

ALTERNATIVE INVESTMENTS IN DC RETIREMENT PLANS: OPPORTUNITIES AND CONCERNS

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In antiquity, all investments were what we now call alternatives — real estate, commodities, private business partnerships, even human capital (slaves). And they were all illiquid. Eventually, in early modern times, the technology and legal structures needed to create liquidity became available, and stocks and bonds were formed out of the assets of businesses and governments. Because liquidity is very valuable, liquid assets became highly preferred and became “traditional” investments. The remaining illiquid ones, known today as alternatives, have attracted great interest from investors seeking to enhance their return by capturing an illiquidity premium.

In the era since modern portfolio theory (MPT) became the guiding principle for portfolio construction, institutions such as pension funds, endowments, and foundations have largely succeeded in realizing this premium. Their success stems from two factors. First, given the long-term nature of their liabilities, they are the natural suppliers of liquidity. Second, they have the sophistication to develop and use the specialized skills and tools needed for adjusting return and risk estimates so that one can sensibly invest across both liquid and illiquid asset classes.

In an attempt to deliver returns comparable to those earned by institutions with very deep liquidity tolerance and technical skills, sponsors of defined-contribution (DC) retirement plans have recently begun including alternatives in their offerings. In this paper, we address what roles alternative asset classes can play in DC plans and, within these plans, in target-date funds (TDFs) specifically. TDFs are of particular importance because they are marketed to practically every retiree and, for many retirees, represent most or all of their savings. We also address challenges in using the standard tools of MPT to incorporate alternatives into DC solutions.

Some of the best minds in financial economics have worked on the problem of constructing portfolios of liquid and illiquid assets for decades. What has been an obscure part of portfolio management is now a mainstream issue. Individuals and their advisors are now being asked to play the traditionally institutional role of liquidity provider and portfolio construction expert. To what extent should alternatives be included in their portfolios? How should we evaluate which ones to include, and in what proportions?

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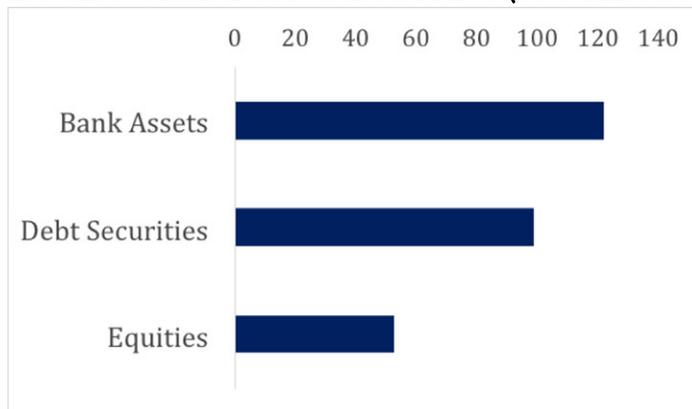
I. HISTORY, THEORY, AND IMPORTANT CONCEPTS

People have always sought ways to invest excess savings. In a pre-industrial society, entrepreneurs, lenders, and equity investors could get by with hand-to-hand trading of unique assets in local markets. But, in a rapidly growing industrial society, the importance of liquidity and clear property claims became amplified. The emergence of national and global markets meant that standardization and transparency conveyed a huge advantage. There is value in knowing that my share of the Union Pacific Railroad is as good as the next person's.

There has long been a two-way market between savers and the many factors of production needed for a functioning economy — not just business capital, but human capital, real estate including farmland, food and water, and other raw materials. Making a large fraction of these assets liquid has contributed greatly to economic growth. Today, the biggest public markets in the world are those that provide clear claims to property and make it convenient and cheap to transact. These are the markets for bank loans, bonds, and stocks. This can be seen in Exhibit 1.²

EXHIBIT 1

LARGEST GLOBAL CAPITAL MARKETS (IN TRILLIONS OF U.S. DOLLARS)



But the process is not complete. Many assets today are still illiquid. A significant part of developed-world market assets, and even larger parts of the emerging world, do not have these attributes. These are the alternative investments now sought out by many investors for their perceived higher returns as well as the potential to diversify stock and bond portfolios.³

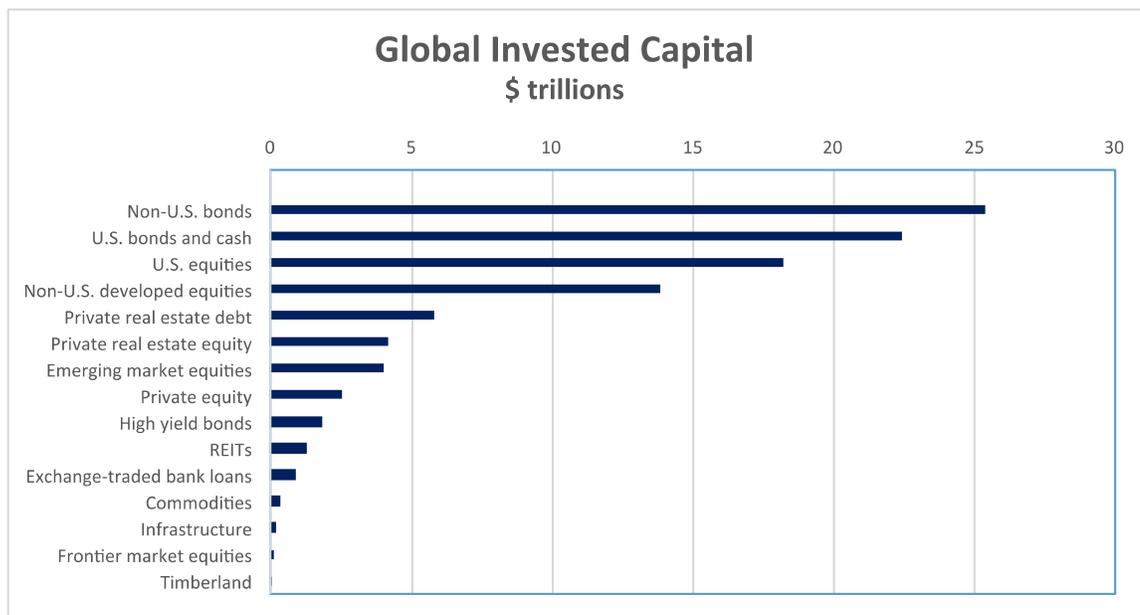
² The IMF data shown in Exhibit 1 involve some double counting of bank assets, for example, bank loans and debt securities held by banks. This, however, does not change the basic message that bank loans, debt securities, and equities are the largest asset classes. We include bank loans because they have even more transparency, relative to the underlying asset, than bond-type debt securities and also have the best property right protections.

³ It is difficult to agree on a common definition of alternative assets. The current convention is to define alternatives as everything but stocks and bonds (and bank loans held by banks.) We adopt this definition, which results in alternatives including a very wide range of assets, from farmland, to toll road revenues, to hedge funds that own unknown combinations of stocks and bonds. Hedge funds are intermediate on the spectrum between illiquid (many years required for liquidity) and liquid (daily liquidity) and need to be treated as such. Appendix I is a list of assets commonly referred to as alternatives.

As the economy becomes more sophisticated and complex, the list of assets that benefit from capital investment becomes even longer, and includes infrastructure, intellectual property, environmental remediation, and short positions (putting pressure on owners and their agents to be more efficient and productive). Thus tradable and investable “alternatives” are a small, but growing and important, group of asset classes.

The much smaller scale of these alternatives can be seen in Exhibit 2. Even the big alternative asset classes are dwarfed by loans, bonds, and stocks, and narrower alternatives such as investable farmland hardly register on a global scale.⁴ These alternative assets can still be part of a well-engineered portfolio of liquid and illiquid securities, but today these alternatives have a liquidity cost and many have limited transparency.

EXHIBIT 2
SIZE OF GLOBAL INVESTABLE ASSET CLASSES, TRILLIONS OF U.S. DOLLARS,
AS OF JUNE 30, 2013⁵



Source: Hewitt EnnisKnupp. “Investment Strategy on Demand Webinar Series.”

How do we figure out how much to hold in alternatives and what kinds of alternatives to hold? How do we measure returns in assets that don’t trade in deep public markets? Is modern portfolio theory the right tool for blending very liquid assets — basically stocks and bonds — with alternatives that are less liquid and less transparent? Or do we need to consider other methods?

⁴ One can make the case that the set of all assets in the world other than stocks and bonds, including those that are not tradable or investable, includes privately owned real estate, farmland, timberland, and even human capital, and is thus much larger than the alternatives shown in Exhibit 2. This observation is mostly theoretical and does not have much bearing on investment decision-making, but for consistency with some of the literature on world wealth, we point it out.

⁵ Here, most of the capitalization of bank loans, shown separately in Exhibit 1, “disappears” into the fixed income and equity categories, representing ownership of the entities that hold the loans.

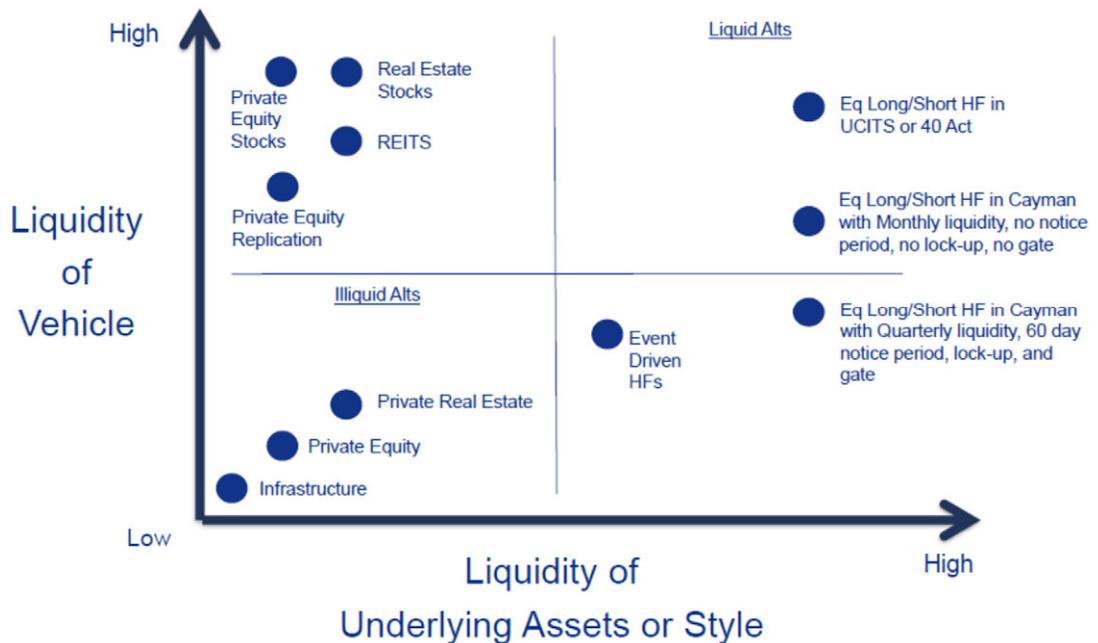
TWO DIMENSIONS OF LIQUIDITY

Of the many issues that arise in trying to answer these questions, two variables will dominate the discussion. The first is the liquidity of the underlying asset or property. The second is the liquidity provided by the investment vehicle (where the vehicle consists of the underlying property claims plus remedies and trading conventions).

Exhibit 3 shows how this framing — “everything but stocks and bonds” — captures the complexity of alternative assets. By portraying liquidity in two dimensions, we’ve made the complex and varied nature of alternative assets more understandable.⁶

EXHIBIT 3

ALTERNATIVE ASSETS PORTRAYED IN TWO DIMENSIONS OF LIQUIDITY



A good example, both in antiquity and today, is a building. The underlying asset is unique and fixed to one location, thus highly illiquid. The technology exists to create almost perfect liquidity: shares in the building can be sold as a real-estate investment trust (REIT). However, most buildings are still held as private equity. Why?

Each legal structure has its advantages and disadvantages, and there are investors for both. The benefits of private real-estate equity are that you have clear control, transparency, and remedies as the owner-manager. There is a customized contract that specifies the operation of the property and the cash flows to which you are entitled. Should there be a default, there is a clear legal process under centuries of property law to remedy the default. The cost of this transparency and control is illiquidity of the vehicle, including a high assembly cost for putting the deal together

⁶ We thank Spencer Rhodes of Allianz Global Investors for this framing, shown in Exhibit 3.

and a high disassembly cost if it is necessary to undo the deal under duress. This combination of control, direct oversight, and illiquidity, brings higher returns.

The benefit of a REIT (public real-estate equity) is the ability to enter and exit the investment by pushing a button. The costs include the fact that you have no control and little transparency. You pay an agent to manage the properties, and you are the residual owner of what the agent did for you. Liquidity is greatly improved, but the investor has no influence over the management of the building, and returns are lower.

Thus, “sell your shares” and “go to court” form the bounds of the potential remedies for disappointment or default. But these are just the extremes; there are intermediate positions, found in the variety of investment structures that exist. Asset-backed securities, especially those backed by mortgages, are an example of this diversity: each deal is unique and defaults accrue to different tranches, with each tranche trading in its own sub-market. The sub-markets offer some liquidity, but are not very deep.

In a \$72 trillion worldwide economy, you should expect to see a market for each of these bundles of characteristics, with considerable variation around the polar extremes. This is exactly what we see in the markets today, and is what we see in Exhibits 1, 2, and 3. Some alternatives are low on the ladders of both liquidity and transparency. Farmland, timber, and toll roads are good examples. Other alternative structures are not very transparent, but the underlying assets are liquid. Market-neutral equity and bond hedge funds are an example. Many other kinds of hedge funds are in the middle, with an unknown percentage of leverage and illiquid assets.⁷

ARE RETURNS HIGHER ON ALTERNATIVE INVESTMENTS?

Many of us who invest primarily in traditional assets — stocks and bonds — have had the experience of comparing our own returns to those of alternatives-heavy institutions such as large university endowments and charitable foundations. The traditional portfolios often fall short in such a comparison. Why?

LIQUIDITY RISK

The first reason is that we are observing the delivery of a liquidity risk premium, but we are not perceiving the risk. For traditional assets, risk is observed directly as daily fluctuations in asset values. Alternative assets usually do not mark to market like that, so the growth of wealth is experienced as a relatively straight upward path. The path can be interrupted, however, when it’s time to sell — either to raise cash for spending or pension benefits, or because the investor wants to rebalance or switch to a different asset. The liquidation price can be much below the price at which the asset is being carried on the books.⁸ This concern applies especially to

⁷ Unfortunately, these attributes are usually learned with precision in periods of financial stress when the hedge fund must provide actual payouts as opposed to a quarterly mark-to-market client letter.

⁸ The late Barton Biggs and other seasoned investors often refer to liquidity as a coward — “it disappears at the first sign of trouble,” to capture the fickle nature of liquidity. “When you don’t need it, it’s abundant; when you need it, it’s gone.” [Personal communication.]

private equity and real estate, where even the manager doesn't know the price that a given asset will bring until she tries to arrange a sale transaction.

This liquidation price risk can be largely avoided if the owner can choose when to sell. Investors whose need for liquidity is far in the future, or who have a lot of flexibility as to when they need the liquidity, can earn a liquidity premium and get a higher return than is available from traditional investments. The source of the liquidity premium is the price discount that a seller or issuer must offer in order to induce investors to buy less liquid assets.

TRANSPARENCY RISK

Lack of transparency is another source of risk in alternatives. With some hedge funds, market-neutral strategies, and leveraged strategies, the underlying assets are liquid and so is the legal vehicle — but the strategy (including holdings and leverage) is not at all transparent. With these strategies, investors must face the risk of not being able to verify that the assets they have are the assets they think they have, and that the assets are worth what the investor thinks they're worth.

As with liquidity risk, investors demand and should receive a return premium (price discount) for transparency risk. Along with this return premium comes an increment to the risk of the asset. Thus, transparency risk also needs to be explicitly incorporated into estimates of risk and return for the total portfolio.

BLOWUP OR TAIL RISK

In addition, some alternatives — especially hedge funds, but also mortgage pools, commodity pools, and other leveraged investments — have blowup risk. This is essentially the risk of a large "left tail" or negative return way out of proportion to ordinary positive and negative returns that the asset experiences as a matter of course.

Such "tail events" often have the feel of a margin call and are sometimes part of a larger systemic failure. By definition, this left-tail risk is perceived to be low and is not often observed or measured. While a 100-year flood may actually occur every 15 years, the 15 years between the floods are seen as calm in risk space and high in return space.

When measured in increments of trailing one, three, five (and even ten) year returns, alternatives will appear to diversify portfolios and enhance returns. We should, however, be on guard against alternatives providing a false sense of security only to fail us catastrophically in uncertain and crisis times.⁹

⁹ In the teeth of the financial crisis, the Harvard University endowment, which has a very long horizon (it has existed for almost 400 years) and is the biggest in the U.S., sold at least \$1.5 billion in private-equity funds at steep discounts as it struggled to meet capital calls and manage the endowment's liquidity profile. [Wire: BLOOMBERG News (BN) Date: 2009-02-11 05:01:01]

II. MPT WITH ALTERNATIVES

Some form of modern portfolio theory (MPT) is used today by almost all practitioners — from large institutions managing hundreds of billions of dollars to individual investors and their advisors. It's hard to imagine that a University of Chicago PhD. dissertation that baffled the author's advisors ("this isn't economics"), and that was only 15 pages long, would so transform the process of saving and investing, as Harry Markowitz' 1952 masterpiece did.¹⁰

But, while mean-variance optimization and other aspects of MPT are now in common use, as investors in alternatives we benefit greatly if we go back and look at the core assumptions in Markowitz optimization, and in MPT in general.

MPT made the tradeoff between risk and return explicit and measurable, and provided a theoretical basis for measuring this tradeoff. But the process *assumes* you have good measures of risk, return, and correlation in the time period you are trying to optimize.

Liquid asset classes, primarily stocks and bonds, provide data that are usable in an optimizer or any other MPT-based tool you might use for setting and adjusting the weights of asset classes in a portfolio. Alternative investments do not yield up such data as easily. If you put alternatives in these portfolios along with liquid investments, the estimates of risk, return, and correlation are not co-measurable across asset classes, and you have to make adjustments.

If you do not make these adjustments, then directly using an optimizer across all these asset classes can be a terrible mistake. The reason is that an optimizer that cannot "see" the illiquidity, lack of transparency, and other risks of alternatives will over-allocate — perhaps dramatically — to those alternatives.

DC-plan sponsors contemplating an alternatives allocation should not, then, engage in risk reduction "by the numbers" as one might for liquid, traditional assets. The conventional risk, return, and correlation numbers don't capture the fundamental risks and other characteristics of illiquid assets.

Thus, building a portfolio that includes alternatives is not a pure MPT or mean-variance problem, and should not be narrowly pursued as such. Rather, it's a problem requiring a step that incorporates the two liquidity dimensions: that of the asset and that of the legal vehicle. Transparency must also be taken into account. In section IV, we offer suggested best practices for adding alternatives to a core portfolio of stocks and bonds. But, before that, it's important to explain why, although alternatives are natural fit for some DB plans, they are difficult to use in DC plans. To help us in this effort, we also review academic and practitioner research on estimating liquidity premiums and liquidity-adjusted correlation and volatilities.¹¹

¹⁰ Recounted by Harry Markowitz in an interview with Stephen A. Buser at the Rady School of Management at the University of California, San Diego, October 8, 2004.

¹¹ Mean-variance optimization, the core concept of MPT, assumes you have co-measurable asset classes with return, risk, and correlation estimates that apply equally to each. For the most part, this is true for stocks, bonds, and cash but, as you get into alternatives, figuring out the asset-class definitions and boundaries becomes difficult. Since the definition of alternatives is "anything but stocks, bonds,

PRIOR WORK ON MEASURING RETURN AND RISK ACROSS TRADITIONAL AND ALTERNATIVE INVESTMENTS

REAL ESTATE

An early attempt to determine what the risk of private real estate would be if it were continuously traded is in Kaplan [1995]. Kaplan used reverse optimization to estimate that the standard deviation of this asset class, calculated on a basis comparable to stocks and bonds, is 17%, about the same as the stock market.

Lummer, Riepe, and Siegel [1994], building on Michaud's [1989] concept of a fuzzy efficient frontier, or frontier with estimation error in the input variables, develop inputs for all of the major asset classes that existed at the time, including unleveraged private real estate. For this real estate category, they estimate a standard deviation of 13.8%, between that of bonds and stocks and much higher than shown by appraisal-based risk estimates, which ignore or suppress market volatility.

VENTURE CAPITAL AND OTHER PRIVATE EQUITY

Studying venture capital returns, Cochrane [2001] corrected for the bias that occurs when only successful projects or deals are observed, and found extreme levels of volatility (as high as 89% for log returns). Chen, Baierl, and Kaplan [2001] estimate a 115.6% standard deviation for venture funds that had liquidated by 1999 — admittedly, a while ago. Extrapolating from this result, these authors suggest investing only 9% of one's total portfolio in illiquid alternatives.

But not all researchers found such high volatility for private equity investments. Moskowitz and Vissing-Jorgenson [2002] find that a portfolio of *all* private equity (including privately held businesses and partnerships, with venture capital making up less than 1% of the total) has a mean and standard deviation close to that of the public equity market. Long [1999] estimates a venture capital standard deviation of only 24.7%. The wide divergence among these risk estimates show that the estimates are not directly comparable to one another. One reason is that there are many stages and types of venture capital, and many methods (all of them involving serious shortcuts) of estimating their return and risk.

ALTERNATIVE INVESTMENTS GENERALLY

Most recently, Pedersen, Page, and He [2014] integrate all these threads into a coherent strategy for understanding the risks and returns of alternative investments generally (real estate, private equity, and hedge funds). They use a multiple risk-factor model to estimate the "true" returns on each traditional and alternative asset class, and calculate "true" volatilities, equity betas, and other statistics based on these returns. Exhibit 4 summarizes their findings.

and cash," they are rarely co-measurable with stocks, bonds, and cash and are the Wild West of asset classes. Moreover, knowing what asset class an alternative asset is in may not be revealing: an alternatives position can be one property or deal, which is less representative of the larger asset class than any stock portfolio ever would be.

EXHIBIT 4

REPORTED VS. ADJUSTED VOLATILITIES, CORRELATIONS, AND EQUITY BETAS OF PRINCIPAL ASSET CLASSES, DECEMBER 1991-DECEMBER 2013¹²

	Volatility (%)		Correlation with equities		Equity beta	
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted
Private equity	11	22	0.75	0.75	0.5	1
Venture capital	25	52	0.41	0.45	0.6	1.4
Infrastructure (listed)	15	17	0.56	0.56	0.5	6
Farmland	7	14	-0.13	0.01	-0.1	0
Timberland	9	17	0.11	0.18	0.1	0.2
Real estate (unlevered)	5	13	0.13	0.52	0	0.4
Hedge fund index	7	9	0.76	0.74	0.4	0.4
Equities	18	19	0.99	0.95	1	1
Bonds	5	6	-0.62	-0.56	-0.2	-0.2

Source: Pedersen, Page, and He [2014], table 3.

Pedersen, Page, and He conclude,¹³

...[R]eported returns may overstated the often-touted diversification benefits of alternative investments... [O]ur approach should *not necessarily* lead investors to avoid illiquid assets; investors should simply require a higher rate of return than they would otherwise. Whereas traditional risk models for alternative assets typically lead to...a false impression that these assets represent a free lunch, [using] our approach [causes]...the relative attractiveness of alternative assets [to be] reduced.

III. IF ALTERNATIVES ARE GOOD FOR DB PLANS, WHY NOT FOR DC PLANS?

Today, plan sponsors, their consultants, and their advisors ask this question: If alternatives are being used to add value in DB plans and endowment funds, then shouldn't DC plans, representing the primary savings vehicle for employees saving for retirement, also include alternatives?

This question is both very important and quite complex. Let's go through it from the lens of the fiduciaries, both the plan sponsor (the ultimate fiduciary) and the portfolio manager (the named fiduciary).

As shown in Exhibit 5, alternatives are widely held in public and corporate defined-benefit (DB) plans. Total alternatives in the exhibit are the sum of real estate, hedge funds, and "other" alternatives. Alternatives range from 14% for public pension funds to an astonishing 61% for large university endowments.

¹² It is unclear what Pedersen *et al.* mean by a correlation of equities with equities that is not equal to one.

¹³ Pp. 41-42; italics in the original.

EXHIBIT 5

Allocation to Alternatives

Endowments over \$1 billion	61%
Defined benefit plans – Corporate	16%
Defined benefit plans – Public	14%

Source: Pensions and Investments, February 4, 2013, asset data as of 9/30/2013; 2012 NACUBO/Commonfund Study.

We wonder whether a 59% allocation to alternatives is prudent for anyone, but the much higher allocations found in public and corporate DB plans make perfect sense. DB plans are not investments by the final user or beneficiary — they're a means to an end. They're a buffer between the potential insolvency of the sponsor and the income promise made to beneficiaries, and a way the sponsor can use market returns to help pay for the benefits. As a pool of assets that is only matched to a liquidity demand in the long run, the DB plan can afford to take liquidity risk with some of their assets.

But how about DC plans, and TDFs in particular? The common refrain in justifying alternative investing in DC plans is as follows: DB plans have benefited from alternatives, so we should bring these gains to DC plans.

But, wait — DC plans are not DB plans!¹⁴ DB plans aggregate individual employees in a common pool and invest to match the average payout liability of that pool. DB plans can better manage periods of illiquidity and have the staff to investigate and manage less transparent investments. A DB plan can act as an intermediary between the illiquidity of (some of) the assets and the liquidity needs of participants, and pay out income when the assets are not generating it.

Since a well-run DB plan can quite accurately forecast its payouts to pension beneficiaries over the next two to three years, it is in a structural position to exploit illiquid assets and realize higher returns with a large portion of its assets. The higher returns come from the discount demanded at purchase and the optionality on the timing of when to sell.

DC-plan assets, in contrast, belong directly to the beneficiary. The beneficiary's liquidity needs, not the sponsor's liquidity needs, are what's relevant. A DC participant can tolerate a small amount of illiquidity in pursuit of a higher return but there is no one with resources to intermediate the liquidity and provide an income no matter what happens to the assets.

For TDFs, the portfolio manager is a fiduciary who is bound by multiple laws and rules, including the '40 Act, the Pension Protection Act (PPA), and DOL regulations.

¹⁴ We have written that DC plans can be equal to DB plans when it comes to savings, risk management, and longevity pooling. However, we have also pointed out that DB plans provide professional actuarial estimates, involve the ability to pool timing risks, and can change the savings (contribution) rate when necessary. *In extremis*, DB plans can even renegotiate payout. DC plans do not have any of this flexibility.

Yet, unlike the DB-plan manager, the TDF manager has very little ability to forecast cash flows. While a DB pension payment is a scheduled obligation of the plan, the decision to make additions or withdrawals from a TDF is solely at the discretion of the plan participant — and the evidence is that participants make withdrawals during times of market stress, thus forcing the TDF manager to potentially realize large losses.

The result is that while TDF managers have begun to put alternatives into their mix, alternatives, especially the less liquid alternatives, have not gained much more than a toehold in most of these funds. This makes sense. The percentage of alternatives in a DC plan, and in a TDF in particular, should be limited, with a bias toward the more developed and more liquid alternatives such as REITs. There should be very limited investment in “super illiquid” assets such as venture capital or private-placement securities. Nor should alternatives held in TDFs *ever* involve the potential for capital calls on the rest of the portfolio.

IV. BEST PRACTICES FOR ALTERNATIVES IN DC PLANS

Three basic principles apply when considering investment of DC-plan assets in alternatives:

1. Two aspects of liquidity are important:
 - The liquidity of the underlying asset, and
 - The liquidity of the legal vehicle.

They need to be explicitly integrated into the investment process.

2. Higher returns are to be expected and come from the lower prices required to purchase assets that have less liquidity and less transparency.

If the investor is a natural liquidity provider (an endowment or DB plans) a strategy and process can be built to exploit the position of being a liquidity premium.

If the investor is a TDF and) is not a natural liquidity supplier, the portfolio manager needs a strategy and process to deal with large discounts when selling in stressed markets, and should not be seduced by the perception of diversification benefits that only hold in good times.¹⁵

If the investor is an individual DC plan participant, he can assess his own liquidity position and potentially choose to be a liquidity supplier, attempting to capture the liquidity premium with part of his assets. However, this requires a level of expertise that we do not generally associate with plan participants. They are unlikely to succeed in this endeavor.

¹⁵ When markets are stressed, all risk assets tend to trade together and down. The shorthand quant terminology is “all the correlations with the risk-free, safe-haven asset(s) go to -1.” Alternatives will experience a super-amplified version of this tendency.

3. Naïve optimization is the wrong tool for understanding risk reduction (or additional risk-taking!) through diversification into alternatives. You have to use basic asset-liability theory and principles of prudence.

You need a seasoned skill set in implementing both mean-variance optimization and dealing with the time-varying and leptokurtic nature of market risks. You need to be wary of consultants and portfolio managers armed with fancy-looking correlation matrixes and mean-variance portfolios. You need to make the adjustments to asset-class risk estimates from Exhibit 4, or if you disagree with those assessment, from your own rigorous statistical work.

Overall, the DC-plan sponsor and TDF portfolio manager should have answers to these basic questions: Does a particular alternative investment match my liability profile? Am I within my legal mandate and safe harbor? Do I have a plan for the inevitable periods of little-to-no liquidity and falling prices? Will my clients understand and approve how I invested their life savings? These — not just “is the portfolio mean-variance efficient?” — are the important questions.

CONCLUSION: RECOMMENDATIONS FOR INVESTORS AND THEIR FIDUCIARIES

There is no general rule, no canonical framing like MPT or its most basic component, mean-variance optimization, saying how to deal with alternatives in DC plans. Rather, we have to use judgment, experience, and knowledge of the regulatory requirements, combined with a thorough understanding of the profile of the liability because all investment portfolios should be designed with paying the liability as the foremost principle.

There are practical rules of thumb that will help all investors who invest in alternatives. We have enunciated three basic rules. We want to re-emphasize that any successful use of alternatives in either an optimization setting or a judgmental framework must involve some adjustment of the expected return downward *and* the risk estimate upward.

We think the marketplace today reflects these conclusions. Large pension plans and endowments run by experienced professionals have matched their asset mix to their liability needs – so there are a lot of alternatives in those programs.

DC plans, in contrast, don't have much in alternatives because the fiduciaries who run these plans are aware of their lack of control over participant investment decisions, need for liquidity at any time, and regulatory requirements. Because of these factors, experienced and prudent sponsors will allocate only modest amounts to alternative investments, either directly or through their choice of TDF managers and families.

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Appendix I Major Types of Alternative Investments

- REITs
- Private real estate
- Private equity
- Commodities
- Commodity trading advisors (CTAs)
- Private lending
- Hedge funds
- Hedge fund beta replication strategies
- Market neutral funds
- Absolute return funds (using futures, options, and leverage)
- Volatility Strategy Funds
- Infrastructure
- Bank loans (CLOs)
- Timberland
- Farmland