ECONOMICS IN PRACTICE

Case Study in Marginal Analysis: An Ice Cream Parlor

The following is a description of the decisions made in 2000 by the owner of a small ice cream parlor in Ohio. After being in business for 1 year, this entrepreneur had to ask herself whether she should stay in business.

The cost figures on which she based her decisions are presented next. These numbers are real, but they do not include one important item: the managerial labor provided by the owner. In her calculations, the entrepreneur did not include a wage for herself, but we will assume an opportunity cost of $30,000 per year ($2,500 per month).

FIXED COSTS

The fixed components of the store's monthly costs include the following:

Rent (1,150 square feet)	$2,012.50
Electricity	325.00
Interest on loan	737.50
Maintenance	295.00
Telephone	65.00
Total	$3,435.00

Not all the items on this list are strictly fixed, however. Electricity costs, for example, would be slightly higher if the store produced more ice cream and stayed open longer, but the added cost would be minimal.

VARIABLE COSTS

The ice cream store's variable costs include two components: (1) behind-the-counter labor costs and (2) cost of making ice cream. The store hires employees at a wage of $5.15 per hour. Including the employer's share of the Social Security tax, the gross cost of labor is $5.54 per hour. Two employees work in the store at all times. The full cost of producing ice cream is $3.27 per gallon. Each gallon contains approximately 12 servings. Customers can add toppings free of charge, and the average cost of the toppings taken by a customer is about $.05:

Gross labor costs	$5.54/hour
Costs of producing one gallon of ice cream (12 servings per gallon)	$3.27
Average cost of added toppings per serving	$.05

REVENUES

The store sells ice cream cones, sundaes, and floats. The average price of a purchase at the store is $1.45. The store is open 8 hours per day, 26 days a month, and serves an average of 240 customers per day:

Average purchase	$1.45
Days open per month	26
Average number of customers per day	240

From the preceding information, it is possible to calculate the store's average monthly profit. Total revenue is equal to 240 customers × $1.45 per customer × 26 days open in an average month: *TR* = $9,048 per month.

PROFITS

The store sells 240 servings per day. Because there are 12 servings of ice cream per gallon, the store uses exactly 20 gallons per day (240 servings divided by 12). Total costs are $3.27 × 20, or $65.40, per day for ice cream and $12 per day for toppings (240 × $.05). The cost of variable labor is $5.54 × 8 hours × 2 workers, or $88.64 per day. Total variable costs are therefore $166.04 ($65.40 + $12.00 + $88.64) per day. The store is open 26 days a month, so the total variable cost per month is $4,317.04.

Adding fixed costs of $3,435.00 to variable costs of $4,317.04, we get a total cost of operation of $7,752.04 per month. Thus, the firm is averaging a profit of $1,295.96 per month ($9,048.00 – $7,752.04). *This is not an "economic profit" because we have not accounted for the opportunity cost of the owner's time and efforts.* In fact, when we factor in an implicit wage of $2,500 per month for the owner, we see that the store is suffering *losses* of $1,204.04 per month ($1,295.96 – $2,500.00).

Total revenue (*TR*)	$9,048.00
Total fixed cost (*TFC*)	3,435.00
+ Total variable cost (*TVC*)	4,317.04
Total costs (*TC*)	7,752.04
Total profit (*TR* – *TC*)	1,295.96
Adjustment for implicit wage	2,500.00
Economic profit	–1,204.04

Should the entrepreneur stay in business? If she wants to make $2,500 per month and she thinks that nothing about her business will change, she must shut down in the long run. However, two things keep her going: (1) a decision to stay open longer and (2) the hope for more customers in the future.

OPENING LONGER HOURS: MARGINAL COSTS AND MARGINAL REVENUES

The store's normal hours of operation are noon until 8 P.M. On an experimental basis, the owner extends its hours until 11 P.M. for 1 month. The following table shows the average number of additional customers for each of the added hours:

Hours (P.M.)	Customers
8–9	41
9–10	20
10–11	8

Assuming that the late customers spend an average of $1.45, we can calculate the marginal revenue and the marginal cost of staying open longer. The marginal cost of one serving of ice cream is $3.27 divided by 12 = $0.27 + .05 (for topping) = $0.32. (See the table that follows.)

Marginal analysis tells us that the store should stay open for 2 additional hours. Each day that the store stays open from 8 P.M. to 9 P.M. it will make an added profit of $59.45 – $24.20, or $35.25. Staying open from 9 P.M. to 10 P.M. adds $29.00 – $17.48, or $11.52, to profit. Staying open the third hour, however, *decreases* profits because the marginal revenue generated by staying open from 10 P.M. to 11 P.M. is less than the marginal cost. The entrepreneur decides to stay open for 2 additional hours per day. This adds $46.77 ($35.25 + 11.52) to profits each day, a total of $1,216.02 per month.

By adding the 2 hours, the store turns an economic loss of $1,204.04 per month into a small ($11.98) profit after accounting for the owner's implicit wage of $2,500 per month.

The owner decided to stay in business. She now serves over 350 customers per day, and the price of a dish of ice cream has risen to $2.50 while costs have not changed very much. In 2001, she cleared a profit of nearly $10,000 per month.

Hour (P.M.)	Marginal Revenue (*MR*)	Marginal Cost (*MC*)	Added Profit per Hour (*MR* – *MC*)
8–9	$1.45 × 41 = $59.45	Ice cream: $0.32 × 41 = $13.12	$35.25
		Labor: 2 × $5.54 = 11.08	
		Total $24.20	
9–10	1.45 × 20 = $29.00	Ice cream: $0.32 × 20 = $6.40	$11.52
		Labor: 2 × $5.54 = 11.08	
		Total $17.48	
10–11	1.45 × 8 = $11.60	Ice cream: $0.32 × 8 = $2.56	–$2.04
		Labor: 2 × $5.54 = 11.08	
		Total $13.64	

A Numerical Example Table 8.6 presents some data for another hypothetical firm. Let us assume that the market has set a $15 unit price for the firm's product. Total revenue in column 6 is the simple product of $P \times q$ (the numbers in column 1 times $15). The table derives total, marginal, and average costs exactly as Table 8.4 did. Here, however, we have included revenues, and we can calculate the profit, which is shown in column 8.

TABLE 8.6 Profit Analysis for a Simple Firm

(1) *q*	(2) *TFC*	(3) *TVC*	(4) *MC*	(5) *P* = *MR*	(6) *TR* (*P* × *q*)	(7) *TC* (*TFC* + *TVC*)	(8) Profit (*TR* – *TC*)
0	$10	$ 0	$–	$15	$ 0	$10	$–10
1	10	10	10	15	15	20	–5
2	10	15	5	15	30	25	5
3	10	20	5	15	45	30	15
4	10	30	10	15	60	40	20
5	10	50	20	15	75	60	15
6	10	80	30	15	90	90	0

Column 8 shows that a profit-maximizing firm would choose to produce 4 units of output. At this level, profits are $20. At all other output levels, they are lower. Now let us see if "marginal" reasoning leads us to the same conclusion.

First, should the firm produce at all? If it produces nothing, it suffers losses equal to $10. If it increases output to 1 unit, marginal revenue is $15 (remember that it sells each unit for $15) and marginal cost is $10. Thus, it gains $5, reducing its loss from $10 each period to $5.

Should the firm increase output to 2 units? The marginal revenue from the second unit is again $15, but the marginal cost is only $5. Thus, by producing the second unit, the firm gains $10 ($15 – $5) and turns a $5 loss into a $5 profit. The third unit adds $10 to profits. Again, marginal revenue is $15 and marginal cost is $5, an increase in profit of $10, for a total profit of $15.