

The Firm, Production and Cost

1. $Revenue = R(p, y) = \sum_{j=1}^m p_j y_j$
2. $Cost = c(x, w) = C = \sum_{i=1}^n w_i x_i = C(y, w)$ where x is chosen optimally
3. $Profit = \pi = \sum_{j=1}^m p_j y_j - \sum_{i=1}^n w_i x_i = py - w_1 x_1 - w_2 x_2$
4. Production function $f(x) = \max_{y \in P(x)} [y: (x, y) \text{ is an element of the production set}]$
 $= \max_{y \in P(x)} [y]$
5. Fixed cost $TFC = \sum_{i=n_1}^n w_i \bar{x}_i$
6. Total variable cost $TVC = \sum_{i=1}^{n_1} w_i x_i$
7. Total cost (TC) $TC = TFC + TVC = \sum_{i=1}^n w_i x_i$
8. Total (physical) product $TPP = y = f(x_1, x_2, x_3, \dots, x_n)$
 $y = f(x_1, x_2, x_3, \dots, x_n)$
 $= 1 - 200x_1 - 20x_2 + 40x_1^2 + 200x_1x_2 + 20x_2^2 - 2x_1^3 - x_2^3$
9. Marginal (physical) product $MP_i = \frac{\Delta y}{\Delta x_i} = \frac{y^1 - y^0}{x_i^1 - x_i^0}$ or $MP_i = \frac{\partial f(x)}{\partial x_i} = \frac{\partial y}{\partial x_i}$
10. Average (physical) product $AP_i = \frac{f(x)}{x_i} = \frac{y}{x_i}$
11. Average, total and marginal product
 - a. When the marginal curve is positive, the total curve will be rising
 - b. When the marginal curve is rising, the total curve will be rising at an increasing rate (becomes steeper)
 - c. When the marginal curve is positive but falling, the total curve will be rising at a decreasing rate (becomes flatter)
 - d. When the marginal curve is greater than the average curve, the average curve is rising
 - e. When the marginal and average curves are equal, the average curve does not change (is usually at a maximum or minimum point)
 - f. When the marginal curve is less than the average curve, the average curve is falling
 - g. For a production function MP and AP intersect at the maximum of AP

Data

x_1	x_2	y TPP	APP 1	A MPP 1	MPP 1	TFC	TVC	TC	AFC	AVC	ATC	AMC	MC
0.0	1.0	0.0			0.00	20.0	0.00	20.00					
1.0	1.0	38.0	38.00	38.00	74.00	20.0	6.00	26.00	0.526	0.158	0.684	0.158	0.081
2.0	1.0	144.0	72.00	106.00	136.00	20.0	12.00	32.00	0.139	0.083	0.222	0.057	0.044
3.0	1.0	306.0	102.00	162.00	186.00	20.0	18.00	38.00	0.065	0.059	0.124	0.037	0.032
4.0	1.0	512.0	128.00	206.00	224.00	20.0	24.00	44.00	0.039	0.047	0.086	0.029	0.027
5.0	1.0	750.0	150.00	238.00	250.00	20.0	30.00	50.00	0.027	0.040	0.067	0.025	0.024
6.0	1.0	1008.0	168.00	258.00	264.00	20.0	36.00	56.00	0.020	0.036	0.056	0.023	0.023
7.0	1.0	1274.0	182.00	266.00	266.00	20.0	42.00	62.00	0.016	0.033	0.049	0.023	0.023
8.0	1.0	1536.0	192.00	262.00	256.00	20.0	48.00	68.00	0.013	0.031	0.044	0.023	0.023
9.0	1.0	1782.0	198.00	246.00	234.00	20.0	54.00	74.00	0.011	0.030	0.042	0.024	0.026
10.0	1.0	2000.0	200.00	218.0	200.00	20.0	60.00	80.0	0.010	0.030	0.040	0.028	0.030
11.0	1.0	2178.0	198.00	178.0	154.00	20.0	66.00	86.0	0.009	0.030	0.039	0.034	0.039
12.0	1.0	2304.0	192.00	126.0	96.00	20.0	72.00	92.0	0.009	0.031	0.040	0.048	0.063
13.0	1.0	2366.0	182.00	62.0	26.00	20.0	78.00	98.0	0.008	0.033	0.041	0.097	0.231
14.0	1.0	2352.0	168.00	-14.0	-56.00	20.0	84.00	104.0	0.009	0.036	0.044		

12. Average cost

Average fixed cost is given by $AFC = \frac{FC}{y} = \frac{TFC}{y}$

Average variable cost is given by $AVC = \frac{VC}{y} = \frac{TVC}{y}$

Average (total) cost is given by $ATC = AC = \frac{TC}{y} = \frac{C}{y} = AFC + AVC$

13. Marginal cost $MC = \frac{\Delta C(y,w)}{\Delta y} = \frac{\Delta TC(y,w)}{\Delta y}$ or $MC = \frac{dC(y,w)}{dy}$

14. Average and marginal costs

- When marginal cost is below the average cost, the average cost curve is falling
- When the marginal and average costs are equal, the average cost curve does not change (is at minimum point)
- When the marginal cost is greater than the average cost, average cost is rising
- The marginal cost curve will intersect AVC and ATC at their minimum points