

# Defined benefit plans are disappearing:

## Author

Peter A. Forsyth



GLOBAL  
RISK  
INSTITUTE

## ARE VARIABLE ANNUITIES THE ANSWER?

Traditionally, defined benefit (DB) plans have shielded retirees from the vagaries of the stock market. However, in an effort to de-risk, many private companies and public institutions are moving to defined contribution (DC) plans. In a DC plan, the employee and employer make regular contributions into a retirement savings account. Usually, the employee decides (with a very limited choice) from a menu of investments. In fact, many of these plans simply ask the employee to select from {High,Medium,Low} risk investments, with few details provided about the actual investments.

During the DC pension accumulation phase, assets are usually managed professionally. However, the situation is often different, once the employee has retired. Upon retirement, the employee has to decide how to invest the amount accumulated in the pension savings account.

It is common wisdom that, over the long term, equities produce a higher rate of return than safe government bonds (the so-called equity risk premium). In most cases, it is necessary for a holder of a DC plan to invest in equities, in order to provide for a reasonable retirement income over 20-30 years.

However, since the retiree must withdraw from the investment account each year (in order to produce retirement income), the DC holder is exposed to significant order of return risk.

To see this, let's examine the case of a hypothetical investor who retired in 2000 with \$1 million USD in his

DC account. The investor was studious, and examined the historical market returns over the period 1925 - 2000. The investor finds that the long term geometric return on the US CRSP1 total return index was about 9.5 per cent per year. The investor decides to invest the entire one million USD nest egg in a total market index, and withdraw \$50,000 per year. Since this withdrawal rate is 5 per cent of the initial capital, and the long term average return of the equity index is 9.5 per cent per year, this would appear to be a conservative withdrawal rate.

Figure 1 shows the result for the investor in this case (Buy and hold, stock only). The stock returns are based on the historical CRSP returns over the period 2000 - 2015 (CRSP Stock Index). The regular withdrawals and the two market shocks (dot-com and financial crisis) have hit the investor very hard. In 2015, the investor is left with about \$400,000.

On the other hand, suppose the investor was very cautious. In 2000, long term US treasuries were yielding about 6.5 per cent. The investor buys \$770,000 of US treasuries, maturing in 2015, which will generate \$50,000 per year. The remaining \$230,000 is invested in the stock index. In this case, the investor's portfolio is also shown in Figure 1 (Buy and hold, stock and bond, after withdrawals). The investor does much better in this case. In 2015, the investor's plan has \$1.2 million.

A more classic strategy involves investing equal amounts in the stock index and short term bonds. The portfolio is rebalanced periodically. In Figure 1, we show the backtest of this strategy, rebalancing monthly (Rebalance, stock weight 50 per cent, after withdrawals). The historic short term T-bill rates



GLOBAL  
RISK  
INSTITUTE



Waterloo Research Institute  
in Insurance, Securities  
& Quantitative Finance

**Figure 1: With/Without Withdrawals**

Investor withdraws \$50,000 per year, initial investment \$1 million USD. CRSP Stock Index: value of investment with no withdrawals. Buy and hold, stock only, after withdrawals: entire capital invested in equity index, with regular withdrawals. Buy and hold, stock and bond, after withdrawals: capital invested in US treasuries and equity index, withdrawals financed from treasuries with regular withdrawals. Rebalance, stock weight 50 per cent, after withdrawals: 50 per cent stock and 50 per cent short term US treasuries, rebalanced monthly, with regular withdrawals.



are used for the bond investment. In this case, the investor ends up with about \$525,000 (after withdrawing \$50,000 annually), quite an improvement over the stock only case. The results for these cases are summarized in Table 1.

This example shows that even over a 15 year period, investing in a broadly diversified equity portfolio can be very risky for a retiree, once the retiree begins to drawdown his accumulated wealth. In fact, we can see here that even the most basic asset allocation problem, that of deciding on the split between government bonds and an equity index, is fraught with peril.

In the past, in a DB plan, this sort of risk was shared amongst the pool of retirees, the current employees and the employer. Now, each individual in a DC plan bears this risk. Clearly, this is a suboptimal situation.

In an effort to provide DC plan holders with a product which replicates, to some extent, a traditional DB plan, insurance companies are marketing Variable Annuities (VAs). Traditional annuity products are extremely unattractive in the current low interest rate environment. VAs on the other hand, allow the holder to participate in stock market gains (thus providing some inflation protection and the chance of earning the equity risk premium) but at the same time providing a minimum guaranteed cash flow each year. In this case, the risk of the guarantee is managed by the insurance company, using sophisticated hedging techniques.

In theory, VAs are a useful financial instrument, from a societal point of view, providing a transfer of risk from an individual to a private corporation. But, are they being priced fairly? This is discussed in the whitepaper *Variable annuities: Fees too high or too low?*.

STRATEGY	INITIAL STOCK INVESTMENT (2000)	INITIAL BOND INVESTMENT (2000)	TOTAL WITHDRAWALS (2000 - 2015)	FINAL PORTFOLIO VALUE
Buy and hold\$	1,000,000	0.00	.0	\$1,876,844
Buy and hold\$	1,000,000	0.0\$	750,000	\$393,370
Buy and hold	\$230,770\$	769,230	\$750,000	\$1,202,349
Rebalance	\$500,000	\$500,000	\$750,000	\$525,159

**Table 1** Comparison of strategies which generate \$50,000 per year, 2000 - 2015, based on historical data. In the rebalancing case, the rebalancing is done monthly, and the bonds are invested in short term T-bills. The short term T-bill rate is based on historic data. Withdrawal rate: \$50,000 annually.