Embedded options in Cash Balance plan

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Executive summary

Three embedded guarantees in cash balance plans:

1. "money-back guarantee": return of participant pay credits at benefit commencement
2. "enhanced money-back guarantee": return of participant pay credits at benefit commencement with a fixed return which might be offered to participant to protect against inflation.
3. "cash-balance guarantee": provides a minimnum interest rate credit to be earned each year. For example, an interest credit rating that provides a yield on 30 year treasury bond but not less than some maximum, say 4.0% per annum.

(1) and (2) are valued using closed form adaptation of Black-Scholes formula, and (3) is valued using Monte-Carlo simulation of risk-neutral rate (Hull White)

Introduction

2011 SOA paper accomplished three objectives:

1. Defined embedded options using two categories:
   - Behavior driven (e.g. retirement, termination)
   - Based on underlyingh financial phenomena
2. Drew parallels between embedded pension plan options and those in life insurance and financial markets
3. Provided results of a survey on prevalence of embedded options in DB plans.

Note that embedded option and guarantees refer to the same thing.

Background

- Survey results from 2011 paper showed that embedded options are usually ignored because they are assumed to have zero or very little value
- Volatile capital markets have either increased value of some gauarantees or highlighted that these guarantees probably should not be ignored
- Economic landscape, regulatory environment and de-risking of plans is forcing pension plans to better understand the risk profile of their plan.
- Trends in actuarail standards are increasingly leaning toward reporting fair values or market-consistent present values for liabilities.
- Two cash balance plans (one with embedded option, one without) will not have the same value.
    - Money-back and enhanced money-back guarantees protect against decline in account balance below sum of pay credits, equivalent to a put option on account value with strike equal to sum of pay credit owned by plan participant. Annual interest credit rate gauarantee can be viewed as an interest rate floor with a strike equal to the minimum interest crediting rate owned by plan participant.
- Paper focus is not on valuing overall cash balance plan liability but just the guarantee portion.

Cash balance plans

- Cash balance plan is a DB plan that provides participant with a periodic pay credit (commonly linked to salary or wages and usually tied to age or experience) and prescribes an interest credit rate that defines how accumulation of pay credits will evolve over time. The benefit under the cash balance plan is expressed as a lump sum, known as the "current account balance".
- The cash balance plan benefit is a contingent liability of the plan sponsor. The contribution of pay credits is not required of the plan sponsor - the plan sponsor has the option of freezing the granting of future pay credits.
- A cash balance plan has the look and feel of a defined contribution plan (DC) or even a simple bank account, but individuals accounts are not actually established.
- The retirement benefit is a "hypothetical account" in which all pension assets for participants of plan are pooled together and managed collectively - the participant does not have control over how the plan's assets are invested. Cash balance plans are sometimes referred to as "hybrid" plans.

Interest crediting rates

- Old regulations (prior to 2010) allowed interest crediting rates based on bond yields of varying maturities or the CPI - margins were also sometimes allowed.

- 2010 regulations introduced new interest credit rates (either of these):
  - Rates based on actual investment return - assets must be diversified to minimize volatility, and mix of bonds and equities would be accetable. Annuitiy contract rates could also be credited as are mutual funds with low volatility.
  - Rates based on bond yields up to fixed rate of return of 5.0%.

Guarantees

Two categories:

1. Guarantee a minimum cumulative rate of return when crediting rate is based on actual portfolio return or equity index only.
2. Guarantee minimum annual rate of return when crediting rate is bond based.

Money-back guarantee:

- Participants must receieve at least sum of their pay credits. Long put owned by plan participants and underwritten by plan sponsor, with guarantee level at benefit commencement being strike price and account balance being the underlying asset.

Enhanced money-back guarantee:

- Interest crediting rates can apply a cumulative floor of up to 3.0% per year through distribution. If this guarantee is written into the plan, plan participants must receive at least their sum of pay credits with up to 3% interest applied each year until benefit commencement. Long put owned by plan participants and underwritten by plan sponsor with guarantee level at benefit commencement being strike price (at x% cumulative return) and account balance being the underlying asset.

Minimum annual interest rate guarantee:

- Bond yield rates can apply minimum interest crediting rate of up to 4.0%. Each year, a participant's account balance would be increased by the greater of the actual yield on the bond or the minimum floor rate. A series of long puts owned by plan participant and underwritten by plan sponsor - downside protection should interest rate fall below strike price and protection is offered every year - however, here payoff is based upon the balance (a stochastic variable).

Historical analysis of cash balance plan guarantees

- Size of money-back guarantee has evaluated using historical data.
- One reason this option has not been seriously explored in past is belief that diversified portfolio will earn positive nominal returns over the long run and therefore the guarantee will be of no value.
- The volatility of annualized returns declines over time, but volatility of total compound returns rises over time.