

Pension Fund Perils: Why Conventional Pairing of LDI with De-risking Glide Paths Produces Inferior Outcomes

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Combined use of traditional Liability Driven Investment (LDI) and funded status responsive de-risking strategies should be decoupled or rebuilt. Embedded inconsistencies in the treatment of risks in these two elements of what has become a popular pension strategy cause irreconcilable conflicts in their execution and imperils the positive pension fund outcome.

This article provides a critique of the combined LDI / De-risking Glide Path strategy as currently implemented by many pension plan managers and also provides an example of an alternative solution that better improves pension plan outcomes.

Our prescription for the pension de-risking glide path approach differs from conventional wisdom. In summary:

- The portfolio of return generating assets does the heavy lifting required to reach the next de-risking trigger and hence its volatility should increase as its assets are re-allocated to LDI strategies
- Beta and alpha are not equally valuable for de-risking process. Return generating assets should prefer liquid alpha strategies unless there is a tactical opportunity in beta
- Approaches that incorporate inflation exposures benefit from little-known correlation to credit spreads

Our prescription results in *faster* de-risking, without undesirable market betas that are unrelated to the liability; avoids illiquid assets that pension funds often gravitate towards in their quest for returns; takes fewer credit risks; and seeks more alpha risks.

Approaches to pension risk management have passed through many phases over the past 40+ years. Higher rate environments of the 1980s made liability immunization programs with treasuries very attractive, but traditional 60/40 or balanced fund strategies persisted as the dominant strategy for pensions. As rates began their secular decline, funding levels continued to deteriorate and while liability-driven investing became popular again in the beginning of the new millennium, significant levels of underfunding prevented most pensions from fully matching their assets and liabilities. A variety of partial risk mitigation solutions began to emerge as the lower rate environment of the past 20 years forced institutional investors to be exposed to higher levels of market risk. New asset classes were introduced into pension plan portfolios in order to achieve higher returns

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and higher levels of diversification. Adverse market volatility was further reduced through creative solutions that incorporated smart beta and risk allocation strategies that delivered lower-volatility at similar levels of long term return. Other strategies sold liquidity back to the market in order to generate additional return in a low yielding environment. Some risk-based approaches also introduced interest rate derivative overlay programs to extend interest rate duration of total assets along with equity risk reduction programs to reduce equity market risk. Finally, de-risking glide paths - and ultimately liability risk transfer to insurance companies - became in vogue as companies continued to struggle with their asset-liability risk and found it expedient to pay insurance companies to assume the problem for them.

In recent years, much has been written about whether pension funds have sufficient assets to support their liabilities, and clearly the source of much of this angst is that...many of them don't. One thing that is clear is that after decades of chasing new and creative solutions, the problem of underfunded pension plans is still here and the debate about who should manage the assets, and how they should be managed, continues with ever-increasing urgency.

This article represents our contribution to this debate, with a special focus on the asset allocation requirements for cost effective pension plan de-risking.

Two Shortcomings of Traditional LDI and De-risking Strategies, as Combined

Type of risk

At this point it is important to differentiate the assets that function as liability hedges and those assets that better assist with the process of de-risking as the plan glides towards a fully hedged status. Long duration bonds function as the best hedge for the liabilities, and as the plan's funded status improves and the de-risking process proceeds, the allocation to bonds increases. While bonds and bond-like derivatives are a core staple of liability-driven investing (LDI) strategies, for most underfunded plans that have a goal of full funding with some help from asset performance it is economically infeasible to allocate 100% of the assets to the liability-matching portfolio. A gradual increase in bond assets over time as funding status increases is part of the de-risking asset allocation process. This is an important distinction between LDI and the process of de-risking. If the liability-matching assets allow the plan to better lock in the current funded status level, then it is only the remaining assets that allow that plan to reach the next funded status threshold in order for the plan to de-risk further. Traditionally, these non-LDI assets are exposed to a significant amount of equity beta, as the long-term expected compensation from taking equity risk is positive. While it is thought to be true that, in the long term, equity beta risk is well compensated, the trouble is that in the shorter time horizon of de-risking process the equity beta is very much dependent on market valuations that are not related to the valuation of the pension liabilities. Therefore, it becomes a tactical rather than a strategic decision to hold equities for a de-risking plan.

While all pension models focus on longer-term horizons, pensions in a de-risking mode have a much lower risk tolerance in the short term. This has caused many pensions to

allocate assets to a variety of alternative investments in order to diversify away from equity beta risk. However, this practice also introduces other risks to the plan, some of which are illiquidity, currency, and/or additional credit default risk. So there is an inconsistency: while pension funds are known for taking the very long view when it comes to illiquidity, if the sponsors are pursuing an LDI/de-risking strategy the additional illiquidity is counterintuitive, given the objective to be dynamic and nimble in the de-risking process.

But assuming that potential illiquidity is at least somewhat of a concern to a pension fund manager, then the Hobson's choice between equity risk or illiquidity likely means that underfunded pension plans that are pursuing joint LDI/de-risking strategies are still carrying too much equity beta risk, or are slowing down the de-risking process while equity risk is mitigated through other less liquid investments, or both. Pension fund managers and their advisors sense this, but tend to reach a type of asset allocation compromise where pension returns may be less optimal and de-risking results are less effective.

So if equity beta isn't desirable as unrelated to the liability, and illiquidity of many other alternatives make them less-desirable for dynamic rebalancing into LDI assets, what is the most effective way to replace the equity beta for a de-risking plan? What other forms of beta and/or alpha are appropriate in aiding in the process of de-risking? From the standpoint of Markowitz efficient frontier generation, risk is a function of return variance and the covariance of the returns of the eligible portfolio elements. Beyond that, to the optimization routine risk is risk. That is, it doesn't matter whether the risk comes from beta or from alpha. From the standpoint of the de-risking process, when it comes to the non-LDI assets or return generating assets, alpha is preferred to most beta since alpha is more process-dependent as opposed to market-dependent. In the shorter-term horizon of de-risking, non-LDI beta introduces more risk. So our only choice seems to be some combination of liquid alpha and/or well compensated liquid beta that has some correlation to liabilities. This particular beta may be different from how the liability matching or LDI assets are invested and doesn't need to match the performance of the liabilities, but should have a positive correlation with liability performance. That's a tall order.

Some of the more publicized alpha alternatives are hedge funds, private investments in equity or debt of corporations, or real estate. We don't intend to dive into the merits and disadvantages of these or other alternative investments on a stand-alone basis but will only superficially observe their fit in a de-risking framework. Many hedge funds return as much beta as alpha – indeed, the fact that there are successful hedge-fund replication techniques is virtual proof that many hedge funds are actually beta masquerading as alpha. The obvious visual correlation between hedge fund returns and equity returns, too, should make one suspicious that hedge funds are a pure source of alpha (see Chart, source Bloomberg, comparing the HFRI Fund of Funds Composite Index to the S&P 500).

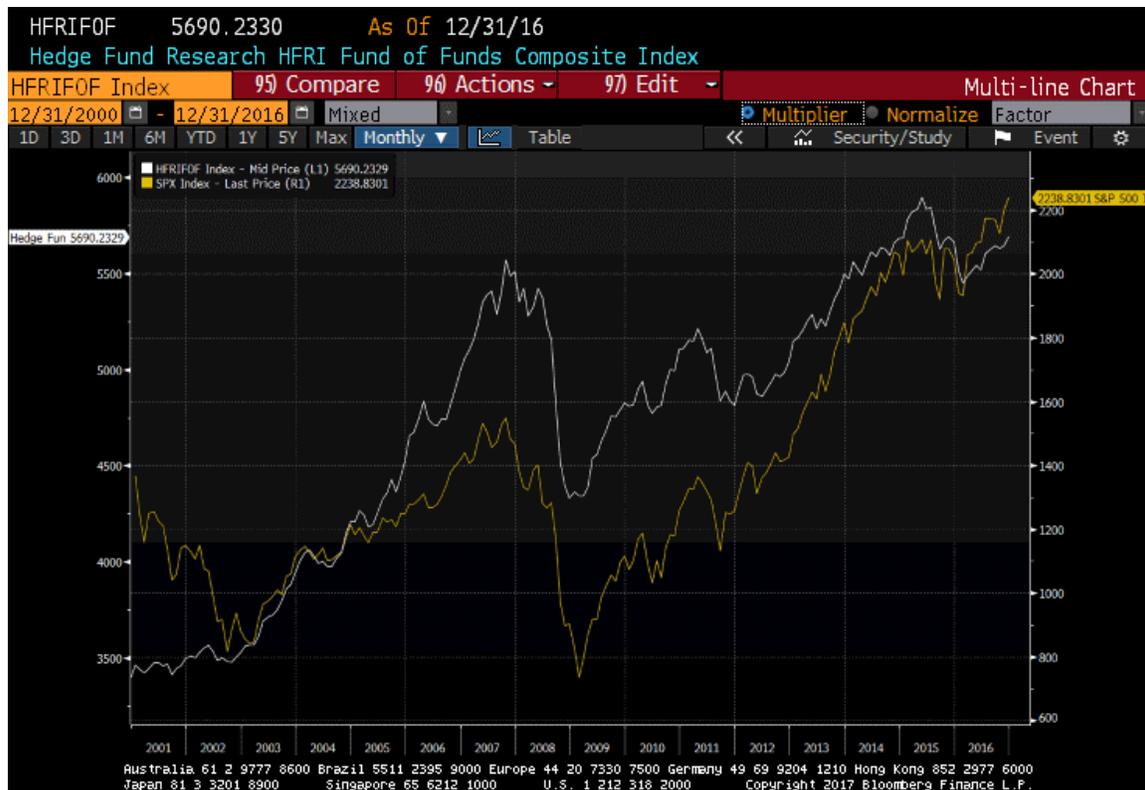


Figure 1: HFRI Fund of Funds Composite Index vs S&P 500

While those hedge funds or private investments that have a higher correlation to fixed income beta may benefit plans with a long time horizon, they suffer from varying degrees of illiquidity, which impedes the de-risking process as previously discussed.

While there may be other examples for a better alternative, we can provide one strategic example that better fits the combined LDI / de-risking criteria we have discussed in this article.

The Better Alternative

We have addressed above the type of risk that pension funds do *not* want to have. But it behooves us as well to point out one type of risk that pension funds really *ought* to have, and yet tend to be underinvested in: inflation exposure, or more accurately real interest rates.

There is a competent literature about the importance of inflation-linked assets to the pension plan.² Importantly, inflation-linked assets are relevant even if the pension benefits are not themselves inflation-linked, since for most pension plans the formula which links the work history of active participants to their future retirement benefits implicitly means that pension benefit accruals for a particular employee are higher the more that employee earns. Since wages generally rise at least partly because of inflation,

² For the iconic example, see Siegel and Waring, "TIPS, the Dual Duration, and the Pension Plan" (*Financial Analysts Journal*, September/October 2004).

this implies that any pension fund with active participants still accruing benefits does in fact have some inflation exposure.

But the importance of inflation to the pension plan goes beyond that liability-side insight. Additionally, pension assets are exposed to inflation – and, especially, large changes in inflation – because on the asset side the majority of the assets of most plans are invested in equities and nominal fixed-income. Both of these asset classes are terribly exposed to increases in inflation, especially when inflation rises above 3-4%.³

We can go still further. While the effects just mentioned are well-established in the literature, one additional benefit from owning inflation-linked assets has not been discussed as far as we can tell, and that is this: the relative value of inflation-linked bonds, compared to nominal bonds, is related to the business cycle and/or level of interest rates level in the same way that corporate spreads are – but without default risk. The chart below (source: Bloomberg data) highlights the connection between credit spreads and 10-year breakevens.⁴ This is important because for most pension funds, the relevant interest rate for discounting liabilities is not the risk-free Treasury rate, but a risky corporate rate; therefore, the liability has credit spread risk and an asset that co-moves with credit spreads – especially without actually having credit risk – is valuable.

³ Remarkably, the myth that common stocks confer some inflation protection has survived decades of contrary experience, both before and after Zvi Bodie's classic "Common Stocks as a Hedge Against Inflation" (*Journal of Finance*, Vol. 31, No. 2, May 1976), in which he concluded forcefully "The regression results...leads to the surprising and somewhat disturbing conclusion that to use common stocks as a hedge against inflation one must sell them short."

⁴ The 10-year simple "breakeven" is merely the yield difference between the 10-year nominal Treasury yield and the 10-year TIPS real yield; it represents roughly the amount of future inflation at which an investor would be indifferent between the two types of bonds.

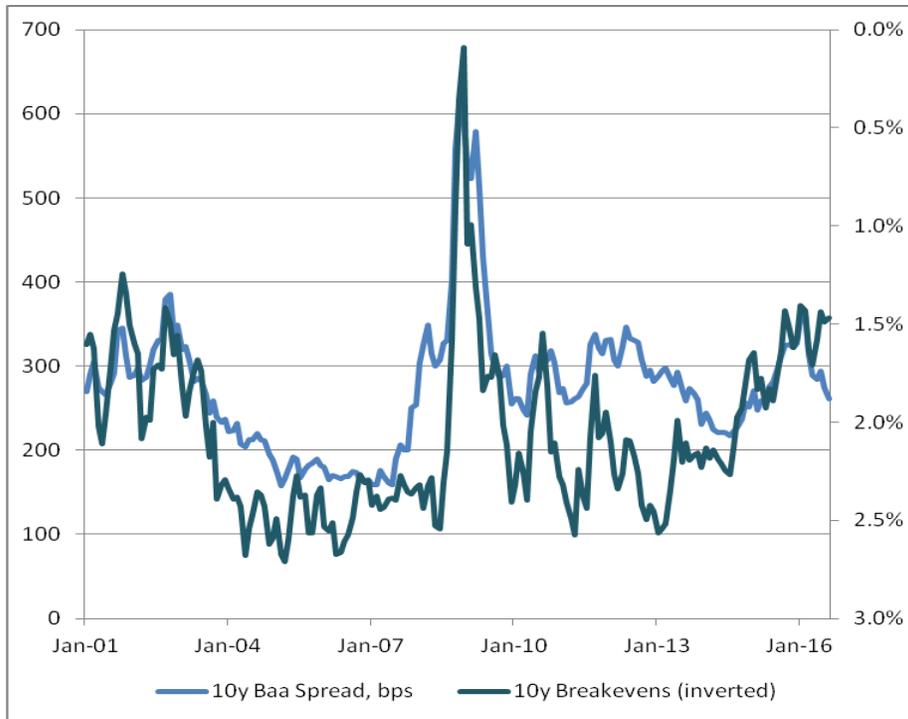


Figure 2: Inflation spreads (“Breakevens”) vs Credit spreads

In our opinion, given a choice between equity beta and inflation/real rate beta, there is no choice: inflation-linked assets are clearly the more valuable risk for a pension fund to own.

Now, pension plans that are pursuing de-risking along with LDI are typically loathe to replace equity risk, given its advantage (over a full cycle, although not necessarily at any given point) in expected return, with real interest rate risk. But inflation-linked markets have an additional benefit, at least in 2017 – they are inefficient, and produce myriad opportunities to generate alpha along with their useful beta. Indeed, we have designed an investment strategy that addresses all of these requirements:

- Historical return commensurate with equity returns, with slightly lower total risk
- Beta from inflation-linked bond markets, which is relevant to pension fund liabilities
- Risk sourced from useful beta, as well as alpha
- Implied credit spread exposure, without actual credit risks, which is relevant to pension fund liabilities
- Superior liquidity to “alts” such as real estate, private equity, or hedge funds – which is more consistent with the de-risking mandate

We call this strategy “Enhanced Systematic Real Return.” In a nutshell, this strategy holds the combination of inflation-linked bonds and breakevens that most efficiently adds inflation protection for a given level of interest rates, and adjusts these proportions based

on the richness or cheapness of inflation-linked bonds to capture additional alpha.⁵

Magnitude of risk

After determining a different, if not more efficient risk vehicle for the non-LDI assets we now turn to the discussion of how much of this risk should be taken at every point of the glide path. Should the risk allocation to return generating risk assets (i.e non-LDI assets) only depend on the dollars allocated to these investments or should the risk allocation be independent of dollars allocated and vary based on the level of leverage and/or asset composition?

Not All Risk is Bad

As we have already alluded, prudent risk has some place in the management of a pension fund on a glide path. Yet, as with the villain in the black hat, we have been conditioned to look at the word “risk” and recoil. But not all risk is bad. Certainly, with LDI approaches risk is a negative – after all, the goal of LDI is to maximize the funded status (difference between assets and liabilities), subject to a limit on the maximum volatility (risk) of the funded status. In that construction, there is no doubt that risk is bad, or anyway that less risk is better. But risk is *not* necessarily bad for de-risking.

This seems counter-intuitive. If we are trying to remove risk, doesn't that imply that risk is bad? Yes – as we just said, risk is bad for the LDI-driven mandate. But the plan that takes less risk has fewer opportunities to reach de-risking thresholds. That is, the more that you de-risk the longer the next increment of de-risking takes. In this context, it is actually helpful to retain more rather than less risk in the non-LDI assets at each de-risking step.

Here is an analogy from basketball: consider the player who constantly heaves up three-point shots. He shoots a lower percentage from beyond the arc, and so the variance of his scoring is quite a bit higher than his variance shooting short jumpers or layups. Let us suppose that **on average**, he scores the same amount per game whether he shoots three-pointers or short jumpers. In an asset management context, we would say that this is a “non-optimized” shooter. He should aim for the same average scoring with lower volatility, right?

Now let us suppose that in a particular game, this player's team is down by 18 points in the final quarter. The coach sends the player onto the court. If this coach is from the pension industry, he instructs his shooter to take only safe shots, because that is how he maximizes his Sharpe Ratio. But if this is actually a basketball coach, he orders his player to take as many three-pointers as he can. Why? He does this because in this situation, risk is good. A strategy of only taking safe shots is guaranteed to lose in this context; only a

⁵ It would be inappropriate to discuss the fine details of this strategy in a thought piece such as this. However, we thought it important to point out that demand for a solution with these characteristics is not hopeless or uninformed. There does exist at least one such solution, and probably others!

highly-volatile strategy has a chance of working.⁶

In the same way, prudent addition of volatility as the plan is de-risking *helps* to de-risk a plan that is under water. So we can see that there is a tension here, and one that is routinely ignored in most LDI/de-risking plans: more volatility is helpful for de-risking, but hurtful inasmuch as it departs from the LDI mandate to maximize the return/risk tradeoff for the funded status. This leads to the phenomenon that is common today, of “hurry up and wait.” As we noted previously: the more that a fund has been de-risked, the longer the next increment of de-risking takes. Each reduction of the proportion of return generating assets to total assets significantly increases the average time until the next de-risking point is reached, as the table below⁷ illustrates:

⁶ This idea isn't exactly alien in finance: if you own an out-of-the-money option, a higher implied volatility increases your delta while if you own an in-the-money option, a higher implied volatility decreases your delta. It's just alien in pension fund management.

⁷ Both Table 1 and Table 2 represent simplified examples where LDI hedging assets and pension liabilities are proxied by the same long-duration bonds, and future pension contributions are excluded from the analysis.

Funded Status	Equity Allocation	Bond Allocation	Mean years to next de-risking trigger ⁸
60%	80%	20%	9.0
70%	40%	60%	12.6
80%	20%	80%	17.8
90%	10%	90%	29.6
100%	5%	95%	55.0

Table 1: Reducing return-generating assets will tend to increase time to next trigger

This is problematic. By de-risking, this plan is becoming too conservative as it approaches being fully funded. We can show that the plan reaches a fully-funded status more quickly when it prudently *avoids* full de-risking. What happens when we allow leverage, and maintain the total portfolio risk even as the bond allocation increases at each trigger? The following table shows the significant result:

Funded Status	Equity Allocation	Bond Allocation	Mean years to next de-risking trigger
60%	80.0%	20%	9.0
70%	58.1%	60%	7.6
80%	45.4%	80%	7.1
90%	36.8%	90%	6.9
100%	30.2%	95%	7.4

Table 2: By maintaining portfolio risk to return-generating assets, de-risking proceeds apace.

Combining the Right Type, and the Right Magnitude, of Risk

When the pension plan pursues a strategy that focuses on risks sourced from alpha and the “right kinds” of beta sources that will tend to match the liability, and de-risks in a way that recognizes that some risk *helps* the de-risking task, then the combined result can be powerful. The chart below (Source: Enduring Intellectual Properties, Inc) compares this new approach with the “classic” LDI plus de-risking approach. The dashed lines represent the “classic” approach, while the solid lines represent an approach that uses our “Enhanced Systematic Real Return” strategy as a substitute for the equity risk of the traditional strategy. In each case, this imaginary pension fund starts year zero at 60% funded, and liabilities grow with the Bloomberg/Barclays/Lehman U.S. Long Government/Credit Index. Also in each case, the top line represents the 90th percentile

⁸ Table is based on a Monte Carlo simulation of a pension fund that begins with the indicated funding status and allocated as shown until it reaches the next de-risking trigger. Returns for stocks and bonds are simulated; the correlation from the last five years is used. The importance of the table isn’t derived from the precision of the assumptions, but from the illustration of the increased difficulty in reaching the next de-risking increment when the fund is already de-risked substantially.

outcome of the Monte Carlo simulation; the bottom line represents the 10th percentile, and the middle line represents the median outcome.

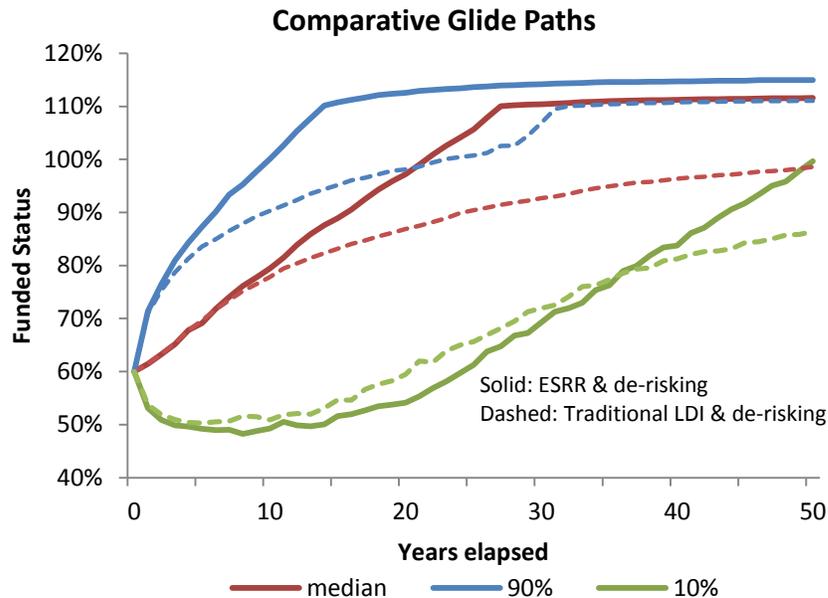


Figure 3: Proper types and magnitudes of risks produce preferable pension outcomes.

There are several facets of this chart worth noting.

Importantly, observe how the median outcome line is linear with our approach, but flattens out with the traditional de-risking approach. This phenomenon is the visual counterpart to Tables 1 and 2; it illustrates how the closer one gets to being fully funded with a traditional glide path, the slower the funded status converges. Our approach, as highlighted in Table 2, is designed to remove that effect. The benefits of that approach aren't only felt on the median outcome, but are apparent on every path as the funded status moves above 75%.

Also, observe that the superior "good" outcomes aren't "paid for" by much worse "bad" outcomes. After all, we could have had even better "good" outcomes if we took lots of extra risk. But in that case, the benefit would have come at a price, and we would see it manifesting in much worse "bad" outcomes. The outcomes here are actually skewed to the positive side.

Finally, although you cannot tell this from the illustration, you should know that this simulation assumes that stocks and bonds have expected returns that are somewhere near their historical mean returns. Unfortunately, presently this seems a generous assumption for the traditional approach. It seems more likely that, going forward, pension plans which are invested heavily in equities will be drawing from a distribution with worse-than-average characteristics due to the high starting valuations. Ditto, of course, for fixed-income...but at least bonds affect both sides of the LDI equation.

Summary

LDI and de-risking glide paths can be combined under certain conditions, but current implementation practices create inconsistencies in how risks are treated and do not facilitate achievement of strategic goals.

Asset beta risks that do not match liability beta risks are useful only in a tactical setting, and then only if they are associated with exceptional returns (that is, the market is cheap tactically).

More effort is required to search out new sources of liquid alpha and beta that facilitate the de-risking process. We have produced one that we believe is useful in this context.

As the plan de-risks along the glide path, the level of risk in the non-LDI assets should be adjusted to preserve a quantum of variance that is useful in the de-risking process, as opposed to just mechanically adjusting allocation dollars in a simple glide path.