

How Company Stock Volatility May Impact Retirement Income

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EXECUTIVE SUMMARY

Fourth-quarter 2008 market activity may serve as a painful reminder of the impact that portfolio volatility can have on investors' retirement security.

In this study, T. Rowe Price analyzes the potential impact of individual stock volatility on retirement income, finding that investing in company stock may reduce an individual's projected retirement income from investments by 60%. In the example provided, a participant's annual retirement income from investments may decline from nearly \$13,500 to \$5,500 if the stock portion of a balanced portfolio was invested in a single stock instead of a well-diversified portfolio of large-cap stocks.

Plan sponsors may wish to consider the potential negative impact of individual stock volatility on retirement income as they evaluate possible revisions to their plans, as well as future retirement plan education and communication efforts.

For many participants and plan sponsors alike, current market conditions motivate a reconsideration of risk—in particular, investment risk, or the uncertainty of the future value of retirement assets. The increased market volatility, recently even higher than it was during the aftermath of the Internet bubble, has weighed heavily on many investors, causing some of them to adjust their portfolios by completely selling out of equities to invest more conservatively.¹ In October 2008, which is noted as the second most volatile month for stocks since 1926,² investors saw the Dow Jones Industrial Average drop by over 1,000 points in one day alone. Another day saw the Dow post a 400-point gain during the last hour to close with a historic 936-point gain.³

For most equity investors, general market risk (often called systematic risk) is unavoidable. It cannot be overcome by diversifying one's portfolio. However, another type of risk, the risk related specifically to an individual stock, can be diversified away. This individual security risk is often called idiosyncratic (or unsystematic) risk, and investors are often not compensated for taking it. And by definition, the volatility of some individual securities will exceed general market volatility. For example, although the S&P 500 Index (Index) experienced 16 trading days with a price swing of 5% or more in the two-month period ended November 30, 2008 (63 trading days), two of the top 10 holdings (based on market capitalization) had twice as many (or more) days

¹ Outflows from equity mutual funds in September and October 2008 were \$56.2 billion and \$68.2 billion, respectively, according to TrimTabs Investment Research Weekly Flow Report, November 12, 2008. These amounts compare to a \$94.5 billion *inflow* into equity mutual funds for all of 2007.

² Based on the percentage of trading days in the month when the Standard & Poor's 500 Index rose or fell by at least 1%.

³ As of November 14, 2008, nine of the 10 largest intraday point swings in the Dow Jones Industrial Average since 1987 have occurred in the period from September 18, 2008, through November 13, 2008 (http://online.wsj.com/mdc/public/page/2_3047-djia_intraday.html).

with share price swings of more than 5%. Looking further at the price swings of the top 10 companies in the Index during the same period, for *half* of the companies, their largest one-day percentage loss *exceeded* the one-day loss for the Index. For one company, the largest one-day percentage loss during the period was nearly three times the largest one-day percentage loss for the Index.

Despite their risk, individual securities are popular among retirement plan participants when they are offered. Employee Benefit Research Institute (EBRI) data show that average allocation to company stock ranges from 16.3% to 21.9% (see Table 1). Surprisingly, older participants have a higher average allocation to company stock than do younger participants. Finally, 14.4% of participants in their 60s hold more than 90% of their retirement assets in company stock. The T. Rowe Price research described in this paper suggests that depending on the other assets of these older participants, allocating such a high percentage to a nondiversified equity investment may severely limit their ability to retire.

EBRI's data also show that lower-income investors tend to allocate a higher percentage on average to company stock than do participants in EBRI's highest income bracket (>\$100,000)⁴ (see Table 2).

In this paper, the impact of investing in individual stocks is analyzed by comparing the projected range of retirement account balances for single-stock equity portfolios to the projected range of balances when the equity portion of the retirement account is invested in a well-diversified equity portfolio, illustrating the cost of nondiversification. The analyses demonstrate that the increased volatility from investing in individual securities is significant. The consequences of portfolio volatility on retirement income are also shown (Figure 1), and we quantify the dramatic increase of the likelihood of running out of money during retirement (Figure 2). The reasons people nevertheless invest in individual securities are explored, and risk-minimization strategies for plan sponsor consideration are also offered.

TABLE 1: Average Allocation of Accounts by Participant Age and Investment Options

Percentage of account balances,^a 2007

		Equity Funds	Lifecycle ^b and Balanced Funds	Bond Funds	Money Funds	Company Stock
Plans With Company Stock						
Age Group	20s	50.5%	16.7%	8.5%	4.7%	16.3%
	30s	55.8%	12.6%	8.3%	3.9%	17.7%
	40s	50.7%	11.7%	9.4%	5.0%	20.9%
	50s	42.3%	11.8%	13.3%	7.9%	21.9%
	60s	34.4%	10.2%	19.9%	12.7%	19.3%

Source: Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project.

^a Minor investment options are not shown; therefore, row percentages will not add to 100%.

^b A lifecycle fund typically rebalances to an increasingly conservative portfolio as the target date of the fund, which is usually included in the fund's name, approaches.

TABLE 2: Average Asset Allocation of 401(k) Accounts by Participant Salary and Investment Options

Percentage of account balances,^a 2007

Salary^b	Equity Funds	Lifecycle ^c and Balanced Funds	Bond Funds	Money Funds	Company Stock
Plans With Company Stock					
\$20,000-\$40,000	40.9%	15.0%	9.9%	12.5%	19.1%
>\$40,000-\$60,000	43.7%	15.1%	10.8%	8.0%	20.3%
>\$60,000-\$80,000	44.4%	13.0%	10.3%	6.7%	23.1%
>\$80,000-\$100,000	46.0%	12.1%	9.9%	6.3%	22.9%
>\$100,000	48.0%	13.2%	9.5%	5.5%	19.6%
All	44.9%	11.6%	12.8%	7.5%	20.5%

Source: Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project.

^a Minor investment options are not shown; therefore, row percentages will not add to 100%.

^b Salary information is available for a subset of participants in the EBRI/ICI database.

^c A lifecycle fund typically rebalances to an increasingly conservative portfolio as the target date of the fund, which is usually included in the fund's name, approaches.

⁴ It is recognized that these higher-income participants may have employer-stock investments outside the plan.

We begin our analysis with a discussion of the methodology behind the results presented herein. The results of this study are based on Monte Carlo modeling, using the following forward-looking, long-term expected gross returns:

- 4.75% for short-term bonds
- 6.5% for intermediate-term, investment-grade bonds
- 10% for large-cap individual stocks and well-diversified stocks
- 11% for mid- and small-cap individual stocks

The uncertainty of the future performance of each of these asset classes is modeled using estimated standard deviations, a standard measure of volatility. Based on statistics published by Barra,⁵ the estimated risk measures (standard deviations) for the median equity within each of several equity asset indices are presented below.

	Large-Cap (Russell 1000 Index)	Small-Cap (Russell 2000 Index)
Systematic Risk	15.6%	19.1%
Specific Risk	22.1%	36.1%
Total	27.7%	41.2%

Therefore, for individual large-cap stocks, a standard deviation of 27% is used, and for individual mid- and small-cap stocks, a standard deviation of 40% is used. Well-diversified stock portfolios are modeled using a standard deviation of 15%, which was based on the S&P 500 Index.

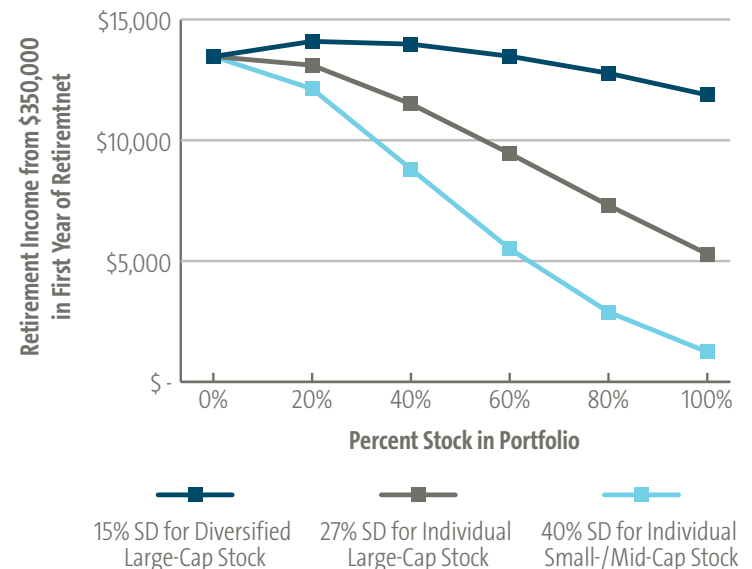
Additional information about the modeling methodology appears at the end of this paper.

The cost of the increased volatility of individual stocks is highlighted in the following example. Assume a 37-year-old employee, John, is contributing \$7,500 annually to his company-sponsored retirement plan. He plans to retire at age 65. Based on guidance from his financial advisor, he has decided to allocate 20% of his retirement plan portfolio to short-term investments (such as a short-term bond fund); 20% to an intermediate-term, investment-grade bond fund; and 60% to equity investments. He has two options for investing the equity portion. His employer, a small company, offers company stock as an option in the retirement plan, but he could also choose to invest in the well-diversified, large-cap stock funds in the plan. If he chooses to invest the entire equity allocation in the well-diversified stock

fund, his projected account balance at retirement is likely to be approximately \$346,000, and unlikely to be less than \$232,000⁶. On the other hand, if he fully invests the 60% equity portion of his retirement assets in his employer's small-cap stock, his balance is likely to be approximately \$308,000⁶ and unlikely to be less than \$124,000⁶—approximately half as much as the diversified strategy. In other words, by investing his equity allocation in a single small-cap stock, John (knowingly or unknowingly) accepted the chance of losing out on a significant amount of money at his retirement date in 28 years by not choosing a well-diversified stock fund instead.

FIGURE 1: Impact of Volatility* of Stock on Annual Retirement Income—90% Simulation Success Rate

*Volatility measure: standard deviation (SD)



As Figure 1 shows, the additional volatility of investing in individual stocks in retirement also has a significant impact on the amount of retirement income a participant can withdraw. Assuming a desired “success” rate of 90%—meaning that only a 10% chance of running out of money during a 30-year retirement is acceptable—a retiree with \$350,000 in retirement assets at age 65 with 60% of the portfolio invested in equities can withdraw between \$5,500 and \$13,500 in the first year of retirement, depending on the volatility of the equity investments.⁷ From our example above, if John had fully invested the equity portion (60%) of this \$350,000 retirement account entirely in his employer's small-

⁵ T. Rowe Price calculations were based on the Barra E3 Risk Model, which is available from MSCI Barra. The calculations used estimate samples in late 2005—a period in the stock market that was deemed to be more representative of long-term averages—rather than estimates sampled in late 2008.

⁶ At the 10th percentile. See investment modeling disclosures at the end of this paper.

⁷ Assuming a 30-year retirement and increasing the initial withdrawal amount 3% annually for inflation.

company individual stock, he could expect to withdraw only \$5,500 in the first year of retirement—only 40% of what he could expect if he invested the 60% equity allocation in a well-diversified, large-cap stock portfolio.⁸ He is taking the chance of “losing” approximately \$8,000 of retirement income *in the first year alone*.

Note from Figure 1 that the differences in retirement income result primarily from the differences in the assumed volatility of the stock portion of the portfolio. As mentioned above:

- 40% standard deviation is assumed for a single small- or mid-cap stock portfolio,
- 27% standard deviation is assumed for a single large-cap stock portfolio, and
- 15% standard deviation is assumed for a well-diversified, large-cap portfolio.

It is also apparent in Figure 1 that while increasing the relative equity portion of the portfolio has a slight impact on the initial withdrawal amounts that can be taken from a well-diversified, large-cap portfolio, when the equity portion of the portfolio consists entirely of a single stock, the negative impact on the initial amounts that can be withdrawn is profound. This is true regardless of whether it is stock in a small-/mid-cap company or a large-cap company.

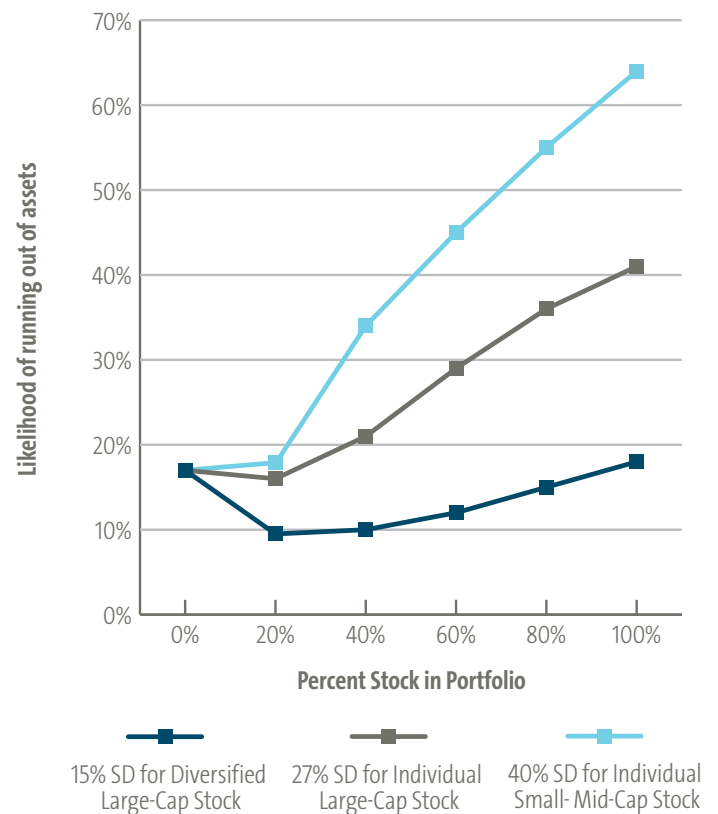
While a retiree investing 60% of a portfolio in a single small-cap stock potentially reduces retirement income to less than half of what it could be by investing in a well-diversified, large-cap portfolio, even investing in individual large-cap stocks cuts first-year retirement income by one-third (from approximately \$13,500 to \$9,500), according to T. Rowe Price’s analysis above.

To summarize, investing in individual stocks increases portfolio volatility, resulting in greater downside risk, lower median projected account balances at retirement, and lower annual income in retirement, assuming a certain simulation success rate.

Next, we analyze the effect of single-stock investing on the likelihood of running out of money in retirement. Figure 2 shows that in order to minimize this risk, participants must invest in a well-diversified portfolio—both with respect to overall asset allocation and with respect to the equity portion of their portfolios. For example, if the equity portion of a retirement portfolio is invested in a well-diversified, large-cap equity portfolio, the likelihood of running out of money ranges from 9% to 17%, which compares to a range of 16% to 42% and 17% to 64% when the equity portion is invested in individual large-cap and individual small- or mid-cap stocks, respectively (see Figure 2).

FIGURE 2 : Increased Stock Volatility* Increases Likelihood of Depleting Retirement Assets—4% Initial Withdrawal Amount

*Volatility measure: standard deviation (SD)



⁸ Assuming a desired “success” rate of 90% and a 30-year retirement. A “success” rate of 90% signifies a retirement income strategy that has a 10% chance of running out of money over a 30-year period.

According to a recent survey of profit sharing and 401(k) plans, just over 21% of all plans offer company stock as an investment option.⁹ There are a number of reasons that plan sponsors offer company stock as an investment option in their retirement plans. Very often, they believe that employer stock investments motivate employees toward improved performance and loyalty. Also, there may be tax advantages and cash flow benefits when employer contributions are made in company stock rather than cash. Finally, there may be the added benefit of having employer stock in friendly hands. Interestingly, anecdotal evidence has also suggested that employers continue to offer company stock simply because they always have.

Nevertheless, in the aftermath of the number of “stock drop” cases after the market slump in 2001 through 2003, many employers have begun making matching contributions in cash rather than in company stock and have lifted restrictions on participants’ ability to diversify out of company stock. A 2006 survey finds that only 23% of plan sponsors exclusively match in company stock, down from 35% in the prior year.¹⁰ Additionally, the survey reports that 67% of plan sponsors making matching contributions in company stock allow participants to diversify immediately, up from 25% in 2005.

Yet despite the number of well-publicized company stock losses highlighting the risk of investing in individual securities, as well as employer efforts to liberalize restrictions on diversifying out of company stock, employees continue to invest in it. Behaviorists suggest a number of reasons for this anomaly. Research has proven the powerful effect of inertia.¹¹ When matching contributions are made in company stock, inertia will result in many employees leaving the money there, even though they may be able to diversify out of it. In addition, behaviorists have noted that employees tend to invest *more* of their salary deferral contributions in company stock when plan sponsors make matching contributions in company stock (compared to when matching contributions are in cash),

suggesting an endorsement effect. There may also exist a familiarity bias: Employees believe that investments they know are “safer” than investments they do not know.¹² Finally, it is well known that all humans tend to be overly optimistic about future outcomes; it is doubtful that any company stock investor believes his investment will decline or perform worse than the market. However, rational minds know that some will.

Some plan participants are aware of possible tax advantages of investing in company stock if the stock has appreciated significantly in value at the time of the rollover.¹³ In this case, a participant may be able to take company stock distributions in kind and invest them in a taxable brokerage account while rolling over the remaining assets from the plan into an individual retirement account (IRA). In so doing, the participant would pay ordinary income taxes only on the cost basis of the shares of company stock and would benefit from the (typically) lower long-term capital gains rate on the gains when the stock is sold. Unfortunately, at the time the investment is initially made, the future value of these potential tax benefits is unknown since the size of the benefits depends on the extent to which the stock has actually appreciated in value when the participant is ready to roll the assets out of the employer retirement plan.

Thus far, this analysis has focused exclusively on the volatility (or risk) of an individual’s investment capital. Such a focus ignores another very important component of an employee’s total capital: his or her human capital. To at least some extent, an individual’s human capital is closely related to (invested in) his or her employer, thereby increasing the total risk of also investing his or her financial capital in this same asset. In other words, the consequences of a company’s downturn not only affect employees’ retirement prospects (to the extent employees are invested in employer stock), it is also very likely to negatively impact their continued employment opportunities with that company (or human capital).

⁹ According to PSCA’s 51st Annual Survey of Profit Sharing and 401(k) Plans. Based on this survey, just over 30% of plans with 1,000 to 4,999 participants offer company stock, and 55% of plans with 5,000 or more participants offer company stock.

¹⁰ Hewitt, 2007 Trends and Experiences in 401(k) Plans.

¹¹ One of the earliest empirical studies highlighting participant inertia in retirement plans was conducted by Brigitte Madrian and Dennis Shea (2001). They showed the powerful effects of inertia by studying participant behavior in a large plan that adopted automatic enrollment. After this initial study, additional work by James Choi, David Laibson, Brigitte Madrian, and Andrew Metrick confirmed these early findings. In addition, empirical evidence by John Ameriks and Steven Zeldes in 2004 showed that most participants never change their investment allocations.

¹² Note that in John Hancock’s Eighth (2002) Defined Contribution Plan Survey, participants responded that they were most familiar with company stock (as a retirement plan asset) and also rated it as less risky than a diversified stock fund.

¹³ Participants should discuss all tax matters with their own tax advisors prior to taking any action.

STRATEGIES

There are a number of effective strategies to manage excess volatility from investing in individual stocks. Alternative strategies are discussed below.

1. Limit or avoid nondiversified retirement plan investments.

Perhaps one of the most effective strategies to overcome the potential risks of employees' investing too much in nondiversified equity portfolios is to limit the extent to which they can.¹⁴

2. Lift any restrictions on diversifying out of individual stocks.

As noted previously, most employers have already lifted such restrictions on company stock. Additionally, the Pension Protection Act of 2006 now requires that any restrictions on employer contributions in company stock must be removed after three years.¹⁵

3. Offer participants simple, practical tactics for divesting.

Of course, simply lifting restrictions may not motivate employees to actually diversify their single-stock investments; inertia may prevail. Employers may wish to offer employees a simple, convenient way to diversify over time.

4. Avoid the endorsement effect.

As noted above, researchers have found that employees tend to invest more of their salary deferral contributions in company stock when their employers make matching contributions in company stock, suggesting that employers' use of company stock in this manner may serve as an endorsement of the stock as a "good" investment option. For that reason, it may make more sense to match an employee's salary contribution using cash instead of company stock.

5. Inform and educate employees about the benefits of diversification.

The Pension Protection Act of 2006 requires that plan sponsors notify employees annually about their right to diversify (along with the benefits of diversification). The results of our research suggest that employers may wish to do even more to educate employees about the risks of nondiversified stock portfolios.

The recent financial crisis and resulting market volatility draw attention to the importance of carefully considering investment risk. While one component of this risk (general market risk) cannot generally be "diversified away," the idiosyncratic risk of investing in individual stocks can be, and in this economic environment, plan participants may be more open to hearing about the benefits of diversification. Employers may wish to consider the diversification strategies discussed above.

And not incidentally, a number of new "stock drop" cases have been filed against several firms that have experienced significant declines in their stock prices.¹⁶ It may be a time for plan sponsors to reconsider how they can minimize their own risk exposure as well.

¹⁴ According to Hewitt's Trends and Experience in 401(k) Plans 2005, 17% of plan sponsors limit employees' investment in the employer stock fund, with the average maximum limited to 30%. In Hewitt's Hot Topics in Retirement 2007, 10% of employers offering company stock planned to set limits in 2007 and 4% planned to eliminate it as an investment option.

¹⁵ Please consult your independent legal counsel for additional information.

¹⁶ "Stock drop" suits were filed in 2008 against Lehman Brothers Holdings Inc., American International Group Inc. (AIG), Bear Stearns, Wachovia Corp., UBS, IndyMac Bank, and Fifth Third Bancorp.

INVESTMENT MODELING METHODOLOGY

Monte Carlo simulations model future uncertainty. In contrast to tools generating average outcomes, Monte Carlo analyses produce outcome ranges based on probability—thus incorporating future uncertainty. In these examples, retirement income data is based on Monte Carlo analysis.

Material Assumptions Include:

- Underlying long-term expected annual returns for the asset classes are not based on historical returns, but estimates, which include reinvested dividends and capital gains.
- Expected returns—plus assumptions about asset class volatility and correlations with other classes—are used to generate random monthly returns for each class over specified time periods.
- These monthly returns are then used to generate thousands of scenarios, representing a spectrum of possible performance for the modeled asset classes. Success rates are based on these scenarios.
- Taxes, required minimum distributions, and net unrealized appreciation are not taken into account, nor are early withdrawal penalties. But fees—average expense ratios for typical actively managed, diversified funds within each asset class—are subtracted from the expected annual returns. No expenses are subtracted from the individual stock asset classes.

Material Limitations Include:

- Extreme market movements may occur more often than in the model.
- Some asset classes have relatively short histories. Expected results for each asset class may differ from our assumptions—with those for classes with limited histories potentially diverging more.
- Market crises can cause asset classes to perform similarly, lowering the accuracy of projected portfolio volatility and returns. Correlation assumptions are less reliable for short periods.
- The model assumes no month-to-month correlations among asset class returns. It does not reflect the average periods of “bull” and “bear” markets, which can be longer than those modeled.
- Inflation is assumed constant, so variations are not reflected in our calculations.
- The analysis does not use all asset classes. Other asset classes may be similar or superior to those used.

Portfolio Construction

Portfolios were designed including only the following asset classes, for illustrative purposes: large-cap individual stock; mid-/small-cap individual stock; diversified stock; bonds; short-term bonds. In situations where the performances of portfolios with different allocations to stock were compared, the remaining balance of each portfolio was always divided equally between bonds and short-term bonds. Diversification theoretically involves all asset classes: equities, bonds, real estate, foreign investments, commodities, precious metals, currencies, and others. Because investors are unlikely to own all these

assets, we selected those most appropriate for long-term investors: stocks, bonds, and short-term bonds. We did not consider real estate because of its illiquidity and investors’ potential exposure from home ownership. Short-term investment-grade bonds were chosen for stability, eliminating a cash allocation because investors are best able to decide that according to their near-term needs.

The initial withdrawal amount is the percentage of the initial value of the investments withdrawn on the first day of the first year. In subsequent years, the amount withdrawn grows by a 3% annual rate of inflation. Success rates are based on simulating 10,000 market scenarios and various asset-allocation strategies and stock assumptions. These rates of “success” are measures of the percentage of simulated scenarios for each strategy that result in a nonzero balance at the end of retirement. The rates of “failure,” or likelihood of running out of money, are determined by subtracting the “success” rates from 100%.

The underlying long-term expected annual return assumptions (without fees) are 10% for stock funds and large-cap individual stock; 11% for mid-/small-cap individual stock; 6.5% for intermediate-term, investment-grade bonds; and 4.75% for short-term bonds (assumed to include any money market or stable value funds). Investment expenses in the form of an expense ratio are subtracted from the expected annual return of each asset class that is a fund. These expenses are intended to represent the average expenses for a typical actively managed no-load mutual fund within each asset class modeled. The expense figures used in the projections are based on historic no-load mutual fund Lipper averages from October 1992 to October 2002: stock funds, 1.211%; bonds, 0.726%; short-term bonds, 0.648%. No expenses are withheld for the large-cap individual stock or the mid-/small-cap individual stock.

We use these expected returns, along with assumptions regarding the volatility for each asset class, as well as the intra-asset class correlations, to generate a set of simulated, random monthly returns for each asset class over the specified period of time, with returns for subsequent months assumed to be statistically independent. The random selection process reflects the way markets behave in general, as opposed to using the same annual rate of return for each time period.

IMPORTANT: The projections or other information generated by the T. Rowe Price Investment Analysis Tool regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. The simulations are based on assumptions. There can be no assurance that the projected or simulated results will be achieved or sustained. The charts present only a range of possible outcomes. Actual results will vary with each use and over time, and such results may be better or worse than the simulated scenarios. Clients should be aware that the potential for loss (or gain) may be greater than demonstrated in the simulations.

The results are not predictions, but they should be viewed as reasonable estimates. Source: T. Rowe Price Associates, Inc.

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