Comparing Strategies for Retirement Wealth Management: Mutual Funds and Annuities

by Gaobo Pang, Ph.D., and Mark J. Warshawsky, Ph.D.

Gaobo Pang, Ph.D., senior economist at Watson Wyatt Worldwide, a global human capital consulting firm, focuses on pension finance and investment. Earlier at World Bank, he conducted macroeconomic research on sovereign debt, growth, and public spending.

Mark J. Warshawsky, Ph.D., director of retirement research at Watson Wyatt Worldwide, conducts and oversees research on employer-sponsored retirement programs and policies, Social Security, insurance products, financial planning, and healthcare financing.

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Executive Summary

- This article compares wealth management strategies for individuals in retirement, focusing on trade-offs regarding wealth creation and income security. Specifically, it compares the following six strategies: (1) systematic withdrawal from mutual funds, (2) fixed payout immediate life annuity, (3) immediate variable annuity for life, (4) variable annuity plus guaranteed minimum withdrawal benefit (VA+GMWB), (5) mix of withdrawals from mutual funds and fixed payout immediate life annuity, one-time wealth split at retirement, and (6) mix of mutual fund withdrawals and fixed payout life annuity, gradual annuitization at certain ages.
- Systematic withdrawals from mutual funds usually give opportunities for greater wealth creation at the risk of large investment losses and income shortfalls.
- Fixed and variable life annuities forgo bequest considerations and distribute the highest incomes.
- A variable annuity with guaranteed minimum withdrawal benefit (VA+GMWB) somewhat addresses both income need and wealth preservation.
- Mixes of mutual funds and fixed life annuities deliver solutions broadly similar to, and even more flexible than, a VA+GMWB strategy.
- Defined contribution plan participants should be aware of contract terms, because fees and charges play a nontrivial role in altering wealth creation and income levels. In-plan institutional pricing of funds may provide better opportunities than lump sum purchase on retail terms.
- None of the strategies obviously dominates, so the best advice may be to segment wealth to establish minimum necessary consumption and hedge against longevity risk, then focus on growth opportunities. Investors should also optimize portfolios to account for benefits from defined benefit plans and Social Security.

As workers retire with their financial assets predominantly in 401(k) plans and IRAs, they need to select a sound strategy to manage their wealth. The strategy should generate a reliable flow of income in retirement and preserve and grow resources for varied needs at advanced ages, as well as, possibly, a bequest. In short, the strategy should deliver financial security, flexibility, and growth.

We compare several wealth management strategies for retirees: systematic withdrawals from mutual funds, one-time complete or partial conversion to fixed or variable payout annuities, years-long phased conversion to fixed life annuities, and variable annuities with the new innovation of a guaranteed minimum withdrawal benefit (VA+GMWB). We assess trade-offs for wealth creation and income security. Values are measured in terms of real purchasing power, that is, after adjustment for inflation. Various asset allocations and levels of fees are considered. The analysis focuses exclusively on qualified accounts, for example, a retired middle-class household in which 401(k) plans and IRAs are the main retirement financial assets. We thus ignore the issue of differential tax treatments for mutual fund withdrawals and annuity payouts in non-qualified accounts.[1]

The simulations show that these strategies cater to varying risk preferences or desired priorities. Systematic withdrawals from mutual funds imply opportunities for greater wealth creation, possibly meeting the needs for bequest, emergency liquidity, and/or uninsured health costs, but this strategy entails large risk of investment losses and bumpy incomes. Absent provisions in their retirement plans, investors may want to use fixed or variable life annuities, which distribute the highest life-long incomes. When investors want to address income and wealth needs, a VA+GMWB offers an alternative. This strategy, however, only delivers nominal income stability and does not necessarily dominate systematic withdrawals in real terms. A mix of mutual funds and life annuities works similarly to VA+GMWB and seems to provide more flexibility in striking a balance between the goals of income maximization and wealth preservation. These findings are based on assumptions that are consistent with the generic products on the market and their average levels of fees and charges. Wealth and income generated will vary substantially when different levels of fees apply, arising from factors such as group bargaining, market competition, product differentiation, and so on.

Building Blocks for Retirement Wealth Management

Strategy 1: Systematic withdrawal from mutual funds. Investors in this strategy are assumed to take a systematic withdrawal as a constant percentage of mutual fund balance in each period.[2] This strategy, by design, will not exhaust the wealth entirely, although it may come close to low or zero dollars in highly adverse situations, and thus implicitly assumes some self-discipline on the part of investors especially in these circumstances. The strategy provides liquidity to investors and bequests potential to their heirs. It allows investors to increase consumption when mutual funds perform well, but also exposes them to significant declines in consumption when investment outcomes are poor.[3]

Strategy 2: Fixed payout immediate life annuity. Retirees in this strategy are assumed to make a one-time purchase of a fixed nominal payout straight life annuity, converting all wealth accumulated. Without an annuity, retirees' income flow and consumption hinge on the speed at which they draw down wealth, in addition to investment success or failure. Retirees may outlive their financial resources if they consume too fast, especially in the context of ever-increasing life expectancy. Or, they may be overly cautious and accept a lower standard of living than their wealth can support. It is a challenge to weigh the considerations. Immediate life annuities, as suggested by various studies, are products that address well the longevity risk and offer a steady flow of income. We use the most widely available annuities that pay fixed nominal benefits for life, and we adjust the payments for inflation to get real values.[4]

Traditional fixed-payout immediate annuities are subject to adverse selection by groups with low mortality expectations, typically do not allow transfer of wealth upon death of the investors, and face timing risk in the purchase price. Adverse selection increases the cost to investors with average or high mortality expectations. The annuity prices are closely determined by, and thus lifetime payout levels are sensitive to, changes in interest rates at time of purchase.[5] It should be noted that various enhancements are available for fixed (and variable) annuities. Such features as guaranteed periods and death benefits, which are not analyzed here, are designed to meet liquidity and bequest needs. In exchange for these features, the level of income delivered to investors will be reduced relative to straight life annuities.

Strategy 3: Immediate variable annuity for life. In this strategy, retirees are assumed to purchase an immediate variable straight life annuity that delivers variable income for life, with no residual. At the time of purchase, the investor selects an assumed interest rate (AIR). This AIR together with the insurer's mortality guarantee determines how many annuity units the investor gets. The annual payout, conditional on survival, is equal to the number of annuity units multiplied by the value of each unit. The number of units remains fixed from the VA issue date onward unless funds are transferred into or out of the VA account. The unit value evolves with the net investment performance of the underlying funds relative to the AIR. The net performance is the gross investment returns net of fund management and insurance fees. The VA payout stream will rise (fall) if the net investment return is higher (lower) than the AIR, or will remain constant if they coincide. The VA investor can deliberately choose a higher AIR to receive larger annuity payouts in earlier years, or choose a lower AIR to tilt the expected benefits to later life.

Strategy 4: Variable annuity plus guaranteed minimum withdrawal benefit (VA+GMWB). The addition of a guaranteed minimum withdrawal benefit rider to conventional deferred variable annuities is one of the recent innovations in annuity products. VA investors choose among the lineups of underlying mutual funds offered by the VA providers. Many variable annuities also carry a death benefit. To make a consistent comparison, this analysis only considers annuities with a common level of basic death benefits (with the remaining account value paid to beneficiaries) and the corresponding insurance fees.

The appeal of VA+GMWB to investors lies in the protection against market declines and the opportunity to profit when the market booms. The actual withdrawal amounts vary with asset portfolios and returns, but the minimum is guaranteed by the rider to be a certain percentage of the nominal guaranteed income base (GIB). The GIB is non-decreasing and can step up on the rider anniversary date if the market performs well.

For instance, consider a $10,000 investment on VA+GMWB with a 5 percent

withdrawal rate; the initial account value and GIB are both $10,000. Suppose there is a 20 percent loss on the investment portfolio in one year, and the account value shrinks to $8,000. The investor is guaranteed the payout of $500 (0.05 × 10,000) in the coming years, regardless of investment losses. If the investment realizes a 20 percent gain instead, the GIB can be reset as $12,000 on the next anniversary date and the investor will get annual payout of $600 (0.05 × 12,000) thereafter. The investor here is assumed to buy the guarantee rider on the bump-up in value. In short, the GIB is the up-to-date highest watermark of account values and is used to calculate the guaranteed annual income level. The account value is the actual market value of the portfolio that fluctuates with investment performance and may be reduced to zero after subtraction of payouts and fees. Note that the extra GMWB rider fee does not have a direct effect on the GIB or the resulting income payouts. This fee, however, reduces the account value, depresses the likelihood of the GIB step-ups, and therefore, has a potential negative effect on the future income stream.

As a variable annuity, this product has the usual mortality and expense charges that are based on the account value. In exchange for the GMWB coverage, investors need to pay an additional rider fee annually on the guaranteed income base. For simplicity, this analysis assumes that investors purchase VA+GMWB for life.[6]

Strategy 5: Mix of withdrawals from mutual funds and fixed payout immediate life annuity, one-time wealth split at retirement. An investor may consider a more complex strategy. Perhaps the most natural composite lineup is a mutual fund systematic withdrawal plus a fixed payout life annuity. Investors adopting such a strategy get a certain percentage of the mutual fund balance in addition to the annuity payout. The former product gives the investors liquidity, flexibility, bequest potential, and opportunities to realize higher returns on the stock market, while the latter guarantees a consumption floor. The specific split of wealth between the two underlying products is essentially determined by the investors' levels of risk tolerance, their bequest motives, and the influences of market terms at the time of purchase.

Strategy 6: Mix of mutual fund withdrawals and fixed payout life annuity, gradual annuitization at certain ages. To make income levels less skewed by one-time conditions in the annuity market, investors in this strategy allocate a larger fraction of wealth to mutual funds in the early years of retirement, escalate the shift to a fixed life annuity with increasing age, and eventually convert all mutual funds into a fixed annuity by a certain age. This phased annuitization will ease the effect of annuity rate fluctuations over time and may help circumvent the psychological obstacle to the (irreversible) purchase of life annuity. A larger mutual fund may facilitate greater wealth creation, leaving a potentially larger bequest in the event of early death. Investors, however, face the accompanying risk—they may not make much or may even lose money in the mutual funds if the equity premium fails to materialize. Wealth loss during the transition can be large, as in Strategy 1.[7]

More Details of the Wealth Management Strategies

Investors are assumed to retire at age 65, with stochastic mortality before the maximum lifespan of 100. Assuming an older age for retirement will not change the comparison of strategies. Investors have initial wealth of $1 million, which can be rescaled to assess alternative economic and personal situations. Consistent with legal restrictions for qualified retirement plans, a unisex mortality table is used in the simulations.

Risk tolerance and asset allocations. Reflecting a generally higher risk aversion of the older population, we assume that investors desire an equal proportion of wealth, a 50-50 split, in high-risk assets (equity) and relatively low-risk assets (bonds or annuities). With wealth being annuitized, the equity share in the remaining assets will correspondingly increase (up to 100 percent) so as to maintain the same overall risk exposure. The whole wealth portfolio may nonetheless deviate from this 50-50 ideal and tilt toward low-risk assets when the non-annuitized wealth is a much smaller size, as a share of net worth.

Specifically, the equity-bond allocation in Strategy 1 is always balanced at 50-50. Investors in Strategy 2 are life annuity price takers (see below about annuity pricing) and skip asset allocation altogether. The same 50-50 asset split is assumed for the underlying investment of the VA and the VA+GMWB in Strategies 3 and 4, respectively. (We later apply a 70-30 mix in the VA+GMWB strategy to allow investors to deliberately choose more aggressive portfolios given the benefit of downside protections of the GMWB. An increase in rider fees, if tied to the portfolio change, will also alter the results. See more discussions below.) In Strategy 5, we somewhat arbitrarily assume that investors at retirement choose to convert 30 percent of their initial wealth to a fixed payout life annuity and invest the remaining 70 percent in mutual funds.[8] Leveraged by the annuity, the equity-bond split in the mutual fund portfolio is adjusted toward more equity to maintain the 50-50 overall risk exposure. In Strategy 6, investors are assumed to make a phased annuitization from age 65 through 75. As the annuity comprises an increasing share of wealth, the equity-bond proportion is dynamically adjusted toward equity, until the maximum 100 percent of the remaining mutual fund portfolio is in equities. Although returns on life annuities generally improve with age because of the mortality credit, actual total fixed payouts may differ substantially because of the stochastic ups and downs in annuity prices over time owing to changing interest rates.

Asset returns and inflation. Equities and bonds are proxied by the S&P 500 and the U.S. Government Bonds Total Return indexes, respectively. Inflation is measured

by the change in the CPI-U index. The dynamics of asset returns and inflations are modeled as a vector autoregressive (VAR) process. The VAR coefficients and variance-covariance matrix, estimated on the 1962–2008 quarterly data, are embedded in the simulations to generate a large number of 36-year series of rates and returns. This approach captures the serial correlations among variables and the contemporaneous correlations of market shocks. Moreover, the VAR-based simulations reproduce the persistent structural shifts or long-run mean reversions of variables, the differing short- and long-term correlations between them, and the changing risk-return trade-off of bonds and stocks across investment horizons (a "term structure"). These characteristics are observed prominently in the historical data.[9] The simulated average value is 4 percent for inflation rate (with standard deviation of 2.8 percent), 8.8 percent for equity return (17.1 percent), and 6.4 percent for bond return (6.7 percent). The data-based simulations show equity and bond returns are significantly positively correlated with inflation over long horizons (10-year frequency), though negative correlations hold in the short term (annual frequency).[10]

Annuity pricing. The underlying assets for fixed life annuities are assumed to be invested in nominal bonds.[11] The calculation of the annuity cost factor uses the government bond yield, which is stochastic through time. Insurance companies also invest in corporate bonds, which have somewhat higher yields, but we assume that the credit spread is used to cover marketing, administration, and other costs as well as bond defaults. The use of life tables for annuitants, rather than those for general population, in pricing implicitly incorporates a good part of the load, which reflects adverse selection in the immediate annuity market. In the pricing of the immediate variable annuity, the same annuitant life tables apply. The AIR is set equal to the average nominal bond yield. The VA contracts also charge fund management and insurance fees.[12]

Table 1: Fees and Charges by Mutual Funds and Variable Annuities

	a. Mutual Fund Expense Ratio			b. Fees & Charges by Variable Annuities	
	i. Conservative asset allocation	ii. Moderate asset allocation	i & ii Together	Insurance charges (M&E&A)	Rider fee for guarantee
Mean (%)	1.28	1.06	1.17	1.22	0.63
Std. Dev. (%)	0.47	0.52	0.50	0.39	0.39
Min (%)	0.15	0.08	0.08	0.25	0.40
Max (%)	2.18	2.21	2.21	1.75	2.00
No. of Obs.	100	100	200	47	29

Notes:

1. Mutual fund expense ratio includes investment management fee, 12b-1 fees, and other expenses. Conservative (moderate) asset allocation reflects the category of mutual funds with relatively low (moderate) risk of fluctuations in asset values and correspondingly lower (higher) return potential.
2. Insurance charges (M&E&A) in variable annuities include mortality and expense risk charges and administrative fees. The calculation in this table considers M&E&As without death benefits or with base death benefits (that is, heirs receive payback of premium if the contract owner dies in the accumulation stage, or account value, but no minimum death benefit guaranteed, in the income stage). Few firms on the market offer plain contracts with no death benefits.
3. This table only considers GMWB rider fees with annual automatic step-up of guaranteed income base. The contract terms of variable annuities on the market vary significantly with regard to maximum issue age, frequency of GIB step-up, rider fee increase upon GIB step-up, guaranteed minimum withdrawal percentage, guarantee coverage period, etc.

Source: For mutual funds, authors' calculations are based on the 100 largest balanced mutual funds (by assets) in each category of asset allocation that are covered by www.morningstar.com, March 2008. For variable annuities, the authors' collected data is from 15 issuing companies, March 2008.

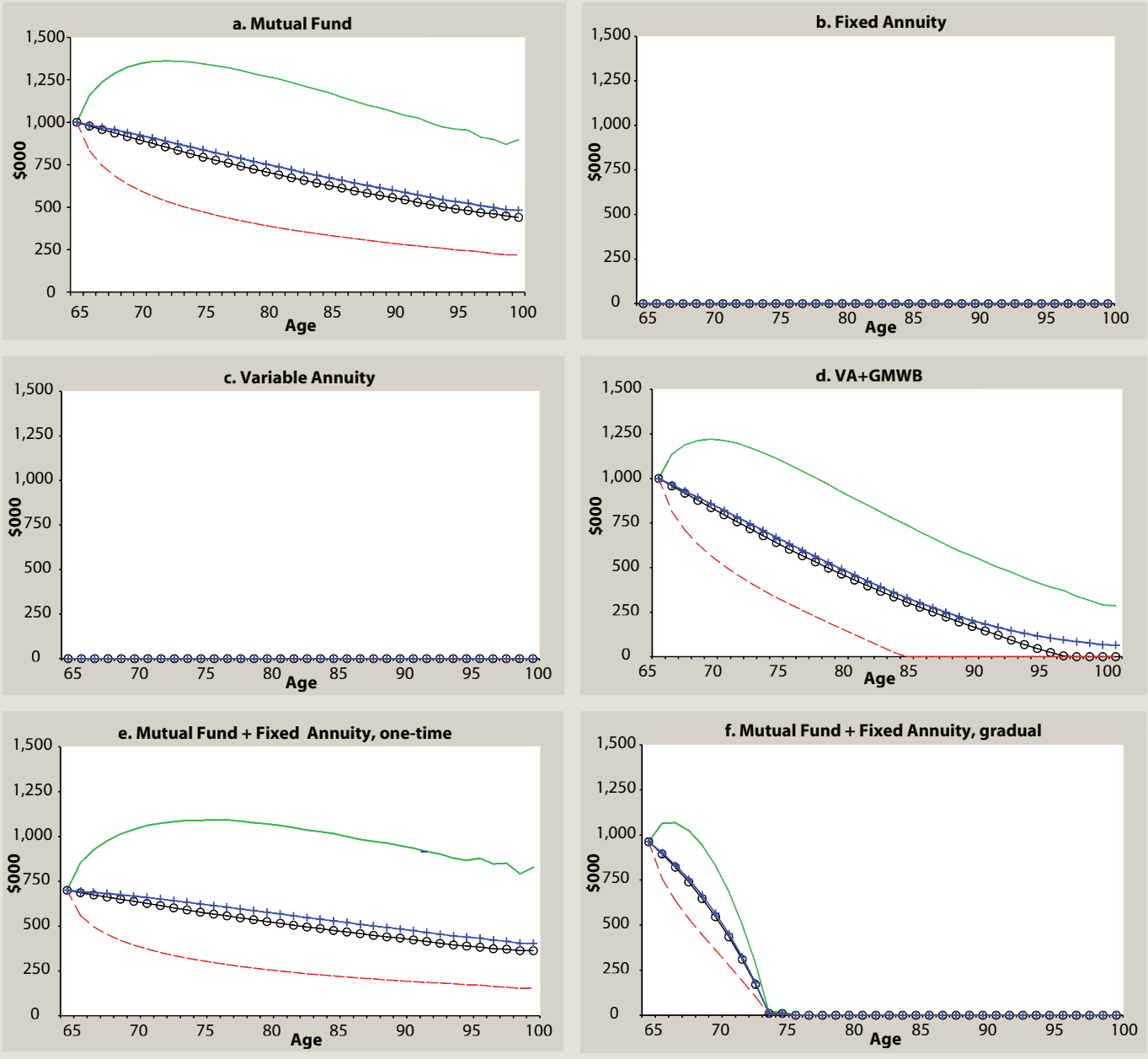
Discretionary wealth balance and income flows. The wealth at an investor's discretion is the mutual fund balance in Strategies 1, 5, and 6. It is zero by definition in the case of one-time full conversion to the fixed life annuity in Strategy 2 or to the VA in Strategy 3. The wealth balance is the account value (if greater than zero) of the VA+GMWB contract in Strategy 4. Consumptions in each period are equal to income flows, which are the 5 percent withdrawal of mutual funds (Strategy 1), or the annuity payouts (fixed in Strategy 2 and variable in Strategies 3 and 4), or a combination of them (Strategies 5 and 6). All data is reported in real terms, that is, inflation-adjusted, as we explain further below.

Fees and charges. Mutual funds and variable annuities charge certain fees and expenses. Based on the average market level of fees for balanced funds sold to retail investors, say, for their IRAs, as reported in Table 1a, we assume that the annual expense ratio for retail mutual funds is 1.2 percent (rounded, same below). For consistency, this same expense is applied to the underlying funds in variable annuities. Variable annuities are assumed to charge an additional 1.2 percent annually on the account value for mortality, expense, and administrative (M&E&A) fees. For the GMWB rider, the VA+GMWB product is assumed to charge 0.6 percent on the GIB, taken from the account balance. These fees are based on market averages, as reported in Table 1b. No sufficient public information exists to allow estimates of institutional pricings. Nonetheless, we discuss group offerings later and illustrate their possible effects if they result in lower fees.

Simulation Results: Trade-offs Between Success, Gain, and Risk Baseline Simulations. We run a large number of simulations (100,000 times), each corresponding to a 36-year path (including age 65) of stochastic outcomes of wealth and income as well as deaths. We assume the investor consumes the withdrawals and annuity payouts (no reinvestment) and the wealth balances plus investment returns carry to the next period.

To evaluate these management strategies, we adjust all wealth and income values by the stochastic realizations of inflation so as to get retirees' real purchasing power. We use several measures of success and risk. First, for real wealth balances among survivors, we identify the average, the 50th percentile (median, most likely), the 5th percentile (bad), and the 95th percentile (good) outcomes. Figure 1 plots the results. The mutual fund investment has the highest upside potential (Figure 1a), with increasing value at possible stake, while the full

Figure 1: Outcome of Real Wealth Balances for Survivors

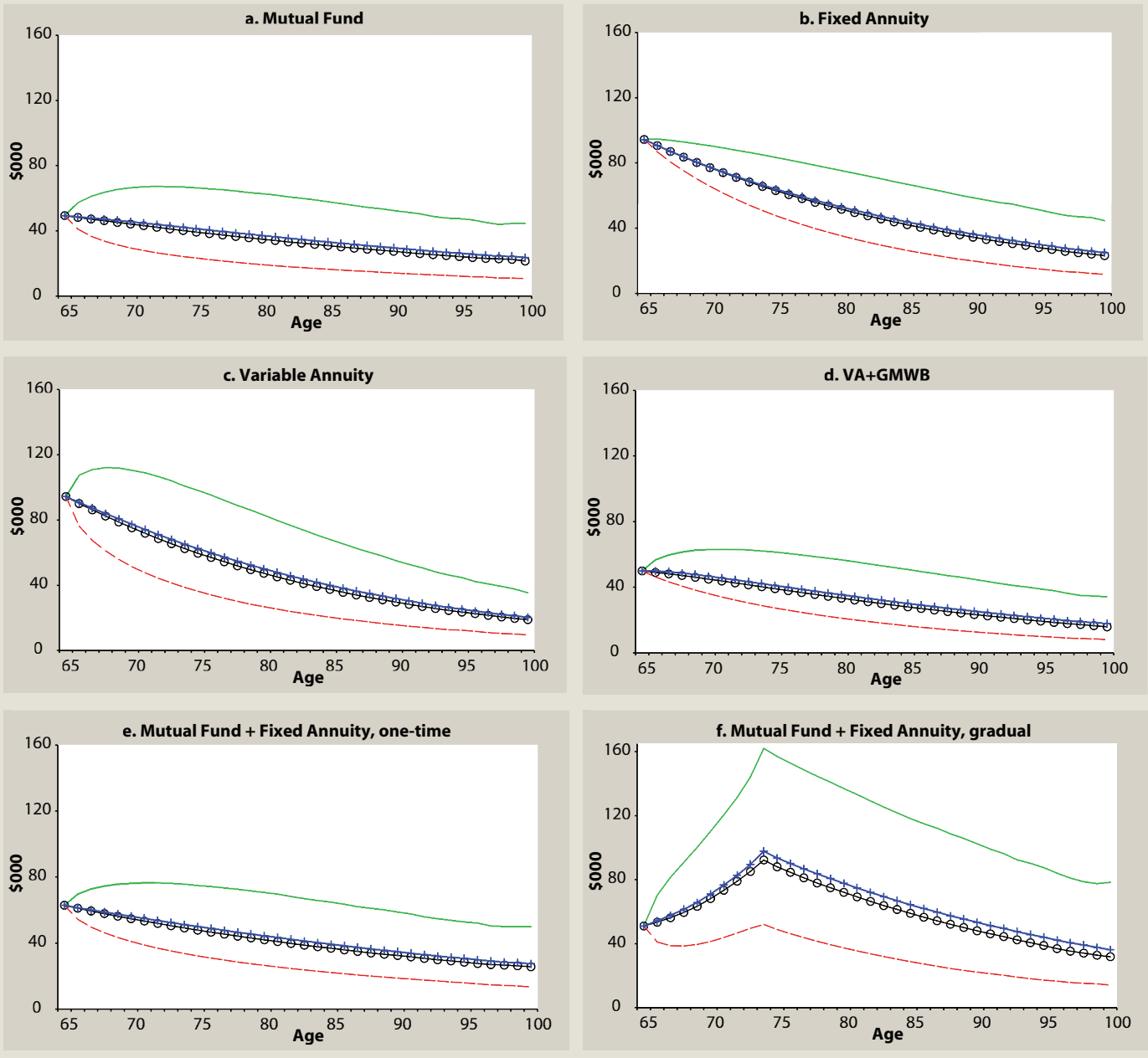


Source: Authors' simulations

adoption of annuities, fixed or variable, naturally implies no wealth at discretion and no bequest (Figures 1b–c). The static one-time blending of mutual fund and fixed life annuity in Strategy 5 is more likely to preserve a large wealth principal for investors' flexibility (Figure 1e), and the dynamic blending in Strategy 6 eliminates wealth self-management beyond age 75 (Figure 1f). Compared to Strategy 1, the wealth balance in Strategy 5 is noticeably lower by design but remains substantial at most ages—the 50th percentile outcome is in the range of $366,000–700,000 in real terms. Different asset mixes would generate different levels. Nonetheless, these outcomes show the appeal of Strategy 5 to some investors who value the longevity insurance but have some resistance to the illiquid nature of traditional life annuities.[13]

The wealth trajectories of VA+GMWB in Strategy 4 are plotted in Figure 1d. The end-of-life account values, if greater than zero, are bequeathed to heirs. The wealth

Figure 2: Outcome of Real Income for Survivors



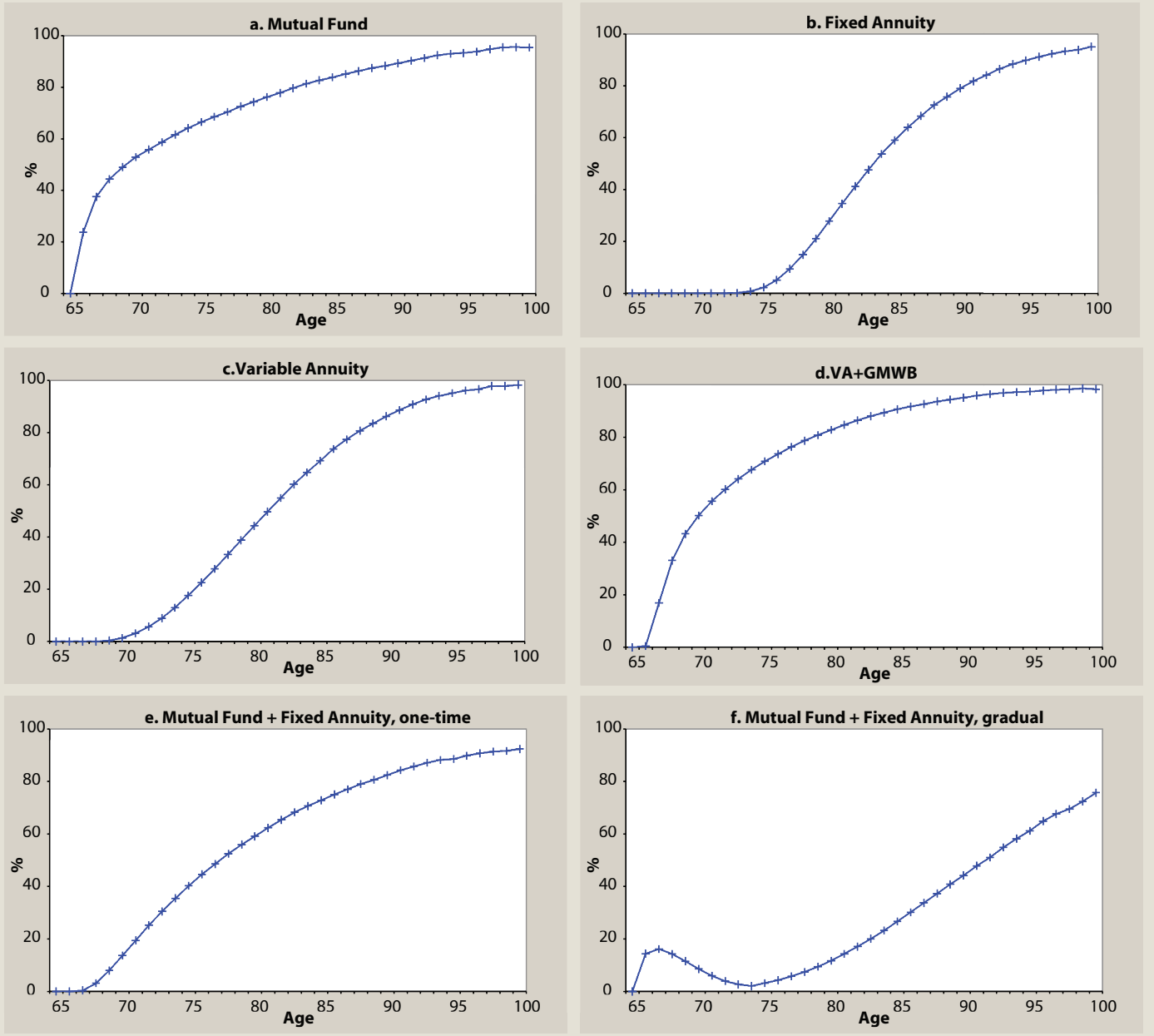
Source: Authors' simulations

balance (the 50th percentile outcome) in this strategy shrinks at a faster rate than it does in Strategies 1 and 5. This outcome suggests investors should think carefully when they use the VA+GMWB product to address wealth needs. Two major factors have come into play: (1) When the GIB steps up in the context of good investment performance, the scheduled wealth withdrawals are boosted too, and so are the GMWB rider charges in dollar terms; and (2) Compared to mutual funds, the additional M&E&A and rider fees reduce the retirement wealth nest egg.

In our second assessment measure, there is a great deal of difference among the strategies with regard to income level and stability. Using the same outcome percentiles as above, Figure 2 (on page 41) shows the levels of real income. As another view of this risk, Figure 3 plots the likelihood of annual income in real dollars falling below $45,000 (a level slightly below the nominal benefit guaranteed by VA+GMWB at initial wealth).

Mutual funds perhaps give investors more wealth control, but the systematic withdrawal strategy entails risk—more likely

Figure 3: Age-Specific Probability of Real Income Falling Below $45,000 for Survivors



Source: Authors' simulations

than not (over 60 percent probability in many years, Figure 3a) investors are confronted with real income shortfalls. Compared with mutual funds, the variable annuity generally yields higher payouts and lower (but still substantial) shortfall risk—compare Figure 2a to 2c and Figure 3a to 3c. This is because no bequest is intended in the VA and there exists mortality credit that cannot be replicated by mutual funds. The annuity providers pool both the initial funds and the mortality risks among the annuitants. When some annuitants die, their funds are allocated to survivors in the pool. The extra asset redistribution forms the mortality credit. This survivorship premium also applies to fixed life annuities. The choice between fixed and variable annuities simply lies in the investors' preferences over income potential and risk. Seeking regular payouts and spending, investors may consider the fixed life annuity or the VA+GMWB. Both deliver income stability, but in nominal terms, and are exposed to inflation risk (see Figures 3b and 3d). The choice between them hinges on the strength of wealth needs. Absent such needs, the former outperforms the latter in delivering real purchasing power, particularly during the early retirement period (compare Figure 2b to Figure 2d).

Investors may wonder whether there are ways to replicate VA+GMWB. Figure 2e shows that a mix of fixed annuities and mutual funds in Strategy 5 delivers similar, or even higher, income flows than the VA+GMWB does (compare Figure 2e to Figure 2d), in addition to preserving generally the same wealth on hand for investors, although with different time and risk profiles (compare Figure 1e to Figure 1d). The VA+GMWB product has the guaranteed and growth portions combined, and imposes M&E&A and GMWB rider fees on the entire allocation. Strategy 5 keeps the guaranteed annuity income and the growth portions separate, and assumes insurance fees (implicit) only on the guaranteed portion. This replication strategy appears to have lower shortfall risk in terms of real income (compare Figure 3e to Figure 3d).

Table 2: Outcomes of Real Wealth and Income with Baseline Assumptions

Strategy	95th percentile ($k)	Median ($k)	5th percentile ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $600k
a. Wealth Balance						
1. Mutual fund	1,272.3	830.7	406.9	829.2	270.5	21.3
2. Fixed life annuity	0.0	0.0	0.0	0.0	0.0	100.0
3. Variable annuity	0.0	0.0	0.0	0.0	0.0	100.0
4. VA+GMWB	1,100.4	642.7	49.2	628.2	328.9	45.8
5. Mutual fund + life annuity, one-time	1,018.1	605.4	278.8	615.2	232.5	49.1
6. Mutual fund + life annuity, gradual	962.0	10.3	0.0	292.5	368.0	73.9
b. Income						
Strategy	95th percentile ($k)	Median ($k)	5th percentile ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $45k
1. Mutual fund	62.9	41.4	20.5	41.3	13.3	60.0
2. Fixed life annuity	94.3	67.7	31.4	66.0	19.8	17.6
3. Variable annuity	102.2	63.9	25.3	64.4	25.0	25.7
4. VA+GMWB	59.1	41.8	20.1	40.7	12.2	59.7
5. Mutual fund + life annuity, one-time	72.3	50.9	26.7	50.4	14.5	36.3
6. Mutual fund + life annuity, gradual	129.8	65.4	36.0	72.2	30.1	13.0

Source: Authors' simulations

This result reveals that income stability offered by VA+GMWB only rests at the nominal level. Still, this product may appeal to investors who are wary of losses in mutual funds when the stock market crashes and stays depressed for a period. The security of the insurance company guarantee in extreme financial conditions, however, is unknown.

Emphasizing real income stability, the 10-year gradual annuitization in Strategy 6 offers another alternative. Ignoring the unusually high income (a peak of about $160,000 with a slim 5 percent probability), investors can reasonably expect to receive significantly improved annuity payouts. The median real incomes are greater than those generated by the one-time annuitization strategies (Figure 2f). The overall inward shift (reduction) of income shortfall risk is substantial (Figure 3f). By this single standard, Strategy 6 perhaps outperforms other strategies. A modest jump in the shortfall risk is observed in the transition years of an investor's 60s, which can be considered as the price for the accommodation of a potential early-death bequest and less regret for the timing of the annuity purchase.

We further examine realized wealth and incomes in all periods, provided that the survivals have occurred. We also calculate the probability of the real wealth balance falling below $600,000 and the probability of real income below $45,000.

Table 2 reports the results. Mutual funds provide opportunities for greater wealth creation, yielding the highest median wealth value ($830,700) among all strategies. The income flow, however, has a high

Table 3: Outcomes of Real Wealth and Income with Alternative Portfolios

Strategy	Wealth Balance				Income			
	Median ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $600k	Median ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $45k
a. Aggressive 70-30 equity-bond portfolio								
1. Mutual fund	860.9	874.0	326.9	20.3	42.9	43.4	16.0	55.4
2. Fixed life annuity	0.0	0.0	0.0	100.0	67.7	66.0	19.8	17.6
3. Variable annuity	0.0	0.0	0.0	100.0	66.6	67.5	27.6	24.0
4. VA+GMWB	659.5	648.0	362.5	44.5	43.8	43.1	13.9	53.6
5. Mutual fund + life annuity, one-time	625.8	660.8	326.1	46.4	52.2	52.6	18.0	34.8
6. Mutual fund + life annuity, gradual	10.6	297.4	376.8	73.7	66.7	74.7	33.8	13.4
b. Conservative 30-70 equity-bond portfolio								
1. Mutual fund	787.0	783.0	245.4	25.3	39.3	39.0	12.0	65.9
2. Fixed life annuity	0.0	0.0	0.0	100.0	67.7	66.0	19.8	17.6
3. Variable annuity	0.0	0.0	0.0	100.0	60.5	61.3	24.1	29.6
4. VA+GMWB	610.9	600.3	315.9	48.9	39.9	38.8	11.5	65.4
5. Mutual fund + life annuity, one-time	570.6	568.4	180.5	55.7	48.7	48.1	13.1	40.9
6. Mutual fund + life annuity, gradual	9.8	286.8	361.5	74.5	63.1	69.2	27.6	14.4

Source: Authors' simulations

likelihood of falling short (about 60 percent chance of being below $45,000), and the median is relatively low ($41,400). This is owing to the relatively conservative withdrawal percentage that should be set low in practice to avoid outliving resources.[14] Investors may thus enjoy a lower welfare than can be actually supported. The variable annuity forms an alternative with significantly higher income ($63,900) and lower shortfall probability (25.7 percent) for investors who need no wealth. In this direction, the fixed life annuity even performs better, with a median income of $67,700 and a shortfall probability of 17.6 percent.

The VA+GWMB product does a reasonable job in keeping up wealth balances in most periods (median $642,700), but creates only a marginal improvement in real income (median value of $41,800 and shortfall probability of 59.7 percent) over Strategy 1. In contrast to VA+GWMB, Strategies 5 and 6 can generally provide investors with greater purchasing power. Strategy 6 does particularly well in terms of assuring a minimum of real income. The real income level can be fine tuned at the compromise of adjusted size of wealth. In other words, catering to their risk preferences and specific economic or intra-family considerations, investors have the flexibility to construct retirement portfolios to meet their needs using traditional products in the market.

Note that the simulations incorporate long-run positive correlations between inflation and asset returns. This should give all strategies relative to nominal fixed annuities (Strategy 2) some advantage in hedging against inflation and preserving real consumption.

A Comparison with Alternative Asset Allocations. We now make alternative assumptions regarding the equity-bond mix in the underlying assets: an aggressive 70-30 portfolio and a conservative 30-70 portfolio versus the baseline 50-50. These allocations fall into the "allowable" range, as major VA+GMWB providers typically limit the equity fraction to around 60-80 percent. Such restrictions enable the providers to contain their risk exposure.

Greater equity holdings create higher wealth and income on average but also imply larger swings (standard deviations) of outcomes (Table 3a). That is, individual investors are more exposed to investment losses as the portfolio grows aggressive. A more conservative portfolio generally leads to a lower level of wealth creation, with a smaller variance (Table 3b). With an aggressive portfolio, combinations with fixed annuities and the GMWB rider become more attractive because investors can use these somewhat "market-proof" payouts to establish a minimum consumption floor. The choice between VA+GMWB and some mixing strategies again depends on the investors' preferences.

A Further Look at VA+GMWB. The GMWB rider helps isolate investors from *nominal* income shortfalls in a down market. This is a "put" option for investors. A more aggressive portfolio gives investors the chance to step up the GIB and correspondingly receive a larger income payout. The difference in expected annual consumption between a 70-30 equity-bond portfolio and a 30-70 portfolio is $3,900, and the wealth balances differ by $48,600, both in real terms.

Is it optimal for investors to select the riskiest portfolio available? The answer depends on two major factors: the size of the

Table 4: Outcomes of Real Wealth and Income for VA+GMWB with Alternative Fees

Fee Levels	Wealth Balance				Income			
	Median ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $600k	Median ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $45k
Baseline fees (M&E&A 1.20% GMWB 0.60%)	642.7	628.2	328.9	45.8	41.8	40.7	12.2	59.7
Max fees (M&E&A 1.75% GMWB 2.00%)	479.0	489.7	356.2	59.7	39.0	38.0	11.6	67.8
High fees (M&E&A 1.60% GMWB 1.50%)	532.6	531.4	349.5	55.8	39.7	38.7	11.9	65.6
Low fees (M&E&A 0.50% GMWB 0.40%)	717.4	698.2	317.8	37.7	43.6	42.6	12.5	54.3
Min fees (M&E&A 0.25% GMWB 0.40%)	738.3	718.5	314.6	35.2	44.1	43.3	12.7	52.7

Source: Authors' simulations

rider fee and the bequest motive. Regarding the former, for financial solvency, insurers of VA+GMWB contracts naturally should charge higher rider fees for assuming higher "guaranteed" risk. In theory, neither investors nor insurers should be in an obviously advantageous position.[15] The majority (approximately 70 percent) of the VA+GMWB providers in Table 1 state in their prospectuses that, upon the automatic step-up or the investor-elected step-up of GIB, the contracts will increase, may increase, or reserve the right to increase the annual rider percentage charges, subject to the contract maximum rates. Changes in market conditions may also trigger such fee hikes.

A strong bequest motive may also keep investors from being too aggressive in investment. VA+GMWB products are presumably more oriented toward generating (or even maximizing) income for consumption. An aggressive portfolio, especially if accompanied by higher fees, can result in leaving a smaller bequest. Nonetheless, if investors have set aside a trust for their heirs from other assets, and if they can get the GMWB rider and VA at reasonably low fees, it is rational for them to be aggressive with portfolios.

Let's now further consider the critical role of fees. We use alternative levels of fees for VA+GMWB to examine how wealth and income are affected under different contract terms. The baseline 50-50 equity-bond portfolio applies here. An improvement in contract terms may be attributable to market competition and financial innovation or to the enhanced market power when large defined contribution (DC) plan sponsors collectively bargain for their participants. On the other hand, market power by providers, for instance through product differentiation and/or misinformed choices by investors, will probably lead to inferior contract terms to investors.

Table 4 reports the simulated results. The maximum and minimum levels of fees are from the market data in Table 1. As it is typically not the case that investors pay maximum or minimum fees in all categories, we introduce two less extreme scenarios—"high" and "low" fees, which respectively represent the 95th and the 5th percentiles of the fees. Not surprisingly, at lower (higher) fees, investors receive a larger (smaller) share of wealth created and enjoy higher (lower) levels of consumption and welfare. What is striking is the magnitude of wealth and income differences when investors pay high fees compared to when a low-fee option is available, other things equal. For instance, the median wealth balance in the low fees scenario is roughly $184,800 higher than in the high fees case. An investor in the former situation would enjoy a higher consumption by about $3,900 a year.

A Consideration of Institutional Pricing. Fees might be lower for large DC plans. Institutional pricing, with simultaneous and proportional reductions in fees for all strategies, would not necessarily change the performance comparisons in a qualitative way. First, lower fund expense on underlying assets would equally apply to mutual funds and VA products, leaving the relative positions of Strategies 1, 3, and 4 intact. Second, with heterogeneous populations formed and the adverse selection problem somewhat mitigated in large DC plans, the reduction in insurance fee should equally apply to fixed and variable group annuities, leaving the comparisons of Strategies 2, 3, and 4 unchanged. By transitivity, these in turn imply that group pricings would not otherwise strengthen or weaken the blending strategies of mutual funds plus life annuities. And third, as the only potential source for overturning results, it is not clear whether an institutional GMWB rider fee would be lower than at the retail level. Theory may not suggest a wholesale-retail price difference because VA+GMWB issuers are assuming greater risks, with no obvious gain of risk diversification, in the face of increased subscription to GMWB guarantees.

Nonetheless, we use the following experiment, assuming uneven reductions in fees, to illustrate the benefit of institutional pricings. Absent relevant data, we assume fund management fee and M&E&As are reduced to a quarter of the baseline assumptions. Fees on any actual plan may be higher or lower. We maintain the baseline assumptions about fixed payout life annuity on the premise that its pricing is more determined by the market structure and adverse selection than by group bargaining. Table 5 (on page 46) reports the simulation results. In contrast to the baseline results in Table 2, this experiment by construction makes strategies involving

Table 5: Outcomes of Real Wealth and Income with Lower Fees

Strategy	Wealth Balance				Income			
	Median ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $600k	Median ($k)	Mean ($k)	Std. Dev. ($k)	Percent below $45k
1. Mutual fund	900.6	904.6	282.1	13.4	45.2	45.3	13.9	49.6
2. Fixed life annuity	0.0	0.0	0.0	100.0	67.7	66.0	19.8	17.6
3. Variable annuity	0.0	0.0	0.0	100.0	75.5	75.2	24.2	11.5
4. VA+GMWB	792.3	771.4	313.0	29.1	45.7	45.1	13.2	47.8
5. Mutual fund + life annuity, one-time	654.9	673.0	254.1	40.3	53.8	53.4	14.9	29.2
6. Mutual fund + life annuity, gradual	8.6	288.0	364.1	74.4	69.2	76.0	31.6	10.5

Note: Mutual fund expense ratio and M&E&As are all 0.30%. Source: Authors' simulations.

mutual funds and VA products more attractive—higher wealth balance and/or income payout plus lower shortfall risks. Note that the improvements in the profiles of VA and VA+GMWB are even greater because both fund management and insurance fees are reduced. These results illustrate the potential gains to investors when prices are changed in their favor. Whether this would tilt investors' preference for one strategy over another essentially depends on the category and magnitude of fee reductions.

Conclusions

With the sponsorship shift toward defined contribution plans by many U.S. employers, more workers will rely on 401(k) plans and IRAs as their primary source of retirement income outside of Social Security. It is a challenge for retirees to foresee future financial needs and precisely allocate resources. Because DC plans are typically self-managed by their participants and lack the automatic withdrawal mechanism featured in most defined benefit (DB) plans, the chances are good that workers may run out of their DC funds or under-consume, given that the length of life is uncertain. To avoid retirement ruin, DC plan participants need to establish a sound wealth decumulation strategy.

This analysis compares wealth management strategies for individuals in retirement, including mutual funds, annuities (fixed, variable, or variable plus a minimum income guarantee) and combinations of them. These strategies each have advantages and caveats, appealing to investors with varying risk preferences and intrafamily needs. Those who allocate assets in the underlying portfolios toward equities are generally seeking opportunities for greater wealth creation, at the cost of greater risk of wealth destruction, while those who use fixed payout annuities or guarantees seek income regularity and stability. Nearly all products, however, define income payments in nominal terms and thus leave real consumption subject to the uncertainty and erosion of inflation. DC plan participants should also be alert to contract terms in these strategies, because the fees and charges play a nontrivial role in altering wealth creation and income levels. They may be better off by exploring in-plan institutional pricing of funds and annuities, if available, than taking lump sums from their DC plans to purchase products on retail terms.

None of the strategies obviously dominates, given the confluence of uncertainties in asset returns, length of life, and varied risk and bequest preferences. Perhaps useful advice to DC plan participants, and plan sponsors in educating and assisting their employees with strategy selection, is to start with a dichotomy. Investors may want to first carve out a safe segment of their wealth to establish minimum necessary consumption and a certain level of hedging against longevity risk. This longevity insurance is being lost with the decline of DB plans but can be restored with some annuitization as a welfare-enhancing strategy in DC plans.[16] This can be achieved through a traditional life annuity or an income guarantee in variable annuities. After this top priority, the remaining wealth can be more oriented for growth opportunities. Also, investors should be aware of how much annuity benefits are available to them from DB plans and Social Security and correspondingly optimize their portfolios.

Endnotes

1. Milevsky and Panyagometh (2001) show that the differential tax treatments significantly alter after-tax wealth outcomes from variable annuities versus mutual funds. Brown and Poterba (2004), however, only find mixed support for the role of tax considerations in generating household demand for variable annuities. We also ignore Social Security, assuming its benefit is used as a floor and protection against poverty.
2. Managed payout funds, that is, some new mutual fund innovations that package an investment and spending mechanism like endowment income funds, can also be modeled as systematic withdrawals.
3. Horneff et al. (2006) show that a fixed percentage withdrawal is appealing to

retirees across a wide range of risk preferences, while other phased withdrawal rules of varying percentages are only appropriate to sub-groups of population. As a sensitivity test, we will later consider a fixed dollar withdrawal.

4. There are few inflation-indexed annuities on the U.S. market. Research on the U.K. market (Finkelstein and Poterba, 2004) has shown that these annuities are even a poorer actuarial value than nominal annuities.
5. See Warshawsky (2007).
6. The GMWB rider can also be purchased for a certain number of years and the rider fee should be generally lower than for lifetime protection.
7. Details about modeling the wealth management strategies are given in a Technical Appendix, which is available from the authors upon request.
8. Pye (2009) shows that annuitizing 25 percent to 50 percent of wealth can effectively reduce the risk of running out of resources and thus retrenching consumption in later life.
9. The VAR specification follows Campbell and Viceira (2004, 2005). Details of the estimation and simulations are described in a Technical Appendix, which is available from the authors upon request.
10. The current financial crisis makes it difficult to predict whether future inflation and asset returns will significantly deviate, upward or downward, from these long-run levels. We make no prejudgment or modifications on the VAR-based expectations. Pye (2009) offers a summary of the dynamics of inflation and asset returns since the 1960s. He also implements an alternative approach to modeling random shocks and mean reversions of these variables.
11. The current insurance law allows a small fraction of underlying account assets in equity investment.
12. The modeling of conventional variable annuity is similar to the calculation of annuity payouts in the TIAA-CREF prospectus (May 2008) for Single Premium Immediate Annuity with Life Funds and the Statement of Additional Information.
13. Ameriks and Ren (2008) show that income annuities, despite the costs and illiquidity, should be a part of an investment and spending plan for investors who desire regular payments and stable spending in late life.
14. Alternatively, we model a "self-annuitization" strategy, that is, a fixed nominal dollar withdrawal equal to 5 percent of initial wealth. This is consistent with fixed life annuities in that they deliver nominal payouts. The "self-annuitization" exposes investors to greater risk of outliving wealth, particularly at advanced ages. The 5th percentile wealth and incomes are lower compared to the baseline Strategy 1. (A fixed *real* dollar withdrawal, that is, a nominal withdrawal increasing with inflation, would generate further lower 5th percentile outcomes.) The increase in such shortfall risk is by a smaller margin for Strategies 5 and 6, though.
15. Milevsky and Salisbury (2006) show that the theoretical no-arbitrage cost of GMWB is significantly higher than fees actually charged by most VA+GMWB products in the market. They view the current under-pricing as unsustainable and expect GMWB fees to eventually increase or product design to change.
16. See Watson Wyatt (2007), for instance.

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