The Problem

You are faced with a critical decision: which monthly phone plan do I subscribe to for my teenager? You have selected two plans, one from Telstra and the other, Optus, each offering different benefits. What follows is helpful as a basic example in the use of defined assumptions, forecasts, and using sensitivity analysis.

Discussion

Both usage plans have their strengths and weaknesses, broken down as follows:

Telstra

Pro: 400 minutes per month, no extra charges for long distance calls

Con: Every minute over 400 is an extra $0.40

Optus

Pro: Unlimited minutes

Con: Long distance charges are $0.08 per minute

Based on past experience with your offspring's phone usage and the resultant costs, you have estimated that your teenager will use 400 minutes, 30% of which are long-distance calls to friends interstate. The usual approach to analysis like this is to build a spreadsheet in Excel; doing so makes it clear the Telstra plan is best, saving you $4.61 per month.

Which mobile phone plan?

	Telstra	Optus
Base Fee	$39.99	$35.00
Included Minutes	400	Unlimited
Additional Minutes	$0.40	$0
Long Distance	$0	$0.08
Total Cost	$39.99	$44.60

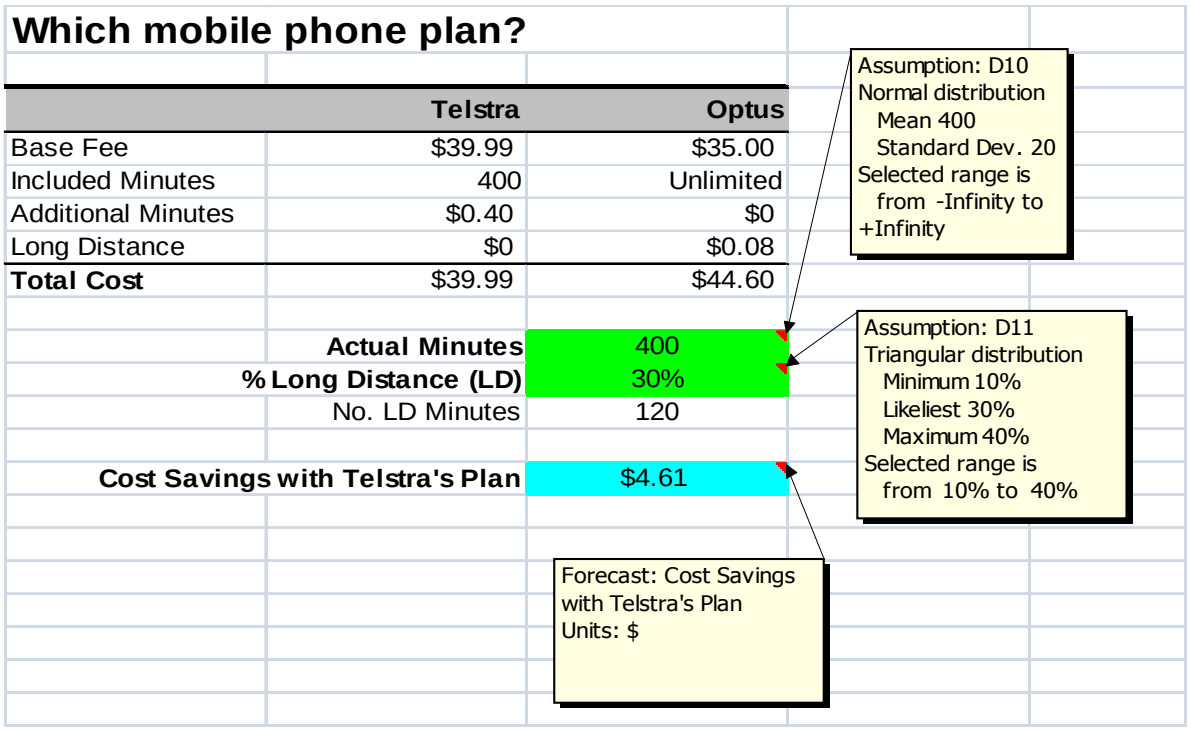
Actual Minutes	400
% Long Distance (LD)	30%
No. LD Minutes	120
Cost Savings with Telstra's Plan	$4.61

But how likely is this scenario, or more importantly, how wrong is this estimate likely to be? Standard sensitivity analysis in Excel, even if you were take the time and use the TABLE function and graph your results, will not answer the question of how probable (or otherwise) the saving of $4.61 per month will actually be.

Another approach might be to change the values in the two cells holding your key assumptions many times, write down the results and then calculate the frequency of each to give you a very rudimentary look at the probability of any particular scenario. Changing the percentage of long distance minutes, you will see that, as the percentage increases, the Optus plan costs more and the Telstra plan looks better and better. Changing only the minutes used produces the opposite effect. Changing both variables at once results in a more complicated relationship, and it takes little imagination to appreciate this complicated situation worsens if you have to adjust three or more variables.

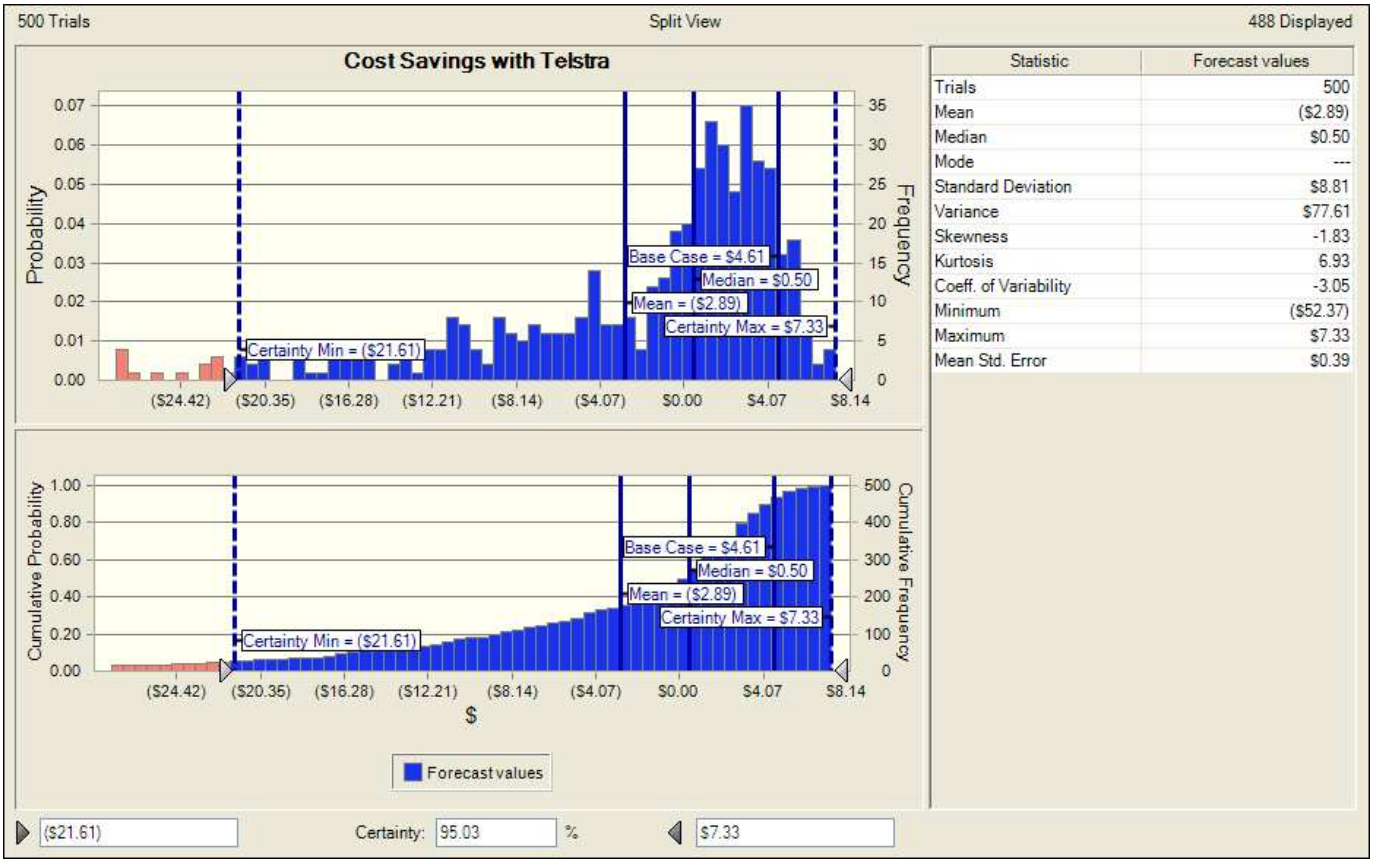
Monte Carlo analysis

The use of Monte Carlo methods, and software such as Oracle's 'Crystal Ball' or '@RISK' by Palisade, gives you a way to describe the uncertainty around the number of minutes you might use and the percentage of calls that are long distance. These two variables, colored green, have been defined as probability distributions, more commonly referred to in either software package as 'assumptions.' The details of each assumption have been made visible in the comments boxes.



When this model is run through a number of trials (called a simulation) it delivers a forecast, 'Cost Savings with Telstra's Plan,' shown in light blue above. Forecasts are equations, or outputs, that you

want to analyse after a simulation. Running this simple model through a simulation of 500 trials (in this case using Crystal Ball as the Monte Carlo generator) provides you with the outputs below.



What do these fancy charts (and they *are* fancy-looking) and statistics tell you? Beginning with the statistic most people commonly look to, the average (or mean), over 500 trials you will not save money with Telstra, you will be $2.89 *worse off.* But averages can be deceptive. After all, would you cross a river if it was, *on average*, only 4 feet deep? Based on how averages are calculated you may well find yourself damper than expected.

At this point reality kicks in, and we unknowingly face a paradox of sorts. Human nature is such that under conditions of uncertainty, people *generally* exhibit a bias known as adjustment or anchoring. Decision makers (YOU) have a tendency to make estimates, in this case it is the likely phone usage by your teenager, by starting at an initial or familiar value and adjusting that to yield a final answer or forecast. We also anchor to familiar statistics, such as averages or medians. The paradox arises because you want to anchor to a number (the past predicts the future, right?), but the truth is there is no perfect model, number or statistic that will provide a consistently accurate solution.

As we state in the manifesto we adhere to:

> "…there is no right model, because the world changes in response to the ones we use….Simple clear models with explicit assumptions about small numbers of variables are therefore the best way to leverage your intuition without deluding yourself."

Your teenager simply may not adhere to the mathematical constructs you put in your Excel spreadsheet. Further, they will probably change their phone usage habits to get the most out of the constraints imposed by the plan (with the right incentives).

Analysis using Monte Carlo methods provides you with a fuller description of likely outcomes. It will NOT provide all the answers, but rather insight into what is *probable.* And knowing what is probable leaves you better informed, leading in turn to better decisions.

Advice on modelling is just one aspect of the services we offer at Analytica. The above points are intended to provide a brief insight into the our offering and the different perspective we take on approaching decision making in uncertain business or project environments.

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