

PRODUCTION AND SUPPLY: INDIVIDUAL AND INDUSTRY SUPPLY CURVES

PART ONE: INTRODUCTION

Let's examine a situation where we have three small cedar fence cutters in western Tennessee supplying a multi-county region with split cedar fencing. We will assume that the market is purely competitive (i.e. no single producer can influence the price of fencing by changing its production levels). The cedar fence pieces are sold in various lengths, but production capacity is measured in standard lots or bundles of 50 rails that are 12' in length.

Firm A has the following cost structure:

Fixed Costs = \$6500
Production Capacity of 900 bundles per year

Table 1. Firm A variable cost schedule.

Production	Variable Cost of Production
300	\$ 4,000
400	4,500
500	5,500
600	7,000
700	9,000
800	11,500
900	14,500

Firm B's production capacity and costs are as follows

Fixed Costs = \$4500
Production Capacity of 900 bundles per year

Table 2. Firm B variable cost schedule.

Production	Variable Cost of Production
300	\$ 6,000
400	7,500
500	9,500
600	12,000
700	15,000
800	18,500
900	22,500

And finally, firm C's production costs are as follows:

Fixed Costs = \$10,500
 Production Capacity of 1200 bundles per year

Table 3. Firm C variable cost schedule.

Production	Variable Cost of Production
500	\$ 7,000
600	7,500
700	8,500
800	10,000
900	12,000
1000	14,500
1100	17,500
1200	21,000

PART TWO: SUPPLY CURVE FOR AN INDIVIDUAL FIRM

Let's just look at firm A's cost structure over various levels of production. The table below shows Firm A's average fixed, variable and total costs.

Table 4. Firm A fixed, variable, total and average cost schedule.

FIRM A				Avg. Fixed	Avg. Var.	Avg. Tot.
Production	Fixed Cost	Variable Cost	Total Cost	Cost	Cost	Cost
300	6,500	4,000	10,500	\$21.67	\$13.33	\$35.00
400	6,500	4,500	11,000	\$16.25	\$11.25	\$27.50
500	6,500	5,500	12,000	\$13.00	\$11.00	\$24.00
600	6,500	7,000	13,500	\$10.83	\$11.67	\$22.50
700	6,500	9,000	15,500	\$9.29	\$12.86	\$22.14
800	6,500	11,500	18,000	\$8.13	\$14.38	\$22.50
900	6,500	14,500	21,000	\$7.22	\$16.11	\$23.33

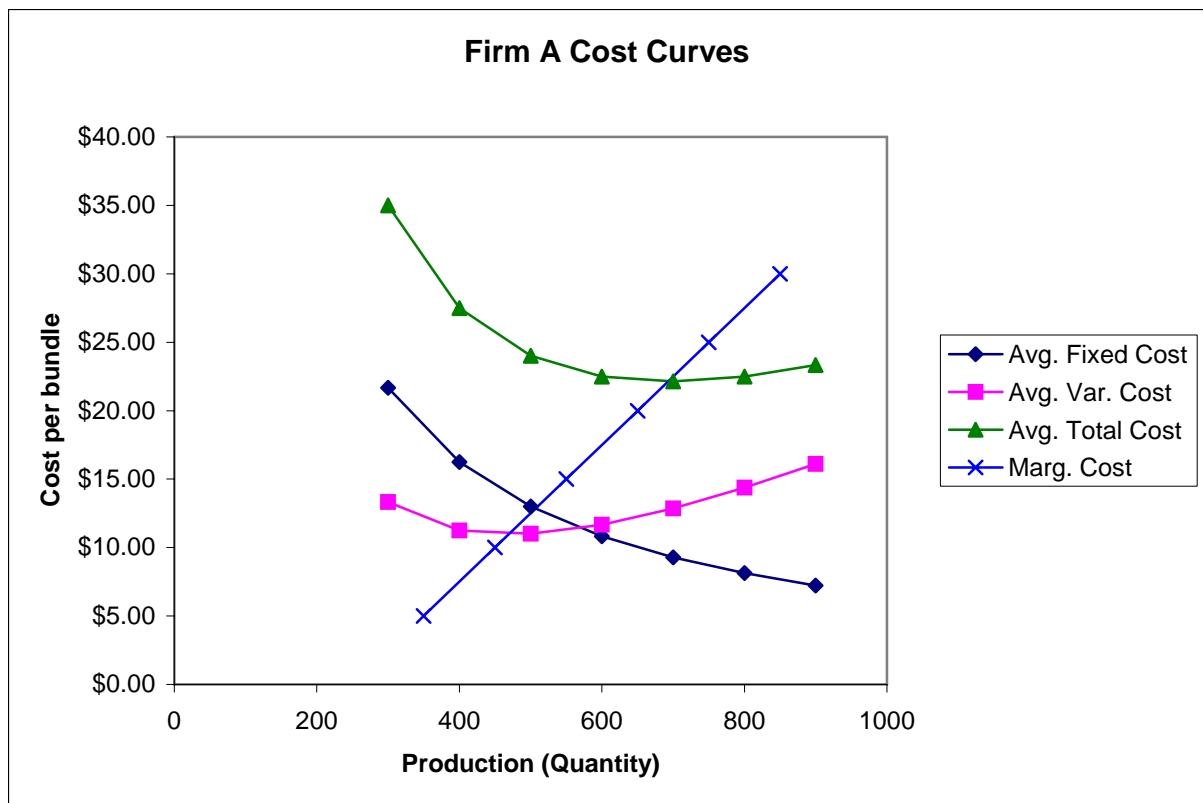
We can also calculate the firm's marginal costs. For example, we can determine from the data in table 1 that the marginal cost for Firm A to increase production from 300 to 400 bundles is \$500, or a marginal cost of \$5 per bundle. The marginal cost of increasing production from 400 to 500 bundles is \$1000 (\$5,500 - \$4,500), or a per-bundle MC of \$10. Because we are calculating the marginal cost between two production values, we would report them at the mid-point of the production values as shown in table 5.

Table 5. Marginal costs of production for Firm A.

Production	MC
350	5
450	10
550	15
650	20
750	25
850	30

Figure 1 shows the average costs and marginal costs for Firm A plotted on a chart. The firm's short-run supply curve is the portion of the marginal cost curve that lies above the average variable cost curve. If the market price for a bundle of cedar fencing were \$20, this firm would remain in operation (producing about 640 bundles). But, over the long run, this firm would be losing money, and would eventually leave the industry. If the price of a bundle were \$10, this firm would not produce any bundles at all and would immediately shut down. If the price of bundles were \$30, then this firm would be making true economic profit.

Figure 1. Average and Marginal Cost Curves for Firm A.



We will calculate the average and marginal costs for Firms B and C in a similar manner to determine their contribution to the overall industry supply in the next section.

PART THREE: INDUSTRY SUPPLY CURVES

When we determine the supply for an industry, we must add all the individual firm's supply at any given marginal price (adding supply quantity horizontally across a given price). Let's look at all three firms and proceed to determine the industry supply, and then look at industry demand and production of each firm.

The first step is to calculate each firm's marginal costs of production to obtain their individual supply curves. Table 6, (below) shows all three firms and their marginal costs for the various levels of output. Note that the quantity for marginal costs is at the mid-point of the two production levels involved in calculating the marginal cost.

Table 6. Total variable and marginal costs of production for firms A, B, and C.

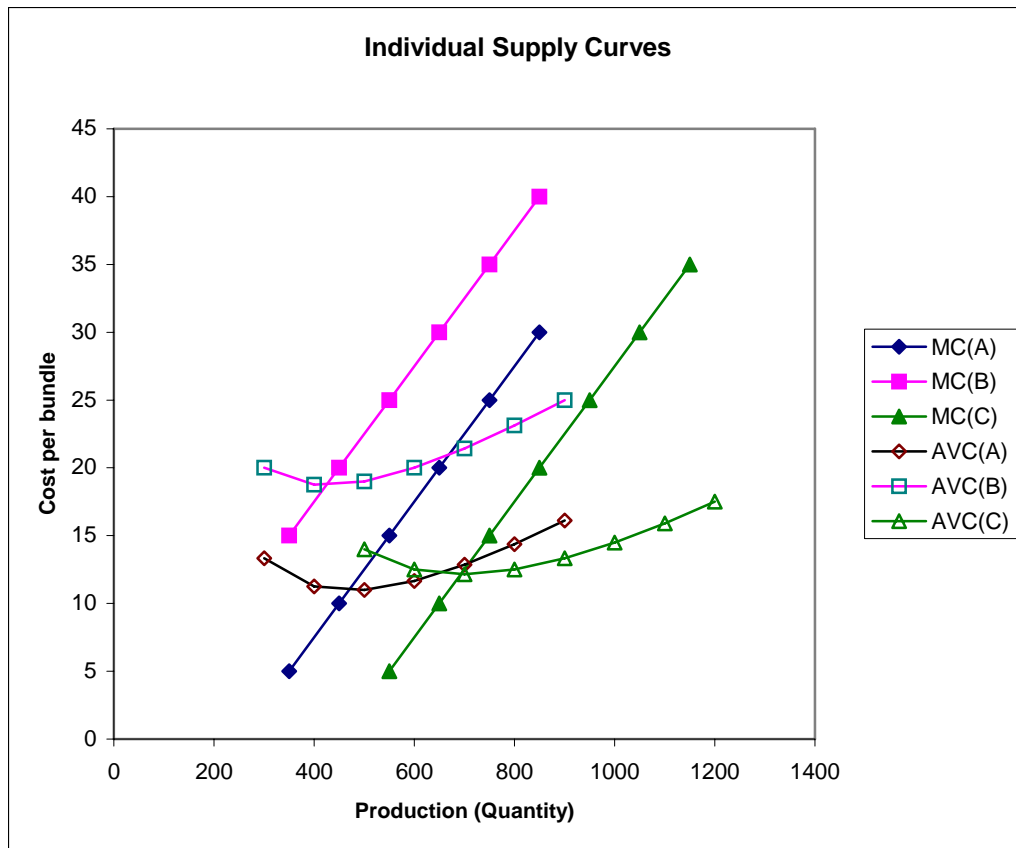
Production	Total Variable Costs of Production			Quantity	Marginal Costs of Production		
	Firm A	Firm B	Firm C		Firm A	Firm B	Firm C
300	4000	6000					
400	4500	7500		350	5	15	
500	5500	9500	7000	450	10	20	
600	7000	12000	7500	550	15	25	5
700	9000	15000	8500	650	20	30	10
800	11500	18500	10000	750	25	35	15
900	14500	22500	12000	850	30	40	20
1000			14500	950			25
1100			17500	1050			30
1200			21000	1150			35

Now, we have the marginal costs, but we aren't quite there yet. Remember, each firm's individual supply curve is only that portion of the marginal cost curve that lies ABOVE average variable costs. Table 7 (below) gives each firm's average variable and average total costs. The average variable costs for each firm from table 7 are plotted for you in figure 2 along with the marginal cost curves (from table 6).

Table 7. Average and total variable costs for firms A, B, and C.

Quantity	Average Variable Cost			Average Total Cost		
	Firm A	Firm B	Firm C	Firm A	Firm B	Firm C
300	13.33	20.00		35.00	35.00	
400	11.25	18.75		27.50	30.00	
500	11.00	19.00	14.00	24.00	28.00	35.00
600	11.67	20.00	12.50	22.50	27.50	30.00
700	12.86	21.43	12.14	22.14	27.86	27.14
800	14.38	23.13	12.50	22.50	28.75	25.63
900	16.11	25.00	13.33	23.33	30.00	25.00
1000			14.50			25.00
1100			15.91			25.45
1200			17.50			26.25

Figure 2. Marginal cost (MC) and average variable cost (AVC) curves



We now can determine the individual firm's supply curves. Firms A and B will not produce any product at prices less than \$15, because these values are below their average variable cost curves. Firm C won't produce anything unless the price is \$20. (Actually, you can see in figure 2 that the average variable cost for firms A and B and C intersect their respective marginal cost curves at values of \$11, \$19 and \$12. But since we only have tabular data, we'll assume that production for Firms A and C will begin with a price of \$15, and for Firm C at \$20.)

By adding up each firm's production at each marginal cost level we'll obtain the overall industry production at various prices. There will be no production below a price of \$15 per bundle. If the price per bundle is \$15, using the data found in the right side of table 6, (which has the marginal costs for each firm at various production levels), we see that Firm A would produce 550 bundles, Firm B would produce 0 bundles (remember, firm B won't start production until price = \$20), and Firm C would produce 750 bundles, yielding an industry supply of 1300 bundles. If the price per bundle increases to \$20, then Firm A produces 650, Firm B produces 450, and Firm C produces 850, for a total of 1950 bundles. Using this logic, the industry-wide supply curve is derived:

Table 8. Industry Supply

Price	Quantity
15	1300
20	1950
25	2250
30	2550
35	2750
40	2850

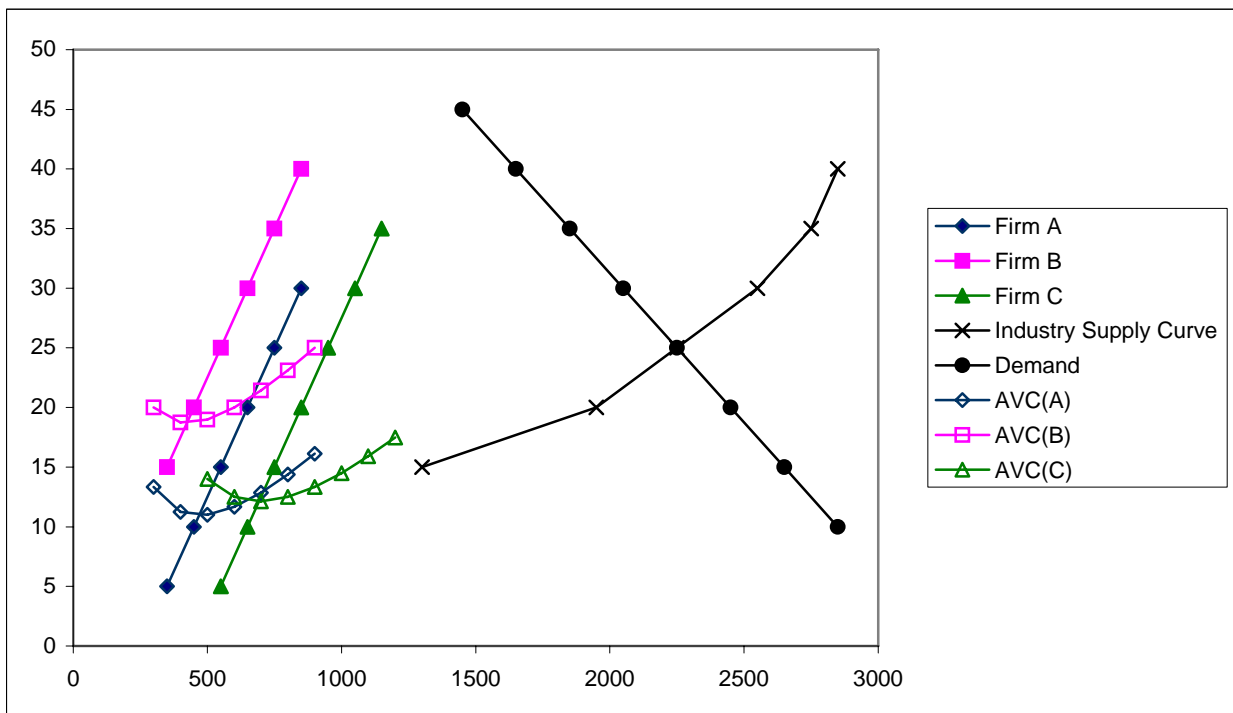
Now, let's say that table 9 provides the regional demand schedule for cedar fence bundles:

Table 9. Regional demand for cedar fence bundles.

Number of Bundles	Price
2850	10
2650	15
2450	20
2250	25
2050	30
1850	35
1650	40
1450	45

Let's now plot the individual and industry supply curves and the regional demand in figure 3. We can see that the market will clear at a price of \$25 per bundle and a quantity of 2250 bundles per year.

Figure 3. Individual and industry total supply and demand for fence bundles.



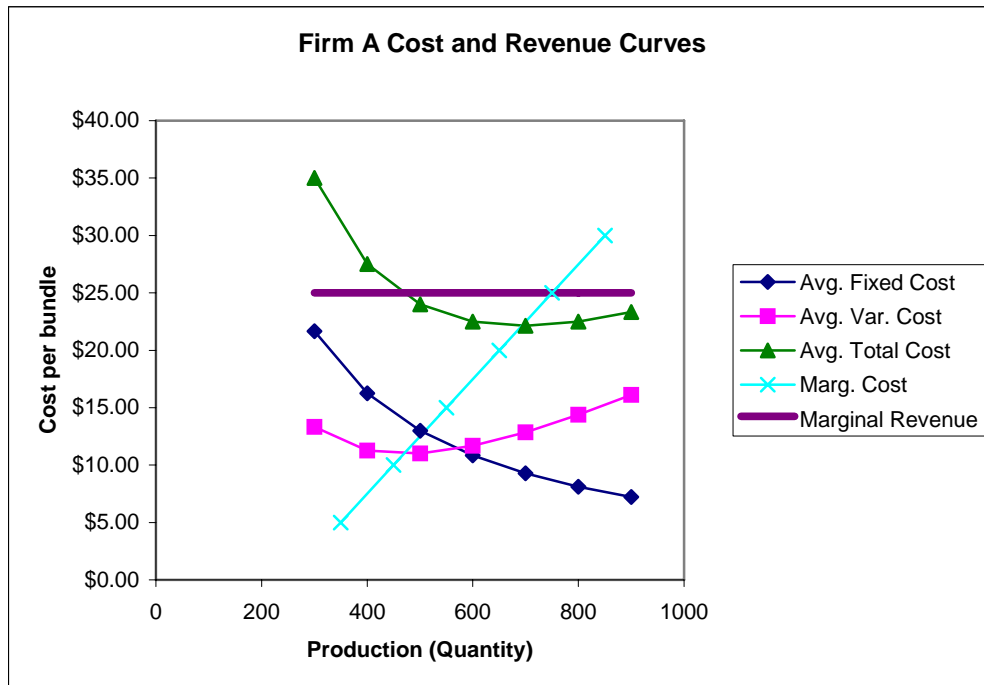
Firm A will produce 750 bundles, Firm B 550 bundles, and Firm C 950 bundles. The market price is above all the firms' average variable cost, so, at least for the short run, all three firms will produce cedar fencing. We've made the connection between individual firm's production and the total market, now let's go back and see how each firm is affected by the overall market price.

PART FOUR: LOOKING BACK AT THE INDIVIDUAL FIRMS

We now have learned that the price the market will set for a bundle of fencing material is \$25. Now we can look at how this market price impacts each firm. We'll look at each firm individually, and see what happens under the market price of \$25.

Firm A will produce 750 bundles and have total revenue of \$18,750. Fixed costs are \$6500, and production costs are \$9000 on the first 700 units of production and \$25/unit on the last 50 units of production (\$1250) for a total cost of \$16,750. Firm A will have a true economic profit of \$2000, assuming that production costs included all necessary returns to the owner of the firm. As you can see in figure 4, the MR curve is above the average total cost curve. The average cost values for Firm A were presented previously on page 2 of this handout.

Figure 4. Firm A cost and revenue curves.



Firm B will produce 550 bundles and have a total revenue of \$13,750. Total costs are \$4500 (fixed), and 10750 (variable: 9500 + 1250) for a total cost of \$15,250. This firm is covering its variable costs, but is not covering its fixed costs. This firm will eventually leave the industry unless it can change its cost structure. We can see from figure 5 and table 10 (below) that the point where $MC=MR$ is BELOW the average total cost curve.

Figure 5. Firm B cost and revenue curves.

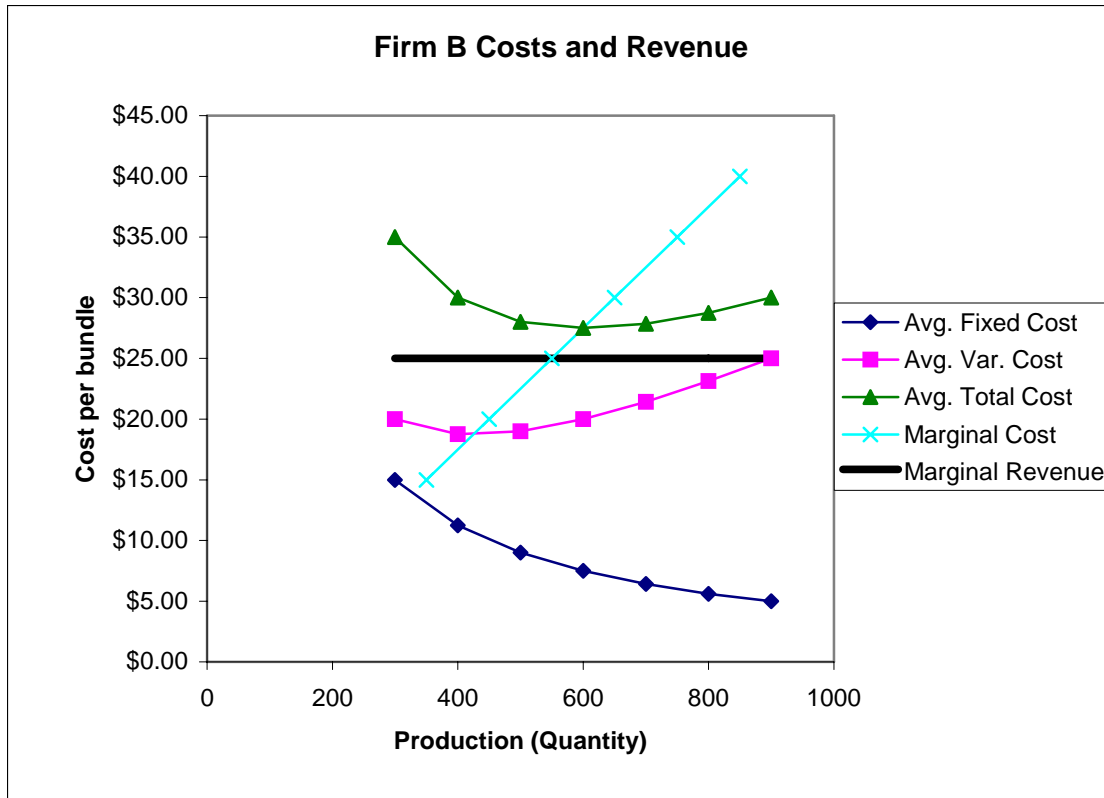


Table 10. Firm B's fixed, variable, total and average cost data.

FIRM B	Fixed Cost	Variable Cost	Total Cost	Avg. Fixed Cost	Avg. Var. Cost	Avg. Tot. Cost
300	4500	6000	10500	\$15.00	\$20.00	\$35.00
400	4500	7500	12000	\$11.25	\$18.75	\$30.00
500	4500	9500	14000	\$9.00	\$19.00	\$28.00
600	4500	12000	16500	\$7.50	\$20.00	\$27.50
700	4500	15000	19500	\$6.43	\$21.43	\$27.86
800	4500	18500	23000	\$5.63	\$23.13	\$28.75
900	4500	22500	27000	\$5.00	\$25.00	\$30.00

Finally, we have firm C, which will produce 950 units for at total revenue of \$23,750. Total costs will be \$10,500 (fixed) and 13,250 (variable: 12,000 + 1,250). We see that total costs are just equal to total revenue, so there is no true economic profit. This company will operate in the long term because it is meeting all its costs (including payments to the owners). However, if the market price declines, or this firm has any cost increases, this situation might change. Figure 6 and table 12 show this firm's cost and marginal revenue curve. Notice that the ATC and MR and MC curves all meet at \$25. This firm is truly a "marginal" firm.

Figure 6. Firm C's costs and revenues.

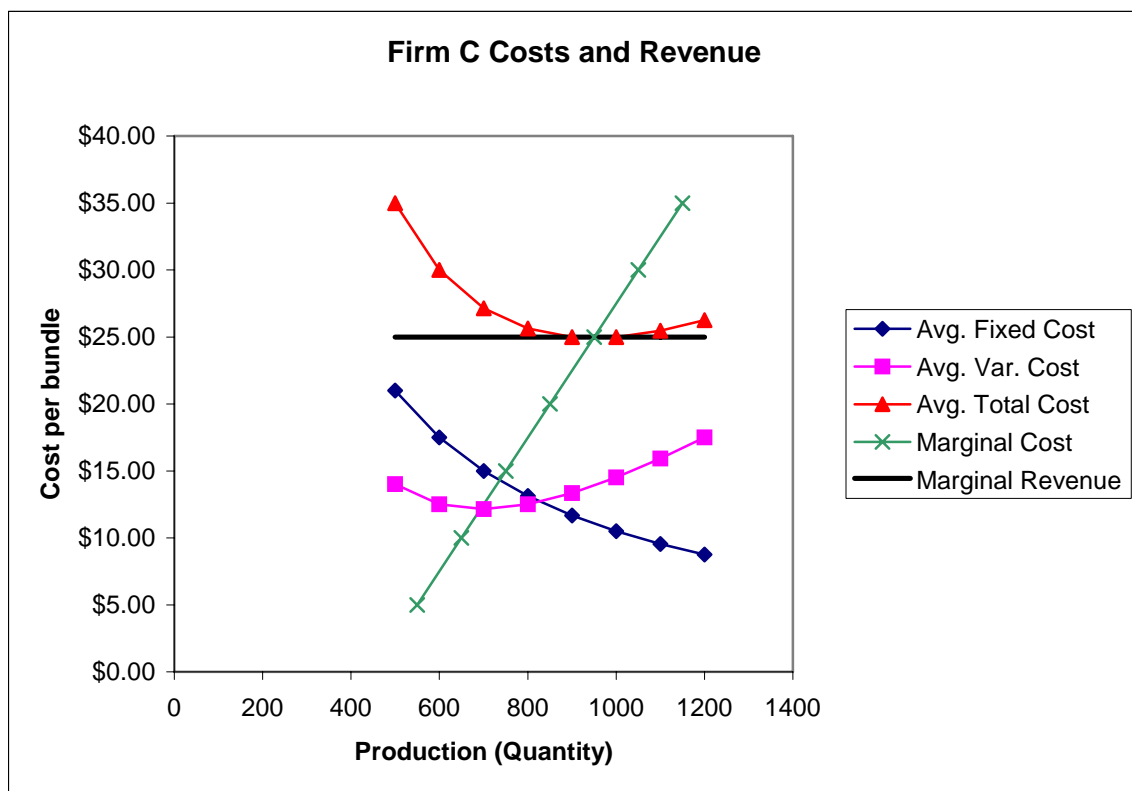


Table 12. Fixed, variable, total and average costs for Firm C.

FIRM C	Fixed Cost	Variable Cost	Total Cost	Avg. Fixed Cost	Avg. Var. Cost	Avg. Tot. Cost
Production						
500	10500	7000	17500	\$21.00	\$14.00	\$35.00
600	10500	7500	18000	\$17.50	\$12.50	\$30.00
700	10500	8500	19000	\$15.00	\$12.14	\$27.14
800	10500	10000	20500	\$13.13	\$12.50	\$25.63
900	10500	12000	22500	\$11.67	\$13.33	\$25.00
1000	10500	14500	25000	\$10.50	\$14.50	\$25.00
1100	10500	17500	28000	\$9.55	\$15.91	\$25.45
1200	10500	21000	31500	\$8.75	\$17.50	\$26.25