Gerald's Column
by Gerald Fitton

During the last few months I hope that I have got you thinking about the meaning of probability. This month I want to persuade you that Information, even what is called Imperfect Information, has a value.

Conditional Probability

The Outcome of many Events is uncertain and so, instead, we resort to estimating probabilities. As with my analysis of the flippin' coin and the hypothetical story of the missing bus, you must leave room in your mathematical model for an "I didn't think of that!" scenario.

In the jargon used by philosophers this subject, conditional probability, is discussed under the grandiose title: "The Probabilistic Epistemology of Knowledge"; in the jargon used by mathematical philosophers it is called "Bayesian Epistemology" because the mathematical content is based on Bayes' Theorem. This philosophical subject relates to the way in which imperfect knowledge can change your belief about such things as buses, coins and even your faith in the scientific method. Some people require more evidence than others.

Absolute Probabilities

Before I discuss the Value of Information allow me to indulge myself with a timely digression. "There is no such thing as the Absolute Probability of anything!"

Consider an Event which has a range of Outcomes. For example, consider the question: "Will an unborn baby be a boy or a girl?" For those not 'in the know' the probability of the baby being a boy is about 0.53. However, if you are the specialist who knows the result of an ultrasound scan then you'll 'know' the child's sex with better than 90% probability!

Let's take another example. Information you have been given indicates that the value of a certain share will almost certainly fall; so you sell. Someone else with different 'inside knowledge' knows a takeover bid is in the wind and 'bets' on the share rising. He buys the shares you sell. Perhaps he'll win his bet; perhaps you will.

Who has the 'right' probabilities? The answer is both are 'right'. The correct value of probability to put into the analysis of the Risk *you* are taking when *you* make a Decision depends on the extent and reliability of the knowledge *you* have. This generalization still applies even when the probability *you* use is of the 'hunch' rather than 'scientific' type.

This brings me to Gerald's First Rule of Gambling. It is: "Never bet on certainties!"

What is a 'Dead Cert' for one person can be a totally contradictory 'Dead Cert' for someone else! Doubling up on Tails will never win if the coin is double headed; remember my flippin' coin?
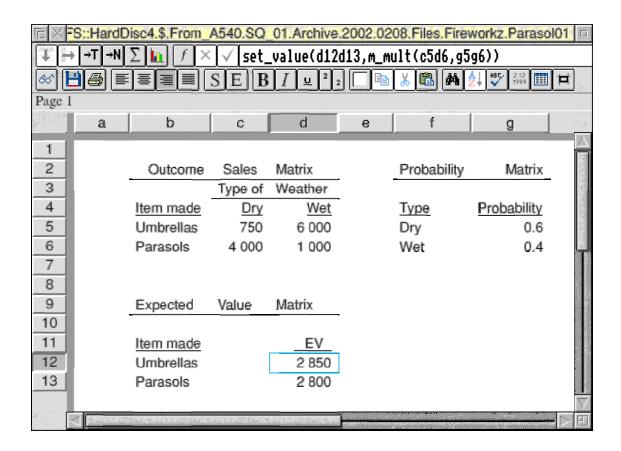
Don't bet on a certainty particularly if someone else, a hustler, or an organisation, is providing you with experimental evidence which reinforces your willingness to bet.

Don't take a bet on a 'Cert' because the odds (the Expected Value of your profits) are in your favour. 10 or even 100:1 on the flippin' coin coming up Tails would still be a bad bet.

When I refer to Gambling I am not necessarily referring to betting money with a bookmaker. You might be taking out an insurance policy, investing in an ISA or buying a house! You might be betting something really important such as your career or something even more precious, your reputation. Don't be hustled into believing anything is certain.

No information

Last month I included a screenshot of an EV matrix which related to our debut as market traders selling either umbrellas or parasols. On the basis of expected values it is better for us to always take umbrellas because, on average, we will sell 50 units more per market day than we would if we always took parasols.

Perfect Information

Without wishing to sound blasphemous I want to introduce you to the concept usually referred to as having a 'Hot Line to God'.

In the case of the sex of the unknown baby there is no doubt that the sex of the baby is fixed even though it is unknown. The probabilities of either 53% (with no information) or 90% (after a scan) do not and can not change the sex of the baby.

In the case of the weather on market day, although it may not have happened yet and may not be predestined, varying our probabilities will not change the outcome of the event!

If we could use the hypothetical 'Hot Line' then we would know in advance whether to take umbrellas or parasols. We would sell either 4000 parasols if it is Dry or 6000 umbrellas if it turns out Wet. It is Dry 60% of the time so, on average, over a long period of time we will sell (4000*0.6 + 6000*0.4) = 2400 + 2400 = 4800 units per market day.

It is relatively easy to include this calculation in a spreadsheet. No screenshot just yet because I have a big one coming!
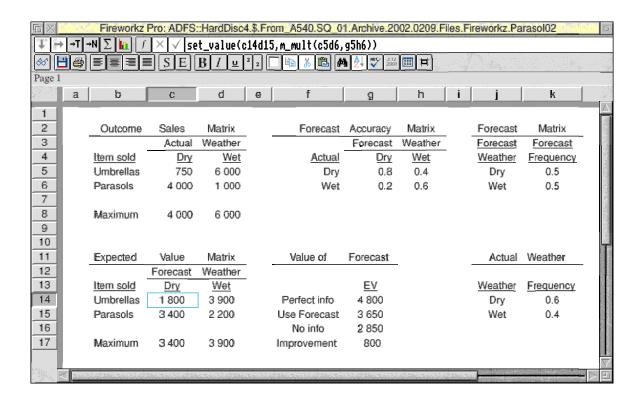
The Value of Perfect Information

Our situation is this. If we had 'Hot Line' we'd sell 4800 units. With no information we'd sell 2850 units. The difference, 4800 – 2850 = 1950 units, is the value of a 'Hot Line' to perfect information.

Although we can never obtain perfect information ("Never bet on certainties") we can calculate its value to us. That value is a limit to how much we should pay for any relevant information. As part of any decision making process the value of perfect information should be calculated and regarded as an upper limit which you might pay for information.

Imperfect Information

Have a look at the screenshot of the spreadsheet below.

It has many interesting features, most of which I shall not describe! This Fireworkz spreadsheet is available in all the usual places. If you want one and if you can't obtain a copy by any other means then contact me and I'll send it to you.

At the bottom of column g you will see the number 800 has been calculated as the value of the improvement we can achieve by paying for an imperfect weather forecast.

The Weather Forecast

The weather forecast can be found in the block of cells, g5h6. The interpretation is this.

The weather is forecast to be either Dry or Wet. When the forecast is Dry it has an 80% chance of being correct. It is harder to forecast Wet weather; a Wet forecast has only a 60% chance of being correct.

Now glance across to the block k5k6. Dry weather is forecast 50% of the time.

The block k14k15 relates to the actual weather. We can not change the fact that 60% of the time it is Dry. The matrix multiplication g5h6 * k5k6 = k14k15 is true but the spreadsheet doesn't make this calculation. What it does is to use the numbers in g5h6 and k14k15 to find appropriate values to enter into k5k6. The formula in k5 includes a spreadsheet function which finds the inverse matrix corresponding to g5h6.

The Expected Value Matrix

The part of the spreadsheet which shows the effectiveness of the forecast is to be found in the block c14d15. The numbers therein can be compared with the block c5d6. All the numbers in c14d15 are 'moderated' when compared with the corresponding cells of c5d6.

If we follow the advice of the weather forecaster then, when there is a Dry forecast, we will take parasols and we'll sell, on average, 3400 units; when the forecast is Wet we'll sell, on average, 3900 umbrellas. The other two values in this matrix serve only to reinforce our belief that we should use the advice we have paid for.

No More Detail

Spreadsheets are powerful tools for calculating expected values and for calculating the value of imperfect information. The technique I've outlined here for evaluating imperfect information (using matrix multiplication) can be extended in many ways which I'll leave to your imagination and to your curiosity.

The spreadsheet I have chosen for my example is relatively simple but is probably complex enough for many of you to have decided you've 'had enough'! However, if you are amongst those who are sufficiently interested then get yourself a copy of the spreadsheet and look at the way it works. If you need assistance then contact me.

Also, as a separate file I have included a practical question about conditional probabilities which relates to whether it is worth paying for an expensive survey before drilling for oil.

I'm sure that those who have followed, at least in outline, the general objectives and implementation of the strategies will have had more than enough to satisfy—so I'll stop there. I want to say something else this month before I 'sign off'.

The Value of Expected Values

This is a 'sort of ' warning which I must include.

You must have 'expected' Expected Values so I couldn't avoid describing them. These EV calculations and related calculations, such as the value of Imperfect Information, are useful if and only if the probability values are reliable (you have a high degree 'faith' in them) and if you base your decisions (what action to take) on calculations of a similar nature and magnitude regularly enough for the 'good luck' and 'bad luck' to average out.

Using the EV technique is totally inappropriate if the decision you make is either unique or rare. Never ever use the EV technique to work out whether you should take a life changing decision. Never ever use the EV technique to justify a decision made about a rare event.

Next month I shall describe a technique which is much more appropriate to such decisions.

Contact

Contact me at gerald@abacusline.demon.co.uk with your feedback. The emails which I've received up to now have all been most interesting.

If you do have a worked solution to the Oil problem (on disc only) then send it to me.