Optimal Lifetime Asset Allocation with Goals-Based, Lifecycle Glide Paths

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Assets should serve a purpose—to fund a lifetime of financial goals. At the highest level, goals can be categorized as either consumption or gifts. Outside of consumption and gifts (including planned and unplanned bequests), assets serve no purpose other than funding taxes and expenses. Therefore, a rational and informed investor should identify lifetime goals and intentionally allocate assets to fund them efficiently. If assets serve the purpose of funding lifetime goals, it naturally follows that optimal lifetime asset allocation should be goals-based and multiperiod.

Brunel [2003]; Nevins [2004]; and Chhabra [2005] introduce goals-based investing frameworks that are influenced by behavioral finance. These approaches bucket goals and/or incorporate shortfall probability as a definition of risk. The resulting portfolios can be suboptimal when viewed from the perspective of portfolio theory. But any sound goals-based method mitigates behavioral bias and provides a framework for more rational decision making, which should lead to better outcomes. The method we present is in the same spirit as this goals-based literature, but it represents a different thread of goals-based research and development, one that is anchored to contemporary portfolio theory and equally valid for both rational and behavioral investors.

Thaler [1985] and Shefrin and Statman [2000] suggest that investors consider their portfolios to be composed of collections of mental accounts, where each mental account funds a discrete goal. For these investors, the covariance matrix among mental accounts is not considered and dollars are not fungible. We have observed in practice that investors view their portfolios both as collections of key mental accounts and as a whole. Total portfolio performance does count and dollars can become fungible, particularly during times of crisis or when trade-offs become necessary.

Some goals are far more important than other goals to investors, and there is diminishing marginal benefit (and mind-share) in accounting for additional mental accounts. A lifetime of annual consumption needs represents the largest and most important liability (goal) for most private investors, and therefore it is the most critical part of any goals-based investing framework. The consumption goal has certain features. It is usually annual and ongoing but not perpetual. It can be level or lumpy depending on investor circumstance. It is often composed of smaller line-item goals (ranging from household budget items to ad hoc lifestyle consumption) and is best viewed in terms of real purchasing power through time. It can be funded by both investable portfolio assets and non-tradeable assets, such as human capital and pensions, depending on the phase of an investor’s lifecycle. Although
this article is focused on the consumption goal, the method we present is easily extended to incorporate other goals, such as wealth transfer and philanthropy (i.e., gifts).

Standard approaches to asset allocation (e.g., Markowitz’s [1952] mean-variance theory) ignore goals, are single-period (e.g., one year), and assume independent asset returns. When extending this standard framework from single-period to multiperiod time horizons, Samuelson [1969] disproved time diversification under independent return assumptions to show that long-term and short-term investors with the same utility (return-to-risk preference) will have the same asset allocation regardless of the time horizon. In the standard framework, multiperiod dynamic asset allocation (as with a glide path) is not superior to single-period static asset allocation when utility is unchanged through time.

However, changes in human capital can produce changes in utility through time. Bodie, Merton, and Samuelson [1992] incorporate human capital into the asset allocation solution to show that the proportion of financial wealth invested in equity should decline with age. For most individuals, the ability to recover from financial disaster by rebuilding savings through human capital diminishes with age, as they cannot so easily alter their labor supply. This is the main justification for retirement glide paths that display decreasing equity allocations with the progression of time. Indeed, retirement glide paths and goals-based investing attempt to solve the same problem of optimal lifetime asset allocation. But retirement glide paths are not customized by the consumption liability, human capital, or risk preference. Their prescribed asset allocation is the same for all investors who have the same number of years until retirement, which is a trade-off for scale over customization.

Additionally, there is evidence that some asset returns are not independent, violating a key assumption when extending the standard mean-variance framework to multiperiod time horizons. Risky assets have historically shown mean-reverting tendencies over longer time horizons, and mean reversion can affect multiperiod asset allocation. Linear glide paths do not exploit mean reversion, which requires a nonlinear function that delays the pace of transition from risky assets to safer assets or a mechanism to temporarily step off a glide path in extreme risk environments, when subsequent mean reversion may be more likely.

Das et al. [2010] introduce a goals-based asset allocation method that uses the specified maximum probability of failing to achieve the return required to reach the threshold level of a goal (shortfall probability) as the definition of risk. The trade-off between return and risk in this method incorporates a value-at-risk (VaR) constraint, and the authors show that the aggregate portfolio of optimal mental account subportfolios also resides on the mean-variance efficient frontier. More broadly, the aggregate portfolio is always mean-variance efficient when each subportfolio also resides on the efficient frontier. However, it is not clear that this definition of risk is more intuitive than specifying some shade of conservative-to-aggressive per goal along a mean-variance efficient frontier.

There are issues to using shortfall probability as the definition of risk to drive portfolio selection in a multiperiod framework. A lower shortfall probability is not necessarily lower risk. Samuelson’s [1963, 1969] arguments on the law of large numbers and time diversification also relate to shortfall probability. For example, a shortfall probability that is somewhat greater than 50% may be inconsequential to funding expected consumption (or other goals) if variance is minimal. Additionally, low shortfall probability can result from a high average return that naturally comes with high variance, despite the fact that the same risk is augmented when it is multiplied. In this case, a low perceived risk is due to high average returns, which is problematic because it suggests return and risk are inversely related. Lower shortfall probabilities can be offset by higher magnitudes of potential shortfall. Risk is the dispersion or uncertainty around the expected value—for any time horizon. Since diversified asset returns are approximately symmetrical, dispersion above and below the expected value is a unified dimension of risk. The expected future value and the magnitude of potential dispersion (uncertainty) around it are what matters when funding targeted future goal thresholds. Specifying a low shortfall probability can lead investors to bear unnecessary risk and overshoot goals on average, resulting in surplus assets that serve no stated purpose and may be disproportionately exposed to estate tax. Investors may intuitively choose maximum shortfall probabilities much less than 50% without fully understanding the implications and consequences.

Sharpe’s [1964] capital asset pricing model (CAPM) is a market equilibrium model that emerged
from mean–variance theory and efficient markets theory. The main idea behind the CAPM is that all efficient portfolios can be constructed from combinations of the single-period risk-free asset (cash) and the mean-variance efficient market portfolio of risky assets. Merton [1973] extended the single-period CAPM to a multiperiod (intertemporal) model that includes state variable hedging, but this model has proven too difficult for practical implementation. Waring and Whitney [2009] and Cochrane [2014] introduce CAPM-based intertemporal portfolio theory that incorporates the multiperiod liability (goals and time). The risk-free asset is redefined as the asset that perfectly hedges the multiperiod liability. The optimal portfolio is a linear combination of the intertemporal risk-free asset and the market portfolio of risky assets, where the relative weighting depends on the investor’s risk aversion. Fama and French [1993] show empirically that stock and bond returns are multifactor, which is inconsistent with the standard CAPM and its single market factor. But their results can be interpreted as consistent with an intertemporal CAPM that includes a term factor (a term structure in the risk-free asset) in addition to a market factor (which is rounded out by size and value factors in the Fama–French model). The goals-based asset allocation method we present is most closely related to contemporary CAPM-based intertemporal portfolio theory, with key modifications in architecture and construction to suit private investors and accommodate real world frictions.

GOALS-BASED, LIFECYCLE GLIDE PATH

Optimal lifetime asset allocation should be goals-based and multiperiod, requiring customization by goals, human capital, and risk preference—with perhaps some mechanism to exploit at least the possibility of mean reversion on occasion. Ideally, risk preference is defined intuitively for private investors. We present a dynamic asset allocation method based on an intertemporal CAPM that incorporates these features to produce a goals-based, lifecycle glide path (GB-LGP)—an asset allocation roadmap that optimally funds lifetime consumption goals while adapting to evolving conditions.

The GB-LGP is the result of the investor’s unique circumstances and utility, and is therefore customized for each investor. It is derived from three interrelated inputs: cash flows (goals), the alignment of cash flows with discount rates (risk preference), and discount rates. The Consumption Goal (Cash Flows)

The method requires an estimate of the expected timing and magnitude of cash outflows from the investment portfolio to fund lifetime consumption. The consumption goal is net of consumption contemporaneously funded from outside of the investment portfolio (e.g., from human capital earnings, Social Security, and pension benefits that are not otherwise saved and invested in the portfolio). This offset incorporates human capital and pension flows into the GB-LGP. The framework is easily modified to handle the full lifetime consumption liability and total human capital and pension assets, but the netting approach described herein facilitates a more focused discussion of the investment portfolio, which is the scope of this article. The estimated consumption goal is provided by the investor, as it is their liability. It is expressed in terms of dollars (or some other unit of currency) of current purchasing power.

Expected consumption occurs over the planning horizon. In most cases, the planning horizon is the number of periods (years) of remaining planned life expectancy from today. This can be informed by life tables or by the investor’s own preference. The distribution phase is the time period within the planning horizon when cash outflows from the investment portfolio fund consumption. The distribution phase typically represents either the later years of the planning horizon or the full planning horizon in the case of an investor who is currently retired or otherwise already funding consumption goals from the investment portfolio. The distribution phase may be preceded by an accumulation phase when the investment portfolio produces no cash outflows and the investor may be using human capital earnings to fund consumption. During the accumulation phase, the investor may be saving from his human capital earnings and making contributions to the investment portfolio to fund future consumption. Each investor has a unique pattern of expected consumption, and therefore the consumption goal is an input to GB-LGP customization.

Years of Safe Asset Reserve as Risk Preference (Alignment)

At all current and future points in time, the GB-LGP is composed of a dynamic mix between a subportfolio of optimally combined safe assets (e.g., cash, investment-grade, and inflation-protected bonds)
and a subportfolio of optimally combined risky assets (e.g., equities, high-yield bonds, and other risky assets). The aggregate portfolio of safe asset and risky asset subportfolios funds lifetime consumption. According to intertemporal CAPM theory, the subportfolio of safe assets would be composed of the intertemporal risk-free asset that perfectly hedges consumption. But as a practical matter, the subportfolio of safe assets can be a close proxy that is sufficiently low risk and aligned to fund consumption with very high confidence from the investor’s perspective. This is a trade-off for functional implementation that considers real world expenses, taxes, and other frictions over an abstract ideal. The two subportfolios offer very different expected return and risk profiles (low expected return and risk versus high expected return and risk). And from a common risk-factor perspective, the two subportfolios should be uncorrelated and therefore driven by different underlying sources of positive average excess return—cash and term beta versus market beta (the two predominant risk premiums in capital markets). Even if the subportfolio of safe assets is not perfectly intertemporal risk-free, all combinations of the two subportfolios are mean-variance efficient in this two-factor framework.

The safe asset reserve is the preferred number of periods (years) of consumption funded by the subportfolio of safe assets today or in the future. The safe asset reserve subportfolio is aligned to fund nearer-term consumption through time, and it is designed to meet those consumption needs even through periods of capital market distress. The risky asset subportfolio is aligned to fund longer-term consumption through time. The selection of a safe asset reserve (in terms of the number of years of consumption protection) is an intuitive expression of the investor’s risk preference. In general, a conservative investor would select a larger safe asset reserve (i.e., more years of consumption funded with safe assets) than a less conservative investor. The number of years of safe asset reserve and when they occur can further depend on the investor’s age, real and potential human capital, outside assets and cash inflows, and whether they are in accumulation or distribution phases.

When a safe asset reserve is selected in consideration of the funding ratio, it is an expression of utility. There is a trade-off between the value of the safe asset reserve and the funding ratio. This perspective of utility is intuitive and pragmatic, and it directly relates to the main objective of funding lifetime consumption. The number of years of safe asset reserve is a primary driver of the GB-LGP’s mix between safe asset and risky asset subportfolios through time. As such, it drives portfolio choice in a multiperiod framework and is a key input to GB-LGP customization.

In addition to imprinting utility and customization on the GB-LGP, the safe asset reserve can also serve as a risk management tool with a behavioral element during times of capital market distress, when it can become a true reserve that is drawn down to fund consumption exclusively. This enables investors to stay the course with their allocation to higher returning risky assets (and their overall goals-based strategy), effectively giving risky assets time to earn their higher expected return—potentially augmented by mean reversion—and recover lost value. A dedicated reserve of safe assets supports both lifestyle consumption and the human psyche through periods of market distress.

Comparative historical summary risk metrics can inform the number of years of safe asset reserve. For example, Mladina [2014] compares historical U.S. stock and bond risk over progressively longer investment horizons (holding periods) and finds that the ratio of stock-to-bond standard deviations progressively shrinks until stabilizing at about seven years, when conditional value-at-risk (CVaR) for stocks and bonds also converge—though standard deviations for stocks remain higher than bonds for all time horizons. A seven-year safe asset reserve may appeal to some investors. (We are careful here to differentiate the historical mean reversion of risky assets from the fallacy of time diversification under independent return assumptions.) Historical and simulated stress tests performed on the two subportfolios separately (along with subsequent recovery time) can provide more granular guidance on the selection of years of safe asset reserve.

We note that the existence of mean-reverting risky assets is not a necessary precondition for this method, but an additional benefit if the higher expected return of risky assets is augmented by mean reversion on occasion. Investors can choose to fund anywhere between zero years and all of the years of consumption during the distribution phase with safe assets, so that the selection of a safe asset reserve still remains an intuitive expression of risk preference that drives portfolio selection regardless of the existence of mean reversion. Investors using this method would still align safe assets to fund nearer-term consumption through time because actuarially they are
always more likely to consume nearer-term distributions, so it is consistent with the marginal utility of wealth.

**Consumable Discount Rates**

Expected future cash outflows from the investment portfolio that fund consumption are discounted to present values by consumable discount rates. These are the gross expected geometric mean returns for safe asset and risky asset subportfolios—adjusted down for relevant expenses, taxes, and inflation—that fund consumption and facilitate a comparison of real purchasing power through time. Mladina [2011] offers one approach to constructing consumable discount rates. Gross expected returns and the inflation forecast can be determined by the investor (or their investment advisor). Expenses and taxes can depend on the investor’s unique circumstances. Consumable discount rates are an input to GB-LGP customization.

**CONSTRUCTION**

The following steps outline the process of creating the GB-LGP:

1. Determine the value of current investment portfolio assets intended to fund expected future consumption. This is the funding ratio’s numerator. (The funding ratio is the current value of investment portfolio assets identified to fund consumption divided by the present value of consumption liabilities to be funded from the investment portfolio.)

2. Determine the consumption goal—the expected consumption funded by the investment portfolio for each period (P) in the planning horizon (P1 to Pn). This is the timing and magnitude of expected real cash outflows from the investment portfolio spanning the first period in the planning horizon (CF1) to the last period in the planning horizon (CFn)—including zero-value cash outflows for periods with no anticipated consumption funding from the investment portfolio (e.g., during the accumulation phase when human capital may be fully funding consumption).

3. According to intertemporal CAPM theory, the safe asset reserve subportfolio would be composed of the intertemporal risk-free asset, constructed from high quality, duration-matched, and inflation-protected bonds and cash. For a close proxy more suited to practical implementation, use mean–variance optimization to determine the optimal combination of safe assets within the safe asset reserve subportfolio. This entails finding the mix of safe assets with the highest Sharpe ratio, where cash might be constrained in consideration of short-term consumption. Consistent with intertemporal CAPM theory, use market equilibrium weights or mean–variance optimization to determine the optimal combination of risky assets within the risky asset subportfolio. This entails finding the mix of risky assets with the highest Sharpe ratio, where the return and risk of risky assets are defined in excess of the return and risk of the safe asset reserve subportfolio.

4. Determine the consumable discount rates for each subportfolio. Best practice is to plan around the expected geometric mean discount rates net of expenses, taxes, and inflation for each subportfolio because that is the expected outcome and the method is adaptive. For simplicity and without loss of generality, the process described herein uses a single consumable discount rate for the safe asset reserve subportfolio and separate single consumable discount rate for the risky asset subportfolio.

5. Determine the number of periods (years) of safe asset reserve (R). The consumable discount rate associated with the safe asset reserve subportfolio is applied to periods P1 to Pr. The consumable discount rate associated with the risky asset subportfolio is applied to periods Pr+1 to Pn.

6. Each cash outflow located at CF1 to CFR is discounted to its present value by the consumable discount rate of the safe asset reserve subportfolio. The sum of these present values represents the GB-LGP’s current target allocation to the safe asset reserve subportfolio per Equation (1):

\[
PV_{SA} = \sum_{p=1}^{R} CF_p / (1 + i_{SA})^p
\]

where

- PV_{SA} is the present value of the safe asset reserve subportfolio;
- R is the number of periods of safe asset reserve (i.e., P1 to Pr);
- CFp is the cash outflow associated with period P;
- i_{SA} is the consumable discount rate for the safe asset reserve subportfolio.
7. The future cash outflows located at CF_{R+1} to CF_N are invested in the risky asset subportfolio until they sequentially enter the safe asset reserve's time horizon (P_1 to P_R) with the progression of time. The present value of the transitioning future cash flow at CF_{R+1} is rebalanced to the safe asset subportfolio when it arrives at P_R in time and becomes CF_R. This effectively serves to replenish the back end of the safe asset reserve (CF_p) as the front end (CF_1) is consumed. Therefore, each future cash outflow located at CF_{R+1} to CF_N is discounted to its present value by its own consumable discount rate that is a geometric average of the safe asset subportfolio discount rate and risky asset subportfolio discount rate, weighted by the respective periods per Equation (2):

\[ i_{[1,P]} = \sqrt{(1 + i_{SA})^P (1 + i_{RA})^{P-R}} - 1 \]

where

- \( i_{[1,P]} \) is the geometric average consumable discount rate from P_1 to P when P > R;
- \( i_{RA} \) is the consumable discount rate for the risky asset subportfolio.

The sum of these present values represents the GB-LGP’s current target allocation to the risky asset subportfolio per Equation (3):

\[ PV_{RA} = \sum_{t=R+1}^{N} CF_t / (1 + i_{[1,P]})^P \]

where

- \( PV_{RA} \) is the present value of the risky asset subportfolio.

The sum of the current target allocation to (i.e., present value of) the safe asset reserve subportfolio plus the current target allocation to (i.e., present value of) the risky asset subportfolio is the present value of the consumption liability and the denominator of the funding ratio.

9. The process outlined thus far outputs a core GB-LGP representing a funding ratio of 1.0 (asset sufficiency) at all points in time. In scenarios where the investor has a funding ratio greater than 1.0, they have surplus assets which are not currently anticipated to fund consumption. Surplus assets are added to the risky asset subportfolio, and they adjust the total current asset allocation, which is composed of the core GB-LGP (representing a funding ratio of 1.0) plus an additional allocation to the risky asset subportfolio for surplus assets. This treatment of surplus assets is consistent with the marginal utility of wealth within an intertemporal CAPM framework. No portion of the surplus would be held in the safe asset reserve subportfolio as long as the consumption liability (a stated goal with priority) is funded in part by risky assets.

10. If investors are risk-averse, the mathematically optimal solution to lifetime asset allocation using this method is to maximize the years of safe asset reserve (R) within the planning horizon (P_1 to P_N) subject to a funding ratio greater than or equal to 1.0. But this objective function is not a rule because the preferred number of years of safe asset reserve can depend on how the investor prefers to assess risk, and indeed they may be risk-seeking. For example, in practice we find that many investors prefer not to fully fund their consumption goal with safe assets even if they can afford to do so.

THE SPECIAL CASE OF ACCUMULATION

During the accumulation phase, the investor may have a funding ratio below 1.0 and be using some of their human capital earnings to save for future consumption. The investor’s savings produce cash inflows into the investment portfolio that incrementally fill up the target asset allocation until eventually a funding ratio of 1.0 is achieved.
The investor is not yet consuming from the portfolio, but has selected a future safe asset reserve to be in place when the distribution phase begins. As a result, the first cash outflow greater than zero is located at the future period when the distribution phase begins (CFD).

The investor may choose to prefund (in periods) some of the future safe asset reserve before filling out the rest of the target asset allocation. This behavior is consistent with the marginal utility of wealth, and with Zanella [2015], who argues that investors in the accumulation phase with risky human capital may decompose their savings into precautionary emergency savings and savings for future consumption. If the safe asset reserve is prefunded by a certain number of periods (X), the associated cash outflows at CF_D to CF_D+X−1 are zeroed-out and moved to CF to CF_D+X−1, which were previously zero-value cash flows. These cash flows are not initially consumed but are available for emergency consumption if necessary (a form of self-insurance) and are carried forward each year with the progression of time until CF_D to CF_D+X−1 and CF_D to CF_D+X−1 are the same (i.e., the investor enters the distribution phase).

The present value of expected future cash inflows into the investment portfolio from saved human capital earnings during the accumulation phase is added to the numerator of the funding ratio to determine whether the investor is saving enough to fund future consumption during the distribution phase. If this modified funding ratio remains below 1.0, the investor can consider the various trade-offs outlined in the next section.

**ADAPTIVE TRADE-OFFS**

If the funding ratio is less than 1.0, the investor can consider personal and economic trade-offs to achieve a funding ratio of 1.0. The investor can consider:

- reducing consumption;
- postponing future consumption and/or saving more (reverting back to the accumulation phase or remaining in it longer);
- reducing the years of safe asset reserve (increasing investment risk and funding risk);
- reducing the planning horizon (increasing longevity risk). (Investors can also consider deferred income annuities to reduce the longevity risk associated with a shorter planning horizon. The associated future cash flows are then removed from the GB-LGP, as they would be funded by the insurer);
- improving investments within each subportfolio (to produce higher consumable discount rates);
- postponing trade-offs with the hope that returns might prove higher than expected, while accepting that trade-offs (such as reducing future consumption) may likely be required in the future.

In scenarios with a funding ratio greater than 1.0, the investor can consider personal and economic trade-offs that suit their preferences. The investor can consider:

- increasing consumption;
- increasing the years of safe asset reserve (reducing investment risk and funding risk);
- increasing the planning horizon (reducing longevity risk);
- allocating some of the surplus to financial goals other than lifetime consumption, such as gifts. For example, the cash outflow(s) associated with a future gift can simply be added to the expected pattern of future cash outflows funded by the GB-LGP and included in the initial optimization. Alternatively, if the investor mentally accounts for the gift separately and with a different risk preference than R, they may choose to fund the future gift with a discrete gift-funding portfolio. If investors are risk-averse, the solution is to maximize the percentage of the discrete gift-funding portfolio allocated to the safe asset subportfolio subject to a total funding ratio greater than or equal to 1.0. However, the investor may be risk-seeking, and they may prefer not to fully fund the gift with safe assets even if they can afford to do so (as may be the case for an aspirational goal). The total asset allocation is then composed of the GB-LGP, the discrete gift-funding portfolio, and any remaining surplus assets. Prioritization may be required with multiple goals, including trade-offs in risk preferences and goal thresholds in consideration of the funding ratio;
- postponing the decision to allocate surplus assets to a future date;
- or alternatively, surplus assets can be viewed as a cushion to the funding ratio in the event that future realized consumable returns are below expectations.
In normal capital market environments, the investor follows the target asset allocation through time (adapting and making changes and trade-offs as needed). In rare but occasional periods of severe capital market distress (when risky assets are significantly devalued), an investor in the distribution phase can choose to draw down the safe asset reserve to fund consumption exclusively for a period of time. In this case, a rebalance to replenish the back end of the safe asset reserve from the risky asset subportfolio can be postponed to wait out a recovery in risky assets with their higher expected returns, potentially augmented by mean reversion. The investor effectively “steps off” the glide path temporarily. However, at all times the investor can consider the implications of the funding ratio, and either make or postpone trade-offs.

Finally, Monte Carlo simulation can be used to assess lifetime goal-funding risks and opportunities, which may inform trade-offs. A probability distribution of funding ratios is generated by repeatedly sampling gross returns of safe asset and risky asset subportfolios separately for each period (P) in the planning horizon (P1 to PN). The gross period returns from each trial are sequenced and geometrically averaged according to the timing and behaviors in steps 5–7, and converted into consumable discount rates. This produces a probability distribution of liability present values, which in turn produces a probability distribution of funding ratios that indicates the probability and magnitude of shortfall and surplus goal-funding scenarios.

**EXAMPLES**

The following exhibits show core GB-LGPs (representing funding ratios of 1.0) under different scenarios. Each scenario employs the algorithm outlined in the “Construction” section. Each glide path results from the unique character of the liability (i.e., cash flows and the alignment of discount rates), and how the character of the liability changes with the progression of time.

The GB-LGP in Exhibit 1 represents a 40-year-old high-net-worth investor in the distribution phase with a 10-year safe asset reserve and a 60-year planning horizon (to age 100) who expects to consume level inflation-adjusted cash outflows. The safe asset reserve is retained through the planning horizon and is fully consumed by the end, without replenishment. All portfolio assets are assumed to be in taxable accounts and the consumable discount rates (after subtracting expenses, taxes, and inflation) in this illustration are 0.5% for the safe asset subportfolio and 3.3% for the risky asset subportfolio.

The GB-LGP in Exhibit 2 represents the same scenario as Exhibit 1, but with a 20-year safe asset reserve.

The GB-LGP in Exhibit 3 represents a 40-year-old working professional in the accumulation phase with human capital fully funding current consumption. He wants a 10-year safe asset reserve in place when he enters the distribution phase (i.e., retires) at age 65 (25 years from today) to consume level inflation-adjusted cash outflows. All portfolio assets intended to fund future consumption are located in tax deferred retirement accounts and the consumable discount rates (after subtracting expenses and inflation but not dividend income tax, interest income tax, or capital gains tax) are assumed to be 0.9% for the safe asset subportfolio and 4.4% for the risky asset subportfolio. The expected cash outflows must also fund the anticipated tax on distributions from the tax-deferred accounts. The last ten years of the accumulation phase in this example (i.e., from 15 to 25 years from today) represent a transition when the safe asset reserve is built up during the accumulation phase in anticipation of the distribution phase. The length and pace of the transition also depends on the years of safe asset reserve selected, so the transition is unified with risk preference. Relative to Exhibit 1, the different shape of this glide path primarily results from the pattern of future cash outflows, which do not begin for 25 years because human capital fully funds consumption during the accumulation phase.

The GB-LGP in Exhibit 4 represents the same scenario as Exhibit 3, except the investor chooses to pre-fund today two years of his 10-year safe asset reserve. The prefunded two years are carried forward each year into the distribution phase. In addition to reducing risk of the GB-LGP in Exhibit 3 during the accumulation phase, the two-year prefunded safe asset reserve can be made available (net of tax and early withdrawal penalties in this case) to fund unanticipated near-term consumption needs in the event of a job loss or other economic distress until earnings from human capital are recreated. In the early years of the accumulation phase, the relative allocation to the safe asset reserve appears to decline initially because it maintains an absolute real value while approaching future consumption funded by the GB-LGP requires increasing portfolio present values due to the time value of money.
Similar to Exhibits 1 and 2, the GB-LGP in Exhibit 5 represents a 40-year-old high-net-worth investor in the distribution phase over the full planning horizon (to age 100) and all portfolio assets intended to fund consumption are in taxable accounts (with associated consumable discount rates). However, in this scenario the investor initially wants a 5-year safe asset reserve in place today while he still has significant potential human capital, and then a 15-year safe asset reserve in place at age 65 through the end of his planning horizon. This scenario represents two different safe asset reserves during the distribution phase, and it is formed from a composite (present value sum) of a discrete GB-LGP with a 5-year safe asset reserve and cash...
outflows spanning the periods from age 40 to age 64 and a second discrete GB-LGP with a 15-year safe asset reserve and cash outflows spanning the periods from age 65 through the end of the planning horizon.

In this example, the transition to a 15-year safe asset reserve appears to be completed before age 65 (25 years from today). This is due to the crossover between a depleting 5-year safe asset reserve and an accruing 15-year safe asset reserve that occurs during the transition. This crossover point varies depending on the different safe asset reserves selected.

The reader might be curious to know how these examples compare to standard asset allocation approaches and conventional glide paths, but that would miss the
point. The standard approaches are not multiperiod optimal. They do not explicitly consider the multiperiod liability (i.e., goals and time). They ignore human capital. They do not define risk preference and utility intuitively for private investors, which increases the likelihood of a misalignment between portfolio selection and the investor's true risk aversion. The GB-LGP is more complete, and more customized to the investor's circumstance. The method is rooted in contemporary portfolio theory, with key modifications to suit private investors and accommodate real world frictions. Cochrane [2014] argues why an intertemporal CAPM should be the benchmark for intertemporal portfolio theory. Our contribution is to make an intertemporal CAPM relevant and workable for private investors with lifetime goals.

CONCLUSION

As a first principle, assets should serve the purpose of funding a lifetime of financial goals. Optimal lifetime asset allocation requires customization by goals, human capital and an intuitive expression of risk preference for private investors. We presented a dynamic asset allocation method based on an intertemporal CAPM that incorporates these features to produce a goals-based, lifecycle glide path—an asset allocation roadmap that optimally funds lifetime consumption. The method adapts to evolving conditions, empowering investors to make informed economic and personal trade-offs with fresh and relevant information related to revised expected consumption, revised years of safe asset reserve, revised consumable discount rates, and an updated view of the funding ratio, which in turn produce a revised GB-LGP and a revised funding ratio.

Importantly, the method provides a framework for informed decision making that supports rational investing by changing the investor’s focus from short-term return and volatility, which they cannot control (a driver of many of the behavioral biases we observe), to lifetime goals, reserves, funding ratios, and adaptive trade-offs, which they can control. This framework can be further supported by education, which also reduces behavioral bias.

We believe goals-based investing is the future of wealth management because it holistically solves the investor's main challenge of optimizing assets to efficiently fund lifetime consumption and gifts. There is more than one way to structure a goals-based investing program. In addition to presenting one method that has proven to work well in practice, we surveyed foundational research and key issues that must be considered in any goals-based asset allocation solution.
ENDNOTES

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1We use utility here in relation to the investment portfolio of financial assets.

2Mladina [2014] explores mean reversion in asset allocation and provides a summary of the literature on mean reversion and predictable variation in expected return.

3See Sharpe, Alexander, and Bailey [1999]. This condition holds when short selling is permitted.

4Asset returns do not need to be normally distributed to use variance. Chamberlain [1983] finds that the mean-variance rule can be employed for any elliptical distribution.

5The Fama–French default (credit) factor for bonds is a linear combination of the market factor, so it is not an independent risk factor.

6High-yield return and risk are dominated by high-yield’s credit beta, which is a linear combination of the market factor. The risky asset subportfolio can also include exposures to alternative risk premiums such as size, value, momentum, trend, and carry.

7Although the minimum variance combination may retain a small allocation to the risky asset subportfolio, the safe asset subportfolio remains less risky in asymmetric scenarios of market distress. The two-factor optimization framework also mitigates the effects of parameter uncertainty and input sensitivity, a common problem in mean-variance portfolio optimization.

8This is a building-block approach that closely ties to cash flow models, which can also be used to calculate consumable discount rates.

9Within each subportfolio, consumable discount rates can differ for each discrete cash outflow based on tax assumptions and time-varying expected returns over different holding periods.

10Instead the investor would first increase the years of safe asset reserve to absorb the surplus into safe assets and consider the other options we outline in the “Adaptive Trade-Offs” section.

11The discount rate on savings from human capital earnings can depend on the unique risk profile of an investor’s human capital. Blanchett and Straehl [2015] argue that human capital has an industry-specific, bond-like risk profile. But it can also have an equity-like risk profile.

12Different consumable discount rates also affect the shape, but only marginally in this scenario.

REFERENCES


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