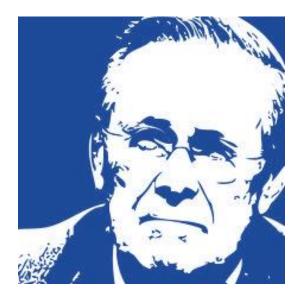# The Koan of Donald Rumsfeld

There are known knowns; there are things we know we know.

We also know there are known unknowns; that is to say, we know there are some things we do not know.

But there are also unknown unknowns – the ones we don't know we don't know.

– Donald Rumsfeld

There is an unmistakable Zen-like quality to this, my favorite of Donald Rumsfeld's often cryptic statements. I like it so much because what Rumsfeld is describing perfectly in his inimitable fashion are the three forms of game theoretic decisions:

Decision-making under certainty – the known knowns. This is the sure thing, like betting on the sun coming up tomorrow, and it is a trivial sub-set of decision-making under risk where probabilities collapse to zero or 1.

Decision-making under risk – the known unknowns, where we are reasonably confident that we know the potential future states of the world and the rough probability distributions associated with those outcomes. This is the logical foundation of *Expected Utility*, the formal language of microeconomic behavior, and mainstream economic theory is predicated on the prevalence of decision-making under risk in our everyday lives.

Decision-making under uncertainty – the unknown unknowns, where we have little sense of either the potential future states of the world or, obviously, the probability distributions associated with those unknown outcomes. This is the decision-making environment faced by a Stranger in a Strange Land, where

http://epsilontheory.com   10/20/2013

traditional cause-and-effect is topsy-turvy and personal or institutional experience counts for little, where good news is really bad news and vice versa. Sound familiar?

The sources of today's market uncertainty are the same as they have always been throughout history – pervasive credit deleveraging and associated political strife. In the Middle Ages, these periods of deleveraging and strife were typically the result of political pursuit of wars of conquest … Edward III and his 14th century exploits in The Hundred Years War, say, or Edward IV and his 15th century exploits in The War of the Roses. Today, our period of deleveraging and strife is the result of political pursuit of *la dolce vita* … a less bloody set of exploits, to be sure, but no less expensive or impactful on markets. PIMCO co-CIO, Mohamed El-Erian, has a great quote to summarize this state of affairs – "Investors are in the back seat, politicians in the front seat, and it is very foggy through the windscreen." – and the events of the past two weeks in Washington serve to confirm this observation … yet again. Of course, central banks are political institutions and central bankers are political animals, and the largest monetary policy experiment ever devised by humans should be understood in this political context. The simple truth is that no one knows how the QE story ends or what twists and turns await us. The crystal ball is broken and it's likely to stay broken for years and years.

We are enduring a world of massive uncertainty, which is not at all the same thing as a world of massive risk. We tend to use the terms "risk" and "uncertainty" interchangeably, and that may be okay for colloquial conversation. But it's not okay for smart decision-making, whether the field is foreign policy or investment, because the *process* of rational decision-making under conditions of risk is very different from the *process* of rational decision-making under conditions of uncertainty. **The concept of *optimization* is meaningful and precise in a world of risk; much less so in a world of uncertainty.** That's because optimization is, by definition, an effort to maximize utility given a set of potential outcomes with known (or at least estimable) probability distributions. Optimization works whether you have a narrow range of probabilities or a wide range. But if you have no idea of the shape of underlying probabilities, it doesn't work at all. As a result, applying portfolio management, risk management, or asset allocation techniques developed as exercises in optimization – and that includes virtually every piece of analytical software on the market today – may be sub-optimal or downright dangerous in an uncertain market. That danger also includes virtually every quantitatively trained human analyst!

All of these tools and techniques *and people* will still generate a risk-based "answer" even in the most uncertain of times because they are constructed and trained on the assumption that probability

estimations and long-standing historical correlations have a lot of meaning regardless of circumstances. It's not their fault, and their math isn't wrong. They just haven't been programmed to step back and evaluate whether their finely honed abilities are the right tool for the environment we're in today.

My point is not to crawl under a rock and abandon any attempt to optimize a portfolio or an allocation … for most professional investors or allocators this is professional suicide. My point is that **investment decisions designed to optimize – regardless of whether the target of that optimization is an exposure, a portfolio, or an allocation – should incorporate a more agnostic and adaptive perspective in an uncertain market**. We should be far less confident in our subjective assignment of probabilities to future states of the world, with far broader margins of error in those subjective evaluations than we would use in more "normal" times. Fortunately, there are decision-making strategies designed explicitly to incorporate this sort of perspective, to treat probabilities in an entirely different manner than that embedded in mainstream economic theory. One in particular – *Minimax Regret* – eliminates the need to assign any probability distribution whatsoever to potential outcomes.

Minimax Regret, developed in 1951 by Leonard "Jimmie" Savage, is a cornerstone of what we now refer to as behavioral economics. Savage played a critical role, albeit behind the scenes, in the work of three immortals of modern social science. He was John von Neumann's right-hand man during World War II, a close colleague of Milton Friedman's (the second half of the Friedman-Savage utility function), and the person who introduced Paul Samuelson to the concept of random walks and stochastic processes in finance (via Louis Bachelier) … not too shabby! Savage died in 1971 at the age of 53, so he's not nearly as well-known as he should be, but his *Foundations of Statistics* remains a seminal work for anyone interested in decision-making in general and Bayesian inference in particular.

As the name suggests, the Minimax Regret strategy seeks to minimize your maximum regret in any decision process. This is not at all the same thing as minimizing your maximum *loss*. The concept of regret is a much more powerful and flexible concept than mere loss, because it injects an element of subjectivity into a decision calculus. Is regret harder to program into a computer algorithm than simple loss? Sure. But that's exactly what makes it much more *human*, and that's why I think you may find the methodology more useful.

Minimax Regret downplays (or eliminates) the role that probability distributions play in the decision-making process. While any sort of Expected Utility or optimization approach seeks to evaluate outcomes in the context of the odds associated with those outcomes coming to pass, Minimax Regret says forget

the odds … how would you *feel* if you pay the cost of Decision A and Outcome X occurs? What about Decision A and Outcome Y? Outcome Z? What about Decision B and Outcome X, Y, or Z? Make that subjective calculation for every potential combination of decision + outcome you can imagine, and identify the worst possible outcome "branch" associated with each decision "tree". Whichever decision tree holds the best of these worst possible outcome branches is the rational decision choice from a Minimax Regret perspective.

This is different from maximum loss calculation in many respects. For example, if the maximum loss outcome is rather apocalyptic, where it is extremely costly to prepare and you're still pretty miserable even if you did prepare, most people will not experience this as a maximum regret outcome even if they make no preparations whatsoever to mitigate its impact. On the other hand, many people will experience substantial regret, perhaps even maximum regret, if the outcome is a large gain in which they do not share because they failed to prepare for it. **Minimax Regret is a subjective decision-making strategy that captures the disutility of both missed opportunities as well as suffered losses, which makes it particularly appropriate for investment decisions that must inevitably incorporate the subjective feelings of greed and fear.**

Minimax Regret requires a decision-maker to know nothing about the likelihood of this future state of the world or that future state. Because of its subjective foundations, however, it requires its practitioners to know a great deal about his or her utility for this future state of the world or that future state. **The motto of Minimax Regret is not Know the World … it's Know Thyself.**

It's also an appropriate decision-making strategy where you DO know the odds associated with the potential decision-outcomes, but where you have so few opportunities to make decisions that the stochastic processes of the underlying probability distributions don't come into play. To use a poker analogy, my decision-making process should probably be different if I'm only going to be dealt one hand or if I'm playing all night. The former is effectively an environment of uncertainty and the latter an environment of risk, even though the risk attributes are clearly defined in both. This is an overwhelming issue in decision-making around, say, climate change policy, where we are only dealt a single hand (unless that Mars terraforming project picks up speed) and where both decisions and outcomes take decades to reveal themselves. It's less of an issue in most investment contexts, but can certainly rear its ugly head in illiquid securities or strategies.

Is this a risk-averse strategy? In theory, no, but in practice, yes, because the most regret-filled outcomes tend to be those that are more likely to be low probability outcomes. If the "real" probability distributions of future outcomes were magically revealed to us … if we could just get our crystal ball working again … then an Expected Utility analysis of pretty much any Minimax Regret decision-making process would judge it as risk-averse. But that's just the point … our crystal ball isn't working, and it won't so long as we have profound political fragmentation within and between the major economic powers of the world.

I'm not saying that Minimax Regret is the end-all and be-all. The truth is that the world is never entirely uncertain or without historical correlations that provide useful indications of what may be coming down the pike, and there are plenty of other ways to be more agnostic and adaptive in our investment decision-making without abandoning probability estimation entirely. But there's no doubt that our world is more uncertain than it was five years ago, and there's no doubt that there's an embedded assumption of probabilistic specification in both the tools and the people that dominate modern risk management and asset allocation theory. Minimax Regret is a good example of an alternative decision-making approach that takes this uncertainty and lack of probabilistic specification seriously without sacrificing methodological rigor. As a stand-alone decision algorithm it's a healthy corrective or decision-making supplement, and I believe it's possible to incorporate its subjective Bayesian tenets directly into more mainstream techniques. Stay tuned …