Eighth Edition

MANAGEMENT AND COST ACCOUNTING

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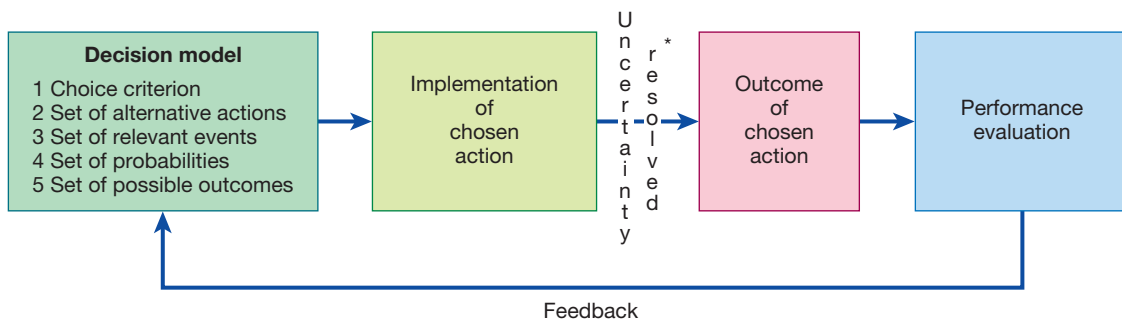## Srikant M. Datar Madhav V. Rajan

Pearson

MANAGEMENT AND COST ACCOUNTING

Exhibit 8.6 | A decision model and its link to performance evaluation

* Uncertainty resolved means the event becomes known.

Examples are growth or no growth in industry demand, and increase, decrease or no change in interest rates. Only one event in a set of mutually exclusive and collectively exhaustive events will actually occur.

4   A set of probabilities, where a **probability** is the likelihood or chance of occurrence of an event.

5   A set of possible **outcomes** that measures, in terms of the choice criterion, the predicted consequences of the various possible combinations of actions and events.

It is important to distinguish actions from events. Actions are choices made by management– for example, the prices it should charge for the company's products. Events are occurrences that management cannot control – for example, a growing or declining economy. The outcome is the operating profit the company makes, which depends on both the action management selects (pricing strategy) and the event that occurs (how the economy performs). Exhibit 8.6 presents an overview of a decision model, the implementation of the chosen action, its outcome and subsequent performance evaluation.

Probabilities

Assigning probabilities is a key aspect of the decision model approach to coping with uncertainty. A **probability distribution** describes the likelihood (or probability) of each of the mutually exclusive and collectively exhaustive set of events. The probabilities of these events will add to 1.00 because they are collectively exhaustive. In some cases there will be much evidence to guide the assignment of probabilities. For example, the probability of obtaining a head in the toss of a fair coin is $\frac{1}{2}$ that of drawing a particular playing card from a standard, well-shuffled pack is $\frac{1}{52}$. In business, the probability of having a specified percentage of defective units may be assigned with great confidence, on the basis of production experience with thousands of units. In other cases, there will be little evidence supporting estimated probabilities. For example, how many units of a new pharmaceutical product will be sold next year?

Expected value

An **expected value** is a weighted average of the outcomes with the probability of each outcome serving as the weight. Where the outcomes are measured in monetary terms, expected value is often called **expected monetary value**.

Managers often prefer being presented with the entire probability distribution. Information can also be presented in three categories: best-case scenario, most likely and worst-case scenario. All three categories remind the user that uncertainty exists in the decision at hand.

Illustrative problem

Reconsider Mary Frost and the booth rental alternatives offered by Computer Conventions to sell Do-All Software:

- Option 1: €2000 fixed fee.
- Option 2: €1400 fixed fee plus 5% of the convention revenues from Do-All sales.
- Option 3: 20% of the convention revenues from Do-All sales (but no fixed fee).

Mary estimates a 0.60 probability that sales will be 40 units and a 0.40 probability that sales will be 70 units. Each Do-All Software package will be sold for €200. Mary will purchase the package from a computer software wholesaler at €120 per unit with the privilege of returning all unsold units. Which booth rental alternative should Mary choose?

General approach to uncertainty

The construction of a decision model consists of five steps that are keyed to the five characteristics described at the beginning of this appendix.

Step 1 Identify the choice criterion of the decision maker. Assume that Mary's choice criterion is to maximise expected net cash inflow at the convention.

Step 2 Identify the set of alternative actions under consideration. The notation for an action is a. Mary has three possible actions:

$$a_1 = \text{Pay €2000 fixed fee}$$
$$a_2 = \text{Pay €1400 fixed fee plus 5% of convention revenues}$$
$$a_3 = \text{Pay 20% of convention revenues (but no fixed fee)}$$

Step 3 Identify the set of relevant events that can occur. Mary's only uncertainty is the number of units of Do-All Software that she can sell. Using x as the notation for an event,

$$x_1 = \text{40 units}$$
$$x_2 = \text{70 units}$$

Step 4 Assign the set of probabilities for the events that can occur. Mary assesses a 60% chance that she will sell 40 units and a 40% chance that she will sell 70 units. Using $P(x)$ as the notation for the probability of an event, the probabilities are:

$$P(x_1) = 0.60$$
$$P(x_2) = 0.40$$

Step 5 Identify the set of possible outcomes that are dependent on specific actions and events. The outcomes in this example take the form of six possible net cash flows that are displayed in a decision table in Exhibit 8.7. A **decision table** is a summary of the contemplated actions, events, outcomes and probabilities of events.

Mary can now use the information in Exhibit 8.7 to calculate the expected net cash inflow of each action as follows:

Pay €2000 fixed fee: $E(a_1) = 0.60\,(\text{€1200}) + 0.40\,(\text{€3600}) = \text{€2160}$

Pay €1400 fixed fee plus 5% of revenues: $E(a_2) = 0.60\,(\text{€1400}) + 0.40\,(\text{€3500}) = \text{€2240}$

Pay 20% of revenues (but no fixed fee): $E(a_3) = 0.60\,(\text{€1600}) + 0.40\,(\text{€2800}) = \text{€2080}$

Exhibit 8.7	Decision table for Do-All Software	
		Probability of events
Actions	$x_1 = 40$ **units sold** $P(x_1) = 0.60$	$x_2 = 70$ **units sold** $P(x_2) = 0.40$
a_1: Pay €2000 fixed fee	€1200*	€3600†
a_2: Pay €1400 fixed fee plus 5% of convention revenues	€1400‡	€3500§
a_3: Pay 20% of convention revenues (but no fixed fee)	€1600#	€2800**

* Net cash flows = (€200 − €120)(40) − €2000 = €1200.
† Net cash flows = (€200 − €120)(70) − €2000 = €3600.
‡ Net cash flows = (€200 − €120 − €10‖)(40) − €1400 = €1400.
§ Net cash flows = (€200 − €120 − €10‖)(70) − €1400 = €3500.
‖ €10 = 5% of selling price of €200.
Net cash flows = (€200 − €120 − €40††) − (40) = €1600.
** Net cash flows = (€200 − €120 − €40‡†) − (70) = €2800.
†† €40 = 20% of selling price of €200.

To maximise expected net cash inflows, Mary should select action a_2 that is, contracting to pay Computer Conventions a €1400 fixed fee plus 5% of convention revenues.

Consider the effect of uncertainty on the preferred action choice. If Mary was certain that she would sell only 40 units of Do-All Software (that is, $P(x_1) = 1$), she would prefer alternative a_3 – pay 20% of revenues and no fixed fee. To follow this reasoning, examine Exhibit 8.7. When 40 units are sold, alternative a_3 yields the maximum net cash inflows of €1600. Because fixed costs are zero, booth rental costs are low when sales are low.

However, if Mary was certain that she would sell 70 units of Do-All Software (that is, $P(x2 = 1)$, she would prefer alternative a_1 – pay a €2000 fixed fee. Exhibit 8.7 indicates that when 70 units are sold, alternative a_1 yields the maximum net cash inflows of €3600. Rental payments under a_2 and a_3 increase with units sold but are fixed under a_1.

Good decisions and good outcomes

Always distinguish between a good decision and a good outcome. One can exist without the other. By definition, uncertainty rules out guaranteeing, after the fact, that the best outcome will always be obtained. It is possible that bad luck will produce unfavourable consequences even when good decisions have been made.

Suppose you are offered a one-time-only gamble tossing a fair coin. You will win €20 if the event is heads, but you will lose €1 if the event is tails. As a decision maker, you proceed through the logical phases: gathering information, assessing outcomes and making a choice. You accept the bet. Why? Because the expected value is €9.50 [0.5(€20) + 0.5(−€1)]. The coin is tossed and the event is tails. You lose. From your viewpoint, this was a good decision but a bad outcome.

A decision can be made only on the basis of information available at the time of the decision. Hindsight is flawless, but a bad outcome does not necessarily mean that a bad decision was made. Making a good decision is our best protection against a bad outcome.

Reference and further reading

Alam, K. (2021) 'Foodpanda to reach breakeven in 2023: CEO', *Dawn,* 17 October (www.dawn.com/news/1)

Miller, J. (2022). 'Germany's shrinking conglomerates enjoy profits surge after streamlining', *Financial Times,* 10 February (https://www.ft.com/content/be06fa73-87ae-4f5d-8351-29f2d0d378b6)

CHAPTER 8

Assessment material

Review questions

Note: To underscore the basic CVP relationships, the assessment material ignores income taxes unless stated otherwise.

8.1 Describe how the special case labelled CVP is different from the general case for predicting total revenues, total costs and operating profit.

8.2 Distinguish between operating profit and net profit.

8.3 Describe the assumptions underlying CVP analysis.

8.4 'CVP is both simple and simplistic. If you want realistic analysis to underpin your decisions, look beyond CVP.' Do you agree? Explain.

8.5 Define contribution margin, gross margin, contribution margin percentage, variable-cost percentage and margin of safety.

8.6 Give an example of how a manager can decrease variable costs while increasing fixed costs.

8.7 Give an example of how a manager can increase variable costs while decreasing fixed costs.

8.8 'There is no such thing as a fixed cost. All costs can be "unfixed" given sufficient time.' Do you agree? What is the implication of your answer for CVP analysis?

8.9 How can a company with multiple products calculate its breakeven point?

8.10 How does an increase in the income tax rate affect the breakeven point?

Exercises

Basic level

*8.11 CVP computations (20 minutes)

Fill in the blanks for each of the following independent cases.

Case	Selling price	Variable costs per unit	Total units sold	Total contribution margin	Total fixed costs	Operating profit/loss
a	£30	£20	70 000	£?	£?	−£15000
b	25	?	180 000	900 000	800 000	?
c	?	10	150 000	300 000	220 000	?
d	20	14	?	120 000	?	12 000

8.12   **CVP, changing revenues and costs** (15–20 minutes)

Soleil Voyages SA is a travel agency specialising in flights between Paris and London. It books passengers on Air Chanson. Air Chanson charges passengers €1000 per round-trip ticket. Soleil Voyages receives a commission of 8% of the ticket price paid by the passenger. Soleil Voyages's fixed costs are €22 000 per month. Its variable costs are €35 per ticket, including an €18 delivery fee by Lièvre-Express SA. (Assume each ticket purchased is delivered in a separate package; thus the delivery fee applies to every individual ticket.)

Required

1 What is the number of tickets Soleil Voyages must sell each month to (a) break even, and (b) make a target operating profit of €10 000?

2 Assume Tortue-Express SA offers to charge Soleil Voyages only €12 per ticket delivered. How would accepting this offer affect your answers to (a) and (b) in requirement 1?

8.13   **CVP, changing revenues and costs** (continuation of Exercise 8.12) (20 minutes)

Air Chanson changes its commission structure to travel agents. Up to a ticket price of €600, the 8% commission applies. For tickets costing €600 or more, there is a fixed commission of €48. Assume Soleil Voyages has fixed costs of €22 000 per month and variable costs of €29 per ticket (including a €12 delivery fee by Lièvre-Express).

Required

1 What is the number of Paris-to-London round-trip tickets Soleil Voyages must sell each month to (a) break even, and (b) make a target operating profit of €10 000? Comment on the results.

2 Soleil Voyages decides to charge its customers a delivery fee of €5 per ticket. How would this change affect your answers to (a) and (b) in requirement 1? Comment on the results.

8.14   **CVP exercises** (20 minutes)

Grünberg Lehrmittelverlag GmbH manufactures and sells pens. Present sales output is 5 million annually at a selling price of €0.50 per unit. Fixed costs are €900 000 per year. Variable costs are €0.30 per unit.

Required
(Consider each case separately.)

1 **a** What is the present operating profit for a year?
   b What is the present breakeven point in revenues?

Calculate the new operating profit for each of the following changes:

2 A €0.04 per unit increase in variable costs.

3 A 10% increase in fixed costs and a 10% increase in units sold.

4 A 20% decrease in fixed costs, a 20% decrease in selling price, a 10% decrease in variable costs per unit, and a 40% increase in units sold.

Calculate the new breakeven point in units for each of the following changes:

5 A 10% increase in fixed costs.

6 A 10% increase in selling price and a €20 000 increase in fixed costs.

8.15   **CVP, changing cost inputs** (5–10 minutes)

Maria Kabaliki is planning to sell a vegetable slicer-dicer for €15 per unit at a country fair. She purchases units from a local distributor for €6 each. She can return any unsold units for a full refund. Fixed costs for booth rental, set-up and cleaning are €450.

Required

1 Calculate the breakeven point in units sold.

2 Suppose the unit purchase cost is €5 instead of €6, but the selling price is unchanged. Calculate the new breakeven point in units sold.

8.16   CVP, international cost structure differences (10 minutes)

Knitwear Ltd is considering three countries for the sole manufacturing site of its new sweater: Cyprus, Turkey and Ireland. All sweaters are to be sold to retail outlets in Ireland at €32 per unit. These retail outlets add their own mark-up when selling to final customers. The three countries differ in their fixed costs and variable costs per sweater.

	Annual fixed costs	Variable manufacturing costs per sweater	Variable marketing and distribution costs per sweater
Cyprus	€6.5 million	€8.00	€11.00
Turkey	4.5 million	5.50	11.50
Ireland	12.0 million	13.00	9.00

Required

1 Calculate the breakeven point of Knitwear Ltd in both (a) units sold, and (b) revenues for each of the three countries considered for manufacturing the sweaters.

2 If Knitwear Ltd sells 800 000 sweaters in 2022, what is the budgeted operating profit for each of the three countries considered for manufacturing the sweaters? Comment on the results.

8.17   CVP, income taxes (10–15 minutes)

Koninklijke Bols Wessanen NV has fixed costs of €300 000 and a variable-cost percentage of 80%. The company earns net profit of €84 000 in 2022. The income tax rate is 40%.

Required

Calculate (1) operating profit, (2) contribution margin, (3) total revenues and (4) breakeven revenues.

8.18   CVP, movie production (10 minutes)

Espasso SA has just finished production of *Tornado*, the latest action film directed by Domingos Vieira and starring Arnaldo Moura and Victoria Rebello. The total production cost to Espasso was €5 million. All the production personnel and actors on *Tornado* received a fixed salary (included in the €5 million) and will have no 'residual' (equity interest) in the revenues or operating income from the movie. Artes e Media Ltda will handle the marketing of *Tornado*. Media agrees to invest a minimum €3 million of its own money in marketing the movie and will be paid 20% of the revenues Espasso itself receives from the box-office receipts. Espasso receives 62.5% of the total box-office receipts (out of which comes the 20% payment to Artes e Media).

Required

1 What is the breakeven point to Espasso for *Tornado* expressed in terms of (a) revenues received by Espasso, and (b) total box-office receipts?

2 Assume in its first year of release, the box-office receipts for *Tornado* total €300 million. What is the operating income to Espasso from the movie in its first year?