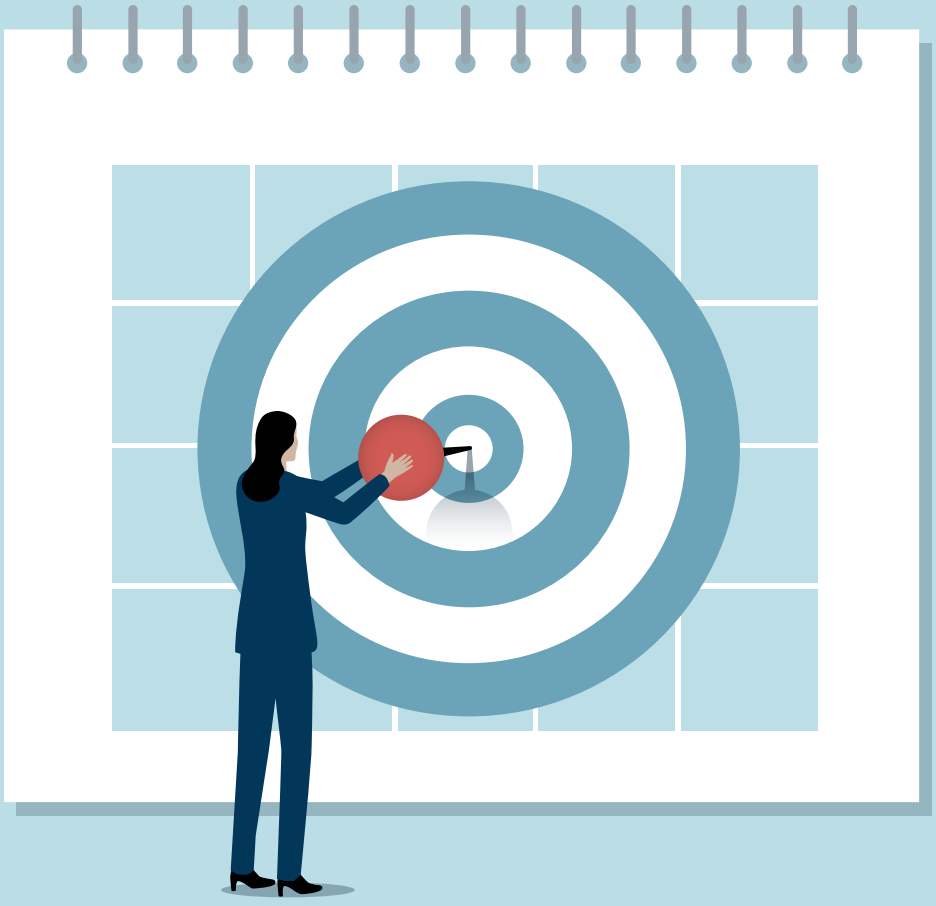
charles SCHWAB Investment Management

Behavior-driven glide path design

Positioning investors for greater self-funded retirement success



Executive summary

The glide path for Charles Schwab Investment Management's (CSIM's) target date funds draws from a pragmatic behaviorally driven asset allocation approach based on extensive research and real-world experience working with data from retirement investors through multiple market cycles. By focusing on how these individuals tend to select their asset allocations and respond to risk, our target date funds seek to enhance the investment experience of everyday working people across all aspects of strategy delivery, from glide path development to portfolio implementation.

Our goal is to help investors secure a successful retirement by supporting lifelong wealth accumulation without unduly placing savings at risk. To achieve this outcome, CSIM's glide path design is based on a framework that carefully quantifies the level of risk investors can tolerate and benefit from as they continually move closer to and through retirement. We strive to holistically manage the notable, interconnected risks that investors may encounter across a lifetime of investing, being mindful of volatility and downside risk controls so that investors continue contributions, even in difficult market climates.

Key takeaways

- CSIM's glide path is built using comprehensive behavioral and quantitative analysis.
- The glide path design evaluates risks holistically using our proprietary risk proxy methodology.
- Diverse inputs and stress tests help our glide path address behavioral tendencies, investment risks, and withdrawal sustainability.
- Our glide path is continually evaluated and strategically evolves to help investors achieve retirement success.

Introduction

This paper provides an overview of the research and pragmatic thinking behind CSIM's target date funds' glide path and how it is designed to lead to stronger investor outcomes. Our glide path design, depicted in Exhibit 1 below, follows a strict investors-first philosophy, both in terms of addressing the greatest threats to retirement security as well as aligning our asset allocation strategy to the evolution of investor risks. This draws from extensive multi-asset management experience and in-depth knowledge of the behaviors that drive investors' savings and spending in retirement.

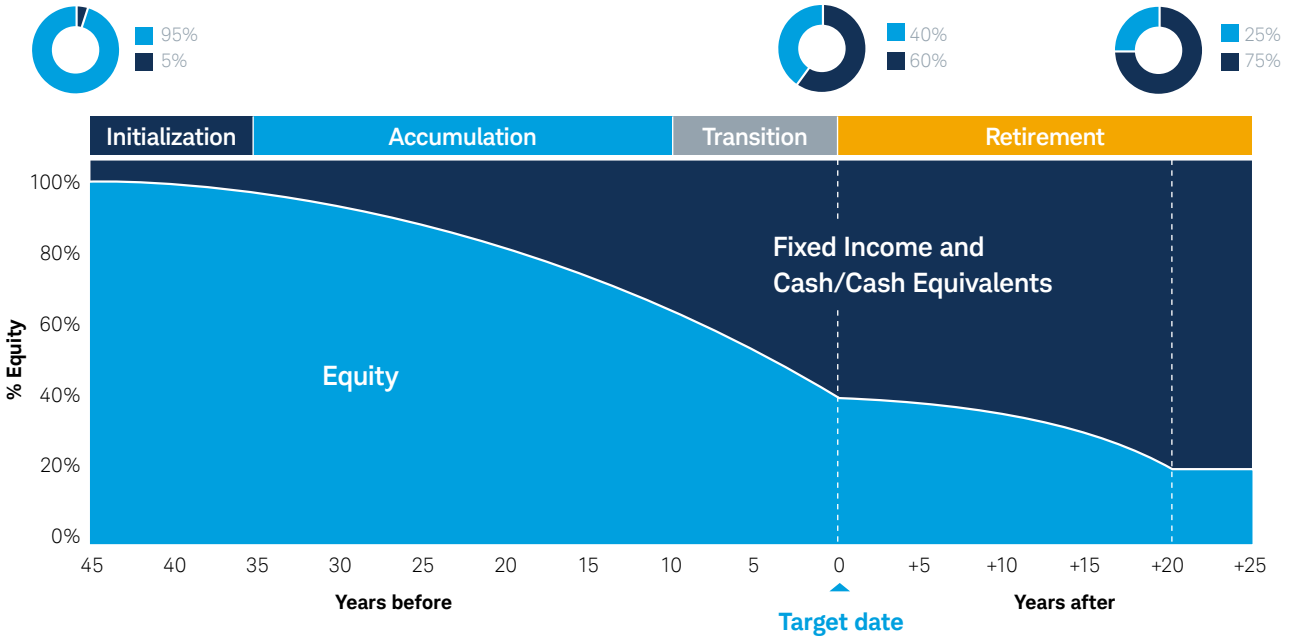
We believe that a target date fund's glide path should:

- Seek a balance between upside potential and managing risk at every stage in the investment lifecycle up to and through retirement
- Implement a risk reduction methodology that seeks to limit the possibility an investor outlives assets (i.e., longevity risk)
- Be delivered through a systematic, objective, and transparent investment process

At its core, our glide path development is fundamentally about identifying the most efficient allocation of risk at various life phases based on the level and type of risk the typical investor is capable of taking on in each phase. The methodical expression of this in a target date fund strategy can help place investors on a safer retirement savings path across a lifetime of investing.

Exhibit 1: Glide path design

CSIM's glide path strives to deliver successful retirements with appropriate risk exposures throughout investors' lifetimes.



Process Overview

The fundamental goal behind our target date fund design is to help investors maximize asset accumulation without unduly placing savings at risk, in order to secure a safe, sustainable income source in retirement. To build a portfolio that strives to achieve this outcome, we developed our glide path utilizing investment and behavioral research and our own experience in working with data from a wide range of retirement investors. This process is highlighted below in Exhibit 2 and discussed in greater detail in the pages that follow.

Key initial inputs

First, we will discuss the key initial inputs into our glide path design, which apply our research about retirement savers and long-term investment views.

Savings profile/Demographic inputs

Our process starts with what we know about investors based on their real-world behaviors. For example, the data from numerous retirement plan participants served by Schwab's 401(k) recordkeeping platform combined with Bureau of Labor statistics and Employee Benefit Research Institute data enable us to better understand the saving patterns, behavioral biases, and anticipated retirement needs for a wide range of investors.

For base-case modeling scenarios, we have synthesized this information to identify a typical investor savings profile, assuming conservative salary deferrals and employer match amounts to anticipate realistic accumulation potential and withdrawal needs (see an example of this in Exhibit 3).

Exhibit 3: Savings profile

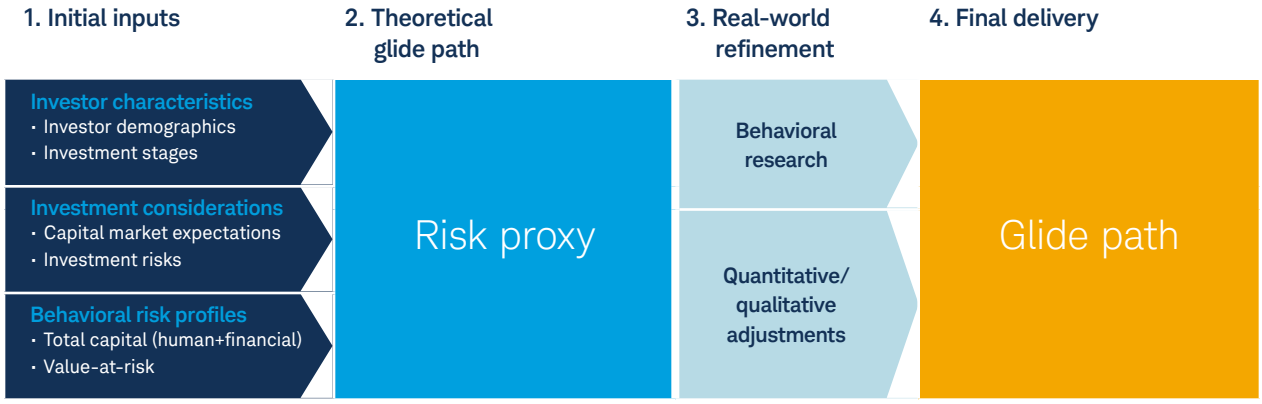
Base-case investor savings profile (nominal)

Age range	25-35	36-45	46-55	56-65
Deferral Rate	4.0%	5.0%	6.0%	7.0%
Employer match	2.0%	2.5%	3.0%	3.5%
Annual salary increase	4.0%	4.0%	3.0%	2.0%

We derive several core expectations from our research of this data. A sample scenario follows:

- Investors tend to be reasonably consistent savers for 40 years and then spenders for 20+ years.
- Deferrals begin at 4% of salary per year for the youngest investors but steadily increase as salary, tenure, and age increase until a final deferral rate of 7% is reached to conservatively estimate retirement balances; employer match contributions are considered a component of investors' retirement savings, with base-case assumption of 50% employee deferral match.

Exhibit 2: From research to implementation—a comprehensive approach to glide path design



- Typical retirement age is 65, and approximate life expectancy is 85 (20 years post target retirement, which corresponds to the lowest equity policy weight in our glide path).
- Average investor salary and deferral projections help analyze risk/return impact across the glide path, with stress test scenarios created to test losses under difficult market conditions; however, investors' individual scenarios will vary based on unique circumstances.

Investment phases

Our research has identified four main investment phases: Initialization (ages 21-30), Accumulation (ages 30-55), Transition (ages 56-65), and Retirement (age 65+). Each phase presents distinct risks based on changing investor characteristics, such as age, remaining working years, salary expectations, savings rates, downside risk tolerance, and need for withdrawals (see Exhibit 4).

The potentially detrimental behaviors we tend to see in investor savings patterns in these segments will be unsurprising to anyone involved with retirement investing. Many investors are simply not saving enough, especially in their younger Initialization and prime Accumulation years.

Behavioral research also shows that investors may chase returns, buying and selling at precisely the wrong time. This can be particularly evidenced in reaction to steep market declines, given that pain of loss has consistently been shown to be much greater than the happiness derived from an equal level of gain.

While glide path design alone cannot control investor usage, it can help support positive behaviors. For example, higher allocations to risk assets early in the glide path may help compensate for savings deficits by maximizing the potential of long-term gains and investment compounding. However, the larger takeaway, in our view, is the importance of volatility controls and reducing the risk of outsized losses in order to keep savers invested and avoid fear-based selling. This becomes increasingly crucial as the glide path progresses and the time to recover from loss becomes shorter. For a real-world example, consider the Transition stage investors entering the 2008 financial crisis with equity-heavy portfolios who may have had to delay retiring to help recover investment losses before starting to make withdrawals—or worse who sold in reaction to notable losses and were never able to recoup their original balances due to missing the subsequent market rebound. Our glide path seeks to reduce these ill-timed dramatic losses by properly allocating risks with the remaining time horizons of our investors.

Exhibit 4: Investment phases

Investors' primary life stages and key considerations throughout the investment horizon

	Initialization	Accumulation	Transition	Retirement
Age range	**21-30**	**30-55**	**55-65**	**65+**
Characteristics	• Many working years ahead • Low salary • Deferrals start at approximately age 25 • Highest human capital • Lowest financial capital	• Increasing salary • Prime earning years • High human capital • Increasing financial capital	• Preparing for retirement • Rapidly falling human capital • Peak financial capital	• No additional income • Withdrawals begin
Major risks	• Low deferral rate • Too little market exposure	• Not accumulating enough wealth • Disrupted savings strategy	• Large market losses	• Loss of purchasing power • Depleting assets

For illustrative purposes only

Capital market expectations

Another key input to modeling a successful glide path strategy is a robust set of long-term capital market expectations. In order to understand the possible market scenarios that investors may experience as they save for and spend in retirement, Charles Schwab Investment Management develops long-term return, volatility, and correlation expectations for each asset class. Our process utilizes both qualitative and quantitative research leveraging internal and external insights to create these expectations for a long-term horizon of at least ten years. We formally review our capital market expectations on an annual basis to ensure that our expectations remain responsive to evolving market conditions. As our return and volatility expectations change over time, we regularly retest our glide path and underlying asset allocation to ensure our structure supports long-term accumulation and withdrawal needs.

Developing the risk proxy—the theoretical glide path

To help better understand the role of risk in glide path design, our research applies these key initial inputs to develop a measure for investor risk tolerance. We call this proprietary metric the risk proxy. We use the risk proxy to firmly base our glide path construction on a realistic foundation of appropriate investment risk levels at different ages and investment phases, drawing from a detailed analysis of projected capital accumulations, required retirement funding levels and a prudent understanding around how investors are likely to experience and react to market volatility.

Quantifying risk in glide path design: Financial and human capital

The premise behind the risk proxy is straightforward. The value an investor places at risk at any point in the glide path draws from two types of capital. Financial capital measures the present value of existing accrued savings balances. Human capital measures the present value of future income and, by extension, future contributions.

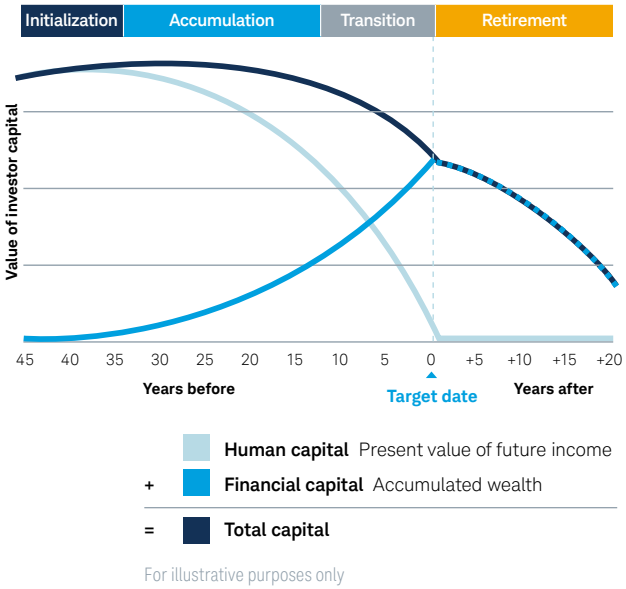
At its most basic level, the risk proxy implies that younger investors beginning their careers typically have limited savings, which translates into low financial capital. This suggests that the real dollar impact from market volatility is insignificant relative to future savings and liability concerns. As such, low financial capital indicates a higher risk tolerance, all things being equal.

Conversely, when investors are young, human capital is significant, given expectations for a large number of working years ahead, years that can help offset market volatility and time to earn and increase income and contributions. When human capital is high, it is further indicative of a higher risk tolerance, all else being equal.

As investors age, they generally have greater financial capital, placing a progressively higher account value at risk as they accumulate more. In addition, their human capital fades over time, but remains important as investor contributions grow. Total capital combines financial capital and human capital to represent the total value a typical investor is placing at risk at various investment stages (see Exhibit 5).

Exhibit 5: Measuring value at risk

Evaluating investors' sources of wealth, and recognizing their value at risk throughout the glide path



For illustrative purposes only

Once total capital is defined, we use it to quantify investors' risk tolerance as a proxy for market risk that is appropriate at various investment stages. We project the annual withdrawal investors can take in retirement under various scenarios to adequately meet their funding needs. In this step, as an added layer of caution, we do not assume Social Security or other post-retirement income sources.

Thus, a simplified version of the risk proxy is represented by the equation below:

$$\frac{\text{Human capital} + \text{Present value of withdrawals}}{\text{Total capital} + \text{Present value of withdrawals}}$$

Note, however, that the proprietary risk proxy metric is a function of many more variables.[1]

The resulting ratio calculates a value between 0% and 100% with a higher value equating to a higher assumed potential market risk tolerance, and vice versa. We then apply this to every age, offering a numerical expression of investor risk tolerance across the glide path, covering an overall time horizon of at least 40 years of saving and 20 years of post-retirement withdrawals (see Exhibit 6 below).

Translating the risk proxy into actual equity exposure

As explained, the risk proxy offers general guidance on determining a prudent glide path slope—the change in equity exposure over time. However, the risk proxy calculation is not intended to be used in isolation. Any single metric, our risk proxy included, cannot entirely reflect all risks that must be accounted for in glide path design.

Thus, relying on a purely quantitative analysis does not completely explain the risk aversion and other emotional and cognitive biases of investors. Accordingly, we make further adjustments to account for behavioral biases, ensure diversification, reduce overall volatility, and protect against dramatic downside risk.

Specifically, our design takes into account potential investor behavior and reactions to market volatility. For example, the design assumes that investors may be more prone to sell after pronounced market corrections. As a result, the glide path intends to reduce maximum potential drawdown and limit the risk of investors selling at inappropriate times, increasing the probability of savers remaining invested and continuing to contribute to help achieve sustainable withdrawal rates in retirement.

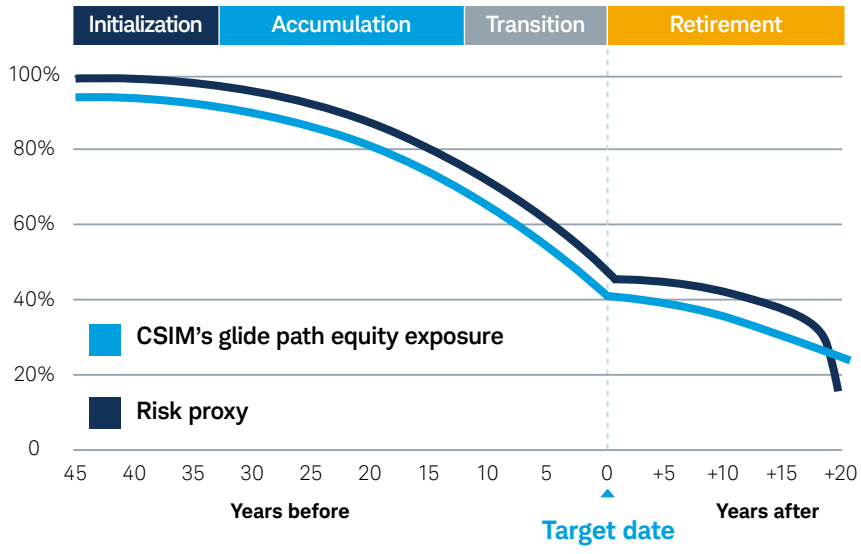


Exhibit 6: Glide path equity allocation
Our model glide path assumptions closely match many employee populations.

Considering this holistic approach, we adjust our final equity market exposure to be slightly more conservative than the purely quantitative risk proxy would suggest, although we still maintain the shape and slope implied by the modeling.

Investment risks

In addition to behavioral risks and our investor-focused approach, there are a number of specific investment risks that we acknowledge and address throughout our glide path, each of which are incorporated into the overall design of our target date funds (see Exhibits 7 and 8).

The nature and magnitude of these investment risks inherently evolve as investors age, moving continually closer and eventually past their retirement dates. They can also change across market and economic cycles.

Asset allocation remains the most useful way to help mitigate these risks, although the interconnected nature of multi-asset investing means that they cannot all be fully eliminated simultaneously. Indeed, decreasing one risk may actually increase another. For example, reducing market and tail risk early in the glide path might increase longevity risk later in retirement. Hence, we believe these investment risks must be viewed holistically to prudently balance the types of risk that investors are vulnerable to at any given life stage.

Sub-asset class diversification

With broad equity/fixed income exposures set, we next begin to use sub-asset classes to further diversify each of these allocations. Our glide path invests in a wide spectrum of asset classes drawn from long-term, strategic allocation decisions, with each segment intended to enhance the risk/return profile throughout the glide path. Some of the major characteristics we consider are long-term risk/return expectations, ability to fundamentally estimate long-term results from inclusion, diversification benefits, availability of implementable strategies, liquidity, specific market segment exposure, cost, downside risk and appropriateness for each investment phase.

Sub-asset class weightings are not held constant, as we believe that risk exposures should change both at the stock and bond level and within those allocations as well. Consequently, both mixes become more conservative over time, intending to better match the investor's changing risk tolerances and liquidity needs. For example, overall equity allocations may be biased toward U.S. large cap securities and generally reduce exposures to historically more volatile segments, such as emerging market, international and small cap equities, as the glide path moves toward retirement.

Exhibit 7: Addressing risk

How CSIM's glide path addresses risk throughout the investment horizon.

	Initialization	Accumulation	Transition	Retirement
Age range	**21-30**	**30-55**	**55-65**	**65+**
CSIM's glide path	• Maximize equity exposures to support long-term growth	• Maintain broad market exposure to support accumulation • Systematically reduce market risk exposure at an increasing rate over time	• Accelerate shift to more conservative assets to protect accumulated wealth and prepare for retirement	• Conservative market exposure at retirement year and beyond • Continue risk reduction for 20 years

Exhibit 8: Investment risks addressed by CSIM's glide path

Challenges	Our approach
Market risk Exposure to investments with higher volatility and risk of large downside market moves Can include exposures to various countries and currencies	• Maximum market exposure for investors with longest time horizon • Less equity for investors near and in retirement. Reduce allocations to more volatile sub-asset classes and active strategies as glide path progresses • Maintain broad diversification to a wide range of sub-asset classes • Larger international exposure early in glide path, increased domestic bias near and in retirement
Longevity risk The risk of investors outliving assets	• Higher level of market exposure early in glide path to support savings growth • Continue to manage exposures for investors throughout their lifespan • Moderate/conservative equity allocations at retirement and continue to roll down beyond the retirement year to match risk tolerance and help offset drawdown needs • Maintain equity exposures well into retirement despite a declining risk proxy, to acknowledge changing mortality rates as investors age • Manage overall volatility to reduce chance of behavioral reaction to market downturns • Ongoing stress tests for age of zero balance under various withdrawal scenarios
Sequence risk The risk of a target fund selling volatile assets during a down market as part of the glide path rolldown	• Maximum annual roll down is less than 4% in any year • Equity roll down slope is flatter after target date • Volatile asset classes and sub-asset classes are systematically reduced each year • Cash allocation provides source of liquidity, reducing need to immediately liquidate more volatile asset classes • Maintain broad diversification throughout glide path • Portfolio managers' use of cash flow during times of market stress
Inflation risk The risk of declining purchasing power	• Maintain allocations to equity and other asset classes that have sensitivity to various sources of inflation throughout glide path, including managing exposures beyond the retirement year • Inclusion of sub-asset classes that may protect against different types of inflation (TIPS, REITS, etc.) • Introduction of dedicated TIPS exposure as the glide path nears retirement
Tail risk The risk of crisis-level losses	• Maintain broad diversification to a wide range of sub-asset classes • Reduce allocations to more volatile sub-asset classes and active strategies as glide path progresses • Maintain a more conservative allocation near and at retirement
Interest rate risk The risk that fixed income assets might lose value when interest rates rise	• Maintain diversified allocations throughout retirement, balancing fixed income and equity exposures to mitigate any specific asset class risk • Increase allocations to lower-duration asset classes such as short term bond and cash as glide path nears and enters retirement

Potential outcomes and stress testing across the glide path

We put our glide path to the test by estimating potential account balances, risks, and downside exposure in various phases using different saving profiles and capital market expectations, as noted earlier. This allows us to better identify potential outcomes under various stress test scenarios for investors over time. Our expected risk/reward improves over time as we transition the glide path toward protection later in life, relative to our earlier focus on wealth accumulation. Additionally, note that the impact of potential market losses is far greater as investors near retirement, further supporting our focus on downside protection in later phases, relative to the less significant impact of potential market loss for a younger investor.

Examples of this output are illustrated in Exhibits 9 and 11. In our stress tests, CSIM's glide path provides increasing protection as investors progress to and throughout their retirement years. Additionally, we estimate our glide path's ability to provide sustainable levels of retirement withdrawals for investors. Exhibit 10 illustrates how long the account might be expected to support various annual withdrawal rates for the typical investor's experience. A 5% withdrawal may provide over 20 years of withdrawals in retirement. A higher 6% withdrawal might exhaust assets at approximately 20 years, and a more modest withdrawal rate of 4% may extend withdrawals well beyond 30 years.

Exhibit 10: Hypothetical withdrawal scenarios

We analyze several different scenarios, and intend to provide for various investor withdrawal needs well into retirement.

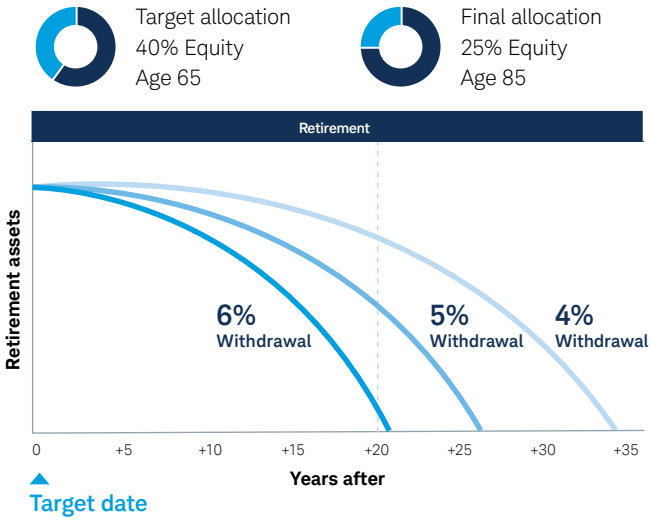
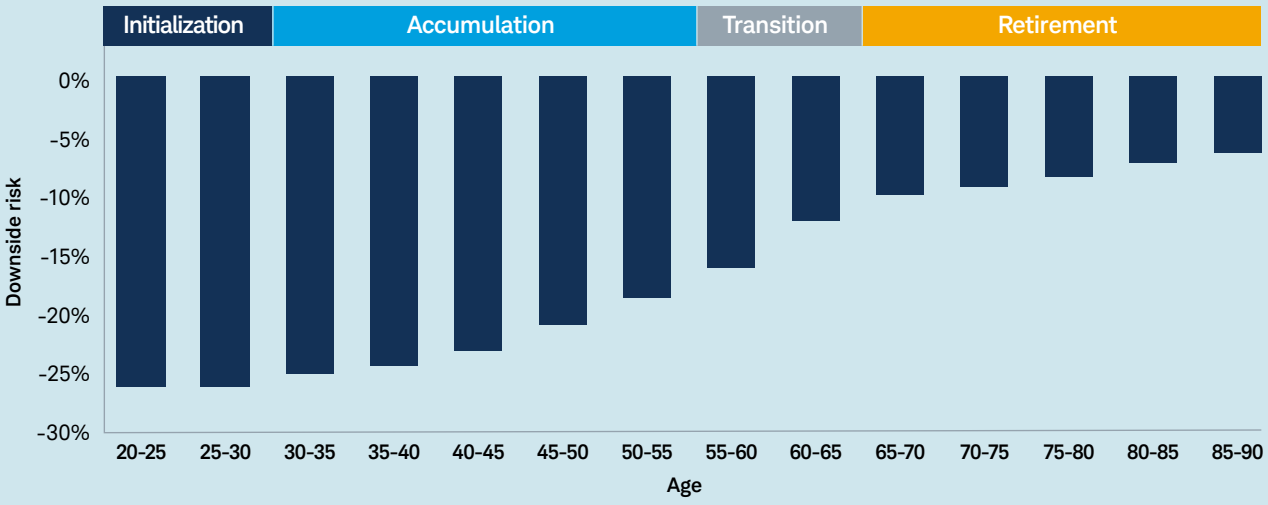


Exhibit 9: Reduced downside risk as investors age[2]



For illustrative purposes only

Exhibit 11: Accounting for the four investment phases

An example of the investor experience throughout CSIM's glide path.

	Age	Average balance with 5% real annual withdrawals starting at age 65	Average potential dollar impact of 10% loss	Average expected return	Average expected risk	Average expected Sharpe ratio	
Initialization	20-25			6.6%	16.5%	0.40	Early savers have minimal impact from market losses, and our glide path maximizes growth potential.
	25-30	$6,610	($660)	6.5%	16.3%	0.40	
	Summary						
	20-30	**$3,700**	**($370)**	**6.5%**	**16.4%**	**0.40**	
Accumulation	30-35	$22,240	($2,220)	6.4%	15.8%	0.40	As savings accumulate, our glide path balances growth with reduced volatility over time.
	35-40	$47,850	($4,790)	6.3%	15.3%	0.41	
	40-45	$88,650	($8,870)	6.0%	14.5%	0.42	
	45-50	$149,170	($14,920)	5.7%	13.3%	0.43	
	50-55	$235,550	($23,560)	5.4%	12.0%	0.45	
	Summary						
	30-55	**$108,690**	**($10,870)**	**6.0%**	**14.2%**	**0.42**	
Transition	55-60	$351,650	($35,160)	4.9%	10.5%	0.47	Nearing retirement, we focus on protecting investors' nest eggs, as the impact from losses could be significant.
	60-65	$517,020	($51,700)	4.3%	8.3%	0.452	
	Summary						
	55-65	**$441,850**	**($44,190)**	**4.6%**	**9.3%**	**0.50**	
Retirement	65-70	$575,140	($57,510)	4.0%	7.0%	0.56	Our glide path emphasizes stability over growth, while helping investors sustain a successful retirement.
	70-75	$514,440	($51,440)	3.9%	6.7%	0.58	
	75-80	$423,690	($42,370)	3.7%	6.2%	0.60	
	80-85	$295,960	($29,600)	3.5%	5.5%	0.64	
	Summary						
	65-85	**$452,310**	**($45,230)**	**3.7%**	**6.3%**	**0.60**	

For illustrative purposes only

Conclusion

CSIM's glide path has been built with the retirement needs of real investors in mind, using a behavioral approach to asset allocation and a history of demonstrated experience through multiple market cycles. In this paper, we have highlighted the extensive research, practical insights, and key portfolio inputs that have gone into building—and monitoring—our glide path design, including:

- A deep understanding of investors and their behavioral biases
- A pragmatic allocation strategy that seeks to holistically balance a full range of investment risks that might be experienced across a lifetime of investing
- A strategic framework accounting for investors' changing wealth accumulation, and projected savings and risk tolerances throughout their lifespans
- A glide path slope aligned with investors' broad risk capacity, utilizing a proprietary measure called the risk proxy
- Tight controls around relative volatility and downside exposure to help increase the probability that savers remain invested and making contributions even in periods of market stress

This intense focus on enhancing the retirement investment experience of everyday working people carries through to all aspects of our target date fund portfolio management, from real-world glide path development to innovative portfolio construction. We believe our emphasis on maximizing retirement outcome potential can help position a greater number of investors to achieve suitable withdrawal levels that are sustainable across retirement.

Charles Schwab Investment Management

With a straightforward lineup of core products and solutions for building the foundation of a portfolio, Charles Schwab Investment Management advocates for investors of all sizes with a steadfast focus on lowering costs and reducing unnecessary complexity.

[1] The CSIM definition of a risk proxy is a function of many variables, such as human capital, financial capital, withdrawals, discount rate, value-at-risk, longevity, risk aversion, age, expected return, and volatility.

[2] Represents the average annual expected return in negative two standard deviation event by age range.

The opinions expressed are not intended to serve as investment advice, a recommendation, offer, or solicitation to buy or sell any securities, or recommendation regarding specific investment strategies. Information and data provided have been obtained from sources deemed reliable, but are not guaranteed. Charles Schwab Investment Management makes no representation about the accuracy of the information contained herein, or its appropriateness for any given situation.

Charles Schwab Investment Management, Inc. (CSIM) is an affiliate of Charles Schwab & Co., Inc. (Schwab) and a subsidiary of The Charles Schwab Corporation.

©2019 Charles Schwab Investment Management, Inc. All rights reserved.

AHA (0319-9G1V) MKT97803-02 (03/19)

For more insights, visit us at schwabfunds.com.

charles SCHWAB Investment Management