CHAPTER YY
CASH FLOW MATCHING

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Cash flow matching has a long and respected history as a way to fund pension benefits. It has its roots in portfolio immunization, first introduced in the high-interest rate environment of the early 1980s by Martin Leibowitz.[1] The objective of this chapter is to explain cash flow matching and its application to pension fund management.

WHAT IS CASH FLOW MATCHING?

Cash flow matching is a fixed-income methodology to match and fund with high certainty a stream of liability cash flows. It has become known as cash flow matching investment (CDI). In defined benefit pensions, the liability cash flows are an actuarial projected benefit payment schedule. Since actuarial projections are not an exact science there can be some actuarial noise or uncertainty depending on which projected liability payments you are attempting to match. There are three types of pension liabilities: Retired Lives, Terminated Vested, and Active Lives.[2] Given their greater certainty, cash flow matching is used only for pension Retired Lives. CDI is a bond portfolio of cash flows that include the principal at maturity (or call date), periodic interest income, and the reinvestment of any excess cash flows greater than the benefit payments that the strategy is funding (liability cash flows). If such reinvestment of excess cash flows is at positive interest rates, the additional earned income will reduce the future funding costs. If risk is defined as the uncertainty of achieving the objective (funding liability payments) then cash flow matching is one of the best approaches to de-risking a pension liability schedule.

The objective of a pension is to secure benefits in a cost-efficient manner. CDI is one of two ways to secure benefits. The other way is through insurance annuities, which tend to be expensive. Bond mathematics proves that the longer the maturity and the higher the bond yield, the lower the bond cost. It is all about the time value of money (present value versus future value). As a result, CDI will skew the weights of its portfolio holdings to longer maturities to

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[1] Martin L. Leibowitz, "The Dedicated Bond Portfolio in Pension Funds – Part 1: Motivations and Basics," *Financial Analysts Journal*, 42(1), 1983, pp. 68-75

[2] Retired lives included workers who have terminated employment and are receiving monthly benefit payments. Active Lives includes workers who have not been terminated and benefits are not yet determined.

reduce cost. The bond yield curve is typically positive sloping such that the longer the maturity the higher the yield to maturity (YTM). This allows cash flow matching to use the interest income of long bonds to partially fund every six months shorter projected liabilities especially if such long bonds have a greater yield than shorter maturity bonds. Since projected pension benefits are monthly, cash flow matching requires sophisticated modeling techniques, such as a cost optimization model, to build a bond portfolio of numerous maturities to cash flow match efficiently the liability cash flow projections at the lowest cost to the pension plan sponsor.

The efficiency of the cash flow matching model is best determined by the amount of excess cash flows to be reinvested. The goal is for no or little excess cash flow reinvestment, but this is quite difficult to achieve. It is ideal, if not a requirement, that the bonds used for cash flow matching are free of options that would disturb the certainty of the cash flows such as call options, put options, floaters, pass-throughs, etc.. In addition, the pension plan sponsor will put constraints on the cash flow matched portfolio (as true for any bond portfolio) from its investment policy statement (IPS). This would include rating, sector, issuer, and issue constraints on the percentage weighting in the portfolio. Fortunately, the fixed-income universe available for cash flow matching is immense allowing for great selection.

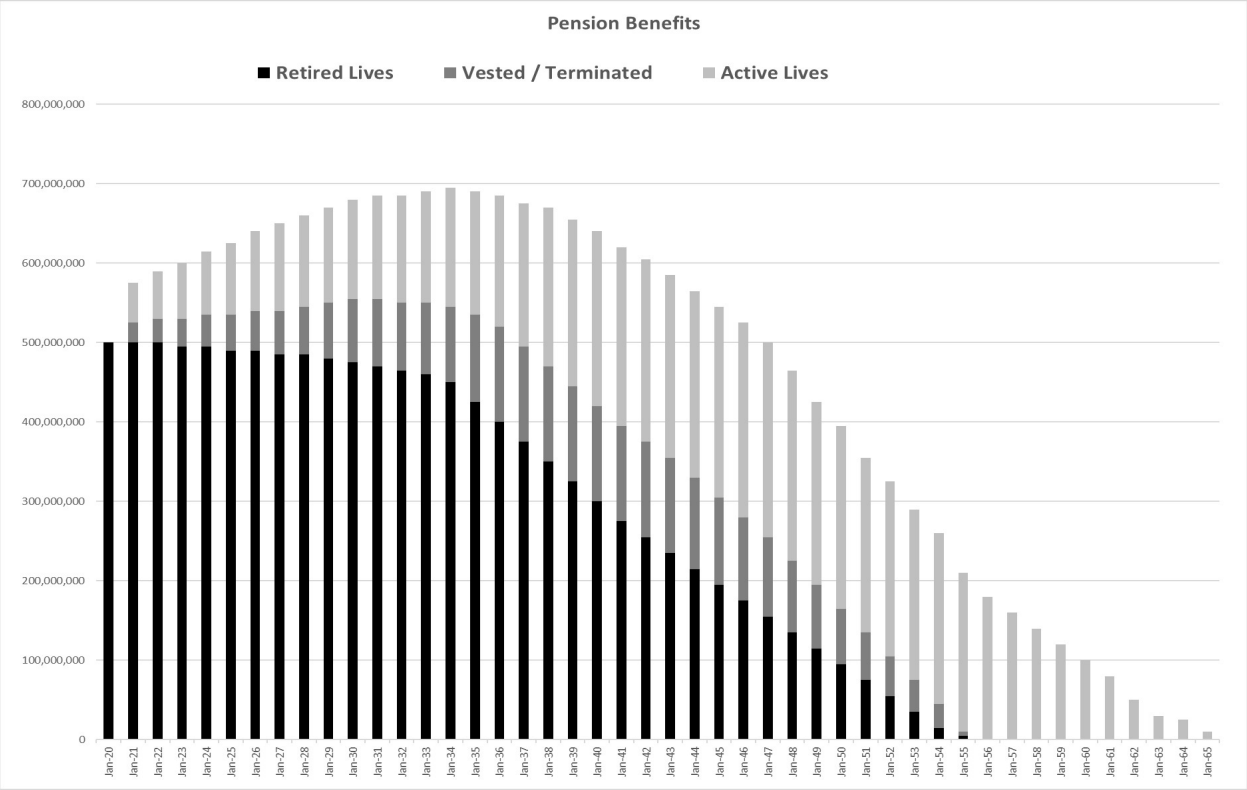
An exact match of bond maturities to liability payment dates could theoretically be accomplished by using U.S. Treasury STRIPS (zero-coupon bonds) but this would not be cost effective due to the fact that STRIPS tend to be the lowest yielding fixed income securities and the time value of money. Such an exact match is referred to as defeasance for accounting purposes where the liability is defeased and removed from the balance sheet provided the liability cash flows are certain. Pre-funded municipal bond issues are an example of a defeasance.

The actuarial projected pension benefit schedule is actually a series of projected benefit schedules for (1) Retired Lives, (2) Vested Terminated,[3] and (3) Active Lives. In the graph below (Exhibit 1) a typical series of projected benefit payments is depicted. The most certain and imminent is the Retired Lives benefit payment schedule. As a result, CDI is a best fit to match and fund Retired Lives and that should be the focus of this investment strategy.

[3] Vested terminated is comprised of workers who have terminated employment but have not started receiving benefit payments.

A pension plan's asset allocation should strongly consider Retired Lives in determining the bond allocation and focus rather than versus a generic bond index benchmark whose cash flows look nothing like the Retired Lives benefit schedule. Pension liability cash flows are like snowflakes, you will never find two alike due to a different labor force, salaries, mortality, and plan amendments. Until you receive the actuarial projection of Retired Lives, the bond allocation is lost without a proper objective. As the actuary updates the projections annually, there may be a need to rebalance the CDI to best match and fit the revised Retired Lives benefit projections.

Exhibit 1 Projected Benefit Payment Schedules



Source: Nuveen Asset Management, "How Old is Your Pension Plan,"2017,

Retired Lives = terminated employment and receiving monthly benefit payments.

Active Lives = not terminated and benefits are not yet determined

The CDI METHODOLOGY

A lower cost and lower risk way to secure benefits is to *cash flow match* the projected future value benefit payments of Retired Lives. In the early 1980s, dedication strategies (cash flow matching) with corporate bonds was in vogue for pensions. This strategy became less common as pension consultants and accounting rules focused on present values (Funded Ratio and Funded

Status) not future values. This led to considerable confusion as to what discount rate to use to calculate the present value of liabilities.

Since contributions are the initial source to fund benefits, current assets need to fund net liabilities (projected benefits – contributions). So, the first step in CDI is to identify with accuracy what you are funding, which is net liabilities. The next step is to identify a universe of bonds that qualify under the client's IPS (i.e., investment grade bonds). Then several iterations are needed to create a bond portfolio that can fund monthly net liabilities at low cost that is in conformity to the client's IPS. A cost optimization model is needed here to achieve low cost by skewing the weights to longer maturities and higher yielding bonds in conformity with the clients' investment policy within the liability benefit payment schedule we are funding. The present allocation to bonds (plus cash) will determine how far out CDI can cash flow match Retired Lives chronologically (i.e, 1-10 years Retired Lives).

An efficient CDI model should be able to reduce funding costs by 8% to 15% on a 1-10 years Retired Lives projected benefit payment schedule and much more if the strategy is funding longer liabilities, currently estimated at 25% to 40% on 1-30 years. This is a serious cost reduction and should be a major consideration of any asset allocation strategy as the *core portfolio*. Funding costs reduction is defined as the difference between the total benefits funded and the cost to purchase bonds for the CDI model. In truth, cash flow matching the liability benefit payment schedule (liability cash flows) at low cost is the ideal way to de-risk a pension plan.

Shown in Exhibit WW.2 is a sample cash flow matching model. The cash flows from principal and interest are used to fund projected liability payments for Retired Lives out 30 years. Note that the portfolio is skewed to longer maturities to take advantage of bond mathematics and achieve lower cost. In fact, there are no bonds shorter than five years. If there is any excess cash flow, it is reinvested at current U.S. Treasury STRIPS rates for the next benefit payment date(s) to be funded. The total cash flow (annually) is then compared to the benefit payment (annually) and a cumulative difference is shown.

It is critical that there are no cumulative cash flow deficits or negative differences. This sample cash flow model was able to fund $1 billion in projected benefit payments at a cost of $558,334,794 for a funding cost savings of $441,665,206 or 44.2% without any cash flow deficient years. This is a considerable funding cost savings that could truly help to stabilize a

pension fund. If the model is run using only U.S. Treasury STRIPS as a defeasance model, the funded costs savings would be 17.4%, which is still a noteworthy savings. Importantly, the plan sponsor gets this savings upon implementation of the cash flow matching model rather than having to wait for uncertain future returns, which will take many years to occur as in active bond management.

Exhibit 2 Cash Flow Matching Model (May 31, 2020)

Payment Year	Principal	Coupon	Reinvestment	Total Cash Flow	Benefit Payment	Cumulative Difference
11/30/2050	21,311,835	552,920	74,379	21,939,133	21,939,133	82,293
11/30/2049	22,251,690	549,264	913,520	23,714,474	23,714,474	82,293
11/30/2048	22,827,363	1,772,029	900,956	25,500,348	25,500,348	82,293
11/30/2047	23,007,720	3,288,970	873,370	27,170,060	27,170,060	82,293
11/30/2046	23,738,170	4,128,424	1,005,689	28,872,283	28,872,283	82,293
11/30/2045	24,826,431	4,750,612	992,946	30,569,989	30,569,989	82,293
11/30/2044	24,332,689	6,934,752	955,072	32,222,513	32,222,513	82,293
11/30/2043	24,799,381	8,149,205	901,990	33,850,576	33,850,576	82,293
11/30/2042	24,489,335	9,916,650	868,234	35,274,219	35,274,219	82,293
11/30/2041	25,132,189	10,497,097	1,114,928	36,744,213	36,744,213	82,293
11/30/2040	24,601,886	12,291,203	1,108,429	38,001,518	38,001,518	82,293
11/30/2039	23,905,823	13,878,625	1,210,418	38,994,866	38,994,866	82,293
11/30/2038	22,906,983	15,799,414	1,220,741	39,927,139	39,927,139	82,293
11/30/2037	22,233,793	17,546,815	1,018,294	40,798,902	40,798,902	82,293
11/30/2036	21,957,028	18,670,389	934,676	41,562,094	41,562,094	82,293
11/30/2035	21,247,502	19,977,162	753,569	41,978,233	41,978,233	82,293
11/30/2034	20,195,218	21,086,617	888,699	42,170,534	42,170,534	82,293
11/30/2033	19,128,171	22,564,153	723,767	42,416,091	42,416,091	82,293
11/30/2032	16,395,067	23,895,751	2,079,808	42,370,626	42,370,626	82,293
11/30/2031	11,379,523	24,475,681	4,689,761	40,544,965	40,544,965	82,293
11/30/2030	10,733,387	25,584,007	1,842,195	38,159,588	38,159,588	82,293
11/30/2029	7,524,555	26,563,553	1,618,857	35,706,965	35,706,561	82,293
11/30/2028	5,382,706	26,676,834	1,532,697	33,592,237	33,591,569	81,889
11/30/2027	3,185,113	27,164,053	1,226,431	31,575,597	31,575,597	81,220
11/30/2026	1,846,466	27,268,308	655,756	29,770,530	29,770,530	81,220
11/30/2025	414,709	27,250,572	312,096	27,977,378	27,977,378	81,220
11/30/2024	0	26,338,449	22,523	26,360,972	26,342,921	81,220
11/30/2023	0	24,885,617	21,173	24,906,790	24,888,739	63,170
11/30/2022	0	24,009,873	20,386	24,030,259	24,012,209	45,120
11/30/2021	0	23,350,387	19,796	23,370,183	23,352,133	27,069
11/30/2020	0	9,020	0	9,020	0	9,019
Cash	0	0	0	0	0	0
	469,754,735	499,826,405	30,501,156	1,000,082,295	1,000,000,000	

Matching Retired Lives liabilities chronologically will buy time for the non-bond assets (which we referred to as the "Alpha assets") to perform and outgrow Active Lives liabilities. Given time (10 years +) most non-bond asset classes tend to outperform bonds. Since liabilities behave like bonds given their present value interest rate sensitivity there is a high probability that

non-bond asset classes should outperform liability growth of Active Lives over an extended time horizon especially in today's low yield environment. This outperformance would enhance the funded status allowing for reduced contribution costs or increased Active Lives benefits or both. The benefits of a cash flow matched (CDI) strategy are numerous:

Secures Benefits: Cash flow matches and funds monthly Retired Lives benefits chronologically
Enhances Funded Ratio /Status: CDI portfolios biased to corporate bonds will out yield a liability discount rate, which creates alpha
Reduces Costs: CDI reduces funding costs (8% to 15% +) and may reduce contribution costs
Reduces Volatility: Reduces volatility of (1) Funded Ratio (2) Contribution Costs
Reduces Risk: (1) Risk = Uncertainty of Funding Benefit Payments and
(2) Funds Benefit Payments (Future Values have No Interest Rate Sensitive)
Enhances Return on Assets (ROA): CDI should *out yield* most active bond managers
Buys Time: (1) CDI matches & funds net liabilities *chronologically,* (2) moves deficit out longer extending the investment horizon, and (3) buys time for non-bond assets (Alpha assets) to outgrow Active Lives.

FUTURE VALUE VERSUS PRESENT VALUE

Actuarial practices use present values (PV) to calculate the pension funded ratio and funded status. But pension benefit payments are future values (FV). This suggests that the future value of assets versus the future value of liabilities is the most critical evaluation. However, it is anyone's guess as to the future value of most asset classes. This is why the PV is used to calculate the funded status. Only bonds (and insurance annuities) have a known future value and have historically been used to cash flow match liabilities (i.e., defeasance, dedication). To prove this point as to the potential misinformation with using a PV calculation, let's use a simple example below.

Consider the following two pensions, A and B, both at $100 million market value would have the same funded ratio in PV dollars:

Pension	Composition	Yield to Maturity	PV	FV
A	100% Treasuries	2.00%	$100 million	$181.7 million
B	100% Corporates	3.00%	$100 million	$244.3 million

As can be seen, pension B is 100% invested in corporate bonds that out yield pension A (100% invested in Treasuries) by 100 bps per year over 30 years. Certainly, plan B has a much greater

FV (at 34.5% higher) and funded status than plan A if future values are used. This suggests that the funded ratio and funded status may not be that accurate or even good indicators of the true economic solvency of a pension plan:

The point of all this is that we need to focus more on the FV of assets vs. liabilities. This is what CDI is all about. It is matching and funding future values (projected benefit payments minus contributions). If you discount liabilities at market rates, they will have discount rates of AA corporates (FASB method) or perhaps, U.S. Treasury STRIPS (defeasance method). A corporate bond portfolio matched to liabilities that out yields liabilities would enhance the funded ratio on a future value basis thereby reducing funding costs. Moreover, a cash flow matched portfolio skewed to longer maturities reduces funding costs significantly because of the greater yield associated with longer dated maturities in a positively sloping yield curve. This is due to the time value of money or present values versus future values, which is integral in CDI construction. This is why cash flow matching of liability future values is the most prudent methodology for lowering risk and cost when de-risking a pension through asset liability management (ALM).

INTEREST RATE RISK

The greatest risk of bonds is their interest rate sensitivity. The longer the maturity and duration of any bond portfolio supposedly the higher the interest rate risk. But since cash flow matching is focused on funding projected benefits (future values) interest rate risk is neutralized or eliminated. Critically, future benefit payments are not interest rate sensitive. The volatility of interest rates will not cause any volatility in projected benefits or future values. As a result, CDI is not concerned about interest rates except for the reinvestment of excess cash flows. In contrast to active bond management where rising interest rates are bad in that they deteriorate bond prices, with CDI higher interest rates are good allowing the cash flow matched portfolio to reinvest at higher interest rates and lower cost.

CDI VERSUS ACTIVE BOND MANAGEMENT

A cash flow matching strategy is focused on generating asset cash flows that will fund liability cash flows (benefit payments). It is not focused on total returns or performance versus a bond index benchmark. Another benefit with a CDI is the low portfolio turnover, which will

reduce transaction costs. Active bond management is focused on outperforming the returns of a generic bond index benchmark. As a result, cash flows are not a consideration here, only the relative total returns to the index benchmark are considered (performance measurement). But no matter what generic bond index is chosen; active fixed income asset management cannot produce enough cash flows to fund benefits since only interest income is used to fund benefits. As a result, actively managed bonds will require help from the performance or Alpha assets to fund benefits. This will create dilution and disruption of the growth rate of such performance assets. With a CDI strategy in place as the pension plan's *core portfolio* to fund the shorter Retired Lives net liabilities (1-10 years +), the Alpha assets are now free to grow without being diluted or unencumbered to pay any benefits. The return on Alpha assets will be volatile, but the liability Beta assets (CDI) buy time (10 years +) for the Alpha assets to grow. The following example illustrates the cash flow difference of bonds managed to a generic index versus cash flow matching to liabilities:

Assumptions:

Bond allocation = $150 million

Net Benefits = $20 million per year for next 10 years

Bond management vs. generic bond index

* YTM = 2.50% (Index YTM = 2.00%)
* Cash flow = $3.75 million annual ($2.50% × $150 million)
* Annual cash flow shortfall = $16.25 million ($20milion − $3.75 million)
* Requires dilution of Alpha assets cash flow to fund net benefits

Cash Flow Matching

* YTM = 3.50% (skewed to A/BBB corporate bonds)
* Cash flow = $20 million annual (principal + income + reinvestment of excess)
* No dilution of Alpha assets cash flows (assets allowed to grow unencumbered)

From the above illustration we see that generic bond index cash flows look nothing like the projected benefit payment schedule of a pension. This leads to a mismatch of cash flows and risk/reward behaviors, which are serious issues over time. Alpha assets need time to perform

without any dilution of their cash flows to pay benefits. CDI matches and funds benefit payments chronologically. CDI will out yield most current bond managers and enhance the return on asset assumption (ROA). CDI buys time for Alpha assets to grow unencumbered. Moreover, bonds managed versus generic bond indexes have the following issues:

* Does not fund benefits plus expenses
* Cash flows do not match a plan's liability cash flows
* Generic bond index skewed to long bonds and Government securities
* Low yielding similar to index benchmark (Aggregate index = 1.42% YTM)

CDI VERSUS LDI

Liability driven investments (LDI) are usually duration-matching strategies or immunization. The pension funded ratio and funded status are present value calculations, anything that affects the PV of liabilities is the concern of LDI or immunization. Since liabilities behave like bonds then the PV of liabilities is extremely affected by the discount rate(s) used to price liabilities. To immunize the pension against this interest rate risk and sensitivity, LDI uses several approaches with the main focus on duration matching liabilities. LDI may use interest rate swaps, futures, derivatives, risk overlays, and the like to assist in duration matching liabilities. They are all hedging tools to help assets match the liability growth rate. Unfortunately, they do not match or fund the liability cash flows.

There are several difficult, if not erroneous, data gathering choices in duration matching strategies, as explained below:

1. **Average duration of liabilities**

   Where do you get the average duration of liabilities? Most, if not all, actuarial reports do not provide this calculation. Moreover, they do not provide the projected liability benefit payment schedule, which you would need to calculate duration. In addition, actuarial reports are annual reports usually lagged three to six months rendering the information seriously delayed. The duration calculation is a PV calculation (not a FV) at a precise moment in time such as the balance sheet. As time and interest rates change, so will duration. Moreover, current assets are funding *net liabilities after contributions,* which is not calculated by the actuary. Only a *Custom Liability Index* (CLI) based on each pension's unique projected Retired Lives benefit payment schedule and projected

contributions could provide an accurate and monthly projected benefit payment schedule and duration profile. But most LDI strategies try to match the growth rate of total gross liabilities not net Retired Lives after contributions. As mentioned earlier, Active Lives are not certain and contain actuarial noise (assumptions that are hard to forecast and maintain over time).

2. Discount Rates

Since the duration of liabilities changes with interest rates (discount rates) this calculation needs to be refreshed and updated on a frequent and accurate basis. According to pension accounting rules[4] and federal funding standards,[5] there is an assortment of discount rates required to price liabilities. Which one to use and what source to use could create several discount rate versions. If a generic bond index is used as a liability proxy, there are more difficulties. Generic bond indexes do not use any of the required pension accounting discount rates preferring market rates! The yield difference could be serious. Any difference in yield creates a difference in the calculation of duration and liability growth rates. Only a custom liability index benchmark using the appropriate discount rates could provide an accurate duration and liability growth rate calculation.

3. Generic Bond Indexes

A common proxy for the average duration of liabilities is to use a generic bond market index, often the Bloomberg Barclay's long corporate index. Such a proxy creates several erroneous data issues. This index has no bonds shorter than 10 years and no durations longer than 19 years although heavily skewed to long coupon bonds. This certainly does not represent any pension liability schedule even if the average durations were similar. Accounting standards and actuarial practices price liabilities as a portfolio of zero-coupon bonds with a single average discount rate based on the present value of this zero-coupon liability portfolio. There are no generic bond indexes that use zero-coupon bonds as their portfolio. There are no generic bond indexes that use pension discount rates in accordance with FASB, GASB, and PPA guidelines. Every pension plan's liabilities are

different and unique to that plan due to different labor force, salaries, mortality, and plan amendments. There is no way any generic bond market index could represent any pension plan liability term structure. Only a custom liability index benchmark could properly represent and measure any pension plan's liabilities providing all of the critical data calculations needed to de-risk the plan and manage assets versus liabilities.

4. Limitations of Duration

Originally formulated by Frederick R. Macaulay in 1938, the duration calculation was created as a way to measure a bond's average life.[6] Duration is defined as the average life of a bond's cash flow in present value dollars. Hopewell and Kaufman demonstrated that the measure of duration as suggested by Macaulay is related to interest rate sensitivity of a bond and the measure derived is referred to as modified duration.[7] Unfortunately, modified duration has very limited use as an indicator of interest rate sensitivity. It has the following inconsistencies as a way to match price or interest rate sensitivity. I call them the "seven flaws of duration" as follows:

P*roportionality:* Doubling the duration does not produce twice the total return. Duration only measures price sensitivity and not income returns.

Same Duration: Even if durations are matched, if income returns are not matched, total returns will not be matched.

Time: Duration is a present value calculation and changes with time so the ending duration will be different than the beginning duration. The longer the time horizon, the more likely that variations will occur in the duration calculation. Over time, the same duration zero-coupon bond and coupon bond will diverge significantly on their ending duration.

Maximum Duration: Duration actually peaks out at high yields such that an extension of maturity will shorten duration.

Large Yield Moves: Modified duration times large yield moves results in large price return mismatches. The larger the yield move the larger the error.

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[6] F. Macaulay, *The Movements of Interest Rates. Bond Yields and Stock Prices in the United States since 1856*, New York: National Bureau of Economic Research, 1938.

[7] M.H. Hopewell and G.G. Kaufman, "Bond Price Volatility and Term to Maturity: A Generalized Respecification," *American Economic Review*, 63(4), 1973, pp. 749-753.

Spot Calculation: Duration is a PV calculation that is only good for a one-day horizon. Every day forward, duration can and should change especially on zero-coupon bonds.

Averages: Using portfolio average durations gives totally inaccurate information. Duration is a function of coupon, yield, and maturity. If any one of these features is distorted, future duration changes will be distorted. The reason for the distortion is that duration is not linear such that a six-year bond will not exhibit the same price sensitivity as a portfolio of equally weighted two and ten-year duration bonds. The classic example of a portfolio average duration problem was the Lehman Government/Corporate bond index for July 1990 which reported the following: coupon = 9.13%, maturity = 9.99 years, price = $100.00, and YTM = 8.57%. How could a portfolio average coupon of 9.13% at an average price of $100.00 equal an 8.57% YTM? The resulting portfolio duration of 5.24 years and its interest rate sensitivity is then suspect too. Unfortunately, most bond active management is based on its portfolio average versus the index benchmark portfolio average to determine its risk/reward characteristics.

5. Interest Rate Sensitivity

Every-one year of duration difference between the liability proxy and the actual duration of each plan's benefit payment schedule results in a 1% mismatch in liability growth for every 100 bps of discount rate change. In truth, the duration mismatch is more likely to be three to five years rather than one year. Given that pension cost for the actuary, administration, asset managers, and consultant are usually way less than 1% a year; such a duration mismatch could be very costly representing years of pension cost. Moreover, most duration matching strategies are heavily skewed to maturities longer than 10-years. This makes the duration matching strategy extremely interest rate sensitive. Given today's historic low yields, there is a high probability of higher rates and negative growth on duration matching strategies over time.

6. Funding Liabilities

Imagine a 12-year average duration liability benefit payment schedule. It could have many different term structure shapes to come up with an average 12-year average duration. Imagine 100% of the assets as the 12-year average duration bond portfolio. If interest rates rise 50 basis points in a year, assets and liabilities supposedly would both have a -6% price return (interest rate movement × duration (as a negative number)). If they had the same income return of 4%, they would match again (note that assets usually do not match the income or yield of liabilities). However, if the duration matching assets are used to *fund* liabilities then a -2% loss (-6% + 4% = -2%) on assets could be funding a one-year liability, which should have a small positive growth rate. So, the assets could be taking a loss each year to fund the next year's liability benefit payments if interest rates continue to rise. This could get to be a serious costly mismatch if interest rates began a secular trend to higher rates for the next five years. But the point is that there is no cash flow matching here, only a duration match so there is both a funding and interest rate risk!

7. **Derivatives**

Interest rate swaps and futures are contracts not true nominal assets. There is no cash flow or funds available to make the liability cash flow payments. They are hedges versus the liability growth rate. In fact, these strategies introduce new risk: counter party risk, interest rate risk, non-matching risk of assets purchased (usually equities) versus liabilities and leverage. In addition, interest rate swaps and futures have all of the problems associated with a liability proxy data gathering.

Summary

The key points of CDI that make it the preferred way to de-risk a pension should be:

1. Pension Objective – is to secure benefits in a cost-efficient manner. CDI stands alone as the most prudent and efficient way to achieve the true pension objective. Insurance annuities are not cost effective.
2. Retired Lives – are the most certain and imminent benefit payment schedule. They also represent the employees who have the longest tenure. These are the liabilities that should

be cash flow matched as a high priority and in compliance with the true pension objective.

3. Funding Cost Savings – CDI will reduce the cost to fund Retired Lives immediately upon implementation of the CDI portfolio. The plan sponsor gets these cost savings up front rather than over a long horizon as return oriented strategies suggest or promise that they will do. The longer the projected benefit payment schedule the higher the funding cost savings. CDI should reduce funding costs by 8% to 15% on 1-10 years of Retired Lives and up to 40% on 1-30 years. The cost savings gets to be invested in the Alpha assets that will likely reduce pension costs in the future.
4. Future Values – projected Retired Lives benefit payments are future value numbers. Duration matching and performance-oriented strategies all deal with present value numbers (returns, funded ratio, funded status). These projected FV benefits are not interest rate sensitive while PV strategies (LDI) are extremely interest rate sensitive.
5. LDI Issues – duration matching and immunization strategies are not proper or accurate de-risking strategies. First is the fact that LDI does not fund benefit payments. Moreover, LDI is full of calculation inaccuracies and even erroneous date gathering. Duration of liabilities is not an easy or static calculation. I listed the "seven flaws of duration" in my limitations of duration section that should be known or understood if you are focused on duration matching. Since the actuary does not provide the duration calculation, the data miseries start there.

"Where is the knowledge lost in information"

T.S. Eliot