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Target Date Investing
A DIFFERENT PERSPECTIVE ON SEQUENCE-OF-RETURNS RISK AROUND RETIREMENT

EXECUTIVE SUMMARY

- Investors saving for retirement must consider a range of factors, including the objectives they wish to achieve and the risks they are willing to take. One factor that often receives significant attention is sequence-of-returns (SoR) risk—the concern that portfolio losses around retirement could impact the ability to support postretirement income needs.
- We recognize that investors may have different retirement objectives, resulting in different risk priorities. While some investors may rationally prefer a strategy that limits the variability of account balances around retirement, most are focused on achieving adequate, sustainable income streams during retirement.[1]
- In target date investing, it is critical to align glide-path design with investors' objectives. To understand the potential trade-offs, it is not only important to evaluate the magnitude of potential losses, but also to view that potential in the context of the full investment life cycle.
- For investors with a longer-term focus on longevity risk, the benefits of maintaining a growth-oriented glide path in their accumulation phase could meaningfully outweigh the potential negative impact of a large market decline close to or soon after retirement.
- Historically, equities have tended to generate higher intermediate- and long-term returns compared with fixed income and cash assets. In our view, the benefits of capturing this equity risk premium outweigh the potential impact of SoR risk. Our analysis suggests that most investors could have achieved higher asset balances at and into retirement by following higher-equity glide paths, even after experiencing large market declines close to retirement.

Investors saving for retirement must consider a range of factors, including the objectives they wish to achieve and the risks they must take to achieve their goals. One factor that often receives significant attention is the concern that portfolio losses around retirement may impact the ability to support postretirement income needs. This risk is often known as sequence-of-returns (SoR) risk.

[1]T. Rowe Price recently surveyed almost 300 defined contribution plan sponsors to understand their views on these complex issues. Please see: Lorie Latham, *Advancing the Way We Think About Perceptions of Risk and Achieving Outcomes*, T. Rowe Price, July 2018. Available on the Web at: https://www4.troweprice.com/gis/institutional/us/en/insights/articles/2018/q3/defined-contribution-advancing-the-way-we-think.html

We recognize that investors may have different retirement objectives, and differing objectives will result in different prioritization of investment risks. While some investors, given their individual circumstances, may prefer a strategy that limits the variability of account balances around retirement, the majority of retirement investors focus on achieving a durable, sustainable income stream to support their retirement needs.

Poor returns experienced close to retirement can impact the likelihood of premature exhaustion of portfolio assets. As a result, many investors understandably pay close attention to movements—particularly downward movements—in their account balances as they approach retirement. Some investors intuitively may gravitate toward strategies that prioritize stable portfolio balances around retirement.

However, a singular focus on the impact of market movements around retirement does not capture the complete picture when it comes to factors that potentially could lead to premature exhaustion of portfolio assets. One needs to consider the full range of risks and their impact on retirement outcomes over the entire investment life cycle.

Focusing solely on the potential for short-term losses near retirement does not take into account an investor's complete financial situation. Investors face other significant risks—including the risk that an overly conservative portfolio will not achieve the growth required to sustain a desired level of postretirement income. In our view, investors are more likely to achieve their goals by balancing these different risks, both before *and* after retirement.

DEFINING SEQUENCE OF RETURNS RISK

SoR risk goes beyond simple volatility risk because it is a function of both the timing of market returns and the timing of portfolio contributions and withdrawals. When cash flows occur over an investment horizon, the sequence of returns—whether monthly, quarterly, or annually—may have a considerable impact on outcomes. While contributions before retirement and withdrawals after retirement both can produce SoR effects, withdrawals after retirement are typically of greater concern because they may "lock in" losses after a period of poor returns, ultimately leading to premature exhaustion of portfolio assets.

As a result, conventional wisdom assumes that in the event of a large drawdown near retirement, investors with relatively conservative asset allocations will be better off because a conservative portfolio will mitigate the impact of a negative portfolio shock. However, this discounts the possibility that following a more growth-oriented strategy during the accumulation phase could provide a larger portfolio balance going into retirement (i.e., the distribution phase).

In other words, the benefit of having a larger accumulated balance going into retirement may outweigh the negative impact of even a large market decline close to or soon after retirement. While a more growth-oriented portfolio might experience a relatively larger percentage loss in a market downturn, it likely still will be worth more in dollar terms, even after that decline.

To put it another way, consider two newly retired investors: One suffers a 5% decline on a $900,000 portfolio, while the other experiences a 10% loss on a $1 million portfolio. A 5% decline would reduce the first investor's portfolio to $855,000, while a 10% loss would leave the second investor with $900,000—or $45,000 more than his or her more conservative counterpart. The second scenario still results in a larger portfolio balance, even though the percentage loss is twice as large. This is why we believe retirement investment strategies should focus not only on the potential for loss in percentage terms, but on potential outcomes in dollar terms.

SOR RISK IN TARGET DATE INVESTING

A key facet of target date design is the construction of asset allocation glide paths that evolve over time and are focused on achieving specific outcomes. It is critical to align those glide paths with the investment objectives that investors aim to achieve.

In general, glide paths with greater emphasis on supporting long-term income needs will have greater exposure to equities and other growth assets. Glide paths with greater emphasis on reducing balance variability around retirement will feature larger exposures to less volatile assets, such as fixed income and cash.

Target date glide paths typically begin with higher allocations to equities and then gradually rebalance into fixed income assets, so that the portfolio becomes more conservative over time. Because target date strategies are designed to span an investor's entire life cycle, there typically is not a sharp transition from preretirement to postretirement positioning. A glide path that is more conservative at retirement typically will have been relatively conservative in the years leading up to retirement.

While concerns over SoR risk usually center on the risk of a large loss near retirement, investors cannot ignore the possibility that an overly conservative glide path will deliver low returns during the accumulation phase. This means that a conservative glide path ultimately could *increase* an investor's risk at retirement by providing a long-term series of portfolio returns that are not adequate to support postretirement income needs.

Conversely, for investors focused on long-term income, the potential benefits of a growth-oriented glide path could outweigh the impact of even a large market decline close to retirement by allowing them to accumulate larger portfolio balances during the accumulation phase.

Historically, reductions in portfolio volatility typically have come at the expense of reductions in expected portfolio returns. Over shorter periods, equity returns have been more volatile relative to fixed income assets. However, the higher short-term volatility of equities also has been associated with higher long-term returns compared with fixed income assets. This equity risk premium has proven durable over long periods, facilitating wealth accumulation by retirement investors.

MANAGING SOR RISK REQUIRES GLIDE-PATH TRADE-OFFS

The implication of these long-term historical relationships is that any attempt to mitigate SoR risk by reducing equity exposure also will require target date investors to lower their postretirement income expectations. In fact, a more conservative glide path actually might increase the risk of premature portfolio exhaustion during the withdrawal phase if an investor is forced to take larger withdrawals from a smaller asset base to meet his or her income needs.

In this sense, asset allocation is a two-edged sword: While reducing portfolio volatility could mitigate SoR risk, the potential for lower expected returns introduces another risk to retirement income. What ultimately matters is the net effect of these two opposing forces as they are reflected in the glide path.

To illustrate this point, consider two identical investors, H and L, who make exactly the same contributions to their retirement accounts over time; the difference being that H follows a higher-equity glide path while L follows a lower-equity glide path.

Should a severe equity bear market be encountered just before retirement, L is likely to experience a lower level of losses. Historically, however, investors with lower-equity glide paths have been more likely to have lower portfolio balances heading into a bear market. The relevant question, then, is which risk is more important: Would a smaller percentage decline leave L better off, or would having a larger portfolio value going into the bear market leave H better off, despite suffering a larger percentage loss?

EVALUATING THE IMPACT OF SOR RISK

To examine the trade-offs required to manage SoR risk, we can measure possible outcomes using different glide paths. Our analysis here uses the benchmark glide paths represented in the S&P Target Date Indexes. This family of indexes is designed to reflect average asset allocations in the universe of glide paths currently available for different target dates, based on a survey of target date providers active in the market.

For each available target date, S&P also maintains two sub-style indexes—the S&P Target Date To Indexes and the S&P Target Date Through Indexes:

- The "To" glide path, which represents average exposures in glide paths that are generally designed to carry investors up to but not beyond the target date, has relatively lower equity allocations.
- The "Through" glide path, which represents average exposures in glide paths that are generally intended to guide portfolio allocations through the withdrawal phase, maintains relatively higher equity allocations.[2]

As investors in 2020 target date funds are now fast approaching retirement, it is this cohort that will be most exposed to SoR risk over the next several years. Accordingly, we can compare the historical performance of the S&P Target Date To 2020 Index, which had approximately 42.5% invested in equities as of December 31, 2017, with the S&P Target Date Through 2020 Index, which had approximately 56.5% invested in equities.

Typical approaches to evaluating SoR risk focus solely on the potential magnitude of losses at specific points in time. Going into retirement, downside equity market volatility obviously could have a different impact on the two S&P indexes. Given that the To 2020 Index glide path has lower equity exposure, it seems reasonable to assume that it would outperform the Through 2020 Index in a down equity market.[3] However, this approach does not consider the differences in portfolio balances that might accrue during the accumulation period.

To understand the potential trade-offs, it is not only important to evaluate the potential magnitude of losses, but also to view that potential in the context of the full investment life cycle and the financial outcomes investors are seeking. This approach allows us to identify the point at which a rational investor might be indifferent between the outcomes of two different glide paths. In other words, given the potential performances of the S&P indexes in the accumulation phase, how big of an equity bear market would it take to equalize the values of two portfolios tracking those same indexes?

Over the 10 years ended December 31, 2017, the S&P Target Date To 2020 Index posted an annualized return of 4.73%, while the S&P Target Date Through 2020 Index returned 5.60%. So a hypothetical investor who invested $100,000 in a portfolio that tracked the returns on the "Through" index over that same 10-year period could have accumulated a portfolio worth $172,450 by the end of 2017. A hypothetical investor whose portfolio tracked the returns on the "To" index, meanwhile, could have ended up with a portfolio worth $158,720—a difference of $13,730, or 8.65%,

[2]Equity allocations for the S&P "To" and "Through" glide paths are shown in Figure A1 in the appendix.
[3]Given that both indexes continue to maintain meaningful equity exposure around the target date, it is important to recognize that neither a "To" or a "Through" strategy may be able to completely insulate an investor from loss.

in favor of the "Through" investor (Figure 1).[4]

From this starting point, we can calculate the equity loss required to make the outcomes equal for both portfolios as they stood on December 31, 2017. If we assume that bond returns were flat following the 10-year accumulation phase, it could take an equity market decline of more than 45% to neutralize the advantage enjoyed by the "Through" portfolio (Figure 2). In this scenario, the "Through" portfolio could have declined by 25.34%, or $43,698, while the "To" portfolio could have lost 19.1% of its value, or $30,262, leaving both investors with portfolios worth slightly less than $129,000.

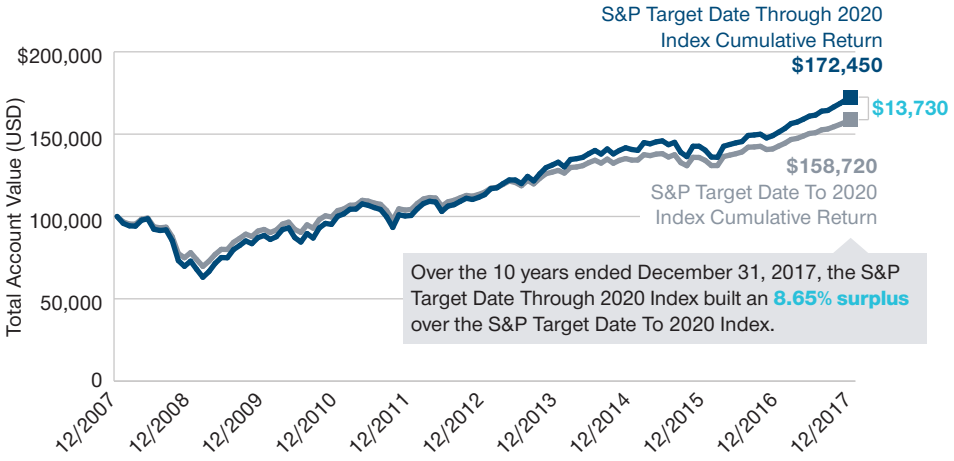
Even in an environment where bond allocations generated a 5% cumulative return during the bear market period, equity prices still might have to fall more than 40% to produce the same ending values for the two portfolios (Figure 3).

In this analysis, we focus on portfolio balances because as a simplifying assumption the current balance can be viewed as the present value of future retirement spending. If we assume that an individual has a set spending strategy, then, all else being equal, a higher balance potentially means that he or she could spend the same amount over a longer period (i.e., the stream of income would last longer) or spend more over a shorter horizon.

In both cases, the SoR risk resulting from market volatility near retirement could have a significant impact on retirement income. However, unless the equity decline were even larger than in the hypothetical scenarios outlined above, the more conservative "To" investor would not enjoy a withdrawal advantage over the more growth-oriented "Through" investor. From an outcome-oriented perspective, the benefit of capturing the equity risk premium over a long investment horizon potentially would outweigh the impact of SoR risk.

FIGURE 1: A Strategically Higher Equity Glide Path Could Have Led to Better Outcomes Over the Last 10 Years

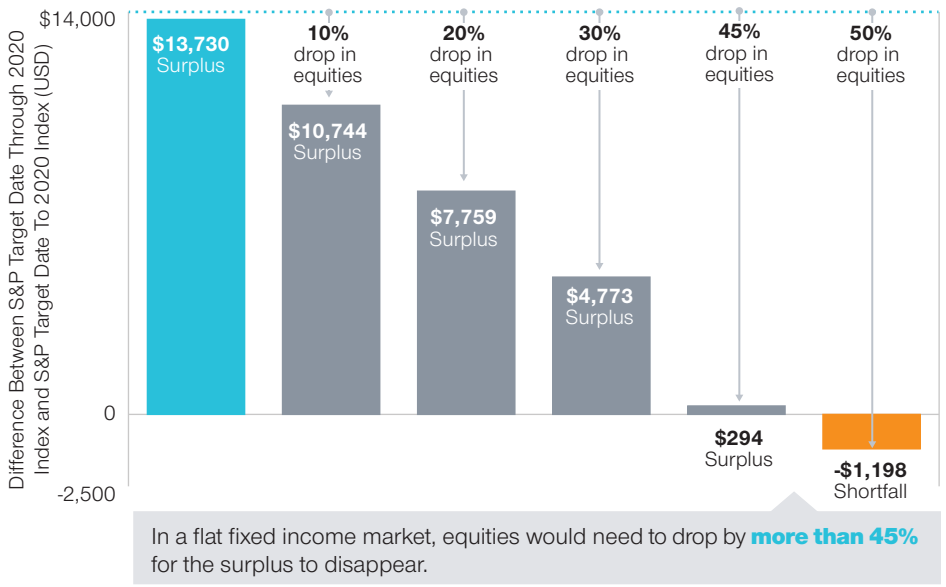
December 31, 2007, Through December 31, 2017



Sources: Standard & Poor's and T. Rowe Price; all data analysis by T. Rowe Price.

FIGURE 2: Hypothetical Bear Market Outcomes in a Flat Fixed Income Market

As of December 31, 2017



Sources: T. Rowe Price and Standard & Poor's; all data analysis by T. Rowe Price.

SOR RISK OVER THE LONGER RUN

To put these potential trade-offs in a broader perspective, it is helpful to observe similar scenarios across a wider range of potential market conditions. Unfortunately, the S&P Target Date To and Through Indexes have relatively short track records, only dating back to May 2007. However, we can simulate

[4]The performances shown here do not reflect the deduction of investment fees or expenses. Past performance cannot guarantee future results. Figure 1 shows the growth of USD 100,000 invested in portfolios tracking the S&P Target Date Through 2020 Index and the S&P Target Date To 2020 Index from December 31, 2007, through December 31, 2017. Figures include changes in principal value, reinvested dividends, and capital gain distributions. All examples are for illustrative purposes only and do not represent the performance of a particular investment. It is not possible to invest directly in an index.

a hypothetical longer-term return comparison by taking the S&P To and Through glide-path allocations and plugging in longer-term historical stock and bond returns.

To do this, we modeled the hypothetical performances of portfolios tracking the S&P To and Through glide paths based on actual historical stock and bond returns experienced by investors over the past 92 years.[5] Our proxy for equity returns was the S&P 500 Index, as calculated by Ibbotson Associates, a financial research firm. Bond returns were based on the Ibbotson U.S. Investment Grade Bond Series. This allowed us to extend our analysis back to 1925—the inception date for the Ibbotson return series.

To reflect the varying situations of target date investors—some of whom may have defaulted into their current glide paths as the result of mid-career job changes—we calculated portfolio performance over 10-, 20-, 30-, and 40-year time horizons, with each horizon ending at the retirement point of the glide path. For each time horizon, we specified a starting salary, a starting portfolio balance, an assumed rate of salary growth, and an assumed annual contribution level. These assumptions are shown in Figure A2 in the appendix.

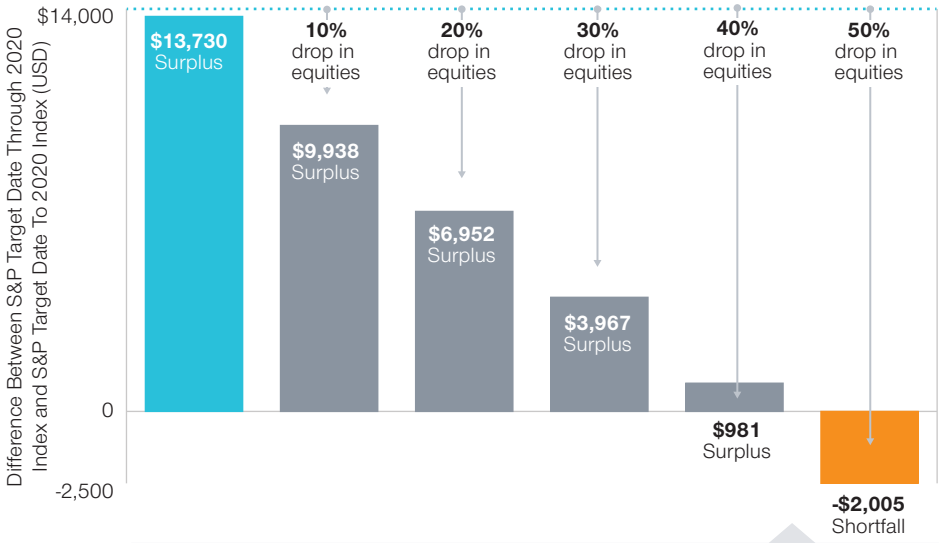
Based on these assumptions, we estimated the hypothetical portfolio balances that investors potentially could have accumulated by following the S&P "To" and "Through" glide paths over each time horizon. Performances were calculated over rolling 12-month periods, rolled monthly, so that, for example, a hypothetical 45-year-old investor with a starting balance of $80,000 who began tracking the "To" glide path on December 31, 1997, could have accumulated a portfolio worth $552,189 over a 20-year time horizon ended December 31, 2017, given the assumed salary levels and contribution rates. If the same hypothetical investor began tracking the "Through" glide path at the end of 1997, his or her portfolio could have been worth $589,718 by December 31, 2017, and so on.

By extending these rolling periods back to 1925, we can generate and compare a large number of hypothetical performance results for the S&P "To" and "Through" glide paths over each time horizon.[6] Our analysis shows that in an overwhelming number of these rolling periods, investors who tracked the higher-equity "Through" glide path could have experienced better outcomes than those with portfolios tied to the lower-equity "To" glide path—even in periods where equity returns were relatively poor immediately before retirement.

Moreover, in the limited number of scenarios in which the higher-equity "Through" glide path might have lagged the more conservative "To" glide path,

FIGURE 3: Hypothetical Bear Market Outcomes in a Fixed Income Market That Appreciates by 5%

As of December 31, 2017



In a fixed income market that appreciated by 5%, equities would need to drop by **more than 40%** for the surplus to disappear.

Sources: T. Rowe Price and Standard & Poor's; all data analysis by T. Rowe Price.

FIGURE 4: Hypothetical Scenario Results

As of December 31, 2017

	10-Year	20-Year	30-Year	40-Year
Total Performance Periods	985	865	745	625
"Through" Outperformance Periods	801	844	741	621
"Through" Outperformance Rate	81.4%	97.6%	99.5%	99.4%
Average Ending Surplus Over All Periods ("Through" Minus "To")	+5.80%	+10.82%	+13.40%	+12.19%
Differential at the 90th Percentile	-2.77%	+2.06%	+4.82%	+5.28%
Largest "Through" Shortfall	-11.33%	-4.96%	-2.65%	-2.65%

Sources: T. Rowe Price, Standard & Poor's, and Ibbotson Associates; all data analysis by T. Rowe Price.

[5]For additional details on the methodology used in our analysis, please see the appendix.
[6]The total rolling performance periods in each time frame covered by our study can be found in Figure A3 in the appendix.

the differences in ending portfolio values were relatively small.

Take, for example, a pair of hypothetical investors who began investing in portfolios tracking the "To" and "Through" glide paths at age 25 and continued to invest until retiring at age 65—a 40-year time horizon:

- Over the 625 possible 40-year rolling periods from 1925 through December 2017, the portfolio accumulated by the investor following the higher-equity "Through" glide path could have been worth an average 12.19% more than the "To" investor's portfolio.
- The "Through" portfolio could have been worth more than the "To" portfolio in 621 of 625 possible periods, or 99.4% of the time.
- The largest shortfall for the "Through" portfolio relative to the "To" portfolio could have been just -2.65%, while the result at the 90th percentile of all periods could have been a +5.28% cumulative performance advantage for the "Through" investor. That is to say, 90% of all results could have shown an advantage of more than +5.28% for the "Through" investor.

Performance statistics for all the time horizons covered in our analysis are shown in Figure 4. The relative positions of the "To" and "Through" portfolios over the rolling periods in each time horizon are visually represented in Figures 5 through 8.

The relationships described above held across the vast majority of historical accumulation periods we examined. The results drive home the historical reality that portfolios with higher equity exposure could have outperformed more conservative asset allocations in the vast majority of periods since 1925.

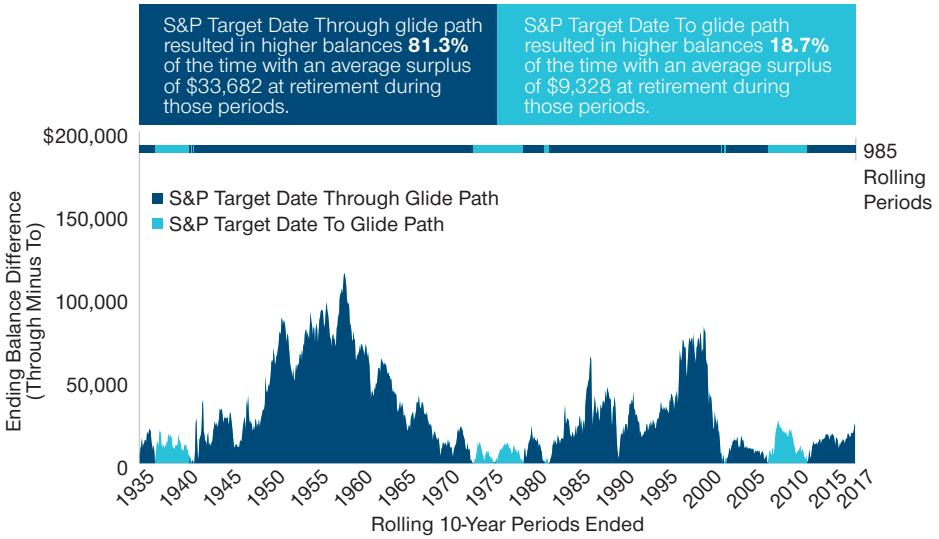
Even as the accumulation periods were shortened and the opportunity to capture the equity risk premium was narrowed, the hypothetical outcomes in our analysis continued to significantly favor higher-equity glide paths. Even over an accumulation period as short as 10 years, a portfolio tracking the S&P "Through" glide path could have outperformed in 801 (or more than 81%) of 985 possible rolling 10-year periods from 1925 through December 2017.

It is fair to recognize that equity bear markets can have a more substantial impact over shorter investment horizons. Indeed, the worst hypothetical result for the "Through" portfolio in our analysis was a -11.33% shortfall relative to the "To" portfolio. However, the average shortfall over those same periods could have been just -3.42%.

In our view, a difference of less than 12% in ending portfolio values is meaningful but hardly catastrophic as a worst-case

FIGURE 5: 10-Year Ending Balances, "Through" Minus "To" Portfolio

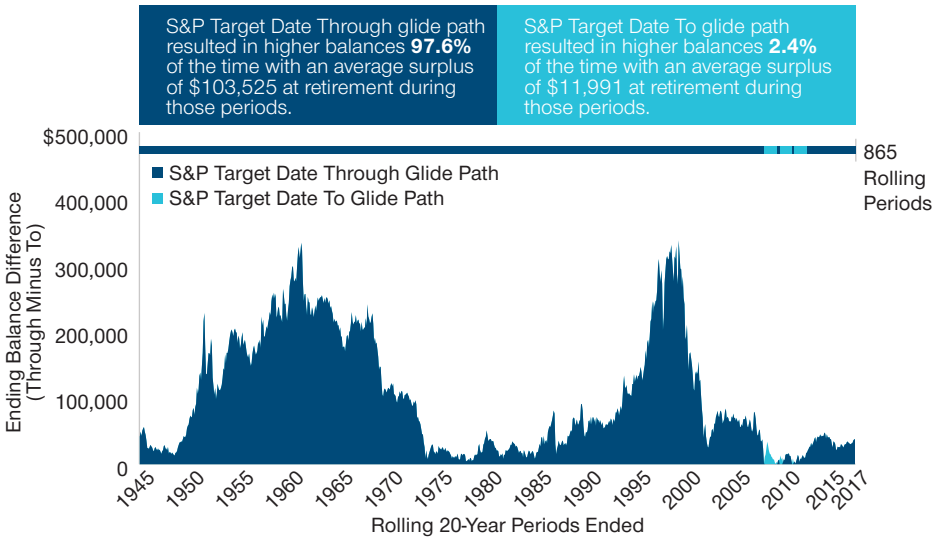
Rolling 10-Year Periods From December 31, 1925, Through December 31, 2017



Sources: T. Rowe Price, Standard & Poor's, and Ibbotson Associates; all data analysis by T. Rowe Price.

FIGURE 6: 20-Year Ending Balances, "Through" Minus "To" Portfolio

Rolling 20-Year Periods From December 31, 1925, Through December 31, 2017



Sources: T. Rowe Price, Standard & Poor's, and Ibbotson Associates; all data analysis by T. Rowe Price.

scenario. This is why we believe the potential benefits of a higher-equity glide path more than outweigh potential SoR risks for most retirement investors.

CONCLUSIONS

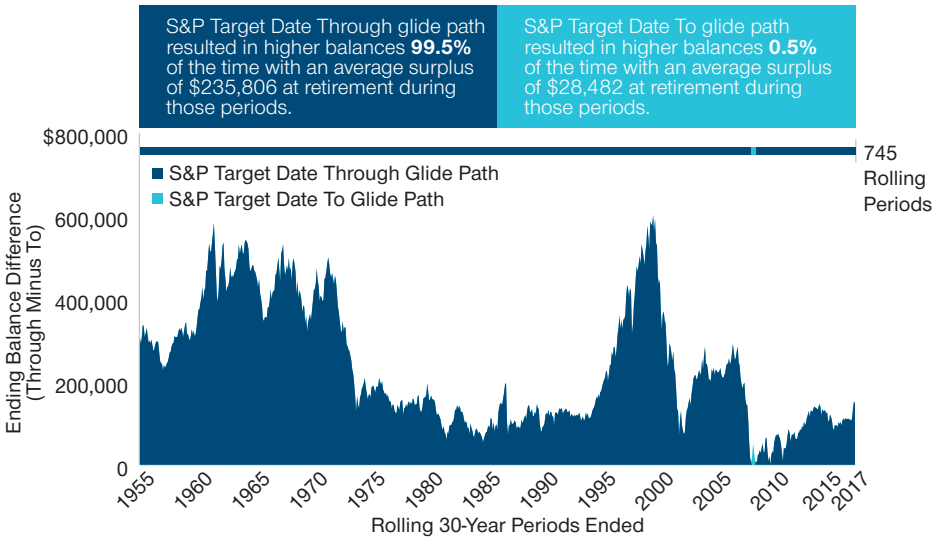
As investors approach retirement, it is not surprising that they may become more sensitive to the risk of a short-term market decline. However, a narrow focus on risk of loss does not take into account the full range of risks that retirement investors face. We believe it important to evaluate SoR risk in a broader, more holistic context, especially if we consider longevity risk and the fact that investors will likely need their income streams to last decades into retirement.

Most retirement investors primarily seek durable, sustainable income streams to support their retirement needs. For these investors, the benefits of a growth-oriented glide path that enables them to accumulate larger portfolio balances during the accumulation phase will tend to meaningfully outweigh the impact of even a large market decline close to retirement, in our view. Efforts to mitigate SoR risk by shifting to a more conservative glide path historically have come at a price: lower expected returns, slower portfolio growth, lower account balances, and lower or less sustainable income streams throughout retirement.

This is not to say that the choice of a conservative glide path is always unjustified. Some investors, given their circumstances, may rationally prefer a strategy that limits the variability of account balances around retirement. But SoR risk mitigation in and of itself does not appear to be a particularly good motive and brings with it other risks. This highlights the need for investors to consider SoR risk within the context of their total financial situations—including their anticipated contribution levels and postretirement income needs.

FIGURE 7: 30-Year Ending Balances, "Through" Minus "To" Portfolio

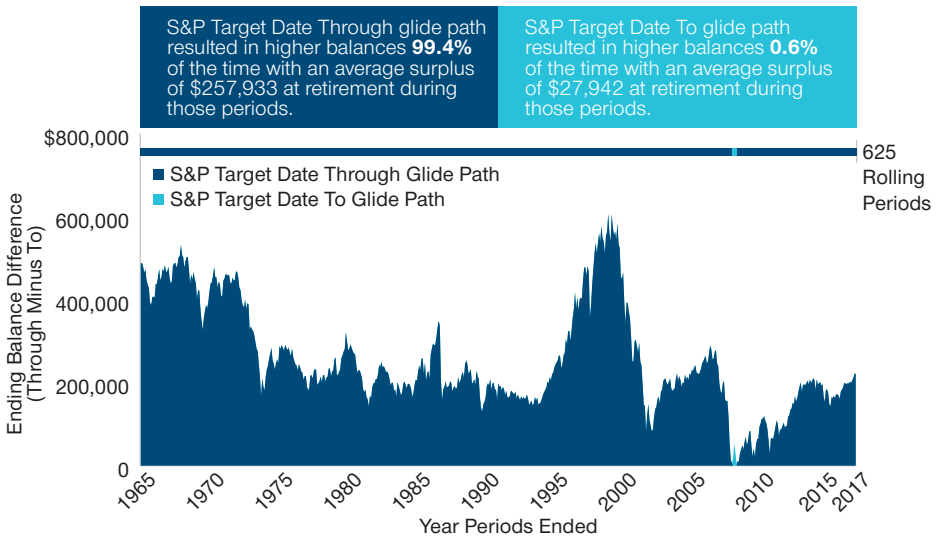
Rolling 30-Year Periods From December 31, 1925, Through December 31, 2017



Sources: T. Rowe Price, Standard & Poor's, and Ibbotson Associates; all data analysis by T. Rowe Price.

FIGURE 8: 40-Year Ending Balances,"Through" Minus "To" Portfolio

Rolling 40-Year Periods From December 31, 1925, Through December 31, 2017



Sources: T. Rowe Price, Standard & Poor's, and Ibbotson Associates; all data analysis by T. Rowe Price.

For investors who have had the opportunity to accumulate savings over the course of long working careers, higher-equity glide paths historically could have delivered higher retirement balances in the vast majority of long-run periods, even after taking SoR risk into account. We believe investors would be wise to consider this experience when choosing target date strategies.

Appendix:
METHODOLOGY

The hypothetical portfolio results shown in Figures 4 through 8 were based on equity and fixed income allocations that corresponded to the glide paths in the S&P Target Date To indexes and the S&P Target Date Through indexes as of December 31, 2017 (source: S&P Dow Jones Indices LLC). The equity allocations in the glide paths for the To and Through indexes are shown in Figure A1.

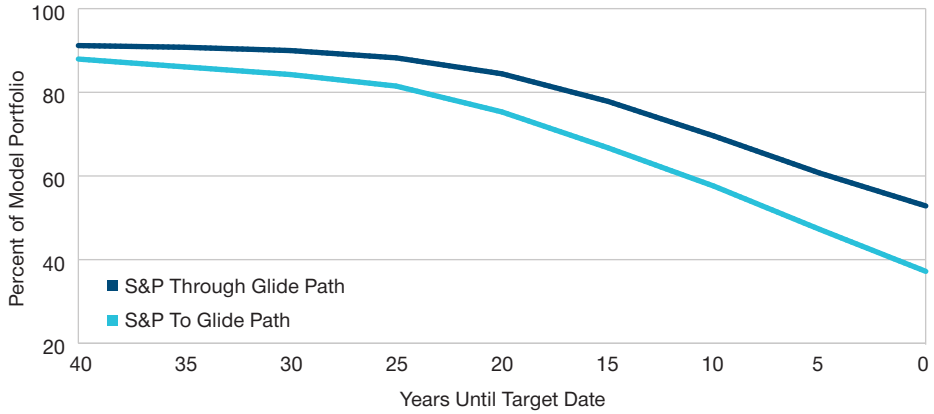
Hypothetical cumulative portfolio performances were calculated for rolling 12-month periods over 10-, 20-, 30-, and 40-year time horizons. These hypothetical performances were based on a set of assumptions regarding the age, beginning balance, beginning salary, salary growth rate, and contribution rate of a hypothetical retirement investor (Figure A2).

Hypothetical portfolio performance was based on the historical performances of asset class benchmarks: for equity allocations, the Ibbotson SBBI U.S. Large Stock Index from January 1, 1926, through January 31, 1970, and the S&P 500 Total Return Index from February 1, 1970, through December 31, 2017; for fixed income allocations, the Ibbotson SBBI U.S. Intermediate Term Government Bond Total Return Index from January 1, 1926, through December 31, 1972 (source: Ibbotson Associates), the Bloomberg Barclays U.S. Government/Credit Total Return Bond Index from January 1, 1973, though December 31, 1976, and the Bloomberg Barclays U.S. Aggregate Bond Total Return Index from January 1, 1976, through December 31, 2017.

The hypothetical results shown represent the differences between the monthly ending values of the hypothetical through-retirement portfolio and the hypothetical to-retirement portfolio over rolling 12-month periods. The rolling performance periods in each time frame are shown in Figure A3.

FIGURE A1: Equity Allocations in S&P Target Date Index Glide Paths

As of December 31, 2017



Source: Standard & Poor's.

FIGURE A2: Scenario Analysis Assumptions

As of December 31, 2017

Time Horizon	Beginning Age	Beginning Balance	Beginning Salary	Salary Growth	Contribution Rate
10-year	55	$130,000	$60,000	3%	10%
20-year	45	80,000	60,000	3	10
30-year	35	40,000	55,000	3	10
40-year	25	0	35,000	3	10

Source: T. Rowe Price.

FIGURE A3: Rolling Performance Periods

Rolling Monthly, December 31, 1925, Through December 31, 2017

Time Horizon	Total Rolling Periods
10-year	985
20-year	865
30-year	745
40-year	625

Source: T. Rowe Price.

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