On the Value of
Direct Investment Objectives

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"*Make things as simple as possible,*
but not simpler."

Albert Einstein

CalPERS, the largest defined benefit (DB) plan in the U.S., released "CalPERS Investment Beliefs" (called for brevity *Beliefs* in this paper) in mid-September 2013. According to the 9/16/2013 press release, this document "will provide a basis for strategic management of the investment portfolio, inform organizational priorities and ensure alignment between the Investment Office and CalPERS staff."

To say that this document is very important would be an understatement. *Beliefs* ought to influence momentous asset allocation decisions for years to come. The very existence of this document is a major step forward toward better pension plan management.

Beliefs covers a broad range of issues related to investing retirement assets. The articulation of investment goals, the identification of primary stakeholders, the role of "liabilities" and other major issues are indispensable for prudent pension plan management.

CalPERS should be commended for its understanding of the importance of a solid foundation in the era of increasingly complex investing approaches. *Beliefs* is a great first step in the right direction. This paper makes the case for the next step in the development of a better foundation.

Beliefs is also noteworthy for what it does *not* contain. Remarkably, the vital objectives "to maximize the safety of promised benefits" and "to minimize the cost of funding promised benefits" are not *directly* addressed in the document. Instead, *Beliefs* advocates a broadly defined objective of *return targeting*: "a key success measure … is delivery of the long-term target return for the fund."

There may be good reasons for the absence of "unconstrained" objectives of benefit safety maximization and funding cost minimization. By itself, the objective of benefit safety maximization may imply unreasonably high funding cost. Similarly, the objective of funding cost minimization by itself may imply

unreasonably high insolvency risk. Clearly, stating these objectives unconditionally may be problematic.

Nonetheless, these vital objectives can and should be addressed directly. A proper articulation of these objectives would require a more comprehensive framework than the one used in *Beliefs*. The basics of this framework are presented in this paper.

Before we get to this framework, however, we should answer the following important questions. Why is it essential to pursue benefit safety maximization and funding cost minimization directly when return targeting is easier to understand and implement? Wouldn't the optimal policy portfolios produced by return targeting maximize benefit safety and minimize funding cost?

The answer to these questions is *return targeting does not necessarily produce policy portfolios that maximize benefit safety and minimize funding cost*.

The next section presents a simple example that demonstrates that return targeting produces portfolios that impose higher funding cost compared to the portfolios produced by the direct objective of funding cost minimization. In other words, return targeting imposes a tangible funding cost "surcharge." This example also demonstrates that return targeting produces portfolios that have inferior benefit safety compared to the portfolios produced by the direct objective of benefit safety maximization.

The message of this paper is simple. The investment objectives should be as direct and clear as possible. Doing otherwise may put the safety of pension benefits at unnecessary risk and increase the cost of their funding.[1]

The Cost of Beliefs: an Example

This section applies certain pronouncements from *Beliefs* to a simple pension plan. This example is specifically designed to highlight the role of direct investment objectives in cost-risk optimization.

Let us consider a pension plan that has made a commitment to make one payment of today's $100 adjusted for inflation in ten years. The primary objective is to fund this payment. The plan actuary has selected the discount rate of 8% for funding purposes. The plan managers have identified three asset

classes (called A1, A2, and A3 for brevity) appropriate for the plan and developed capital market assumptions (presented in the Appendix).

The goal of this section is to apply *Beliefs* in a sensible manner to generate investment solutions. Then this section presents an alternative framework that goes beyond *Beliefs*, and compares the solutions generated by this framework and *Beliefs*.

Let us start with Investment Belief 5, which states that "CalPERS must articulate its investment goals ..." In addition, the first sub-belief states that "a key success measure for the CalPERS investment program is delivery of *the long-term target return* for the fund" (emphasis added). Furthermore, Investment Belief 7 states that "CalPERS aims to maximize return for the risk taken," so *Beliefs* in essence endorses mean-variance optimization. Let us apply these beliefs to our funding problem.

A sensible common choice for the long-term target return is the discount rate. According to Investment Belief 5 and 7, we should utilize the efficient portfolio (i.e. the one with the lowest volatility) whose geometric mean is equal to the target return. *Exhibit 1* presents this portfolio and its key characteristics.

Exhibit 1

Efficient 8.00% Portfolio	
A1	48.4%
A2	27.3%
A3	24.3%
Total	*100.0%*
Geometric Mean	8.00%
Arithmetic Mean	8.10%
Standard Deviation	4.72%

The actuarial liability is equal to $62.25. Let us assume for simplicity that the plan's market value of assets is equal to its actuarial liability, thus the plan's funded ratio is 100%.

While some may call this plan "fully funded", the probability that the plan will fulfill its commitment is a mere 50%.[2] The plan, however, is right on schedule to fund the commitment.

Better solutions require a better framework. Let us assume that the primary investment objectives are to maximize the safety of benefits and minimize the cost of their funding (*ceteris paribus*, or other things being equal).

The primary risk is defined as the *shortfall event* (there are insufficient assets to make a due payment). There are several useful measurements of the primary risk that include the shortfall probability, size, and volatility. Note that the actuarial discount rate plays no role in this framework.

For simplicity, let us focus on the shortfall probability here. Let us find the portfolio that minimizes the shortfall probability given the plan's asset value $62.25 (assuming no additional contributions). *Exhibit 2* presents this portfolio (Portfolio A) and puts it side by side with the efficient 8.00% portfolio.

Exhibit 2

	Efficient 8.00% Portfolio	Portfolio A
A1	48.4%	70.0%
A2	27.3%	0.0%
A3	24.3%	30.0%
Total	*100.0%*	*100.0%*
Geometric Mean	8.00%	8.49%
Arithmetic Mean	8.10%	8.79%
Standard Deviation	4.72%	8.08%
Assets	$62.25	$62.25
Shortfall Probability	50.0%	43.0%

Thus, the lowest shortfall probability is 43.0%. The "efficient" portfolio in a portfolio-centric framework that meets the target return 8% with the lowest volatility is in fact inefficient in a framework that focuses on funding success.

It is informative to note that the efficient 8.00% portfolio has lower return and risk than Portfolio A. On the surface, it is tempting to say, "well, of course higher returns generate lower shortfall probabilities." Beneath the surface, however, this statement does not withstand a close scrutiny. As we will see shortly, changes the risk/return characteristics of a portfolio do not have a predictable impact on shortfall probabilities.

Sometimes higher-return-higher-risk portfolios generate lower shortfall probabilities. And sometimes lower-return-lower-risk portfolios generate lower shortfall probabilities. Even lower-return-higher-risk portfolios may generate lower shortfall probabilities, as we see below.

Next, let us assume that the shortfall probability of 43.0% is too high for this plan. As a result, the plan is considering making additional contributions to lower the shortfall probability. For simplicity, let us assume that the plan intends to make just one contribution at the present and considers two levels of shortfall probability: 25% and 10%.

Exhibit 3 shows the results for the shortfall probability of 25%.

Exhibit 3

	Efficient 8.00% Portfolio	Portfolio B
A1	48.4%	45.4%
A2	27.3%	26.2%
A3	24.3%	28.4%
Total	*100.0%*	*100.0%*
Geometric Mean	8.00%	7.97%
Arithmetic Mean	8.10%	8.08%
Standard Deviation	4.72%	4.91%
Assets	$62.25	$62.25
Additional Contribution	$7.41	$7.01
Shortfall Probability	25.0%	25.0%
Cost Surcharge	**5.7%**	

Portfolio B is the one that delivers the lowest additional contribution ($7.01) to achieve the shortfall probability of 25%. Note that Portfolio B has *lower expected return and higher risk* than the efficient 8.00% portfolio, which nonetheless requires additional $0.40 (=7.41 – 7.01) to achieve the same result. Thus, the efficient 8.00% portfolio (reminder: this portfolio was generated according to Investment Belief 5 and 7) carries a 5.7% surcharge.

In all fairness, Investment Belief 5 deserves the benefit of the doubt. While calling for the "delivery of the long-term target return," this belief is silent about the value of this target return. It is possible, at least in theory, that using some value other than 8% as the target return, we may find a portfolio that produces lower additional contribution for a given shortfall probability.

Exhibit 4 shows the results for the shortfall probability of 10%.

Exhibit 4

	Efficient 8.00% Portfolio	Portfolio C	Portfolio D
A1	48.4%	35.4%	38.9%
A2	27.3%	38.0%	39.0%
A3	24.3%	26.6%	22.1%
Total	*100.0%*	*100.0%*	*100.0%*
Geometric Mean	8.00%	7.70%	7.74%
Arithmetic Mean	8.10%	7.78%	7.80%
Standard Deviation	4.72%	4.10%	3.74%
Assets	$62.25	$62.25	$62.25
Additional Contribution	$14.82	$12.92	$14.05
Shortfall Probability	10.0%	10.0%	10.0%
Cost Surcharge	**14.7%**		**8.7%**

Portfolio C is the one that delivers the lowest additional contribution ($12.92) to achieve the shortfall probability of 10%. Note that Portfolio C has *lower expected return and lower risk* than the efficient 8.00% portfolio, which requires additional $1.90 (=14.82 – 12.92) to achieve the same result – a surcharge of 14.7%. Portfolio D is generated according to Investment Belief 5 using the

target return of 7.74%, requires additional $1.13 (=14.05 – 12.92), and carries a surcharge of 8.7%. This is the best return targeting can do.

The key conclusion of this discussion is *the analysis of portfolio risk and return is insufficient for funding problems*.

Is Return Targeting a Good Idea?

The prior section presented examples of portfolios generated by a return targeting methodology that are efficient in the risk-return space, but inefficient in the cost-risk-commitment space and may not serve the plan stakeholders well. The main reason for this inefficiency is portfolio return targeting essentially ignores the key characteristics of the plan's financial commitments.

Moreover, return targeting creates a problem with the "hierarchy" of beliefs. Many plan managers tend to regard the actuarial discount rate as "the long-term target return" for the portfolio construction. Many actuaries tend to regard the portfolio expected return as a good candidate for the discount rate. Then, who is higher in the hierarchy of pension plan management – actuaries or portfolio managers? In other words, what is the right "order of operations" – to develop the discount rate first and policy portfolio next, or vice versa? *Beliefs* gives no answer to this quintessential "chicken-egg" question.

Furthermore, return targeting essentially assumes that the same policy portfolio would be used in all years. Yet, it is becoming increasingly clear that the portfolios of institutional and individual investors should evolve over time. The presence of illiquid investments also leads to evolving portfolios. Retirement plans in general and DB plans in particular are moving toward efficient glide paths that are geared toward generating optimal outcomes.

The assumption "the-same-portfolio-in-all-years" may soon become an artifact of a bygone era. Return targeting should not be too far behind.

Investment Goals vs. Success Measures

The value of transparent performance and success measures is self-evident. Proper articulation of investment goals is important as well. *Beliefs* appropriately reflects these views.

Yet, success measures and investment goals are fundamentally different. Simplicity, for example, is an unquestionable virtue as far as success measures are concerned. In contrast, overly simplistic investment goals may lead to sub-optimal solutions.

The discussion in the prior section is a good example of these observations. "The long-term target return" may be a useful success measure – after all, it is informative to compare the actual and assumed portfolio returns. *Beliefs* appropriately calls this measure "a key success measure for the CalPERS investment program." Yet, as demonstrated in the prior section, the "delivery of the long-term target return" *as an investment goal* may be problematic.

Beliefs also correctly states that "liabilities must influence the asset structure." Clearly, the plan's funding status is a simple and useful success measure – it compares the actual asset value with the scheduled asset value determined by the actuarial funding method.

Yet, *Beliefs* presents no investment goals as related to "liabilities," and understandably so. The problem is conventional actuarial "liabilities" have no direct relationship to the ability to pay benefits. For instance, even if the plan reached the funding status of 100%, the shortfall probability still would be somewhere around 50%. Managing a DB plan at a coin toss level is not necessarily a great idea.

To incorporate the plan's financial commitments into policy portfolio analysis, one needs to move from the conventional actuarial "liabilities" to a more comprehensive concept of stochastic present values. These issues, however, are outside of the scope of this paper.[3]

Overall, *Beliefs* suggests certain useful success measures and states that "CalPERS must articulate its investment goals." The implementation of this belief, however, may require additional work. The next section offers an alternative framework for the development of investment goals.

An Alternative Framework

As was previously discussed, the "unconstrained" objective of benefit safety maximization may imply unreasonably high funding cost. Similarly, the "unconstrained" objective of funding cost minimization by itself may imply

unreasonably high insolvency risk. The following questions arise naturally. How do we accommodate seemingly conflicting objectives of benefit safety maximization and funding cost minimization? How do we achieve high benefit safety and low funding cost when high benefit safety generally implies high funding cost, and vice versa?

In fact, similar questions have already been answered. The answer, which is universally recognized as sensible, is one of the cornerstones of Modern Portfolio Theory (MPT). MPT can provide valuable guidance to finding optimal investment solutions for funding problems, even though MPT is not directly applicable to funding problems.

MPT has two seemingly conflicting general objectives: to maximize expected return and minimize risk. However, the "unconstrained" objective of expected return maximization may imply unreasonably high risk. Similarly, the "unconstrained" objective of risk minimization may imply unreasonably low expected return.

The solution MPT offers is to recognize the fundamental relationship between risk and return and merge these objectives. In effect, risk and return constrain each other. Specifically, MPT considers the following objectives:

- to maximize expected return given risk;
- to minimize risk given expected return.

Both of these objectives lead to the same set of efficient portfolios – *the mean-variance efficient frontier*. Thus, the solution is a set of efficient portfolios rather than a single portfolio.

Let us apply the MPT mindset to funding problems. We recognize that benefits safety and funding cost constrain each other. Then we combine the objectives of benefit safety maximization and funding cost minimization as follows:

- to maximize benefit safety given funding cost;
- to minimize funding cost given benefit safety.

Similar to MPT, these objectives lead to the same set of efficient portfolios – *the cost-risk efficient frontier*. As a result, we deal with the objectives of benefit

safety maximization and funding cost minimization *directly*. We deal with the trade-off between cost and risk *directly* as well.

This author is optimistic that this framework would represent a meaningful step forward in finding optimal investment solutions for funding problems.

Conclusion

Make no mistake about it – *Believes* is a great document. The "imperfections" of this document are reflections of the current state of affairs in the DB plan industry. There has been significant progress in the area of cost-risk management of retirement plans recently. This author would like to encourage the authors of *Beliefs* to look into the latest developments in this area.

There is still a great deal of confusion regarding the role of portfolio returns, actuarial liabilities, and other aspects of pension funding. In many cases, going back to the basics could be exceedingly useful. Here is how DB plan managers may want to proceed.

If the plan managers believe that the goal of the plan is to maximize the safety of benefits, then the beliefs document should directly state "*the goal of the plan is to maximize the safety of benefits*."

If the plan managers believe that the goal of the plan is to minimize the cost of funding, then the beliefs document should directly state "*the goal of the plan is to minimize the cost of funding*."

If the plan managers believe that both of these goals are important, then the beliefs document should directly state "*the goal of the plan is twofold: to maximize the safety of benefits and minimize the cost of their funding*."

That may be a great place to start optimal policy portfolio design in earnest.

APPENDIX: Capital Market Assumptions

Risk/Return

	Geometric Mean	Arithmetic Mean	Standard Deviation
A1	8.00%	9.15%	16.00%
A2	6.00%	6.38%	9.00%
A3	4.00%	7.94%	30.00%
Inflation	3.00%	3.02%	2.00%

Correlation Matrix

	A1	A2	A3
A1	1		
A2	0.0	1	
A3	-0.7	-0.5	1
Inflation	-0.9	-0.4	0.9

All portfolio return and inflation factors are assumed to have lognormal distributions.

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Endnotes

[1] This author would be remiss if this article didn't mention a short, powerful, and stunningly controversial paper written almost two decades ago. The late great Fischer Black published arguably his last paper entitled "The Plan Sponsor's Goal" in the July-August 1995 issue of the Financial Analysts Journal (Black [1995]). Fischer Black's parting message to the plan sponsor community was straightforward: "... how we set up the goals of a pension plan sponsor matters a lot." This author considers Beliefs as a (somewhat belated) recognition of the wisdom of Black [1995].

Black [1995] contains two main points. First, a clear articulation of investment objectives is exceedingly important. Second, minimization of the cost of funding is a worthy goal. Namely, "... a plan sponsor may want to choose an investment strategy to minimize the present value of future contributions to the plan." See Black [1995]. This author would like to encourage pension practitioners to revisit this remarkable paper. See Mindlin [2009A] for a detailed analysis of Black [1995]. Mindlin [2013] puts Black [1995] in a larger historical context.

[2] Under the lognormal return factor assumption, the geometric mean is equal to the median return. See Mindlin [2011] for more details.

[3] See Mindlin [2009B] for more details.

Important Information