

## **Incremental Analysis for Decision Making**

### **(Relevant to Paper II – PBE Management Accounting and Finance)**

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Incremental analysis is a key topic in decision-making questions. These questions include deciding on acceptance of a special order; optimal production mix with constrained resources; adding or dropping a product line or a segment; making or buying a component or part; selling, scrapping or rebuilding defective products and further processing of joint products after being split off.

This is a long topic involving many applications. In this article we focus on acceptance of a special order and adding or dropping a produce line or segment. Incremental means difference. The best way to analyze the situation is to compare the profit and loss before and after taking the decision.

#### **Acceptance of a special order**

This refers to the situation when a company receives requests to provide a good or service which is not in their regular schedule. Examples include production of ad-hoc orders on apparel, or the provision of special cleaning services. Before management makes the decision of whether or not to accept the special order, they have to assess if additional profit brought in by the acceptance.

Suppose PBE Company produces caps for sports brand names. The company currently produces and sells 200,000 caps and has a monthly fixed cost of \$500,000. The variable cost per cap is \$4 which consists of \$3 direct material and \$1 direct labour. Each cap is sold for \$10 to sports retailers. If PBE receives a special order for 15,000 caps at \$9 each, should management accept this order?

### Situation 1 – spare capacity

First we simplify the situation by assuming that PBE has spare capacity to take up the special order. The fixed cost of \$500,000 is incurred regardless of whether PBE takes up the order or not. This cost is a sunk cost which is irrelevant to our decision-making process. The only concern is whether after accepting the order will bring in additional profit. We can present the result as follows:

|         | Order rejected | Order accepted |
|---------|----------------|----------------|
| Revenue | \$0            | \$135,000      |
| Cost    | \$0            | (\$60,000)     |
| Profit  | \$0            | \$75,000       |

When the order is rejected, no additional revenue is received or cost incurred. If the order is accepted, PBE will have additional revenue of \$135,000 ( $\$9 \times 15,000$ ) and additional cost (variable) of \$60,000 ( $\$4 \times 15,000$ ), bringing in additional (or incremental) profit of \$75,000.

### Situation 2 – full capacity

The picture will be different if PBE is already running at full capacity. When full capacity is reached, there is no surplus to accept an additional order. If it is accepted, the current orders will have to be given up. Accepting an order of 15,000 caps of \$9 each means PBE has to give up the original order worth \$10 each. The result can be presented as follows:

|                  | Order rejected | Order accepted |
|------------------|----------------|----------------|
| Revenue          | \$0            | \$135,000      |
| Cost             | \$0            | (\$60,000)     |
| Opportunity cost | \$0            | (\$90,000)     |
| Profit           | \$0            | (\$15,000)     |

The only difference to Situation q is the opportunity cost of \$90,000, which is the cost of giving up 15,000 caps worth \$10 minus the variable cost of \$4. If the order is accepted, the loss is \$15,000. Therefore, the order is not accepted.

### Situation 3 – full capacity and avoidable fixed overhead

This time the situation changes slightly; the \$500,000 fixed overhead can be reduced by \$100,000 can be reduced if we accept the special order. Assume again there is no spare capacity. The result now is :

|                          | Order rejected | Order accepted |
|--------------------------|----------------|----------------|
| Revenue                  | \$0            | \$135,000      |
| Cost                     | \$0            | (\$60,000)     |
| Avoidable fixed overhead | \$0            | \$100,000      |
| Opportunity cost         | \$0            | (\$90,000)     |
| Profit                   | \$0            | \$85,000       |

Though PBE still needs to bear the opportunity cost of \$90,000, the avoidable fixed overhead saving of \$100,000 gives an overall profit of \$85,000 if the order is accepted.

### **Minimum quoted price**

Sometimes candidates are asked about the minimum price quoted if the order is accepted. The opportunity cost is \$90,000 and avoidable fixed cost is \$100,000 giving a total relevant cost of (\$10,000). If the order for 15,000 caps is accepted, the minimum price quoted =  $(\$10,000)/15,000 = \$0.67 + \$4$  (variable cost of the cap) = \$3.333.

|                          | Order rejected | Order accepted |
|--------------------------|----------------|----------------|
| Revenue                  | \$0            | \$50,000       |
| Cost                     | \$0            | (\$60,000)     |
| Avoidable fixed overhead | \$0            | \$100,000      |
| Opportunity cost         | \$0            | (\$90,000)     |
| Profit                   | \$0            | \$0            |

### Situation 4 – limited labour hours

Assume now that each labour hour costs \$20 and there are only 10,000 labour hours available. The variable cost per cap is still \$4 which consists of \$3 direct material and \$1 direct labour. Each cap uses  $\$1/\$20 = 1/20$  hour or 3 minutes' labour time. Assume that a special order uses \$3 material and 2 minutes' labour time. The size of the order is 15,000 caps. We can determine the minimum quoted price as follows.

First, we look at the original contribution income statement:

|                  |                  | per cap |
|------------------|------------------|---------|
| Sales            | \$2,000,000      | \$10    |
| Direct materials | (\$600,000)      | \$3     |
| Direct labour    | (\$200,000)      | \$1     |
| Fixed overhead   | (\$500,000)      |         |
| Profit           | <u>\$700,000</u> |         |

The original contribution to fixed costs and profit is \$1,200,000. When we face limiting factor like labour hours, we divide this contribution by the limiting factor:

Contribution / labour hours = \$1,200,000 / 10,000 labour hours = \$120 / labour hour = \$2/minute

On the basis of accepting special order of 15,000 caps, each cap uses \$3 material and 2 minutes of labour time which is equivalent to 2 minutes / 60 minutes x \$20 = \$2/3

|  | per cap |
|--|---------|
| Direct materials                       | \$3     |
| Direct labour                          | \$2/3   |
| Contribution (2 minutes x \$2 /minute) | \$4     |
| Minimum sales price                    | \$7 2/3 |

We can verify our answer by producing the contribution income statement for the individual caps:

|                  | Original         | Special order   | Total            |
|------------------|------------------|-----------------|------------------|
| Sales            | \$1,900,000      | \$115,000       | \$2,015,000      |
| Direct materials | (\$570,000)      | (\$45,000)      | (\$615,000)      |
| Direct labour    | (\$190,000)      | (\$10,000)      | (\$200,000)      |
| Fixed overhead   | (\$500,000)      | \$0             | (\$500,000)      |
| Profit           | <u>\$640,000</u> | <u>\$60,000</u> | <u>\$700,000</u> |

When the special order is received, it uses up 15,000 caps. This is equivalent to 500 labour hours. In this situation, the labour hours are the limiting factor. We have 10,000 labour hours only. Taking the special order means using 500 labour hours leaving only 9,500 labour hours for the original production. This is

equivalent to 190,000 caps (9,500 hours x 60 minutes / 3 minutes). If the special order is taken at the minimum quoted price of \$7 2/3, the total profit is still \$700,000 which is same as before taking the special order.

### Add or drop a product line or segment

The technique used in deciding whether or not to accept a special order can be extended to adding or dropping a product line or segment. All we need is to compare the profit and loss before the decision and after the decision.

Suppose PBE Company has three business segments: cap, apparel and accessories. The contribution income statement is as follows:

|                     | Cap         | Apparel     | Accessories | Total         |
|---------------------|-------------|-------------|-------------|---------------|
| Sales revenue       | \$2,000,000 | \$1,200,000 | \$400,000   | \$3,600,000   |
| Variable cost       | (\$800,000) | (\$840,000) | (\$360,000) | (\$2,000,000) |
| Contribution margin | \$1,200,000 | \$360,000   | \$40,000    | \$1,600,000   |
| Fixed overhead      | (\$500,000) | (\$200,000) | (\$120,000) | (\$820,000)   |
| Net profit          | \$700,000   | \$160,000   | (\$80,000)  | \$780,000     |

The accessories segment reports a loss and management wants to remove that segment. When it is removed, the fixed cost cannot be reduced immediately. This may be due to fixed rental charges and labour costs. We may compare the results of keeping or removing the accessories segment:

|                     | Continue    | Remove      |
|---------------------|-------------|-------------|
| Sales revenue       | \$400,000   | \$0         |
| Variable cost       | (\$360,000) | \$0         |
| Contribution margin | \$40,000    | \$0         |
| Fixed overhead      | (\$120,000) | \$120,000   |
| Net profit          | (\$80,000)  | (\$120,000) |

When the segment stays, the loss is \$80,000 but this loss rises to \$120,000 if the segment is removed. Since the loss would be even greater if the segment were removed, it is better to keep it. The result is confirmed by presenting the revised contribution income statement. The fixed overhead of \$120,000 of the accessories segment is split according to the sales revenue of the remaining two segments.

|                     | Cap                | Apparel            | Total                |
|---------------------|--------------------|--------------------|----------------------|
| Sales revenue       | \$2,000,000        | \$1,200,000        | \$3,200,000          |
| Variable cost       | <u>(\$800,000)</u> | <u>(\$840,000)</u> | <u>(\$1,640,000)</u> |
| Contribution margin | \$1,200,000        | \$360,000          | \$1,560,000          |
| Fixed overhead      | <u>(\$575,000)</u> | <u>(\$245,000)</u> | <u>(\$820,000)</u>   |
| Net profit          | <u>\$625,000</u>   | <u>\$115,000</u>   | <u>\$740,000</u>     |

The overall profit is \$740,000, compared with overall profit of \$780,000 when the accessories segment is kept. Therefore it is better to keep this segment.

Note that as well as considering quantitative reasons, we need to assess non-quantitative factors such as loss of customers, reputation and reduced overall market share when deciding whether or not to drop a segment.