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On Retirement

Retirement Spending Reality

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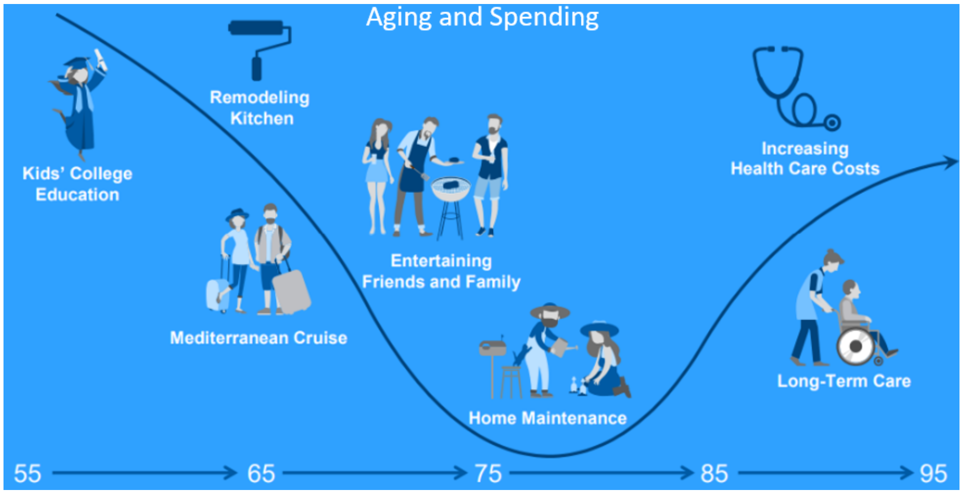
The traditional way to estimate a person's retirement needs is to assume they will spend some portion of their final salary every year, adjusted for inflation. This simplification tends to overestimate how much a retiree will need and inaccurately represents spending patterns. Empirically, spending is typically front-loaded in the more active retirement years. This pattern actually increases plan risk, especially the risk of not being able to meet essential expenses.

We constructed six retiree profiles corresponding with differing circumstances and priorities among retirees. For example, some prioritize travel while others choose to spend on home projects. The results corroborate the importance of accurately identifying spending patterns and show how three key strategies can mitigate risk: (1) time-segmented bucketing; (2) working early in retirement; and (3) cutting spending when investment returns are poor.



An Industry Crutch

The financial services industry often talks about the goal of saving for retirement as a challenge of "income replacement." Build a big enough nest egg and, when the time comes to switch off salary income, you can simply switch on a new paycheck funded from the portfolio and other instruments like annuity withdrawals, Social Security and pension benefits. In this happy scenario, cash hits your bank accounts just as it did before, and a new retiree's lifestyle continues on just as it had before.

The problem with this framing is that the same lifestyle isn't in the cards regardless of a retiree's finances. Just by retiring, we enter a significantly different lifestyle, with different activities and different spending. Midlife pursuits revolving around younger families, several week-a-year vacations and work-oriented expenses (an underappreciated item of the household budget) will likely be replaced by expenses associated with hobbies and experiences the newly retired didn't previously have the time to pursue.

Partial Retirement

Complicating matters further, more and more retirees are no longer abandoning the labor force entirely when they retire, opting instead to continue working in some capacity. Their reasons range from shoring up their finances, to staying active and connected to their communities, to an ongoing passion for their life's work. Whatever the motivation, working during retirement has become increasingly common, and the trend shows no sign of abating.

In this issue of *On Retirement*, we explore the implications of the way people actually behave in retirement, as opposed to the tidy simplification of "income replacement" often used as shorthand in the industry. To do so, we first investigate the spending data, sketching out a taxonomy of spending profiles based on different sets of retirement priorities, into which most kinds of consumption patterns can be fit. We will use these profiles to gain a better understanding of the importance of details the industry shorthand omits. Specifically, does a much-simplified picture of spending and salary income have the potential to materially distort estimates of progress toward goals? Would recommendations around investment strategy and other financial decisions look different if these key inputs were more precisely represented? Finally, we discuss some opportunities investors have to align their decisions with the type of retiree they envision themselves becoming.

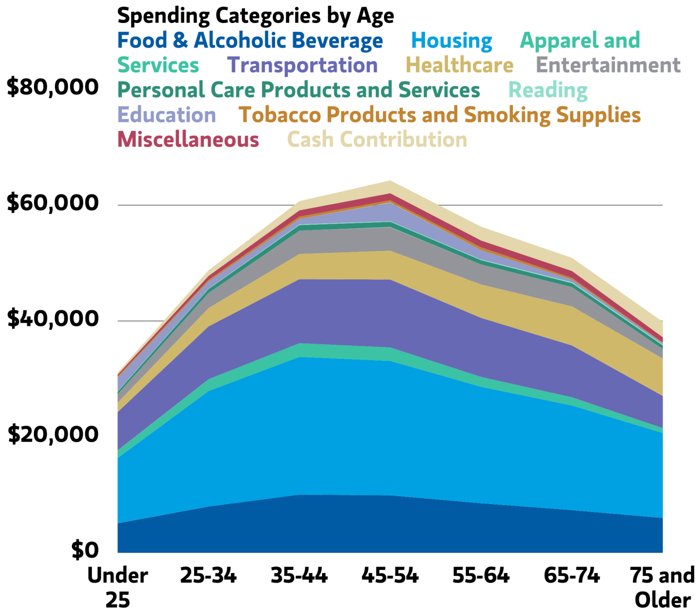
Reality? Spending Falls

One consequential way in which retirement data conflicts with the industry's representation of the problem is in spending growth rates. Income replacement is typically defined as a constant inflation-adjusted expenditure. In other words, if you're spending $100,000 in your first year of retirement, you'll be spending a higher nominal amount 20 years later—around $146,000, assuming inflation of 1.9% per year. However, that $146,000 won't go any further than the $100,000 did 20 years earlier, due to the decline in purchasing power. The assumption, presumably, is that people become accustomed to a certain standard of living that they retain throughout their lives.

That assumption is not a good one, however, according to the Bureau of Labor Statistics Consumer Expenditure Surveys (see Exhibit 1). While it may vary between individuals, the data shows that as people get deeper into retirement, spending in real terms typically declines, in spite of the significance and magnitude of health care costs later in life. In fact, household spending peaks between ages 45 and 54, after which it starts to fall, with the drop accelerating around retirement.

The categories of spending driving the overall decline include food, housing, apparel, transportation, entertainment, personal care and education. The main exception, unsurprisingly, is health care. Notwithstanding the large numbers associated with health care expenses later in retirement, the increase in that category does not outweigh the decline in other spending categories. Consequently, on average, the 75-plus age cohort spend 36% less than they did in the years leading up to retirement (ages 55 to 64).

Exhibit 1: Spending and Its Composition Varies by Age



IN BRIEF: The Bureau of Labor Statistics Consumer Expenditure Surveys (CE) report shows that, on average, older retirees spend significantly less than younger retirees, and the composition of spending of the two demographics is also different.

WHAT'S HAPPENING? The CE is a snapshot of the spending of American households. It reveals that age affects spending and its composition in broad categories such as entertainment and health care. The highest spending levels occur in midlife, and the decline accelerates as people enter retirement. It also reveals that most categories of spending decline except health care.

WHAT'S NEXT? We look to corroborate the declining spending contrasts with more robust studies that follow the same individuals over time. We also look to understand the implications of these spending patterns, which conflict with common shorthand assumptions.

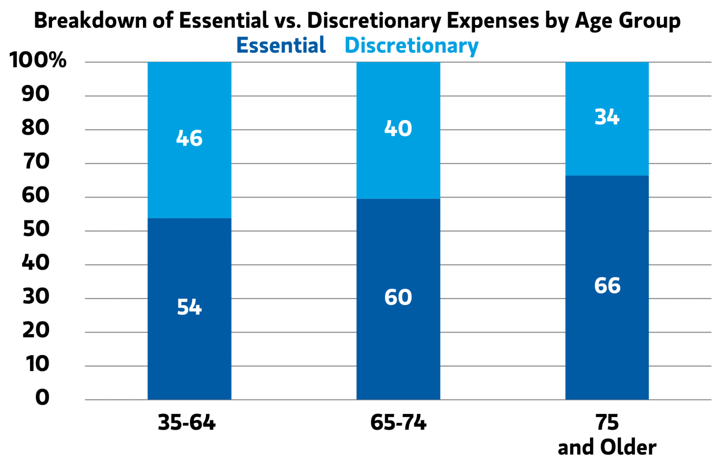
Source: Consumer Expenditure Survey Annual Calendar Year Table from Bureau of Labor Statistics as of Sept. 11, 2018

Exhibit 2: The Changing Mix of Essential and Discretionary Spending With Age

IN BRIEF: While total spending tends to decline during retirement, the nondiscretionary spending portion increases.

WHAT'S HAPPENING? The changing mix of spending in the data shows that most categories of spending decline steadily throughout retirement, with the exception of health care. Other nondiscretionary spending also tends to decline less than discretionary spending, thus resulting in proportionally increased essential spending and raising the consequences of a shortfall.

WHAT'S NEXT? In addition to the effect of real-world spending patterns on the likelihood of meeting total spending needs, we want to understand the impact on less flexible essential spending.



Please see Endnotes for details of the assumptions used in this analysis.
Source: Morgan Stanley Wealth Management, Consumer Expenditure Survey Annual Calendar Year Table from Bureau of Labor Statistics as of Sept. 11, 2018

Essential vs. Discretionary

While overall spending levels may decline with age, the shifting pattern of spending categories means that the proportion earmarked for basic needs is significantly increasing relative to purely discretionary—and thus more easily deferred—spending. This has important implications for the effective "belt tightening" strategies that we've explored in these pages before, wherein a retiree cuts spending when the portfolio performs poorly. Obviously, there are limits to cuts in spending, and most people would see nondiscretionary spending as a hard floor beneath which any spending reduction would have major implications for happiness. We have broken out the relative change in discretionary versus nondiscretionary spending by age cohort, attesting to the degree to which the nondiscretionary proportion of spending increases with age (see Exhibit 2.) The notion of a decline in spending driven for the most part by nondiscretionary expenses as time goes by supports increasingly conservative portfolio strategies. And the passage of time affects the value of guaranteed income streams like Social Security payments, pensions and annuities with lifetime income guarantees.

Longitude vs. Latitude

While it's possible the differences in spending patterns uncovered in the consumer spending survey can be accounted for by the different generational habits (such as the contrast between baby boomers and a more thrifty "silent generation"), longitudinal studies reject that explanation. These studies track the behavior of specific individuals over time, providing evidence that people steadily cut their spending with age (more steeply among more affluent households, and less steeply for those less affluent households with lower proportions of discretionary spending).[1, 2]

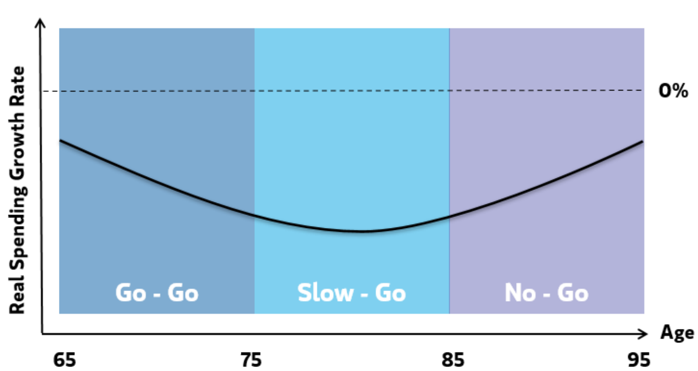
There isn't unanimity among such studies, however. For example, in Estimating the True Cost of Retirement, David Blanchett dug into the longitudinal data in the RAND Health and Retirement Study (HRS), and found that, after a steady period of decline, spending tends to increase again by more than the rate of inflation toward the end of retirement due to health care expenses.[3] This pattern, though, is less in conflict with other studies and sources of data than it is evidence of a more pronounced version of what we see in general across studies. Essentially, spending tends to decline increasingly over the course of retirement before growing, or at least falling less rapidly, with end-of-life health care and long-term care spending.

Spending's Smile

The path of spending growth forms the shape of a smile (see Exhibit 3). In *The Prosperous Retirement*, author Michael Stein characterized the retirement spending smile as arising from retirement's three distinct phases: the "Go Go" years, the "Slow-Go" years, and the "No-Go" years.[4] The Go-Go years represent the active phase of retirement, where young retirees take full advantage of the extra leisure time they suddenly have to spend on activities like travel, dining out and hobbies. In Slow-Go years, less supportive health and potentially changing priorities tend to reduce the appeal of these types of activities, resulting in substantial decreases in spending. In the No-Go years, activity-related spending stops almost entirely, but spending growth rates increase again (if not to a higher absolute level, at least to a lower rate of decline), as health care expenditures grow.

While everyone must face the increasing limitations imposed by aging, the way the process impacts any single individual's spending pattern will obviously depend on their own priorities and circumstances. Adjusting spending assumptions to reflect typical spending patterns may not reflect the implications for any one individual. Consequently, to test the way that differing spending patterns impact measures of retirement readiness and strategy recommendations relative to an approach based on income replacement, we tested multiple spending patterns. Each of these six patterns were based on a generic profile, which the data suggests captures a great deal of variation among retirees.

Exhibit 3: The Retirement Spending Smile



IN BRIEF: Average inflation-adjusted retirement spending growth forms a smile in the chart below. It declines until the Slow-Go phase of retirement before increasing again in the No-Go phase late in retirement.

WHAT'S HAPPENING? Year-to-year growth in inflation-adjusted retirement spending falls at a lower rate in the most active Go-Go phase of retirement. It declines more rapidly in the less-active Slow-Go phase, before picking up again in the No-Go phase late in retirement, with increasing health care costs. The higher rates on each end and the lower rate in the middle growth pattern form a smile.

WHAT'S NEXT? We look parse the data to determine how the spending patterns of sub-categories of retirees differ from the overall average.

Source: Morgan Stanley Wealth Management as of June 2019

Profiles in Spending

The six retiree profiles that give rise to varying spending patterns are "Smilers," "Project Makers," "Entertainers," "Globe Trotters," "YOLOers" and "Health Care Spenders." The spending pattern for Smilers is depicted in Exhibit 3. At the beginning of retirement, spending is highest, but declines with age until there is a deceleration in spending reductions late in retirement, thus tracing the growth "smile."

Project Makers tend to spend heavily on housing, including real estate taxes, remodeling, repairing and refurbishing and taking on additional housing-related debt. As a rubric, it is meant to apply to other projects as well, such as restoring an antique car or donating time and money to community-oriented projects. These retirees are inclined to spend more in earlier retirement years and have a lower fraction of essential versus discretionary expenses than the average retiree. Entertainers represent the large group of retirees who spend more of their income in food and beverage categories, commonly due to their fondness for entertaining friends and family. This sub-category usually does not spend heavily on other sources of entertainment outside the home. As a result, their overall spending tends to decline more rapidly early in retirement than other groups.

The Big(ger) Spenders

The other three profiles are modeled as having higher levels of overall spending. In contrast to Entertainers, Globe-Trotters spend a larger fraction of their budget on travel prior to retiring. Once retirement arrives and work no longer poses a constraint on how much travelling they now can do, travel expenses have substantial room to grow, especially in the Go-Go and Slow-Go stages of retirement. These retirees tend to see less of a decline in spending and discretionary expenses tend to represent a larger share of total spending.

Exhibit 4: Spending Pattern Assumptions by Retiree Profile

IN BRIEF: We list the assumptions for seven spending patterns associated with differing retiree profiles to test the impact of the assumption of spending patterns on progress monitoring.

WHAT'S HAPPENING? We identify five different profiles of retirees spending priorities and circumstances that are common, but differ meaningfully from the average. For each profile, as well as the average retiree (a Smiler) and one who spends in line with the industry shorthand (Income Replacers), we list assumptions of initial spend, real spending growth rate, essential versus discretionary spending and retirement age.

WHAT'S NEXT? We use these assumptions to examine implications for plan metrics such as probability of success and shortfall, as well as to test different strategies with the potential to mitigate risk in a retirement plan.

Retiree Profiles	Retirement Age	Initial Spending of Retirement Assets	Real Spending Growth Rate			Portion of Essential Expenses		
			Go-Go	Slow-Go	No-Go	Go-Go	Slow-Go	No-Go
Smilers	65	6.0%	-1.0%	-2.0%	-1.0%	60%	65%	65%
Project Makers	65	6.0%	-0.5%	-0.5%	-1.0%	50%	50%	60%
Entertainers	65	6.0%	-1.5%	-1.5%	-1.0%	70%	70%	70%
Globe-trotters	65	7.2%	1.0% to 0.0%	0.0% to -1.0%	-1.0%	40%	40%	60%
YOLOers	62	+30% 62-65 +20% at 65	1.0% to -0.1%*	-0.1% to -1.0%	-1.0%	40%	40%	60%
Health Care Spenders	65	6.0%	-1.0%	-1.0% to 1.0%	1.0%	75%	75%	75%
Income Replacers	65	5.1%	0.0%	0.0%	0.0%	60%	60%	60%

*Linearly interpolated between age 62 and age 75
Source: Morgan Stanley Wealth Management as of June 2019

The term "YOLOers" borrows from 21st century youth culture and its acronym for the old saying, "you only live once." YOLOers are those who take early retirement in order to travel and/or seek new experiences and adventure. YOLOers' spending tends to spike in earlier retirement years, both on account of these activities and because they are ineligible for Medicare and thus need to cover health insurance out of pocket.

Speaking of health care, Health Care Spenders are retirees that spend a significant share of their disposable income on health care through things like higher insurance premiums for Medicare supplemental policies, prescription drugs expenses and treatments in excess of coverage. For this group, health care spending picks up much faster in later retirement years than it does on average, resulting in spending growth at those ages.

Analytical Assumptions

The spending assumptions for each of the other retiree profiles are specified relative to the Smilers, which we take as the baseline set of assumptions. Spending among Smilers begins a low nominal growth rate that translates into a 1% annual decline in real spending per year during the Go-Go phase of retirement (ages 65 to 75). The decline accelerates to an actual decline in nominal dollar spending, translating into about a 2% decrease per year in real spending during Slow-Go phase (75 to 85). Finally, during the No-Go phase of retirement (defined as age 85 and above), the spending rate reaccelerates back to a slightly increasing rate of nominal spend, translating to a 1% per year decline in inflation-adjusted terms. We estimate these spending rates are consistent with the more affluent cohort of retirees.

Exhibit 4 itemizes how the spending pattern assumptions differ by retiree profile, specifically with respect to initial spending rate, real spending growth rate and the relative split of essential and discretionary expenses in each of the three phases of retirement. Among the groups, Globe-Trotters and YOLOers have the most risk-enhancing spending patterns, with initial spending among Globe-Trotters 20% higher than average at the onset of retirement and decreases in spending happening at a lower rate until the No-Go phase. YOLOers are assumed to incur an additional 30% spending before reaching 65, and from that point forward taking on spending patterns similar to the Globe-Trotters.

Spending Patterns, Not Funding Levels

In contrast to our more realistic retiree profiles, "Income Replacers" feature constant real spending throughout retirement. To evaluate the materiality of that pattern of spending independently to how well funded a retiree is, Income Replacers are assumed to spend the same nominal amount overall as Smilers do, but get there by spending less initially and more later on in retirement.

If, on the other hand, Income Replacers were assumed to spend the same amounts as Smilers initially, then that would mean substantially higher overall retirement spending and a substantially lower funding level for the same amount of retirement savings. As we know, low funding levels mean higher withdrawal rates, substantially lower probabilities of success and substantially higher metrics of downside risk. Of course, this is one of the ways that the simplification of income replacement distorts reality: People may spend less in retirement than they anticipated (and have planned for). To the extent that is the case, retirement savers may be more well-funded than they realize. This is another reason why estimating spending accurately is so critical.

The Hypothetical Retiree

We tested our spending patterns for five of the six spending patterns and the income replacers control group on a hypothetical new retiree who is age 65 and has a tax-exempt portfolio of $2 million that is invested 60% in equities and 40% in investment grade bonds. Furthermore, we assume a baseline initial spending amount of $120,000, or 6%, from the portfolio in the first year of retirement, not including Social Security and other sources of income. We did investigate higher and lower spend rates to test the potential sensitivity; however, the results were largely consistent.) For each subsequent year, the nominal spending amount is calculated by applying the applicable real growth rate for that retiree profile in addition to assumed inflation of 1.9% per year to the spending amount in the previous year.

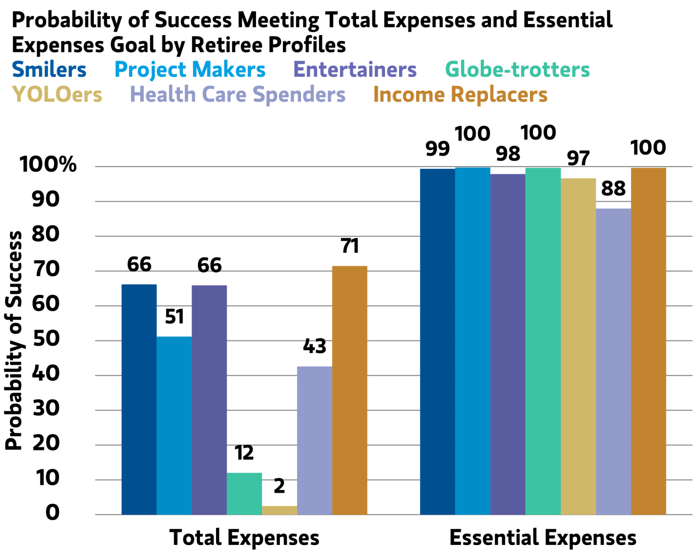
The initial spending for Globe-Trotters is $144,000 per year due to a substantial increase in early retirement spending on travel. The assumptions for YOLOers are slightly different, as they retire at age 62 instead of 65 and have even higher baseline initial spending rates than Globe-Trotters, at $187,200 in their first year of retirement. This higher level is maintained until age 65, when they become eligible for Medicare and their spending patterns begin to resemble those of Globe-Trotters. Note that we don't use a defined horizon for the analysis as each retiree's experience is different. Instead, we look at planning metrics like risk to retiree objectives or terminal account value, which in our view incorporates the uncertainty associated with longevity.

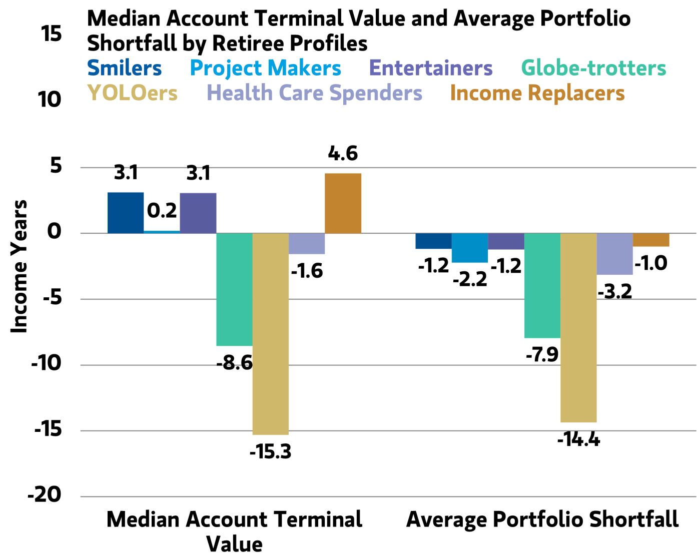
Exhibit 5: Retiree Profiles, Spending Patterns and Plan Metrics

IN BRIEF: Realistic spending patterns impact plan metrics negatively, especially for those that signify higher overall spending and early retirement.

WHAT'S HAPPENING? Substituting empirical spending patterns for an income replacement approach means that more of total spending occurs early in retirement, which negatively impacts plan metrics. The largest impacts are on probability of success to total expenses and median terminal value, where even Project Makers with similar spending levels have substantially less attractive outcomes.

WHAT'S NEXT? We can use the more realistic spending patterns to test strategies and determine to what extent they can mitigate the higher levels of risk these patterns indicate.





Please see Endnotes for details of the assumptions used in this analysis.
Source: Morgan Stanley Wealth Management as of June 2019

Patterns of Success and Failure

The effect of these different assumptions of probability of success results, portfolio terminal value and shortfall risks are detailed in Exhibit 5. While an income replacement approach to modeling retirement spending liabilities may be a conservative way to estimate the overall amount of spending, the pattern of spending tends to underestimate retirement plan risk. For example, the probability of success of Smilers falls significantly to 66% from the 71% recorded for Income Replacers. This is because a flat growth rate path establishes less spending in the early years and more later on, which decreases sequential risk relative to the more front-loaded spending of the typical retirement spending smile.

The underestimation of plan risk is even more significant by comparison with other retiree profiles as they generally fare worse than Smilers, especially the Health Care Spenders, Globe-Trotters and YOLOers profiles which face higher overall spending hurdles. Entertainers and Project Makers have similar to slightly lower success probabilities than Smilers at 66% and 51%, respectively. Among the bigger spenders, Health Care Spenders fare best, with a 43% probability of success. The deterioration in plan status for Globe-Trotters and YOLOers on the other hand is enormous, with probabilities of success declining to 12% and 2%, respectively, due to higher spending in the Go-Go and Slow-Go retirement phases, and the longer retirement horizon in the case of YOLOers. The effect of these spending patterns on the probability of success for essential expenses is much less significant, with the exception of Health Care Spenders whose spending pressures are nondiscretionary.

Median account terminal value is a measure of the median amount of assets left in the portfolio at mortality (measured in years of income). Average portfolio shortfall is a measure of the average deficit in scenarios in which the retirement plan failed to cover for all expenses, also measured in income years. Not surprisingly, the big spender profiles, Health Care Spenders, Globe-Trotters and YOLOers, saw a significant deterioration in these metrics. Relative to the Income Replacers baseline, the median terminal portfolio value ranges from 3.1 years of income for Entertainers and Smilers to a shortfall of 15.3 years of income for YOLOers. Average portfolio shortfall increases from one year for Income Replacers to a range of 1.2 to 14.4 years of income for the other spending profiles.

Investment Strategy Implications

A fair summary of Exhibit 5 is that realistic spending patterns and the amounts spent can have an enormous impact on assessing the health of a retirement plan. Another implication is that a more accurate picture of spending has the potential to affect a retiree's selection of a strategy and, indeed, their spending decisions. For example, an investor who resembles an Entertainer might find that she should anticipate less overall retirement spending than she might have, thus providing a boost to funding levels. In addition, more of that spending will be front-loaded and more will be on essential expenses. Given that combination, the investor is more likely to need a lower risk portfolio than that which would be appropriate with a lower funding level and longer-dated liabilities composed of a lower fraction of essential expenses.

Overall risk posture is not the only element of investment strategy that matters in planning for retirement. Another is the timing of risk-taking with respect to an investor's age, as for example with target-date retirement strategies that position the portfolio more aggressively for younger investors and less aggressively for older ones. One strategy that seeks to take advantage of varying risk exposure is "time segmented bucketing" (TSB). In one flavor of the strategy, the portfolio is divided into three buckets, with funds allocated to each in accordance to the spending needed for the three retirement phases. The strategy invests conservatively for Go-Go phase spending and takes on growth assets for more distant No-Go spending, while electing a balanced portfolio to invest in Slow-Go funds.

A feature of TSB is that more aggressively invested funds are left untouched for extended periods and therefore given more time to recover in the event of a market drawdown without facing liquidations at depressed prices in order to fund withdrawals. This holds out the prospect that plan risk can be reduced relative to where it would be otherwise. Because TSB strategy is configured around spending amounts, it is essential to accurately assess the spending needs in each retirement phase to make it work, especially where spending is front-loaded in retirement, as characterized by the more realistic spending profiles.

Helpful Spending Specifics

Investing isn't the only component of retirement strategy that retirees have the flexibility to change. As mentioned earlier in this report, it is increasingly common for retirees to continue to work in some form in the early retirement stage, whether for financial reasons or otherwise. The additional income from nonportfolio sources will obviously lower financial risk during retirement. Popular choices among the increasing number of retirees electing to work at least part-time include consulting and contract work that gives them flexibility while offering them remuneration at a preretirement level. To evaluate the financial impact of working in retirement here, we'll assume some contract work in its Go-Go phase, earning about 20% of their expenses.

Another noninvestment approach that has a strong empirical basis—belt-tightening—was discussed in the previous issue (see "Retirement Income in Volatile Markets," *On Retirement*, Feb. 27, 2019). In belt-tightening, a retiree will vary withdrawals based on the portfolio's performance, cutting back when the funding ratio dips. The approach leverages a retiree's spending flexibility both to limit downside when performance is poor and maximally leverage the market's empirical tendency to recover after drawdowns.

In this analysis, we assume the retiree can reduce spending by 15% of what it would otherwise be any time her funding ratio dips below 90%. She furthermore will shave an additional 10% if her funding ratio dips below 75%. On the flip side, she will increase spending 15% back toward planed spending at a funding ratio of 110% and a further 10% if the ratio hits 125%. To ensure that the cuts are not overly dramatic, the cumulative spending reduction is capped at 20% of target spending. This approach could be a good solution for Project Makers, Globe-Trotters and YOLOers; more of their spending is discretionary, so there is more scope for voluntary spending cuts.

Mitigants Mitigate

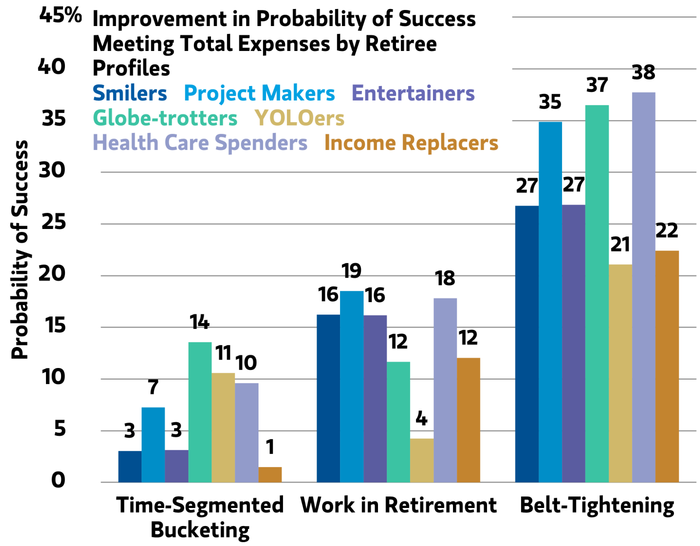
As illustrated in Exhibit 6, the potential for each of these strategies to substantially increase plan success probabilities and decrease downside risks is considerable. But what is not shown is their potential for success when the strategies are used in tandem. Among the three approaches, the spending flexibility strategy of belt-tightening provided the greatest improvement in probability of success on total expenses, while TSB had the most impact on the likelihood of meeting essential expenses. Health Care Spenders specifically experienced significant improvement in essential expense probabilities. In general, the three approaches also mitigate downside plan risk as measured by expected shortfall.

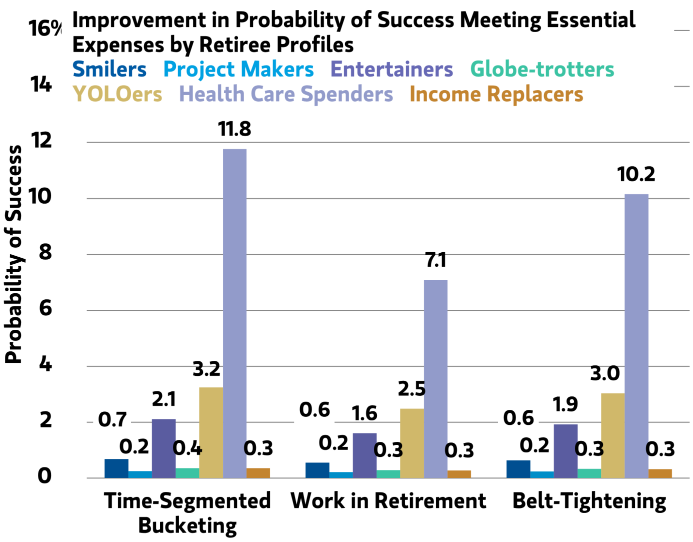
Exhibit 6: Three Risk-Mitigating Strategies — Each Improve Plan Metrics

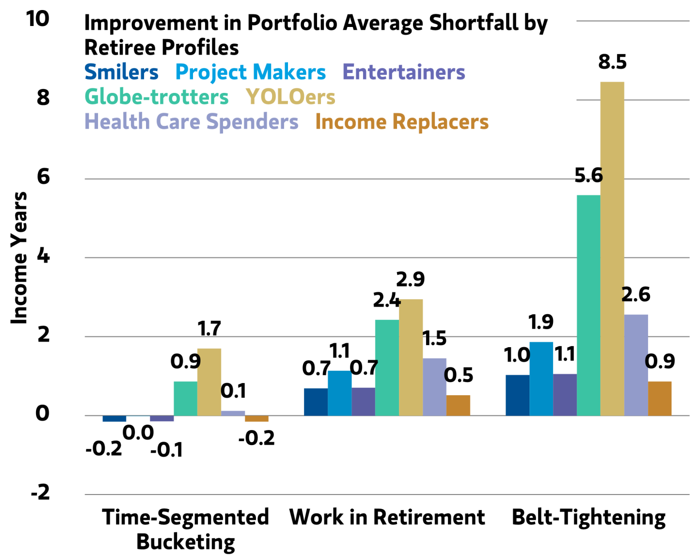
IN BRIEF: There is improvement in most plan metrics for all three strategies risk-mitigating strategies—belt-tightening, work in retirement and time-segmented bucketing.

WHAT'S HAPPENING? Each of the three strategies tested had a substantial mitigating effect on risk independently for most of the spending categories and most metrics. Belt tightening provided the greatest lift for the higher spending profiles, while working in retirement and TSB also led to improvement. TSB had the greatest impact on improving essential expense probability for Health Care Spenders.

WHAT'S NEXT? Areas for additional research include more testing of combinations of strategy, and analysis of the way different inflation rates for components of spending might impact this analysis.







Please see Endnotes for details of the assumptions used in this analysis.
Source: Morgan Stanley Wealth Management as of June 2019

In summary, there are several ways that an income replacement approach toward modeling retirement spending distorts progress and advice. This report highlights the importance of an accurate reflection of spending, as well as how different investment strategies and the realities of retirement work and spending flexibility can be exploited to the benefit of the retiree. This is especially true for retirement profiles that put additional stress on retirement plans, such as spending heavily early in retirement or retiring before being eligible for Medicare.

A Note on Inflation

In our analysis, we have assumed that all retirees face the same inflation rates, notwithstanding their differing spending compositions. Inflation, however, varies according to category of expense. For example, food, apparel and transportation inflation haves been much lower historically than health care and personal care products and services. On a related basis, there is evidence that the simple CPI-U measure that is used to index Social Security benefits might underestimate the true cost of inflation for retirees.[5] A deeper dive into potential future inflation scenarios and what they can mean for retirement planning is beyond the scope of this report. That said, the different components of inflation could be regarded as a source of spending pattern variation, the implications of which our analysis helps to illuminate. More study is needed on this point, and we will return to this issue in the months ahead.

Endnotes

[1]Ty Bernicke, "Reality Retirement Planning: A New Paradigm for an Old Science," *Journal of Financial Planning,* 2005

[2]Jonathan Fisher, David Johnson, Joseph Marchand, Timothy Smeeding, Barbara Boyle Torrey, "The Retirement Consumption Conundrum: Evidence from a Consumption Survey," Center for Retirement Research, 2005.

[3]David Blanchett, "Estimating the True Cost of Retirement," Morningstar, 2013

[4]Michael Stein, *The Prosperous Retirement: Guide to the New Reality,* 1998.

[5]See discussion on CPI-E measure by Bureau of Labor Statistics.
https://www.bls.gov/news.release/cpi.br12396.a06.htm

For more information about the funding ratio, Monte Carlo simulation, and the risks to hypothetical performance, please see the special report, Introducing the Morgan Stanley Wealth Management Retirement Framework.

Model Calculation Assumptions: The analyses in this publication are based, in part, on a Monte Carlo simulation, which involves repeated sampling of asset class returns from a known distribution.

IMPORTANT: The projections or other information generated by this Monte Carlo simulation analysis regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. Results may vary with each use and over time.

The assumptions used in the analyses outlined in the Exhibits in this report are listed below.

Exhibit 2: Essential and nonessential expenses are added up based on BLS expenditure categories. Essential expenses include: (1) food at home; (2) housing expenses including owned dwellings, rented dwellings, other lodging, utilities, fuel, public services, household operations and housekeeping supplies; (3) transportation expenses including gasoline and other fuel, other vehicle expense, and public and other transportation; (4) health care; and (5) personal care products and services. Nonessential expenses include: (1) food away from home; (2) alcoholic beverages; (3) household furnishings and equipment; (4) apparel and services; (5) vehicle purchases; (6) entertainment; (7) reading; (8) education; (9) tobacco products and smoking supplies; (10) miscellaneous; (11) cash contributions; and (12) personal insurance and pensions.

Exhibit 5: The hypothetical retirees are assumed to be a 65-year-old female (62-year-old for YOLOers) who starts retirement with $2,000,000 initial savings in a tax-exempt account utilizing a 60%/40% equity/bond investment strategy. All retirees have individual initial withdrawal rate, adjusted by their individual real growth rate and inflation rate at 1.9% per year. Results are based on a Monte Carlo simulation that simulates both asset returns and investor mortality based on the Social Security Office Actuarial Period Life Table 2016. GIC capital market assumptions are used to simulate asset class returns from age 65.

Exhibit 6: The hypothetical retirees are assumed to have the same initial savings and expense patterns as in Exhibit 5. Retirees in Exhibit 5 follow a systematic withdrawal strategy: target withdrawal amount is taken from the portfolio in the beginning of every year regardless of portfolio performance. Three risk-mitigating strategies are described below.

Time-segment bucketing (TSB) assumes three investment pools for near-term goals (one to 10 years), intermediate-term goals (11 to 20 years) and long-term goals (21+ years). Initial savings are separated into three pools based on present value of liability. Near-term pool has the most conservative allocation (bond heavy), and long-term pool has the most aggressive allocation (equity heavy). The overall initial allocation is also 60%/40% equity/bond. Each investment pool is rebalanced to its initial allocation at the end of each year. When any bucket is not enough for expenses, the withdrawal will be taken from next bucket. At the end of near-/medium-term investment horizon, any surplus will be added to long-term pool.

Work in retirement strategy assumes retirees work part time in the first 10 years of retirement. Part-time income compensates 20% of their initial expenses for 10 years.

Belt-tightening strategy allows temporary decrease and increase in annual withdrawal. Before withdrawal every year, funding ratio is estimated using an age-specific single premium immediate annuity conversion price. The following four scenarios are applied every year: annual withdrawal may be reduced by 25% if funding ratio is lower than 75%; annual withdrawal may be reduced by 15% if funding ratio is lower than 90%; annual withdrawal may be increased by 15% if funding ratio is greater than 110%; and annual withdrawal may be increased by 25% if funding ratio is greater than 125%. At any point, cumulative withdrawal reduction cannot be greater than 20% of cumulative target withdrawal, and an increase in spending is only triggered if cumulative withdrawal is below its target.

Glossary

DRAWDOWN This term refers to the largest cumulative percentage decline in net asset value or the percentage decline from the highest value or net asset value (peak) to the lowest value net asset value (trough) after the peak.

FAILURE RATE The probability that an investment portfolio has failed to provide for the desired level of income throughout retirement, with mortality defined either as a set horizon or an uncertain variable.

FUNDING RATIO This ratio is the present value of retirement liabilities divided by the current market value of an investor's retirement savings. In essence, this ratio measures how sufficient a person's savings are relative to projected goal, in this case, retirement needs.

VOLATILITY This is a measure of the magnitude of variability of the returns of an asset class or security. It is generally the case that a larger dispersion of return implies greater risk, as this implies more substantially adverse outcomes for a given level of likelihood of their occurrence. Volatility is measured statistically as the forecasted standard deviation of return. Standard deviation can be thought of as the average difference between an individual data point (in this case an observed investment return) and the average value of all data points under consideration.

Disclosure Section

Risk Considerations

General: Hypothetical performance should not be considered a guarantee of future performance or a guarantee of achieving overall financial objectives. Asset allocation and diversification do not assure a profit or protect against loss in declining financial markets.

Hypothetical performance results have inherent limitations. The performance shown here is simulated performance based on benchmark indices, not investment results from an actual portfolio or actual trading. There can be large differences between hypothetical and actual performance results achieved by a particular asset allocation.

Despite the limitations of hypothetical performance, these hypothetical performance results may allow clients and Financial Advisors to obtain a sense of the risk / return trade-off of different asset allocation constructs.

For index, indicator and survey definitions referenced in this report please visit the following: https://www.morganstanley.com/wealth-investmentsolutions/wmir-definitions

Indices used to calculate performance: The hypothetical performance results in this report are calculated using the returns of benchmark indices for the asset classes, and not the returns of securities, fund or other investment products.

Indices are unmanaged. They do not reflect any management, custody, transaction or other expenses, and generally assume reinvestment of dividends, accrued income and capital gains. Past performance of indices does not guarantee future results. Investors cannot invest directly in an index.

Performance of indices may be more or less volatile than any investment product. The risk of loss in value of a specific investment is not the same as the risk of loss in a broad market index. Therefore, the historical returns of an index will not be the same as the historical returns of a particular investment a client selects.

Investing in the market entails the risk of market volatility. The value of all types of securities may increase or decrease over varying time periods.

This analysis does not purport to recommend or implement an investment strategy. Financial forecasts, rates of return, risk, inflation, and other assumptions may be used as the basis for illustrations in this analysis. They should not be considered a guarantee of future performance or a guarantee of achieving overall financial objectives. No analysis has the ability to accurately predict the future, eliminate risk or guarantee investment results. As investment returns, inflation, taxes, and other economic conditions vary from the assumptions used in this analysis, your actual results will vary (perhaps significantly) from those presented in this analysis.

The assumed return rates in this analysis are not reflective of any specific investment and do not include any fees or expenses that may be incurred by investing in specific products. The actual returns of a specific investment may be more or less than the returns used in this analysis. The return assumptions are based on hypothetical rates of return of securities indices, which serve as proxies for the asset classes. Moreover, different forecasts may choose different indices as a proxy for the same asset class, thus influencing the return of the asset class.

International investing entails greater risk, as well as greater potential rewards compared to U.S. investing. These risks include political and economic uncertainties of foreign countries as well as the risk of currency fluctuations.

Alternative investments may be either traditional alternative investment vehicles, such as hedge funds, fund of hedge funds, private equity, private real estate and managed futures or, non-traditional products such as mutual funds and exchange-traded funds that also seek alternative-like exposure but have significant differences from traditional alternative investments. The risks of traditional alternative investments may include: can be highly illiquid, speculative and not appropriate for all investors, loss of all or a substantial portion of the investment due to leveraging, short-selling, or other speculative practices, volatility of returns, restrictions on transferring interests in a fund, potential lack of diversification and resulting higher risk due to concentration of trading authority when a single advisor is utilized, absence of information regarding valuations and pricing, complex tax structures and delays in tax reporting, less regulation and higher fees than open-end mutual funds, and risks associated with the operations, personnel and processes of the manager. Non-traditional alternative strategy products may employ various investment strategies and techniques for both hedging and more speculative purposes such as short-selling, leverage, derivatives and options, which can increase volatility and the risk of investment loss. These investments are subject to the risks normally associated with debt instruments and also carry substantial additional risks. Investors could lose all or a substantial amount of their investment. These investments typically have higher fees or expenses than traditional investments.

Bonds are subject to interest rate risk. When interest rates rise, bond prices fall; generally the longer a bond's maturity, the more sensitive it is to this risk. Bonds may also be subject to call risk, which is the risk that the issuer will redeem the debt at its option, fully or partially, before the scheduled maturity date. The market value of debt instruments may fluctuate, and proceeds from sales prior to maturity may be more or less than the amount originally invested or the maturity value due to changes in market conditions or changes in the credit quality of the issuer. Bonds are subject to the credit risk of the issuer. This is the risk that the issuer might be unable to make interest and/or principal payments on a timely basis. Bonds are also subject to reinvestment risk, which is the risk that principal and/or interest payments from a given investment may be reinvested at a lower interest rate.

Interest on **municipal bonds** is generally exempt from federal income tax; however, some bonds may be subject to the alternative minimum tax (AMT). Also, municipal bonds acquired in the secondary market at a discount may be subject to the market discount tax provisions, and therefore could give rise to taxable income. Typically, state tax-exemption applies if securities are issued within one’s state of residence and, if applicable, local tax-exemption applies if securities are issued within one’s city of residence. The tax-exempt status of municipal securities may be changed by legislative process, which could affect their value and marketability.

Treasury Inflation Protection Securities’ (TIPS) coupon payments and underlying principal are automatically increased to compensate for inflation by tracking the consumer price index (CPI). While the real rate of return is guaranteed, TIPS tend to offer a low return. Because the return of TIPS is linked to inflation, TIPS may significantly underperform versus conventional U.S. Treasuries in times of low inflation.

Yields are subject to change with economic conditions. Yield is only one factor that should be considered when making an investment decision.

Companies paying **dividends** can reduce or cut payouts at any time.

Investing in smaller companies involves greater risks not associated with investing in more established companies, such as business risk, significant stock price fluctuations and illiquidity.

Stocks of medium-sized companies entail special risks, such as limited product lines, markets, and financial resources, and greater market volatility than securities of larger, more-established companies.

Value investing does not guarantee a profit or eliminate risk. Not all companies whose stocks are considered to be value stocks are able to turn their business around or successfully employ corrective strategies which would result in stock prices that do not rise as initially expected.

Growth investing does not guarantee a profit or eliminate risk. The stocks of these companies can have relatively high valuations. Because of these high valuations, an investment in a growth stock can be more risky than an investment in a company with more modest growth expectations.

Asset allocation and diversification do not assure a profit or protect against loss in declining financial markets.

Credit ratings are subject to change.

REITs investing risks are similar to those associated with direct investments in real estate: property value fluctuations, lack of liquidity, limited diversification and sensitivity to economic factors such as interest rate changes and market recessions.

Rebalancing does not protect against a loss in declining financial markets. There may be a potential tax implication with a rebalancing strategy. Investors should consult with their tax advisor before implementing such a strategy.

These risks are magnified in countries with **emerging markets and frontier markets**, since these countries may have relatively unstable governments and less established markets and economies.

Investing in currency involves additional special risks such as credit, interest rate fluctuations, derivative investment risk, and domestic and foreign inflation rates, which can be volatile and may be less liquid than other securities and more sensitive to the effect of varied economic conditions. In addition, international investing entails greater risk, as well as greater potential rewards compared to U.S. investing. These risks include political and economic uncertainties of foreign countries as well as the risk of currency fluctuations. These risks are magnified in countries with emerging markets and frontier markets, since these countries may have relatively unstable governments and less established markets and economies.

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