CENTER *for* RETIREMENT RESEARCH *at* BOSTON COLLEGE

To: Connecticut Retirement Security Board

From: Center for Retirement Research at Boston College (CRR)

Date: 6/15/2015

Re: Guarantees

Connecticut will have to decide the extent to which participant contributions and returns should be guaranteed. This analysis considers both guarantees purchased from financial institutions and guarantees provided by the State of Connecticut. It considers three levels of guarantees: 1) a return of contributions at retirement; 2) a return of contributions plus a 1-percent nominal rate of return at retirement; and 3) a 1-percent nominal rate of return *each year*.

Guarantees purchased from financial institutions

The cost of a guarantee depends on its generosity, the extent to which participants are permitted to invest in risky assets, and the guarantee period. For a guarantee that applies at retirement for participants investing in a target date fund, financial institutions quoted an annual premium of 0.95 percent of plan balances for a return-of-contributions guarantee and 1.50 percent for a 1-percent-nominal-rate-of-return guarantee. At current interest rates, financial institutions can only offer a 1-percent-nominal-rate-of-return guarantee *each year* by requiring participants to give up all, or almost all returns in excess of 1 percent.[1] Table 1 reports the impact of guarantees on minimum and average replacement rates under the above assumptions.

Table 1: *Impact of Guarantees on Minimum and Average Replacement Rates*

Guarantee type	Minimum replacement rate	Average replacement rate
None	0%	27.4%
Return of contributions at retirement	5.9%	21.7%
1-percent nominal rate of return at retirement	6.7%	18.7%
1-percent nominal rate of return each year	11.0%	11.0%

Source: Authors' calculation, and financial institution data.

[1] The current one year interest is about 1 percent. Offering a guaranteed return of 1-percent plus some upside potential violates the no arbitrage condition – that financial markets do not permit investors to earn above market returns without taking on more risk.

All three guarantees put a low floor on replacement rates but substantially reduce average replacement rates – from 27.4 percent to 21.7 percent for the return-of-contributions guarantee at retirement, from 27.4 percent to 18.7 percent for the 1-percent-nominal-rate-of-return guarantee at retirement, and from 27.4 percent to 11.0 percent for the guarantee of a 1-percent nominal rate of return each year.

It would be historically unprecedented for either guarantee of assets at retirement to be called. Based on historical data, the chance of a return-of-contributions guarantee being called is less than 0.05 percent (five in ten thousand). The chance of a 1-percent-nominal-rate-of-return guarantee being called is 1.1-percent. On the other hand, over a one-year time horizon, a 50:50 stock-bond portfolio has an approximately 36 percent probability of providing a negative return.

Connecticut provides a guarantee

If the State of Connecticut provided the guarantee, it would have to decide how to manage the risk. One option is to hedge the liability and pass the cost on to the participant. Connecticut could hedge the guarantees that apply at retirement by purchasing hedging instruments from insurers paying the 0.95 or 1.50 percent of assets under management referred to above. The only effective means of hedging the annual return guarantee is by investing almost exclusively in short-term Treasuries.

A second option would be to make a commercial judgment that the risk was acceptable. Table 2 reports the probability of the guarantees which apply at retirement being called, and the expected payout in millions of dollars, conditional on it being called, for cohorts turning age 62 in 2025, 2035, 2045, and 2052.

Table 2: *Probability of Guarantee Being Called and Expected Payout*

Year cohort turns 62		2025	2035	2045	2052
Return of contributions at retirement	Probability of being called	2.4%	0.5%	0.1%	*
	Expected payment (millions)	$24.7	$46.4	$56.4	*
1-percent nominal rate of return at retirement	Probability of being called	4.7%	1.3%	0.4%	0.2%
	Expected payment (millions)	$28.9	$57.3	$81.0	$99.5
1-percent nominal rate of return each year	Investments limited to Treasuries, no cost to State				

Source: Authors' calculations.

If the State of Connecticut provided an annual guarantee, and permitted participants to invest in risky assets, the expected payout on an annual guarantee would be a prohibitively large. If participants invested in a 50:50 bond portfolio, the expected annual claim would be 2.7 percent of assets under management.

A third option would be for the State of Connecticut to create a reserve to meet potential claims under the guarantees which apply at retirement. The question then arises, how big a reserve should it create? It is neither feasible nor reasonable to create a reserve sufficient to meet the largest possible claim. An alternative might be to use the tools of finance theory to value the guarantee, and to create a reserve of that amount. Finance theory yields valuations of 0.10 and 0.20 percent of plan balances for the two guarantees of assets at retirement, substantially less that the 0.95 and 1.50 percent quoted by financial institutions, reflecting the assumption of finance theory that hedging instruments are available. Since the expected payout under an annual guarantee would be very large, the State of Connecticut would need to limit participants to investing in short-term Treasuries (rather than build a reserve) to provide a 1-percent-annual-rate-of-return guarantee.

Methodology

The calculations assume that nominal stock and bond returns are lognormally distributed. We use Ibbotson (2013) data for large company stocks and long-term corporate bonds for 1926-2012. We assume that the risk-free rate has declined by 1 percent relative to historic norms, but that there has been no change in the equity and corporate bond risk premiums. We therefore reduce historic nominal returns by 1 percent. We further reduce returns by the 0.437 percent by which the average inflation rate during 1926-2012 exceeded our 2.5 percent inflation projection. This calculation yields the following distribution:

$$m = \begin{pmatrix} 0.0846 \\ 0.0498 \end{pmatrix}, S = \begin{pmatrix} 0.0390 & 0.0024 \\ 0.0024 & 0.0058 \end{pmatrix}$$

The estimates of the impact on replacement rates of guarantees priced using the tools of finance theory assume the above distribution of returns and that insurers' aversion to risk matches the market average. The estimates of the impact on replacement rates of guarantees purchased from financial institutions assume that the annual cost of return-of-contributions guarantee is 0.95-percent of the plan balance, and that the annual cost of the 1-percent-nominal-rate-of-return guarantee is 1.5 percent of the plan balance, the average of the two quotes. Participants invest in a target date fund in which the-percentage invested in equities is 100 minus the participant's age. Participants join the plan at age 25 and retire at age 62. Workers' earnings profiles are based on the same data presented in Figure 1 of the memo "Initial Contribution Rates and Auto-Escalation" provided to the Connecticut Retirement Security Board. The denominator in the replacement rate is average real lifetime earnings.

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