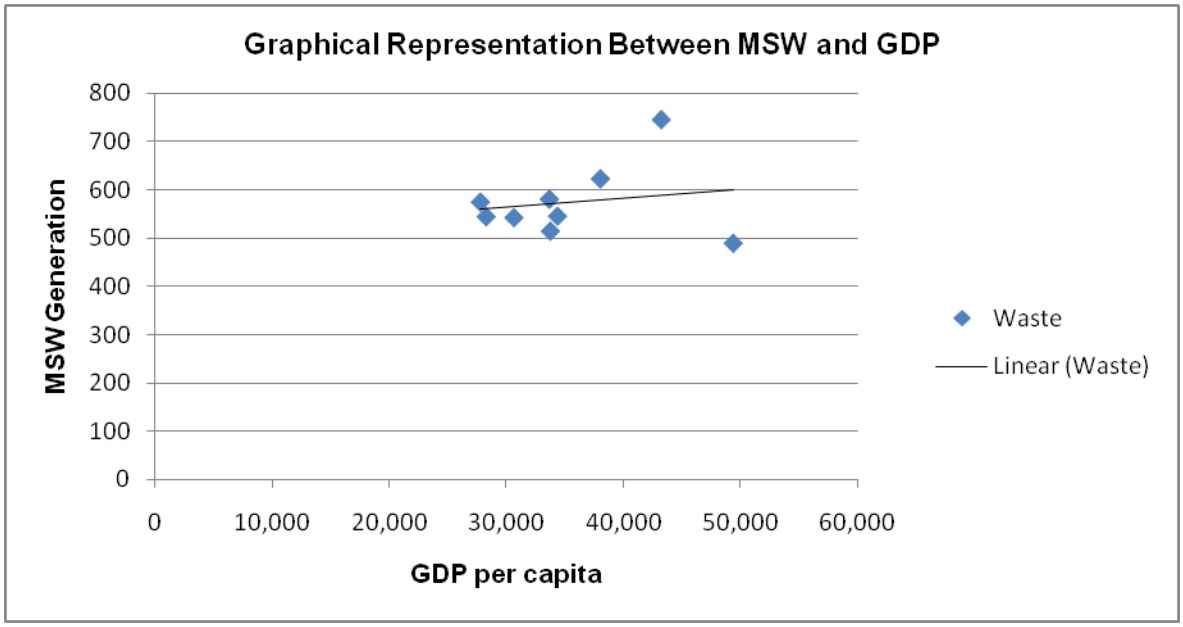
reduces the amount of vapors released into the atmosphere during refueling. However, the key is that the CAFE standards were *not* aimed at reducing the tailpipe emissions from automobiles as were other federally-mandated regulations (such as the requirement for catalytic converters). Hence, this set of regulations by itself should not have been expected to bring about dramatic improvements in environmental quality.

b. Serious criticism has been lodged against the CAFE standards because U.S. automakers responded by using more plastics in automobiles (to make the cars lighter in weight) to meet the more restrictive standards. Explain how the use of this particular technology affects your answer to part (a). Are there any other relevant issues associated with this manufacturing decision?

Increased use of plastics in automobile production can have detrimental effects on the environment. Of major concern is the fact that plastics are not easily recycled, based on present technology. This means that the plastic parts of scrapped automobiles end up in landfills or converted to toxic emissions during incineration. In either case, the flow of residuals from consumption is increased, with little opportunity for a diversion of that flow through recycling and reuse. There is also an increase in contaminating residuals generated from the supply-side of the market as plastics production adds to the amount of toxic emissions and effluents released into the environment.

4. Using the data in Table 1.2, graphically illustrate the relationship between a country's per capita GDP and its per capita municipal waste generation. What conclusion can you draw from your graphical analysis?

Graph:



As discussed in the text and as indicated by the slope of the trendline in the above graphic,there appears to be a positive relationship between a nation's GDP (or its industrialization) and its waste generation. If the data for Norway were removed, the positive linear relationship would be stronger.

One reservation with the above analysis is that there may be many contributing factors (e.g., social, economic, or political)that are not captured by this simple graphic.

5. Use your basic knowledge of economic principles to discuss how the market premise operates under the "polluter-pays principle."

The "polluter-pays principle" is based directly on the incentives that drive market activity. Specifically, a price is assigned to pollution, and the polluter is made to pay this price for every unit of contamination released to nature. In theory, the price is set to cover any damages to health or the ecology associated with any contamination. Hence, the "full costs" of production are captured within the market transaction. Furthermore, since costs erode profits, the profit-maximizing producer has an incentive to reduce the amount of polluting residuals released.

6. Reconsider the problem of loss of U.S. wetlands and the implications for biological diversity. Briefly contrast how a command-and-control policy approach to this problem would differ in intent and implementation from a market approach.

[Students can approach this question from a number of perspectives. The important point is that the response should compare the use of direct rules or standards under command-and-control with the incentive-based motivation of a market approach. For example, a command-and-control policy might take the form of restrictions on construction, such as mandating a minimum distance between a building site and a wetland area. Conversely, a market approach would attempt to *encourage* wetlands conservation, possibly through levying higher taxes on land areas adjacent to wetlands or by subsidizing activities that preserve existing wetlands.]

PAPER TOPICS

Design for Recycling: An International Comparison *(Nissan and BMW, or any two other firms)*

Biodiversity Trends in the United States *(or any country of choice)*

Current Findings of Environmental Damage Linked to the BP Oil Spill

Beyond GDP: An International Initiative to Measure National Well-Being

China's Environment Since the 2008 Olympic Games

Assessing the Success or Failure of the CAFÉ standards

Chapter 2
MODELING THE MARKET PROCESS: A REVIEW OF THE BASICS

1. Suppose $Q_D = 200 - 4P$ and $Q_S = 100$ describe market demand and market supply in a given market.

a. Algebraically find equilibrium price and quantity and support your answer graphically.

$P_E = 25$; $Q_E = 100$ [Students should present a basic model of supply and demand, labeling the equilibrium price and quantity and all other relevant points on the graph.]

b. What is unusual about this market? Give an example of a good or service that might be characterized in this way.

In this market, the supply curve is a vertical line at a quantity of 100 units. Such a supply function may be representative of any good or service available in a fixed amount. The classic example is land. However, there are other possibilities such as the number of seats in a football stadium or the number of original paintings by Picasso.

2. In 1995, the Food and Drug Administration (FDA) published new labeling standards for bottled water. (The full text of the final rule can be found at **http://cfr.vlex.com/vid/165-110-bottled-water-19705533**.) Prior to that time, bottlers could sell regular tap water under a bottled water label. In fact, the FDA estimated that approximately 25 percent of the supply of bottled water was nothing more than ordinary tap water. Consider how these tougher standards eliminated 25 percent of the supply of bottled water. If market demand is unaffected, what qualitative impact would this labeling change have on equilibrium price and quantity for bottled water? Support your answer with a graphical model.

Given the reduction in the supply of bottled water, the equilibrium price should rise and the equilibrium quantity should decrease. [The graph should show a shift left of the market supply curve and the qualitative effect on equilibrium price and quantity.]

3. Suppose the market for organically grown wheat is modeled through the following market supply and demand functions:

$$P = 10 + 0.5Q_S \text{ and } P = 22 - 2.5Q_D,$$

where Q_S and Q_D are in millions of bushels, and P is price per bushel.

a. Find the market equilibrium price, P_E, and market equilibrium quantity, Q_E.

Market equilibrium arises where Q_S equals Q_D, or where Q_E = 4 million bushels and P_E = \$12 per bushel.

b. Now determine the value of producer surplus and consumer surplus at equilibrium.

Consumer surplus is found as the area above equilibrium price up to the demand curve aggregated over all units of output sold, which is \$20 million. Producer surplus is found as the area between equilibrium price and the supply curve aggregated over all units sold, or \$4 million.

4. Reconsider the implications of the revised labeling standards discussed in Question 2 in the context of the hypothetical market for bottled water modeled in the text. Recall that the market demand and market supply equations are

$$Q_D = -100P + 1{,}150 \text{ and } Q_S = 400P - 100,$$

where P_E = \$2.50 and Q_E = 900.

Now, suppose the change in standards results in a new market supply of $Q_S' = 400P - 350$, with no change in market demand.

a. Determine the new P_E' and Q_E' for bottled water. Do your results agree with your intuitive answer to Question 2?

P_E' = \$3.00 and Q_E' = 850. Yes.

b. Graphically illustrate the market for bottled water before and after the change in labeling standards. Be sure to label all relevant points.

[Students should present a supply and demand model with numerical values assigned to the intercepts and the equilibria that correspond to the specific equations given. The graph should illustrate the decline in market supply and the quantitative effect on P_E and Q_E.]

c. Compare the values of consumer surplus and producer surplus before and after the change in labeling standards. Is this result expected? Why or why not?

	Consumer Surplus	**Producer Surplus**
Before	\$4,050.00	\$1,012.50
After	\$3,612.50	\$ 903.125

Both the increase in price and the decline in quantity tend to lower consumer surplus, which means that a lower consumer surplus is expected in this case. However, predicting the change in producer surplus is more difficult, since the price rise should increase it, but the quantity decline should decrease it.

5a. Describe a real-world government policy that creates a market surplus. Be sure to carefully define the relevant market.

[Any number of responses is possible. Most students likely will cite an instance of some government price control. As long as the control is held *above* equilibrium price, a surplus will result. A classic example is the minimum wage law. In this case, students should state that the relevant market is the supply and demand for unskilled labor.]

b. Explain the efficiency implications of such a policy. Be specific.

[Students should address the effect of government intervention on the signaling mechanism of price. By forcing price above equilibrium, suppliers are willing to bring more of the good or service to market than demanders are willing and able to purchase. In the context of labor markets, the minimum wage creates unemployment of unskilled laborers.]

c. In the instance you have described, what is the government's motivation for intervening in the market in this way?

[Often, the motivation for such price controls stems from equity issues rather than efficiency concerns. Establishing a minimum wage is a policy aimed at protecting workers from exploitation and at assuring all workers at least a basic standard of living.]

PAPER TOPICS

Recent Trends in Consumer Environmentalism: A Study of Demand
(Analyze a specific market in which shifts in demand reflect consumers' reaction to an environmentally-related issue.)

Profit Incentives Can Help the Environment
(Select a firm whose profitability or profit level has improved as it has pursued some environmentally-responsible action.)

The Influence of Environmentalism on Industry
(Discuss how public concern for the environment has altered the direction and/or structure of a particular industry.)

An International Environmental Market
(Choose a market for some environmentally-based good or service that competes at a global level , and conduct an economic comparison of two firms that are based in two different countries. For example, address their individual responses to consumer demand, how they promote their pro-environmental

approach to product design or production, the energy conservation measures they pursue, etc.)