Back to the Future- Forecasting and Budgeting Techniques

Ben Bullman First Intuition
benbullman@fi.co.uk

first intuition
where people count

Budgets/ Forecasts/ Projections

Attempt to identify what might happen in the future.

What could this be based on?

Time series analysis

A time series is a **series** of figures recorded over a period of **time** such as:

- Sales per month for the last 3 years (which would be a series of 36 figures)
- Output from production each week for previous 6 months (a series of 26 figures)
- Total cost per month for the last 10 years (a series of 120 figures)

Most time series are made up of patterns within the figures and if we can identify the patterns this can allow us to predict what will happen to the time series in the future.

What determines the pattern?

Components of a time series

A **time series** is likely to contain four different patterns: a trend (T), a seasonal variation (SV), a cyclical variation (CV) and a random variation (RV). These are extracted from a series of past figures recorded over time and then used to forecast the likely future results.

Trend – the trend is the underlying long-term movement in a consistent direction, over a prolonged period of time. For example, there is probably an upward trend in sales of smart phones over the last five years.

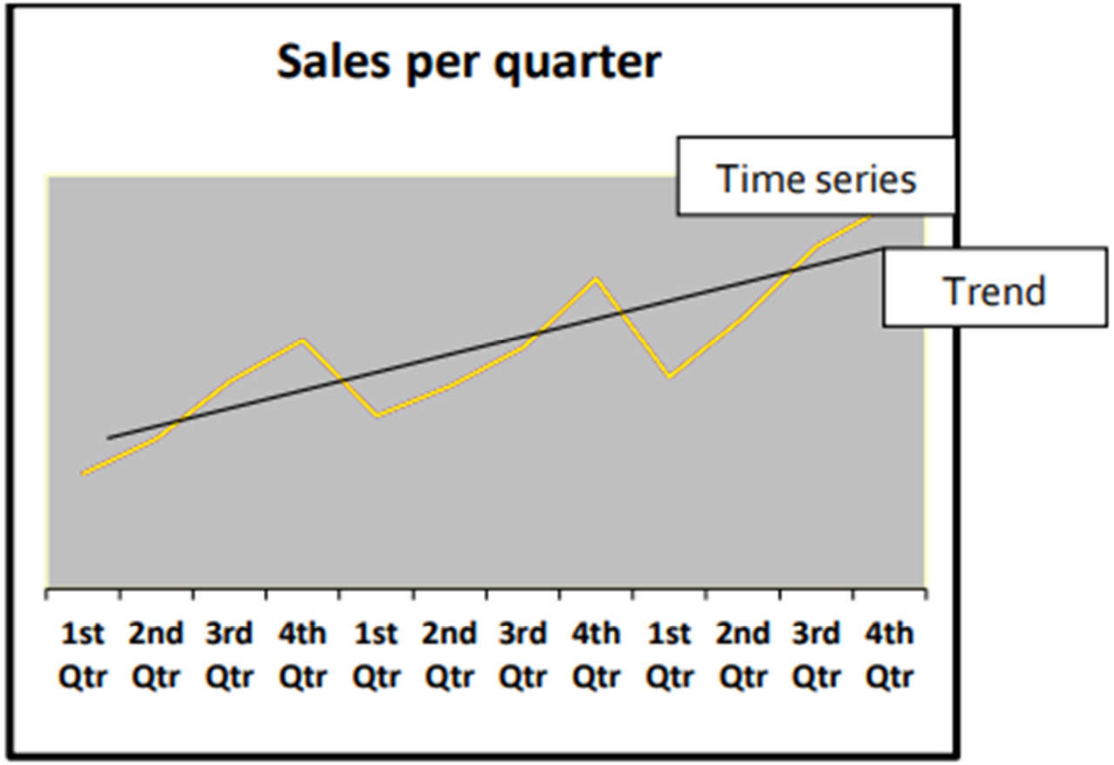
Seasonal variation – seasonal variations are predictable, recurring fluctuations over the short-term, typically of up to a year in duration. For example, if we are an ice cream retailer there is likely to be a repeating pattern within our sales figures showing that sales in the summer months are higher than average and sales in the winter months are below average. Seasonal variations do not just have to occur over a year, they could be a repeating pattern on a weekly basis i.e. the sales of newspapers are generally higher than average on a Monday and Friday and lower in the middle of the week.

Cyclical variation – cyclical variations are recurring patterns like seasonal variations but tend to occur over a longer period of time which is not usually of fixed length. An example would be the impact of the economic cycle. We know that we tend to move from recession to boom but it is impossible to say how long it will take.

Random variation – random variations are unpredictable fluctuations caused by random events such as a natural disasters or war. An example of this may be the unusually high sales of umbrellas in June 2006 due to unusually wet weather conditions. This is not a pattern that is expected to repeat and is impossible to predict in advance.

Showing a time series on a graph

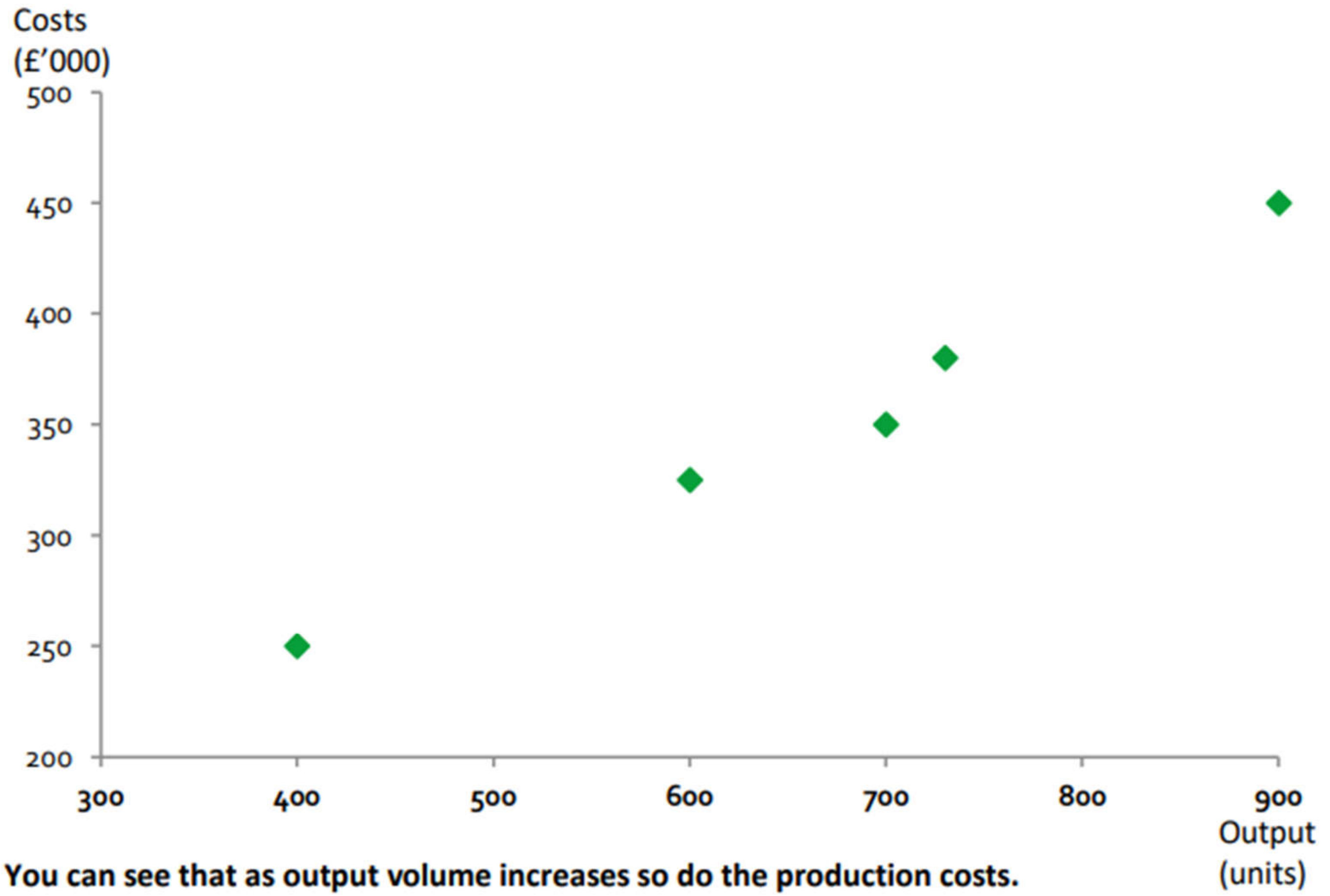
If we were to build up a Time Series of results over several years we could plot those results on a graph:



Linear regression (the method of 'least squares')

Linear regression is a method which can be used to forecast future costs or sales by looking at what has happened in the past. It assumes that there is a reliable 'linear' (straight line) relationship between certain factors i.e. as the volume of **output** increases the **production costs** incurred would be expected to increase. In order to come up with a forecast, this method starts by looking at historical data to find the so-called 'line of best fit' that best shows the relationship between the variables.

For example, let's say that we have data for production output and costs for the last five months. These figures could be plotted on a scatter graph and might look like this:



You can see that as output volume increases so do the production costs.

You can probably also see that the increase is not exactly 'linear' meaning that you could not draw a straight line that went through all five points on the graph. Life is rarely that neat and tidy!

first intuition
where people count

We can use linear regression to find the 'line of best fit' between two variables. The 'line of best fit' is the line that comes closest to passing through the points on the graph and helps us to establish the relationship between the two variables (for instance, if output rises by 100 units then costs might rise by around £50,000). The 'line of best fit' will be expressed as a formula or a 'regression equation' as it is often known. The equation will look something like:

$y = a + bx$

We need to come up with estimates of the value of 'a' and 'b' in the regression equation and we do this by looking at the historical data that we have available.

We could, for example, use the expression: $y = a + bx$ to show the breakdown of a semi-variable cost where:

y = total costs as measured by the upright y-axis on the graph.
x = volume of production outputs measured by the flat x-axis on the graph.
a = the point that the line intercepts the y-axis which is the fixed cost.
b = the slope of the line which is the variable cost per unit.

What about inflation??

Index numbers can be calculated over long periods of time. For example, the Retail Price Index compares the average cost of household expenditure to its equivalent cost in the base year of 1987.

The Retail Price Index (RPI)

RPI measure changes in the prices of items of expenditure of the average household. To calculate the index weightings are given to a 'basket' of more than 650 typical goods and services that households regularly buy (including milk, sugar, bread and clothes). As prices can be expected to change over time the RPI can be used to **inflate or deflate costs at different points in time for more meaningful comparison**.

If costs are deflated this means that the effects of inflation are removed (using the RPI figures) so that comparisons of costs can be made in '**real terms'**. For example, let's say that the wages cost of a company was:

- £40,000 in year 1
- £50,000 in year 5 (an increase of £10,000 or £10,000/£40,000 = 25%)

It obviously looks like the wage cost has increased by 25% between year 1 and year 5 but much of this increase is likely to be caused by inflation. If we know that the RPI index values were 100 in year 1 and 130 in year 5 we can see that inflation has been 30% over the period which is actually higher than the increase in the wages cost. In 'real terms' the wages cost has therefore fallen.

A few problems

- The past is no guarantee of the future
- The world is changing/ unexpected
- True linear relationships are rare
- We become slaves to the past

Sceptical…..

What could we ask……?

- Source of data
- Have we enough data
- How closely is data grouped

Uncertainty

What can we do?

Uncertainty in forecasts

Due to the nature of forecasting there will always be an element of uncertainty, particularly involving external factors that are outside of our control such as sales demand and material prices.

There are various ways that we can try to reduce the impact of uncertainty:

- **Flexible budgets** – this involves preparing a variety of different budgets for several levels of activity. For instance we could draw up a budget based on very strong sales demand (a 'best case' scenario), another budget based on weak demand (a 'worst case' scenario) and a more middle-of-the–range budget somewhere in between the other two.
- **Regular re-forecasting** – since conditions in the market are likely to change as the year develops we could regularly revisit our budgets and update them as likely outcomes become more certain. For instance if the economy starts to move into recession during the year we could reduce our expectations for demand levels for the later months of the year.
- **Planning models** – various software and spreadsheet models could enable us to more accurately predict a range of possible outcomes.
- **Rolling budgets** – as we saw in an earlier chapter (chapter 2) rolling budgets help us to deal with uncertainty with the regular refreshing and updating of the budget to account for uncertainties as they change or become more certain.

Expected values

If it is possible to identify the possible outcomes which could occur and if we can establish their associated probabilities, we can use this information to calculate an expected value.

If the outcome is (x) and the probability is (p) by multiplying each outcome by its probability and adding all of the results together (Σpx), an overall weighted average or expected value (EV) can be calculated. Expected values will be used in forecasting and decision making.

Limitations of using EV principles

- EVs are not so relevant in one-off decision-making situations since they represent a long run average value.
- EV ignores the spread of possible returns (i.e. risk) since it is averaging outcomes.
- EV relies on the accuracy of the probabilities.

Sensitivity analysis

This technique allows the decision maker to understand better how the assumptions that they have made might affect the final decision.

Sensitivity analysis can be used to calculate the maximum percentage change in a variable before the decision would change. This may be at zero profit (sometimes referred to as breakeven analysis) or if it fails to achieve a desired profit. At the breakeven point, the calculation is:

Sensitivity % =Profit level/Variable (Revenue or Cost) × 100%

Alternatively sensitivity analysis can be used to determine whether a decision would change if a variable changed by a certain percentage.