Monte Carlo or bust?

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Monte Carlo summons up images of casinos and glamour: in this article we discuss why it should summon up thoughts of better budgeting, investment and risk appraisal. This article explores how we can start to model real world influences and the uncertainty these bring in virtually all aspects of treasury and financial analysis.

We live in an uncertain world. At every turn plans must adapt to changing circumstances as risks become reality and unforeseen influences arise. In the business world people like certainty and as finance professionals our fixed budgets and targets are a way of life. The risk to these "certain" plans is hard to quantify and explain (see my sister article to this "How the Gain-Loss spread helps you manage risk", April 19). So, while we adapt all the time as humans to change, in the business world inflexibility is often baked in.

Monte Carlo simulation is the ability to build a model and test one or more random variables through this model thousands of times to build up a data set of potential outcomes. It is surprisingly easy to build into day to day use and incredibly powerful once you do. Once mastered the limitations are really around the imagination of the user. By testing the interaction of several variables at once it can be used to;

- Take investment appraisal to a new level modelling real world factors and risks
- Test risk management solutions such as hedging positions
- Test budgets and business plans to uncover the range of outcomes and plan for uncertainties
- Develop real options strategies
- Challenge and test strategic assumptions
- Model portfolio positions and asset allocation
- Test headroom and liquidity plans

The starting point is to build a model. This is something you would inevitably be doing anyway but the more time and effort invested in this stage the better the ultimate output. The model needs to reflect how one or more variables influences the outcomes. If we take a common situation, a new business opportunity, we default to a standard Net Present Value style format which I am sure is familiar to all of you. The layout looks like a profit and loss statement with some modifications for cash, working capital and CAPEX. At this point how often do we ask ourselves *"how much can these assumptions change?"*

Traditional methods of modelling investment decisions just cannot answer this question and to be frank, at this point we, as a finance community have started to lose the attention of the wider, non-finance, audience. We need better ways of reflecting the real world, or to put it another way: *reflecting several moving parts*.

For example, revenue might be based on the state of the economy, competition, commodity prices, even the weather. These factors lend themselves to an estimate of the likelihood of change and it would be a poor

management team not able to identify these influences on the businesses they manage. But the thought process not numerical precision is the objective here. What we should not be aiming for is over complication. The act of including Monte Carlo simulation in the analysis forces decision makers to define and articulate the real-world factors that impact results. In many ways that is a critically important success in its own right.

A summary of the actual technique in Excel is included in the box below. Once built a Monte Carlo enabled model can be used to start answering lots more questions than the "static" model ever could. Figure one shows a sample of the output for an investment project. The blue line is the NPV, and in a static model that is all that you see.
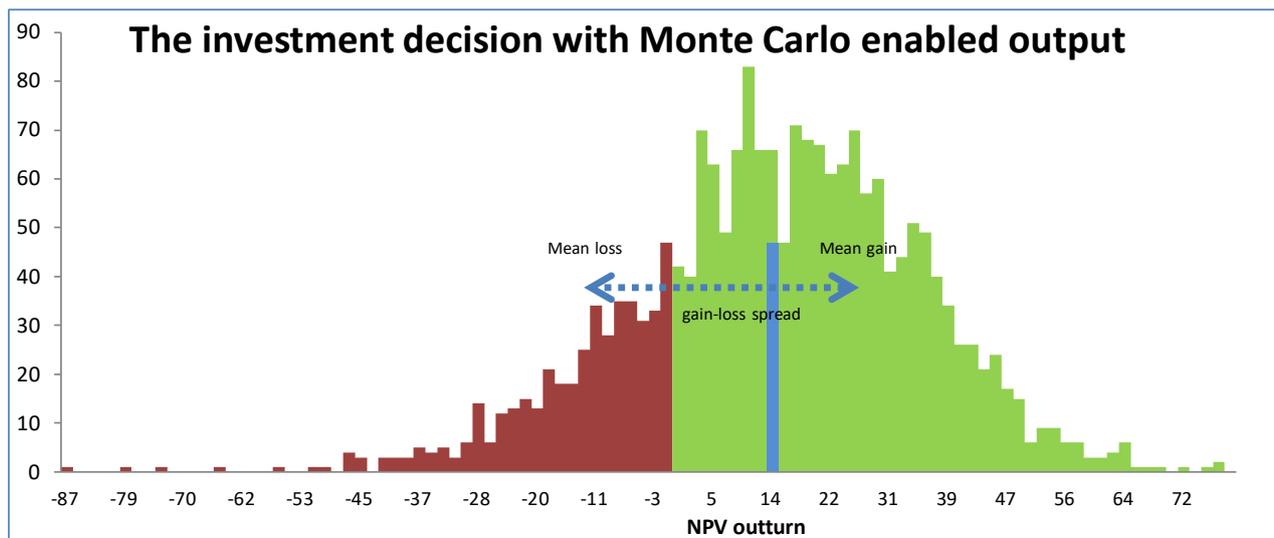
With a data set of thousands of outcomes, it is easy to see the probability of success or failure and even the maximum cash outflow for liquidity planning purposes. The effect de-risking measures can be quantified. For instance, mitigations such as buying insurance, paying extra at the design stage to build more flexibility or structuring the manufacturing process differently to be more adaptable can all be modelled to see if they add or decrease the overall value and how they change the risk profile. While experienced management will already be considering these factors without using a Monte Carlo enabled model this may be happening in an unstructured way especially when complex interactions are involved. Bringing the ability to mirror this thinking, at least in part, to financial analysis greatly increases its relevance to the business decision. All it takes is a small leap of faith in collating estimates around the probability outcomes around the handful of critical influences identified at the "design" stage. We are not used to doing this as finance professionals, but we think like this all the time in our business and personal lives.

A last word; no model can mirror reality to any real degree of precision. Our aim as finance professionals is to support strategic thinking but never replace it with a spreadsheet. Adopting the dynamic Monte Carlo enabled approach espoused here opens many more doors in achieving this objective whilst at the same time allowing the results to be communicated in an understandable manner.

Excited? Well I think you should be!

How do you build Monte Carlo analysis into a spreadsheet investment model?
• **Build the model**
• **Identify one or two key influencers on the various elements of the model such as revenue, labour and materials costs, working capital or CAPEX.**
• **Estimate (or research the market data) on the range of these influences**

- **Build a link between this influence and its outcome to the financial model**
- **Consider the strength of correlations between these influences**
- **Combine the use of the Excel functions "random number" and "normal distribution" to generate a random outcome for the influence in question.**
- **Use Excel's "data table" function to store the result of the financial model for this randomly generated outcome**
- **Repeat 1000+ times with a data table consisting of 1,000s of rows**

The above is a high-level summary to the technique and the author would be happy to explain further. Please contact him on enquiries@mwacc.co.uk to discuss.