The Pitfalls of "Sequential Risk"

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SUMMARY. *Glide path designers are increasingly utilizing the concept of "sequential risk" in their work. This paper reviews the basics of "sequential risk" and finds the concept lacking. We conclude that "sequential risk" analysis in isolation is unlikely to produce conclusive results. Overall, "sequential risk" based arguments alone should be taken with a healthy dose of skepticism.*

Glide path designers are increasingly facing the need to justify various aspects of their work. The concept of "sequential risk" is emerging as one of the key arguments many glide path designers offer. The primary objective of this paper is to review the basics of this concept and its utility.

"Sequential" Risk in Aircraft Design

Loosely speaking, "sequential risk" is an observation that certain "sequences" of returns may lead to detrimental outcomes for long-term investors. The "sequential risk" observation identifies certain undesirable economic scenarios and implies that the primary goal is to avoid such scenarios.

To illustrate the logic of the "sequential risk" observation, let us consider a similar situation in the area of aircraft design. Think of an aircraft safety manager who is overly concerned about the following "sequence" of events: an aircraft makes a sharp *left* turn and subsequently crashes. Under this manager's supervision, the primary objective of aircraft design is to avoid this particular sequence. Furthermore, let us assume that the manager has a perfect solution that makes the "sharp-*left*-turn-then-crash" sequence perfectly impossible.

Are the manager's aircraft perfectly safe? Of course, they are not. "Sharp-*right*-turn-then-crash" and a multitude of other "sequences" are still possible. It is also possible that the aircraft designed to avoid the "sharp-*left*-turn-then-crash" sequence is much more predisposed to the "sharp-*right*-turn-then-crash" and other sequences. Moreover, it is quite possible that the manager's "solution" has

decreased the overall aircraft safety even though one particular undesirable sequence of events is no longer possible.

But the "sharp-*left*-turn-then-crash" sequence is a considerable risk, is it not? Of course, it is. As such, this risk should be managed in the context of overall aircraft safety, not in isolation. The manager should consider the impact of any solution on all aspects of aircraft safety.

Does the manager have a serious problem? Of course, he does. His definition of risk is woefully inadequate. The manager's job is to prevent crashes, period. A prudent approach to the problem of aircraft safety is to consider all scenarios that may lead to crashes. Identifying a particular undesirable scenario and ignoring all others is next to irresponsible.

"Sequential" Risk in Glide Path Design

Let us get back to the area of glide path design. "Sequential risk" in funding problems may exist in the presence of risky assets and financial commitments (cash flows). "Sequential risk" is essentially an observation that there are sequences of returns that have similar annualized returns but generate quite dissimilar outcomes for long-term investors. "Sequences" that have lower returns when asset values are higher and higher returns when asset values are lower tend to produce inferior outcomes.

Initially, the "sequential risk" observation was used to refute overly simplistic approaches to certain funding problems. For example, a deterministic financial calculator can reveal the following fact:

> Given $1,000, one can withdraw over $50 in today's dollars annually for 25 years if portfolio returns are 2% above inflation.

A 65-year-old retiree would be grossly mistaken if he concluded from this fact that he could safely withdraw over 5% of his assets annually till he turns 90 if his portfolio returns were 2% above inflation on average. Today, no asset has a guaranteed return of 2% above inflation. A portfolio that generates 2% above inflation on average would come with substantial risks. One of these risks would be the risk of front-loaded inferior returns (the "sequential risk"). Surely, back-

loaded superior returns would balance out and generate the required returns on average. But the outcomes would still be disappointing since those superior returns would apply to lower asset values.

In this example, the concept of "sequential risk" is useful as an easy-to-understand illustration of the retiree's mistaken conclusion. However, this example does not demonstrate that the concept of "sequential risk" is useful in general. What this example does demonstrate is that the retiree should not rely on an inadequate deterministic model. In the world of risky assets, one should be exceedingly skeptical of the results of deterministic calculators.

These days, few glide path designers operate in the purified world of "riskless" averaged returns. The consensus is risks and financial commitments do matter. In this context, the "sequential risk" observation is just a useful illustration to an already well-known occurrence.

In a more realistic world, the value of the "sequential risk" observation is uncertain at best, even though the observation is sound. The problem is "sequential risk" neither constitutes a proper quantitative definition of risk nor produces well-defined arguments.

Let us try to define "sequential risk" quantitatively. "Sequential risk" could be defined as two consequent events: substantial asset losses around the retirement date and a failure to fund a pre-determined level of post-retirement spending. To quantify this risk for a given glide path, one could take the following steps:

1. Specify the timeframe (e.g. within 2 years of the retirement date).
2. Specify the magnitude of losses within the timeframe (e.g. 20%).
3. Specify a measurement of the ability of the remaining assets to fund the pre-determined level of spending (e.g. the probability of shortfall) and a threshold for this measurement (e.g. a 90% probability).

If the value of the selected measurement exceeded the threshold, the glide path would be considered too ("sequentially") risky.

A quantitative definition of "sequential" risk, however, would create a different problem. This problem is similar to the problem with the "sharp-left-turn-then-

crash" sequence discussed in the previous section. It makes little sense to identify a particular undesirable scenario and ignore others. A prudent approach to glide path design is to consider *all* scenarios that may lead to undesirable outcomes.

One of the problems of concentrating on a particular scenario (in this case, substantial asset losses around the retirement date) is the inability to control other scenarios. For example, a glide path may manage the "sequential risk" well, but have inferior long-term expected returns that make the desired level of spending highly unlikely to be funded. This glide path may still be sub-optimal despite its ability to manage the "sequential risk."

The objectives and risks should reflect the best interests of the stakeholders of investment programs in the most straightforward manner. For example, if the primary objective is to fund a pre-determined level of post-retirement spending, then the primary risk should be defined as "a failure to fund a pre-determined level of post-retirement spending." *All* scenarios that may lead to this failure should be considered. Doing otherwise may lead to sub-optimal investment solutions and be a disservice to the program's stakeholders.

Conclusion

The concept "sequential risk" is just an observation. Moreover, this observation is not terribly insightful – it merely informs us that asset prices may decline substantially at the most inopportune times. An investment strategy that is solely based on this observation may be sub-optimal and should be taken with a healthy dose of skepticism.