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**THE 5% GUARANTEED MINIMUM WITHDRAWAL  
BENEFIT: PAYING SOMETHING FOR NOTHING?**

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## EXECUTIVE SUMMARY

Due to the aging of the baby boom generation retirement income has become a topic of widespread interest. Retirees want products that insure they will not outlive income, have some inflation protection, and at the same time maintain flexibility and control. The Guaranteed Minimum Withdrawal Benefit (GMWB) product seems to offer everything that retirees are looking for. However, a deep dive into the data will reveal that it does not offer much value. We believe that the fees will result in a diminished estate, and a retiree would most likely not outlive the income stream it produces even without purchasing the protection. Furthermore, we believe that a life annuity would provide better inflation protection and can potentially leave a larger estate.

## INTRODUCTION

The advantages of purchasing life annuities have been previously documented; for example, see <http://www.tiaa-crefinstitute.org/research/trends/docs/tr100106b.pdf>. The life annuity offers the opportunity to maximize lifetime income, especially when compared to systematic withdrawals. Since the strategy of systematic withdrawal includes the risk of outliving income, a retiree needs to carefully limit the amount withdrawn. Although there are disadvantages to using a life annuity, for example the loss of an estate value or the potential investment loss due to early death, these risks can be mitigated with the purchase of a guarantee period.

A fixed annuity will pay a set amount of money for life. Since inflation will erode the value of the payment over time, some issuers include an inflation rider to their fixed annuities. Another way to reduce the effects of inflation is to purchase a variable annuity. The initial payment from a variable annuity uses an Assumed Interest Rate (AIR), with the payment changing based on the actual return of the underlying investments compared to the AIR. For example, if the AIR is 4%, as long as the underlying fund earns more than 4% the payment will increase, while if it earns less than 4% the payment will decrease. Since over time an appropriate asset allocation can yield a “real” return of greater than 4%, the variable annuity has significant potential to outpace inflation. For example, if the return of the underlying funds in the variable annuity average 7.5% a year, the payment will increase, on average, approximately 3.5% a year. As long as inflation is 3.5% or less, the growth rate of this payment stream will outpace inflation.

Because payments are dependent on the performance of the underlying investments, the risk of the variable annuity is obvious; if the stock market crashes, the payment will not only be unable to outpace inflation, it will be reduced in nominal dollars as well. While the annuity may also have some guaranteed minimum floor, it may not be enough to minimize concerns about the risk.

## THE 5% SOLUTION

Two of the risks inherent in variable annuities – the inability to leave an estate and the potential for very low income – led to the creation of a new product, the 5% Guaranteed Minimum Withdrawal Benefit (GMWB.) In general terms the product works as follows: the policyholder invests funds, say \$100,000, with the issuer. First year income will be 5% of that total, or \$5,000. The money is placed in an underlying investment; for example, a fund that tracks the S&P 500. At the end of the year the remaining balance will depend on the return of the underlying investment less expenses. If the balance is greater than the initial balance (\$100,000), the annual

payment will increase to 5% of that new remaining balance. If not, the payment remains at its current level (\$5,000). In each subsequent year the payment will be the greater of 5% of the remaining balance, or the prior year's payment. Upon the death of the policyholder, the remaining balance, if any, belongs to the estate.

Essentially, the policyholder is being guaranteed at least \$5,000 (per \$100,000 of investment) a year for life, with the potential for large increases if the underlying funds perform strongly. For this guarantee the issuer charges a fee, and those fees can be steep.

## WHAT IS THE INVESTOR BUYING?

This product only has value if the performance of the underlying funds is extremely poor. For example, if the S&P index has a 0% return for 20 years, and the policyholder is still alive, then the \$5,000 income guarantee has value; at that point the account balance is zero but annual payments of \$5,000 will continue for life. But the vast majority of the time, the investor is only receiving his or her own money back, along with its investment earnings. And for this he or she is paying as much as 75 or even 100 basis points per year. In addition, as we will demonstrate later, annuitization is a better way to guarantee lifetime income.

We think this point is important enough that it bears repeating. *If market performance is similar to the past few decades, the buyer is paying for an insurance feature that has little value.*

We will attempt to prove this by answering the following question. What would happen if an individual used this withdrawal scheme without the protection of the issuer? Would the retiree outlive income? In other words, what is the value of the promise of guaranteed income for life with the 5% Guaranteed Minimum Withdrawal Benefit?

## DETERMINISTIC SIMULATIONS

Simulations were run using historical returns of the S&P 500. For each run we picked a starting year and used the actual returns for the following 30 years. Using the withdrawal amounts as determined by the GMWB rules, we calculated year-end balances and illustrated whether or not the retiree would have run out of money without the GMWB income protection. We also calculated how much the retiree would have paid for the guarantee had the GMWB been purchased. The charge for the guarantee is assumed to be 65 basis points. Note that the results are all per \$100,000 invested. An initial investment of \$500,000 will have income five times as great and all results and differences will be five times larger.

### Good Market Performance

Exhibit 1 shows results assuming the individual began benefits in 1980. The last column shows that without the GMWB protection the accumulation at year-end 2007 is over \$720,000. Under this scenario, there was no need to purchase the guarantee, because the earnings far exceeded the yearly withdrawal. In the column labeled Actual Balance you can see that with an annual 65 basis point charge the accumulation in the GMWB is about \$450,000. Thus, for the 28-year period shown the guarantee has cost the estate over \$250,000, on an initial investment of \$100,000.

It should be obvious that if the stock market performs well, there is no value in this guarantee, and the costs can be great.

### **Poor Market Performance**

Exhibit 2 uses an assumed retirement date of 1973. We selected this date because it represented a terrible time to be invested in the stock market, immediately before a two-year market crash where the S&P lost almost 40% of its value. While the initial account balance of \$100,000 declines to \$56,000 after two years, the market soon recovers, and 30 years after retirement there is over \$470,000 still in the account without the GMWB protection. Again, the guarantee had no value, and paying the 65 basis points a year in expense charges costs the estate almost \$200,000 (per \$100,000 invested).

The worst post-WWII 30-year period for this withdrawal scheme started in 1955 and is illustrated on Exhibit 3. Even in this case, the guarantee did not pay off. In summation, there has not been a single 30-year period since WWII where the guarantee offered by this product had any value. However, it does appear to pay off when we include starting dates during the Great Depression.

### **Depression Scenario**

Exhibit 4 shows the result assuming a starting date of 1930. If an investor were taking withdrawals of 5% a year without GMWB protection, subject to the \$5,000 minimum, he or she would have liquidated the account by 1944. This means that for a retiree still alive 14 years later (for TIAA annuitants, the probability of a 70 year old living for 14 years is over 70%; for 65 year olds it is over 80%) the guarantee would have been worth the cost.

Of course, before purchasing the product specifically to protect against this scenario one still needs to ask the following question: Will the issuer have enough money to fulfill its guarantees? If the market were to have such poor performance, would the issuer remain solvent?

## **STOCHASTIC SIMULATIONS**

While we have examined historical returns from different starting points and shown that this product would not have offered value - with the exception of retirements during the depression - one can argue that these illustrated returns represent only one set of data. It does not tell us the probability of running out of money using this withdrawal strategy without the protection of the GMWB.

We ran simulations using the S&P data, but rather than arranging them in the order they occurred, we did a random draw from the data. For each run we randomly selected 25 or 30 annual returns (with replacement) and using those returns we determined if the retiree would outlive income without the protection. We ran this simulation several thousand times.

We ran the simulation using post-WWII data and found that over 25- and 30-year periods the probability of running out of money was 5% or less. In other words, without the GMWB protection the retiree would have had lifetime income 95% of the time without paying unnecessary fees. Furthermore, the loss on the upside is large. For the 95% of cases where the retiree did not outlive income, the average value of the account with GMWB protection was \$150,000 less (per \$100,000 invested) after 25 years and \$300,000 less (per \$100,000) after 30 years.

To be complete in our analysis, we then ran the simulations using the entire data set, from 1926 through 2007. We found that over a 25-year period, the probability of running out of money is approximately 15%, while over 30 years the probability of outliving income is under 20%. Note that the retiree must still be alive after 25 or 30 years for these numbers to have meaning. Using this type of simulation one can argue that this product does offer downside protection. However, the loss on the upside is again rather large. For the 80% or 85% of the runs where the retiree did not outlive income, the value of the GMWB account after 25 years was over \$150,000 less due to the fees. After 30 years the GMWB account value was over \$300,000 lower than it would have been without the fees.

Furthermore, the probability of exhausting the account over 20 years is only about 7%, so even if this product offers value for younger retirees, it certainly should not be purchased at older ages when the odds are high that death will occur before the account is depleted.

## **COMPARISON TO AN ANNUITY**

We next demonstrate the loss of living income a retiree would experience by purchasing a guaranteed minimum withdrawal product rather than an annuity. At age 65, with a 4% AIR and the A2000 mortality table set back 2 years, we calculate an initial annual annuity payment of \$6,646 per \$100,000 invested. This is higher than the \$5,000 benefit of the GMWB, but subject to decline if there is poor market performance. We will start by comparing the annuity to the 5% guaranteed product using the 1955 starting date. Since annuity issuers do charge fees, for these examples we assumed equal fees in both products, or to simplify we assumed no fees in either product. Of course a low fee annuity provider would have even better results than the ones described below.

Exhibit 5 shows the annual payments assuming an underlying investment in a fund that tracks the S&P 500. As you can see, the annuity income is higher than the GMWB income in every year. While the 5% guaranteed benefit product does have a higher death benefit (by definition, the annuity has a death benefit of zero), within 23 years the accumulated value of the “excess income” of the annuity is greater than the GMWB death benefit. The excess income is calculated by taking the difference between the annuity payment and the GMWB payment and investing it in the same underlying fund. Note that the life expectancy for a 65 year old under the mortality table chosen is greater than 23 years, so we can say that, with similar expense levels, there is a greater than 50% chance that the life annuity offers more value than the GMWB. Exhibit 6 and 7 repeat this comparison using the 1973 and 1980 data. Again, the annuity income is almost always higher, and the accumulated value of the excess of annuity payments over the GMWB payments will be greater than the remaining balance of the GMWB before life expectancy is reached.

### **Annuity with a Guarantee Period**

As mentioned earlier, a guarantee period in a life annuity reduces the risk of a “bad investment” caused by early death and allows for an estate value. On Exhibit 8 we show a comparison of a

GMWB and a life annuity with a 20-year guarantee period. Note that the guarantee period is the minimum number of years that payments will be made. If death occurs within 20 years of purchase, the estate can continue to receive payments until the 20th year or take a lump sum equal to the present value of future payments. If death does not occur within 20 years, payments will continue for the life of the annuitant.

For this illustration we show a column for the death benefit and a column for the excess benefit from the annuity (with the total benefit equal to the sum of the two.) The death benefit column assumes death immediately before the next payment is due. It is equal to the present value of the next payment times the number of guaranteed years remaining, discounted at 4% (the AIR). After 20 payments there is no longer a death benefit, though the excess benefit continues to grow. It now takes 26 years for the excess benefit to pass the GMWB death benefit; however we need to make two points. The “life expectancy” of this payment stream (the average number of payments) is actually longer than 25 years, since no one receives less than 20 years of payments. Second, the GMWB has only a small advantage in the early years, while the annuity has large advantages in the later years. Discounting the differences with interest and mortality will result in the annuity having a higher present value than the GMWB.

### **Partial Annuity**

Last, there is yet another way to use an annuity that can offer greater value than the GMWB. While the GMWB is said to offer income and flexibility, it only offers a choice of one or the other. If the flexibility is used to take a portion of the account balance for additional spending, future income will be reduced. (In some cases the future income can be reduced dramatically, depending on the product design.) As we have shown above, the annuity payment on a similar investment will have a larger payment than the GMWB. Therefore, we suggest a partial annuity, taking only a portion of your money and using it to buy an annuity, with the rest of the money remaining to accumulate and representing complete flexibility for the retiree to withdraw as needed. Withdrawals from the remaining balance can be used to either cover a temporary reduction in income due to poor market performance, or for a one-time need. In either case, future income will not be reduced.

Exhibits 9 and 10 use a variable annuity producing an initial payment of \$5,000. This annuity requires an investment of \$67,416, resulting in an initial account balance of \$32,584 from the original \$100,000. In Exhibit 9 the account balance is used to cover short-term needs due to market declines, while in Exhibit 10 the account balance was also used for a one-time \$10,000 need after 10 years. In the latter example, the GMWB income is reduced pro-rata based on the ratio of the withdrawal amount to the account balance. Again we see the annuity offers value above and beyond the GMWB, resulting in either a higher estate value (even for those who do not exceed their life expectancy) or a higher level of annual income.

## **CONCLUSION**

The guaranteed minimum does not appear to offer much in the way of value. The risk that it is protecting against has not occurred in 70 years. If a retiree wants to ensure ongoing income and an estate upon death, and does not want to purchase an annuity, a fixed percentage systematic

withdrawal should suffice without further depleting the accumulation with an additional annual fee. Of course, income might be reduced dramatically if the underlying investments perform poorly. However, you can design your own 'minimum floor' to prevent a decline in income, with minimal risk of outliving income. In fact, using the same 5% rule appears to minimize that risk. So why pay 65 or more basis points for it?

Furthermore, if you want to leave an estate, you can buy an annuity and take the excess income and invest it. This can result in an even larger estate than the GMWB product offers. In addition, this annuity option can offer even greater flexibility, since the accumulation of the excess income is fully liquid, unlike the GMWB product where the account balance is needed to produce future income. If the investment performed poorly, there may not be any account balance to withdraw. Last, you can annuitize a portion of your accumulation to match the income you need, and leave the rest for other needs or to your estate.

**EXHIBIT 1**

	S&P return	Benefit Base	GMWB		Non-GMWB
			Payment	Actual Balance	Balance
1980	32.42%	\$100,000	\$5,000	\$125,149	\$125,799
1981	-4.91%	\$125,149	\$6,257	\$112,241	\$113,672
1982	21.41%	\$125,149	\$6,257	\$127,861	\$130,412
1983	22.51%	\$127,861	\$6,393	\$147,979	\$151,936
1984	6.27%	\$147,979	\$7,399	\$148,432	\$153,599
1985	32.16%	\$148,432	\$7,422	\$185,395	\$193,188
1986	18.47%	\$185,395	\$9,270	\$207,450	\$217,888
1987	5.23%	\$207,450	\$10,373	\$206,037	\$218,369
1988	16.81%	\$207,450	\$10,373	\$227,207	\$242,961
1989	31.49%	\$227,207	\$11,360	\$282,340	\$304,531
1990	-3.17%	\$282,340	\$14,117	\$257,885	\$281,208
1991	30.55%	\$282,340	\$14,117	\$316,404	\$348,687
1992	7.67%	\$316,404	\$15,820	\$321,582	\$358,398
1993	9.99%	\$321,582	\$16,079	\$333,932	\$376,517
1994	1.31%	\$333,932	\$16,697	\$319,221	\$364,534
1995	37.43%	\$333,932	\$16,697	\$413,588	\$478,033
1996	23.07%	\$413,588	\$20,679	\$480,865	\$562,865
1997	33.36%	\$480,865	\$24,043	\$606,091	\$718,572
1998	28.58%	\$606,091	\$30,305	\$736,407	\$884,974
1999	21.04%	\$736,407	\$36,820	\$841,993	\$1,026,606
2000	-9.11%	\$841,993	\$42,100	\$721,550	\$894,818
2001	-11.88%	\$841,993	\$42,100	\$593,259	\$751,415
2002	-22.10%	\$841,993	\$42,100	\$423,880	\$552,557
2003	28.69%	\$841,993	\$42,100	\$485,840	\$656,907
2004	10.87%	\$841,993	\$42,100	\$486,502	\$681,637
2005	4.91%	\$841,993	\$42,100	\$460,750	\$670,939
2006	15.80%	\$841,993	\$42,100	\$479,324	\$728,196
2007	5.49%	\$841,993	\$42,100	\$455,755	\$723,763

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.



**EXHIBIT 2**

	S&P return	GMWB		Non-GMWB	
		Benefit Base	Payment	Actual Balance	Balance
1973	-14.66%	\$100,000	\$5,000	\$80,423	\$81,073
1974	-26.47%	\$100,000	\$5,000	\$54,809	\$55,936
1975	37.20%	\$100,000	\$5,000	\$67,687	\$69,885
1976	23.84%	\$100,000	\$5,000	\$76,982	\$80,353
1977	-7.18%	\$100,000	\$5,000	\$66,164	\$69,943
1978	6.56%	\$100,000	\$5,000	\$64,526	\$69,203
1979	18.44%	\$100,000	\$5,000	\$69,853	\$76,042
1980	32.42%	\$100,000	\$5,000	\$85,228	\$94,074
1981	-4.91%	\$100,000	\$5,000	\$75,639	\$84,701
1982	21.41%	\$100,000	\$5,000	\$85,112	\$96,765
1983	22.51%	\$100,000	\$5,000	\$97,496	\$112,421
1984	6.27%	\$100,000	\$5,000	\$97,645	\$114,156
1985	32.16%	\$100,000	\$5,000	\$121,790	\$144,261
1986	18.47%	\$121,790	\$6,089	\$136,278	\$163,692
1987	5.23%	\$136,278	\$6,814	\$135,350	\$165,082
1988	16.81%	\$136,278	\$6,814	\$149,257	\$184,873
1989	31.49%	\$149,257	\$7,463	\$185,475	\$233,277
1990	-3.17%	\$185,475	\$9,274	\$169,410	\$216,902
1991	30.55%	\$185,475	\$9,274	\$207,852	\$271,059
1992	7.67%	\$207,852	\$10,393	\$211,254	\$280,660
1993	9.99%	\$211,254	\$10,563	\$219,367	\$297,080
1994	1.31%	\$219,367	\$10,968	\$209,703	\$289,860
1995	37.43%	\$219,367	\$10,968	\$271,695	\$383,280
1996	23.07%	\$271,695	\$13,585	\$315,890	\$454,984
1997	33.36%	\$315,890	\$15,794	\$398,154	\$585,703
1998	28.58%	\$398,154	\$19,908	\$483,761	\$727,500
1999	21.04%	\$483,761	\$24,188	\$553,123	\$851,289
2000	-9.11%	\$553,123	\$27,656	\$474,001	\$748,600
2001	-11.88%	\$553,123	\$27,656	\$389,724	\$635,296
2002	-22.10%	\$553,123	\$27,656	\$278,456	\$473,351

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

**EXHIBIT 3**

	S&P return	Benefit Base	GMWB		Non-GMWB
			Payment	Actual Balance	Balance
1955	31.56%	\$100,000	\$5,000	\$124,332	\$124,982
1956	6.56%	\$124,332	\$6,217	\$125,056	\$126,556
1957	-10.78%	\$125,056	\$6,253	\$105,183	\$107,335
1958	43.36%	\$125,056	\$6,253	\$141,014	\$144,911
1959	11.96%	\$141,014	\$7,051	\$149,068	\$154,349
1960	0.47%	\$149,068	\$7,453	\$141,311	\$147,586
1961	26.89%	\$149,068	\$7,453	\$168,884	\$177,814
1962	-8.73%	\$168,884	\$8,444	\$145,335	\$154,584
1963	22.80%	\$168,884	\$8,444	\$167,005	\$179,459
1964	16.48%	\$168,884	\$8,444	\$183,593	\$199,199
1965	12.45%	\$183,593	\$9,180	\$194,935	\$213,676
1966	-10.06%	\$194,935	\$9,747	\$165,291	\$183,414
1967	23.98%	\$194,935	\$9,747	\$191,577	\$215,313
1968	11.06%	\$194,935	\$9,747	\$200,673	\$228,302
1969	-8.50%	\$200,673	\$10,034	\$173,131	\$199,715
1970	4.01%	\$200,673	\$10,034	\$168,333	\$197,288
1971	14.31%	\$200,673	\$10,034	\$179,648	\$214,050
1972	18.98%	\$200,673	\$10,034	\$200,502	\$242,739
1973	-14.66%	\$200,673	\$10,034	\$161,242	\$198,591
1974	-26.47%	\$200,673	\$10,034	\$109,879	\$138,646
1975	37.20%	\$200,673	\$10,034	\$135,683	\$176,456
1976	23.84%	\$200,673	\$10,034	\$154,300	\$206,098
1977	-7.18%	\$200,673	\$10,034	\$132,604	\$181,987
1978	6.56%	\$200,673	\$10,034	\$129,306	\$183,233
1979	18.44%	\$200,673	\$10,034	\$139,962	\$205,137
1980	32.42%	\$200,673	\$10,034	\$170,747	\$258,356
1981	-4.91%	\$200,673	\$10,034	\$151,518	\$236,130
1982	21.41%	\$200,673	\$10,034	\$170,471	\$274,503
1983	22.51%	\$200,673	\$10,034	\$195,248	\$324,002
1984	6.27%	\$200,673	\$10,034	\$195,523	\$333,654

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

**EXHIBIT 4**

			<b>GMWB</b>		<b>Non-GMWB</b>
	S&P return	Benefit Base	Payment	Actual Balance	Balance
1930	-24.90%	\$100,000	\$5,000	\$70,695	\$71,345
1931	-43.34%	\$100,000	\$5,000	\$36,573	\$37,591
1932	-8.19%	\$100,000	\$5,000	\$28,337	\$29,922
1933	53.99%	\$100,000	\$5,000	\$35,287	\$38,377
1934	-1.44%	\$100,000	\$5,000	\$29,200	\$32,897
1935	47.67%	\$100,000	\$5,000	\$35,087	\$41,195
1936	33.92%	\$100,000	\$5,000	\$39,642	\$48,472
1937	-35.03%	\$100,000	\$5,000	\$21,857	\$28,244
1938	31.12%	\$100,000	\$5,000	\$21,453	\$30,477
1939	-0.41%	\$100,000	\$5,000	\$15,736	\$25,373
1940	-9.78%	\$100,000	\$5,000	\$9,036	\$18,380
1941	-11.59%	\$100,000	\$5,000	\$2,918	\$11,830
1942	20.34%	\$100,000	\$5,000	\$0	\$8,219
1943	25.90%	\$100,000	\$5,000	\$0	\$4,052
1944	19.75%	\$100,000	\$5,000	\$0	\$0
1945	36.44%	\$100,000	\$5,000	\$0	\$0
1946	-8.07%	\$100,000	\$5,000	\$0	\$0
1947	5.71%	\$100,000	\$5,000	\$0	\$0
1948	5.50%	\$100,000	\$5,000	\$0	\$0
1949	18.79%	\$100,000	\$5,000	\$0	\$0
1950	31.71%	\$100,000	\$5,000	\$0	\$0
1951	24.02%	\$100,000	\$5,000	\$0	\$0
1952	18.37%	\$100,000	\$5,000	\$0	\$0
1953	-0.99%	\$100,000	\$5,000	\$0	\$0
1954	52.62%	\$100,000	\$5,000	\$0	\$0
1955	31.56%	\$100,000	\$5,000	\$0	\$0
1956	6.56%	\$100,000	\$5,000	\$0	\$0
1957	-10.78%	\$100,000	\$5,000	\$0	\$0
1958	43.36%	\$100,000	\$5,000	\$0	\$0
1959	11.96%	\$100,000	\$5,000	\$0	\$0

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

**EXHIBIT 5**

	GMWB Payment			Annuity	
	S&P return	Payment	Actual Balance	Payment	Excess Benefit
1955	31.56%	\$5,000	\$124,982	\$6,646	\$2,166
1956	6.56%	\$6,249	\$126,522	\$8,407	\$4,607
1957	-10.78%	\$6,326	\$107,239	\$8,614	\$6,152
1958	43.36%	\$6,326	\$144,668	\$7,390	\$10,345
1959	11.96%	\$7,233	\$153,872	\$10,187	\$14,889
1960	0.47%	\$7,694	\$146,865	\$10,967	\$18,247
1961	26.89%	\$7,694	\$176,595	\$10,594	\$26,835
1962	-8.73%	\$8,830	\$153,119	\$12,926	\$28,231
1963	22.80%	\$8,830	\$177,188	\$11,344	\$37,755
1964	16.48%	\$8,859	\$196,069	\$13,394	\$49,259
1965	12.45%	\$9,803	\$209,455	\$15,002	\$61,237
1966	-10.06%	\$10,473	\$178,965	\$16,221	\$60,247
1967	23.98%	\$10,473	\$208,897	\$14,028	\$79,101
1968	11.06%	\$10,473	\$220,370	\$16,723	\$94,791
1969	-8.50%	\$11,018	\$191,556	\$17,858	\$92,992
1970	4.01%	\$11,018	\$187,777	\$15,712	\$101,602
1971	14.31%	\$11,018	\$202,053	\$15,713	\$121,508
1972	18.98%	\$11,018	\$227,293	\$17,271	\$152,009
1973	-14.66%	\$11,365	\$184,273	\$19,758	\$136,888
1974	-26.47%	\$11,365	\$127,140	\$16,213	\$104,219
1975	37.20%	\$11,365	\$158,843	\$11,463	\$143,124
1976	23.84%	\$11,365	\$182,638	\$15,123	\$181,898
1977	-7.18%	\$11,365	\$158,976	\$18,007	\$175,004
1978	6.56%	\$11,365	\$157,294	\$16,072	\$191,500
1979	18.44%	\$11,365	\$172,839	\$16,467	\$232,856
1980	32.42%	\$11,365	\$213,824	\$18,754	\$318,132
1981	-4.91%	\$11,365	\$192,519	\$23,878	\$314,411
1982	21.41%	\$11,365	\$219,939	\$21,833	\$394,436
1983	22.51%	\$11,365	\$255,525	\$25,488	\$500,526
1984	6.27%	\$12,776	\$257,969	\$30,024	\$550,238

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

Annuity assumes a Single Life Annuity, Age 65, 4% AIR, and mortality based on Annuity 2000 table, set back 2 years.

**EXHIBIT 6**

	GMWB			Annuity	
	S&P return	Payment	Actual Balance	Payment	Excess Benefit
1973	-14.66%	\$5,000	\$81,073	\$6,646	\$1,405
1974	-26.47%	\$5,000	\$55,936	\$5,454	\$1,366
1975	37.20%	\$5,000	\$69,885	\$3,856	\$305
1976	23.84%	\$5,000	\$80,353	\$5,087	\$485
1977	-7.18%	\$5,000	\$69,943	\$6,057	\$1,431
1978	6.56%	\$5,000	\$69,203	\$5,406	\$1,958
1979	18.44%	\$5,000	\$76,042	\$5,539	\$2,957
1980	32.42%	\$5,000	\$94,074	\$6,308	\$5,648
1981	-4.91%	\$5,000	\$84,701	\$8,032	\$8,254
1982	21.41%	\$5,000	\$96,765	\$7,344	\$12,867
1983	22.51%	\$5,000	\$112,421	\$8,573	\$20,140
1984	6.27%	\$5,621	\$113,496	\$10,099	\$26,162
1985	32.16%	\$5,675	\$142,497	\$10,319	\$40,714
1986	18.47%	\$7,125	\$160,375	\$13,114	\$55,329
1987	5.23%	\$8,019	\$160,325	\$14,938	\$65,504
1988	16.81%	\$8,019	\$177,908	\$15,115	\$84,804
1989	31.49%	\$8,895	\$222,235	\$16,977	\$122,135
1990	-3.17%	\$11,112	\$204,431	\$21,464	\$128,287
1991	30.55%	\$11,112	\$252,378	\$19,984	\$179,062
1992	7.67%	\$12,619	\$258,149	\$25,086	\$206,219
1993	9.99%	\$12,907	\$269,741	\$25,971	\$241,189
1994	1.31%	\$13,487	\$259,611	\$27,467	\$258,512
1995	37.43%	\$13,487	\$338,248	\$26,757	\$373,509
1996	23.07%	\$16,912	\$395,468	\$35,357	\$482,378
1997	33.36%	\$19,773	\$501,026	\$41,841	\$672,728
1998	28.58%	\$25,051	\$612,008	\$53,653	\$901,769
1999	21.04%	\$30,600	\$703,736	\$66,333	\$1,134,752
2000	-9.11%	\$35,187	\$607,644	\$77,201	\$1,069,563
2001	-11.88%	\$35,187	\$504,449	\$67,470	\$970,947
2002	-22.10%	\$35,187	\$365,556	\$57,168	\$773,491

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

Annuity assumes a Single Life Annuity, Age 65, 4% AIR, and mortality based on Annuity 2000 table, set back 2 years.

**EXHIBIT 7**

	GMWB			Annuity	
	S&P return	Payment	Actual Balance	Payment	Excess Benefit
1980	32.42%	\$5,000	\$125,799	\$6,646	\$2,180
1981	-4.91%	\$6,290	\$113,641	\$8,462	\$4,138
1982	21.41%	\$6,290	\$130,335	\$7,737	\$6,782
1983	22.51%	\$6,517	\$151,690	\$9,032	\$11,390
1984	6.27%	\$7,584	\$153,141	\$10,640	\$15,351
1985	32.16%	\$7,657	\$192,271	\$10,872	\$24,538
1986	18.47%	\$9,614	\$216,395	\$13,816	\$34,049
1987	5.23%	\$10,820	\$216,326	\$15,739	\$41,006
1988	16.81%	\$10,820	\$240,052	\$15,925	\$53,862
1989	31.49%	\$12,003	\$299,863	\$17,886	\$78,559
1990	-3.17%	\$14,993	\$275,839	\$22,614	\$83,448
1991	30.55%	\$14,993	\$340,534	\$21,055	\$116,855
1992	7.67%	\$17,027	\$348,321	\$26,430	\$135,943
1993	9.99%	\$17,416	\$363,962	\$27,363	\$160,464
1994	1.31%	\$18,198	\$350,294	\$28,939	\$173,447
1995	37.43%	\$18,198	\$456,399	\$28,190	\$252,100
1996	23.07%	\$22,820	\$533,605	\$37,252	\$328,021
1997	33.36%	\$26,680	\$676,035	\$44,082	\$460,656
1998	28.58%	\$33,802	\$825,784	\$56,527	\$621,532
1999	21.04%	\$41,289	\$949,553	\$69,887	\$786,917
2000	-9.11%	\$47,478	\$819,896	\$81,338	\$746,004
2001	-11.88%	\$47,478	\$680,655	\$71,085	\$678,181
2002	-22.10%	\$47,478	\$493,245	\$60,231	\$538,238
2003	28.69%	\$47,478	\$573,658	\$45,115	\$689,618
2004	10.87%	\$47,478	\$583,376	\$55,825	\$773,834
2005	4.91%	\$47,478	\$562,211	\$59,513	\$824,456
2006	15.80%	\$47,478	\$596,062	\$60,034	\$969,260
2007	5.49%	\$47,478	\$578,701	\$66,845	\$1,042,904

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

Annuity assumes a Single Life Annuity, Age 65, 4% AIR, and mortality based on Annuity 2000 table, set back 2 years.

**EXHIBIT 8**

	<b>GMWB</b>			<b>Annuity with 20 year guarantee</b>			
	S&P return	Payment	Actual Balance	Payment	Death Benefit	Excess Benefit	Total Benefit
1955	31.56%	\$5,000	\$124,982	\$6,084	\$105,134	\$1,427	\$106,561
1956	6.56%	\$6,249	\$126,522	\$7,697	\$103,829	\$3,063	\$106,892
1957	-10.78%	\$6,326	\$107,239	\$7,886	\$85,600	\$4,125	\$89,725
1958	43.36%	\$6,326	\$144,668	\$6,766	\$113,017	\$6,544	\$119,560
1959	11.96%	\$7,233	\$153,872	\$9,326	\$116,092	\$9,669	\$125,761
1960	0.47%	\$7,694	\$146,865	\$10,040	\$106,551	\$12,072	\$118,623
1961	26.89%	\$7,694	\$176,595	\$9,699	\$122,895	\$17,863	\$140,758
1962	-8.73%	\$8,830	\$153,119	\$11,834	\$101,366	\$19,045	\$120,411
1963	22.80%	\$8,830	\$177,188	\$10,385	\$111,724	\$25,298	\$137,021
1964	16.48%	\$8,859	\$196,069	\$12,263	\$115,852	\$33,431	\$149,283
1965	12.45%	\$9,803	\$209,455	\$13,734	\$114,832	\$42,013	\$156,845
1966	-10.06%	\$10,473	\$178,965	\$14,850	\$89,924	\$41,723	\$131,647
1967	23.98%	\$10,473	\$208,897	\$12,842	\$95,565	\$54,667	\$150,232
1968	11.06%	\$10,473	\$220,370	\$15,310	\$89,132	\$66,085	\$155,217
1969	-8.50%	\$11,018	\$191,556	\$16,349	\$66,596	\$65,345	\$131,941
1970	4.01%	\$11,018	\$187,777	\$14,384	\$54,306	\$71,466	\$125,772
1971	14.31%	\$11,018	\$202,053	\$14,385	\$45,633	\$85,541	\$131,174
1972	18.98%	\$11,018	\$227,293	\$15,811	\$35,482	\$107,479	\$142,962
1973	-14.66%	\$11,365	\$184,273	\$18,089	\$14,843	\$97,461	\$112,305
1974	-26.47%	\$11,365	\$127,140	\$14,843	\$0	\$74,221	\$74,221
1975	37.20%	\$11,365	\$158,843	\$10,495	\$0	\$100,638	\$100,638
1976	23.84%	\$11,365	\$182,638	\$13,845	\$0	\$127,701	\$127,701
1977	-7.18%	\$11,365	\$158,976	\$16,486	\$0	\$123,286	\$123,286
1978	6.56%	\$11,365	\$157,294	\$14,714	\$0	\$134,942	\$134,942
1979	18.44%	\$11,365	\$172,839	\$15,076	\$0	\$164,221	\$164,221
1980	32.42%	\$11,365	\$213,824	\$17,169	\$0	\$225,147	\$225,147
1981	-4.91%	\$11,365	\$192,519	\$21,861	\$0	\$224,073	\$224,073
1982	21.41%	\$11,365	\$219,939	\$19,988	\$0	\$282,517	\$282,517
1983	22.51%	\$11,365	\$255,525	\$23,334	\$0	\$360,775	\$360,775
1984	6.27%	\$12,776	\$257,969	\$27,487	\$0	\$399,028	\$399,028

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

Annuity assumes a Single Life Annuity, Age 65, 4% AIR, and mortality based on Annuity 2000 table, set back 2 years.

**EXHIBIT 9**

		<b>GMWB</b>		<b>Partial Annuity</b>		
	S&P return	Payment	Actual Balance	Payment	Add (Withdraw)	Account Balance
1955	31.56%	\$5,000	\$124,982	\$5,000	\$0	\$32,584
1956	6.56%	\$6,249	\$126,522	\$6,325	\$76	\$34,803
1957	-10.78%	\$6,326	\$107,239	\$6,481	\$155	\$31,189
1958	43.36%	\$6,326	\$144,668	\$5,560	(\$766)	\$43,614
1959	11.96%	\$7,233	\$153,872	\$7,664	\$430	\$49,312
1960	0.47%	\$7,694	\$146,865	\$8,250	\$557	\$50,103
1961	26.89%	\$7,694	\$176,595	\$7,970	\$277	\$63,927
1962	-8.73%	\$8,830	\$153,119	\$9,725	\$895	\$59,163
1963	22.80%	\$8,830	\$177,188	\$8,534	(\$295)	\$72,289
1964	16.48%	\$8,859	\$196,069	\$10,077	\$1,218	\$85,620
1965	12.45%	\$9,803	\$209,455	\$11,286	\$1,483	\$97,947
1966	-10.06%	\$10,473	\$178,965	\$12,203	\$1,730	\$89,650
1967	23.98%	\$10,473	\$208,897	\$10,553	\$81	\$111,248
1968	11.06%	\$10,473	\$220,370	\$12,581	\$2,108	\$125,894
1969	-8.50%	\$11,018	\$191,556	\$13,435	\$2,417	\$117,404
1970	4.01%	\$11,018	\$187,777	\$11,820	\$802	\$122,946
1971	14.31%	\$11,018	\$202,053	\$11,821	\$803	\$141,457
1972	18.98%	\$11,018	\$227,293	\$12,993	\$1,975	\$170,655
1973	-14.66%	\$11,365	\$184,273	\$14,865	\$3,500	\$148,624
1974	-26.47%	\$11,365	\$127,140	\$12,198	\$833	\$109,896
1975	37.20%	\$11,365	\$158,843	\$8,624	(\$2,741)	\$147,017
1976	23.84%	\$11,365	\$182,638	\$11,377	\$12	\$182,081
1977	-7.18%	\$11,365	\$158,976	\$13,547	\$2,183	\$171,034
1978	6.56%	\$11,365	\$157,294	\$12,091	\$726	\$183,028
1979	18.44%	\$11,365	\$172,839	\$12,389	\$1,024	\$217,991
1980	32.42%	\$11,365	\$213,824	\$14,109	\$2,744	\$292,298
1981	-4.91%	\$11,365	\$192,519	\$17,964	\$6,600	\$284,221
1982	21.41%	\$11,365	\$219,939	\$16,425	\$5,061	\$351,217
1983	22.51%	\$11,365	\$255,525	\$19,175	\$7,810	\$439,845
1984	6.27%	\$12,776	\$257,969	\$22,588	\$9,812	\$477,850

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

Annuity assumes a Single Life Annuity, Age 65, 4% AIR, and mortality based on Annuity 2000 table, set back 2 years.



**EXHIBIT 10**

	S&P return	GMWB			Partial Annuity		
		Benefit Base	Payment	Actual Balance	Payment	Add (Withdraw)	Account Balance
1955	31.56%	\$100,000	\$5,000	\$124,982	\$5,000	\$0	\$32,584
1956	6.56%	\$124,982	\$6,249	\$126,522	\$6,325	\$76	\$34,803
1957	-10.78%	\$126,522	\$6,326	\$107,239	\$6,481	\$155	\$31,189
1958	43.36%	\$126,522	\$6,326	\$144,668	\$5,560	(\$766)	\$43,614
1959	11.96%	\$144,668	\$7,233	\$153,872	\$7,664	\$430	\$49,312
1960	0.47%	\$153,872	\$7,694	\$146,865	\$8,250	\$557	\$50,103
1961	26.89%	\$153,872	\$7,694	\$176,595	\$7,970	\$277	\$63,927
1962	-8.73%	\$176,595	\$8,830	\$153,119	\$9,725	\$895	\$59,163
1963	22.80%	\$176,595	\$8,830	\$177,188	\$8,534	(\$295)	\$72,289
1964	16.48%	\$177,188	\$8,859	\$196,069	\$10,077	\$1,218	\$85,620
1965	12.45%	\$186,069	\$9,303	\$198,773	\$11,286	(\$8,017)	\$87,265
1966	-10.06%	\$198,773	\$9,939	\$169,837	\$12,203	\$2,265	\$80,523
1967	23.98%	\$198,773	\$9,939	\$198,242	\$10,553	\$615	\$100,594
1968	11.06%	\$198,773	\$9,939	\$209,130	\$12,581	\$2,642	\$114,654
1969	-8.50%	\$209,130	\$10,457	\$181,786	\$13,435	\$2,978	\$107,634
1970	4.01%	\$209,130	\$10,457	\$178,200	\$11,820	\$1,364	\$113,369
1971	14.31%	\$209,130	\$10,457	\$191,748	\$11,821	\$1,365	\$131,152
1972	18.98%	\$209,130	\$10,457	\$215,700	\$12,993	\$2,537	\$159,063
1973	-14.66%	\$215,700	\$10,785	\$174,875	\$14,865	\$4,080	\$139,226
1974	-26.47%	\$215,700	\$10,785	\$120,655	\$12,198	\$1,413	\$103,411
1975	37.20%	\$215,700	\$10,785	\$150,742	\$8,624	(\$2,161)	\$138,916
1976	23.84%	\$215,700	\$10,785	\$173,323	\$11,377	\$592	\$172,766
1977	-7.18%	\$215,700	\$10,785	\$150,867	\$13,547	\$2,762	\$162,926
1978	6.56%	\$215,700	\$10,785	\$149,272	\$12,091	\$1,306	\$175,005
1979	18.44%	\$215,700	\$10,785	\$164,024	\$12,389	\$1,604	\$209,176
1980	32.42%	\$215,700	\$10,785	\$202,919	\$14,109	\$3,324	\$281,392
1981	-4.91%	\$215,700	\$10,785	\$182,700	\$17,964	\$7,179	\$274,402
1982	21.41%	\$215,700	\$10,785	\$208,722	\$16,425	\$5,640	\$340,000
1983	22.51%	\$215,700	\$10,785	\$242,492	\$19,175	\$8,390	\$426,812
1984	6.27%	\$242,492	\$12,125	\$244,812	\$22,588	\$10,463	\$464,693

## Assumptions:

Initial Balance of \$100,000 invested in a fund with net returns equal to the S&P 500.

Withdrawal equals 5% of current Benefit Base.

The Benefit Base is the greater of the current account balance or the prior year Benefit Base.

GMWB expenses are 65 basis point of beginning of year benefit base, paid at year-end.

Annuity assumes a Single Life Annuity, Age 65, 4% AIR, and mortality based on Annuity 2000 table, set back 2 years.

## **ABOUT THE AUTHORS**

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