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Custom Liability Benchmarks: THE NEXT PHASE IN LDI PRECISION

EXECUTIVE SUMMARY

- As corporate defined benefit plan sponsors have shifted to liability-driven investment (LDI) strategies, many have sought fixed income benchmarks that more closely match the duration of plan liabilities compared with standard core market measures such as the Barclays Aggregate Index and the Barclays Government/Credit Index.
- Longer-duration benchmarks, such as the Barclays Long Credit Index or more specialized duration-targeted or compound indexes, improve the match of duration, spread, and curve risk along some key rates, but still may result in more liability tracking error than sponsors wish to accept.
- T. Rowe Price has developed a benchmark customization methodology that we believe will enable plan sponsors to provide their managers with more precise investment mandates while also improving performance attribution for both plan assets and liabilities.
- We use our LDI customization process to create a benchmark for a hypothetical sponsor with the objective of minimizing tracking error relative to the accounting value of liabilities. Additional customization examples using other sponsor objectives will be highlighted in future T. Rowe Price studies.

THE EVOLUTION OF LDI BENCHMARKS

The adoption of Liability-driven investment (LDI) strategies by corporate plan sponsors has driven a related evolution in the benchmarks used to measure fixed income performance. Sponsors and consultants have sought to adopt benchmarks that better align their fixed income mandates with their LDI goals. However, while existing LDI-oriented benchmarks make it possible to match duration, spread, and curve risk along some key rates, they still are market-weighted, and thus do not reflect the unique exposures embedded in each pension plan's liability structure.

T. Rowe Price thinks the time has come to take LDI benchmarking to an even higher level of customization. To that end, we have developed a framework for benchmark construction that we believe will make it possible to align a sponsor's LDI objectives and fixed income mandates with a previously unattainable level of precision.

The key to our methodology is the construction of benchmarks at the most granular level—the individual cash flows, both principal and coupon—that can be derived from a desired fixed income opportunity set. These cash

flows are analyzed to generate a model benchmark that matches, as precisely as possible, the plan's projected cash flows. The benchmark is then reset each year to track the plan's actuarial experience, new cash flow accruals, and bond market developments.

T. Rowe Price's approach offers similar potential benefits as a composite credit or duration-targeted benchmark, but with an enhanced level of plan specificity. Some of the potential advantages of greater benchmark precision:

- Enables sponsors to better align their fixed income allocations with key LDI goals, whether those objectives are to reduce balance sheet impact, limit the volatility of Pension Protection Act (PPA) funded status, position for a risk transfer, or outperform plan liabilities.
- Removes an unnecessary step in the investment process. Using a traditional market-cap weighted benchmark, a sponsor's fixed income managers would first take positions relative to the index, then determine how they match the liability structure. A custom LDI benchmark eliminates that second step, aligning tracking error with plan liabilities rather than a market benchmark.
- Gives fixed income managers greater leeway to take tactical positions relative to liabilities, while encouraging more productive discussions of relative returns and performance attribution.

A more detailed description of T. Rowe Price's customization methodology can be found in the Appendix on page 6.

AN EXAMPLE OF A CUSTOM LDI BENCHMARK: HEDGING LIABILITIES

To highlight the potential benefits of T. Rowe Price's LDI customization process, we created a benchmark for the hypothetical plan liability cash flows shown in Figure 1, below.

We assume the sponsor's LDI objective is to minimize portfolio tracking error relative to liability returns as determined using the discount rates specified in U.S. Accounting Standards Codification (ASC). Accordingly, the benchmark was constructed from the AA component of the Barclays U.S. Credit Index. In our view, such a benchmark could be appropriate for sponsors who:

- are sensitive to balance sheet and/or income statement impact,
- have already moved far along an existing de-risking glide path, and
- intend to retain the plan.

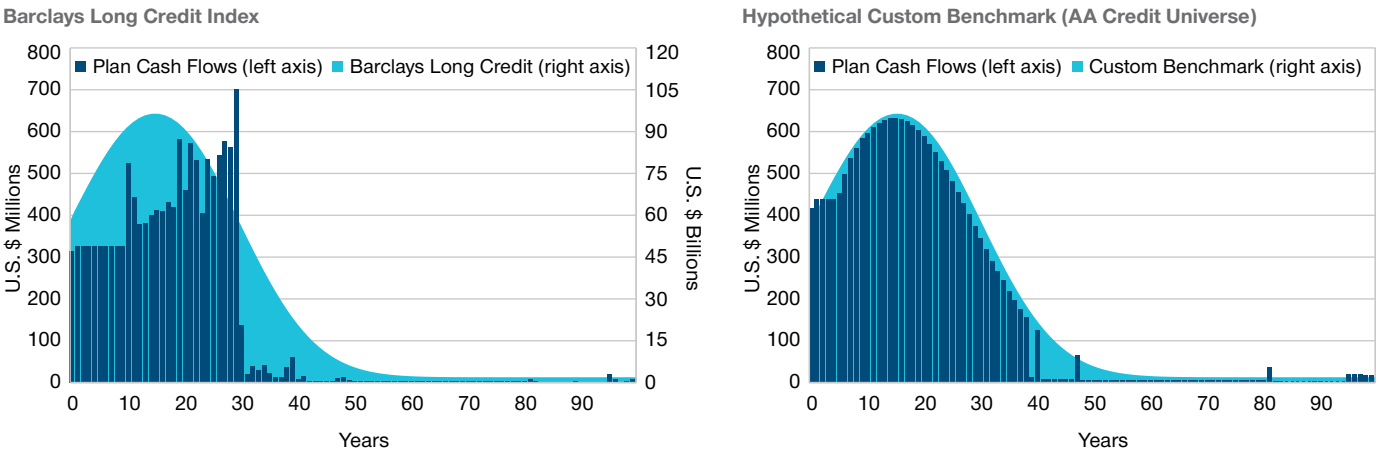
The hypothetical custom benchmark provides a much more precise match of the liability structure than would be possible using a standard market-weighted index, such as the Barclays Long Credit Index (Figure 1A).

The cash flow match in the custom benchmark (Figure 1B) is not perfect—no surprise given that the benchmark was created from a universe of coupon securities. However, our optimizer took into account where the mismatches fell on the maturity spectrum. Mismatches in the early years were not penalized as harshly as those in the later years, where there was more interest rate risk.

One of the largest cash flow mismatches in the custom benchmark stems from the relative scarcity of high-quality issues in the 40–50 year range—a maturity segment where the plan has some expected cash flows. The ten largest issues in the benchmark are shown in Figure 2, page 3.

We believe benchmarks constructed in this manner have the potential to deliver lower tracking error and lower average monthly return differences relative to liabilities, compared with other common LDI benchmarks (Figure 3, page 3, and Figure 4, page 4).

FIGURE 1: Custom LDI Benchmarks Can Provide More Precise Matching of Plan Liability Cash Flows
Hypothetical Plan Cash Flows Valued Using ASC Discount Rates



Data as of 30 Sept 2015

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

POTENTIAL BENEFITS OF A CUSTOM BENCHMARK

Liability-relative tracking error is a critically important metric for LDI managers and plan consultants to measure and monitor. Failing to do so may lead to:

- unexpected income statement and balance sheet results,
- larger than expected corporate cash requirements for buyouts and/or lump-sum offerings,
- difficulty in determining LDI program success.

We believe an LDI benchmark constructed using the process described above should allow plan sponsors to significantly reduce liability tracking error compared with market cap-weighted benchmarks, including long duration benchmarks such as the Barclay's Long Credit Index.

Generally, customization should simplify communication among managers, sponsors, and consultants. A typical LDI composite benchmark may include as many as five different indexes (Figure 5, page 4), so focusing on a single benchmark should leave less room for confusion.

Customization should also improve portfolio attribution on both the asset and the liability side, enabling managers to better assess the impact of issue-specific events—such as maturity roll-off, calls, upgrades, and downgrades—on the liability hedge. This, in turn, should also allow managers to provide clients and their consultants with more detailed and insightful performance data and analysis (Figure 6, page 5).

The fact that the benchmark reflects actual liability characteristics should help keep managers focused on the sponsor's true objectives, rather than pursuing

FIGURE 2: Ten Largest Issues in a Hypothetical Custom Liability Hedging Benchmark[1]

As of 30 Sept 2015

Issues	Index Weight
Los Angeles Community College 6.75 '49	2.95%
IBM 5.88 '32	2.12
Walmart 5.25 '35	1.97
Port Authority NY & NJ 4.93 '51	1.94
Shell 6.38 '38	1.86
Walmart 6.50 '37	1.64
Memorial Sloan Kettering 4.13 '52	1.45
Port Authority NY & NJ 4.96 '46	1.40
California Bay Area Toll 6.26 '49	1.33
Connecticut 5.85 '32	1.33

Source: T. Rowe Price.

"We believe an LDI benchmark constructed using the process described above should allow plan sponsors to significantly reduce liability tracking error compared with market cap-weighted benchmarks"

FIGURE 3: Key Characteristics of Hypothetical Plan Cash Flows, Barclays Benchmarks, and a Hypothetical Custom Liability Hedging Benchmark[1]

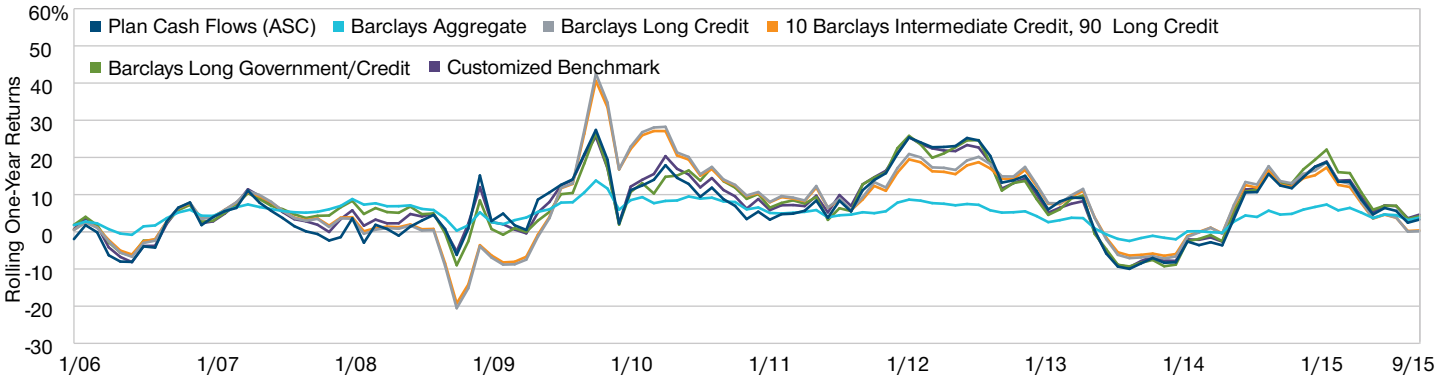
	February 2005 through September 2015			
	Yield as of 30 Sept 2015	Annualized Return	Liability-Relative Tracking Error	Average Monthly Return Difference
Sample Plan Liability (ASC)	4.38%	5.58%	N/A	N/A
Barclays Aggregate	2.26	4.52	7.13%	1.58
Barclays Long Credit	4.88	5.99	4.85	0.98
Barclays Long Gov/Credit	4.04	6.40	3.45	0.73
10% Barclays Intermediate Credit, 90% Barclays Long Credit	4.65	5.90	4.78	0.98
T. Rowe Price Custom Benchmark – Example 1	4.10	6.34	2.30	0.37

Source: Barclays; data analysis by T. Rowe Price.
Past performance is no guarantee of future results. Custom benchmark and Sample Plan returns do not reflect the deduction of management fees.

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

FIGURE 4: Rolling One-Year Gross Returns on Hypothetical Plan Cash Flows and LDI Benchmarks, Including a Hypothetical Custom Liability Hedging Benchmark

Jan 31, 2006 rough September 30, 2015



Sources: Barclays, T. Rowe Price.
Past performance is no guarantee of future results. Custom benchmark and Sample Plan returns do not reect the deduction of management fees.

FIGURE 5: A Typical Composite LDI Benchmark

Component Benchmarks	Weight
Barclays Credit 3–5 Year Index	5%
Barclays Credit 5–7 Year Index	10
Barclays Credit 7–15 Year Index	15
Barclays Credit 15–25 Year Index	50
Barclays 20+ Year STRIPS Index	20

Source: T. Rowe Price.

"A typical LDI composite benchmark may include as many as five different indexes, so focusing on a single benchmark should leave less room for confusion."

outperformance of a less representative market index.

AVOIDING FORCED SELLING

At the same time, however, custom LDI benchmarks have the potential to improve absolute performance by making it possible for managers to avoid forced selling, enabling them to take a more tactically agile approach.

Many conventional market benchmarks, including both the Barclays Aggregate Index and the Barclays long series of indexes, have maturity minimums—one year in the case of the Barclays Aggregate Index; 10 years for the long series. As pension cash flows roll down inside these minimums, index-relative managers must choose whether to sell the bonds hedging those liabilities or continue to hold them. The first option increases liability-relative tracking error and transaction costs; the second contributes to benchmark tracking error—and is likely to lead the portfolio to under-yield the index, especially if long-duration benchmarks are used.

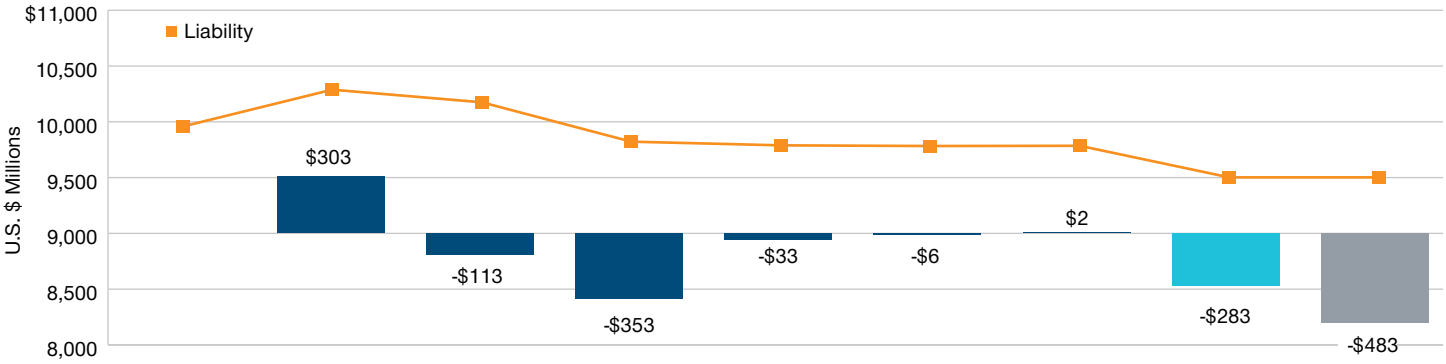
By contrast, because the asset weights in a custom benchmark roll down with liability cash flows, managers can hold bonds for as long as their investment thesis remains attractive. They may also have greater flexibility to access the potential excess returns available on less-liquid securities.

In other words, a custom benchmark should encourage a "cheapest to deliver" mind-set, with managers focused on finding the least expensive bonds that match liability cash flows, assuming their default risk criteria are met.

BENEFITS OF BENCHMARK FLEXIBILITY

In addition to potentially improving manager performance—in terms of both liability tracking error and absolute returns—a custom benchmark approach makes it possible for sponsors to reset benchmarks with greater precision if their investment objectives, plan liability characteristics, or the composition of the investment opportunity set change significantly.

FIGURE 6: Sample Liability Reconciliation Report



	31 Dec 2014 Beginning Liability	Interest Cost	Treasury Curve Movement	Credit Spread Movement	Impact of New Issues	Impact of Upgrades	Impact of Downgrades	Service Cost and Benefit Payments	30 Sept 2015 Ending Liability
Dollar Change	—	$303	-$113	-$353	-$33	-$6	$2	-$283	-$483
Liability	$9,985	$10,288	$10,175	$9,822	$9,789	$9,783	$9,785	$9,502	$9,502
Return	—	3.04%	-1.13%	-3.54%	-0.33%	-0.06%	0.02%	-2.83%	-2.00%

Source: T. Rowe Price.

THE TIME IS RIGHT FOR CUSTOMIZATION

No investment solution is perfect, and custom LDI benchmarks do present potential challenges, especially for plans that are new to LDI strategies or are concerned they may lack the resources or expertise to administer a customized approach. Many sponsors also may have doubts about the transparency of benchmarks created and/or calculated by asset managers themselves.

The idea of a manager calculating returns on an unpublished benchmark may, at first glance, appear to present an obvious conflict of interest. However, most leading investment consulting firms are now familiar with the customization concept, and have the technical skills and investment tools to monitor and validate reported performance in a transparent way. We believe our own methodology is consistent with the CFA Institute's standards for investment performance benchmarks.[1]

That said, the use of customized benchmarks requires a high level of coordination and cooperation among plan sponsors, actuaries, investment consultants, and asset managers. An accurate projection of expected liability cash flows, for example, is a critical input to the optimization process. Repeated scenario tests also may be necessary to perfect the structure. Sponsors will want to consult closely with their consultants and actuaries before adopting new LDI processes or altering existing ones.

CONCLUSIONS

The dramatic improvement in funded status that many corporate defined benefit plans experienced in 2013 has revived interest in portfolio de-risking. However, as plan sponsors focus more closely on their fixed income allocations, they may also want to consider whether the tools for managing those allocations could be improved.

Our view is that the objectives many sponsors have in mind for their plans—whether the desired end game is steady-state target volatility, lump-sum payouts, or pension annuitization—will require much more precise liability tracking than existing market cap-weighted benchmarks can provide. Compound or duration-targeted indexes are an improvement but can still result in an uncomfortable amount of tracking error relative to the sponsor's goals.

To meet this challenge, T. Rowe Price has developed an innovative method for LDI benchmark customization, one we believe will make it possible to align a sponsor's investment objectives and fixed income mandates with a previously unattainable level of precision. This, in turn, should facilitate a clearer, more productive dialogue among sponsors, consultants, and managers about plan and manager performance, leading to more effective LDI strategies and improved results over time.

Additional examples of how this benchmark framework can be used for sponsors with varying objectives will be highlighted in future T. Rowe Price studies.

[1] For a benchmark to be credible and useful to investors, it must fairly and accurately represent key attributes of the market segment or financial instrument in question. In particular, benchmarks should be investable, measureable, (with some frequency for performance attribution), appropriate, reflective of current investment opinions, specified in advance (publically known at the start of an evaluation period where possible), and owned (i.e., there is appropriate accountability)." CFA Institute, Benchmarks and Indices Issue Brief, April 2013.

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,
- demonstrate their performance relative to plan liabilities more precisely.

T. Rowe Price's system is not vendor specific and can be used on any fixed income analytics platform, such as Barclays POINT or Citigroup's Yield Book.

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

The first step in T. Rowe Price's customization process is to identify the opportunity set that best matches the sponsor's risk tolerance and investment 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 sponsors de-risking priorities:

- The PPA rate segments used to calculate funded status are also used for lump-sum payouts. Sponsors concerned about the volatility of required contributions, and those considering a cash-out window, would be likely to prefer a high-quality corporate AAA to A universe.
- Sponsors seeking to minimize balance-sheet volatility also are likely to focus their opportunity set on higher-quality credits rated AA.
- Since plan termination values are calculated the same way an insurance company would value a risk transfer, sponsors primarily concerned with limiting the volatility of final cost would likely use a Treasury Plus (AAA rated) universe plus a defined spread.
- Sponsors interested in improving funded status—and thus willing to accept greater liability-relative tracking error—might include BBB rated, crossover, or high yield debt in their opportunity sets, while still constructing benchmarks and portfolios that reflect the duration, convexity, and cash flow profile of their plan liabilities.

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.

These curves are critical because they allow us to value a plan's expected cash flows in a replicable, transparent, and representative way—creating a powerful tool for performance measurement.

A sponsor primarily concerned about accounting impact, for example, could use the yield curve to calculate the monthly returns on the plan's liabilities. Portfolio performance could then be evaluated relative to those returns.

Figure 7, below, provides two examples of yield curves that could have been generated from the Barclays AA credit universe, one on 31 Dec 2013 and the other on 30 June 2014.

STEP THREE: ESTIMATE THE PRESENT VALUE OF LIABILITIES

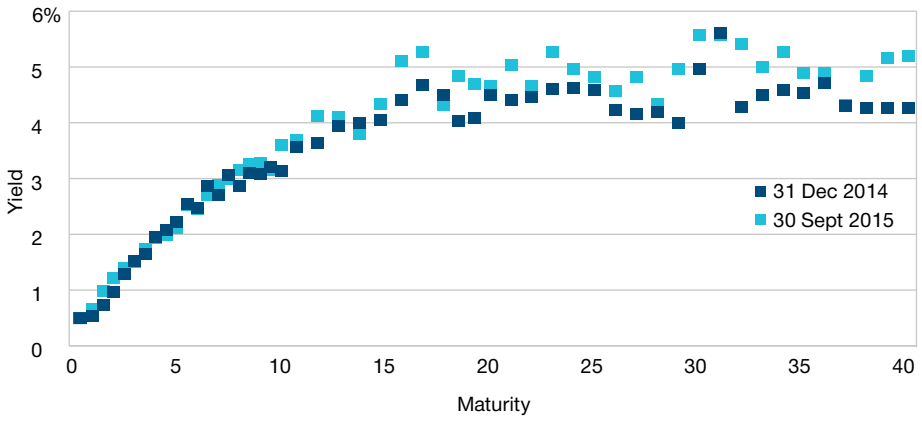
Discounting plan cash flows using the model curve provides the yields needed to determine the plan's interest rate sensitivity at each point on the curve. The curve is stressed by incrementally increasing and decreasing the yields at each point in order to determine key rate durations (KRD).

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.

Because even the broadest fixed income opportunity set will have a shortage of needed maturities in certain years, the benchmark will not be able to perfectly

FIGURE 7: Yield Curves Constructed From the Barclays U.S. AA Credit Universe



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

match liability cash flows at every point. The emphasis is on accurately matching the liabilities that contribute most to overall duration, which for most plans will typically be in years five through 35. 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.

EXISTING LIABILITY CURVES ARE NOT ADEQUATE FOR A CUSTOMIZED LDI BENCHMARK

Some sponsors may wonder why an entirely new liability curve must be created for a customized LDI benchmark. Why not use an existing liability curve—such as an accounting curve developed by a plan actuary for minimizing balance sheet liability and pension expense, or the PPA curve published each month by the IRS?

The answer is that existing yield curves lack the level of detail and marked-to-market precision required for a fully customized LDI benchmark. The PPA yield curve, for example, is averaged over the trailing month, meaning that yields on the first day of the month impact the curve as much as yields on the last day. This makes plan liabilities impossible to match over short time periods.

The discount rates used in U.S. accounting standards codification (ASC) are often based on a small selection of bonds (typically 15 to 20) that have higher-than-market yields for their ratings category—usually because they are on the edge of a downgrade. This group is also not pre-specified, and in any case does not reflect a diversifiable investment opportunity set. This also makes liability values calculated using certain ASC curves poor benchmarks for LDI managers.

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