CHAPTER 1 Cost behaviour

Introduction

As a manager, you might find yourself asking your accountant for the cost of one of your products. The answer you expect to be given is probably a specific amount of money, e.g. £49.55. If your accountant replies ‘Why do you want to know?’ you may think he (or she) is being unnecessarily awkward and assume that he is in a bad mood for some reason or other. However, the accountant’s reply is actually very sensible, even though it would have been better for him to reply ‘The answer depends on why you want to know.’ At first, this may seem very strange to you but a product has several different costs, each of which serves a different purpose. As you will see in the next few chapters of this book, there are several different costing systems in existence, each giving a different answer to your original question.
The absorption costing system gives the absorption cost; the variable costing system gives the variable cost; and the activity-based costing system gives the activity-based cost. They all give the correct cost in the context of their own system. Each system is a financial model based on its own rules and assumptions. Different rules and assumptions result in different numerical answers. For example, the product in question may have an absorption cost of £49.55, a variable cost of £20.95 and an activity-based cost of £142.00. Each of these three answers is correct.

The word ‘cost’ is a general word and is often used in a general sense. However, when a manager asks an accountant for the cost of a product, the manager usually has a specific purpose in mind. The reason why the accountant replied ‘Why do you want to know?’ is that he wanted to determine the manager’s specific purpose so that he could give the right answer. He was actually trying to be helpful rather than awkward! In this chapter, we will look at the different ways in which costs can behave and see how some of these form the bases of the different costing systems.

Learning objectives

Having worked through this chapter you should be able to:

- explain the difference between manufacturing, trading and providing services;
- explain the difference between product and period costs;
- explain the difference between variable and fixed costs;
- explain what semi-variable costs and stepped fixed costs are;
- find fixed and variable elements of semi-variable costs using the high–low method;
- draw a scattergraph based on periodic cost and output data and interpret it;
- explain in outline what regression analysis is;
- explain the difference between direct and indirect costs;
- compare variable cost analysis with absorption cost analysis;
- explain the basis for analysing activity-based costs;
- say what relevant costs are used for.

Types of business

There are three main categories of businesses: manufacturers, traders and service businesses. Manufacturers make the goods they sell by converting raw materials into finished products. Traders buy in goods and sell them without altering them in any significant way (they may be repackaged and re-presented). Service businesses create
intangible products – for example, banks, accountants, lawyers, financial advisers, freight companies, railways, theatrical agents, education and training institutions. So costs can be described as manufacturing costs, trading costs or service costs.

It is worth noting that the type of organization affects the format of the financial accounts. Gross profit is meaningful for a manufacturer or trader but much less so for a service business. Production accounts (to calculate the cost of production) are essential for manufacturers but not applicable to traders or service businesses. However, it is wise not to be too pedantic about this as services tend to be mainly intangible but often include minor tangible items such as chequebooks, sets of accounts, property deeds, share certificates, bills of lading, rail tickets, contracts of employment and degree certificates. In these cases you would probably agree that gross profit is inappropriate.

On the other hand, manufacturers often include a small service element in their products. When you buy a new car, the first two services may be free of charge and there may be a three-year warranty. The price of a new computer usually includes the right to use a selection of software applications for word processing, spreadsheets, databases, etc.

But what about pubs, restaurants and clubs? Are they manufacturers, traders or service providers? The answer is, of course, that they can be all three. The meals are created on the premises, the drinks are bought in and waiting at table, pouring drinks, etc., are pure services. The same applies to residential health clubs and activity holidays where you learn to produce something tangible such as a painting or a piece of pottery.

Figure 1.1 illustrates the relationship between these different types of organization. The darker-coloured circle shows the approximate position of a restaurant. The empty circle represents firms such as furniture makers, and the lighter-coloured circle could represent a national chain of off-licences.

**Product and period costs**

There are two ways of including costs in the profit and loss account. First, they can be included as part of the production cost of the products made. The production cost of all goods sold in the period gives the total *cost of sales* figure, which is deducted from *sales revenue* to give *gross profit*. Closing stock of finished goods is also valued at production cost. This is how production costs of goods unsold at the year-end are carried forward to
the year in which they are sold. (This complies with the accounting rule/concept of realization.) These costs are known as **product costs**.

Second, the full amount of non-production overheads for marketing, administration, etc. appears directly in the profit and loss account of the period in which they were incurred. No attempt is made to apportion them to different financial years. These costs are known as **period costs**.

Product and period costs will be discussed further in Chapter 11, ‘Comparison of profits under absorption and variable costing’.

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**Variable and fixed costs**

**Variable costs**

These are costs which vary **in total** with a measure of activity – for example, the total cost of raw materials increases as output increases (see Figure 1.2b). Take the example of a business making furniture – if the number of chairs produced doubles then the cost of raw materials also doubles.

[Note: Direct labour is always a variable cost when calculating product costs. However, when looking at the overall total costs of a business, it is often thought of as a fixed cost (provided operatives are employed on a ‘permanent’ basis, e.g. paid monthly).]

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**Figure 1.2** Patterns of variable and fixed cost behaviour
Fixed costs

These are costs incurred for a period of time, which, within a given range of production and/or sales activity, do not change (see Figure 1.2c). Continuing the furniture-making example above, if the number of chairs produced doubles, the business rates on the premises do not change.

Note that variable costs can be calculated per unit of output but that fixed costs refer to the business as a whole. Variable costing assumes that the variable cost per unit stays the same over a range of activity (see Figure 1.2a). This means that total variable costs increase linearly with activity (see Figure 1.2b).

Great care must be taken if fixed cost per unit is used in calculations. This measure will change every time the number of units changes, i.e. fixed cost per unit is not fixed!

Stepped fixed costs

When a certain level of production and/or sales activity is reached, there is a sudden increase in fixed costs from F1 to F2 (see Figure 1.2d). For example, when output increases significantly, it may be necessary to put on an extra work shift. This occurs at activity level A and entails extra costs for items such as supervision, security, heating and lighting, etc.

Semi-variable costs

Although there are several costs which are either purely variable or purely fixed, many costs are semi-variable. The utilities, such as telephone and electricity, often have a fixed cost element such as line rental or a standing charge which has to be paid irrespective of usage. In addition, there is also a cost per unit used. The graph of the semi-variable cost (see Figure 1.2e) combines the features of graphs (b) and (c).

If the semi-variable cost covers a range of activity including a stepped fixed cost, it would behave as shown in graph (f). This graph is obtained by combining graphs (b) and (d).

Try the following question for yourself (answer at the end of the chapter).

Match the following cost descriptions to the appropriate graph in Figure 1.3.

a) This graph shows a variable cost with a price discount activated after a certain quantity has been purchased.

b) This graph shows a semi-variable cost which reaches a maximum at a specified quantity of purchases.

c) This graph shows a variable cost with 10 free units for every 100 bought.

d) This graph shows the fixed cost per unit.

e) This graph shows a variable cost which has a minimum charge.

f) This graph shows the variable cost of a scarce item. When local supplies have been exhausted, it has to be purchased abroad, entailing extra transport costs.
Analysis of semi-variable costs into their fixed and variable elements

It is not just the utilities that have semi-variable costs. Many other costs, such as security and maintenance, also follow this pattern. Often, only the total amounts of these semi-variable costs are known and the fixed and variable elements have to be worked out mathematically. Three alternative ways of doing this are shown below.

The high–low method

Figure 1.4 shows the machine maintenance costs and the output level of products for the first six monthly periods of the year.

Only two sets of monthly information are used, one from the highest-output month (month 3 = 600 units) and the other from the lowest-output month (month 6 = 500 units).

<table>
<thead>
<tr>
<th>Month</th>
<th>Output (units)</th>
<th>Maintenance cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>586</td>
<td>12,340</td>
</tr>
<tr>
<td>2</td>
<td>503</td>
<td>11,949</td>
</tr>
<tr>
<td>3</td>
<td>600</td>
<td>12,400</td>
</tr>
<tr>
<td>4</td>
<td>579</td>
<td>12,298</td>
</tr>
<tr>
<td>5</td>
<td>550</td>
<td>12,075</td>
</tr>
<tr>
<td>6</td>
<td>500</td>
<td>12,000</td>
</tr>
</tbody>
</table>

Figure 1.4 Monthly maintenance costs
Highest (month 3) 600 units £12,400
Less: Lowest (month 6) 500 units £12,000
Difference 100 units £400

Since both the £12,400 and the £12,000 include the fixed cost element, this is eliminated by the subtraction and the £400 difference is due solely to the variable cost of the 100 units difference.

Variable cost per unit produced = £400/100 units = £4/unit

Using this in month 6:

Variable cost of 500 units = 500 × £4 = £2,000
Total cost of 500 units = £12,000
Therefore, fixed cost of 500 units = £10,000

These cost elements can be checked by applying them to the other month used, month 3:

Variable cost of 600 units = 600 × £4 = £2,400
Fixed cost of 600 units = £10,000
Therefore, total cost of 600 units = £12,400

This shows the calculations to be correct. However, if any of the other months not used in the calculation is chosen to test the results, it will probably not work! This is because the high–low method uses the information from only two months. It ignores all the other information. It assumes that the relationship between the cost and production output is a linear one, i.e. if all the monthly points were plotted on a graph, they would all be points on the same straight line. In fact, this is not so, as you can probably see from Figure 1.4. For instance, month 2 has a higher output (503 units) than month 6 (500 units) but a lower maintenance cost.

It can be seen that the high–low method is a fairly crude way of estimating the fixed and variable cost elements of a semi-variable cost. However, its advantage is that it is easy to understand and easy to calculate.

**Scattergraphs**

If the monthly information shown above (in the high–low method) was plotted on a graph it would look like Figure 1.5.

The line of best fit is drawn on the graph by eye. The intersection of this line and the vertical cost axis gives the fixed cost element. This is read from the graph and should be close to £10,000.

The slope of the line,

\[
\frac{\text{change in cost}}{\text{change in output}} = \frac{2,384}{600} = £3.97
\]
gives the variable cost per unit. You may remember the equation for a straight line is

\[ y = a + bx \]

where \(a\) is the intersection with the vertical axis and \(b\) is the slope of the line. In this context, the fixed cost is \(a\) and the variable cost per unit is \(b\).

The disadvantage of this method is that drawing the line of best fit by eye is subjective and different individuals will produce slightly different lines. However, it does have the advantage of using all the available information and, like the high–low method, a scattergraph will give a workable estimate and is easy to understand.

**Regression analysis**

This method is similar to the scattergraph but the line of best fit is not drawn by eye. The equation for the line is calculated by a statistical technique called regression analysis. It is sometimes known as least squares regression. It is more precise than the other two methods but it is much more complex mathematically. The technique of regression analysis is not covered by this book. It is sufficient for you to know of its existence and availability if needed.

The most important thing to remember is that, although it is more precise than the high–low and scattergraph methods, it still only gives an estimate of the fixed and variable cost elements. The extra complexity involved may not be worth the improvement in accuracy gained.

![A scattergraph](image_url)
Self-assessment question S1.2

Try the following question for yourself (answer at the end of the chapter).

As the manager of an Indian restaurant with a take-away service, you have been asked to prepare a detailed budget for next year. To help you with this, you need to know the fixed and variable cost elements of your delivery cost to customers’ homes.

The following information is available from the monthly accounts. Calculate the fixed and variable cost elements using the high–low method.

<table>
<thead>
<tr>
<th>Month</th>
<th>No. of deliveries</th>
<th>Total delivery cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>403</td>
<td>662.70</td>
</tr>
<tr>
<td>August</td>
<td>291</td>
<td>561.90</td>
</tr>
<tr>
<td>September</td>
<td>348</td>
<td>613.20</td>
</tr>
<tr>
<td>October</td>
<td>364</td>
<td>627.60</td>
</tr>
<tr>
<td>November</td>
<td>521</td>
<td>768.90</td>
</tr>
<tr>
<td>December</td>
<td>387</td>
<td>648.30</td>
</tr>
</tbody>
</table>

Absorption costs: direct and indirect

Direct cost

This is expenditure which can be economically identified with, and specifically measured in, a product.

Consider an advertising agency specialising in the production of television adverts. The cost of hiring a celebrity to appear in one such advert is a measurable direct cost of that advert. Similarly, if the company is a furniture manufacturer, the cost of materials used to make a chair and the pay of the operative assembling it are measurable direct costs of that chair.

Indirect cost (or overhead)

This is expenditure which cannot be economically identified with, and specifically measured in, a product.

There are many, many different overheads including expenses such as the supervisor’s pay, depreciation of fixed assets, business rates and insurance. Somehow, a proportion of these non-measurable expenses has to be included in the total product cost. Absorption costing is one way of doing this. It is based on the assumption that costs can be analysed into their ‘direct’ and ‘indirect’ components. For each product, the direct cost is measured but the indirect cost is estimated.

Absorption cost = direct cost + indirect cost
The estimates of indirect costs are usually based on some connection or correlation between the cost and a measure such as machine hours used, direct labour hours used or total cost of direct materials used. Absorption costing is the subject of Chapter 9.

**Comparison of alternative cost analyses**

Variable costing analyses total costs into fixed and variable components. Absorption costing analyses total costs into direct and indirect components. In itself, this is not problematical as these two systems of costing, variable and absorption, are independent financial models. However, it is not unusual to be confused by these terms and how they interrelate. The aim of Figure 1.6 is to clarify these relationships.

![Figure 1.6 Alternative cost analysis](image)

**Cost analysis by activity**

This analysis is based on the principle that costs are caused by activities and that activities are caused by products or services. The activity-based cost of a product is a result of determining the costs of all the activities caused by that product. This principle is fundamentally different from the correlation principle used in absorption costing.

Activities are identified and their costs calculated before being attached to products via a measure of the activity called a cost driver. Activity-based costing gives significantly more accurate product costs than absorption costing but it has difficulties of its own and does not give 100% accurate costs. This subject is discussed at length in Chapter 10.
Each product can have several different costs.

The cost of a product depends on the purpose for which this information is required.

Business types can be divided into three categories: manufacturing, trading and providing services.

Period costs are written off to the profit and loss account of the period for which they were incurred.

Product costs are built into the production cost of manufactured items and are accounted for by either the cost of sales figure for the year in which they were incurred or carried forward to the next period in the closing stock valuation figure.

Total cost can be analysed into variable and fixed cost elements.

Semi-variable costs have both variable and fixed cost elements.

Fixed costs are stable only up to a certain level of activity; above this, they step up to a higher level.

There are three ways of analysing semi-variable costs into their fixed and variable components: the high–low method, scattergraphs and regression analysis.

Total cost can be analysed into direct and indirect cost elements.

Costs can be analysed causally according to production activities and activities can be analysed causally by products.

As an aid to decision making, costs can be analysed into relevant and irrelevant types.

Direct and indirect costs are similar to, but different from, variable and fixed costs.
Further reading


Answers to self-assessment questions

S1.1 Cost behaviour graphs
a) Graph 6
b) Graph 5
c) Graph 4
d) Graph 1
e) Graph 3
f) Graph 2

S1.2 Indian take-away delivery costs
Only two sets of monthly information are used, one from the highest-activity month (November = 521 deliveries) and the other from the lowest-activity month (August = 291 deliveries).

\[
\begin{align*}
\text{Highest (November)} & : 521 \text{ deliveries} \quad £768.90 \\
\text{Less: Lowest (August)} & : 291 \text{ deliveries} \quad £561.90 \\
\text{Difference} & : 230 \text{ deliveries} \quad £207.00 \\
\end{align*}
\]

\[\text{Variable cost per delivery} = \frac{£207.00}{230} = £0.90/\text{delivery}\]

Using this in November:

\[
\begin{align*}
\text{Variable cost of deliveries} & = 521 \times £0.90 = £468.90 \\
\text{Total cost of 521 deliveries} & = £768.90 \\
\text{Therefore, Fixed cost of 521 deliveries} & = £300.00 \\
\end{align*}
\]
These cost elements can be checked by applying them to the other month used, August:

Variable cost of 291 deliveries = 291 × £0.90 = £261.90
Fixed cost of 291 deliveries = £300.00
Therefore, Total cost of 291 deliveries = £561.90

Review questions

1. Explain the difference between manufacturing, trading and providing services.
2. Explain the difference between product costs and period costs.
3. Explain the difference between variable and fixed costs.
4. Explain what semi-variable costs and stepped fixed costs are.
5. Describe the advantages and disadvantages of finding the fixed and variable elements of semi-variable costs using the high–low method.
6. Describe the advantages and disadvantages of finding the fixed and variable elements of semi-variable costs using a scattergraph.
7. Explain in outline what regression analysis is.
8. Explain the difference between direct and indirect costs.
9. Compare variable cost analysis with absorption cost analysis.
10. Explain the underlying theory of activity-based costing.
11. Explain the difference between relevant and irrelevant costs.

The answers to all these questions can be found in the text of this chapter.