



Cash Balance Plans: Insights, Framework and Solutions

Introduction

Liability driven investing (LDI) has been established as an effective strategy to increase predictability and reduce volatility for defined benefit plan sponsors. Throughout this paper we compare and contrast a “traditional plan” to a “cash balance plan.” The employee benefit under a traditional plan is typically based on a mathematical formula that accounts for the number of years of service and the employee’s salary (or a fixed dollar per year of service) at retirement. The employer is then responsible for delivering the defined benefit pension payments, usually in terms of monthly income, upon retirement.

In a cash balance plan, the benefits provided at retirement are linked to the contributions made by the plan sponsor (and sometimes the participant), accumulated up to retirement using a plan-defined interest crediting rate. The benefit is expressed as an account balance, much like a defined contribution plan. A common approach to determining the interest crediting rate for a cash balance plan is to peg it to either a 30-year or 10-year Treasury yield.¹ At retirement, the accumulated account balance is paid out as a lump sum (an account-based benefit) or can be converted into an annuity form of payment (an annuity-based benefit similar to traditional plans).

As the costs and risks of providing traditional final average pay pension plans have increased over time, and as employee preferences for portability and an easy to understand benefit have evolved, plan sponsors have looked to alternative forms of benefit design. Cash balance plans have become increasingly popular and have grown significantly within the retirement plan universe.

In fact, Employee Benefits Security Administration (EBSA) research indicates that the popularity of cash balance plans has soared since 2000. Since that time, cash balance plans have increased from less than 3% as a percentage of all defined benefit plans to over 40%.²

Under a traditional defined benefit plan, expected future benefit payments are fixed. As a result, the total liability value fluctuates due to changes in the discount rate, making interest rates and credit spreads the primary market risks to hedge. In addition to the traditional discount rate risk, cash balance plans introduce crediting rate risk as future benefit payments can fluctuate with changes in the interest crediting rate. This extra dynamic introduces another important factor to consider in developing the hedging solution (beyond interest rate and credit spread risks).

In this paper, we present the hedging implications of cash balance plans due to the presence of an interest crediting rate linked to a market Treasury yield. In our experience, many defined benefit pension plans use this approach, leading to significant implications for the appropriate LDI strategy.

Understanding cash balance plans

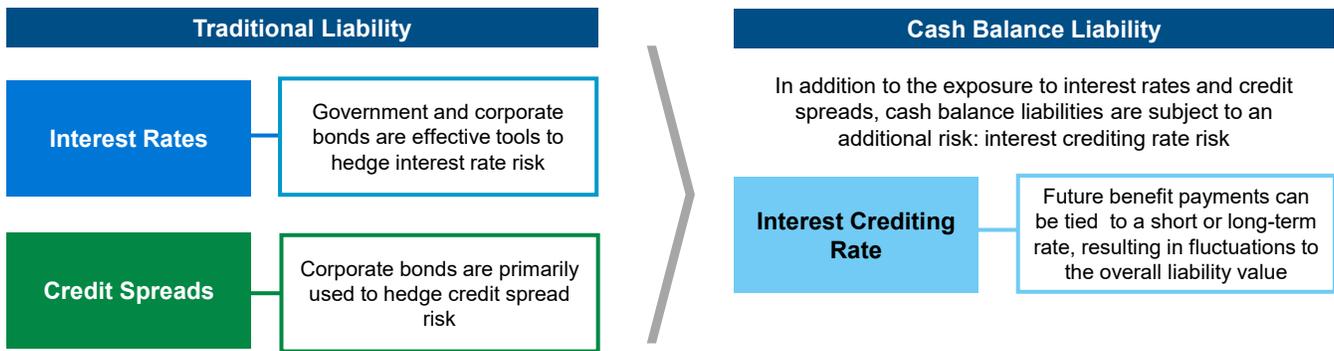
Duration implications

Within a cash balance plan, the participant’s notional cash balance account grows each year based on an interest crediting rate defined in the plan document. To fully understand the risks associated with cash balance plans, we need to take a closer look at how the interest crediting rate can affect the most effective solution.

To illustrate the crediting rate risk of cash balance plans, let us consider a simple numerical example with the following characteristics:

- Interest crediting rate is tied to the 30-year Treasury yield
- Assume the Treasury curve is flat
- All Treasury yields are 3%

Figure 1: Market risk to hedge



Source: LGIM America. For illustrative purposes only.

Consider a cash balance plan with a single participant that has a \$100 cash balance account and is expected to retire in 1 year. Because the plan specifies that the account balance increases at the end of each year based upon the 30-year Treasury rate (determined at the beginning of the plan year), we would expect the notional account balance in one year's time to be equal to \$103 ($\$100 \times (1 + 3\%) = \103). In order to calculate the present value of this liability, we will use an illustrative discount rate of 3% given the yield curve is flat in our scenario.³

$$\text{Liability present value} = \text{Expected Cashflow} / (1 + \text{Discount Rate})$$

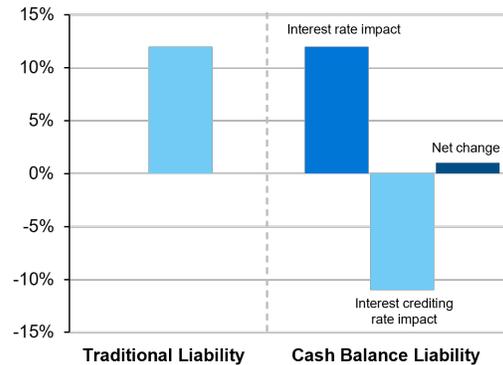
$$\text{Liability present value} = \$100 \times (1 + 3\%) / (1 + 3\%) = \$100$$

If the entire Treasury yield curve increases or decreases by the same amount, the expected account balance increases or decreases due to the crediting rate, but at the same time the discount rate change impacts the present value of the account balance by the same amount. This leads us to conclude that the cash balance plan has very little or even no interest rate sensitivity (i.e. duration) in total as the impact on the expected cash balance account from the changes in interest rates is offset by the change in the discount rate. Unlike traditional plans, the dollar balance for the notional cash balance account is sensitive to Treasury yields, and therefore to interest rates, resulting in this non-traditional dynamic as highlighted in the example.

Many plan sponsors have adopted custom LDI strategies to tailor the fixed income portfolio's characteristics to mirror that of the liability with the objective of tracking the liability over time. A typical traditional plan can have significant sensitivity to changes in interest rates, equating to liability durations usually above 10 years.⁴ However, a cash balance liability may have very little interest rate duration as changes in interest rates affect both the interest crediting rate and discount rate, broadly offsetting each other. Therefore, a strategy designed to hedge a traditional liability may be inappropriate for hedging a cash balance liability as the interest rate duration of the liability may be very different.

Figure 2 illustrates a simple comparison of the percentage change in liability value (traditional vs. cash balance) due to a 100 basis point decrease in interest rates.

Figure 2: Interest rate sensitivity – 100 bps decrease



Source: LGIM America. For illustrative purposes only.

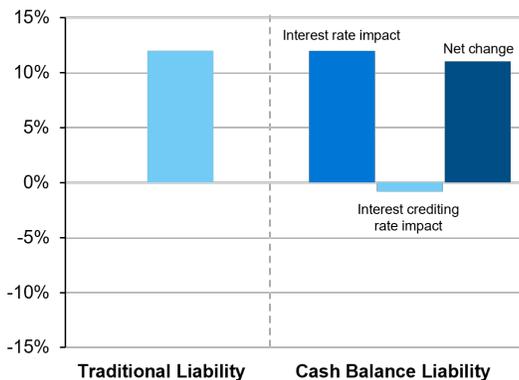
As demonstrated in Figure 2, changes in interest rates have a straightforward effect on a traditional liability. Our example shows that given a 100 basis point decrease in interest rates, the traditional liability value will increase by approximately 12%. However, cash balance plans have the added intricacy of the interest crediting rate. As we described earlier, this additional nuance has an offsetting effect (illustrated by the negative light blue bar in Figure 2), leading to little or even no duration in total. In practice, when interest rates fall, a participant's projected cash balance account at retirement will decrease from the previous projection as the crediting rate is now lower. However, this is effectively offset by the corresponding drop in the discount rate, leading to an unchanged present value. It is imperative for plan sponsors to understand the sensitivities of their plan's liability in order to implement an effective strategy.

Up to this point, we have not focused on the credit spread duration of cash balance plans. This adds yet another dynamic that plan sponsors of cash balance plans need to understand. Like traditional plans, cash balance plan's value their liabilities on corporate discount curves which

includes a credit and Treasury component. We've already established that the presence of the interest crediting rate (when linked to a Treasury yield) effectively offsets the interest rate sensitivity of the discount rate. However, the credit spread component still exists, resulting in cash balance plans having credit spread duration similar to that of traditional plans.

Figure 3 highlights this dynamic, representing the percentage change in liability value for a 100 basis point tightening in credit spreads for a traditional liability vs. a cash balance liability.

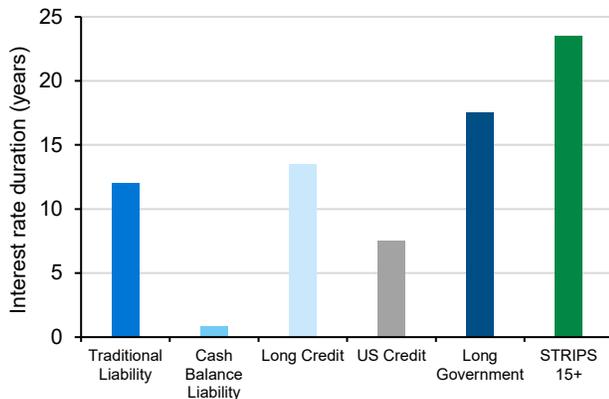
Figure 3: Credit spread rate sensitivity – 100 bps decrease



Source: LGIM America. For illustrative purposes only.

From a solutions perspective, using market-based benchmarks to hedge a traditional liability can be appropriate. However, given duration implications of cash balance plans, it can be difficult and inappropriate to effectively hedge a cash balance liability's duration risk with standard market-based benchmarks (see Figure 4). As a result, an element of customization may be recommended which is further explored in the following sections.

Figure 4: Interest rate duration⁵



Source: LGIM America. For illustrative purposes only.

As illustrated in Figure 4, a plan sponsor can create an effective hedging program by combining the available market-based benchmarks to target the duration of a traditional liability. However, a solution solely utilizing market-based benchmarks is likely to be an inadequate hedging strategy for many cash balance plan liabilities due to the nature of the interest crediting rate. In fact, they may actually increase risk rather than reduce it because the interest rate durations are likely to be too high. In our opinion, it is generally recommended that cash balance pension plans adopt a custom strategy (including both a Long Credit component and a Treasury overlay) to capture the unique risks a cash balance liability presents.

Curve Implications

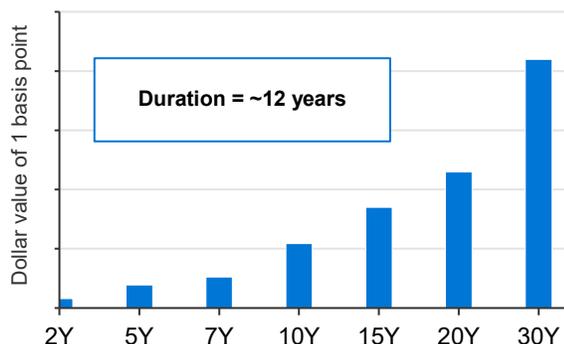
Although we conclude that many cash balance plans may have little to no interest rate sensitivity in aggregate, in practice it is often not so simple. Pension plan liabilities are valued using an entire yield curve and rarely does the curve move in a parallel manner. It is important to understand the interest rate sensitivities across the curve, not just in aggregate, as cash balance plans can have different curve exposures. To provide a more holistic picture of the interest rate risk inherent in cash balance plans, Figure 5 illustrates this dynamic.⁶

For review, we define key rate duration as the plan's interest rate sensitivity isolated at a specific point along the curve. For our example purposes, we have used 7 key rate duration buckets across the curve. To highlight the differences between the two plans above, if 30-year Treasury yields increase in the Traditional example (and there is no change in the other buckets along the curve), the liability present value will fall. In contrast, if we have the same movement in the 30-year Treasury yield in the Cash Balance example, the liability present value will increase due to the negative duration impact at the 30-year point. Understanding the underlying curve exposures of cash balance plans can be a prudent exercise to determine the appropriate investment strategy.

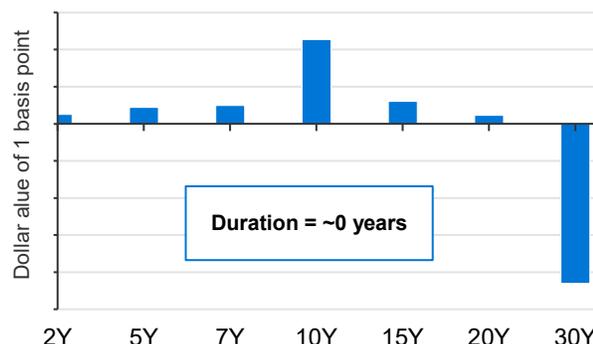
This dynamic reinforces the notion that a custom solution is best practice to appropriately hedge the unique risks that many cash balance plans present. Specifically, customizing the plan's Treasury allocation to include Treasury derivatives will allow the plan to add short positions at the 30-year key rate duration point to match the liability exposure. The derivatives position adds flexibility within the hedging solution to target the plan sponsor's strategic interest rate hedge ratio. Adopting a custom approach can reduce funded status volatility by aligning the fixed income portfolio more closely to the liability.

Figure 5: Interest rate risk inherent in cash balance plans

Key rate duration profile – Traditional



Key rate duration profile – Cash Balance*



Source: LGIM America. For illustrative purposes only. These illustrative key rate duration profiles are meant to highlight the difference of a cash balance plan vs a traditional plan. The above does not represent any particular plan with LGIM America. *Crediting rate based on 30-year Treasury yield.

Presence of floors

To provide participants with a more stable and valuable benefit amount at retirement, many cash balance plans combine an interest crediting rate linked to Treasury bond yields with a minimum level (floor) on the rate of balance increases in any year. As we previously reviewed, a participant's cash balance effectively grows each year based on the interest crediting rate. The benefit to participants arises in the environment of low interest rates as their cash balance can grow at the minimum floor level as opposed to the lower, market rate. From a market's perspective, the plan has essentially provided an option to its participants, resulting in economic consequences to the plan from a liability perspective.

Let us consider the example of a cash balance plan that employs an interest crediting rate that is the greater of 4% (the floor) or the 30-year Treasury yield. The challenge presented by floors in regards to implementing an effective hedging program stems from the fact that a solution appropriate for when rates are above the floor is not equally appropriate for when rates are below the floor. The presence of a floor within the plan requires a more dynamic approach for the plan sponsor. It is a prudent strategy to adopt a rigorous monitoring system because the interest rate sensitivity of the plan will change substantially as rates fluctuate around the floor.

Scenario: 30-year Treasury yield below the floor

When the 30-year Treasury rate is below the stated floor level, the participant's cash balance will grow at the percentage specified as the floor. This essentially fixes the projected account balance (since it is not sensitive to interest rate changes), resulting in a liability exposure similar to a traditional plan. In our opinion, LGIM America would recommend building a traditional LDI solution, primarily focusing on hedging the liability's interest rate and credit spread risk.

See traditional liability profile in Figure 5.

Scenario: 30-year Treasury yield above the floor

When the 30-year Treasury rate is above the floor, the participant's cash balance account will grow based on the fluctuating market yield. The projected account balance is no longer fixed and has become variable, leading to a liability duration that will be lower, possibly close to zero. In addition to the reduced interest rate sensitivity, the liability can be exposed to unusual curve exposures as outlined in the previous section. This will require the plan sponsor to adopt a more customized investment strategy than the one implemented to hedge a traditional liability.

See cash balance liability profile in Figure 5.

It is important to adopt open lines of communication between the plan sponsor, asset manager, investment consultant and the plan's actuary in order to appropriately understand the risks. Implementing a formal monitoring process and agreeing to an action plan in advance as rates near and ultimately breach the floor can be effective tools in managing the varied risks inherent in a cash balance plan with a floor.

The use of swaptions has often been discussed as a possible solution for managing cash balance plans with floors. Depending on the direction of rates, purchasing receiver swaptions (to add duration) or payer swaptions (to remove duration) struck at the level of the floor can manage the duration of the asset portfolio to mirror that of the liability. The challenge with swaption strategies can be the cost, particularly when the strike of the floor is close to the current implied crediting rates. In a volatile environment where Treasury rates are fluctuating around the floor, buying and selling swaptions to mirror the liability duration may cause more harm than good as the plan effectively "buys high and sells low" (adds duration when it is more expensive and sells duration when it is cheaper). A more pragmatic solution may involve a rigorous monitoring system and a phased approach. Instead of adding or removing all the duration at one point in time, an

incremental approach may prove to be more realistic and economical.

Hedging the economic liability

We recognize that there are different approaches to determine the projected cash balance value at retirement.

We've found the two most common are:

- Use a long-term assumption and set a fixed interest crediting rate (may or may not change from year to year)
- An economic, mark-to-market approach which calculates future expected interest crediting rates using implied forward rates from the Treasury yield curve (changes each year with changes in market interest rates)

In most cases, we believe that the LDI solution should hedge and reflect the true underlying economics of the cash balance liabilities. The first method listed above assumes a fixed crediting rate which results in a measured risk profile similar to a traditional liability. This approach may align the performance of the solution with the actuarial liability in the short-term, but over the longer-term, it may lead to added funded status volatility and tracking error as the underlying economics of the liability are realized.

In our opinion, LGIM America recommends designing an LDI solution to recognize the underlying economics of the plan, capturing the specific interest rate sensitivity that the cash balance liability presents. If a plan sponsor adopts a custom LDI strategy to address the underlying economic risks, it also makes sense to align the plan's funded status

measurements with the market-based hedging strategy (this requires effective coordination with the plan's actuary). A mismatch between the plan's long-term assumption of the crediting rate and the market-implied crediting rate can lead to differences in the liability measurements and how the hedging strategy performs.

A static long-term assumption can potentially lead to overstating the liability in certain environments, and understating it in others. It can actually exaggerate measured funded status volatility even when interest rate risk is fully hedged on an economic basis. Aligning the liability measurement with the intent of the hedging program can lead to better funded status outcomes as the actual economics of the liability are realized.

Conclusion

Because cash balance plans with yield-based crediting rates operate differently than traditional plans, it is vitally important for investment strategy, contribution strategy, and actuarial assumption setting to operate in a coordinated fashion to meet plan sponsor goals. The challenges a cash balance plan present can be complicated but are certainly solvable.

The more common fixed income market-based benchmarks employed by pension plans are almost always inappropriate for the cash balance plans described in this paper, and can potentially increase risk rather than reduce it. Exploring a custom liability benchmarking solution can be a prudent exercise for cash balance plans to appropriately manage the unique interest rate sensitivities.

1. Additional interest crediting rate methodologies employed by plan sponsors can include rates based on changes in CPI, fixed rates, based on segment rates, among others. In this paper, we present the hedging implications of cash balance plans due to the presence of an interest crediting rate linked to a market Treasury yield. Our previous cash balance paper titled "Risk Management Solutions for Cash Balance Plans" goes into further depth on the various crediting rate options.
2. The Private Pension Plan Bulletin report from EBSA was produced in September 2019 and extracts data from 2017 Form 5500 Annual Reports.
3. In practice, discount rates are based on high-quality corporate bond curves, inclusive of both a Treasury and spread component. For simplicity, our example assumes a discount rate of 3%.
4. A plan's liability duration depends on a range of factors and plan characteristics, but typically we see traditional liability durations in the range of ~10-14 years.
5. Figure 4 displays the duration for a set amount of market-based benchmarks that are typical in a pension plan's fixed income allocation. For illustration purposes, we've assumed a traditional liability has a duration of 12 years and a cash balance liability has effectively no duration.
6. Example represents a scenario where the interest crediting rate is linked to the 30-year Treasury yield. Other crediting rates would have a different affect. We've focused on a 100% traditional and a 100% cash balance scenario in order to demonstrate the distinctive risk profiles. However, many plans have transitioned from a traditional form of payment to a cash balance benefit, leaving elements of both within the liability sensitivities.

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