Glide Path 2.0:

The Next Generation

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The concept of a *glide path* is rapidly becoming one of the key terms of investment management. Glide path – a term that takes its origins in aviation – has come to signify the evolution of an investor's portfolio over time. Glide paths are an essential feature of target date funds that are steadily gaining popularity among DC plan participants. DB plans are increasingly abandoning the conventional "the-same-portfolio-in-all-years" approach in favor of evolving glide paths. Other investment and saving programs – e.g. 529 plans – are adopting glide paths as well.

There is no shortage of information about glide paths. Most target date fund managers publicize their glide path design methodologies. Numerous investment consultants promote their customized approaches to glide path design. As a result, we are witnessing an ever-increasing flow of publications on this subject.

Yet, the overwhelming majority of these publications deal primarily with the issues of conventional portfolio management – asset class selection, manager research, investment choice architecture, active/passive options, fees, and many others. The importance of these issues notwithstanding, the reality is that the primary matters of glide path design – the selection of optimal portfolios and their evolution over time – are typically ignored.

In all fairness, those authors that concentrate on conventional portfolio management and steer clear of the essential matters of glide path design – optimal portfolio selection and evolution – deserve little blame. Normally, it is not their job to develop new theories. They utilize the methodologies that are currently available and do their best under the circumstances.

And what methodologies are currently available in the area of glide path design? Academic researchers have been striving to offer scientifically rigorous ways to construct glide paths for decades.[1] The results of all this work, however, have failed to impress most practitioners.[2] Consequently, many feel that there has been little academic work with significant practical applications in the area of glide path design.

Overall, all these efforts have produced little more than raging debates and abundant confusion. There is neither a broadly recognized framework nor a set of commonsense principles to construct efficient glide paths. It is clear that the theory and practice of glide path design is in need of a better framework and greater clarity.

This paper offers the foundation for a better framework. The key message this paper is if we are willing to accept a couple of modest and sensible assumptions, then there are advanced economic theories readily available for the design of efficient glide paths. This author is optimistic that the resulting framework will become a mainstream approach to glide path management.

Glide Paths and Their Use

A glide path is a series of portfolios that span from the present to some point in the future. A glide path is essentially a new name for an old concept – strategic long-term asset allocation. Conventional strategic asset allocation employs a single "policy" portfolio to serve as a stationary rebalancing target. In contrast, the term "glide path" emphasizes that this long-term rebalancing target is evolving rather than stationary.

A glide path has two closely connected but fundamentally different components. The first component is the actual portfolio at the present that must be implemented and managed. The second component is the rest of the glide path that contains *anticipated* portfolios that are *expected* to be utilized in the future.

DC plans were the first to adopt glide paths on a large scale. The justification for a glide path was based on the belief that a plan participant's portfolio should evolve from more aggressive to more conservative over the participant's life cycle.[3] A glide path was considered an important part of the financial services provided to the participant. Conventional portfolio analysis for a hypothetical investor led to a portfolio-centric framework for glide path design. This perspective is sometimes called DC 1.0.

This perspective is rapidly evolving into an outcome-oriented framework for investors with well-defined financial commitments. The primary objective of a DC plan is to achieve a specific outcome, i.e. to fund a particular level of post-retirement income. In this framework, a glide path is a major component of a comprehensive long-term investment and saving program. To ensure that the program has a reasonable likelihood of success, a glide path should be connected to all aspects of the program – contribution rates, asset values, retirement income products, and others – that impact the outcomes. This perspective is sometimes called DC 2.0.[4]

DB plans are also beginning to embrace glide paths and the "outcome-oriented" mindset in general. Many believe that DB plans should employ more conservative portfolios as they mature. Some DB plans make commitments to achieve a specific funding level by a particular future date. As this date approaches, it is reasonable to reduce risk and employ more conservative portfolios. This portfolio evolution should be anticipated and reflected in the selection of a realistic contribution rate at the present. Thus, there is a need for glide paths.

Overall, it is increasingly apparent that glide paths are necessary for a variety of funding problems. As long as the goal is to have a realistic and internally-consistent funding model, the assumption "the-same-portfolio-in-all-years" may be an unreasonable oversimplification. The need for better glide path design methodologies is clear.

The Principles of Glide Path Design

Like any other science, the science of finance is based on certain principles. In order to introduce a new methodology, one needs to present the principles that serve as the foundation of the methodology. The selection of these principles is a major challenge.

Unlike many other sciences, few principles of finance are inviolable. As long as human behavior is involved, we can find deviations from virtually any assumption. Therefore, few principles of finance are unquestionably true – they are just assumptions that can be accepted or rejected.

However, financial theories that are based on imperfect principles can be remarkably effective. To name just one prominent example, the "no arbitrage" assumption leads to the development of an elaborate theory that has valuable real-life applications. The criteria for selecting assumptions is their reasonability, not inviolability.

This section presents two modest yet consequential principles for the construction of efficient glide paths. These principles lead to the development of a quantitative methodology of glide path design that has several attractive qualities. While this author is convinced that these principles are reasonable, the reader is encouraged to explore this issue in detail.

It is important to note that investors typically construct their glide paths in the context of the *funding objective* – to ensure that their "in-flow" commitments and investment returns are sufficient to fund their "out-flow" commitments. This observation leads to the first principle.

Principle 1. *The goal of efficient glide path design is to achieve the funding objective.*

This principle implies the outcome-oriented approach and suggests the concept of glide path efficiency in the context of the funding objective. This concept may be developed as follows.

The stochastic present value of all (in- and out-flow) commitments is a highly effective technical tool for quantifying the success of the funding objective. We call this present value *Required Assets* (*RA*).[5] The funding objective is achieved if and only if *RA* is less or equal to the investor's existing asset value. Therefore, *RA* and its stochastic properties are of paramount importance for the success of the funding objective.

This assumption also allows us to introduce the concept of *rationality* in the context of the funding objective. Namely, a rational investor would necessarily select a glide path that *optimizes* the preferred quantitative measurement. In other words, the investor would not settle for a glide path that generates a sub-optimal value of the measurement.[6]

There are many ways to optimize the stochastic properties of *RA*. One of these ways is to employ the ideas embedded in the classic Modern Portfolio Theory (MPT). In a nutshell, one can replace portfolio return with *RA*, take into account the directional difference (we prefer *high* portfolio returns, but *low RA*), and follow MPT. Specifically, similar to the interplay between the expected return and volatility of return in MPT, the investor may want to minimize the expected value of *RA* given the volatility of *RA* and minimize the volatility of *RA* given the expected value of *RA*. As a result, we get a *cost-risk efficient frontier* – an expansion of MPT to funding problems.[7]

While this approach generates efficient glide paths, it is silent about the relationships between portfolios within a glide path. The following principle is instrumental in this respect.

Principle 2. *Investors re-examine their strategic asset allocations regularly.*

Principle 2 implies that optimal glide path design involves multiple asset allocation decisions. Here is why this principle influences the relationships between portfolios within a glide path.

Let us assume that the investor has selected an optimal glide path. When the time comes to re-examine the glide path at some future point, the investor is not obligated to obediently adopt the original glide path. At the time, the investor should optimize the remaining "sub"-glide path (the original glide path without the past portfolios) in the context of the funding objective. The investor should keep the original glide path only if the remaining "sub"-glide path is optimal at the time. Therefore, in a realistic and internally-consistent glide path model, *all "sub"-glide paths of an optimal glide path should be optimal as well*.

The investor and his ageing "clones" that select all these "sub"-glide paths can be viewed as decision-makers ("players") that have objectives, actions, and preferences. Players, their objectives, actions and preferences are the classic objects of *game theory*. Thus, Principles 1 and 2 put the design of optimal glide paths in a much more expansive theoretical framework.

Under common rationality assumptions, an optimal glide path should represent a *Nash Equilibrium* (NE) strategy – one of the key concepts of game theory. Moreover, an NE glide path should be constructed via the process of "*backward induction*," which means that the right direction of glide path optimization is backwards.[8] While we could reach the same conclusion without putting optimal glide path design in the context of game theory, it is important to realize that this idea has deep roots in an advanced theory with extensive practical applications.

The idea of backward induction is applied to the construction of an optimal glide path as follows. The last portfolio in the glide path should be selected first, the second to last portfolio should be selected next using the already selected last portfolio, the third to last portfolio should be selected next using the two already selected portfolios, and this process should continue until the entire glide path is selected. As a result, the entire glide path and all its "sub"-glide paths are optimized and consistent with Principles 1 and 2.

Overall, the two modest principles outlined in this section put the area of efficient glide path design in the context of well-developed theories – MPT and game theory – that can provide a constructive framework and fertile ground for further developments.

The Next Generation of Glide Paths

We call the glide paths designed according to the principles outlined in the prior section *Glide Path 2.0*. These principles, while seemingly innocuous, have profound consequences. This section sketches out some of these consequences.

Most importantly, the glide paths generated according to these principles possess highly desirable qualities. As applied to DC plans, NE glide paths maximize the post-retirement sustainable income (given the contributions and risk profile).[9] As applied to DB plans, NE glide paths maximize the safety of the promised benefits (given the level of contributions) and minimize the contributions required to fund these benefits (given the risk profile). These features may be vital for the participants and sponsors of retirement plans.

In the Glide Path 2.0 framework, a glide path is no longer merely a financial service that is based on a vaguely substantiated cliché "more stocks for the young, more bonds for the old." A glide path now is an indispensable part of a comprehensive valuation model that takes into account all aspects of the investor's funding objective.

A glide path is no longer a static object set in stone once and forever. The efficiency of a glide path should be regularly re-evaluated in light of the ever-changing expectations of capital markets. Most investment consultants, for instance, revisit their capital market assumptions at least annually. An efficient glide path should be re-examined every time there is a substantial change in the investor's vision of capital markets.

In the Glide Path 2.0 framework, all portfolios in an efficient glide path are closely connected. The myopic short-term view of portfolio management is no longer adequate. In the presence of a specific investor with well-defined financial commitments, today's efficient portfolio is generated as a result of the construction of an efficient glide path.

Conclusion

The assumption "the-same-portfolio-in-all-years" may soon become an artifact of a bygone era. There is a rapidly emerging consensus that the portfolios of institutional and individual investors should evolve over time. The importance and acceptance of glide paths are expected to grow.

In particular, retirement plans are rapidly moving from the portfolio-centric model to the outcome-oriented model. The new model requires the next generation of efficient glide paths that are geared toward generating optimal outcomes. This paper takes initial steps in this direction.

This author is optimistic that the framework presented in this paper will be useful for practitioners that design and use glide paths.

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ENDNOTES

[1] As a prominent example, the late great Paul Samuelson had endeavored to rationalize evolving glide paths for more than four decades. See Mindlin [2013] for more details.
[2] One (and possibly the only) notable exception is the human capital theory. This theory distinguishes financial assets and human capital, which is assumed to be "more bond-like than stock-like." CAPM is subsequently used to determine the financial asset portfolio. Despite several major flaws, the human capital theory does provide some useful insights. In particular, it justifies evolving glide paths. See Idzorek [2008] and Mindlin [2014B] for more details.
[3] Mindlin [2014B] attempts to identify the sources for this belief.
[4] See Schaus [2010] for more details.
[5] It is important to realize that contribution and payout commitments should have opposite signs. In this present value calculation, the contribution commitments are negative and the payout commitments are positive.
[6] In the language if game theory, rational players are sometimes called "*habitual payoff maximizers*."
[7] MPT is just one of many ways to incorporate the funding objective into glide path design. Examples of other ways include, but are not limited to, the *RA* based methodologies analogous to the Safety-First and downside protection approaches. See Mindlin [2014A] for more details.
[8]R. Aumann, the 2005 Nobel Prize laureate in economics, described backward induction as "the oldest idea in game theory" and “nothing seems simpler or more natural.” See Aumann [1995] for more details.
[9] This property of NE glide paths requires matching the existing asset value and the optimal present value. See Mindlin [2010] for more details.