# Recitation 1: Elasticity, Demand and Supply

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# Contents

# 1 Exercise 1: Computing the Demand Elasticity

Given the following price-quantity combinations $A = (5, 3)$, $B = (1, 4)$:

1. derive the linear demand function that generates them;
2. provide a graphical representation of the direct demand curve and the inverse demand curve;
3. compute the price elasticity of the demand curve in the two points.

## 1.1 Solution

Given the linearity assumption, we can use the equation of a line passing through two points to obtain the slope of the demand function:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\partial p(Q)}{\partial Q} = \frac{1-5}{4-3} = -4$$

The intercept of the demand curve with the $y$ axis, called $k$ can be found by sustitution:

$$1 = -4(4) + k \implies k = 17$$

Hence, the general equation of the inverse demand curve is: $P(Q) = 17 - 4Q$. The equation of the direct demand curve is: $Q = 4.25 - 0.25P$.

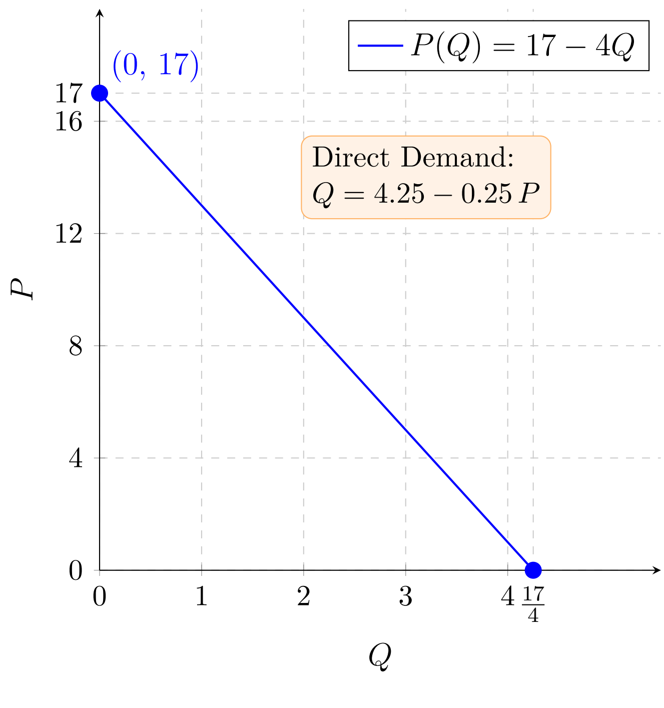


Figure 1: Graphical representation of the inverse demand curve

Now let's compute the value of the elasticity at the two points. Recall the general formula $\epsilon = \frac{\partial Q}{\partial P}\frac{Q}{P}$. Hence, we have

$$\epsilon_A = -0.25\frac{5}{3}$$
$$\epsilon_B = -0.25\frac{1}{4}$$

# 2 Exercise 2: Revenues, Elasticities, Profits

Take the following total cost and total revenue functions:

$$TC = 3Q$$
$$TR = (12 - 2Q)Q$$

Prove that the module of the elasticity at the point of maximum revenue is 1, while at the point of maximum profits is $\geq 1$.

## 2.1 Solution

The inverse demand function and the direct demand function are equal to:

$$P(Q) = \frac{TR}{Q} = 12 - 2Q \Longrightarrow Q = 6 - \frac{1}{2}P$$

The elasticity is then $\epsilon = -\frac{1}{2}\frac{P}{Q}$.
The maximum revenue value of $Q$ satisfies $\frac{\partial TR}{\partial Q} = 0 \Longrightarrow 12 - 4Q = 0 \Longrightarrow Q = 3$. At this value, the price is $P(3) = 12 - 6 = 6$. The elasticity is $\epsilon = -\frac{1}{2}\frac{6}{3} = -1$.

The value of $Q$ that maximizes profits instead has to satisfy:

$$\frac{\partial TR(Q)}{\partial Q} - \frac{\partial C(Q)}{\partial Q} = 0$$
$$12 - 4Q - 3 = 0$$
$$Q^* = \frac{9}{4}$$

The corresponding price will be $P(\frac{9}{4}) = 12 - 2\frac{9}{4} = 7.5$. The elasticity becomes $\epsilon = -\frac{1}{2}\frac{7.5}{\frac{9}{4}} = -\frac{15}{9} < -1$.

# 3 Exercise 3: Total Cost, Average Cost, Marginal Cost

The table below represents, for each output level, the corresponding levels of labour and capital that are required in the production process.

| Output | Labour | Capital |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 1 | 2 |
| 2 | 2 | 4 |
| 3 | 3 | 6 |
| 4 | 4 | 8 |
| 5 | 5 | 10 |

Table 1: Production Data

Suppose fixed costs are equal to 10, unit labour costs are constant and equal to 2, and unit capitla costs are constant and equal to 5. For each level of output, define:

1. the total cost faced by the firm;
2. the value of the average cost function and marginal cost function

### 3.1 Solution

The solution is reported in the table below.

| Output | Tot. Cost | Avg. Cost | Marginal Cost |
|---|---|---|---|
| 0 | 10 | $\infty$ | 12 |
| 1 | 22 | 22 | 12 |
| 2 | 34 | 17 | 12 |
| 3 | 46 | 15.3 | 12 |
| 4 | 58 | 14.5 | 12 |
| 5 | 70 | 14 | 12 |

Table 2: Cost functions

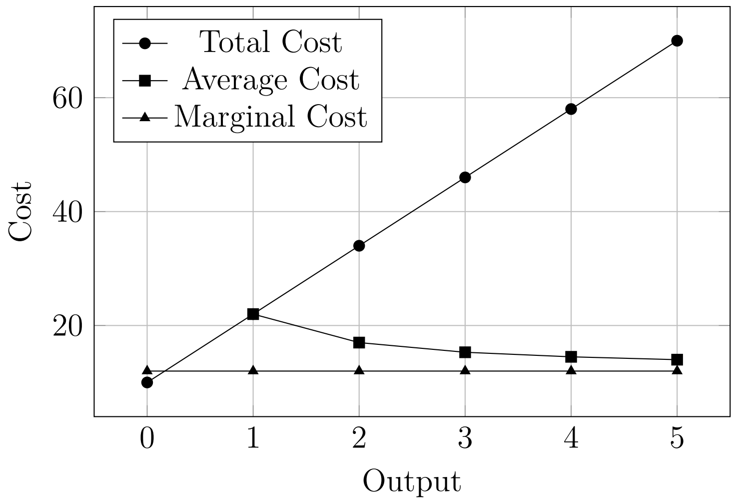


Figure 2: Cost Functions

## 4 Individual and Aggregate Supply Functions

Firm 1 and 2 have the following supply functions:

$$Q_1 = 2p$$
$$Q_2 = \max\{p - 2; 0\}$$

Represent them graphically, as well as the aggregate industry supply function.

### 4.1 Solution

Firm and industry supplies are displayed in the table and figure below.

| $p$ | $Q_1$ | $Q_2$ | $Q_tot$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 2 | 0 | 2 |
| 2 | 4 | 0 | 4 |
| 3 | 6 | 1 | 7 |
| 4 | 8 | 2 | 10 |
| 5 | 10 | 3 | 13 |
| 6 | 12 | 4 | 16 |

Table 3: Price-Quantity combinations

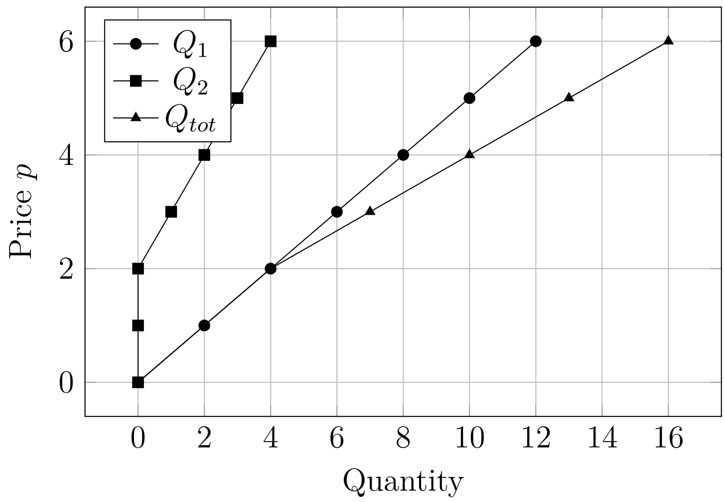


Figure 3: Inverse supply functions