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Hedging a Cash Balance Liability: A CUSTOM BENCHMARK APPROACH

EXECUTIVE SUMMARY

- Recent improvements in the funded status of many corporate defined benefit plans have accelerated interest in liability-driven investing (LDI) and led many sponsors to more clearly articulate their LDI objectives. However, the fixed income benchmarks typically used to measure the performance of LDI strategies can be improved.
- T. Rowe Price has developed a methodology for constructing custom LDI benchmarks at the most granular level—from the individual cash flows, both principal and coupon, derived from a given fixed income opportunity set.
- Due to the benefit formula mechanics of many cash balance plans, a unique solution customized to each specific plan is required to ensure that LDI benchmarks accurately reflect the interest rate exposures embedded in each cash balance plan's liability.
- To highlight the potential benefits of T. Rowe Price's LDI customization process, we have created a benchmark for a hypothetical cash balance plan with the following characteristics:
  - Half of the liability is associated with the cash balance design and half is derived from the legacy final average pay plan that existed prior to cash balance conversion (Figure 1, page 2).
  - Cash balance benefits are payable as lump sums.
  - Participants' notional account balances receive an annual interest credit based on the 30-year Treasury yield, with a minimum of 3.50%.

THE NEXT STEP IN LDI EVOLUTION

As corporate defined benefit plans increasingly have shifted their focus to portfolio de-risking, many have sought fixed income benchmarks that are better aligned with the specific objectives they hope to achieve through liability-driven investing (LDI). Some sponsors have shifted to longer-duration measures, such as the Barclays Long Credit Index or Barclays Long Government/ Credit Index, while others have adopted compound benchmarks or duration-targeted indexes.

T. Rowe Price believes an even higher level of customization is both necessary and feasible. Accordingly, we have developed a methodology for constructing custom fixed income benchmarks at the most granular level possible—the individual cash flows, both principal and coupon, derived from a given fixed income opportunity set.

Based on the bonds in the relevant opportunity set, we create a benchmark that matches, as precisely as possible, a plan's projected liability cash flows. To ensure continuous liability matching, this investable benchmark is then reset each year to reflect the plan's actuarial experience, new pension cash flow accruals, and bond market developments.[1]

SPONSOR OBJECTIVE: REPLICATE THE INTEREST RATE EXPOSURES OF A CASH BALANCE LIABILITY

The first step in our approach for cash balance plans is to segregate the projected cash flows for each benefit structure and develop separate benchmarks for each. This is necessary because final average pay and cash balance cash flows have different interest rate exposures. The two benchmarks would then get weighted based on the amount of liability associated with each benefit design to form a single benchmark for the total liability replication.

In this example, we assume the sponsor is focused on accounting results and so we use AA rated bonds in the benchmark construction. The value of the final average pay cash flows will depend on movements in both the underlying Treasury rates and the credit spread between Treasuries and AA bonds. We use our cash flow optimizer to create an investable benchmark for just the liabilities stemming from the legacy final average pay plan (Figure 2a, below).

We use a similar approach for the separate cash balance cash flows (Figure 2b, page 3), but there are three nuances that make the process different than for the final average pay cash flows:

1. The expected cash flows are less stable year over year, reflecting the fact that lump-sum payments can fluctuate significantly based on actuarial experience.

   Impact: It is more important to match duration, convexity, and yield than the cash flows for the cash balance plan, so our optimizer penalties are adjusted accordingly.

2. The cash flows are already indexed to Treasury rates since the interest credit for participant account balances is based on the yield on the 30-year Treasury bond.

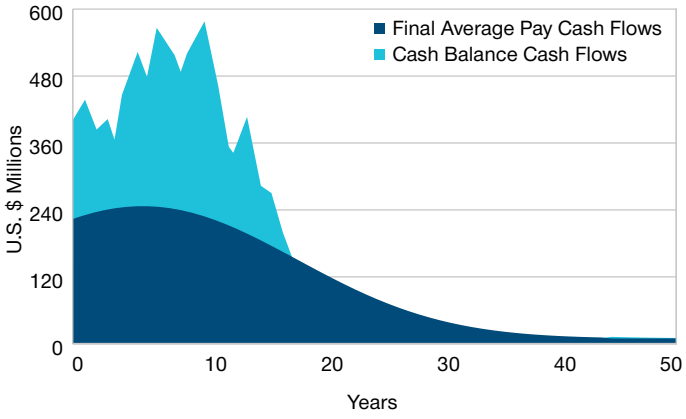
   Impact: The benchmark should have the same spread duration as the cash flows, but all of the Treasury duration should be hedged out of the benchmark by including short positions using derivatives such as Treasury futures or interest rate swaps.

3. The plan has a minimum interest rate that could affect the duration calculation depending on the relative relationship between the minimum crediting rate and the current market rate.

   Impact: The notional value of the derivatives should change based on the market environment. If the current 30-year Treasury yield is below the minimum interest crediting rate, then the cash balance liability will have full exposure to changes in Treasury rates and the short derivative positions will not be necessary in the benchmark. On the other hand, if the current 30-year Treasury yield is above the minimum rate, the short derivative positions should be included in the benchmark to reflect the notion that the cash flows are already indexed to Treasury rates.

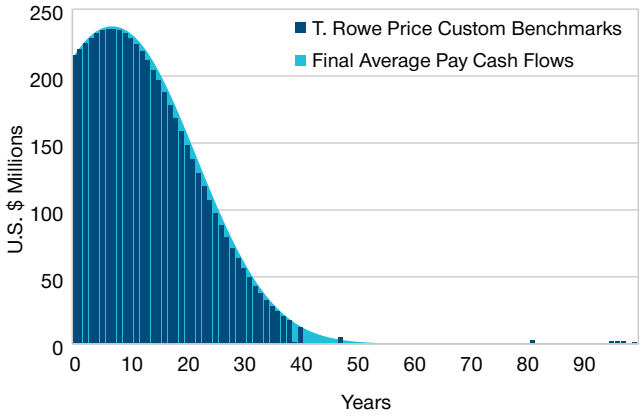
The result of the process is a cash bond benchmark that matches cash flows, duration, spread duration, and yield, with offsetting positions in Treasury-based derivatives for the cash balance plan. The benchmarks, optimized separately, would then be combined into a single benchmark for the overall plan (Figure 3 and Figure 4, page 3).

FIGURE 1: Plan Cash Flows for a Hypothetical Cash Balance Plan
Including Both Average Final Pay and Cash Balance Liabilities
As of 30 Sept 2015



Source: T. Rowe Price.

FIGURE 2A: Hypothetical Custom Benchmark (AA Credit Universe)
For Final Average Pay Component of Plan Liability
As of 30 Sept 2015



Sources: Barclays, T. Rowe Price; data analysis by T. Rowe Price.

[1] For a fuller description of T. Rowe Price's methodology, please see the Appendix on page 4.

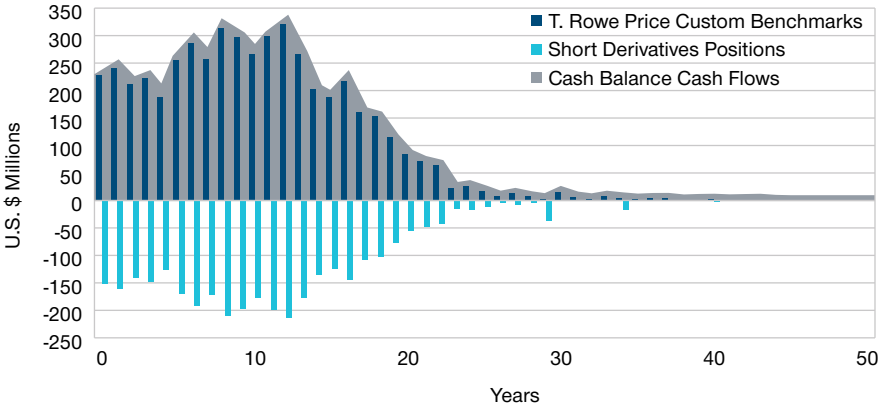
CONCLUSIONS

T. Rowe Price believes LDI performance benchmarks should reflect each plan sponsor's specific investment goals and objectives. To that end, we have developed a customization methodology that we believe will enable sponsors to align their fixed income allocations and their LDI objectives with far greater precision than either standard market benchmarks or more specialized duration-targeted or compound indexes.

By isolating each portion of a cash balance plan's unique liability structure and using our cash flow optimization approach, we can replicate the liability's interest rate and credit spread exposures with an investable and representative benchmark. This benchmark should enable sponsors to provide investment managers with more precise mandates, improve performance attribution for both plan assets and plan liabilities, and potentially reduce portfolio tracking errors relative to liabilities.

FIGURE 2B: Hypothetical Custom Benchmark (AA Credit Universe)
For Cash Balance Component of Plan Liability

Data as of 30 Sept 2015



Sources: Barclays, T. Rowe Price; data analysis by T. Rowe Price.

FIGURE 3: Top 10 Issues in Hypothetical Custom Cash Balance Benchmarks[2]

As of 30 Sept 2015

Final Average Pay Component of Liability	Weight
IBM 5.88 '32	2.04%
Walmart 5.25 '35	1.59
Quebec 7.50 '29	1.44
Connecticut 5.85 '32	1.37
Statoil 7.15 '29	1.31
Ohio 3.99 '29	1.30
Shell 6.38 '38	1.27
Oregon 5.99 '27	1.24
Massachusetts 4.91 '29	1.19
Walmart 6.50 '37	1.18

Cash Balance Component of Liability	Weight
IBM 5.88 '32	2.35%
Statoil 7.15 '29	2.20
Oregon 5.89 '27	2.18
Ohio 3.99 '29	2.18
Connecticut 5.85 '32	2.10
Massachusetts 4.91 '29	2.00
Walmart 5.88 '27	1.89
Korea Export-Import Bank 3.25 '26	1.80
Quebec 7.50 '29	1.75
IBM 7.00 '25	1.39

Source: T. Rowe Price.

FIGURE 4: Key Characteristics of Hypothetical Plan Cash Flows and T. Rowe Price Custom Liability Benchmarks[2]

As of 30 Sept 2015

	Duration	Credit Spread Duration	Convexity	Yield	Average Quality
Final Average Pay Component of Liability	9.7	9.7	1.8	4.11%	AA
T. Rowe Price Custom Benchmark	9.5	9.5	1.4	3.49	AA
Cash Balance Component of Liability	2.8	8.4	1.2	3.85	AA
T. Rowe Price Custom Benchmark	2.7	8.2	0.9	3.25	AA

Source: Barclays, T. Rowe Price; data analysis by T. Rowe Price.

[2] Please refer to the disclosures at the end of this material for important additional information.

Appendix: Constructing Custom LDI Benchmarks

T. Rowe Price has developed its own custom LDI benchmark methodology, which we believe has the potential to:

- reduce liability tracking error compared with market cap-weighted benchmarks and composites;
- allow managers to tailor their investment process more closely to sponsor objectives in terms of spread, duration, and curve sensitivities; and
- demonstrate their performance relative to plan liabilities more precisely.

STEP ONE: DEFINE THE OPPORTUNITY SET BASED ON THE SPONSOR'S LDI OBJECTIVES

Hedging asset performance should be monitored as closely as possible against the liability measurement most meaningful to the sponsor. Because different regulatory and accounting regimes use different discount rates, the optimal opportunity set will depend on the sponsor's de-risking priorities.

STEP TWO: CONSTRUCT A YIELD CURVE

Once the relevant fixed income opportunity set has been defined, bonds are broken down into their discrete coupon and maturity cash flows. In essence, this procedure treats every cash flow as if it were a separate zero-coupon bond, then uses those flows to construct a zero-coupon yield curve that can be matched against the plan's cash flows.

STEP THREE: ESTIMATE THE PRESENT VALUE OF LIABILITIES

Discounting plan cash flows using the model curve provides the yields needed to determine the plan's interest rate sensitivity at each point on the curve. The curve is stressed by incrementally increasing and decreasing the yields at each point in order to determine key rate durations (KRD).

STEP FOUR: OPTIMIZE THE BENCHMARK

Asset cash flows are matched to liability KRDs, taking into account how much impact each point on the curve has on the overall present value of plan liabilities. The result is a customized benchmark in which asset and liability weights are matched relatively precisely, especially in the most interest rate-sensitive portion of the curve.

With the structure in place, the mandate to the asset manager becomes relatively straightforward: Either replicate or outperform the liability-matching cash flow benchmark, while also matching spread and curve sensitivities as closely as possible using instruments that are actively traded and have a reasonable degree of market liquidity.

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