1999 ECONOMICS COMPREHENSIVE: MICRO ESSAY (100 pts)

Suggested Answers

Instructions:

There are 19 questions with clearly labelled point values. The question itself is bolded and italicized and space is provided underneath the question for you to present your answer. If you need additional space, use the back and clearly indicate that your answer is continued there.

Most of the questions are designed to be answered with a few sentences of explanation and perhaps a graph. Show your work for all questions that require some calculation.

DO NOT SPEND TOO MUCH TIME ON ANY PARTICULAR QUESTION! If you get stuck, go on and return to the question later. If you don't, you will run out of time.

The Micro Essay part of the 1999 Economics Comprehensive Exam will test your knowledge of microeconomic theory by asking a series of questions about different aspects of the airline industry.

THE AIRLINE INDUSTRY

The Market for Air Travel in the North Atlantic (adapted from Mansfield, Microeconomics, Ninth Edition, Norton Publishing, pp. 160-2.)

"Air travel between North America and Europe is a very big business, as reflected by the fact that about 12 percent of all international air passengers travel between these two continents. The North Atlantic market is marked by at least two noteworthy characteristics. First, the bulk of the travellers are non-business travellers. About 46% of all passengers are vacation travellers, 34 percent are visiting relatives and friends, and the rest are business travellers. Second, there is considerable seasonable variation in the demand for air travel in this market, the peak season being the summer. About 37% of all traffic in this market occurs in the third quarter of the year.

Many major international airlines, such as American, Delta, British Airways, Lufthansa, Air France, and SAS fly between Europe and North America. They, as well as a host of industry and government analysts, are vitally interested in the demand for air travel in this market. In particular, they are interested in the price and income elasticities of demand for such air travel. J.M. Cigliano of the Lockheed-California Company has published the results of a study in which he estimated these elasticities.[1] His findings have been used in a variety of contexts, as we shall see below.

Table 1 shows the estimated elasticities of demand for air travel between the United States and Europe, as well as between Canada and Europe.

Table 1: Price and Income Elasticities of Demand for Air Travel in the North Atlantic Market

Route	Price elasticity	Income Elasticity
United States to or from Europe	-1.2	1.9
Canada to or from Europe	-0.8	1.8

In the questions below, assume that Cigliano's estimates are correct.

[1] J.M. Cigliano, "Price and Income Elasticities for Airline Travel: The North Atlantic Market:, Business Economics, September 1980.

Question 1 (5 pts): In a sentence or two, interpret the price elasticity of demand for the U.S.-Europe route.

A price elasticity of -1.2 means that a small increase in price, say 1%, will lead to a 1.2% decrease in quantity of tickets demanded on the U.S.-Europe route.

For the Canada-Europe route, the income elasticity (1.8) is about the same as between the United States and Europe, but the price elasticity (.8) is much lower in absolute value. In part, this may reflect a different mix of air travellers.

Compared to the U.S.-Europe route, a relatively large proportion of the travelers between Canada and Europe may be business travellers whose travel plans are relatively insensitive to the price of air travel. Whatever the reasons for the difference between the Canada-Europe and the U.S.-Europe routes in the price elasticity of demand, this difference is of considerable interest to the airlines.

Question 2 (5 pts): How would increases in air fares affect sales revenues for the U.S.-Europe routes and for the Europe-Canada routes?

Demand for air travel between the US and Europe is price elastic (that is, the elasticity is greater than 1 in absolute value). This means that customers and potential customers are relatively sensitive to changes in price. An increase in price would therefore result in a drop in sales revenue.

In contrast, demand for travel between the Canada-Europe routes is relatively inelastic. As a result, increases in fares would result in increases in sales revenues.

Question 3 (5 pts): How might the demand for air travel between Europe and the US be affected by a recession in which consumer incomes dropped by 3%?

The income elasticity of demand, defined as the percentage change in quantity demanded divided by percentage change in price, is 1.9 for US-Europe routes and 1.8 for Canada-Europe routes. The fact that they are both positive indicates that this kind of air travel is a normal good -- that is, demand is positively related to income.

A 3% drop in income would result in a 3 x 1.9 = 5.7% <u>decrease</u> in demand for US-Europe routes and a 3 x 1.8 = 5.4% drop in demand for Canada-Europe travel.

Table 2 shows the estimated elasticities of demand for each of three fare categories of air travel between the United States and Europe.

Table 2: Price and Income Elasticities of Demand for Air Travel between the United States and Europe

Fare Category	Price elasticity	Income elasticity
First class	-0.4	1.5
Regular economy	-1.3	1.4
Excursion	-1.8	2.4

Question 4 (5 pts): The elasticities shown above are market demand elasticities. Are price elasticities of demand for individual airlines lower or higher (in absolute value)? Explain why in a sentence or two.

Market elasticities are always lower than individual firms' demand elasticities. The reason is that there are many more substitutes for the products of a particular firm than there are for the market taken as a whole. For example, US Airways may have many competitors on its Indy-Detroit flight (such as Northwest, TWA, Continental, American); while the substitutes for air travel between Indy and Detroit are only car travel, bus, and rail travel.

Question 5 (5 pts): Suppose that the linear demand curve for flights between Indianapolis and Detroit is Q = 337.5 - 0.75 P, where P is price in dollars and Q is hundreds of passengers. The observed price is $250 and average daily volume is 150. Calculate the price elasticity of demand at this point.

$$\text{Elasticity} = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in price}}$$

$$= \frac{\frac{dQ}{Q}}{\frac{dP}{P}} = \frac{dQ}{dP} \cdot \frac{P}{Q}$$

$$= -.75 \cdot \frac{250}{150}$$

$$= -1.25$$

Question 6 (5 pts): Suppose that Northwest Airlines has a monopoly on the Indy-Detroit route. What must the marginal cost per passenger be in order for the results above to make sense?

We are looking for a value for MC that is consistent with Northwest charging a price of $250 and setting a quantity of 150 given the demand structure described.

The inverse demand curve in the above problem is

$$P = 450 - 1.33Q.$$

Thus, total revenue is

$$TR = PQ = 450Q - 1.33Q^2$$

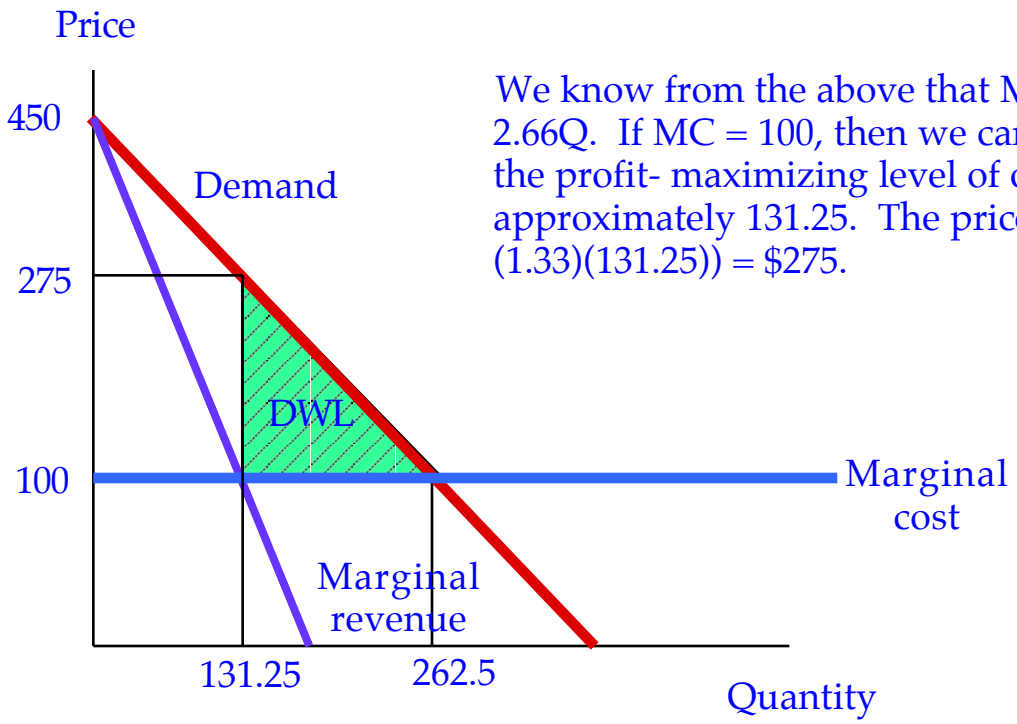
Marginal revenue is

$$MR = dTR/dQ = 450 - 2.66Q$$

At a profit maximizing output level, MR = MC. If the profit maximizing output level is 150, then it must be the case that

$$MC = 450 - (2.66)(150) = \$50.$$

Question 7 (5 pts): Illustrate this monopolist's problem below. Identify the deadweight loss by shading it in, and calculate its value. For the sake a simplicity, assume a constant marginal cost of $100. (Note: This value is different than the answer you obtained above in Question 6.)



We know from the above that MR = 450 - 2.66Q. If MC = 100, then we can conclude that the profit- maximizing level of output is approximately 131.25. The price is (450 - (1.33)(131.25)) = $275.

DWL is the net benefit that society gives up as a result of the market being monopolized. It is equal to the difference between marginal willingness to pay (as measured by the demand curve) and marginal cost over the units not produced by this firm.

From the demand curve, we know that the output level where P = MC is 337.5 - (100)(.75) = 262.5. Thus, deadweight loss is (.5)(262.5-131.25)(275-100) = $11,484.37

Excerpt from Joel J. Smith, "Airline disputes charge of gouging: Northwest says market determines Detroit fares," Detroit News, December 22, 1998.

Northwest Airlines has decided to fight back against mounting criticism that its dominance at Detroit Metropolitan Airport allows it to keep ticket prices artificially high.

Officials at the Minneapolis-based airline said Monday the fact it handles nearly 80 percent of passengers at Metro Airport has little to do with pricing policies.

"We're not charging people based on what they want to pay, but what they are willing to pay," said Tom Bach, managing director of domestic revenue management for Northwest.

Question 8 (5 pts): Evaluate Mr. Bach's argument. Did he effectively refute the charge of monopolistic behavior?

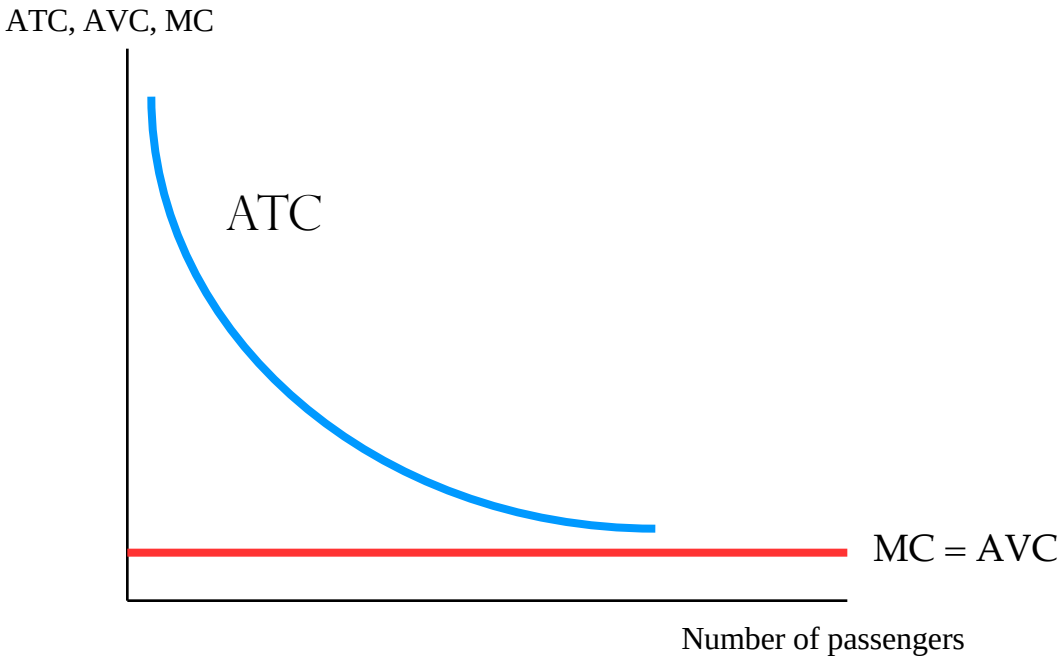
Charging people what they are willing to pay is exactly what a monopolist does! Therefore, Mr. Bach is admitting to monopolistic practices. Firms that are competitive have no control over prices and behave as price takers.

Airline costs typically include categories for food, marketing (airline advertising), maintenance, inflight service (cost of crews), ticketing, administrative expenses, fuel, and interest on debt. Some of these are sensitive to the number of flights, some are sensitive to the number of passengers, and some are fixed. Thus, what costs are variable depends on whether the flight schedule has been set.

Question 9 (3 pts): After the flight schedule is set, which costs are variable (i.e., passenger sensitive)?

After the schedule is set, the only passenger sensitive costs would be food and ticketing.

Question 10 (6 pts): Draw a plausible set of short run cost curves in the set of axes below that are consistent with the airlines' situation after their flight schedule is set. Use your diagram to explain in a paragraph why *load factors* are of great interest to airline executives. (Load factor is defined as the percentage of seats on a given flight that are occupied by fare-paying passengers.)



This suggests that for low load factors (that is, few passengers) average costs are very high and the profit margin will be correspondingly low or even negative. This is because such a large percentage of their costs are fixed and do not vary with volume. A nearly empty plane will result in losses for the firm.

Excerpt from "Northwest, kitchen workers reach deal." Detroit News, 12/24/98 p B3.

Northwest Airlines and its 148 flight kitchen employees Wednesday signed a new four-year labor contract.

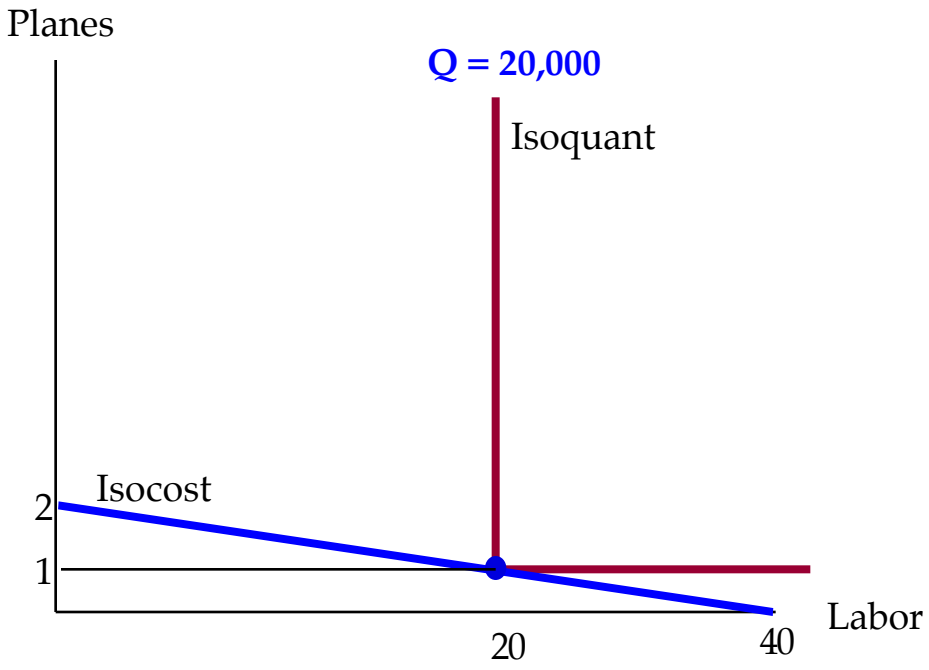
The workers, represented by the International Association of Machinists, will earn a 14-percent wage increase over the life of the contract. They also will receive a lump sum check equal to 3.5 percent of their wages for 29 months from Aug. 1, 1996. The new contract guarantees no layoffs and 50 percent increase in pension benefits.

Northwest still must resolve contract issues with its two largest unions representing the mechanics and flight attendants.

Suppose for the sake of simplicity that it takes only two inputs to produce a flight from Indy to Detroit: labor (L) and planes (P). The production function is Q = 1,000 * min{20P, L}, where L is labor in person-hours, P is number of plane-hours, and Q measures passenger-miles. The cost of labor is initially $50 and the cost of the plane is $1000 per hour.

Question 11 (8 pts): Draw the isoquant for Q =20,000 passenger miles and the isocost line that is associated with the cost-minimizing input combination. Be sure to label the axes.

To produce 20,000 passenger miles, the airline can use 1 plane and at least 20 units of labor, or 20 units of labor and at least 1 plane. This is an example of a fixed proportions production function. Obviously, the cost minimizing input combination is 1 plane and 20 units of labor.

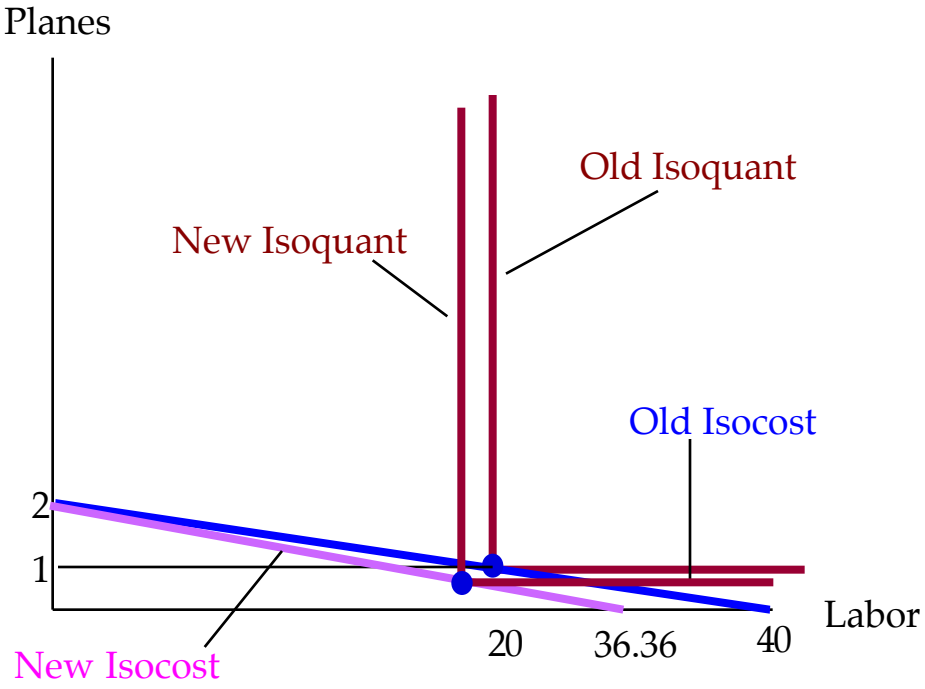


If the cost of a plane is $1000 and the cost of a unit of labor is $50, then the total cost of producing 20,000 units in the most efficient way is $1000 + (20)($50) = $2000. The isocost line associated with this level of cost is $2000 = $50L + $1000P.

Rearranging into point-slope form, we obtain P = 2 - .05L.

Question 12 (5 pts): Use your graph on the previous page to show the effect of a 10% increase in the price of labor on the firm's output decision, assuming no increase in total costs. (Note: You do not need to calculate the new output level exactly.)

If labor costs go up 10%, then a unit of labor will cost (1.1)($50) = $55. Assuming that the firm still spends $2000, the isocost line equation now becomes $2000 = $55L + $1000P, or P = 2 - .055L. The slope of the line is thus steeper. Output obviously goes down, as represented below by the movement to a lower isoquant.



The airline industry was deregulated during the Carter administration with the Airline Deregulation Act of 1978. The fundamental assumption underlying the policy change was that the market was "contestable" -- that is, that potential competition would be so vigorous because of **low barriers to entry into or exit from the industry** that there would be little opportunity to exploit monopoly power before a new entrant would move in to compete away those rents. Unsuccessful entrants would be able to dispose of their expensive capital equipment easily by selling or leasing to rival companies or to freight or mail transport services. In addition, it was assumed that large established airlines had **no inherent advantage** over small start-up airlines, i.e., that customers viewed the services of both types of competitors as perfectly substitutable.

Others disagree, claiming that factors such as limited landing slots constitute barriers to entry. Some demand studies purport to show that consumers, other things equal, prefer to fly established carriers. In addition, some studies suggest that large established airlines use techniques such as frequent flyer miles and travel agent commissions in

order to maintain a market advantage over small entrants. If this were true, then potential competition would not be effective as a restraining force and large airlines would profitably dominate the market.

The contestability hypothesis has been tested in several papers on the airline industry. Morrison and Winston[2] estimated a regression using pooled time-series cross-section data from 1978 to 1988. Their results have been adapted and reproduced below, with standard errors in parentheses.

$$\ln(\text{FARE}) = \underset{(.003)}{.501} \bullet \ln(\text{DIST}) - \underset{(.005)}{.201} * \ln(\text{NEC}) - \underset{(.0004)}{.0014} * \ln(\text{POT})$$

where: ln indicates the natural log
FARE = round trip fare in dollars
DIST = distance in miles of the particular route
NEC = number of competitors who also serve that route
POT = potential competition, as measured by carriers that serve at least one of the airports in a particular city-pair but who do not serve that particular route

[For example, if there are three carriers that fly found-trip between Detroit and Indy, NEC is 3. If there are 10 carriers that that operate out of either Detroit or Indy but who don't fly between them POT = 10.]

Question 13 (5 pts): Do the estimated coefficients have the sign that you would expect? Explain.

Yes, they do. One would expect that longer flights cost more, so the coefficient on distance should be positive. Both actual and potential competition should have negative signs, i.e., should put downward pressure on fares.

Question 14 (5 pts): Are they statistically significant at some reasonable level? How do you know?

You answer this question by looking at the t-statistic, which is (Actual value - Expected value under the null hypothesis)/Standard Error. The expected value under the null in all cases is 0. All three coefficients have t-statistics greater than 3.5 in absolute value, indicating that they are all significantly different from zero at a reasonable level.

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[2] Morrison, S., and C. Winston, "The Dynamics of Airline Pricing and Competition," American Economic Review, May 1990, pp. 389-391.

Question 15 (5 pts): What do you conclude about the contestability hypothesis?

Potential competition seems to put downward pressure on price. The coefficient should be negative and it is in fact significant, but the number is so small that, economically speaking, it is not very important. Thus we distinguish between statistical significance and economic importance of a variable.

Question 16 (5 pts): In the specification above, notice that fuel costs were not included. Suppose that fuel costs went up at the same time that the number of potential competitors went up. How might a proponent of the contestability hypothesis use this information to attack the regression results?

Changes in the omitted variable, fuel costs, might bias the regression results. An increase in fuel costs should increase fares, other things equal. If the contestability hypothesis were true, an increase in potential competitors should, other things equal, lower fares. These two effects tend to offset each other, however, and the estimated coefficient for potential competitors may be smaller in absolute value than the true population parameter because of the confounding effect of the omitted variable.

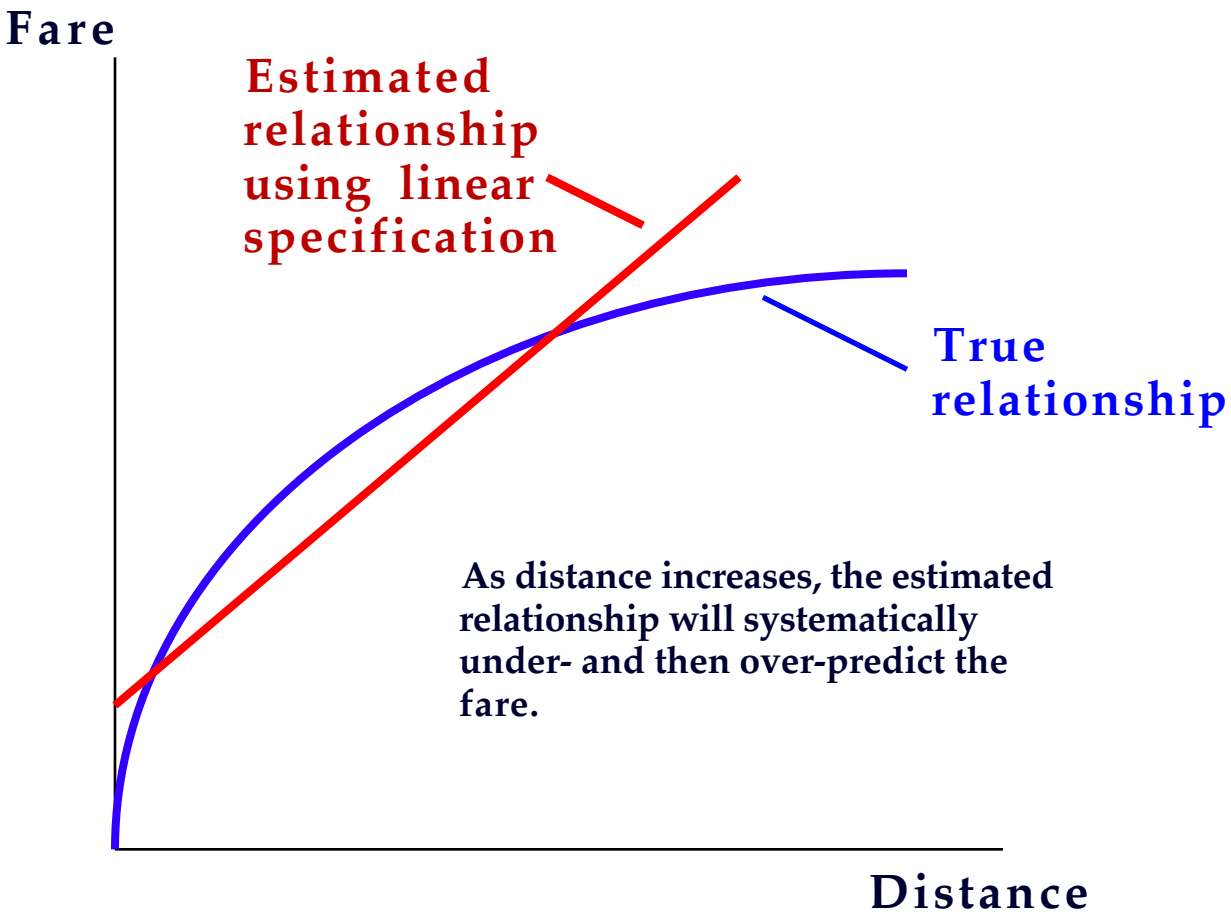
Question 16 (5 pts): Suppose for the moment that the fare depends only on distance and that the true relationship is

$$\ln(\text{Fare}) = 0 + 0.5\ln(\text{Dist}) + \varepsilon \quad .$$

An airline economist (who doesn't know the true relationship) says "let's employ this linear specification:

$$\text{Fare} = \beta_0 + \beta_1(\text{Dist}) + \varepsilon$$

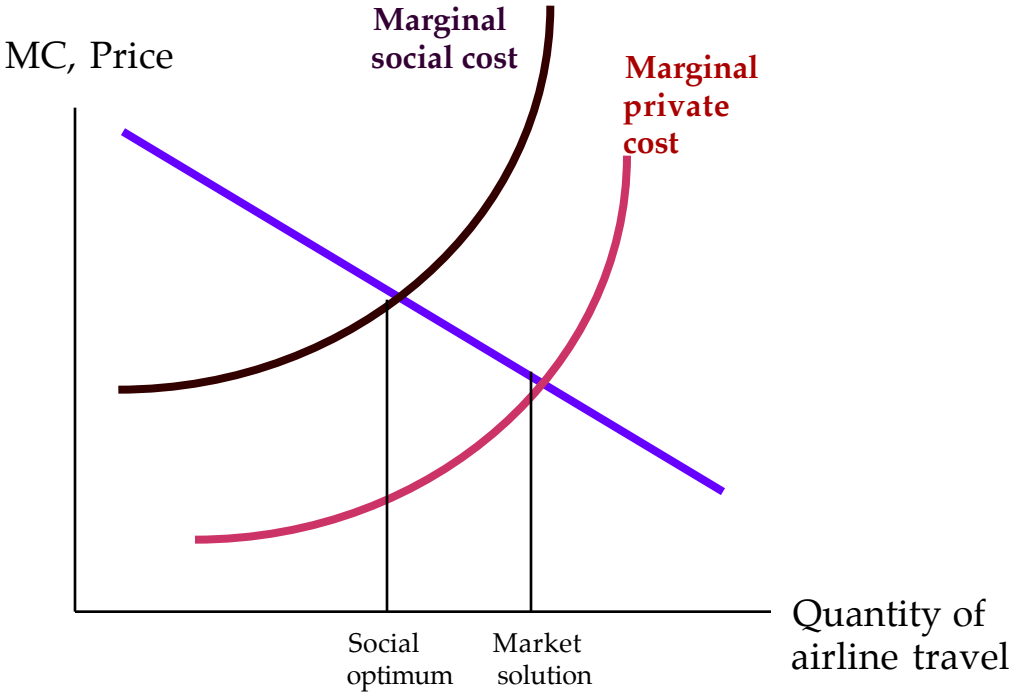
to estimate the relationship between round-trip fare and route length and then use the resulting estimates to predict our competitor's fares." What problems will she encounter?



It is convenient to live near a major airport, but one of the drawbacks is the amount of noise generated by incoming and outgoing flight traffic. In other words, noise is a negative production externality.

Question 17 (5 pts): Use a diagram, with quantity of air travel on the horizontal axis and dollars (price, marginal cost) on the vertical axis, to show that the market will <u>oversupply</u> air travel in the absence of government intervention. (If you cannot draw the graph, please explain in words the intuition behind what is going on.)

This question deals with the notion about externalities. The example given is one of a negative production externality. Specifically, the production of airline travel services generates additional social costs (noise) that are not taken into account by the private decision-maker (the airline). The solution we see in the market is where marginal private cost and demand intersect. The solution that maximizes total social net benefit is where marginal social cost and demand intersect.



All major airports have noise limits or restrictions that are usually non-tradable and allocated across airlines according to each firm's share of passenger traffic. Some airports have taken the step of imposing noise surcharges on carriers that exceed their specified limits.. For example, the schedule for the Dresden airport's surcharges are shown below.

	NOISE SURCHARGE Rate (German marks per ton)	
	International Flights	Domestic Flights
Type 1 Aircract	16.75	16.75
Type II Aircraft	18.75	18.75
Type III Aircraft	29.20	29.20

Question 19 (5 pts): On the graph you drew for Question 18 on the previous page, show the effect of such a surcharge on the market result. Below, describe the results and speculate on how the appropriate level of surcharge might be chosen. (If you cannot draw the graphs, explain in words what you think is going on.)

A surcharge is designed to increase the private costs in order to make them more closely resemble the true marginal social cost. Of course such an action would cause airlines to reduce air traffic and thus move toward the social optimum.