Delivering Additional Income Through Lower-Cost Products and Services Available in the Defined Contribution Industry

An easy way for sponsors and advisors to improve financial wellness and retirement readiness programs

IRIC

INSTITUTIONAL RETIREMENT INCOME COUNCIL

Premise

Defined contribution (DC) plans can deliver more retirement income due to the lower cost of investment funds, deaccumulation solutions, and products. This paper will attempt to quantify the additional retirement income participants receive by keeping their assets in their DC plans through retirement versus utilizing noninstitutional funds and the services of an advisor/broker.

Assumptions and process

This paper will examine the lifetime income of a hypothetical participant who saves for retirement with lower-cost funds and chooses inexpensive deaccumulation solutions in retirement. We will attempt to quantify the additional retirement security that is achieved by these lower-cost investment and institutional distribution products and strategies that are now available in our DC system.

Investment assumptions

Everyone intuitively recognizes that DC plans provide participants access to lower-cost investment options and lower-cost distribution options than participants could obtain on their own or with the assistance of an advisor. Simply stated, DC plans use their institutional bargaining power to provide their participants better investment options and better deaccumulation options. For this paper, we will examine how the participant's balance at retirement is affected by a cost differential of 20 basis points, 40 basis points and 60 basis points[1] due to the better pricing achieved in retirement plans. We will then examine how deaccumulation options deliver additional income at retirement (age 65) through three different cost scenarios:

1. Non-guaranteed: Utilization of periodic payments or systematic withdrawals from the plan to create an income stream for the participant. Specifically, we will utilize the required minimum distribution factors to create a systematic withdrawal from their account with the same 20, 40 and 60 basis point differentials.

2. Guaranteed minimum withdrawal benefit from a variable annuity: We will use the expenses identified with three or four top insurers and the calculated cost difference between their retail guaranteed minimum withdrawal benefit (GMWB) and the GMWBs made available in their DC practices.[2] Based on the research completed, the fees difference between the

[1] Some of the research used to determine these differences include 401(k) book of averages; Difference in Vanguard funds between Investor share class and Institutional share class is approximately 19 basis points; For some mutual fund firms, 12b-1 fees often represent the difference between A shares at NAV and Institutional shares (12b-1 fees generally average about 25 basis points). For America funds, the average expense ratio for A shares at NAV (no sales load) was approximately 73 basis points, while R4, R5 and R6 shares were lower than their A share NAV offering counterpart by 2 basis points, 20 basis points and 36 basis points, respectively. There are many instances where qualified plans offer significantly lower cost differentials through CITs than the assumptions in this paper. Likewise, it is understood that due to index investing, ETFs and zero-cost mutual funds, savvy individuals can often create low-cost portfolios. The authors believe that an analysis of 20, 40 and 60 basis points differentials is a reasonable approach for analysis purposes.

[2] Several papers, research and interviews were used to approximate the cost differential between GMWBs in the DC market versus GMWBs in the individual market. In a 2013 report, The Next Evolution in DC Retirement Plan Design by Steve Vernon, the cost differential was determined to be approximately 200 basis points. In interviews with two prominent insurers who are members of IRIC, the cost differential of GMWBs offered in DC plans ranged from 1.2% to 1.6% lower than their retail counterparts. Also see testimony to the ERISA Advisory Council regarding Lifetime Income Solutions as a Qualified Default Investment Alternative (QDIA) — Focus on Decumulation and Rollovers by IRIC where findings include that a GMWB variable annuity offered by a typical insurance company on the retail side can have all-in fees at or above 3 where a GMWB offered by (those) same insurers on a DC institutional platform would have fees of approximately 1.5%, or half of the retail cost.

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institutional market and the retail market for GMWBs ranged from 2% to 1.2%. Due to fee sensitivity and awareness in the retail and DC market and believing that the fee difference may be getting smaller, the authors determined to use a 1% fee differential between low-cost GMWBs offered in DC plans versus some higher-cost GMWBs that are offered in the individual retail market.

3. Fixed deferred annuity/immediate annuity: We will review the pricing models utilized by insurers to price deferred fixed annuities and immediate annuities in the retail space versus how those models change when pricing the same or similar annuities in the DC market.[3] Specifically, we will determine the delta in annuity payout rates provided by insurers for their DC/institutional business.

Conclusion

The objective and conclusion of this paper is to provide plan sponsors a better understanding of the additional security they can provide to their plan participants by providing lower-cost investments and integrating lower-cost withdrawal strategies and products available in our DC marketplace. Due to the compounding effect over long periods of time, the additional income and security that can be provided through DC plans by using lower-cost investments and products is significant.

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Caveats

The paper would like to point out the advantages and value of having an advisor so that the paper is not seen as an assault on the advisory profession or value advisors bring to their clients. Research shows that clients who use an advisor generally are better off than clients who do not use an advisor. This paper is focused on additional income through lower cost and how those lower costs translate to additional security through the life of a participant, especially as it relates to decumulation products and solutions in the DC marketplace. Also, the reader should note that IRIC is not recommending any specific solution or product and recognizes that different assumptions, annuity rates, equity exposure and other factors will cause certain products to appear better than others. The only consistent conclusion is that lower cost generates significantly more income for plan participants over their retirement years.

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[3] IRIC determined that it is difficult to determine a cost differential within the Institutional market, as pricing and annuity rates depend on many factors as outlined in research paper by Cannex. See 2021 research, *How Competitive Are Income Annuity Providers Over Time?* However, for purposes of this paper, IRIC conservatively assigns an annuity rate of 25 and 50 basis points better for institutional markets versus the retail market. To substantiate this, IRIC interviewed insurance company actuaries who indicated rates could be at least 25 basis points lower due to no commissions in the institutional space. Other favorable pricing would be provided due to institutional bargaining position of a large DC plan, better anti-selection in a DC plan, lower distribution cost due to default scenarios and adoption through QDIA that provides new annuitants and new premiums automatically. Additionally, Hueler research found the following as outlined in a letter to the Employee Benefits Security Administration dated May of 2010: "Hueler recently conducted a 12-week analysis of institutional annuity quotes versus five possible annuity retail offerings for a $100,000 annuity. The results showed on a consistent basis that institutional quotes produced higher monthly income amounts than those available in the retail annuity market. When comparing institutional quotes to five retail sources on over 400 individual annuity quote scenarios, the average difference showed a 6.37% advantage over the retail sources. It is important to note that the maximum difference was in the double digits (approximately 15%) from a single provider retail offering. Over time, these differentials significantly impact the guaranteed income individuals receive." In today's annuity market a 6.37% differential represents approximately a 25-plus-basis-point advantage to the institutional market. Finally, antidotal research by the author indicates that higher annuity rates can still be obtained via the Hueler platform versus the retail marketplace for similar/identical fixed annuities of 25 to 50 basis points.

Summary of Findings

Accumulation: The analysis assumes a typical participant that starts her career shortly after graduating college at 23 years of age. The assumptions in her DC plan are as follows:

- We assume a starting salary of $39,000 with an average of a 4% raise each year through her career.
- We assume a savings rate of 6% with a matching contribution of 50% for each dollar contributed. We assume the 6% saving rate applies through her career, and we assume the same matching formula throughout her career.
- We assume a conservative asset allocation with an average 5% return for each year through her saving/accumulation years.
- As noted earlier, we determined that reasonable assumptions would include that the institutional funds available in DC plans would have lower costs than investments the participant could achieve on her own. We calculated three scenarios with the following results[4]:
  - If the Institutional investments had a modest 20-basis-point advantage, this participant would have approximately $46,500 in additional accumulated savings.
  - If the Institutional investments had a moderate 40-basis-point advantage, this participant would have approximately $95,800 in additional accumulated savings.
  - If the Institutional investments had a significant 60-basis-point advantage, this participant would have approximately $148,000 in additional accumulated savings.

Decumulation scenario #1 — systematic withdrawals: We now determine how decumulation strategies in DC plans compare with similar decumulation strategies the participant may pursue on her own or in conjunction with an advisor through a rollover IRA. The first such scenario assumes the participant withdrawals her assets using the current required minimum distribution table as the basis to determine the systematic withdraw amount each year using the following assumptions:

- Distributions begin at age 65.
- The three scenarios noted above where Institutional/lower-cost investments are assumed to have anywhere from a 20-basis-point advantage to a 60-basis-point advantage are used.
- We show the distributed amount and the remaining account balance through age 95.

In total, the additional income, additional account balance available for bequeath and overall aggregate benefit are significantly higher when Institutional or lower-cost funds are used. Table 1 summarizes the additional benefits and security. The analysis shows that participants should be able to receive an aggregate marginal benefit of at least $268,000 when the advantage of institutional shares is just 20 basis points lower and as much as $798,000 of additional lifetime security when the advantage is 60 basis points. **See Appendix #1 for details**.

In total, the additional income, additional account balance available for bequeath and overall aggregate benefit are significantly higher when Institutional or lower-cost funds are used.

Table 1. Decumulation Scenario #1: Systematic Withdrawals

	Institutional shares with a 20-basis-point advantage	Institutional shares with a 40-basis-point advantage	Institutional shares with a 60-basis-point advantage
Additional balance remaining in DC plan available for additional bequeath to beneficiary	$124,000	$220,000	$326,000
Additional income received by participant in DC plan	$144,000	$301,000	$472,000
Total marginal benefit by keeping assets in DC plan	$268,000	$521,000	$798,000

[4] See Appendix #1 for a detailed spreadsheet showing results of the hypothetical analysis using these assumptions.

Decumulation scenario #2 — guaranteed minimum withdrawal benefit: Next we assumed that the same participant utilized the plan's GMWB offering with the following assumptions:

- We assumed the participant maintained a 60/40 balance fund either in plan or if rolled over to an IRA.
- In footnote 2, we show how we derived the assumption that Institutional GMWBs have an overall cost that is approximately 1% lower than their higher-cost retail counterparts.
- We apply the fees to the market value of the GMWB but recognize some products calculate part of the fee against the income base and apply the fee to the market value.
- We assume the participant withdrawals her balance based on single life and begins distributions at age 65. Most products in the market will provide a 5% withdrawal rate (calculated against the income base or the market value, whichever is higher).
- We recognize that some retail products provide for "rollups" of the income base during accumulation where the income base will be the higher of the market value or the prior income base multiplied by 5%. These rollups are generally discontinued when withdrawals start (in this example, age 65). Additional product difference such as return of premium death benefits can exist, but the primary benefits of the guaranteed income and downside protection are consistent across all products. The cost difference drives the most significant difference in retirement security as displayed by the worksheets and summarized below.
- We apply the applicable 60/40 returns from 1990 to 2020 and again assume the participant lives to age 95.

As in the decumulation scenario #1, the participant in scenario #2 receives significantly more income and has a significantly higher balance at age 95 due to the lower cost in the institutionally priced products. Table 2 summarizes the higher income received over the life of the participant and the additional account value. Additionally, the detailed spreadsheet used to derive this information is provided in **Appendix #2.**

Table 2. Decumulation Scenario #2: Guaranteed Minimum Withdrawal Benefit

	Retail/Higher-cost version	Institutional/Lower-cost version	Additional income/security offered by the institutional offering over the life of the participant
Total lifetime income received by participant	$ 2,578,000	$ 2,803,000	$ 225,000
Market value at age 95	$488,000	$ 1,095,000	$ 607,000
Total aggregate benefit			**$ 832,000**

Decumulation scenario #3 — deferred fixed and immediate fixed annuities: For ease of example and to keep analysis simple, we applied a 5% annuity rate for the retail market and a 5.25% and 5.5% annuity rate for the institutional market (see footnote 3). And we assume that the annuity rate is the same for both deferred annuities (where a participant purchases income over the last five or 10 years before retirement but does not begin to receive guaranteed income until age 65) as well as immediate fixed annuities (where a participant purchases income upon retirement at age 65 and receives income shortly after the purchase of the annuity). IRIC does recognize the benefit of purchasing income over the last 10 years before retirement, as such a scenario allows a participant to purchase income over a longer time horizon and diversifies out of a single point in time (at retirement) where annuity rates may be comparatively low. By purchasing income over a longer time horizon, participants are purchasing income at different rates and through different market cycles, enabling them to have a guaranteed income stream in retirement without having a point-in-time risk for interest/annuity rates.

As in the two above scenarios, lower cost (better annuity rates) provides significantly better income for participants. **See Appendix #3.**

Table 3 summarizes the additional income received by participants with higher annuity rates through the institutional marketplace.

Table 3. Decumulation Scenario #3: Deferred Fixed and Immediate Fixed Annuities

Retail annuity income received through age 95	Institutional annuity income received through age 95 (25-basis-point differential)	Institutional annuity income received through age 95 (50 basis point differential)
$1,643,000	$1,725,000	$1,807,000

With a 25-basis-point differential , a participant would receive approximately $82,000 more in income through age 95, while a 50-basis-point advantage produces over $164,000 in additional income.

Conclusion: Plan sponsors can significantly improve the retirement readiness of their workforces by offering lower-cost income products.

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Appendix 1. Additional Accumulation During Saving Years for Hypothetical Participant

Typical 401(k) participant

Age 23 in the year 2021. Saves at the match rate (6%) for entire career. Match is $.50 on the dollar up to 6%. Investment gains average 5% per year

Age	Year	Salary	Raise (4% per year)	Saving at 6%	Match when saving 6%	Total Savings	Balance at end of year assuming 5% investment gain	Assume additional fee reduction of 20 bps or 5.2 percent return	Assume additional fee reduction of 40 bps or 5.4 percent return	Assume additional fee reduction of 60 bps or 5.6 percent return
23	2021	$39,000.00	$40,560.00	$2,340.00	$1,170.00	$3,510.00	$3,685.50	$3,692.52	$3,699.54	$3,706.56
24	2022	$40,560.00	$42,182.40	$2,433.60	$1,216.80	$3,650.40	$7,702.70	$7,724.75	$7,746.84	$7,768.95
25	2023	$42,182.40	$43,869.70	$2,530.94	$1,265.47	$3,796.42	$12,074.07	$12,120.27	$12,166.59	$12,213.03
26	2024	$43,869.70	$45,624.48	$2,632.18	$1,316.09	$3,948.27	$16,823.46	$16,904.11	$16,985.06	$17,066.33
27	2025	$45,624.48	$47,449.46	$2,737.47	$1,368.73	$4,106.20	$21,976.14	$22,102.84	$22,230.20	$22,358.20
28	2026	$47,449.46	$49,347.44	$2,846.97	$1,423.48	$4,270.45	$27,558.92	$27,744.71	$27,931.68	$28,119.85
29	2027	$49,347.44	$51,321.34	$2,960.85	$1,480.42	$4,441.27	$33,600.20	$33,859.65	$34,121.09	$34,384.55
30	2028	$51,321.34	$53,374.19	$3,079.28	$1,539.64	$4,618.92	$40,130.08	$40,479.45	$40,831.97	$41,187.66
31	2029	$53,374.19	$55,509.16	$3,202.45	$1,601.23	$4,803.68	$47,180.45	$47,637.86	$48,099.97	$48,566.85
32	2030	$55,509.16	$57,729.53	$3,330.55	$1,665.27	$4,995.82	$54,785.08	$55,370.63	$55,962.97	$56,562.19
33	2031	$57,729.53	$60,038.71	$3,463.77	$1,731.89	$5,195.66	$62,979.78	$63,715.74	$64,461.20	$65,216.28
34	2032	$60,038.71	$62,440.26	$3,602.32	$1,801.16	$5,403.48	$71,802.42	$72,713.42	$73,637.37	$74,574.47
35	2033	$62,440.26	$64,937.87	$3,746.42	$1,873.21	$5,619.62	$81,293.15	$82,406.36	$83,536.87	$84,684.97
36	2034	$64,937.87	$67,535.38	$3,896.27	$1,948.14	$5,844.41	$91,494.44	$92,839.81	$94,207.87	$95,599.02
37	2035	$67,535.38	$70,236.80	$4,052.12	$2,026.06	$6,078.18	$102,451.25	$104,061.73	$105,701.50	$107,371.13
38	2036	$70,236.80	$73,046.27	$4,214.21	$2,107.10	$6,321.31	$114,211.19	$116,122.96	$118,072.05	$120,059.22
39	2037	$73,046.27	$75,968.12	$4,382.78	$2,191.39	$6,574.16	$126,824.62	$129,077.37	$131,377.10	$133,724.85
40	2038	$75,968.12	$79,006.84	$4,558.09	$2,279.04	$6,837.13	$140,344.84	$142,982.06	$145,677.80	$148,433.45
41	2039	$79,006.84	$82,167.12	$4,740.41	$2,370.21	$7,110.62	$154,828.23	$157,897.49	$161,039.00	$164,254.54
42	2040	$82,167.12	$85,453.80	$4,930.03	$2,465.01	$7,395.04	$170,334.43	$173,887.74	$177,529.47	$181,261.95
43	2041	$85,453.80	$88,871.95	$5,127.23	$2,563.61	$7,690.84	$186,926.54	$191,020.67	$195,222.21	$199,534.15
44	2042	$88,871.95	$92,426.83	$5,332.32	$2,666.16	$7,998.48	$204,671.27	$209,368.14	$214,194.61	$219,154.45
45	2043	$92,426.83	$96,123.91	$5,545.61	$2,772.80	$8,318.41	$223,639.17	$229,006.26	$234,528.72	$240,211.35
46	2044	$96,123.91	$99,968.86	$5,767.43	$2,883.72	$8,651.15	$243,904.83	$250,015.60	$256,311.59	$262,798.80
47	2045	$99,968.86	$103,967.62	$5,998.13	$2,999.07	$8,997.20	$265,547.13	$272,481.46	$279,635.46	$287,016.57
48	2046	$103,967.62	$108,126.32	$6,238.06	$3,119.03	$9,357.09	$288,649.43	$296,494.15	$304,598.14	$312,970.58

Age	Year	Salary	Raise (4% per year)	Saving at 6%	Match when saving 6%	Total Savings	Balance at end of year assuming 5% investment gain	Assume additional fee reduction of 20 bps or 5.2 percent return	Assume additional fee reduction of 40 bps or 5.4 percent return	Assume additional fee reduction of 60 bps or 5.6 percent return
49	2047	$108,126.32	$112,451.37	$6,487.58	$3,243.79	$9,731.37	$313,299.84	$322,149.25	$331,303.31	$340,773.26
50	2048	$112,451.37	$116,949.43	$6,747.08	$3,373.54	$10,120.62	$339,591.49	$349,547.90	$359,860.82	$370,543.94
51	2049	$116,949.43	$121,627.41	$7,016.97	$3,508.48	$10,525.45	$367,622.78	$378,797.17	$390,387.13	$402,409.28
52	2050	$121,627.41	$126,492.50	$7,297.64	$3,648.82	$10,946.47	$397,497.71	$410,010.30	$423,005.61	$436,503.67
53	2051	$126,492.50	$131,552.20	$7,589.55	$3,794.78	$11,384.33	$429,326.14	$443,307.15	$457,846.99	$472,969.72
54	2052	$131,552.20	$136,814.29	$7,893.13	$3,946.57	$11,839.70	$463,224.13	$478,814.48	$495,049.77	$511,958.75
55	2053	$136,814.29	$142,286.86	$8,208.86	$4,104.43	$12,313.29	$499,314.28	$516,666.41	$534,760.66	$553,631.27
56	2054	$142,286.86	$147,978.34	$8,537.21	$4,268.61	$12,805.82	$537,726.11	$557,004.79	$577,135.07	$598,157.56
57	2055	$147,978.34	$153,897.47	$8,878.70	$4,439.35	$13,318.05	$578,596.36	$599,979.62	$622,337.59	$645,718.25
58	2056	$153,897.47	$160,053.37	$9,233.85	$4,616.92	$13,850.77	$622,069.49	$645,749.58	$670,542.53	$696,504.88
59	2057	$160,053.37	$166,455.50	$9,603.20	$4,801.60	$14,404.80	$668,298.01	$694,482.41	$721,934.49	$750,720.63
60	2058	$166,455.50	$173,113.72	$9,987.33	$4,993.67	$14,981.00	$717,442.96	$746,355.50	$776,708.93	$808,580.91
61	2059	$173,113.72	$180,038.27	$10,386.82	$5,193.41	$15,580.24	$769,674.35	$801,556.39	$835,072.78	$870,314.17
62	2060	$180,038.27	$187,239.80	$10,802.30	$5,401.15	$16,203.44	$825,171.69	$860,283.35	$897,245.14	$936,162.61
63	2061	$187,239.80	$194,729.40	$11,234.39	$5,617.19	$16,851.58	$884,124.43	$922,745.95	$963,457.94	$1,006,382.98
64	2062	$194,729.40	$202,518.57	$11,683.76	$5,841.88	$17,525.65	$946,732.58	$989,165.72	$1,033,956.70	$1,081,247.51
65	2063	$202,518.57	$210,619.32	$12,151.11	$6,075.56	$18,226.67	$1,013,207.22	$1,059,776.79	$1,109,001.27	$1,161,044.74
							Additional balance at retirement for each scenario	**$46,569.57**	**$95,794.06**	**$147,837.52**

Appendix 1a/Scenario 1. Additional Income Received Using the IRS-required Minimum Distribution Tables and Low-cost Institutional Funds

Balance at 5% return	$1,013,207.22	5.2 percent	5.4 percent	5.6 percent
Additional balance at retirement for each scenario		$46,569.57	$95,794.06	$147,837.52

Age	New starting balance	Balance as of 12/31 with 5% growth	RMD based on 5% return scenario	Balance as of 12/31 with 5.2% growth	RMD based on 5.2% return scenario	Balance as of 12/31 with 5.4% growth	RMD based on 5.4% return scenario	Balance as of 12/31 with 5.6% growth	RMD based on 5.6% return scenario
60	2.584%								
61	2.653%								
62	2.717%								
63	2.793%								
64	2.865%								
65	2.950%	$1,013,207.22		$1,059,776.79		$1,109,001.27		$1,161,044.74	
66	3.030%	$1,032,484.55	$29,888.60	$1,081,997.19	$31,262.36	$1,134,406.33	$32,714.43	$1,189,895.60	$34,249.66
67	3.125%	$1,051,257.03	$31,287.38	$1,103,768.32	$32,787.76	$1,159,432.06	$34,375.92	$1,218,453.14	$36,057.41
68	3.215%	$1,069,325.51	$32,851.78	$1,124,877.89	$34,492.76	$1,183,852.60	$36,232.25	$1,246,477.56	$38,076.66
69	3.322%	$1,086,689.54	$34,383.09	$1,145,321.41	$36,169.32	$1,207,659.50	$38,065.60	$1,273,956.62	$40,079.24
70	3.425%	$1,103,115.77	$36,103.09	$1,164,848.45	$38,051.01	$1,230,584.45	$40,122.07	$1,300,603.35	$42,324.66
71	3.534%	$1,118,604.23	$37,778.41	$1,183,453.60	$39,892.57	$1,252,616.42	$42,143.83	$1,326,401.04	$44,541.76
72	3.650%	$1,133,031.10	$39,527.00	$1,201,000.10	$41,818.52	$1,273,605.08	$44,262.45	$1,351,185.09	$46,869.71
73	3.774%	$1,146,263.99	$41,351.10	$1,217,341.16	$43,831.70	$1,293,388.26	$46,481.49	$1,374,777.08	$49,312.85
74	3.922%	$1,158,159.00	$43,255.42	$1,232,316.56	$45,937.59	$1,311,788.34	$48,807.30	$1,396,980.81	$51,878.59
75	4.065%	$1,168,377.67	$45,418.36	$1,245,557.52	$48,326.53	$1,328,403.89	$51,443.09	$1,417,359.83	$54,784.00
76	4.219%	$1,176,927.28	$47,494.55	$1,257,061.73	$50,631.91	$1,343,222.10	$53,999.62	$1,435,889.83	$57,615.68
77	4.367%	$1,183,631.41	$49,659.27	$1,266,630.38	$53,040.46	$1,356,019.68	$56,675.91	$1,452,320.91	$60,585.94
78	4.546%	$1,188,541.82	$51,686.82	$1,274,307.76	$55,311.22	$1,366,832.48	$59,214.67	$1,466,679.41	$63,419.95
79	4.733%	$1,191,242.49	$54,025.17	$1,279,636.07	$57,923.66	$1,375,157.08	$62,129.37	$1,478,412.14	$66,667.91
80	4.951%	$1,191,604.03	$56,381.51	$1,282,462.58	$60,565.18	$1,380,814.73	$65,086.18	$1,487,311.48	$69,973.25
81	5.155%	$1,189,244.35	$58,990.36	$1,282,360.94	$63,488.31	$1,383,330.20	$68,357.23	$1,492,848.32	$73,629.35
82	5.405%	$1,184,340.74	$61,300.79	$1,279,505.90	$66,100.58	$1,382,874.41	$71,305.14	$1,495,188.25	$76,950.36
83	5.650%	$1,176,338.51	$64,018.35	$1,273,281.35	$69,162.41	$1,378,763.24	$74,749.89	$1,493,571.91	$80,820.91
84	5.952%	$1,165,372.86	$66,459.60	$1,263,814.70	$71,936.58	$1,371,114.09	$77,895.99	$1,488,104.20	$84,382.33
85	6.250%	$1,150,805.46	$69,367.65	$1,250,393.94	$75,227.31	$1,359,132.89	$81,614.19	$1,477,899.75	$88,577.91
86	6.579%	$1,132,824.13	$71,925.34	$1,233,201.02	$78,149.62	$1,342,993.18	$84,945.81	$1,463,120.76	$92,368.73

Age	New starting balance		Balance as of 12/31 with 5% growth	RMD based on 5% return scenario	Balance as of 12/31 with 5.2% growth	RMD based on 5.2% return scenario	Balance as of 12/31 with 5.4% growth	RMD based on 5.4% return scenario	Balance as of 12/31 with 5.6% growth	RMD based on 5.6% return scenario
87	6.944%		$1,111,211.60	$74,527.37	$1,211,977.60	$81,131.06	$1,322,389.51	$88,354.18	$1,443,407.86	$96,257.25
88	7.299%		$1,085,746.85	$77,166.98	$1,186,459.30	$84,164.57	$1,297,007.60	$91,832.02	$1,418,389.47	$100,236.02
89	7.752%		$1,056,819.68	$79,251.92	$1,157,048.59	$86,603.22	$1,267,261.22	$94,672.48	$1,388,488.96	$103,532.50
90	8.197%		$1,023,640.88	$81,923.60	$1,122,857.82	$89,693.25	$1,232,151.71	$98,236.82	$1,352,582.54	$107,634.28
91	8.696%		$986,722.91	$83,904.77	$1,084,423.20	$92,037.29	$1,192,238.36	$100,995.78	$1,311,251.47	$110,867.13
92	9.259%		$945,966.47	$85,802.46	$1,041,611.51	$94,298.19	$1,147,347.39	$103,673.47	$1,264,273.80	$114,022.49
93	9.901%		$901,295.43	$87,589.87	$994,314.19	$96,445.94	$1,097,331.05	$106,236.34	$1,211,454.71	$117,062.90
94	10.526%		$852,661.07	$89,237.26	$942,452.23	$98,447.05	$1,042,073.25	$108,646.75	$1,152,633.06	$119,946.13
	11.236%	**Remaining balance for bequeth**	$762,907.41	$89,753.66	$887,095.72	$99,205.35	$982,730.10	$109,691.76	$1,089,056.44	$121,329.61
	11.905%									
	12.821%	**Tot withdrawals using RMDs through age 95**		**$1,772,311.54**		**$1,916,133.25**		**$2,072,962.02**		**$2,244,055.18**
	13.699%									
	14.706%									
	15.625%									
	TOTAL additional bequeth				**$124,188.31**		**$219,822.69**		**$326,149.03**	
	TOTAL additional income				**$143,821.71**		**$300,650.48**		**$471,743.64**	
	TOTAL marginal accumulative benefit				**$268,010.02**		**$520,473.17**		**$797,892.66**	

Appendix 2/Scenario 2. Additional Income Using an Institutional GMWB Contract as an Investment Option

Balance at 5% return	$1,013,207.22
Balance using 5.2% return for Institutional scenario	$1,059,776.79

Additional balance at retirement for each scenario, beginning at at 65

Age	Market return of a 60/40 balance fund. Actual returns used from 1990 to 2020 beging at age 65.*	Balance as of age 65 (BOY) from spread sheet #1 assuming 20 bps scenario	Market value for retail / higher cost GMWB at end of year	Average annual retail fee of 2.70%	Withdrawal of 5% single life retail / higher cost GMWB at end of year	Income Base - retail GMWB	Market Value for Inst / lower cost GMWB at end of year	Average annual retail fee of 1.70%	Withdrawal of 5% single life Inst / lower cost GMWB at end of year	Income Base of Inst GMWB
65	–0.19%		$976,160.40	$28,613.97	$52,988.84	$1,059,776.79	$986,758.17	$18,016.21	$52,988.84	$1,059,776.79
66	25.53%		$1,146,028.98	$26,356.33	$52,988.84	$1,146,028.98	$1,168,913.80	$16,774.89	$52,988.84	$1,168,913.80
67	8.32%		$1,153,134.36	$30,942.78	$57,301.45	$1,153,134.36	$1,187,850.21	$19,871.53	$58,445.69	$1,187,850.21
68	10.25%		$1,182,539.29	$31,134.63	$57,656.72	$1,182,539.29	$1,230,018.89	$20,193.45	$59,392.51	$1,230,018.89
69	–1.16%		$1,077,766.31	$31,928.56	$59,126.96	$1,182,539.29	$1,133,339.40	$20,910.32	$61,500.94	$1,230,018.89
70	28.74%		$1,299,289.69	$29,099.69	$59,126.96	$1,299,289.69	$1,378,293.43	$19,266.77	$61,500.94	$1,378,293.43
71	14.01%		$1,381,274.87	$35,080.82	$64,964.48	$1,381,274.87	$1,479,046.68	$23,430.99	$68,914.67	$1,479,046.68
72	22.37%		$1,583,907.89	$37,294.42	$69,063.74	$1,583,907.89	$1,710,813.30	$25,143.79	$73,952.33	$1,710,813.30
73	17.39%		$1,737,388.57	$42,765.51	$79,195.39	$1,737,388.57	$1,893,699.24	$29,083.83	$85,540.67	$1,893,699.24
74	13.98%		$1,846,496.57	$46,909.49	$86,869.43	$1,846,496.57	$2,031,560.55	$32,192.89	$94,684.96	$2,031,560.55
75	–1.79%		$1,671,264.05	$49,855.41	$92,324.83	$1,846,496.57	$1,859,081.06	$34,536.53	$101,578.03	$2,031,560.55
76	–3.21%		$1,480,167.51	$45,124.13	$92,324.83	$1,846,496.57	$1,666,222.15	$31,604.38	$101,578.03	$2,031,560.55
77	–8.98%		$1,214,959.12	$39,964.52	$92,324.83	$1,846,496.57	$1,386,691.60	$28,325.78	$101,578.03	$2,031,560.55
78	20.04%		$1,333,308.20	$32,803.90	$92,324.83	$1,846,496.57	$1,539,432.81	$23,573.76	$101,578.03	$2,031,560.55
79	9.37%		$1,329,915.03	$35,999.32	$92,324.83	$1,846,496.57	$1,555,929.28	$26,170.36	$101,578.03	$2,031,560.55
80	4.74%		$1,264,720.47	$35,907.71	$92,324.83	$1,846,496.57	$1,501,651.50	$26,450.80	$101,578.03	$2,031,560.55
81	11.12%		$1,278,885.10	$34,147.45	$92,324.83	$1,846,496.57	$1,541,529.04	$25,528.08	$101,578.03	$2,031,560.55
82	5.99%		$1,228,635.59	$34,529.90	$92,324.83	$1,846,496.57	$1,506,082.61	$26,205.99	$101,578.03	$2,031,560.55
83	–19.44%		$864,290.84	$33,173.16	$92,324.83	$1,846,496.57	$1,086,118.72	$25,603.40	$101,578.03	$2,031,560.55
84	18.79%		$911,030.41	$23,335.85	$92,324.83	$1,846,496.57	$1,170,158.38	$18,464.02	$101,578.03	$2,031,560.55
85	12.93%		$911,904.00	$24,597.82	$92,324.83	$1,846,496.57	$1,199,989.14	$19,892.69	$101,578.03	$2,031,560.55
86	3.75%		$829,154.16	$24,621.41	$92,324.83	$1,846,496.57	$1,123,010.89	$20,399.82	$101,578.03	$2,031,560.55

*From http://www.lazyportfolioetf.com/allocation/stocks-bonds-60-40/; Vanguard Total Stock Market: simulated. BND - Vanguard Total Bond Market: simulated

Additional balance at retirement for each scenario, beginning at at 65										
Age	Market return of a 60/40 balance fund. Actual returns used from 1990 to 2020 beging at age 65.*	Balance as of age 65 (BOY) from spread sheet #1 assuming 20 bps scenario	Market value for retail / higher cost GMWB at end of year	Average annual retail fee of 2.70%	Withdrawal of 5% single life retail / higher cost GMWB at end of year	Income Base - retail GMWB	Market Value for Inst / lower cost GMWB at end of year	Average annual retail fee of 1.70%	Withdrawal of 5% single life Inst / lower cost GMWB at end of year	Income Base of Inst GMWB
87	11.13%		$806,727.03	$22,387.16	$92,324.83	$1,846,496.57	$1,127,332.79	$19,091.19	$101,578.03	$2,031,560.55
88	19.23%		$847,754.18	$21,781.63	$92,324.83	$1,846,496.57	$1,223,376.20	$19,164.66	$101,578.03	$2,031,560.55
89	9.85%		$816,043.77	$22,889.36	$92,324.83	$1,846,496.57	$1,221,503.34	$20,797.40	$101,578.03	$2,031,560.55
90	0.44%		$705,276.35	$22,033.18	$92,324.83	$1,846,496.57	$1,104,534.37	$20,765.56	$101,578.03	$2,031,560.55
91	8.71%		$655,338.63	$19,042.46	$92,324.83	$1,846,496.57	$1,080,384.20	$18,777.08	$101,578.03	$2,031,560.55
92	14.15%		$638,050.08	$17,694.14	$92,324.83	$1,846,496.57	$1,113,314.00	$18,366.53	$101,578.03	$2,031,560.55
93	–3.17%		$508,271.71	$17,227.35	$92,324.83	$1,846,496.57	$957,517.58	$18,926.34	$101,578.03	$2,031,560.55
94	21.94%		$513,738.36	$13,723.34	$92,324.83	$1,846,496.57	$1,049,741.12	$16,277.80	$101,578.03	$2,031,560.55
95	15.70%		$488,199.52	$13,870.94	$92,324.83	$1,846,496.57	$1,095,126.84	$17,845.60	$101,578.03	$2,031,560.55
		Total withdrawals			$2,578,104.22				$2,803,048.98	

*From http://www.lazyportfolioetf.com/allocation/stocks-bonds-60-40/; Vanguard Total Stock Market: simulated. BND - Vanguard Total Bond Market: simulated

Appendix 3/Scenario 3. Additional Income When Using Institutional Fixed-income Annuities and Deferred Annuities

Age	Balance as of age 65 (BOY) from spread sheet #1 assuming 20 bps scenario	Annuitized at 5% til age 95	Annuitized at 5.25% til age 95	Annuitized at 5.5% til age 95
65	$1,059,776.79	$52,988.84	$55,638.28	$58,287.72
66		$52,988.84	$55,638.28	$58,287.72
67		$52,988.84	$55,638.28	$58,287.72
68		$52,988.84	$55,638.28	$58,287.72
69		$52,988.84	$55,638.28	$58,287.72
70		$52,988.84	$55,638.28	$58,287.72
71		$52,988.84	$55,638.28	$58,287.72
72		$52,988.84	$55,638.28	$58,287.72
73		$52,988.84	$55,638.28	$58,287.72
74		$52,988.84	$55,638.28	$58,287.72
75		$52,988.84	$55,638.28	$58,287.72
76		$52,988.84	$55,638.28	$58,287.72
77		$52,988.84	$55,638.28	$58,287.72
78		$52,988.84	$55,638.28	$58,287.72
79		$52,988.84	$55,638.28	$58,287.72
80		$52,988.84	$55,638.28	$58,287.72
81		$52,988.84	$55,638.28	$58,287.72
82		$52,988.84	$55,638.28	$58,287.72
83		$52,988.84	$55,638.28	$58,287.72
84		$52,988.84	$55,638.28	$58,287.72
85		$52,988.84	$55,638.28	$58,287.72
86		$52,988.84	$55,638.28	$58,287.72
87		$52,988.84	$55,638.28	$58,287.72
88		$52,988.84	$55,638.28	$58,287.72
89		$52,988.84	$55,638.28	$58,287.72
90		$52,988.84	$55,638.28	$58,287.72
91		$52,988.84	$55,638.28	$58,287.72
92		$52,988.84	$55,638.28	$58,287.72
93		$52,988.84	$55,638.28	$58,287.72
94		$52,988.84	$55,638.28	$58,287.72
95		$52,988.84	$55,638.28	$58,287.72
		$1,642,654.03	$1,724,786.73	$1,806,919.43
		Marginal benefit in income	**$82,132.70**	**$164,265.40**