Commitment Driven Investing: An Introduction

Commitment Driven Investing (CDI) is a cost-risk management framework designed for the optimization of the process of funding financial commitments for individual and institutional investors. The primary objective of the framework is to generate optimal asset allocation and contribution strategies for investors with financial commitment to fund (e.g. DC and DB plans, foundations and endowments). In particular, the framework generates Nash equilibrium optimal glidepaths that maximize investors' standard of living in retirement, which is perfectly suited for the design of target date funds.

The CDI framework is designed to take care of the best interests of the stakeholders of financial commitments – to minimize the riskiness and cost of funding the commitments. The framework optimizes the relationships between the components of the funding triangle "Commitment-Cost-Risk." The framework generates efficient investment strategies that provide optimal trade-offs between an investor's commitments, the risks the investor is willing to take and the contributions that the investor is willing to make.

The article describes the role of financial commitments in investing and the presence of risky assets. The article discusses the traditional approach to the management of portfolios of risky assets and the need for a better methodology. Compared to the traditional approach, CDI adds an additional dimension to optimization and eliminates the time disconnect between the optimization and decision points. A side-by-side comparison of the optimization procedures in CDI and modern portfolio theory is presented as well.

CDI provides a flexible and powerful methodology for the management of investing and saving programs. By focusing the best interests of all stakeholders of these programs, CDI offers a fully-integrated, disciplined and scientifically rigorous strategy for managing the key aspects of the process of funding financial commitments.

For questions, comments, or more detailed presentation of the issues discussed in this article, please contact

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Investing and Commitments

In a world full of uncertainties and anxieties, individuals and institutions make commitments to accumulate certain assets in the future. Participants of defined contribution (DC) plans strive to achieve secure retirements in the future; defined benefit (DB) pension plans promise to make future benefit payments to plan participants; foundations and endowments pledge support to their causes. These are examples of financial commitments made at the present to have readily available assets in the future.

Financial commitments play a special role in investing. Investors do not invest in a vacuum – they contribute their resources and take a multitude of risks mainly to fund their financial commitments. A commitment is the reason a particular investment program exists in the first place. The objective of funding the commitment is the driving force behind the asset allocation and contribution policies as well as the guiding light for risk taking.

Generally, it is a challenge to guarantee that an investor's financial commitment will be funded. Most investors endeavor to fund their financial commitments by virtue of managing portfolios of risky assets. These portfolios may have the capability to deliver the money when it is due, but make no firm promise to do so. Thus, the resources a typical investor is willing to contribute to fund the investor's commitment may turn out to be insufficient to fund the commitment. For better or worse, investors in risky assets live without absolute guarantees of the results of their investment programs.

As demonstrated by recent experience, the ride for investors in risky assets may get very bumpy. The losses for investors in many "near- or in-retirement" target date funds (TDF), for example, exceeded 20% in 2008, and some lost more than 40%. These results look especially troubling in light of the fact that asset allocation for many TDFs has neither theoretical substance nor transparency.

The common measurements of financial health for DB plans have been volatile in the last decade. These measurements have significantly deteriorated lately for most plans, and many plans are significantly underfunded. It is becoming increasingly clear that asset allocation methodologies utilized by DB plans need major improvements.

Foundations and endowments have experienced substantial asset volatility lately. Recent losses have considerable difficulties for the programs these institutions fund. These problems accentuate the fact that asset-“liability” modeling for foundations and endowments is in its infancy.

Overall, traditional asset allocation methodologies have not served institutional and individual investors well. At the same time, asset allocation remains the primary determinant of investment performance. It is clear that individual and institutional investors need a better asset allocation framework.

The purpose of this paper is to introduce a simple, yet powerful and flexible cost-risk management framework for individual and institutional investors that have financial commitments to fund. The primary objective in this framework is to take care of the best interests of the major stakeholders of investment programs – to minimize the risk and cost of funding financial commitments. To highlight the role of financial commitments, this framework is called *Commitment Driven Investing* (CDI).

Portfolios of Risky Assets

Portfolios of risky assets have been analyzed in countless publications written by academics and practitioners. One of the cornerstones of portfolio analysis has been modern portfolio theory (MPT), which was introduced more than half a century ago. Over the last several decades, many institutional and individual investors have utilized MPT to design efficient portfolios of risky assets. Most DB plans have utilized MPT as the main analytical tool for the long-term management of their policy portfolios. The education of DC plan participants has relied a great deal on the conclusions and recommendations of MPT.

Yet, after significant declines in equity prices in 2000-2002 and 2008-2009, many investors have experienced a significant deterioration of their financial health. Individual investors near or in retirement have been hit especially hard. Consequently, a growing number of practitioners are beginning to question the ability of the economic theory in general and MPT in particular to produce meaningful recommendations to investors. Some even declare that MPT is dead.

MPT is a fine economic theory that does well what it is intended to do – the portfolio analysis for a *hypothetical* investor. MPT was never designed to serve investors with *specific* financial commitments. The problem is not the quality of this theory, but in the scope of its applicability. Regardless of the investor’s financial commitments, MPT performs one-period optimization of future asset values assuming that the asset value is known at the present.

For an investor with a financial (multi-period) commitment to fund, the challenge is exactly the opposite. The future values - the commitment - are given. The present value – the existing asset value plus the present value of future contributions – is uncertain. The investor's biggest challenge is at the present – how much to invest and how to allocate the assets. Naturally, it would make sense to optimize the objects of the investor's interest at the decision time – at the present. The need for a new framework that properly brings the commitment into the picture is clear.

As demonstrated in later sections, CDI is MPT "in reverse" in a certain sense, as MPT's paradigm "known present – optimized future" turns into CDI's paradigm "known future – optimized present."

From a Line to a Triangle

CDI is based on the following common-sense assumptions regarding investors' objectives:

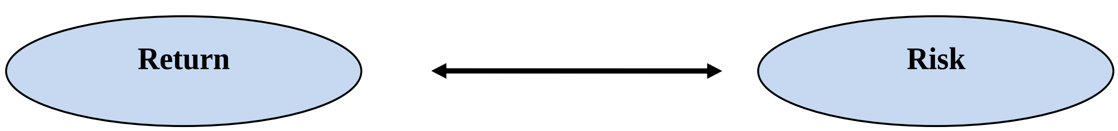
- to maximize the sustainable commitment;
- to minimize the riskiness of funding the commitment;
- to minimize the cost of funding the commitment.

Thus, investors' objectives have three major components: commitment, cost, and risk.

Historically, institutional and individual investors have managed the riskiness of their investment programs primarily via the risk/return analysis of their portfolios, consistent with MPT. In this framework, there are two major components of the portfolio optimization problem: return and risk. The picture is essentially *two*-dimensional (see *Exhibit 1*).

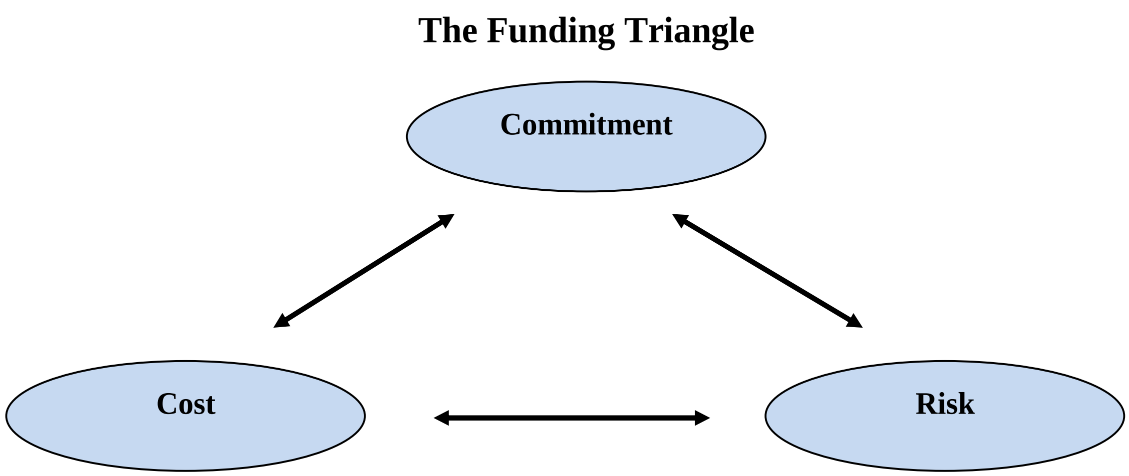
Exhibit 1

The Risk-Return Line



The presence of a financial commitment changes this picture dramatically. The commitment itself represents a new component. The return considerations become a subset of more encompassing cost considerations. The concept of risk obviously remains, but becomes much more comprehensive. As a result, the funding problem involves three components: commitment, cost, and risk, which form *the funding triangle*. The picture is *three*-dimensional (see *Exhibit 2*).

Exhibit 2



All three components of the funding triangle and the relationships between them are indispensable for finding optimal solutions to the funding problem. In particular, there is no risk management without cost analysis; there is no cost management without risk analysis. The commitment must be feasible given the resources the investor is willing to contribute and the risk the investor is willing to take. The cost must be reasonable given the commitment and the risk budget. The risk must be tolerable given the commitment and the cost structure.

Clearly, there are fundamental relationships between all three components of the funding triangle. The stakeholders of investment programs have to manage all three components at the same time, even though investors may not have total control over these components.

Basic Definitions and Assumptions

Let us define basic objects under consideration. Think of an investor with a financial commitment to fund. *Commitment* is defined as a series of future payments that may be of uncertain timing, magnitude, and likelihood. *Cost* (a.k.a. "human capital") is defined as a stream of future contributions that, along with the existing assets and investment returns, will be used to fund the commitment. These contributions may be of uncertain timing, magnitude, and likelihood as well.

While the definitions of commitment and cost are relatively straightforward, the concept of risk is not clear-cut. Investors usually face a multitude of risks, so risk is a multi-headed creature. Therefore, risks must be classified and prioritized. CDI is based on the following assumptions of utmost importance.

1. The investor's primary objective is to fund the commitment.
2. The investor's primary risk is the failure of the primary objective.
3. The investor wishes to minimize the primary risk.
4. The investor wishes to minimize the resources required to fund the commitment. In other words, the investor wishes to minimize the cost of funding the commitment.

One of the biggest challenges for the investor is to make asset allocation and contribution decisions. Since the investor must act at the present, the commitment and the stream of future contributions must be measured at the present. In other words, it is necessary to calculate present values of the investor's commitments. Logically, the concept of *stochastic present value* is the main analytical tool for risk analysis in this framework.

In general, present value of a cash flow is equal to the asset value required at the present to fund the commitment. Since the commitment is funded via investing in risky assets, this asset value is uncertain. Therefore, present values of pension commitments funded by risky assets are inherently uncertain and should be modeled stochastically.

In its simplest form, given commitment $P_1, \ldots, P_n$ and portfolio returns $R_1, \ldots, R_n$, stochastic present value RA is defined as

$$RA = \sum_{k=1}^{n} \frac{P_k}{(1+R_1)\ldots(1+R_k)}$$

Random variable *RA* is called *Required Assets* associated with given commitment and policy portfolio. The properties of *RA* are directly related to the ultimate outcome of the investment program. For example, the asset value required at the present to have a *P*% chance that the commitment fill be funded is equal to the *P*th percentile of *RA*.

RA represents the value of *assets required* at the present to fund the commitment. Since the investor wishes to minimize the cost of funding the commitment, *RA* should be minimized. More details about the minimization of *RA* are in later sections.

The Funding Triangle Optimization

One of the most important parts of the funding problem – asset allocation – may appear to be hidden in the funding triangle, but only seemingly so. Asset allocation plays a major role in the management of all components of the triangle. Asset allocation is one of the most important means in the optimization of the funding triangle. Asset allocation is in fact one of the main aspects of CDI.

It is informative to look at the optimization objectives in the two-dimensional "Risk/Return" framework. There, the objective of portfolio optimization is either "minimize risk given return" or "maximize return given risk." In other words, one component of the line is optimized given the other component. It can be shown that both objectives lead to the same set of optimal policies (efficient frontier).

The situation in the funding triangle "Commitment/Risk/Cost" is similar, although more complex. There are several different objectives for the optimization of the funding triangle. Similar to the two-dimensional case, these objectives are formulated according to the principle "given two components, optimize the third".

The objective of *maximizing the commitment given cost and risk* is applicable to a DC plan participant who wishes to maximize her standard of living in retirement. The objective of *minimizing risk given cost and commitment* is applicable to DB plan participants who wish to maximize the safety of their benefits. The objective of *minimizing cost given risk and commitment* is applicable to taxpayers/shareholders who wish to minimize the cost of running a DB plan.

One of the most important properties of the funding triangle is, under certain conditions, optimization objectives lead to the same set of optimal investment strategies. For example, given a DB plan's pension commitment, the objectives of "minimizing cost given risk" and "minimizing risk given cost" lead to the same efficient frontier. Therefore, as far as asset allocation is concerned, there is no conflict between the best interests of plan participants (low risk) and taxpayers/shareholders (low cost).

Let us take a closer look at optimization procedures. Stochastic present value *RA* is not a conventional function that can be optimized using traditional analytical tools. In general, we optimize not stochastic objects, but their measurements, and MPT provides a valuable guidance in this area.

The main object in MPT is portfolio return. For a portfolio of risky assets, the return is uncertain, yet it is desirable to maximize it. Here is how MPT deals with this problem. For a given policy portfolio *X* and risk aversion parameter $t \geq 0$, "risk-adjusted expected return" *R* is defined as

$$R = E_X - t \cdot S_X$$

where E_X is expected return and S_X is standard deviation of return. E_X and $t \cdot S_X$ can be interpreted as the investor's "reward" and "penalty" for risk taking. The objective is to maximize *R* for each risk aversion parameter $t \geq 0$. The result of this optimization procedure is the classic mean-variance efficient frontier.

We may follow a similar approach to minimize *RA*. For a given policy portfolio *X* and risk aversion parameter $t \geq 0$, "risk-adjusted expected cost" *C* is defined as

$$C = E_X + t \cdot S_X$$

where E_X is mean of *RA* and S_X is standard deviation of *RA*. E_X and $t \cdot S_X$ can be interpreted as the investor's "reward" and "penalty" for risk taking.

Clearly, the definitions of "risk-adjusted expected return" *R* and "risk-adjusted expected cost" *C* are analogous, yet different. "Risk-adjusted expected return" *R* is equal to the *sum* of "reward" E_X and "penalty" $t \cdot S_X$. "Risk-adjusted expected cost" *C* is equal to the *difference* between "reward" E_X and "penalty" $t \cdot S_X$. This is a reflection of the directional difference between CDI and MPT – investors want *high* returns and *low* cost. Therefore, the "penalty" is subtracted from the "reward" when we deal with returns and added to the "reward" when we deal with cost.

Exhibit 3 contains side-by-side comparison of the optimization procedures in CDI and MPT. The key difference between them is the object of analysis – stochastic present value *RA* in CDI vs. portfolio return in MPT. The directional difference between CDI and MPT is reflected in the formulations of the optimization problems, which are analogous yet different (see *Optimization Problems* in *Exhibit 3*).

Exhibit 3

Commitment Driven Investing vs. Modern Portfolio Theory		
	CDI	**MPT**
Object of Analysis	Required Assets (*RA*)	Portfolio Return
Object Preferred	Low	High
Equation	$C = E_X + t\ S_X$ where E_X is mean of *RA*, S_X is standard deviation of *RA*	$R = E_X - t\ S_X$ where E_X is mean return, S_X is standard deviation of return
Optimization Problems	Given C, Maximize t Given t, Minimize C	Given R, Maximize t Given t, Maximize R

This section presents the “Mean-Variance” version of CDI. Other versions (e.g. Safety-First and Downside Protection) are outside of the scope of this paper.

Multi-Period Asset Allocation and Nash Equilibrium

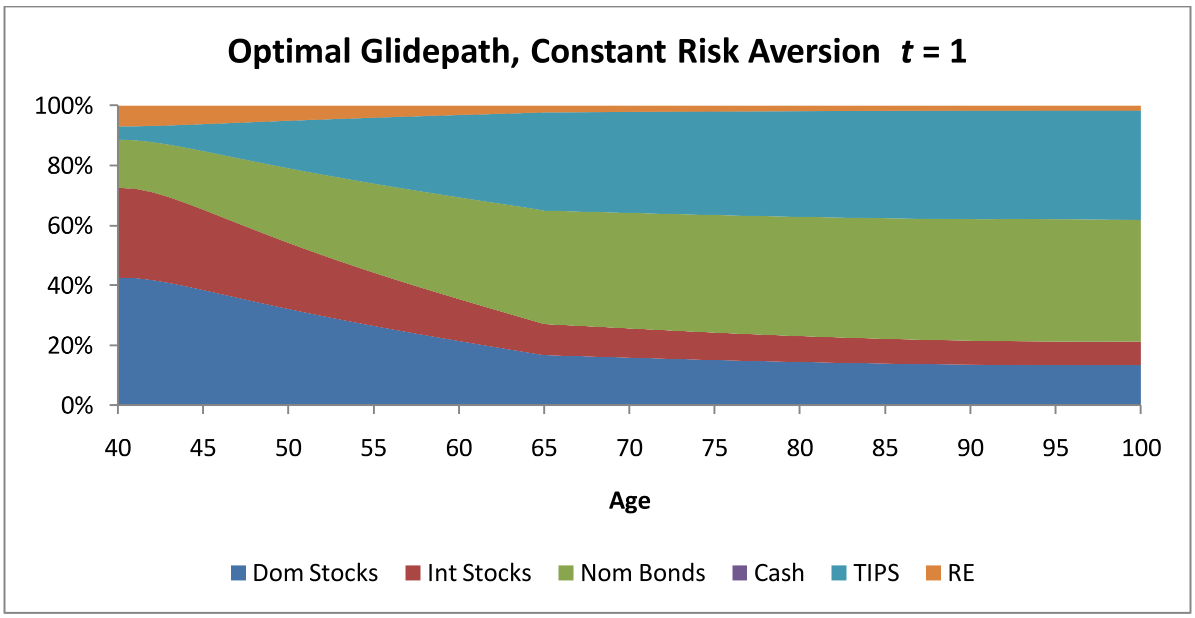
CDI is inherently multi-period optimization methodology. Any multi-period asset allocation strategy (a.k.a. glidepath) contains two major parts: the current portfolio and a series of portfolios the investor should rationally expect to utilize in the future. All portfolio selections are interrelated, as all these portfolios serve the same primary purpose – to fund the commitment.

Assuming that the investor rebalances her portfolio at the beginning of each year, the investor is expected to make a series of portfolio selections. It is useful to think that different investors (rather than the same investor at different points in time) make these portfolio selections. Effectively, there are the investor herself at the present and her aging “clones” in all subsequent years. All these investors have the same goal – to fund the commitment, and all these investors seek a mutually beneficial strategy.

The collective goal of all these investors is to develop a strategy according to which every investor's action is the best response to the actions of other investors. Under broad conditions, such a strategy should represent a *Nash equilibrium* solution to the funding problem. (A set of actions represents a Nash equilibrium solution if no decision-maker can benefit by unilaterally changing her action.) One of the cornerstones of CDI is the fact that there exists a unique Nash equilibrium strategy for a common funding problem.

For a DC plan investor, one of the most remarkable features of CDI is *a Nash equilibrium investment strategy maximizes the investor's standard of living in retirement* given risk and cost budgets. *Exhibit 4* shows a Nash equilibrium glidepath for constant risk-aversion with parameter $t = 1$.

Exhibit 4



Conclusion

This paper introduces the basics of *Commitment Driven Investing*. More details about CDI, its scientific underpinnings, quantitative tools and optimization methodologies will be presented in further publications from *CDI Advisors Research*. The applications of CDI to the development of the cost-risk optimal policy portfolios for DB plans, the optimal glidepath design for target date funds, the asset-"commitment" analysis of foundations and endowments will be presented as well.

For questions, comments and requests, please contact *requestinfo@cdiadvisors.com*.