RELEVANT TO ACCA QUALIFICATION PAPER P3

Studying Paper P3?
Performance objectives 7, 8 and 9 are relevant to this exam

Business forecasting and strategic planning

Quantitative data has always been supplied in the Paper P3 50-mark question and candidates are expected to draw conclusions from it. For example, declining profitability might imply that a company is facing stiff competition from powerful rivals and that it, therefore, has to decide on a strategy that could increase its survival chances.

However, the strategic advice was often given without the benefit of proper forecasts other than an implicit assumption that historical trends were going to continue: if market share had been decreasing for a number of years it was assumed that it would continue to decrease unless action was taken.

Section A2e of the revised Paper P3 *Study Guide*, relevant from June 2011 onwards, specifically includes 'Evaluate methods of business forecasting used when quantitatively assessing the likely outcome of different business strategies'. Therefore, the use of forecasting has become a much more explicit requirement. In addition to its use in strategic decisions, forecasting could also affect certain other syllabus updates such as the requirement to build a business case (where costs and benefits have to be estimated), investment appraisal, the budgetary process, pricing, and risk and uncertainty, including decision trees.

An outline of the key forecasting techniques

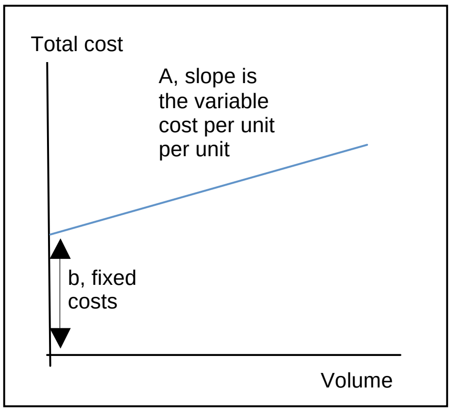
The recent examiner's article explaining the syllabus changes stated that the key techniques include linear regression, the coefficient of determination, time series analysis and exponential smoothing. All but the last item should have been studied in Paper F5. In the exam, interpretation and an awareness of limitations rather than calculations will be required.

1 Linear regression

Least squares linear regression is a method of fitting a straight line to a set of points on a graph. Typical pairs of graph axes could include:

- total cost v volume produced
- quantity sold v selling price
- quantity sold v advertising spend.

The general formula for a straight line is y = ax +b. So, 'y' could be total cost and 'x' could be volume. 'a' gives the slope or gradient of the line (eg how much the cost increases for each additional unit), and 'b' is the intersection of the line on the y axis (the cost that would be incurred even if production were zero).



You must be aware of the following when using linear regression:

- The technique guarantees to give the best straight line possible for any set of points. You could supply a set of people's ages and their telephone numbers and it would purport to a straight-line relationship between these. It is, therefore, essential to investigate how good the relationship is before relying on it. See later when the coefficients of correlation and determination are discussed.
- The more points used, the more reliable the results. It is easy to draw a straight line through two points, but if you can draw a straight line through 10 points you might be on to something.
- A good association between two variables does *not* prove cause and effect. The association could be accidental or could depend on a third variable. For example, if we saw a share price rise as a company's profits increase we cannot, on that evidence alone, conclude that an increase in profits causes an increase in share price. For example, both might increase together in periods of economic optimism.
- Extrapolation is much less reliable than interpolation. Interpolation is filling the gaps within the area we have investigated. So, if we know the cost when we make 10,000 units and the cost when we make 12,000 units, we can probably make a reasonable estimate of the costs when we make 11,000 units. Extrapolation, on the other hand, is where you use data to predict what will occur in areas *outside* the region you have investigated. We have no experimental data for those areas and therefore run the risk that things might change there. For example, if we have never had production of more than 12,000 units, how reliable will estimates of costs be when output is 15,000 units? Overtime might have to be paid, machines might break down, more production errors might be made.
- Remove other known effects, such as inflation, before performing the analysis, or the results are likely to be distorted.

2 The coefficients of correlation and determination

The coefficients of correlation (r) and determination (r^2) measure how good a fit the linear regression line is. If r = 1, there is perfect positive correlation, meaning that all the points will fit on a straight line, and as one variable increases so does the other. If r = -1, there is perfect negative correlation meaning that all the points will fit on a straight line, and as one variable increases the other decreases. If r = 0 there is no correlation and the two variables show no association (age and telephone numbers).

The coefficient of determination, r^2, is similar but is, perhaps, easier to understand. If r^2 is 80% (or 0.8) this implies that 80% of the changes in one variable can be explained by changes in the other. Note carefully: this does *not* mean that 80% of the changes in one is caused by 80% of changes in the other. Even good correlation does not prove cause and effect.

3 Time series analysis

A time series shows how an amount changes over time. For example, sales for each month, profits for a number of years, market share over each quarter. Because strategic management inevitably implies trying to look into the future, time series analysis is extremely important. Very often the starting point for predictions will be based on historical patterns of growth or decline, or a recognition that, in the past, amounts seem to have varied randomly.

Time series are often analysed by using moving averages, and the new Paper P3 *Pilot Paper* contains an excellent example of how this is likely to be examined: not by performing the calculations (no one in their right mind would do this manually nowadays) but by interpreting the results. In the following table, column 3 shows the readings (sales units) for each quarter for three years.

Year (1)	Quarter (2)	Sales (units) (3)	4-part moving average (4)	8-part centred moving average (5)	Seasonal variation (6)
1	1	2,000			
	2	900			
			1,250		
	3	1,000		1144	-144
			1,038		
	4	1,100		1050	50
			1,063		
2	1	1,150		1094	56
			1,125		
	2	1,000		1126	-126
			1,128		
	3	1,250		1115	135
			1,103		
	4	1,110		1125	-15
			1,148		
3	1	1,050		1104	-54
			1,060		
	2	1,180		1021	159
			983		
	3	900			
	4	800			

Time series analysis usually recognises four effects:

- A trend. This is the underlying growth or decline in an amount. For example, sales of a product could show increases year-on-year.

  To find a trend first decide on a likely periodicity or seasonality. For example, 6 for the trading days of the week, 4 for seasons of the year. Then ensure that the average is centred on a ‘season’. Above it has been assumed there are four seasons, so 4-part averages are first calculated : 1,250 = (2,000 + 900 + 1,000 + 1,100)/4. That average is between seasons 2 and 3. To obtain a centred average, average with the next one: 1,144 = (1,250 + 1,038)/2. Here, the 8-point moving averages move up and down implying no strong trend.
- Seasonal variations. These are variations which repeat fairly consistently within a period of no more than a year. For example, although the trend could be increasing, sales in summer could always be higher than sales in winter. Variations are identified by the differences between the actual results and the trend figures. Again, this table has been designed to show no stable seasonable variations and all seasons show both positive and negative effects.
- Cyclical variations. These are variations which repeat over longer than a year. For example, economic boom and depression.

- Random variations. Unexpected changes in what might be expected. For example, a very cold winter could provoke much larger than normal sales of certain products.

Time series analysis usually concentrates on the first two effects. Once again, if must be emphasised that even if a strong trend has been identified there is no guarantee that this will continue in the future. For example, a product life cycle curve might show a strong growth trend early in a product's life, but then at some point, growth will fall off, and probably even further in the future the trend will show decline. Any prediction, even if based on a large amount of historical data and using recognised and sophisticated techniques, can still be prove to be very different to the actual results that occur. Judgment has always to be applied when assessing how much to believe the results.

Let us say that we want to predict the sales for Quarter 1 of Year 4. Remember, in this table, we have detected no well-defined trend and no well-defined seasonal variations.
There are three methods

- The random walk model: next period's prediction is based on the latest actual and would, therefore, be predicted to be 800. However, because the data obviously moves up and down frequently this method might place too much emphasis on the latest actual result.
- The simple moving average method: next period's prediction is based on the latest moving average and would therefore be predicted to be 1,021. This averages out the 'ups and downs' in the data, but suffers from two potential problems:
  (i) The predicted value lags the actual results because so much historical data is included in the prediction. One could easily argue that 1,021 looks much too high given recent actual results.
  (ii) Every time a new moving average is calculated, the oldest component of the calculation is removed from the calculation, and a new one taken in. It can be considered as unrealistic and erratic to drop a reading so abruptly.
- Exponential smoothing. Whereas time series analysis was a topic in Paper F5, exponential smoothing was not, but it can be regarded as a refinement of the moving average technique. Here, a weighted average of the last actual result and the last predicted result is used as the next prediction. The weighting factors used are arbitrary, and alter how much importance is given to the last actual result and how much to the last estimated result; this varies how stable or volatile the predictions are. So, if we began the process from Year 3 Season 2 and used weighting factors of 0.5 and 0.5, the prediction for Season 3 would be:

  $0.5 \times 1{,}180 + 0.5 \times 1{,}021 = 1{,}101$

The prediction for Season 4 would be:

0.5 x 900 + 0.5 x 1,101 = 1,001

And for Year 4 season 1 would be:

0.5 x 800 + 0.5 x 1,001 = 901

In general, the new prediction will usually not lag behind latest results as much with simple moving averages, and historical results are not abruptly dropped. Instead, their importance to the prediction gradually decreases.

Dealing with risk and uncertainty in predictions

In the discussions above it has been emphasised that past performance is no guarantee of future performance. It would, therefore, be unconscionable to plough ahead with plans based on estimates that you know must be unreliable without examining what might go wrong.

You need to know two technical terms:

- Uncertainty occurs when you know that there might be alternative outcomes, but cannot attach a probability to each of those occurring. There, decisions rely greatly on personal attitude to risk and, in particular, should examine the bad or worst case scenarios as these can lead to trouble.
- Risk is where we feel we can assign probabilities to the various outcomes. The normal method of attack is to calculate the expected value of the outcome.

Expected values can be fine if a project is repeated many times because the expected value will equate to the long-term average result. However, most strategic plans, and any projects making them up, are once-off. That introduces two problems:

- usually the expected value is *not* an expected outcome
- the expected value gives no hint about the spread of results that might occur.

For example:

	Probability of the outcome occurring, p	Scenario 1		Scenario 2	
	P	Profit $	P x Profit	Profit $	P x profit
Outcome 1	0.2	7,500	1,500	30,000	6,000
Outcome 2	0.8	6,250	5,000	625	500
Expected value			6,500		6,500

Here, both scenarios have the same expected values, but Scenario 1 has very little risk. With Scenario 2, however, outcome 2 could be very serious indeed for the organisation.

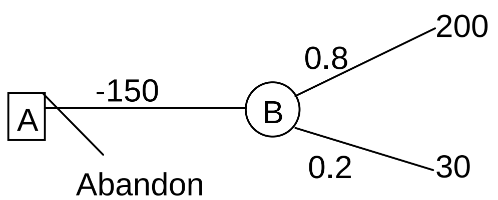
Risk can be handled by:

- Toleration: the risk is thought to be so small that it can be borne. For example, Scenario 1 above might be tolerable.
- Treat: do something to reduce the risk. Perhaps we could carry out a plan in phases and see how each stage does rather than being committed to the whole plan from the start. Alternatively, escape routes might be available.
- Transfer: perhaps by means of insurance, by sub-contracting some of the tasks and by entering into a joint venture.
- Terminate: the risk is so great and so impervious to treatment or transfer that we choose to avoid the opportunity altogether.

Sensitivity analysis can play an important role in deciding how risk should best be handled: assumptions are varied and the outcomes monitored. Often sensitivity is measured by the percentage that an assumption can be varied before a project breaks even, though there is no need always to measure to the break even point.

Two other additions to the syllabus can be looked at here. Learning objective F4e looks at project 'gateways' and within Section G there is a requirement to evaluate strategic and operational decisions, taking into account risk and uncertainty using decision trees.

Look at the following example: a development project is budgeted to cost $150 million and it is estimated that after two years income will be $200 million if the project is successful (probability 0.8), or only $30 million if the project is unsuccessful (probability 0.2). On a decision tree, this can be represented as:



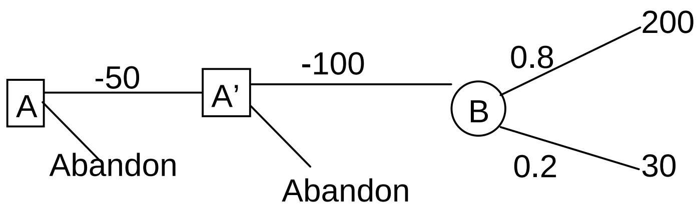
The expected monetary value at point B is: 0.8 x 200 + 0.2 x 30 = 166 (circles represent where expected values have to be calculated)

The decision to be made at point A (decision points are represented by squares) is either to abandon the project (zero financial effect) or to go for it with an expected profit of 166 – 150 = 16.

It looks as though the company should proceed with the project, but that decision depends on its forecasts and those could be wrong. You will see that if the expenditure rose by just over 10%, or if the successful income fell from 200 by 10% to about 180, or the probabilities changed to about 0.7/0.3, then the project would be breaking even or worse.

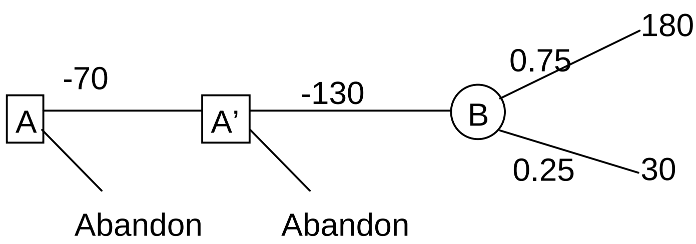
Let us say that actual expenditure rose to 200 and that, although the project was successful, its income there fell to 180 only. We would wish that we had not embarked on the venture as it has made a loss of 20 (= -200 + 180).

Now imagine that we could have the project in phases:



At the outset, A, our decision would be to go ahead if we were happy about the risks (expected monetary value as before = 16)

Say that A' is now one year later. We will have better knowledge about how the project is turning out (70 was spent in year 1 instead of 50) and perhaps altered probabilities and estimates. The decision tree could be displayed as:

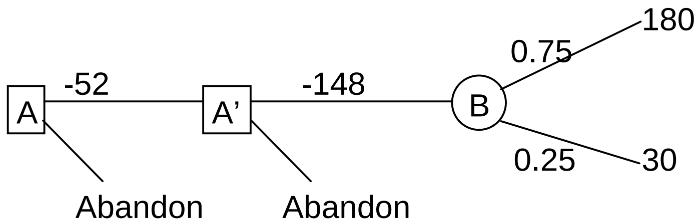


Note that the 70 already spent is now a sunk cost and not relevant to any decision about continuation of the project. We are now at A' on the diagram. The second phase has an increased cost, income has fallen and success is less likely, perhaps because we have now identified additional technical difficulties. As it stands the expected value of continuing is:

$$-130 + 0.75 \times 180 + 0.25 \times 30 = 12.5$$

This implies that it is worth carrying on, but the reliability of the estimates and the sensitivities would need to be looked at carefully.

However, say that after the first year, the project showed the following:



Now the expected value of continuing at A' is:

$$-148 + 0.75 \times 180 + 0.25 \times 30 = -5.5$$

Now, we would be more likely to abandon the project in the light of the new information that has become available.

As time passes and projects progress, estimates inevitably change. This example illustrates how our decision-making might be affected by those changes and emphasises how important it is continually to keep matters under review and to build in as much flexibility as possible, such as break clauses in leases or options to extend operations

Summary

- From June 2011, Paper P3 candidates will be required to 'Evaluate methods of business forecasting used when quantitatively assessing the likely outcome of different business strategies'. Emphasis will be on evaluating methods and results.
- Linear regression allows an objectively obtained straight line to be fitted to any set of points, but of itself says nothing about how good or reliable the fit is, nor whether there is a cause/effect relationship.
- The coefficients of regression and determination allow assessment of fit.
- Time series analysis allows both trends and seasonal variations to be estimated. It can be criticised because historical readings are abruptly dropped as the calculation progresses. The calculated

trends can lag substantially behind what the actual data is currently doing.
- Exponential smoothing is an approach which weights the latest actual results and the latest predicted results to give the next predicted result. Past data ‘fades’ from the calculation and the time lags are usually not so great.
- No prediction method, no matter how scientific gives guaranteed answers and sensitivity analyses can give some information about the risks involved.
- Decision trees allow a series of decisions and outcomes to be mapped out and investigated.
- Where possible, because the future is always uncertain, organisations should always try to build flexibility into their planning and investment. For example, break clauses in leases and options to extend or expand operations.

Ken Garrett is a freelance lecturer and author