

# TARGET DATE FUND RESEARCH

## INSIGHTS

### Ready! Fire! *Aim?*

How some target date fund designs  
are missing the mark on providing  
retirement security  
to those who need it most

## About JPMorgan Asset Management – Global Multi-Asset Group

The **Global Multi-Asset Group (GMAG)** has been managing portfolios on behalf of institutional investors including defined contribution and defined benefit pension plans, endowments and foundations for over 25 years. The Group, which consists of 43 investment professionals with an average of 10 years of industry experience, combines its capital markets, strategic and tactical asset allocation, portfolio construction and active risk budgeting capabilities with one of the broadest product offerings in the industry. JPMorgan's variety of return sources extends across asset classes, geographies and proven investment methodologies. This global product palette provides GMAG's experienced multi-asset class investment specialists with access to the ideal, low correlation building blocks necessary for structuring efficiently diversified portfolios.

**SmartRetirement**, the Group's target date strategies, provides defined contribution plan sponsors and participants with institutional quality investment solutions. Our fund designs combine the skills and asset classes to which our most sophisticated DB plans have access, with over 20 years of insights on participant behavior from JPMorgan Retirement Plan Services, recognized as one of the most innovative and participant-focused record keepers in the industry.

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## Foreword

Over the past several years, many of our clients have taken steps to make their 401(k) plans more robust, hoping that participants will be able to generate sufficient savings to ensure a safe retirement. These efforts have become even more focused recently as numerous studies have illustrated how poorly prepared many participants are for retirement.

The passage of the Pension Protection Act of 2006 and issuance of proposed regulations by the U.S. Department of Labor have given sponsors significant new powers to help participants meet their retirement goals. We view sponsors' new ability to automatically enroll participants, increase their contributions, and adopt new default investment options as critical tools in the battle to engender more consistent savings and investing behavior by participants. We also think these tools create a new implicit social contract between sponsors and employees, one which requires plan sponsors to clearly articulate the goals of their default funds, and to clearly communicate what individuals need to do as plan participants.

We began the research behind this paper because we believe target date funds are sponsors' best choice in the new environment. Although prior studies of target date funds have identified important issues, our intuitive understanding of how participants use their 401(k) accounts made us feel the research was incomplete. As a result, we undertook a rigorous, quantitative examination of savings and spending patterns, based on our proprietary database covering the 1.3 million participants whose 401(k) accounts are administered by JPMorgan Retirement Plan Services. We were not surprised to find that participants have changing levels of contributions and that they take frequent loans and distributions from their accounts, particularly once they reach the age of 59½. But we were surprised to see what a large impact this participant cash flow volatility could have on their expected 401(k) balances at retirement.

We then examined several types of target date retirement fund designs, and found that the volatility embedded in their design was counterproductive, especially in combination with participants' volatile cash flows. We therefore propose a target date structure that accommodates both types of volatility — an institutional quality portfolio that is broadly diversified, more efficient, and thus more effective at helping participants to achieve retirement income security. We believe this goal is especially important for those employees who are not engaged in their retirement planning — and the ones most likely to be defaulted into target date funds.

We hope this research will assist plan sponsors in evaluating this new type of investment, and will help as many participants as possible retire with the income they need.

Sincerely,

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## Ready! Fire! *Aim?*

# How some target date fund designs are missing the mark on providing retirement security to those who need it most

### Executive Summary

In the Pension Protection Act of 2006 and proposed rules from the Department of Labor, sponsors have been granted important new powers, enabling them to take a more active role in helping participants to achieve retirement security, through automatic enrollment, contribution escalation and the choice of target date funds and other default investment options within their defined contribution plans.

Sponsors' more direct role in helping participants achieve greater security is essential. Many workers are no longer able to count on the certainty of a defined benefit pension, so that defined contribution plans have been elevated from supplemental plans ten or twenty years ago to a primary source of retirement income. 401(k) plans will have to replace about 40% of workers' pre-retirement income (with roughly another 40% coming from Social Security benefits), but many participants are still not fully engaged in their retirement planning.

We believe that a prudent goal for plan sponsors is to help as many participants as possible achieve retirement income security. We see this as a measurable goal, where success is defined by the proportion of responsible, real-world participants that arrive at retirement with 401(k) savings sufficient to purchase — whether they choose to or not — a lifetime annuity replacing roughly 40% of their working income.

Our unique perspective — combining JPMorgan Asset Management's 25 years of experience in managing multi-asset portfolios for major institutional investors with JPMorgan Retirement Plan Services' 20 years of insights on participant behavior — leads to our belief that with their new powers and a clearly defined objective, plan sponsors are well-positioned to help participants achieve their income replacement goals. Motivated by this conviction, we have researched two vital 401(k) issues in our efforts to design institutional quality target date funds that incorporate an understanding of real participant behavior and truly “hit the mark” for plan sponsors and their participants:

1. How realistic is the fund industry's modeling of participants' career-long saving and spending patterns?
2. What is the target date portfolio design that will best stand up to the stresses of real life saving and investing?



This paper presents the results of our comprehensive research on the changing obligations of plan sponsors, the savings and investment behavior and responsibilities of participants, and the expanding role of default investment programs, in particular target date retirement funds. Key findings include:

- **Oversimplified industry assumptions:** Participants contribute less to their accounts, and borrow and withdraw more, than most target date providers have assumed in their research.
- **Two types of volatility:** We find that the volatility from cash flows into and out of participant accounts — from loans, withdrawals and contribution holidays — amplifies the effect of market volatility on retirement outcomes. The interaction of the two factors means many participants can be partially out of the markets during crucial years for building capital.

Several important implications for plan sponsors emerge from our findings:

- **Volatility in participant cash flows must be included** both in plan design and the evaluation of target date fund strategies. Target date portfolios should not be evaluated in terms of “equity glide paths,” but by broadly defined “asset allocation glide paths,” conventional risk measures such as the Sharpe ratio, and through Monte Carlo simulations that account for the sequence of market returns and participant cash flows in projecting the range of 401(k) balances at retirement.
- **A broadly diversified portfolio** that extends beyond conventional stocks and bonds to non-traditional assets, such as direct and public real estate, emerging market debt and equity, and high yield bonds, and brings to the individual participant the diversification and risk efficiency characteristic of sophisticated institutional portfolios, can lead to better income replacement outcomes, especially for those participants who need it most.
- **Income replacement, for a greater number of participants:** In our simulations of a 10,000 participant population under real-life assumptions from our participant research, the SmartRetirement strategy compares favorably to three other categories of fund design (which we refer to as *Aggressive*, *Concentrated* and *Conservative*) and shows higher 401(k) account balances at retirement for portfolios below the 50th percentile of possible retirement outcomes — the events that put participants at greatest risk of not replacing the crucial 80% of working income they will need in their retirement years.

We believe that when sponsors apply these findings through effective default participation and savings provisions, as well as a prudently diversified target date default investment option, 401(k) plans can be strengthened such that income replacement levels will be on a par with levels supplied by many defined benefit plans. Defined benefit plans may be disappearing from the American workplace, but thoughtful 401(k) implementation with strong defaults for saving and investing can be the next best thing.

## Fortifying retirement income security

Over the past decade, the U.S. retirement system has begun to shift much of the burden of investment decision-making and risk-taking from the employer to the individual, shaking employees' confidence in a secure retirement. As this trend continues, the challenge of saving enough for retirement is compounded by increases in life expectancy and the fear of outliving life savings.

DC plans are becoming the dominant pillar of support for retirement income

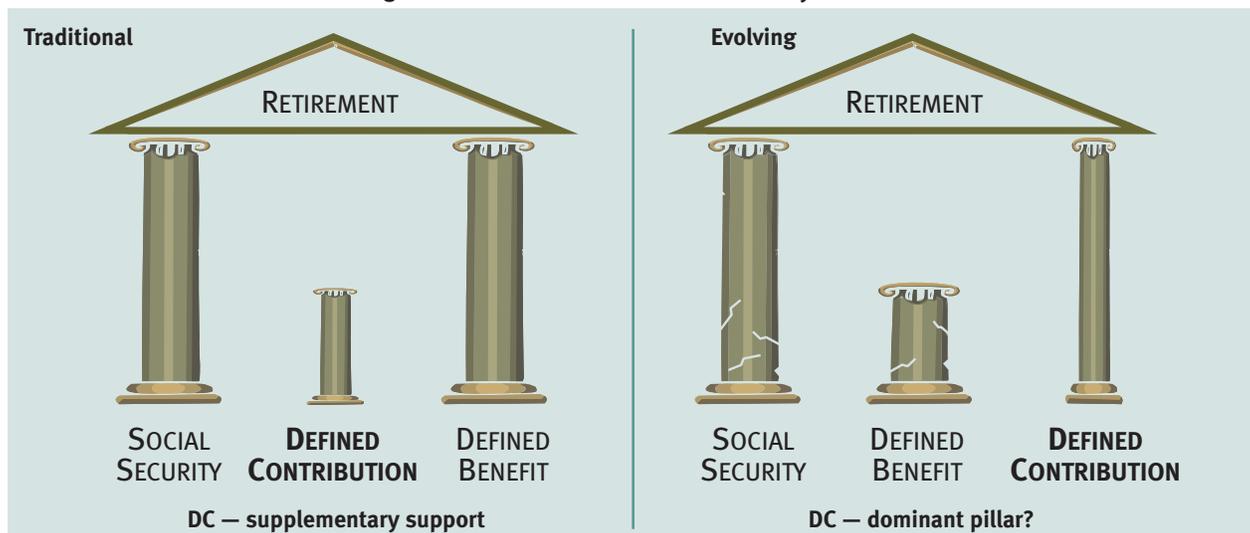
Retiring workers have traditionally relied on three pillars to support their retirement: government-sponsored Social Security, and employer-sponsored defined benefit (DB) and defined contribution (DC) programs. Social Security and defined benefit plans each replaced about 40% of working income, making up the 80% generally needed in retirement to maintain an equivalent lifestyle.<sup>1</sup> Profit-sharing and 401(k) plans served largely as supplements.

As illustrated in Exhibit 1, the future of retirement income looks quite different, however, as 401(k) plans become a dominant pillar of retirement income and defined benefit plans decline in stature.

In addition to the changing balance among these income sources, the certainty of retirement income has shifted as well. We do not believe, as some industry participants have assumed, that Social Security benefits should be eliminated from one's analysis as a component of retirement income. However, we acknowledge that Social Security is likely to experience a slow decline over the very long run. (Please see *"The reliability of Social Security benefits"* on the following page.)

Of greater immediate concern is the decline of defined benefit plans which, as the name suggests, have traditionally offered the security of a specified

**Exhibit 1: The traditional and evolving structures of retirement income security**



Source: JPMorgan Asset Management

<sup>1</sup> The Aon Consulting/Georgia State University 2004 Retirement Income Replacement Ratio Study, Aon Consulting.

benefit at retirement. Funding these promises is the responsibility of the sponsor, whose retirement income pledges are strengthened by employer cash flows and government-sponsored insurance. Assets to meet these liabilities are expertly managed by institutional investment consultants and asset managers. However, an increasing number of plan sponsors are closing or freezing their DB plans, weakening this traditional pillar of retirement income.

Defined contribution plans, on the other hand, focus on the dollars going into the plan, rather than the level of benefits that are paid out. And as DC plans have evolved in the U.S., the final investment and contribution decisions have been left up to participants — many of whom do not have the time, talent or interest to manage their retirement assets. In fact, JPMorgan Retirement Plan Services (RPS) found that among the plans they administer, 40% to 70% of participants fall into the category of investment “delegators” — those least likely to be actively engaged in investment planning for

retirement. In terms of savings behavior, we observe that many employees start saving too late, and take too long to reach suitable contribution rates. In addition, a surprisingly large number start withdrawing at age 59½, before they retire.

The 401(k) plan is just 25 years old, so there is not a full career cycle of retirement outcomes to observe, but from the pessimistic conclusions reached in numerous academic and provider surveys<sup>2</sup>, it appears few workers save enough, or manage their investments astutely enough, to arrive at the finish line with the security of 80% replacement of working income.

In short, today’s workers must assume the burden of funding and managing their own retirement income security as sponsors move their plans from the traditional sturdy defined benefit pillar to the more delicate one of defined contribution. Clearly, fortifications and changes in the roles of plan sponsors and participants are required if defined contribution plans are to stand up under this shift in the retirement burden.

### **The reliability of Social Security benefits**

Our model of income replacement assumes that any person who is working today will be able to count on Social Security retirement benefits for a portion of their post-working income. In contrast, the models proposed by some other target date fund managers conclude that the system is too fragile to count on in 20 or 30 years and thus discount Social Security altogether. We believe this approach goes too far and forces the target date portfolio to set its sights on expected returns and risk that are imprudently high.

The concern over Social Security is well known. The U.S. work force, which funds the program through payroll taxes, is not growing as quickly as the base of retirees. Left unchanged, the program will first become cash-flow negative, then insolvent, and then bankrupt. The system’s evolution is slow, however, and fairly predictable. Social Security’s own estimates acknowledge that cash flow deficits are projected to begin in 2017, and the assets of the fund will be exhausted at 2040. However, they also point out that the taxes collected at rates presently in force would still be sufficient to pay 74% of estimated annual benefits in 2040, and 70 percent of scheduled benefits as far out as 2080.<sup>3</sup>

In our view, the system will likely undergo an overhaul of both the tax revenue and benefit sides, but Social Security does not appear to be in imminent danger of collapse and moreover is unlikely to be dismantled altogether. The current structure has built in both slow increases to retirement age and reductions in benefits; these are the sorts of adjustments we expect to see in the future, and using recent experience as a guide, DC plan participants and sponsors will have many years of lead time to adjust their savings and investing behaviors.

<sup>2</sup> Including Annual 401(k) Benchmarking Survey 2005/2006 Edition Deloitte & Touche USA, LLP; *Boomers Won't Retire Because They Can't* by Alicia H. Munnell, Steven A. Sass and Jean-Pierre Aubry, Boston College Center for Retirement Research.

<sup>3</sup> The 2006 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Trust Funds, U.S. Government Printing Office.

### New powers for DC plan sponsors

Fortunately, some structural reinforcements are already underway. In new provisions included in the Pension Protection Act of 2006 and in draft regulations, Congress and the U.S. Department of Labor (DOL) have validated the importance of securing income replacement and have provided DC sponsors with important new powers. Among them is the broader ability to increase savings through automatic enrollment and auto-escalation of contributions.

In its draft regulations issued in late September 2006, the Department of Labor sent a clear message that sponsors should also take a role in guiding DC investment.<sup>4</sup> Sponsors will likely be granted a safe harbor to replace conservative money market and stable value funds as default options with investment strategies seeking risk and return suitable for retirement investing. (The DOL's allowed options are target date strategies, managed account services and broadly diversified funds that invest for employees of all ages.)

### Target date funds as default options

Target date funds provide automatic asset allocation according to a participant's age, investing more aggressively to build capital early in the employee's career and reducing exposure to market volatility to preserve capital as retirement approaches.

An initial wave of target date fund adoption has been driven primarily by the simplicity and breadth of the solution: once the participant invests in the appropriately dated fund, the portfolio is in the hands of experienced professionals implementing institutional investment strategies.

We believe target date funds will become the most popular default option once DOL rules become effective. When combined with auto-enrollment and escalating contributions, target date strategies, in our opinion, can offer the best opportunities for income replacement, especially among "delegators" who would prefer to have someone else do their investing.

### A new social contract

An implicit new social contract is being defined between employer and worker as plan sponsors increasingly adopt target date strategies as default options and exercise auto-enrollment and escalation rules to strengthen their DC plans. If these strategies are to deliver 40% income replacement with some level of reliability, both participants and sponsors will have to hold up their respective ends of the bargain.

*Participants* need to save more, start saving earlier, contribute regularly, and leave their savings intact until retirement. Auto enrollment and escalation should help participants carry out their responsibilities. Sponsors need to remember, however, that auto-enrollment and escalation will not prevent participants from choosing to decrease contributions or from taking loans and withdrawals. In a later section, and in Appendix 1, we take a close look at the cash flows in participant accounts, highlighting trends that sponsors need to recognize in selecting a default target date investment option.

<sup>4</sup> Federal Register, September 27, 2006, "Default Investment Alternatives Under Participant Directed Individual Account Plans; Proposed Rule."

*Sponsors* have a multi-faceted responsibility, as illustrated by Exhibit 2. We believe sponsors need to take the following steps in evaluating and selecting a target date default option for their plan:

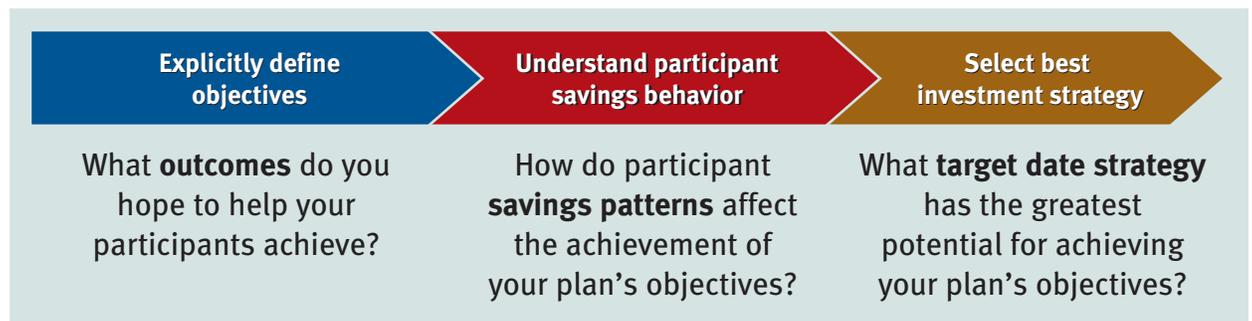
1. **Explicitly define their objective** in providing a default target date strategy — in terms of the retirement outcomes being sought for participants.
2. **Understand participant savings patterns** and their impact on achieving the retirement outcome as defined.
3. **Select the target date strategy that is likely to provide the best fit** in line with these clearly defined objectives and an understanding of the impact of participant behavior on investment outcomes.

This paper draws on the unique perspective of JPMorgan — over 25 years’ experience in managing sophisticated, diversified portfolios for major institutional investors, integrated with over 20 years of insights from JPMorgan Retirement Plan Services (RPS), recognized as one of the most innovative and participant-focused record keepers in the industry.

In this paper we present our proprietary research on target date funds and:

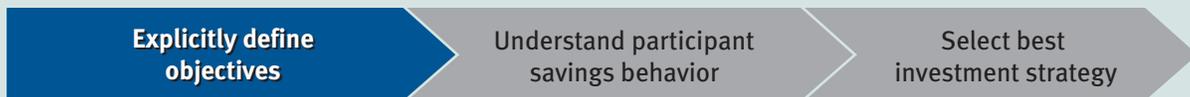
- **Define our view of a prudent goal for both plan sponsors and participants:** to help as many participants as possible achieve a 401(k) balance *at retirement* sufficient to replace roughly 40% of working income which, when added to Social Security benefits, will allow them to maintain their pre-retirement lifestyle.
- **Illustrate, based on studies using our proprietary database of 1.3 million 401(k) participants,** how standard industry assumptions of saving and investing behavior are overly simplified and why the incorporation of actual observed participant behavior matters in designing and evaluating target date strategies.
- **Compare in detail four approaches to target date fund investing,** including JPMorgan’s SmartRetirement design. These four designs demonstrate markedly different philosophies toward risk and diversification over the participant’s lifetime, and vary in their degrees of success in providing participants with retirement income security.

**Exhibit 2: Selecting a default target date strategy for your DC plan**



Source: JPMorgan Asset Management

## Selecting a default target date strategy — Step 1



## Objective: Help as many participants as possible meet their income replacement goals at retirement

As DC plans move from a supplemental program to the primary pillar of support for retirement income, we see a single fundamental purpose for the plan emerging. For participants, we believe the base-line goal is to replace working income — to save the amount needed to fund a hypothetical annuity to pay out the roughly 40% of working income which, together with Social Security, can provide the 80% of working income needed to keep up pre-retirement lifestyles.

Sponsors' goals are complementary. From their viewpoint, a successful 401(k) plan is one that provides the highest probability of replacing working income to the greatest number of employees.

Sponsors, like participants, want a DC plan that offers, as closely as possible, the security of a traditional DB plan's income replacement.

Much of the industry research on target date funds has framed a goal for sponsors of establishing life-long investing programs (i.e., from "graduation to grave"). We believe for many plans this approach may not be appropriate as it extends the investment horizon into an unknowable future.

Retirement is an individual journey for each participant: some people stop working altogether while others start second careers or open a business. Each person's financial situation is unique as well, depending on a spouse's retirement income, family needs and resources. As a result, cash flows are extremely difficult to predict and errors in estimating them, which we think are likely, can lead to significant portfolio volatility in retirement.

### The goal: replacing working income

Income replacement at retirement is a more prudent and realistic goal that aligns the objectives of the sponsor and participant:

- It presents a known time horizon — from the date "hired until retired."
- Assets *at retirement* can be projected with some degree of certainty from estimated contributions and ranges of investment earnings, in contrast to cash flows *after retirement* which are much harder to predict.
- A retirement date target coincides with the time that the worker stops earning and contributing to the plan, and thus it represents a milestone for both the sponsor and the participant.
- When modeled with an annuity purchase at retirement, an income replacement goal compares the outcome of the sponsor's 401(k) plan with a traditional defined benefit plan — the "gold standard" of retirement vehicles.

The discussion on "*The math of income replacement*" which follows provides the data for a simple example. Assume participants in a DC plan retire with a final salary of \$65,000 and can purchase an annuity providing roughly 35% of that income for about \$400,000. A plan sponsor with an income replacement objective should choose the target date strategy that is likely to help the largest percent of participants reach this \$400,000 retirement savings goal.

The investment horizon: "Graduation to grave" or "Hired until retired"?

Whether or not retirees choose to purchase an annuity with their 401(k) balances at retirement, **we believe that helping the greatest number of participants to meet their annuity target is a definable and prudent objective for plan sponsors.** This well-specified goal can lead to more informed evaluation of target date strategies, and allow sponsors to more clearly articulate what will be required from participants to meet their individual income replacement goals.

### **The math of income replacement**

Conventional wisdom on living in retirement holds that people can maintain their working years' lifestyle on a lower income: they've often satisfied the mortgages on their homes, stopped saving, and are paying lower tax rates. The industry's rule of thumb recommends planning to replace around 80% of working income.

A more rigorous analysis arrives at a replacement rate of about 77% for working incomes of around \$85,000.<sup>5</sup> Social Security retirement benefits currently replace about 35% of an \$85,000 working income at age 65. With defined benefit plans becoming a less common source for the remaining amount, 401(k) plans are emerging as an alternative source to make up the difference of roughly 42%. At lower levels of working income, however, a smaller replacement ratio will suffice, due to lower income tax rates in retirement and proportionally greater Social Security benefits. For working incomes of around \$65,000, the total replacement rate is only 75% and Social Security replaces around 40%, so the remaining replacement rate declines to about 35%.

Income replacement can also be viewed in terms of a lump sum — the amount needed, hypothetically, to purchase an annuity that would provide that level of income for life. Estimates of the lump sums differ, depending on the return embedded in the annuity and whether the income stream adjusts with inflation. Although there are a number of methods for measuring the value of a portfolio at retirement, we use the price of an annuity to derive an equal measure for the 401(k) balance needed to provide a minimum income replacement level.

In our analyses, we focused on populations of retirees earning final salaries, on average, of \$65,000. Market prices of annuities replacing 35% of that income were about \$400,000 in late 2006. Alternatively, final salaries of \$85,000 would require around \$600,000 to replace around 42% of that income.<sup>6</sup>

<sup>5</sup> The Aon Consulting/Georgia State University 2004 Retirement Income Replacement Ratio Study, Aon Consulting.

<sup>6</sup> Our analysis assumes a 5% return and a 2.5% inflation rate. Academic research and industry pricing center around these numbers but can vary dramatically. Annuity amounts are inflation-adjusted to represent today's dollars.

## Selecting a default target date strategy — Step 2



# Participant savings patterns matter: What you don't know about your participants can hurt them

Most of the industry analysis we have seen to date on target date funds lays out oversimplified assumptions on participants' pay increases, salary levels and contributions to their accounts. It also assumes that balances are left intact and fully invested for an entire 40-year career.

The reality of participant behavior is altogether different, as we have learned from studying the 1.3 million participants whose 401(k) accounts are administered by JPMorgan Retirement Plan Services. Real-world employees start saving late, and take too long to get up to speed. Salaries don't reach the levels one might expect because most people are given raises in just two out of three years. Quite a few people take loans against their 401(k)s. And many start withdrawing at age 59½, as soon as tax penalties no longer apply.

When compared to the simplistic assumptions of participant behavior built into the projections of many target date funds, these real world traits of actual participants result in much lower contributions and thus have a substantially negative effect on participants' asset levels at retirement. Exhibit 3 summarizes the typical assumptions made in target date simulations and the corresponding behavior we have observed.

The primary difference between the simplified assumptions made in the models of many target date funds versus our analysis is the assumed volatility of cash flows. These simplistic assumptions assume that every participant behaves the same way. They all make contributions every year, and increase them regularly to reach 10% at age 35, and do not take loans, withdrawals or contribution holidays.

Simplified industry assumptions do not reflect real participant behavior

**Exhibit 3: Participant savings behavior**

	<b>Simplified industry assumptions</b>	<i>versus...</i>	<b>Reality: JPMorgan research findings</b>
<b>Contributions</b>	Rates start at 6%, increase year by year, reaching 10% of salary by age 35.		On average, contribution rates start at 6% and increase slowly, reaching 8% of salary by age 40, and 10% not until age 55.
<b>Salary raises</b>	Participants get a raise every year.		On average, participants get raises every 2 out of 3 years.
<b>Loans</b>	Participants don't borrow.		20% of participants borrow, on average, 15% of account balance.
<b>Pre-retirement distributions</b>	Premature distributions don't happen.		15% of participants over the age of 59½ withdraw, on average, 25% of assets.
<b>In retirement distributions</b>	Participants withdraw a consistent 4%–5% annually.		The average participant withdraws over 20% per year at or soon after retirement.

Sources: AllianceBernstein "Target-date Retirement Funds — A Blueprint for Effective Portfolio Construction," October 2005; JPMorgan Retirement Plan Services participant database, 2001–2006.

Although many participants may behave this way, we have found a wide variation in savings behavior across age groups. For example, in our analysis of the 1.3 million participants in the JPMorgan Retirement Plan Services database, we found most participants do not reach 10% contributions until age 55. In terms of outflows, some 20% of participants have outstanding loans against their 401(k) assets between the ages of 30 and 50, while roughly 15% of participants make near-retirement age withdrawals starting at age 59½. (We discuss our findings on these characteristics in detail in Appendix 1.)

Naturally, the difference in the assumptions has a large impact on the assets projected to be available at retirement. Exhibit 4 illustrates two alternative scenarios for a participant starting at age 25 and retiring in 2006 at age 61. One scenario (the upper line) makes the simple assumption of 6% contributions at the outset increasing to 10% contributions after age 35.

In the second case (the lower line) the participant also increases contributions to 10% by age 35, but

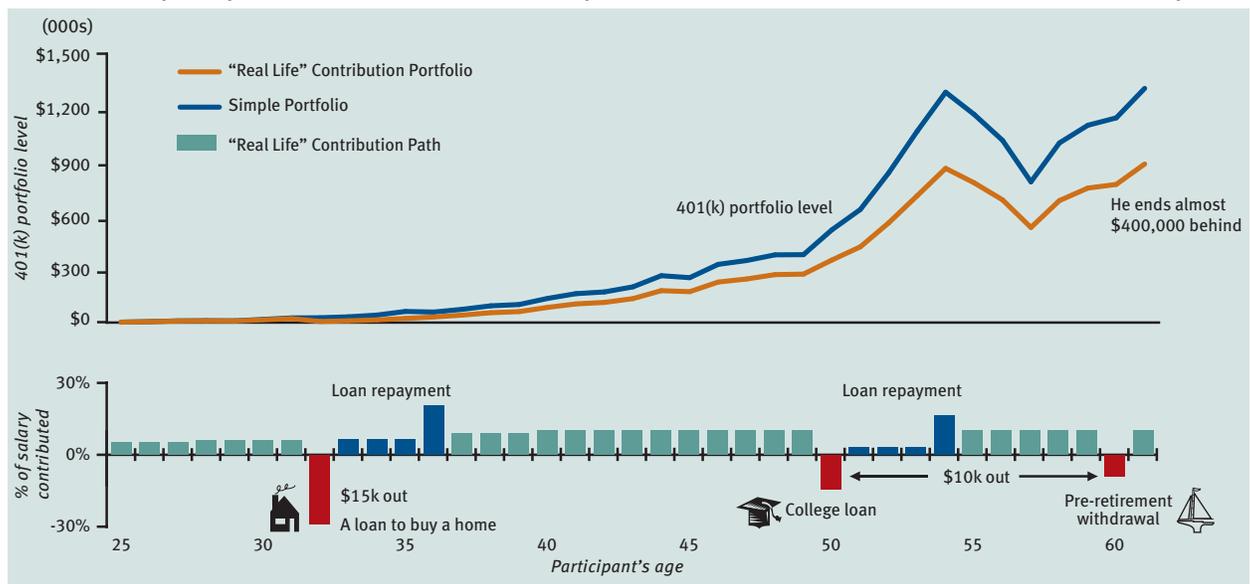
makes a few loans and withdrawals during his career. At age 32 he takes a loan of \$15,000 to buy a house; he repays it over the next four years but during that time stops his contributions. At age 50, he takes a second loan of \$10,000 to pay his children's college tuition (again stopping contributions for four years), and at age 60, he takes a withdrawal of \$10,000 to buy his dream boat for retirement. From our observations of the large JPMorgan Retirement Plan Services participant population, we know these shortfalls in contributions and abrupt withdrawals are fairly common.

To keep the example simple, both accounts are assumed to be invested 100% in the S&P 500 stock index, earning the historical returns of the last 35 years, ending in 2006. When the participant turns 61 in 2006, the two versions of the account stand at about \$1.3 million and \$900,000.

The overall outcome is obvious: contributing less and withdrawing before retirement hurt the final value. But in this case, the participant took small loans and stopped contributions twice, each time for four years.

**Realistic assumptions of contributions and withdrawals must be part of target date fund design**

**Exhibit 4: How participant contributions and withdrawal patterns can affect retirement outcomes (illustrative example)**



Source: JPMorgan Asset Management estimates. For illustrative purposes only. Hypothetical accounts are assumed to be invested 100% in the S&P 500 stock index.

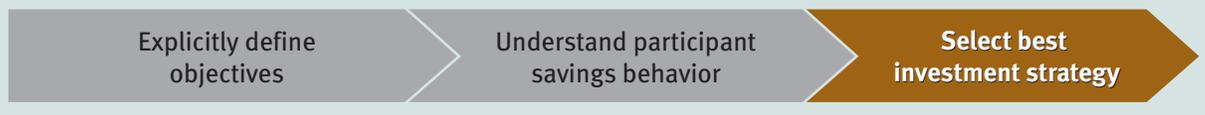


Even though he was only *partially* out of the market for about ten years — including his pre-retirement withdrawal — the interaction of these swings in cash flows with large moves in the market reduced his account balance by about one-third, or \$400,000.

This illustrative example may appear to be an extreme case, because the participant was partially out of the market for several very strong years late in his career. However, loans and withdrawals are common, and most 401(k) portfolios share this market volatility, due to a high correlation to the S&P 500. **But the important conclusion is this: a**

**sponsor that is evaluating a comprehensive default investment strategy such as a target date fund needs to understand actual participant behavior and its implications for long run investing.** Any volatility in cash flows can amplify the volatility of the portfolio; volatility in both components, therefore, should be incorporated into fund design. The sponsor can be proactive through automatic escalation or leave that responsibility to the employee, but in any case, realistic assumptions on contributions and withdrawals must be part of every sponsor's evaluation of target date funds.

### Selecting a default target date strategy — Step 3



## Broadly diversified strategies can help sponsors boost more participants over the income replacement hurdle

If the goal of a 401(k) plan is replacing roughly 40% of participants’ working income, and along the way the investment strategy will have to compensate for volatility in both contributions and market returns, what type of target date strategy is likely to be most effective?

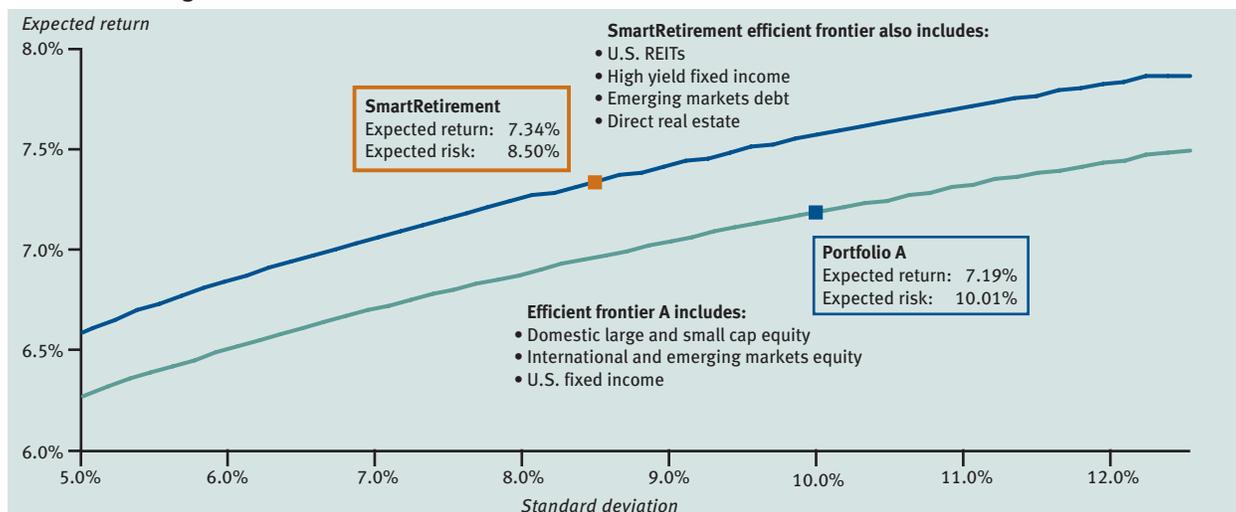
### The importance of institutional quality diversification

Participant funds must be put to work in a strategy that builds capital but does not expose participants to undue risk along the way. We propose a target date design that is efficient, broadly diversified, and invests in a wide range of institutional quality assets: the JPMorgan SmartRetirement strategy. The SmartRetirement portfolio holds a significant amount of equities but applies them more efficiently by diversifying across large cap, small cap, international and emerging market allocations. It also allocates about 20% of the portfolio to

additional diversifying assets, including real estate (both public and direct), emerging market debt, and high yield fixed income. By virtue of greater diversification within the traditional asset mix, and by adding extended and diversifying assets, the SmartRetirement portfolio is designed to use risk as efficiently as possible, to generate the highest return per unit of risk (standard deviation of returns) — a characteristic of institutional quality portfolio construction.

Investing at controlled levels of risk generates more predictable investment results than an undiversified mix high in equities. Diversification can lessen the dispersion of retirement savings outcomes across participants so that even participants with below-average investment results (due to the confluence of market volatility and the timing of their cash flows) have a better chance of meeting their income replacement goals at retirement.

**Exhibit 5: Pushing out the efficient frontier**



Sources: JPMorgan Asset Management Capital Market assumptions — 2006, using arithmetic returns (see Appendix 3), JPMorgan Asset Management, and industry prospectuses.

The above information is provided for illustrative purposes only. Information shown is based upon market conditions at the time of the analysis and is subject to change. There can be no guarantee the expected results will be met.

### **Pushing out the efficient frontier**

Diversification is deemed to be “efficient” when the assets added increase the return per unit of risk, and the more effective the diversification, the more efficient the portfolio. Exhibit 5 depicts an efficient frontier analysis, which illustrates how adding diversifying and return-enhancing assets to a portfolio can improve efficiency — increasing expected return, while actually lowering risk. The graph describes the expected performance of two portfolios — a representative Portfolio A and the SmartRetirement strategy — each constructed from different groups of assets. The upward sloping lines are the efficient frontiers for each portfolio. Both points on the lines are efficient portfolios representing the mix of assets that earns the highest expected return at a specified level of risk, given the returns of the assets in that portfolio, and the correlation among them. Importantly, points on the frontier also represent the lowest level of risk for a portfolio, given a level of expected return.

The lower line represents the asset classes typically found in core DC plan fund lineups and in many target date funds. It includes large cap and small cap U.S. equities, international equities (including emerging markets) and fixed income. Portfolio A on this line achieves a total expected return of about 7.2% with a total expected volatility of 10%.

The upper line builds on the efficiency of the first frontier by adding diversifying assets such as emerging markets equity, REITs, direct real estate, and high yield and emerging markets debt. The efficient frontier moves up and to the left, because the new assets create a more efficient use of risk. The SmartRetirement portfolio is able to achieve slightly higher expected returns of over 7.3% (compared with 7.2%), and does so with a dramatically lower level of expected volatility (8.5% compared with 10%). This represents a 15% drop in total expected volatility, with no sacrifice in expected return. This is as close to a “free lunch” as one gets in portfolio management.

### **Moving along the frontier**

The first step in creating an investment portfolio is to define an efficient frontier from the asset classes to be included. The second step is determining where along the frontier to invest — selecting a target portfolio level of expected risk or return. In the case of target date fund design, this step involves an additional dimension — adjusting the portfolio allocation over time, i.e., moving along the efficient frontier in the direction of lower risk as participants approach their target retirement date. This added dimension of target date funds is referred to by many in the industry as the “glide path,” a construct which captures both the combination of assets within the portfolio as well as shifts in asset allocation over time.

## Comparing target date fund designs

In researching the portfolio composition and simulated investment outcomes of target date funds, we have identified three categories of fund design which we will refer to as *Aggressive*, *Concentrated* and *Conservative*. Each strategy starts out holding mostly equities and then switches over to large allocations to bonds or cash at the end. But the dynamics of the shift, as well as the addition of diversifying non-traditional assets, make a considerable difference to the overall results.

Based on actual funds in the marketplace, Exhibit 6 summarizes the projected portfolio allocations over time for the three types of strategies and the SmartRetirement design. Given our stated objective of helping the greatest number of participants reach their replacement income goals at retirement, we will focus primarily on these glide paths through age 65.

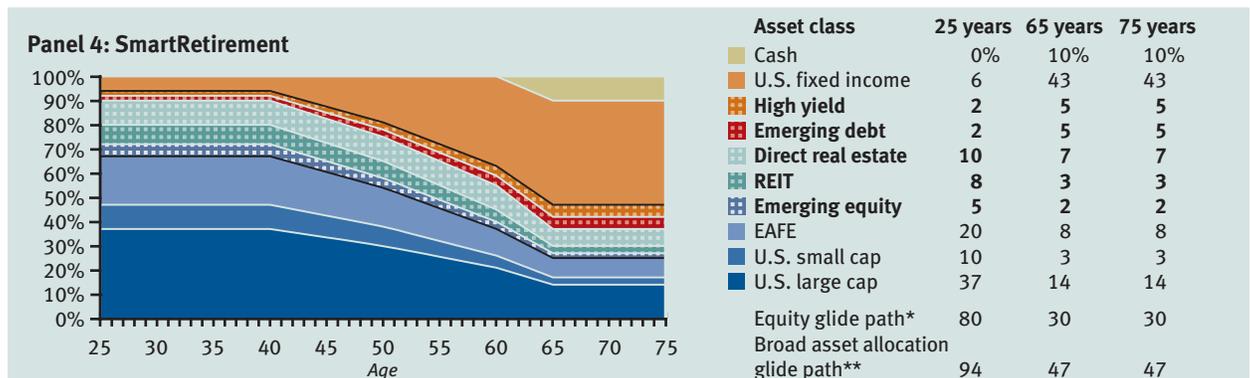
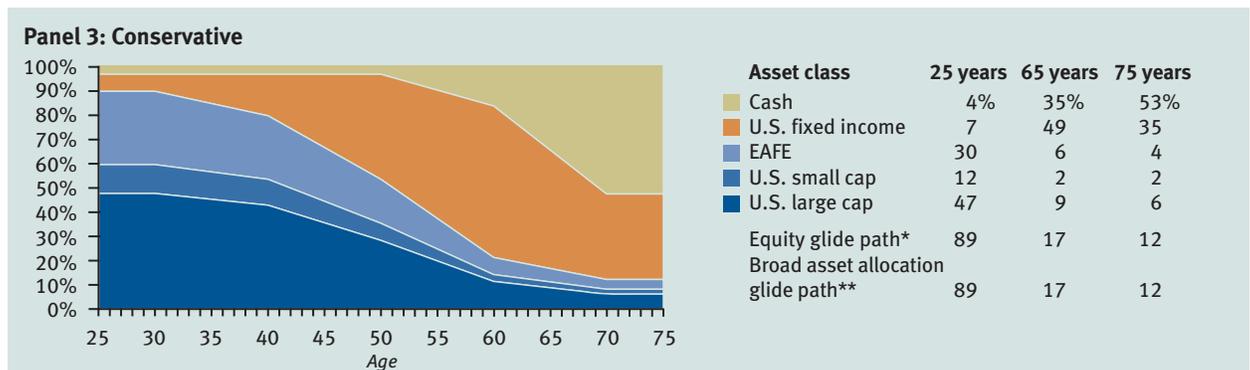
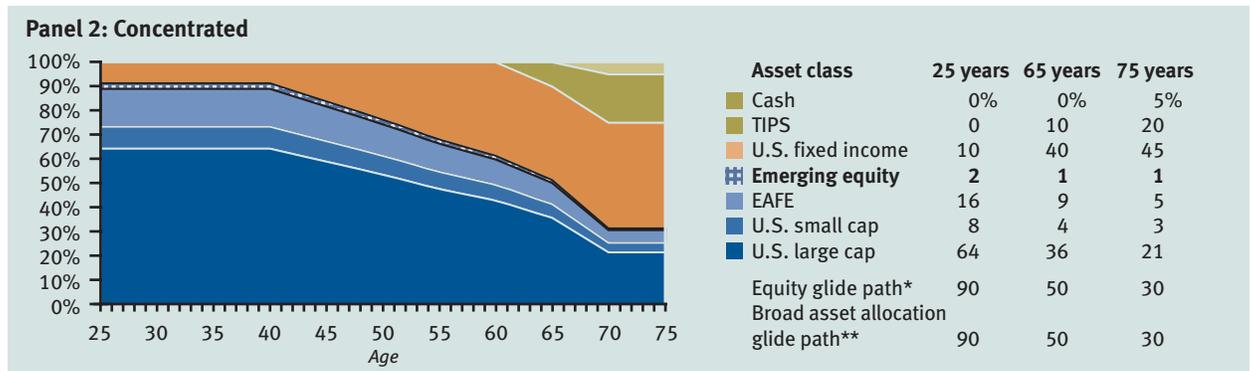
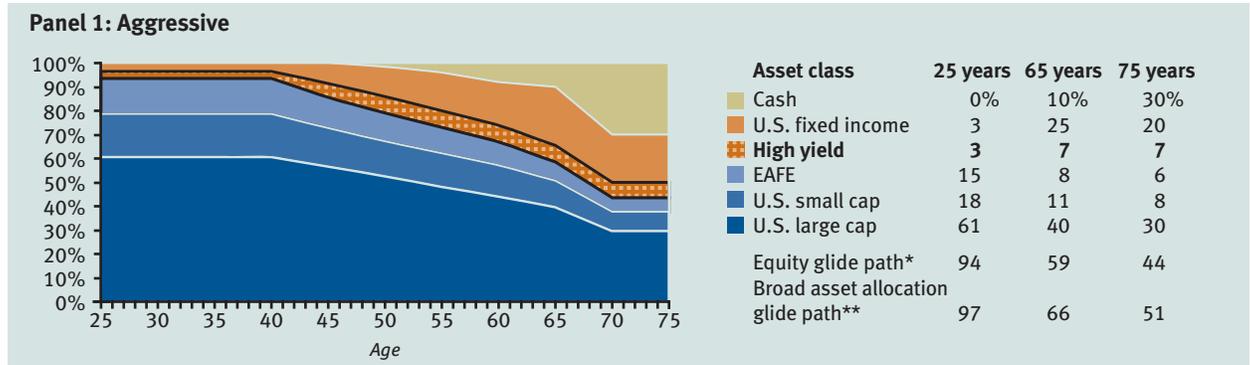
*The Aggressive Portfolio* has the highest equity allocation over the entire period. At participant age 25, it opens with 94% of assets diversified among U.S. large and small cap as well as non-U.S. stocks. It maintains that proportion until age 40, when the equity allocation starts to decrease, reaching 59% at age 65, and then leveling off to 44% at age 70 and beyond. The Aggressive strategy allocates just 6% to bonds in the first year, but offsets the decreasing equity stake at age 40 and beyond with a rising allocation to both high yield and investment grade bonds.

*The Concentrated Portfolio* follows much the same path as the Aggressive strategy, although it holds a few percent less in equity all along, reaching 50% at age 65, and ending with a 30% equity allocation at age 70 and beyond. Within its equity allocation, the Concentrated strategy holds U.S., international and a few percent of emerging market equities. This strategy is more concentrated than the Aggressive strategy in that a higher proportion of its equity allocation is in large cap U.S. stocks, while its fixed income allocation does not include high yield debt.

*The Conservative Portfolio*, relative to Aggressive and Concentrated, holds the lowest allocation of equities at all times in its life span: starting at 89% at age 25, equities drop to 66% of assets as early as age 44 and to 17% at age 65. Its equity holdings are diversified with about one-third in international stocks. However, it moves quickly to bonds, although investment grade only, and allocates large amounts to cash, which reaches 35% of total assets by age 65.

*The SmartRetirement Portfolio*, reflecting JPMorgan's target date fund design, holds a wider spectrum of assets over the participant's entire career. It holds fewer equities at the outset than the other three strategies and decreases its allocation thereto more rapidly than Aggressive and Concentrated. However, SmartRetirement consistently devotes about 25% of the portfolio to diversifying assets like real estate, emerging market equity, high yield and emerging market debt. These diversifying assets appear in Exhibit 6, panel 4, as the cross-hatched area in the center.

**Exhibit 6: Comparing asset allocation glide paths**



Sources: JPMorgan Asset Management, and industry prospectuses.

\* "Equity glide path" includes U.S. equity (large and small), EAFE, Emerging equity and REITs.

\*\* "Broad asset allocation glide path" includes all assets with expected volatility greater than 7.5%. Includes all asset classes listed above except cash, U.S. investment grade bonds and TIPS.

Sponsors should look beyond equity content to a more broadly defined “asset allocation glide path”

A simpler comparison of the four funds’ asset allocations is shown in the four panels of Exhibit 7. SmartRetirement earns expected returns at the high end of the range, as do the Aggressive and Concentrated portfolios (shown in Panel 1), but with a lower equity content (Panel 2). The result, shown in Panel 3, is far lower expected volatility for SmartRetirement.

The greater efficiency of the diversified SmartRetirement design is best illustrated by the path of the four funds’ Sharpe ratios over time (Panel 4). The high equity content of the Aggressive and Concentrated portfolios, as well as their relatively undiversified equity allocations, ranks them lower in Sharpe ratio terms. The Conservative portfolio compares very well in terms of Sharpe ratio (though not, as we saw, in expected returns), due in part to its large fixed income allocation in later years.

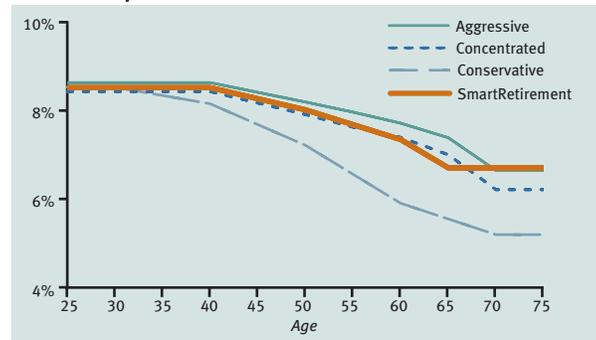
#### Beyond “equity glide paths”

Exhibit 7 points out the limitations of the “equity glide path,” a widely adopted shorthand for a target date strategy’s investment profile, which can be misleading as a relative measure of efficiency. An equity glide path measures how much equity a target date portfolio starts out with, and how rapidly the allocation drops off. Because it looks at only the equity content, and most target date funds seek return with equities, “equity glide path” has become synonymous with return potential. Equity glide path could also be synonymous with likely risk or volatility, however, because equities also show the highest swings in historical return among major asset classes.

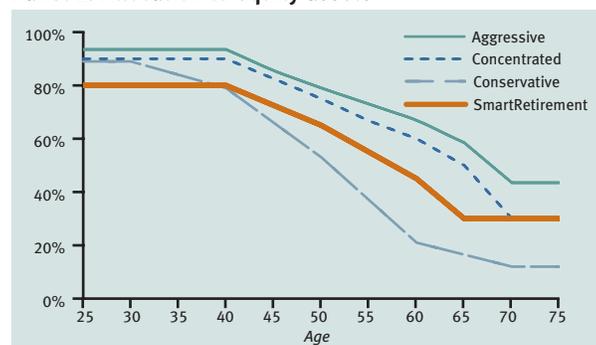
We believe that sponsors need to think beyond equity content to a more broadly defined “asset allocation glide path.” Many other asset classes can compete with equities on their expected return, and when combined with equities in efficient, institutional quality portfolios, can present considerably lower investment risk. JPMorgan’s SmartRetirement target date strategy devotes about 25% of assets to extended equities and bonds as well as real estate all along the glide path, as seen in Exhibit 6, Panel 4. The resulting portfolio is designed to deliver returns similar to those of the equity-intensive strategies (Exhibit 7, Panel 1) but with far greater efficiency.

### Exhibit 7: Target date fund characteristics\*

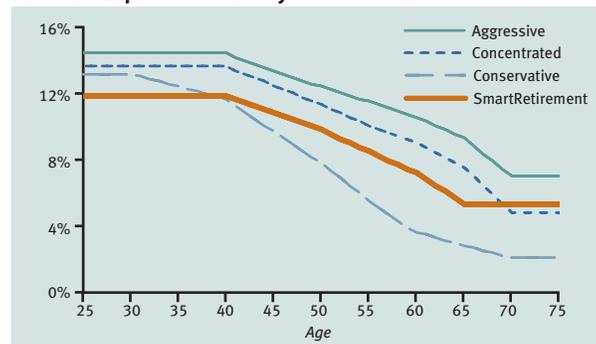
#### Panel 1: Expected returns



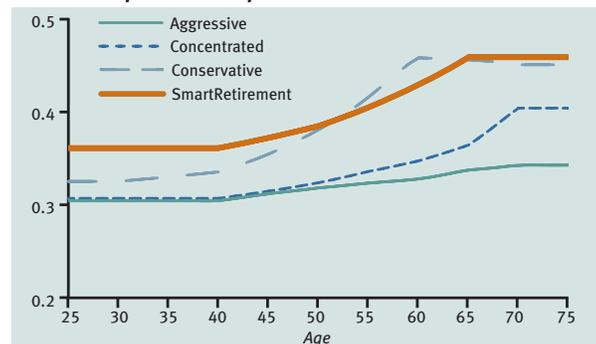
#### Panel 2: Allocation to equity assets



#### Panel 3: Expected volatility



#### Panel 4: Expected Sharpe ratios\*\*



\* Results are based on analysis derived from JPMorgan Asset Management long-term capital markets assumptions — 2006 (using arithmetic returns), JPMorgan Asset Management, and industry prospectuses.

\*\*The Sharpe ratio compares a portfolio’s expected return above a risk-free rate to its volatility, as measured by standard deviation of expected return. The assumed risk-free rate is 4.2%.

## Research results: Putting target date fund designs to the “real participant” test

Comparing expected return, volatility and Sharpe ratios for target date portfolios based on their broad asset allocation glide paths and capital market return assumptions is important, but provides an incomplete picture when evaluating different target date fund designs. Such analysis focuses entirely on expectations of *market* returns at different points in time, leaving participant cash flows and their cumulative interaction with market volatility out of the equation. Assume, for example, a 20% one-year drop in stock prices: a participant in the middle of his career has more time to recover than someone about to retire. Timing and the efficient use of risk are crucial to success.

A technique that incorporates the level, volatility and sequence of returns, as well as other crucial variables, is Monte Carlo analysis. It generates simulations to produce a distribution of outcomes, rather than a one-point average estimate. In order to have a large sample of retirement outcomes to observe, we constructed Monte Carlo models that simulate 10,000 separate lifetime examples. Our Monte Carlo

methods are discussed in the simulation results that follow, and explained in detail in Appendix 2.

In this section of the paper, we compare Monte Carlo simulation results for the four target date fund designs along several dimensions:

- expected 401(k) account values at retirement based on “simplified assumptions” of participant behavior versus JPMorgan’s findings from analysis of our proprietary participant database
- the interaction of volatile cash flows and volatile markets
- the “downside penalty” of too little savings
- how portfolio allocation relates to retirement uncertainty.

### Participants in the real world

Earlier, we discussed participant behavior and concluded that most managers of target date funds are far too optimistic in their assumptions on cash flows into participant accounts. They assume participants will increase contributions to 10% in their thirties. Although the Pension Protection Act’s

### Monte Carlo analysis methods

In order to best reflect participant behavior, we did not assume one set of “typical” contributions or withdrawals built in to all simulations, but instead created 10,000 different participants or savings and withdrawal patterns, combined with different sets of market return paths.

The simulations each incorporate the variability of participants’ cash flows and of market returns to provide a full representation of all possible portfolio outcomes. The participant model simulates contribution rate, salary increases, loans and withdrawals from accounts, both near and post-retirement, and reflects the distribution of these factors in the RPS participant database. For example, if 20% of 60 year olds in the JPMorgan RPS population took withdrawals each year, then about 2,000 of the 10,000 simulations will make withdrawals when they reach 60.

The simulation methods are presented in greater detail in Appendix 2.

## Assumptions for target date fund comparisons

### Asset returns

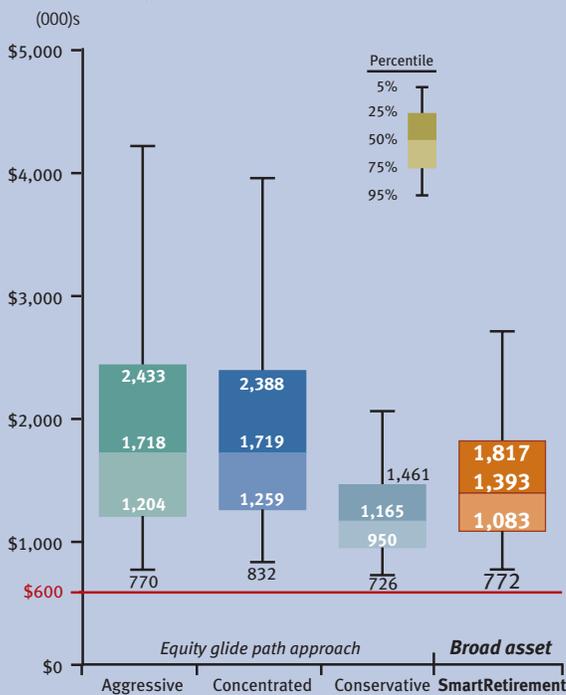
We based our analyses of investment results on forward-looking capital market assumptions, rather than historical returns. History can create misleading estimates for two reasons: first, the last twenty years include the greatest bull markets on record for both stocks and bonds, and second, they represent an incomplete or unrepresentative history for extended assets, such as REITs, emerging market equity and emerging market debt. Therefore historical returns do not provide the information needed for a reasonable forward projection.

Accordingly, our portfolio simulations incorporate JPMorgan Asset Management’s long-term capital market assumptions, which are detailed and described in Appendix 3.

The exhibit below illustrates the vast difference in account balances projected from the unusual historical returns of 1987 to 2006 (left panel) and from our forward-looking capital market assumptions (right panel). The value of the median simulations are from about 30% to 50% less across fund designs with forward-looking market assumptions. These examples differ only in their returns and both incorporate “simplified participant assumptions,” that is, consistent contributions equal to 10% of pay after age 35 and no loans or withdrawals, as seen in Exhibit 8.

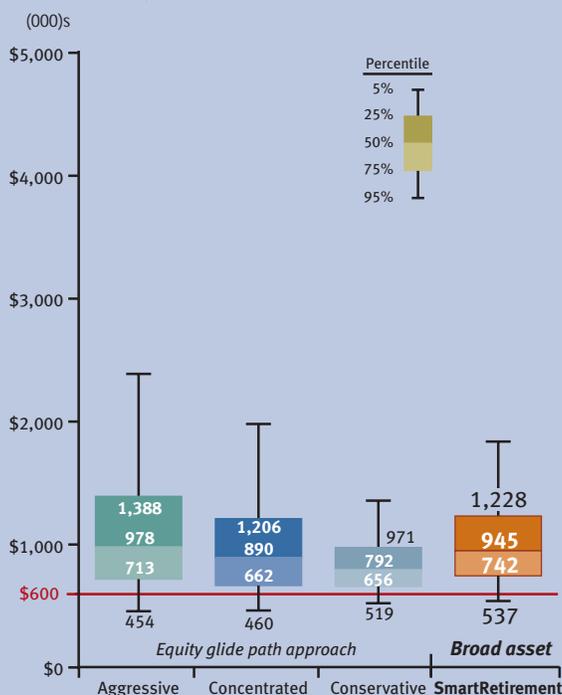
### Range of expected account balances at retirement with:

#### Simplified participant and historical return assumptions\*



\* See Appendix 3, Exhibit A3-1 for historical return assumptions.

#### Simplified participant and JPMorgan forward-looking return assumptions\*



\* Results are based on analysis derived from JPMorgan Asset Management long-term capital markets assumptions — 2006.

Sources: JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. See Appendix 3, Exhibit A3-1 for a comparison of historical and forward-looking assumptions. All dollar values are inflation-adjusted.

## A guide to the “box-and-whisker” charts:

The box marks the range of the 25th, 50th (median) and 75th percentile outcomes, from top (best) to bottom (worst). The whiskers reaching out from the top and bottom of the box show the range up to the 5th and down to the 95th percentiles of the distribution of outcomes. The red lines on the charts, at either \$600,000 (simplified assumptions) or \$400,000 (JPMorgan participant research-based assumptions), represent the target for income replacement. (The estimate is higher under simplified assumptions due to that scenario’s more optimistic view of salary increases.) See discussion “The math of income replacement” on page 6 and see Exhibit 8 for participant assumptions.

safe harbor for sponsors who adopt auto-escalation policies will certainly move contributions in the right direction, we do not believe — based on what we know from the JPMorgan Retirement Plan Services database — that participants will reach a 10% contribution rate so early and remain at that level throughout their careers. Auto-escalation will not prevent participants from actively choosing to lower their contribution rates.

The industry also has not taken withdrawals into account in asset allocation. We have found that about 15% of participants take money from their accounts

before retirement. We believe this has a greater effect on participant assets than sponsors or most target date fund managers realize.

Our simulation results contrast retirement outcomes under what we believe are realistic assumptions for contributions and withdrawals, based on our findings from analysis of real-world participant behavior, with projections based on the “simplified assumptions” of most managers. Exhibit 8 reiterates the two sets of assumptions.

**Exhibit 8: Participant savings behavior assumptions for target date strategy simulations**

	<b>Simplified industry assumptions</b>	<i>versus...</i>	<b>Reality: JPMorgan research findings</b>
<b>Contributions</b>	Rates start at 6%, increase year by year, reaching 10% of salary by age 35.  All participants have the same contribution pattern.		On average, contribution rates start at 6% and increase slowly, reaching 8% of salary by age 40, and 10% not until age 55.  Contribution patterns differ across participants.
<b>Employer match</b>	3% for all participants		3% for all participants
<b>Salary raises</b>	Participants get a raise every year.		On average, participants get raises every 2 out of 3 years.
<b>Loans</b>	Participants don't borrow.		20% of participants borrow, on average, 15% of account balance.
<b>Pre-retirement distributions</b>	Premature distributions don't happen.		15% of participants over the age of 59½ withdraw, on average, 25% of assets.
<b>In retirement distributions</b>	Participants withdraw a consistent 4%–5% annually.		The average participant withdraws over 20% per year at or soon after retirement.

Sources: AllianceBernstein “Target-date Retirement Funds — A Blueprint for Effective Portfolio Construction,” October 2005; JPMorgan Retirement Plan Services participant database, 2001–2006.

As illustrated in Exhibit 9, the differences in cash flow into participants' accounts under these two sets of assumptions translate into large variations in projected outcomes. Investment returns in both cases are taken from JPMorgan's capital market assumptions; therefore, the differences in account balance at retirement are due entirely to differences in participant cash flows.

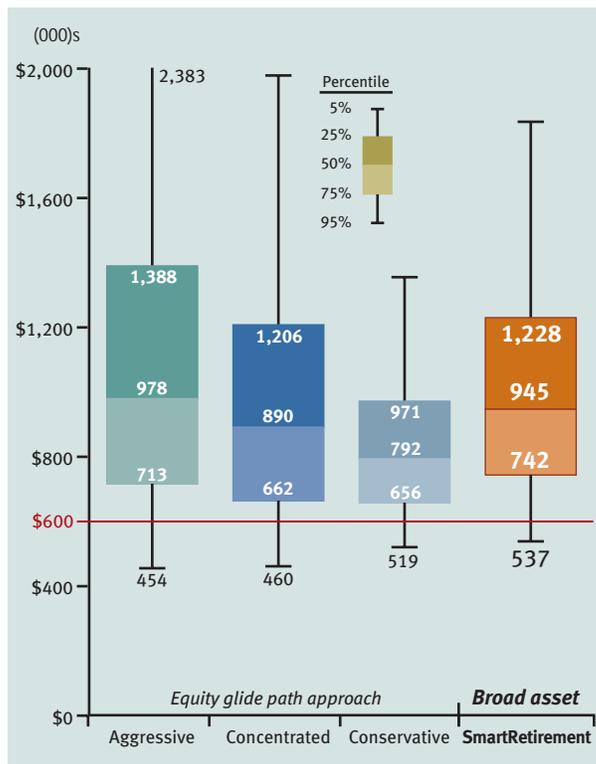
The red lines on each graph, at \$600,000 and \$400,000 respectively, represent the target for income replacement. (The estimate is higher under "simplified assumptions" due to that scenario's more optimistic view of salary increases.)<sup>7</sup>

Across the four portfolios, the median account based on real-world JPMorgan participant research findings is uniformly 40% lower than results using the "simplified assumptions" of most target date fund research. In Exhibit 9, panel 1, the median of simplified assumptions portfolio outcomes is estimated at between \$800,000 and \$1 million at

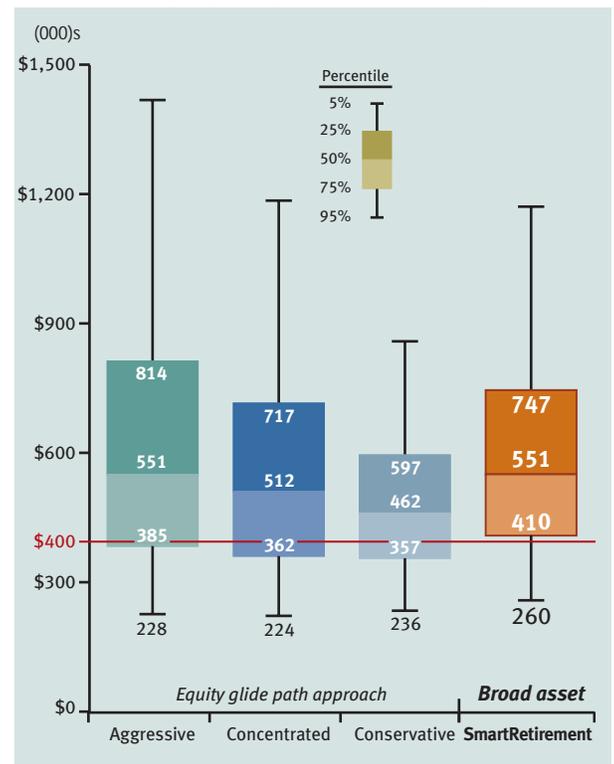
retirement, while in panel 2, based on the more realistic JPMorgan participant research findings, the median account at retirement ranges from \$460,000 to \$550,000. Clearly, the "simplified assumptions" lead to an overstatement of the likely range of portfolio outcomes.

The downside consequences of our participant behavior findings — a more accurate representation of how participants conduct themselves — are fairly severe. Not only are the expected account balances lower under more realistic test conditions, but the proportion of participants expected to reach retirement with the targeted income replacement also suffers. In the "simplified assumptions" case, about 85% of participants in all four funds attain the assets required for the target income replacement, but with the more realistic JPMorgan research-based assumptions, the proportion crossing the finish line with adequate assets drops to a low of 65% for the Conservative design, and a high of 76% for SmartRetirement.

**Exhibit 9: Range of expected account balances at retirement with:\***  
**Panel 1: Simplified participant assumptions**



**Panel 2: JPMorgan participant research findings**



\*Results are based on JPMorgan Asset Management long-term capital market assumptions — 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

<sup>7</sup> Please refer to the discussion on "The math of income replacement" on page 6.

Efficient use of risk means less extreme results on the upside and the downside

### Investment results

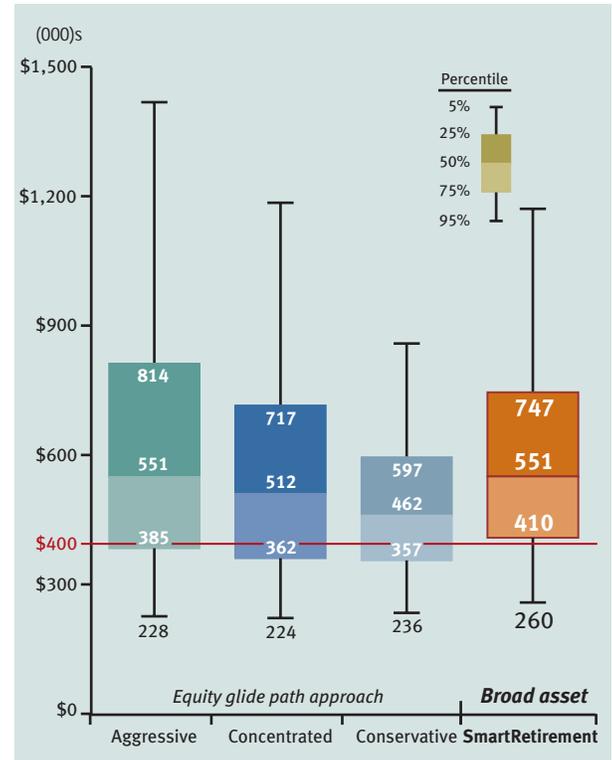
Our analysis also reveals the differences across the four target date strategies' investment approaches, as illustrated in Exhibit 10. The simulations represent a very broad sample of observations — 10,000 simulated participants, each with a different profile of contributions and withdrawals, and each facing a different simulated market.

The Aggressive strategy leads the range of outcomes on the upside — with the top 25% over \$800,000 and the top 5% reaching toward \$1.5 million. Its portfolio strategy seeks the highest return and risk, and thus it would be expected to outperform on the upside, benefiting the most from the simulations that contain the strongest markets.

However, the Aggressive design also appears to be less efficient in its use of risk, as shown by its more extreme results on both the upside and downside. In terms of these box-and-whisker graphs, funds with greater efficiency are more compact. In Exhibit 10, the Conservative strategy is the most compact, owing to its high allocation to cash. Aggressive is the most dispersed and least risk-controlled, as a result of its high allocation to equities throughout the entire analysis.

SmartRetirement has a narrower range of outcomes than either the Aggressive or Concentrated strategies due to its higher efficiency. However, because SmartRetirement does not sacrifice expected return in decreasing risk, it is not shifted lower on the expected value scale, as is the Conservative design.

**Exhibit 10: Range of expected account balances at retirement with JPMorgan participant research findings\***



\* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions — 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

At the median outcome, SmartRetirement and the Aggressive approach are tied at an estimate of around \$550,000. The Concentrated portfolio ranked third, at \$512,000, and the Conservative portfolio trailed by about 10%, due to its cautious asset allocation.

### A note on increasing savings

What if a participant or sponsor feels they require more than 40% of working income from their 401(k) plan at retirement — can more aggressive investing play a role?

Some investors may feel less confident about the reliability of Social Security payments or they may foresee expenses that could raise their spending needs in retirement. While more aggressive investing may produce higher returns in some situations, it widens the dispersion of possible outcomes and will increase the probability of retiring with fewer assets than would a more diversified, institutional quality strategy.

As we will see in the exhibits that follow, those with below-median outcomes fare better with the SmartRetirement strategy versus strategies with higher equity allocations.

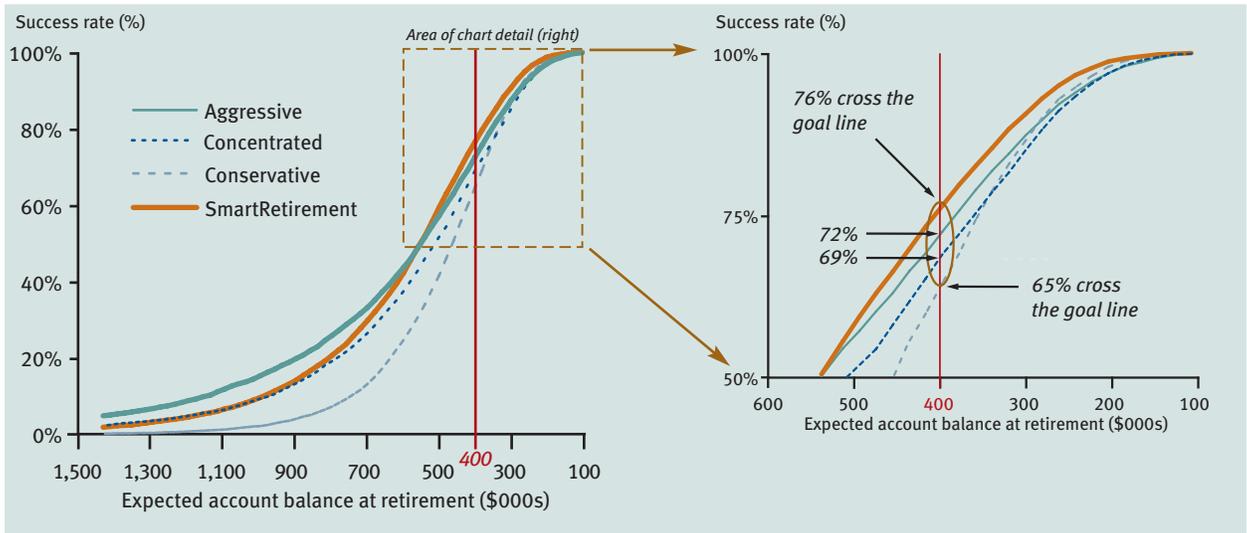
The only way to be certain of retiring with more assets is to save more.

Exhibit 11 presents the cumulative distribution of the simulations: each line plots the percentage of participants whose account value at retirement exceeds the value on the horizontal axis. As the enlarged view shows, with SmartRetirement 76% of participants are expected to reach the income replacement benchmark, versus 72% for Aggressive, 69% for Concentrated, and 65% for Conservative. These percentage differences translate, for a plan with 10,000 participants, to an expected 400 to 1,100 more individuals reaching their retirement goals under the SmartRetirement strategy, as seen in Exhibit 12. Moreover, due to its more efficient use of investment risk, the SmartRetirement portfolio provides the highest account values to approximately

50% of the population, measuring from the median to the lowest expected outcomes, as seen in Exhibit 11.

Keep in mind that our simulations generate a base of participants that is homogeneous in terms of income. We believe that SmartRetirement’s ability to provide the highest account values at the mid to low ranges of outcomes is significant. As a fiduciary, do you want to select a fund that excels only on the upside, when stock markets are strong and participants are making maximum contributions? Or do you want to provide a broad base of participants with an investment strategy that performs well under many market conditions, and gives real participants the best chance of income replacement in retirement?

**Exhibit 11: Expected success rates for exceeding different 401(k) values at retirement (with JPMorgan participant research findings)\***



\* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions — 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

**Exhibit 12: Additional participants expected to cross the income replacement goal with the SmartRetirement fund design (Plan with 10,000 lives; account balance goal of \$400,000)\***

Other target date designs		SmartRetirement	
Strategy	Expected success rate	Expected success rate	Expected participant impact
Aggressive	72%	76%	4% or 400 more successes
Concentrated	69%	76%	7% or 700 more successes
Conservative	65%	76%	11% or 1,100 more successes

\* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions — 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions.

### Analyzing outcomes from the bottom up

We believe plan sponsors considering target date funds as a default option should focus most of their attention on the outcomes for participants who could end up below the median. While any participant may find target date strategies a simple, attractive investment vehicle, these funds are likely to be of greatest interest to the 40% to 70% in most plans who are “delegators” — those who tend to be least involved in retirement planning. If the objective is to help as many participants as possible achieve a roughly 40% income replacement goal, then in our view it is critical that careful consideration be given to the bottom 50%, some of whom (as a result of cash flow or market volatility and timing) may fail to retire with the 401(k) assets they are likely to need. Exhibit 13 illustrates our simulation results again, but concentrates on the outcomes at the median and below. (As seen previously, participants with outcomes above the median have all succeeded in reaching the \$400,000 goal.)

Of the four target date designs, the one that most closely resembles the asset classes and allocations of most 401(k) plans today is the Conservative fund, which thus serves as a baseline case for comparison to the rest.

The additional risk of the Aggressive and Concentrated designs versus the Conservative portfolio, provides only a small benefit at the 75th percentile (\$28,000 and \$5,000 respectively), and produces a small decrease at the 95th percentile, relative to the Conservative strategy.

The higher efficiency of SmartRetirement, however, raises the 95th percentile outcome by \$24,000 versus Conservative. SmartRetirement’s 75th percentile outcome is \$53,000 higher than (or 15% above) Conservative, and more importantly, clears the \$400,000 income replacement threshold.

### The penalty of missing the target

Our second analysis considers the results from the four target date funds in the context of economic utility — trying to measure economic well-being at the date of retirement.

Place yourself at the cafeteria at lunchtime. The cheeseburger costs \$4, and you have \$5 — you can get lunch, and a cookie, too. But let’s say you only have \$3, and you can’t afford any lunch at all. The penalty of having \$1 too little (no lunch) hurts more than the benefit of having an extra \$1 (the cookie) helps.

**Exhibit 13: Range of expected account balances (median and below) with JPMorgan participant research findings\***



\* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions — 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

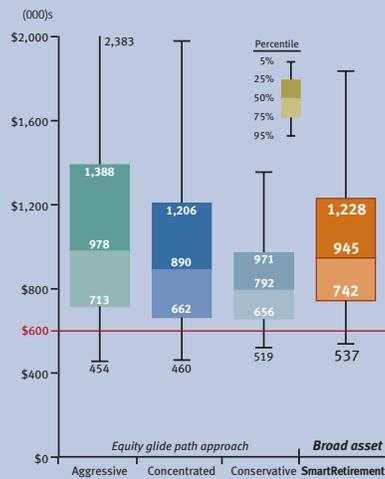
To help more participants succeed, focus on outcomes below the median

## A closer look at contributions and withdrawals\*

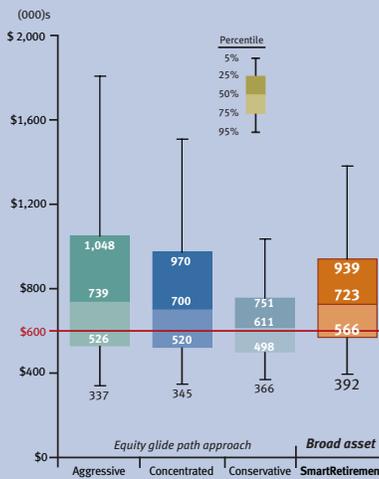
The disparity in retirement savings outcomes under “simplified assumptions” versus the JPMorgan participant research findings is due to the combined impact of differing hypotheses for several components of savings behavior — but most important are contributions and withdrawals. It is the added volatility from each component that leads to the notable effect on outcomes at retirement. The following graphs look at the *independent* impact of withdrawal and contribution patterns (based on JPMorgan’s research) on the results across target date strategies.

Range of expected account balances at retirement with:

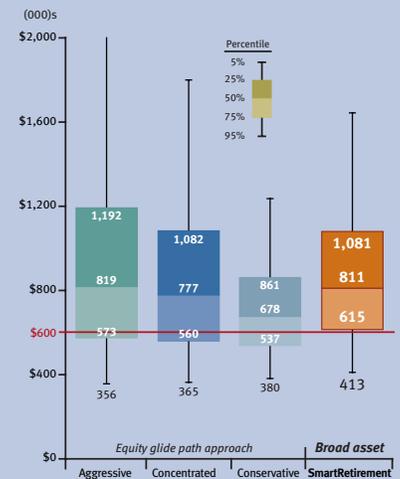
**Panel 1: Simplified participant assumptions**



**Panel 2: JPMorgan research — contributions only†**



**Panel 3: JPMorgan research — loans and near-retirement withdrawals only†**



† Simplified participant assumptions are used for all other behavior components. See Exhibit 8.

While automatic escalation should help to lessen the shortfall in participants’ contributions, it will not stop all the cash outflows from the typical 401(k) plan. The difference in the outcomes of Panel 1 (steady 10% contributions at age 35 and beyond, annual raises and ending salary of \$85,000, with no loans or withdrawals) versus Panel 3 is that the former incorporates the full set of “simplified assumptions,” and the latter isolates the effects of actual loan and withdrawal patterns based on JPMorgan’s participant research. With equivalent saving assumptions, the loans and early withdrawals in Panel 3 reduce the median outcome of all four strategies by 13% to 16%. Although the majority of participants do not take loans or withdrawals, the significant volatility added to the portfolio by the observed level of these cash outflows makes a significant impact on portfolio values at retirement and pulls down the overall averages.

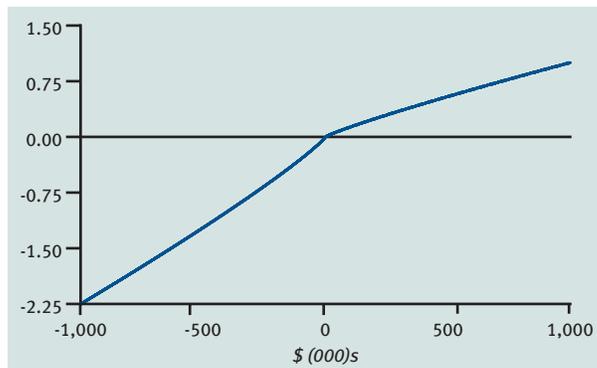
A comparison of the results in Panel 1 and Panel 2 (JPMorgan findings on contributions; all other assumptions are “simplified”) isolates the effect of lower contributions on 401(k) account balances. All median outcomes are 20% to 25% lower.

The results in Panel 2 also argue against the notion that a high allocation to equities all along the glide path can overcome a career of insufficient contributions. If a high proportion of equities were able to “lift all boats” — participants with both weak and strong contribution histories — then the Aggressive portfolio should provide higher outcomes at all percentiles. That is, the lower end of the Aggressive outcomes — the territory that includes those participants with weak contributions as well as weak market performance — should be higher than all other strategies. However, at the 95th percentile, the Aggressive allocation creates the lowest expected result, and at the 75th percentile, it only marginally outperforms the Concentrated and Conservative allocations, but does not improve on the results of the more efficient SmartRetirement portfolio. It is true that a high equity allocation results in higher outcomes on the upside, but it also creates a wider range on the downside. In general, the volatility of an equity-intensive approach adds to the volatility of outcomes, even in the long run.

There is no quick fix to these long horizon investment challenges. Participants have to save, and leave their assets untouched. Sponsors need to impose auto-escalation programs, to educate participants about the hazards of withdrawals, and to provide a default program that makes the most efficient use of investment risk.

\* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions — 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

**Exhibit 14: Penalty of loss function for retirement surplus or deficit**

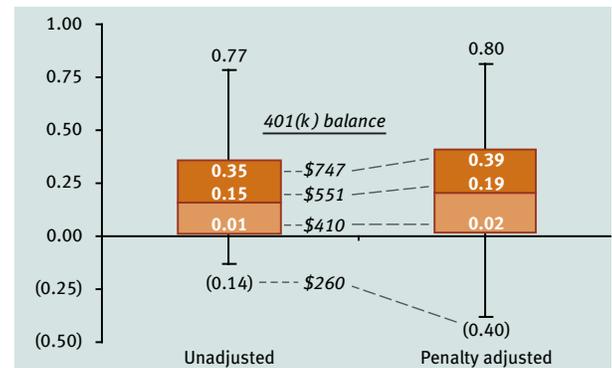


Sources: JPMorgan Asset Management; Prospect Theory: An Analysis of Decision Under Risk, Daniel Kahneman and Amos Tversky, 1979.

Consider the cafeteria scenario, on a far bigger scale, in retirement. For our simulated participants, having extra income is a welcome benefit, but the opposite situation — retiring with less than the \$400,000 they need — could mean a very difficult adjustment in their lives. They may have to move to less desirable housing, sacrifice trips to see the grandkids, or be unable to meet unplanned expenses. We have tried to measure the penalty of that downside by applying a methodology developed by behavioral economists Daniel Kahneman and Amos Tversky.<sup>8</sup> They have devised a utility function that recognizes this asymmetry — the idea that the pain from having, say, \$5,000 too little in annual income is greater than the pleasure that comes from having \$5,000 more.

Exhibit 14 plots our assumption of utility, as it corresponds to being over or under the \$400,000 target retirement savings amount. Positive utility is enjoyable while negative utility is not, and a balance of \$400,000 has zero utility. The function's steeper slope under \$400,000 tracks the degree of the penalty. When measured in utility terms, the pain of each dollar of deficit is about 2.5 times the pleasure of a surplus.

**Exhibit 15: SmartRetirement's expected utility with JPMorgan participant research findings\***



Sources: JPMorgan Asset Management; Prospect Theory: An Analysis of Decision Under Risk, Daniel Kahneman and Amos Tversky, 1979; industry prospectuses.

\* Results are based on analysis derived from JPMorgan Asset Management long-term capital markets assumptions — 2006. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

As an example, consider the utility of the outcomes for the SmartRetirement design. Exhibit 15 shows two box-and-whisker graphs. First, the graph on the left translates the dollar values of the simulation into utility terms, but with no penalty: the 25th percentile outcome, \$747,000, scores a positive utility value, 0.35. The 75th percentile outcome was quite close to \$400,000, and thus scores roughly break-even on the utility scale. The 95th percentile falls well short, at \$260,000, and registers a negative utility score, (0.14), before applying the penalty.

The box-and-whisker on the right (Exhibit 15) shows the application of the penalty of loss function. The 25th percentile participant, with \$747,000 (\$347,000 more than he needs), gains just 0.04 in utility to 0.39, and the 75th percentile participant, near breakeven on his income replacement amount, is still about zero. For the 95th percentile participant, however, whose savings are short by \$140,000, utility drops from an unadjusted (0.14) to (0.40) with the penalty — as illustrated by the much longer whisker on the right, reaching into negative utility. The \$140,000 shortfall is at least as painful (-.40) as the \$347,000 surplus is enjoyable (+0.39).

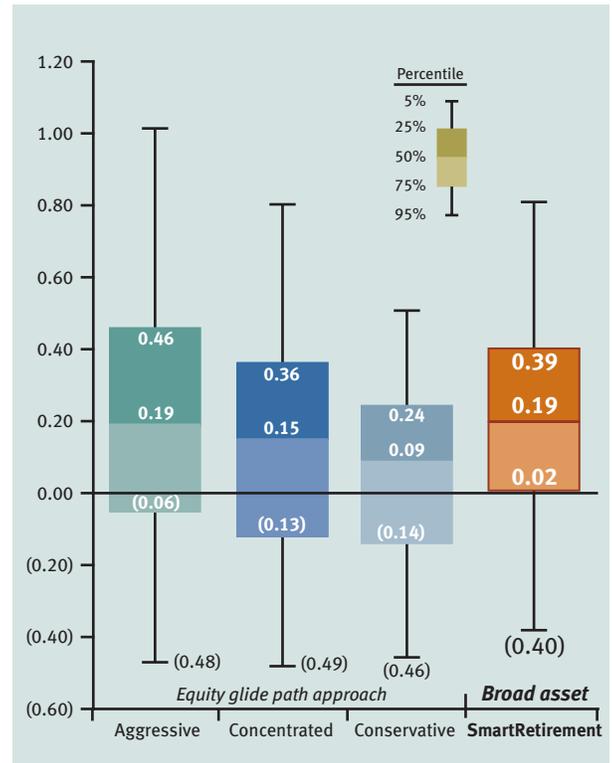
<sup>8</sup> Kahneman, Daniel, and Amos Tversky, 1979, Prospect Theory: An Analysis of Decision Under Risk, *Econometrica* 47, 263-91.

**Exhibit 16: Simulation results with JPMorgan participant research findings**

**Panel 1: Range of expected account balances at retirement\***



**Panel 2: Range of expected utility values at retirement, with penalty of loss adjustment\***



\* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions – 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

Sources: JPMorgan Asset Management; Prospect Theory: An Analysis of Decision Under Risk, Daniel Kahneman and Amos Tversky, 1979. \* Results are based on analysis derived from JPMorgan Asset Management long-term capital market assumptions – 2006, JPMorgan Asset Management, and industry prospectuses. See Exhibit 8 for participant assumptions. All dollar values are inflation-adjusted.

Broad asset diversification can help more participants succeed

Last, we consider the utility and shortfall penalty across the four target date fund strategies. Exhibit 16, Panel 1 shows the range of monetary outcomes for the four fund designs. Most simulated participants are “above” or slightly “below the line” of the \$400,000 income replacement threshold, in dollar value terms.

In terms of utility, though, the outcome distributions “below the line” are deeper in negative territory, as illustrated by panel 2 of Exhibit 16. The utility measures of the Concentrated and Aggressive strategies show the drawback of a fund structure that generates a wide range of outcomes: the participants

on the downside suffer more per dollar of shortfall than those on the upside benefit per dollar of surplus. The SmartRetirement approach shows the smallest penalty to retirees, since over 75% are expected to pass their retirement income goals, and those that don’t make it miss by a smaller margin than under the other three target date strategies.

This analysis highlights the central theme of SmartRetirement’s design: a broadly diversified portfolio that makes efficient use of investment risk and replaces with greater certainty the required level of retirement income for the largest share of participants.

## The role of active management

The results presented in this paper illustrate the importance of diversification in target date portfolio strategies in light of the impact that the volatility of market returns and participant cash flows can have on retirement savings outcomes.

However, all results were based on expected returns of market indices. Portfolio diversification and efficient use of risk in target date investing does not end with allocation to a diversified mix of passive asset class strategies:

- First, although passive strategies offer low-cost exposure to the equity and fixed income markets, these strategies are designed to keep pace with market indices, rather than outperform them. We believe actively managed strategies can add significant amounts of return over passive strategies.
- Second, we believe that risk-adjusted returns can be enhanced by diversifying not only across, but within asset classes — incorporating a range of

actively managed investment processes and methodologies. (Examples are long-short versus long-only equity strategies, and quantitative or behavioral versus fundamental strategies.)

- Third, we believe in actively managing allocations to asset classes within narrow and specified bands to take advantage of perceived short-term differences in the relative attractiveness of these asset classes, which can enhance returns and help manage risk.

However, increasing efficiency through active management requires access to a broad range of asset classes, styles and investment processes, and expertise in portfolio construction to blend these diversifying sources of volatility and return. These attributes are the components of institutional quality defined benefit investing. They are necessary ingredients for bringing true institutional quality retirement income security to DC participants, a goal to which we think every plan sponsor should aspire.

Diversifying  
across actively  
managed  
investment  
processes can  
enhance risk-  
adjusted returns

## Conclusion: Target date solutions for the real world

The 401(k) system isn't working very well: after 25 years, we see that most participants don't make very good actuaries, asset allocators, or long-term planners, even when their own futures are at stake. But the 401(k) has not been a complete failure, far from it: many participants hold diversified accounts with suitable asset allocations. The majority, however, are not saving enough, and not investing efficiently. From our observations of a large participant base, unpleasant surprises await many American workers, at a time when it may be too late for them to change financial course.

Congress and the Department of Labor addressed these chronic 401(k) weaknesses through the Pension Protection Act and subsequent proposed new rules. The new laws don't mandate any actions by sponsors, but they have created the freedom to shore up employees' retirement security, with safe harbors: default participation in plans, automatic escalation of contributions, and default investment options that earn market returns. With these new default savings and investment capabilities, 401(k)s can achieve much more.

Target date programs represent a quantum leap in DC investments: in one package, the individual's assets are allocated to the right markets, will be fully invested all the time, and managed by professionals.

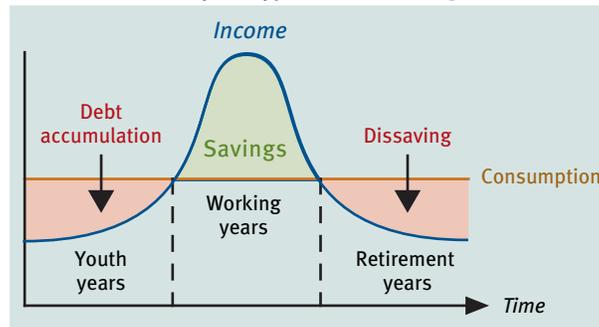
The arrival of the Pension Protection Act also presents a chance for sponsors to reevaluate their relationships. When you offer a 401(k) plan, who are you serving, and what are you trying to accomplish? Lifetime employment may be gone from American business, and with it perhaps the defined benefit plan, but with the right structure, sponsors can provide a generous slice of retirement security while employees are with them, and even help them save more adequately and consistently throughout their careers.

Today, 401(k) sponsors realize that their fiduciary obligation is not met by offering the widest range of mutual funds. We believe it calls for guiding people toward better saving behavior and offering an investment program that provides the highest probability of income replacement for the largest number of people. Lifetime income guarantees may not be part of the DC plan structure, but with a comprehensive, well-designed target date investment program, sponsors can give their employees the best chance for building their savings into a secure source of retirement income.

## Appendix 1: Participant savings behavior

Economists have long studied the savings patterns of both individuals and countries and developed hypotheses to explain the behavior they observe. The various models differ in their details, but most posit that individuals look ahead to the future and base consumption and savings patterns on their expected incomes. They predict that people dissave early in their careers when incomes are low, save for the long-term as incomes rise, and then dissave again later in life after they stop working. Exhibit A1-1 illustrates one leading model, the “life cycle hypothesis” of Franco Modigliani and Robert Ando<sup>1</sup> (Milton Friedman developed a similar “permanent income hypothesis”).<sup>2</sup>

**Exhibit A1-1: Life cycle hypothesis of Modigliani & Ando**



Source: theshortrun.com

The reasoning behind these savings hypotheses also appears in the design of the current generation of target date investment funds for defined contribution retirement accounts. They assume that participants know what they’re up against, and start saving early. Investment allocations are set to provide rapid growth, followed by capital preservation, and assets are gradually drawn down by annual spending in retirement.

We have looked at how people respond to the challenges of saving and investing not from the perspective of classical theory, but from our own

experience as an institutional investment manager and an administrator of 401(k) accounts. Our real-world statistical sample is the 1.3 million employees in over 350 plans administered by JPMorgan Retirement Plan Services (RPS), sponsored by over 250 employers, covering 2001 through 2006.

We find that the real-life experience of U.S. workers is quite different from Professors Modigliani’s and Friedman’s models, and follows more closely the “relative income” hypothesis that Harvard University economics professor James Duesenberry proposed in the late 1940s. An early behavioralist, Duesenberry believed that people base their consumption habits on their own earnings, but also take important cues from their friends and neighbors; moreover, he believed, when faced with a drop in income, individuals resist cutting their standard of living and sacrifice savings instead.<sup>3</sup> His hypothesis fits the real world we have observed: many participants start their 401(k) savings at low rates, and take many years to reach the necessary levels. Others contribute episodically. A few withdraw from their 401(k)s in mid-career, and many people near retirement start drawing on their accounts as soon as they are not subject to tax penalties.

In the rest of this section, we share the lessons we learned on the reality of savings behavior.

### Contributions

*401(k) participants are not saving enough:* A rule of thumb among financial planners holds that to replace two-thirds of an employee’s end-of-career income requires giving up between 10% to 12% of salary to a tax-deferred plan — assuming contributions start early, are made every year, and the funds are left intact and invested efficiently.

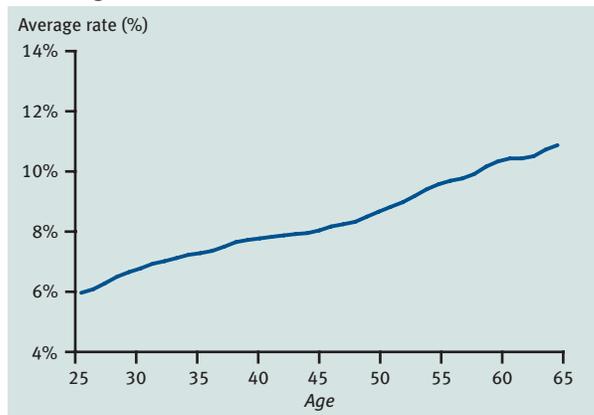
<sup>1</sup> Modigliani, F. and Ando, A. “The life cycle hypothesis of saving: Aggregated implications and tests,” *American Economic Review*, 53, 55-84.

<sup>2</sup> Samuelson, Paul, and William Nordhaus. *Economics*, 18th Edition, McGraw-Hill, 2005.

<sup>3</sup> Frank, Robert H. “The Mysterious Disappearance of James Duesenberry,” *The New York Times*, June 9, 2005.

We find that employees are not saving nearly enough overall to clear these hurdles. Exhibit A1-2 below details the contribution rates of the JPMorgan Retirement Plan Services population: starting at 6% of salary at age 25, participants take nearly 20 years to reach 8% on average, and another ten years to reach 10% at age 55.

**Exhibit A1-2: Participant average contribution rates versus age**

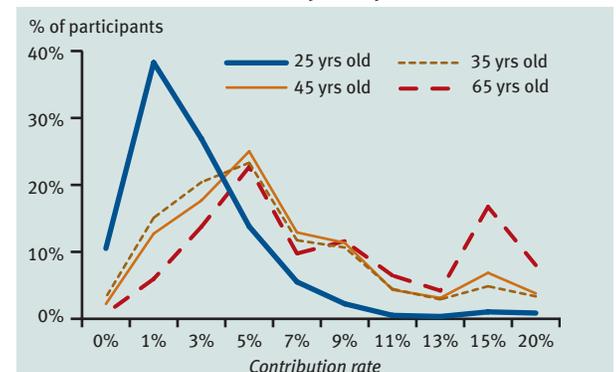


Source: JPMorgan Retirement Plan Services, RPS participants, 2001–2006

The statistics behind Exhibit A1-2 include only employee contributions, however, and do not take into account employer matches. The annual survey of large 401(k) plans by Hewitt Associates (administrator for plans with a total of 1.6 million participants) finds that employers commonly match employee contributions up to 6% of pay and that contribution rates tend to cluster in the range of 5% to 6%, even for older employees, until the period of acceleration at age 60.<sup>4</sup> In the JPMorgan Retirement Plan Services database, we found the average match across all plans to be roughly 3% of compensation. Thus if both employers and employees are contributing 4% or 5% of pay, employees may be saving enough — assuming an employee starts early, contributes regularly and leaves her savings intact all the way to retirement. We find that for many employees, however, this is not the case.

Although average rates rise steadily with age, the distribution of contributions is wide at all times. Exhibit A1-3 illustrates the range of contributions for different age points. Twenty-five year olds clearly save little: a large number of employees are contributing zero or just one percent. This is likely driven by young workers' lower pay, but it probably also reflects default levels at the time of enrollment. At age 65, 10% to 15% of participants are saving between 10% and 20% of pay, reflecting “catch-up” provisions that expand maximum allowed contributions. Aside from these two outlier groups, the distribution of savings rates is quite similar across ages, and is bunched at 5%.

**Exhibit A1-3: Distribution of participant contribution rates**



Source: JPMorgan Retirement Plan Services, RPS participants, 2006

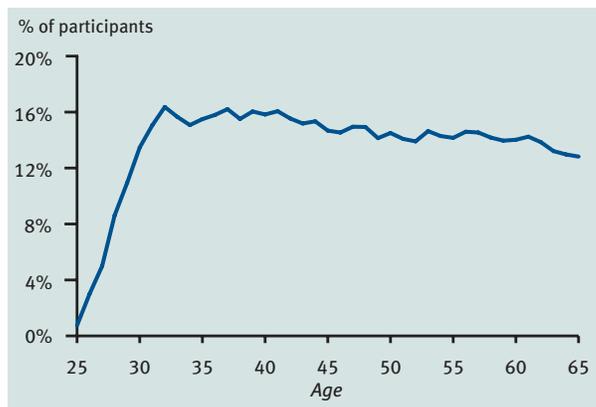
### Inertia

Human nature is resistant to change, and most 401(k) participants are only human: notwithstanding easy access to 401(k) accounts online and reminders at birthdays, anniversaries and raises from employers, participants seldom increase their contribution rates. Exhibit A1-4 illustrates how few people in the JPMorgan Retirement Plan Services population changed savings rates between 2001 and 2006 — a period of six years.

<sup>4</sup> “How well employees are saving and investing in 401(k) plans 2005 universe benchmarks,” *Research Highlights*, Hewitt Associates LLC, Lincolnshire, IL.

Each year an average of only 15% of participants make changes to their contribution rates. Even when participants change their deferral rates, the changes are counterintuitive: approximately 35% of changes to contributions are decreases, across all ages. About 10% of participants stopped their contributions entirely in our sample period of 2001 through 2006, and 60% of those who stopped contributions sat out for longer than a year.

**Exhibit A1-4: Participants' tendency to change contribution rates**



Source: JPMorgan Retirement Plan Services, RPS participants, 2001–2006

#### Exceptions are the rule

Although the worst examples of contribution behavior appear to be at the margin — for example, the 10% of participants who stop deferring — the marginal participants add up quickly, so there is plenty of room for improvement. Keep in mind that a stubborn 20% or so never participate in most plans, and while 25 year olds may be the toughest group to persuade, the effort is worthwhile: with such a long reinvestment period to work with, they also have the most to gain from early investing.

#### Withdrawals before retirement

We also found that many participants draw on their 401(k) accounts before retirement.

A few participants make taxable withdrawals in mid-career — between 2% and 3% of participants from ages 30 to 45. Near retirement, however — after age 59½, when participants are able to withdraw from their accounts without tax penalties — withdrawals are not uncommon. In the JPMorgan Retirement Plan Services participant universe, we observed that between 12% and 15% of near-retirement-aged workers were withdrawing from their 401(k)s. Some participants had in fact retired, but a large proportion of these workers start withdrawing about 25% of their assets while they are still working, at a time when their asset balances are probably highest, and they have the most to gain from tax-free reinvestment.

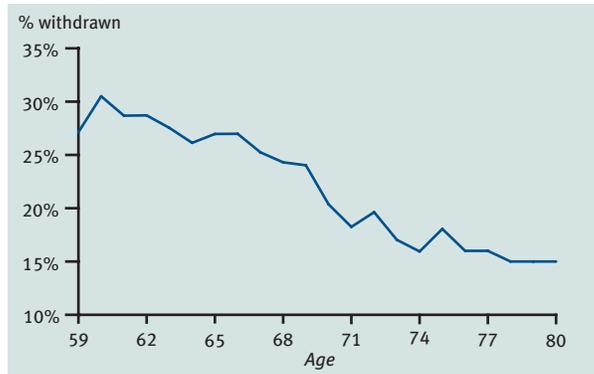
**Exhibit A1-5: Participants making withdrawals after age 59½**



Source: JPMorgan Retirement Plan Services, RPS participants, 2001–2006

Approximately 35% of changes to contribution rates are decreases

**Exhibit A1-6: Annual withdrawals after age 59½ as a percentage of portfolio assets**

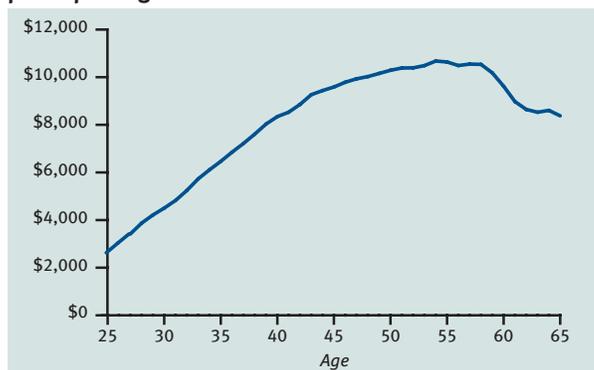


Source: JPMorgan Retirement Plan Services, RPS participants, 2001–2006

#### 401(k) loans

We also found that about 20% of participants borrow against their 401(k) assets at a given time. Most often, the participant is between 30 and 40 years old at the time of the first loan, and borrowings are substantial, ranging from 15% to 22% of the account balance. About one-third of those who borrow once take another loan. Contribution rates for participants who borrow from their 401(k)s tend to be lower than for non-borrowers by about two percentage points.

**Exhibit A1-7: Average 401(k) loan size versus participant age**



Source: JPMorgan Retirement Plan Services, RPS participants, 2001–2006

To our surprise, the impact of borrowing on a participant’s assets at retirement is not material. The loan does not actually leave the account and the participant liquidates a portion of his or her investments and issues a note to the account. Thus, the biggest effect is a temporary difference in return — five years’ or less interest on the notes, versus the earnings on the original investment — but the assets remain intact, unlike a taxable pre-retirement withdrawal. However, as we saw in the case of our hypothetical participant (Exhibit 4, page 8), the timing of these loans, especially when accompanied by a contribution decrease, can have a material impact on ending balances if they coincide with a big move in the markets.

#### JPMorgan Retirement Plan Services (RPS) proprietary participant database

Our findings on participant behavior are based on our analysis of the JPMorgan Retirement Plan Services (RPS) proprietary database of over 1.3 million participants, a representative sample of DC plan participants in the U.S. Our RPS database covers over 250 employers and 350 plans with participants from approximately 30 industries (ranging from financial to healthcare to industrials and consumer products) in over 36 states across all major regions of the U.S.

The average salary range for the group is \$30,000 to \$70,000, with about 10% below \$10,000 and 10% above \$100,000. Our analysis covers the period from 2001 through 2006.

## Appendix 2: Monte Carlo simulations

### Overview

Target date portfolios present special challenges in estimating expected returns: their asset allocations change over time, and the sequence of both cash flows and market returns can affect results. Historical results, therefore, often are not a good representation of future performance, as the order of returns or extreme market events are not likely to repeat exactly. A common approach to solving these problems is a series of Monte Carlo simulations. Named for the famous casino in Monaco, Monte Carlo simulations incorporate both randomness and repetitiveness to create large samples of observations and minimize the influence of outlier values in returns or the order of returns.

By using a series of repeating computations, the simulations create a large number of outcomes for the portfolio, each with an independent path of returns which combined have a specified average and volatility. In the simulations for this paper, we used changing, or stochastic, return patterns to generate 10,000 different possible portfolio outcomes.

Although the most common application of Monte Carlo simulations in portfolio construction is to simulate various market return scenarios, assumptions on other variables can also be incorporated. Our Monte Carlo simulations encompass two different stochastic processes: the *capital markets simulator* and the *participant behavior simulator*.

### Capital markets simulator

There are several ways to determine potential returns on a portfolio. The simplest is a static return model, where an expected average market return is applied for each period. A static analysis can approximate the level of long-term average returns, but it ignores the impact of volatility.

A more useful approach generates a distribution of simulated returns with the desired long-term average and standard deviation, but it assumes that each year is independent of the next. This approach accounts for the importance of volatility, but it still ignores correlations among assets, as well as asset trends or mean reversions that can distort short-term movements and alter the volatility of the portfolio. A slightly more complex approach, *stochastic return generation*, incorporates all of the typical characteristics of asset returns (long-term average, volatility, correlation and autocorrelation), while introducing additional randomness into the returns to prevent exclusive reliance on historical or assumed patterns.

In order to develop the most robust analysis of these portfolios, we applied simulated market returns using stochastic return generation to incorporate uncertainty in future market returns. Our approach combined four layers to simulate a fully robust market environment.

- **Return generator:** Asset returns were generated so that future values were dependent on previous returns and the long-term mean, volatility and autocorrelation levels of the assets remained near their desired levels.
- **Market environment generator:** We incorporated correlations among assets so that over time, asset returns maintained the desired relationships. For example, high U.S. equity returns were unlikely to correspond to low or negative international equity returns.
- **Long-term trend generator:** We also built in long-term return trends. Assets that typically show normally distributed historical returns have normally distributed simulations. Other assets with mean-reverting returns, such as interest rates, show simulated returns that tend towards an average over time.

- **Randomness generator:** Asset returns were influenced by a small amount of random noise to introduce realistic shorter-term movements.

This multi-layered approach also gave us the ability to stress-test the portfolios by changing the underlying assumptions of average returns, volatility, or correlations to simulate more extreme market environments.

#### **Participant behavior simulator**

Understanding target date funds also requires careful modeling of the behavior of fund participants. In order to best reflect the diversity of behavior in the simulations, we have not assumed “average” contributions or withdrawals, but instead created a distribution of participant behaviors that collectively has the same characteristics as our sample from the JPMorgan Retirement Plan Services participant database. To model a participant base that resembled the real world, we generated simulated values for several variables:

- Participant contribution rate
- Event of salary growth

- Event and size of loans
- Event and size of near-retirement withdrawals
- Event and size of post-retirement withdrawals

For example, if 20% of 60 year olds in the JPMorgan Retirement Plan Services population took withdrawals each year, then about 2,000 of the 10,000 simulations will make withdrawals at age 60. The 10,000 simulations each incorporate the variability in participant cash flows and market returns to best account for all possible portfolio outcomes. Similar to the capital market simulator, this participant simulator allowed us the flexibility to test the portfolios’ sensitivity to changes in each variable.

These robust processes for simulating both market returns and participant traits, as well as the number of simulations run, provide a comprehensive sample for comparing the characteristics of different target date designs and give us confidence in our results.

## Appendix 3: Capital market assumptions

Exhibit A3-1 contains the forward-looking and historical return assumptions used in our simulations of expected account balances in this paper. (See page 16, “Assumptions for target date fund comparisons” for a discussion of the differences in the range of expected outcomes under these two sets of return assumptions.)

Historical long-term averages and standard deviations are a common choice for looking at expected returns and volatilities, but they introduce several potential problems.

First, for some of the assets in a fully diversified portfolio being assembled today, such as REITs or emerging market equity, the historical returns available cover relatively short periods of time that might not incorporate full market cycles or structural changes, or they may be dominated by the '90s bubble. In these cases, a relatively small error in estimating the average or standard deviation of returns can have a dramatic impact on the results of the long-run simulation. To account for these potential problems, a common alternative is to use estimates of the expected returns and volatility of the assets. Our simulation estimates are based on

JPMorgan’s long-term capital market assumptions for returns, volatilities and correlations across a broad range of asset classes.

### JPMorgan Asset Management long-term capital market return assumptions

Our capital market assumptions (Exhibit A3-2) are developed each year by our Assumptions Committee, a multi-asset class team of senior investors across the firm. The Committee relies on the input and expertise of a range of portfolio managers and product specialists, striving to ensure that the analysis is consistent across asset classes. Each estimate undergoes a rigorous review of its underlying rationale with the senior management of JPMorgan Asset Management. The results are used by many institutional investors, including pension plans that employ them in developing and supporting their expected return assumptions for financial reporting purposes.

NOTE: Returns in Exhibit A3-2 on the following page are geometric, while those in Exhibit A3-1 are arithmetic, creating a difference of from 75 to 100 basis points for each asset.

**Exhibit A3-1: Historical and forward-looking return and volatility assumptions for retirement account simulations**

	Arithmetic returns (%)*		Volatility (%)		
	Historical	JPMorgan	Historical	JPMorgan	Index
U.S. large cap	12.33%	8.36%	14.64%	15.46%	S&P 500
U.S. small cap	11.94	9.32	18.73	20.19	Russell 2000
U.S. REITs	6.87	7.85	13.04	13.62	MS REIT and NAREIT prior to '95
International equity	7.09	9.74	15.11	14.84	MSCI EAFE
Emerging markets equity	14.73	11.18	22.53	23.61	MSCI EM Free
U.S. fixed income	7.18	5.32	4.11	3.71	Lehman Agg
Emerging markets debt	13.03	8.44	14.78	14.37	EMBI Global
U.S. high yield	9.12	7.71	7.55	10.00	Lehman High Yield (Salomon History)
Cash	4.64	4.25	0.58	0.51	U.S. T-bill
Direct real estate	8.16	6.99	7.33	7.13	NCREIF
TIPS	6.59	4.87	5.07	4.93	Lehman

Source: JPMorgan long-term capital market assumptions — 2006.

\* All returns are arithmetic.

The above information is provided for illustrative purposes only. Information shown is based upon market conditions at the time of the analysis and is subject to change. There can be no guarantee the expected results will be met.

## Exhibit A3-2: JPMorgan Asset Management long-term capital market return assumptions

	Expected 10–15 year annualized compound USD returns	Rationale
U.S. Inflation	2.50%	Inflation to remain generally well-contained, but risks are to the upside given tight supply-demand balance in energy.
U.S. Real GDP	3.25%	Productivity growth expected to remain strong, but below the exceptional gains of recent years.
U.S. Cash	4.25%	Higher real short-term rates than in recent years, as Fed needs to work hard to contain inflation.
U.S. Treasuries (10-yr) TR	4.75%	10-yr yields to rise toward equilibrium level of 5.25%, but decline in bond prices to hurt returns as yields rise.
U.S. Aggregate TR	5.25%	Spreads near equilibrium, but rise in Treasury yields to hurt returns until adjustment is complete.
U.S. Long Duration Gov't/Corp	5.25%	Bond yields expected to rise, but search for yield expected to put cap on longer term rates.
U.S. TIPS TR (nominal)	4.75%	Real yields expected to rise, hurting returns in early years.
U.S. High Yield TR	7.25%	Spreads assumed to widen from current historically low levels. Some haircut to returns from expected defaults.
Non-U.S. World Govt. Bond Index TR (local currency)	3.00%	Bond yields expected to rise, hurting returns in early years.
Non-U.S. World Govt. Bond Index TR (USD)	4.75%	Decline in the dollar (particularly against Japan, whose weight in WGBI is large) to provide an average 175bp per annum boost to returns.
Emerging Market Debt TR	7.50%	Spreads assumed to widen, but by less than High Yield; assumes secularly improving credit quality of EM universe.
U.S. Municipal TR	4.00%	Bond yields expected to rise, hurting returns in early years.
U.S. Large Cap TR	7.25%	Sum of below building blocks (EPS Growth + Dividend Yield + Impact of Changes in P/E Multiples).
U.S. Large Cap EPS Growth	5.50%	Boost from productivity acceleration is waning. EPS growth expected to be slightly below nominal GDP growth.
U.S. Large Cap Dividend Yield	2.25%	Dividend payout ratios expected to rise.
U.S. Large Cap P/E Impact on Return	-0.50%	Expect minor amount of multiple contraction, taking multiples back toward averages of past low inflation periods.
U.S. Mid Cap TR	7.50%	25 bps premium over Large-Cap. Small-Caps have become comparatively expensive and no longer appear to warrant a return premium relative to Mid-Caps.
U.S. Small Cap TR	7.50%	
U.S. Large Cap Growth TR	7.00%	Value expected to outperform growth over long time periods.
U.S. Large Cap Value TR	7.50%	
EAFE TR (local currency)	7.75%	Non-U.S. economic and (especially) profit performance expected to improve, fueling a small rise in P/E multiples.
EAFE TR (USD)	8.75%	Decline in the dollar (particularly against Japan) to provide an average 100bp per annum boost to USD EAFE returns.
Emerging Market Equity TR (USD)	8.75%	Improved economic and profit performance by EM economies. Currencies likely to rise over time vs. USD.
Private Equity TR (Industry median)	8.50%	Forecast is modestly above those on higher-risk categories of public equity. Only top quartile managers can be expected to substantially beat public market returns. (See note below.)
U.S. Direct Real Estate (unlevered)	6.75%	Less than equity return, more than fixed income. Reflects strong operating income yields.
REITs	7.00%	A bit higher than return on direct real estate due to leverage. Premium constrained due to comparatively expensive REIT valuations.
Hedge Fund (non-directional) TR	5.75%	Hedge Funds to deliver only moderate returns but with comparatively low risk. Top managers expected to beat these returns. (See note below.)
Hedge Fund (directional) TR	7.00%	

As of November 30, 2005

Note: Private Equity and Hedge Funds are unlike other asset classes shown above, in that there is no underlying investible index. The return estimates shown above for these assets are our estimates of industry medians; the dispersion of returns among different managers in these asset classes is typically far wider than in traditional assets. Given the complex risk-reward tradeoff in these assets, we counsel clients to rely on judgment rather than quantitative optimization approaches in setting strategic allocations to these asset classes. Please note all information shown is based on assumptions; therefore, exclusive reliance on these assumptions is incomplete and not advised. The assumptions should not be relied upon as a recommendation to invest in any particular asset class. The individual asset class assumptions are not a promise of future performance. Note that these asset class assumptions are passive-only; they do not consider the impact of active management. Return estimates are on a compound or internal rate of return (IRR) basis. Equivalent arithmetic averages, as well as additional notes, are shown on the next page.

**Exhibit A3-2: JPMorgan Asset Management long-term capital market return assumptions (continued)**

				Correlation Matrix																												
		Expected Volatility	Annualized Compound USD Return	Mean Expected USD Return	U.S. Inflation	U.S. Cash	U.S. Treasury Index	U.S. TIPS	U.S. Aggregate	U.S. Municipal	U.S. Long Duration Govt/Corp	U.S. High Yield	Non-U.S. World Govt. (hedged)	Non-U.S. World Govt. (unhedged)	Emerging Market Debt	U.S. Large Cap	U.S. Large Cap Value	U.S. Large Cap Growth	U.S. Mid Cap	U.S. Small Cap	EAFE (unhedged)	EAFE (hedged)	Emerging Market Equity	REITs	U.S. Direct Real Estate	Hedge Fund	Hedge Fund (non-directional)	Hedge Fund (directional)	Private Equity			
Fixed Income	U.S. Inflation	1.0%	2.50%	2.50%	1.00																											
	U.S. Cash	0.5%	4.25%	4.25%	0.00	1.00																										
	U.S. Treasury Index	4.7%	4.50%	4.60%	-0.08	0.11	1.00																									
	U.S. TIPS	4.9%	4.75%	4.87%	0.07	-0.06	0.77	1.00																								
	U.S. Aggregate	3.7%	5.25%	5.32%	-0.09	0.12	0.97	0.75	1.00																							
	U.S. Municipal	3.3%	4.00%	4.05%	-0.09	0.08	0.87	0.72	0.88	1.00																						
	U.S. Long Duration Govt/Corp										1.00																					
	U.S. High Yield	10.0%	7.25%	7.71%	-0.13	-0.11	0.00	0.04	0.14	0.14	0.22	1.00																				
	Non-U.S. World Govt. (hedged)	2.6%	4.75%	4.78%	-0.03	0.30	0.73	0.52	0.72	0.65	0.70	0.05	1.00																			
	Non-U.S. World Govt. (unhedged)	8.1%	4.75%	5.06%	-0.07	-0.18	0.43	0.41	0.42	0.39	0.38	0.00	0.32	1.00																		
Emerging Market Debt	14.4%	7.50%	8.44%	0.03	0.00	0.08	0.17	0.18	0.16	0.19	0.49	0.13	0.04	1.00																		
Equities	U.S. Large Cap	15.6%	7.25%	8.36%	-0.10	0.05	-0.19	-0.16	-0.07	-0.11	-0.04	0.49	-0.06	-0.04	0.55	1.00																
	U.S. Large Cap Value	14.5%	7.50%	8.46%	-0.10	0.04	-0.18	-0.11	-0.07	-0.11	-0.04	0.45	-0.02	0.00	0.55	0.90	1.00															
	U.S. Large Cap Growth	19.6%	7.00%	8.73%	-0.08	0.04	-0.18	-0.18	-0.08	-0.12	-0.05	0.47	-0.11	-0.06	0.49	0.94	0.71	1.00														
	U.S. Mid Cap	17.6%	7.50%	8.89%	-0.11	0.02	-0.20	-0.13	-0.11	-0.12	-0.07	0.49	-0.15	0.01	0.57	0.86	0.82	0.82	1.00													
	U.S. Small Cap	20.2%	7.50%	9.32%	-0.11	-0.04	-0.24	-0.16	-0.14	-0.15	-0.09	0.53	-0.16	0.00	0.53	0.71	0.61	0.74	0.88	1.00												
	EAFE (unhedged)	14.9%	8.75%	9.74%	-0.08	-0.11	-0.22	-0.13	-0.13	-0.12	-0.09	0.46	-0.15	0.20	0.53	0.79	0.71	0.74	0.75	0.71	1.00											
	EAFE (hedged)	14.8%	8.75%	9.74%	-0.04	0.05	-0.33	-0.26	-0.23	-0.23	-0.17	0.48	-0.17	-0.26	0.54	0.81	0.72	0.77	0.73	0.69	0.85	1.00										
	Emerging Market Equity	23.6%	8.75%	11.18%	-0.03	-0.19	-0.29	-0.12	-0.19	-0.16	-0.15	0.52	-0.20	-0.04	0.68	0.70	0.64	0.67	0.73	0.72	0.75	0.74	1.00									
	REITs	13.6%	7.00%	7.85%	-0.03	-0.08	-0.02	0.11	0.04	0.09	0.07	0.31	0.08	0.16	0.38	0.29	0.42	0.18	0.40	0.45	0.29	0.22	0.37	1.00								
	U.S. Direct Real Estate	7.1%	6.75%	6.99%	-0.05	0.15	0.25	0.22	0.29	0.26	0.28	0.19	0.26	0.14	0.26	0.25	0.28	0.20	0.26	0.23	0.18	0.15	0.16	0.40	1.00							
Other	Hedge Fund	6.0%	6.50%	6.67%	0.01	0.06	-0.08	-0.03	-0.01	0.02	0.03	0.45	-0.01	-0.13	0.59	0.54	0.43	0.57	0.61	0.69	0.57	0.63	0.65	0.26	0.18	1.00						
	Hedge Fund (non-directional)	4.0%	5.75%	5.83%	-0.03	0.35	-0.04	0.03	0.04	0.04	0.05	0.48	0.04	-0.08	0.55	0.45	0.44	0.41	0.52	0.54	0.37	0.43	0.41	0.29	0.23	0.67	1.00					
	Hedge Fund (directional)	7.0%	7.00%	7.23%	-0.02	0.01	-0.13	-0.04	-0.04	-0.01	0.00	0.53	-0.05	-0.04	0.64	0.67	0.56	0.68	0.75	0.82	0.69	0.71	0.73	0.35	0.22	0.85	0.65	1.00				
	Private Equity	30.0%	8.50%	12.30%	-0.05	-0.08	-0.21	-0.12	-0.12	-0.10	-0.06	0.53	-0.18	-0.02	0.46	0.56	0.40	0.64	0.70	0.91	0.60	0.59	0.67	0.33	0.16	0.60	0.52	0.82	1.00			

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(continued from prior page)

Expected returns employ proprietary projections of the “equilibrium” returns of each asset class (as well as equilibrium estimates of their future volatility). We estimate the “equilibrium” performance of an asset class or strategy by analyzing current economic and market conditions and historical market trends. Equilibrium estimates represent our projection of the central tendency (going out over a very long time period) around which market returns may fluctuate, because they reflect what we believe is the value inherent in each market. It is possible that actual returns will vary considerably from this equilibrium, even for a number of years. References to future returns for either asset allocation strategies or asset classes are not promises or even estimates of actual returns a client portfolio may achieve.

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## Selected References

- AllianceBernstein LP. *Target-date Retirement Funds — A Blueprint for Effective Portfolio Construction*. New York: 2005.
- Aon Consulting. *The Aon Consulting/Georgia State University 2004 Retirement Income Replacement Ratio Study*. Aon Corporation: Chicago, IL: 2004.
- Deloitte & Touche USA LLC. *Annual 401(k) Benchmarking Survey 2005/2006 Edition*. New York, NY: 2006.
- Frank, Robert H. “The Mysterious Disappearance of James Duesenberry.” *The New York Times*, June 9, 2005.
- Hewitt Associates LLC. “How Well Employees Are Saving and Investing in 401(k) Plans: 2005 Universe Benchmarks.” *Research Highlights*. Lincolnshire, IL: 2005.
- Kahneman, Daniel and Tversky, Amos. “Prospect Theory: An Analysis of Decision Under Risk.” *Econometrica*, volume 47, 1979.
- Modigliani, F. and Ando, A. “The life cycle hypothesis of saving: Aggregated implications and tests,” *American Economic Review*, 53, 55-84.
- Munnell, Alicia H., Sass, Steven A., and Aubry, Jean-Pierre. *Boomers Won't Retire Because They Can't*. Boston, MA: Boston College Center for Retirement Research, 2006.
- Samuelson, Paul and Nordhaus, William. *Economics*, 18th Edition. New York: McGraw-Hill, 2005.
- U.S., Department of Labor. “Default Investment Alternatives Under Participant Directed Individual Account Plans; Proposed Rule.” [Federal Register, September 27, 2006.](#)
- U.S., Social Security Administration. [The 2006 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Trust Funds.](#)

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