Should the Plan Include a Guarantee?

Connecticut will have to decide the extent to which participant contributions and returns should be guaranteed. The cost of a guarantee depends on its generosity, the extent to which participants are permitted to invest in risky assets, and career length. This analysis considers four levels of guarantees: 1) investment in a principal protection fund until balances reach $15,000, a conservative target date fund thereafter, and a guarantee of a return of premiums paid; 2) a return of premiums paid; 3) a return of premiums paid plus 2.5 percent interest; and 4) a return of premiums paid, plus inflation, assumed to be 2.5 percent, plus 2.5 percent interest.

The assumption is that the guarantee applies to the average return over the participant's entire career; it would be prohibitively expensive to guarantee an annual return. The asset allocation for Option 1 is that participants initially invest in short-term deposits, switching to a conservative target date fund once they have accumulated $15,000. The asset allocation for Options 2-4 is a typical target date fund throughout.

Monte-Carlo simulations based on historical data are used to calculate the probability that the guarantee will be called, the expected payment in millions conditional on the guarantee being called, and the level of contribution required to finance the guarantee.

Options 1 and 2, which both guarantee only a return of contributions, would be most unlikely to be called, but would also do little to reduce variation in participant outcomes (see Table). The Option 1 guarantee would never be called for workers who do not accumulate more than $15,000. More generous guarantees greatly increase both the risk that the guarantee will be called and the expected payout. Connecticut could reduce the risk by increasing the bond allocation in the target date fund, although at the cost of reducing expected returns and benefits.

The probability of the guarantee being called declines as the plan matures. For the cohort attaining age 62 in 2055, who are enrolled from age 22, the probability of the 2.5 percent nominal return guarantee being called is only 0.3 percent, compared with 6.3 percent for the cohort attaining age 62 in 2025, who are enrolled from age 52. But, conditional on the guarantees being called, the expected payout increases for younger birth cohorts.

Table. *The Cost of Guarantees*

Year cohort attains age 62	Investment strategy	Guarantee	2025	2035	2045	2055
Probability of being called	TDF after $15,000	1. Return of contributions	0.9%	0.1%	*	*
	TDF throughout	2. Return of contributions	1.2%	0.1%	*	*
		3. 2.5% nominal	6.3%	1.9%	0.6%	0.3%
		4. 2.5% real	23.0%	14.7%	10.0%	6.7%
Expected payment ($ millions)	TDF after $15,000	1. Return of contributions	$5m	$14m	**	**
	TDF throughout	2. Return of contributions	$15m	$29m	$52m	$29m
		3. 2.5% nominal	$23m	$53m	$85m	$128m
		4. 2.5% real	$37m	$100m	$192m	$328m
Required contribution plus guarantee premium	Baseline	No guarantee	$1,230	$1,230	$1,230	$1,230
	TDF after $15,000	1. Return of contributions	$1,232	$1,235	$1,233	$1,232
	TDF throughout	2. Return of contributions	$1,250	$1,242	$1,238	$1,237
		3. 2.5% nominal	$1,300	$1,310	$1,315	$1,320
		4. 2.5% real	$1,410	$1,531	$1,664	$1,817

Source: Authors' calculations.

Notes: * indicates an occurrence of less than 0.05 percent (five in ten thousand), ** indicates that the frequency of occurrence is too low to yield reliable cost estimates

The above analysis understates the cost of the guarantee because it fails to put a value on the risk that is transferred from plan participants to Connecticut taxpayers. We use the tools of finance theory to calculate the market price of guarantees in a manner that reflects both the risk of the guarantee being called and the provider's aversion to bearing this risk. For the cohort retiring in 2055 and investing in a typical target date fund throughout, a return of contributions guarantee could be funded through an increase in premiums of only $7 per year ($1,237 minus $1,230). But more meaningful guarantees would be substantially more expensive. The market value of guarantees on an even more conservative all-bond portfolio is very similar. Although large losses are less likely on all-bond than on target date portfolios, the more generous guarantees are more likely to be called due to lower expected returns.

Guarantees could be made self-financing by requiring participants to give up some of the upside return. But finance theory tells us that even if participants gave up all the upside, a self-financing guaranteed rate of return on current contributions could not exceed the risk-free rate. Even a zero-percent real rate of return guarantee would require the participant to give up most of the return in excess of the risk-free rate.

The affordable options appear to be 1 and 2. Option 1 slightly reduces the probability of losing money over a lifetime, but at the cost of significantly reducing expected returns. It eliminates the risk of new participants losing money – an important consideration if participants seeing losses may withdraw from the plan. Option 2, which guarantees the return of principal only, exposes the participant to much more variance in outcomes.

Methodology

The calculations assume that nominal stock and bond returns are normally distributed:

$$\mu = \begin{pmatrix} 0.0939 \\ 0.0593 \end{pmatrix}, \Sigma = \begin{pmatrix} 0.0382 & 0.0023 \\ 0.0023 & 0.0057 \end{pmatrix}$$

and that real returns are distributed:

$$\mu = \begin{pmatrix} 0.0658 \\ 0.0312 \end{pmatrix}, \Sigma = \begin{pmatrix} 0.0394 & 0.0040 \\ 0.0040 & 0.0079 \end{pmatrix}$$

based on Ibbotson (2013) data for large company stocks and long-term corporate bonds for 1926-2012. We use nominal returns to calculate the probability of a nominal guarantee being called and the cost, conditional on the guarantee being called. We reduce returns by the 0.437 percent by which the average inflation rate 1926-2012 exceeded our 2.5 percent inflation projection. We use real returns to calculate the probability and cost of a real guarantee.

The market value of rate of return guarantees assumes a risk-free real rate of return of one percent. The market value is estimated assuming that insurers' aversion to risk matches the market average and that equity and bond returns have the same distributions they have displayed in the past.

We assume that 40 percent of the 2013 Connecticut private sector workforce ages 22-61 of 1.073 million (which excludes the self-employed) will enroll in the program and that participants are equally distributed over the 1954-1993 birth cohorts, yielding 10,730 participants in each birth year. The average salary is assumed to be $41,000, increasing at the assumed inflation rate of 2.5 percent. The contribution rate is 3 percent of salary. In one scenario, contributions are invested in short-term deposits yielding a nominal 3.5 percent until the participant has accumulated $15,000. Once the plan balance reaches $15,000, it is transferred to a target date fund in which the percentage invested in equities is 80 minus the participant's age. In the other scenario, the percentage in equities is 100 minus the participant's age.

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