



**PRICE
PERSPECTIVE**[®]

March 2017

In-depth analysis and insights
to inform your decision-making.

Target Date Strategies

THE BENEFITS OF THE T. ROWE PRICE APPROACH

- Assessing the skill of target date managers is not a simple process, as performance reflects decisions made on multiple levels, including glide-path design and diversification, the pursuit of tactical asset allocation opportunities, and management of the underlying portfolios.
- While all target date managers make active decisions related to the glide-path design and diversification, the underlying implementation of these designs can be done passively, actively, or through a combination of passive and active. Some managers take a passive approach, adhering to their long-term strategic allocations and indexing the underlying portfolios. Others, like T. Rowe Price, use an active approach that can include both tactical asset allocation and actively managed underlying portfolios.
- T. Rowe Price conducted a study to evaluate whether our active approach to target date implementation has outperformed passively managed alternatives. We compared the performance of our Retirement Funds (RFs) that had at least a 10-year track record with custom passive benchmarks in order to quantify the value added by active implementation, including tactical allocation and excess returns on the underlying T. Rowe Price funds.
- We believe longer-term performance results are most meaningful when assessing target date performance. Our study found that all 11 of the RFs studied outperformed their passive benchmarks in at least 84% of rolling five-year periods and in 100% of rolling 10-year periods from inception through December 31, 2016, net of fees. RF outperformance was primarily driven by positive contributions from tactical asset allocation and active security selection.
- For all 11 RFs, tactical allocation added value in 95% or more of all rolling five-year periods and in 100% of rolling 10-year periods since inception.
- For nine of the 11 RFs, security selection added value in at least 84% of all rolling five-year periods while, once again, all 11 RFs posted a positive contribution from active security selection over every rolling 10-year period since inception.
- We believe the success of T. Rowe Price's target date program stems from the firm's core strengths, including the quality of our asset allocation team, the depth of our global research platform, and the experience and disciplined approach of our portfolio managers.

Figure 1



Source: T. Rowe Price



Hit rates

The hit rate records the percentage of times a fund beat its designated benchmark, net of fees and trading costs, over a specified time period (e.g., 10 years). Think of this as a measure of how often a client might look at his or her monthly statement and find that a fund has outperformed for that time period.

To demonstrate that T. Rowe Price's target date process is creating value for our clients by outperforming purely passive strategies, we examined the performance of all of our Retirement Funds (RFs) that had at least 10-year track records as of December 31, 2016 (see list, [Figure 12](#), page 8). These 11 RFs held virtually all (99.9%) of the Retirement Fund assets managed by the firm as of that date.¹

We examined relative returns for three different metrics:

- To quantify the total value added by T. Rowe Price's active target date implementation, RF returns in each rolling period were compared with custom passive benchmarks created by T. Rowe Price that closely mirror the strategic allocations of each RF as it moves along its glide path.
- To quantify the value added by T. Rowe Price's tactical allocation process, RF returns calculated using each fund's fixed strategic asset allocation were compared with the returns based on actual allocation weights.
- To quantify the value added by active security selection, excess returns—net of fees and other costs—were calculated for the underlying funds in each RF (these funds are shown in [Figure A2](#), page 11). Returns were calculated relative to each underlying fund's asset class, sector, or style benchmark. Returns were then aggregated to show the total excess returns for each RF.

As can be seen, the first metric—the overall value added by T. Rowe Price's active implementation—is primarily composed of the second two metrics: the additional returns achieved through tactical asset allocation and the excess returns contributed by

active security selection in the underlying funds. This relationship is illustrated in [Figure 1](#), above.²

For all three metrics in our analysis, two performance measures were calculated:

- Hit rates: The percentage of the total rolling periods in each time frame in which the RF outperformed its custom passive benchmark or in which tactical allocation or active portfolio management made a positive contribution to RF returns.
- Excess returns: The annualized return for each RF relative to its passive benchmark, or the return contribution (either positive or negative) made by tactical asset allocation or active security selection in the underlying funds. Excess returns were calculated for each rolling period and then averaged across all the periods in each time frame.

Our study examined RF performance over both short- and long-term rolling time periods. However, we feel strongly that longer time horizons provide the most meaningful measures of target date implementation, as they smooth out the effects of shorter-term market fluctuations that can produce a distorted picture of relative active performance. Accordingly, our analysis was focused primarily on performance over rolling five-year and rolling 10-year periods, rolled monthly.³

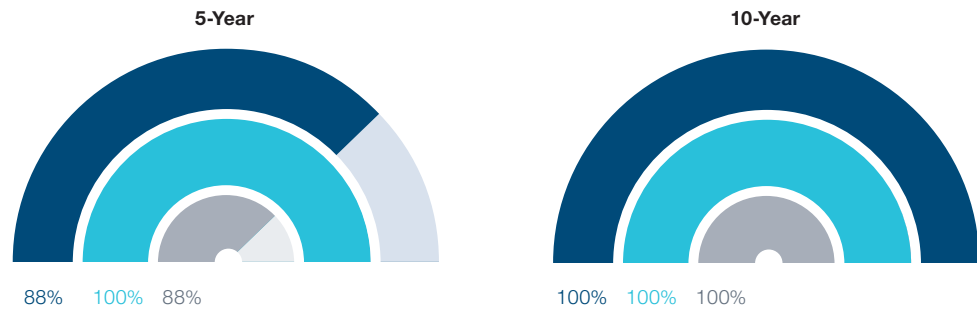
¹ One Retirement Fund with a relatively distant target date (2060) was excluded from the study because of its short performance track record. A list of the Target Funds and their inception dates can be found in [Figure A1](#) (page 11) in the appendix.

² Certain asset sectors—such as high yield bonds, international bonds, and emerging market bonds, as well as a “real asset” allocations of natural resources and real estate stocks—are not represented in T. Rowe Price's custom passive benchmarks. These out-of-benchmark allocations may materially affect RF excess returns relative to the custom passive benchmarks. Excess returns attributable to out-of-benchmark assets are included in the relative performance results shown in this paper but are not broken out separately. A table showing out-of-benchmark contributions to excess returns (positive or negative) can be found in [Figure A7](#) in the appendix on page 13.

³ Shorter-term results (for rolling 1- and 3-year periods) are displayed in [Figures A4, A5, and A6](#) in the appendix on pages 12 and 13.

Figure 2Fund Inceptions Through
December 31, 2016

- Total Active Implementation
- Tactical Asset Allocation
- Active Security Selection

Time-Weighted Average Hit Rates for T. Rowe Price Retirement Funds**Figure 3**Fund Inceptions Through
December 31, 2016

Sources: Bloomberg Barclays, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Time-Weighted Average Annualized Value Added (in Basis Points) for T. Rowe Price Retirement Funds

Study Results

Overall, we found that long-term performance for the 11 RFs in our study was strongly positive for all three metrics across both 5- and 10-year time frames since fund inception (Figures 2 and 3, above). In other words, in far more rolling periods than not, T. Rowe Price's Retirement Funds added value for investors at each stage of active target date implementation.⁴

- **Tactical asset allocation:** The performance contribution from tactical allocation was positive in every 10-year rolling period for every fund since inception (i.e., a 100% hit rate). Hit rates also were overwhelmingly positive across five-year rolling periods (averaging 99.5%). Value added was positive and relatively consistent across all time frames (Figure 4, page 4).
- **Active security selection:** Excess returns also were positive in every 10-year rolling period for every RF since inception and strongly positive (averaging 90%) across five-year rolling periods. Excess returns were positive across all time frames for all funds (Figure 5, page 4).
- **Total active implementation:** Hit rates were positive in every 10-year rolling period for every RF and averaged 88% across five-year rolling time periods for all RFs. Annualized excess returns were consistently positive across all time frames for all funds (Figure 6, page 4).

Positive Shorter-Term Results

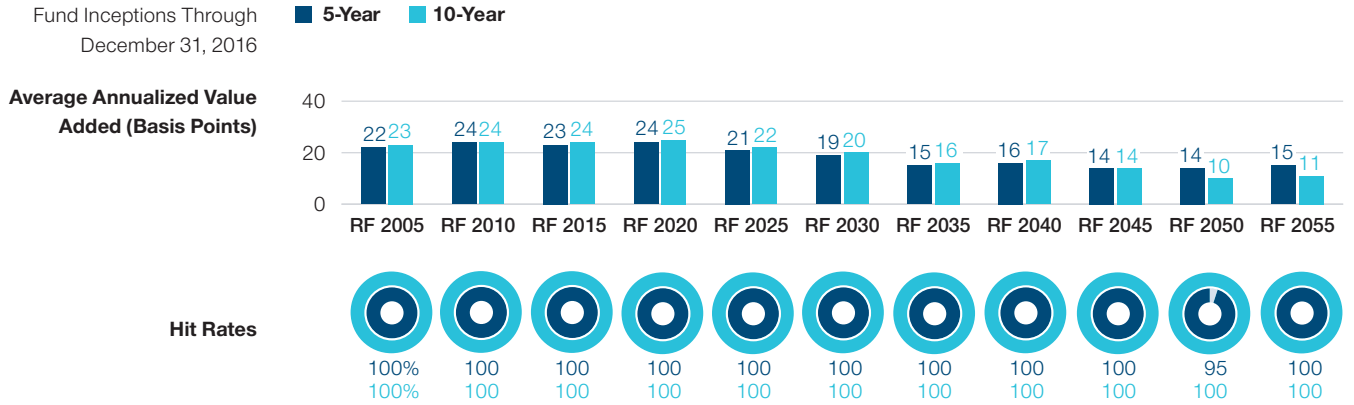
Although the primary focus of our study was on longer-term active performance, we also examined relative returns and hit rates over shorter time horizons—rolling one-year and three-year periods. Among our findings:

- **Tactical asset allocation:** Hit rates for tactical allocation were positive across the vast majority of rolling three-year time periods (91% average) for all RFs and most rolling one-year periods (73% average). Value added was positive, on average, for all RFs across both one-year and three-year periods (Figure A4, page 12).
- **Active security selection:** Active performance was generally positive (average 77%) across rolling three-year periods and also positive (average 60%) across rolling one-year periods for nine of the 11 funds. While one-year hit rates were slightly negative (i.e., just below 50%) for two of the funds, active returns from security selection were positive, on average, for all 11 funds across both one- and three-year time periods (Figure A5, page 12).
- **Total active implementation:** Hit rates for all RFs were firmly positive, averaging 85% across three-year rolling periods and 60% across one-year rolling periods. Again, the total value added by T. Rowe Price's implementation process was positive across both one- and three-year periods for all RFs (Figure A6, page 13).

Past performance is not a reliable indicator of future performance. See page 9 for standardized performance.

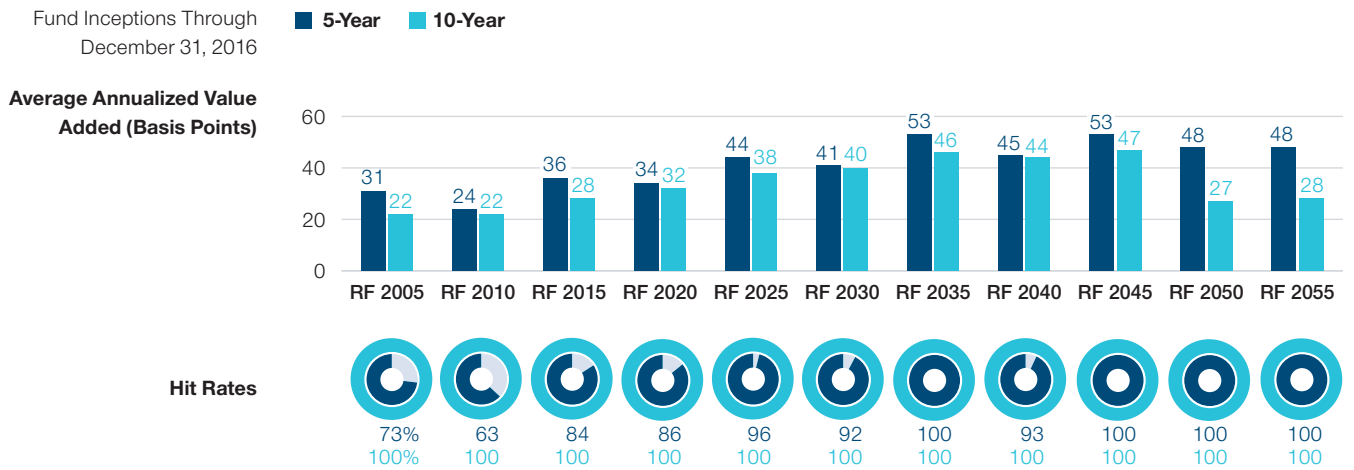
⁴ Performance averages were calculated for all 11 RFs within each time frame. These averages were time weighted to reflect their differing inception dates. The weights for each fund in each time frame can be found in Figure A12 in the appendix on page 16.

Figure 4 Hit Rates and Value Added by Tactical Allocation



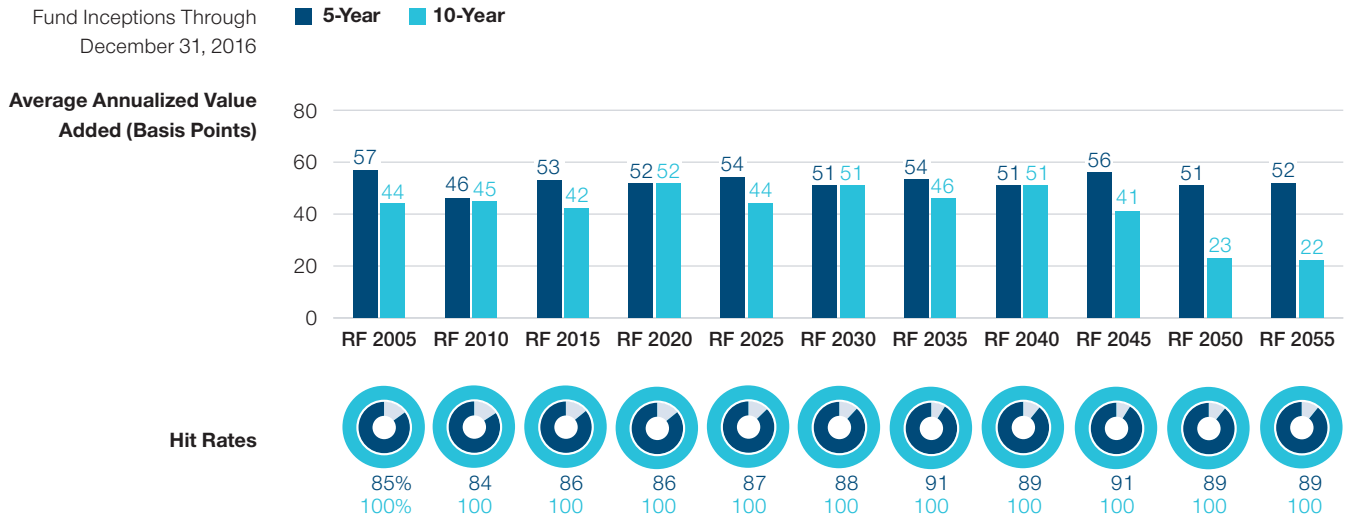
Sources: Bloomberg Barclays, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Figure 5 Hit Rates and Value Added by Active Security Selection



Sources: Bloomberg Barclays, Credit Suisse, J.P. Morgan, MSCI, Russell, Standard & Poor's, and T. Rowe Price; data analysis by T. Rowe Price.

Figure 6 Hit Rates and Value Added by Total Active Implementation



Sources: Bloomberg Barclays, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Custom Passive Benchmark

Active security selection

Tactical allocation

Benchmarking Target Date Strategies

Target date design is inherently an “active” process in that managers must make independent judgments about desired retirement objectives and expected market conditions.

Because glide-path effects—such as the level of equity exposure—can dominate fund performance relative to common target date indexes (such as those maintained by Standard & Poor’s), T. Rowe Price has created its own custom passive benchmarks for the Retirement Funds. These benchmarks are constructed from four indexes that reflect the broad asset classes in the underlying RF portfolios:

- U.S. Equity: The Russell 3000 Index.

- Non-U.S. Equity: The MSCI All Country World Index ex USA.
- Fixed Income: The Bloomberg Barclays U.S. Aggregate Bond Index.
- Inflation Focused Fixed Income: The Bloomberg Barclays U.S. 1–5 Year Treasury TIPS Index.

The custom benchmarks mirror the strategic allocations for each fund as they move along their glide paths but do not include tactical adjustments.

The custom passive benchmarks allow us to measure the value added or detracted by T. Rowe Price via tactical allocation and active security selection.

Background

The features that have made target date funds such popular retirement investment vehicles, especially in 401(k) and other defined contribution plans, also require investors to delegate a number of key decisions to their target date managers. These include:

- **Glide-path design:** How quickly allocations to growth-oriented asset classes, such as equities, are reduced as the strategy approaches and then passes through its target date.
- **Glide-path diversification:** How target date portfolios are allocated among the various asset classes, sectors, or investment styles. Asset allocation is a complex discipline that requires careful analysis of expected long-term performance characteristics.
- **Tactical asset allocation:** Whether the strategy’s managers adhere to their long-term strategic portfolio mix or try to enhance

returns and/or reduce risk by adjusting the asset allocation to take advantage of valuation anomalies or other shorter-term market opportunities.

- **Underlying portfolio management:** Whether the managers of the underlying portfolios simply seek to replicate the performance of asset class benchmarks or attempt to enhance returns through security selection or other active techniques.

Each of these decisions may affect long-term investment performance—and thus influence retirement outcomes. The glide path and the diversification mix can be thought of as setting the long-term strategic design for a target date strategy, while tactical asset allocation and management of the underlying portfolios reflect the ongoing implementation of the strategic design. Target date managers tend to take very different approaches to both strategic design and the implementation process, which will generate performance differences across managers.

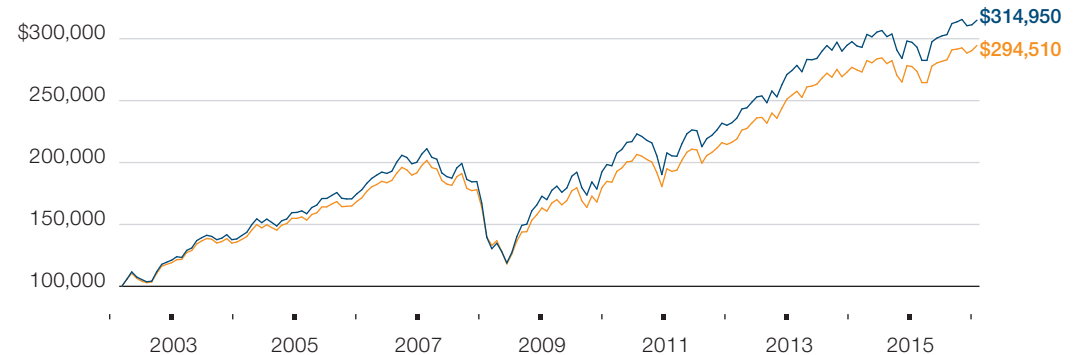
Figure 7

September 30, 2002,
Through December 31, 2016

TRP Retirement 2020 Fund ■
Custom Passive Benchmark ■

Example of the Benefits of T. Rowe Price’s Target Date Implementation

Portfolio Growth Potential Relative to T. Rowe Price Custom Passive Benchmark



7.41%, 8.96%, and 5.19% were the fund’s 1-, 5-, and 10-year average annual total returns as of 12/31/2016. Current performance may be higher or lower than the quoted past performance, which cannot guarantee future results. Share price, principal value, and return will vary, and you may have a gain or loss when you sell your shares. Average annual total return figures include changes in principal value, reinvested dividends, and capital gain distributions. To obtain the most recent month-end performance, please visit our website or contact a T. Rowe Price representative at 1-800-225-5132. The fund’s expense ratio is 0.66% as of its most recent fiscal year ended 5/31/2016.

TRP = T. Rowe Price.

Sources: T. Rowe Price,
Standard & Poor’s;
data analysis by T. Rowe Price.

The strategic designs of target date funds should be informed by their investment objectives. These objectives can vary across target date providers, leading to varying design choices—both in the glide path and in the underlying portfolios—that reflect the relative importance different providers attach to different goals.

Some examples:

- A glide-path design that emphasizes protection against retirees outliving their assets might include a higher allocation to equities. On the other hand, a glide path designed to reduce the risk of large capital losses near retirement might seek a lower level of return volatility.
- A manager who believes there is little room to improve on market returns might construct target date portfolios using only passive allocations, while one who sees opportunities to enhance returns with security selection might include actively managed allocations.

As a result of these differences, target date performance needs to be interpreted carefully. Strategic design decisions and prevailing market conditions both can have significant effects on relative performance. Therefore, the specific objectives incorporated in the strategic design should be a key consideration when evaluating performance.

For this reason, we believe each level of the target date process should be examined separately as well as collectively. Underperformance at the strategic level—in glide-path design, for example—may obscure outperformance in the implementation process, such as active management of the underlying assets. While the strategic design of the glide path and the underlying diversification require target date managers to make active decisions, most investors focus on implementation when evaluating whether their managers are adding active value.

Benefits for Investors

Since its inception on September 30, 2002, through December 31, 2016, the T. Rowe Price Retirement 2020 Fund outperformed its custom passive benchmark by 51 basis points, annualized. In other words, if an investor had invested \$100,000 in a hypothetical portfolio that earned the same return as the custom benchmark, his or her portfolio could have been worth just over \$294,500 by the end of 2016. The same amount invested in the T. Rowe Price

Retirement 2020 Fund, meanwhile, could have grown to \$314,950, net of fees and costs—an increase of more than \$20,000 in ending portfolio value (Figure 7, page 5).

Even a \$20,000 difference in ending portfolio values can be quite meaningful to retirement outcomes. For example, assuming no further portfolio growth, an individual retiring with a portfolio worth \$314,950 would be able to withdraw \$15,748 a year over a 20-year retirement, while an individual with just \$294,510 would only be able to withdraw \$14,726 a year. For some retirees, that \$1,022 difference could have a meaningful impact on living standards.

Additional key highlights of our study findings are summarized below.

Tactical Asset Allocation

- All 11 RFs saw a positive contribution from tactical allocation in 95% or more of all rolling five-year periods, and all 11 RFs saw positive tactical allocation results in every rolling 10-year period since inception (Figure 4, page 4).
- The value added through tactical allocation (Figure 4) was also positive and relatively consistent across all time frames.

Active Security Selection

- Active security selection added value in at least 84% of all rolling five-year periods for all but two of the 11 RFs, while once again, all 11 RFs showed positive excess returns over every rolling 10-year period since inception (Figure 5, page 4).
- Excess returns ranged from 15 to 57 basis points of outperformance and were typically larger for longer-dated funds, primarily reflecting their higher equity allocations and more intensive use of active security selection.⁵

Total Active Implementation

- Ten of the 11 RFs outperformed their T. Rowe Price custom passive benchmark in at least 85% of all rolling five-year periods (Figure 6, page 4).
- All 11 RFs outperformed their custom benchmark in every 10-year rolling period since inception.
- Annualized excess returns (Figure 6) were consistently positive.

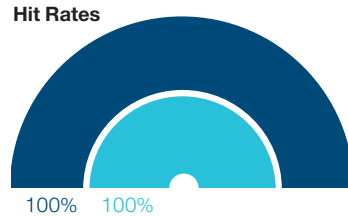
⁵ The Retirement Funds include allocations to a passive core large-cap equity strategy that seeks to track the returns on the S&P 500 Index. These passive allocations increase as the RFs approach their target dates. As a result, longer-dated RFs have greater exposure to active large-cap growth and value funds, while those at or past their target dates are more heavily invested in the passive core large-cap allocation.

Figure 8

Fund Inceptions Through
December 31, 2016

5-Year ■
10-Year ■

Time-Weighted Average Hit Rates and Value Added by Tactical Asset Allocation



Value Added in Basis Points



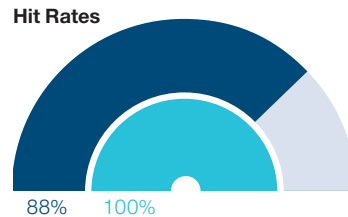
Sources: Russell, MSCI, Bloomberg Barclays, and T. Rowe Price; data analysis by T. Rowe Price.

Figure 9

Fund Inceptions Through
December 31, 2016

5-Year ■
10-Year ■

Time-Weighted Average Hit Rates and Value Added by Active Security Selection



Value Added in Basis Points



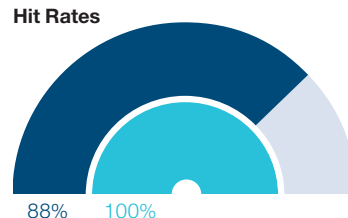
Sources: Russell, MSCI, Bloomberg Barclays, J.P. Morgan, Credit Suisse, and T. Rowe Price; data analysis by T. Rowe Price.

Figure 10

Fund Inceptions Through
December 31, 2016

5-Year ■
10-Year ■

Time-Weighted Average Hit Rates and Value Added by Total Active Implementation



Value Added in Basis Points



Sources: Russell, MSCI, Bloomberg Barclays, J.P. Morgan, Credit Suisse, and T. Rowe Price; data analysis by T. Rowe Price.

Performance Averages

To provide a high-level summary of the relative effectiveness of T. Rowe Price's target date process, we also calculated performance averages for all 11 Retirement Funds across all three metrics in our analysis. To account for the differing inception dates (and thus, longevity) of each RF, these averages were time weighted—that is, the results are based on the percentage of the total performance periods in each time frame provided by each RF.

These time-weighted averages reflect the same patterns shown for the individual Retirement Funds: Positive contributions to returns from tactical asset allocation and active security selection both were relatively stable across time frames (Figures 8 and 9, at left). Hit rates improved steadily over longer time periods for all three metrics, and value added versus T. Rowe Price custom passive benchmarks was positive over all time frames (Figure 10, at left).

The time-weighted averages also highlight another beneficial aspect of the T. Rowe Price process: the relative consistency of RF performance over time. Not only were hit rates and excess returns positive, on average, across the various time frames studied, but the data also show that positive excess returns were typically larger than negative excess returns.

This pattern is displayed in Figure 11 (page 8), which compares time-weighted average returns across the three metrics used in the study (total active implementation, tactical allocation, and active security selection). The top row of each table shows average excess returns in the larger number of rolling periods in which funds showed positive relative performance, while the bottom row of each table shows average excess returns in the smaller number of periods with negative relative performance. As can be seen, positive returns were larger than negative returns across all time frames of all three metrics.

A Disciplined Long-Term Approach

Target date strategies have become indispensable retirement investment vehicles for many individual investors and for a growing majority of those participating in defined contribution plans or other tax-deferred retirement savings programs. The target date concept relieves investors of the complex, specialized tasks of constructing a diversified retirement portfolio and selecting managers for the underlying components.

T. Rowe Price's target date process seeks to improve outcomes for our clients at multiple levels—via glide-path design, strategic diversification, tactical asset allocation, and active management of many of the underlying portfolio strategies.

We believe in the value of long-term active management, and our target date process seeks to meaningfully enhance retirement outcomes for investors both through tactical asset allocation and active security selection in the underlying strategies.

Our study of 11 of T. Rowe Price's Retirement Funds (those with sufficiently long track records for a meaningful analysis) confirms that our process has added value for investors by outperforming a purely passive implementation process since the program was launched in

2002. We attribute our success to T. Rowe Price's core strengths as a firm, including the quality of our asset allocation team, the depth of our global research platform, and the experience and disciplined approach of our portfolio managers.

Figure 11 Time-Weighted Average Excess Returns in Positive and Negative Rolling Periods

Fund Inceptions Through
December 31, 2016

Value Added by Total Active Implementation

Rolling periods

Basis Points	1-Year	3-Year	5-Year	10-Year
Average Positive Excess Return	157	69	62	47
Average Negative Excess Return	-88	-49	-18	N/A

Value Added by Tactical Allocation

Rolling periods

Basis Points	1-Year	3-Year	5-Year	10-Year
Average Positive Excess Return	31	22	19	21
Average Negative Excess Return	-13	-5	-2	N/A

Value Added by Active Security Selection

Rolling periods

Basis Points	1-Year	3-Year	5-Year	10-Year
Average Positive Excess Return	105	56	48	35
Average Negative Excess Return	-61	-21	-13	N/A

N/A = No negative rolling periods

Sources: Russell, MSCI, Bloomberg Barclays, J.P. Morgan, Credit Suisse, and T. Rowe Price; data analysis by T. Rowe Price.

Figure 12 Retirement Funds Included in Our Performance Study

Source: T. Rowe Price.

Fund	Inception Date
Retirement 2005 Fund	2/27/2004
Retirement 2010 Fund	9/30/2002
Retirement 2015 Fund	2/27/2004
Retirement 2020 Fund	9/30/2002
Retirement 2025 Fund	2/27/2004
Retirement 2030 Fund	9/30/2002
Retirement 2035 Fund	2/27/2004
Retirement 2040 Fund	9/30/2002
Retirement 2045 Fund	5/31/2005
Retirement 2050 Fund	12/29/2006
Retirement 2055 Fund	12/29/2006

Important Information

STANDARDIZED PERFORMANCE

Annualized total returns for periods ended December 31, 2016.

Fund (Inception Date)	Gross Expense Ratio [†]	1-Year	3-Year	5-Year	10-Year
Retirement 2005 Fund (NAV) (2/27/2004)	0.58%	6.72%	3.52%	6.27%	4.71%
Retirement 2005 Combined Index Portfolio*		5.86	3.71	6.07	4.34
Retirement 2010 Fund (NAV) (9/30/2002)	0.58	7.11	3.72	7.03	4.76
Retirement 2010 Combined Index Portfolio*		6.26	3.92	6.81	4.46
Retirement 2015 Fund (NAV) (2/27/2004)	0.62	7.31	3.98	8.06	5.04
Retirement 2015 Combined Index Portfolio*		6.91	4.26	7.84	4.74
Retirement 2020 Fund (NAV) (9/30/2002)	0.66	7.41	4.19	8.96	5.19
Retirement 2020 Combined Index Portfolio*		7.61	4.57	8.73	4.91
Retirement 2025 Fund (NAV) (2/27/2004)	0.69	7.55	4.35	9.75	5.32
Retirement 2025 Combined Index Portfolio*		8.21	4.83	9.53	5.06
Retirement 2030 Fund (NAV) (9/30/2002)	0.72	7.69	4.52	10.43	5.45
Retirement 2030 Combined Index Portfolio*		8.79	5.03	10.20	5.18
Retirement 2035 Fund (NAV) (2/27/2004)	0.74	7.64	4.56	10.87	5.52
Retirement 2035 Combined Index Portfolio*		9.22	5.15	10.68	5.28
Retirement 2040 Fund (NAV) (9/30/2002)	0.75	7.63	4.61	11.12	5.64
Retirement 2040 Combined Index Portfolio*		9.59	5.24	10.96	5.41
Retirement 2045 Fund (NAV) (5/31/2005)	0.75	7.69	4.62	11.14	5.65
Retirement 2045 Combined Index Portfolio*		9.71	5.29	10.99	5.42
Retirement 2050 Fund (NAV) (12/29/2006)	0.76	7.71	4.65	11.14	5.65
Retirement 2050 Combined Index Portfolio*		9.71	5.29	10.99	5.42
Retirement 2055 Fund (NAV) (12/29/2006)	0.76	7.73	4.64	11.14	5.64
Retirement 2055 Combined Index Portfolio*		9.71	5.29	10.99	5.42

[†]End of most recent fiscal year as of 12/31/2016.

*The Combined Index Portfolio, which is the broad-weighted benchmark for each fund, is an unmanaged portfolio composed of the Russell 3000 Index, MSCI All Country World Index ex USA, Bloomberg Barclays U.S. Aggregate Bond Index, and Bloomberg Barclays U.S. 1–5 Year Treasury TIPS Index.

Source: T. Rowe Price.

Current performance may be higher or lower than the quoted past performance, which cannot guarantee future results. Share price, principal value, and return will vary, and you may have a gain or loss when you sell your shares. The performance information shown does not reflect the deduction of any redemption fee; if it did, the performance would be lower. To obtain the most recent month-end performance, please visit our website or contact a T. Rowe Price representative at 1-800-225-5132. The average annual total return figures include changes in principal value, reinvested dividends, and capital gain distributions.

Appendix

STUDY METHODOLOGY

We examined the performance of 11 T. Rowe Price Retirement Funds (RFs) to determine the value added for clients by the firm's target date design process and investment implementation, both at the RF level and in the management of the underlying strategies.

The Study Universe

The 11 RFs included in the study (Figure 12, page 8) were those that had at least 10-year performance histories as of December 31, 2016. One RF with a relatively distant target date (2060) was excluded from the study because of its short performance track record. The Retirement 2060 Fund inceptioned June 23, 2014. A separate set of target date funds using an alternative T. Rowe Price-designed glide path (the target glide path) also was excluded from the study because of the funds' extremely limited historical track records. See Figure A1 (page 11) for a list of these funds and their inception dates.

As of December 31, 2016, each RF invested its assets in a portfolio of up to 18 underlying T. Rowe Price funds covering the major global equity and fixed income sectors (Figure A2, page 11). Seventeen of the 18 underlying T. Rowe Price funds were actively managed, while one—a core large-cap U.S. stock allocation—used passive management to replicate the returns on the S&P 500 Index.

Performance Periods

The performance of each Retirement Fund in the study was examined across 1-, 3-, 5-, and 10-year rolling periods (rolled monthly) since each RF's inception through December 31, 2016. Because these inception dates—and thus, fund longevities—differed, the number of rolling performance periods also varied for each RF. The total rolling periods in each time frame for each RF are shown in Figure A3 (page 12).

It should be noted that the number of rolling performance periods declined as the time frames were lengthened. The number of rolling 10-year periods was particularly small, especially for Retirement Funds with 2045, 2050, and 2055 target dates. Accordingly, the performance results shown for 10-year rolling periods may have relatively limited statistical significance, particularly for the Retirement 2050 and Retirement 2055 Funds, both of which had only one 10-year rolling performance period as of December 31, 2016.

Full performance results for each RF over 1-, 3-, 5-, and 10-year rolling periods can be found in Figures A4, A5, and A6 on pages 12 and 13.

Performance Metrics

Our analysis used two specific measures to quantify RF performance:

- Hit rates: the percentage of all rolling periods in each time frame (one, three, five, and 10 years) in which an RF either outperformed a specific benchmark or a component of T. Rowe Price's target date process made a positive contribution to RF returns (see "Performance Benchmarks," below).
- Excess returns: the actual margin of relative RF performance (either positive or negative) against a specific benchmark, or the contribution (positive or negative) that a component of the T. Rowe Price target date process made to RF returns, each in basis points. Excess returns for rolling periods of more than one year were annualized. The excess returns shown in the various tables in the study are the average results across all of the rolling time periods in each 1-, 3-, 5-, and 10-year time frame.

Performance Benchmarks

The objective of the study was to quantify the value added by tactical asset allocation and active management of the underlying strategies. Accordingly, hit rates and excess returns were calculated relative to:

- Custom passive benchmarks created by T. Rowe Price for each RF.
- Hypothetical returns for the RFs based solely on their long-term strategic asset allocations and glide paths (in other words, excluding the effects of tactical allocation).
- The appropriate asset class, sector, and/or style benchmarks for the 18 underlying T. Rowe Price funds in the RF portfolios. For each rolling period, the active performances of the underlying funds were aggregated to determine if they collectively added to or detracted from RF performance.

Figure A1

Not included in the performance study.

Source: T. Rowe Price.

T. Rowe Price Target Funds

Fund	Inception Date
Target 2005 Fund	8/20/2013
Target 2010 Fund	8/20/2013
Target 2015 Fund	8/20/2013
Target 2020 Fund	8/20/2013
Target 2025 Fund	8/20/2013
Target 2030 Fund	8/20/2013
Target 2035 Fund	8/20/2013
Target 2040 Fund	8/20/2013
Target 2045 Fund	8/20/2013
Target 2050 Fund	8/20/2013
Target 2055 Fund	8/20/2013
Target 2060 Fund	6/23/2014

Figure A2

As of December 31, 2016

Source: T. Rowe Price.

*Not included: Cash Reserves Fund.

**From inception to 2006, our conservative fixed income allocation was a mix of the T. Rowe Price Short-Term Bond Fund and the T. Rowe Price Summit Cash Reserves Fund (renamed the Cash Reserves Fund on August 1, 2016). In 2006, the T. Rowe Price Short-Term Income Fund replaced these two funds. In May 2011, the name and investment objective of the T. Rowe Price Short-Term Income Fund changed to the T. Rowe Price Inflation Focused Bond Fund, which is now known as the T. Rowe Price Limited Duration Inflation Focused Bond Fund.

Underlying T. Rowe Price Funds in Retirement Fund Portfolios*

Fund	Date Included
U.S. Equity	
Equity Index 500	9/30/2002
Growth Stock	9/30/2002
Value	9/30/2002
Mid-Cap Growth	9/30/2002
Mid-Cap Value	2/1/2004
Small-Cap Stock	9/30/2002
New Horizons	11/1/2005
Small-Cap Value	11/1/2005
Non-U.S. Equity	
Overseas Stock	12/1/2006
International Stock	9/30/2002
International Value Equity (formerly International Growth & Income)	2/1/2004
Emerging Markets Stock	5/1/2007
Fixed Income	
New Income	9/30/2002
High Yield	9/30/2002
Emerging Markets Bond	5/1/2008
International Bond	5/1/2008
Limited Duration Inflation Focused Bond**	9/30/2002
Other	
Real Assets	7/1/2010

Figure A3 Rolling Periods in Each Time Frame

Fund Inceptions Through
December 31, 2016

Source: T. Rowe Price.

Fund	Time frames			
	1-Year	3-Year	5-Year	10-Year
Retirement 2005 Fund	143	119	95	35
Retirement 2010 Fund	160	136	112	52
Retirement 2015 Fund	143	119	95	35
Retirement 2020 Fund	160	136	112	52
Retirement 2025 Fund	143	119	95	35
Retirement 2030 Fund	160	136	112	52
Retirement 2035 Fund	143	119	95	35
Retirement 2040 Fund	160	136	112	52
Retirement 2045 Fund	128	104	80	20
Retirement 2050 Fund	109	85	61	1
Retirement 2055 Fund	109	85	61	1

Figure A4 Hit Rates and Value Added by Tactical Allocation

Fund Inceptions Through
December 31, 2016

Hit Rates

Rolling periods

Average Annualized Value Added (Basis Points)

Rolling periods

Fund
Retirement 2005 Fund
Retirement 2010 Fund
Retirement 2015 Fund
Retirement 2020 Fund
Retirement 2025 Fund
Retirement 2030 Fund
Retirement 2035 Fund
Retirement 2040 Fund
Retirement 2045 Fund
Retirement 2050 Fund
Retirement 2055 Fund

1-Year	3-Year	5-Year	10-Year
76%	97%	100%	100%
80	99	100	100
73	97	100	100
79	96	100	100
73	95	100	100
76	96	100	100
73	87	100	100
74	90	100	100
69	86	100	100
61	79	95	100
64	86	100	100

1-Year	3-Year	5-Year	10-Year
22	23	22	23
25	25	24	24
22	24	23	24
23	25	24	25
20	22	21	22
20	20	19	20
17	17	15	16
18	17	16	17
15	14	14	14
11	12	14	10
12	14	15	11

Sources: Bloomberg Barclays, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Figure A5 Hit Rates and Value Added by Active Security Selection

Fund Inceptions Through
December 31, 2016

Hit Rates

Rolling periods

Average Annualized Value Added (Basis Points)

Rolling periods

Fund
Retirement 2005 Fund
Retirement 2010 Fund
Retirement 2015 Fund
Retirement 2020 Fund
Retirement 2025 Fund
Retirement 2030 Fund
Retirement 2035 Fund
Retirement 2040 Fund
Retirement 2045 Fund
Retirement 2050 Fund
Retirement 2055 Fund

1-Year	3-Year	5-Year	10-Year
48%	51%	73%	100%
48	54	63	100
61	69	84	100
59	77	86	100
64	83	96	100
61	82	92	100
66	86	100	100
62	82	93	100
63	86	100	100
62	89	100	100
63	89	100	100

1-Year	3-Year	5-Year	10-Year
22	22	31	22
15	19	24	22
31	28	36	28
27	30	34	32
41	38	44	38
35	38	41	40
49	47	53	46
39	43	45	44
53	51	53	47
55	57	48	27
55	57	48	28

Sources: Bloomberg Barclays, Credit Suisse, J.P. Morgan, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Figure A6 Hit Rates and Value Added by Total Active Implementation

Fund Inceptions Through
December 31, 2016

Fund	Hit Rates				Average Annualized Value Added (Basis Points)			
	Rolling periods				Rolling periods			
	1-Year	3-Year	5-Year	10-Year	1-Year	3-Year	5-Year	10-Year
Retirement 2005 Fund	60%	75%	85%	100%	51	45	57	44
Retirement 2010 Fund	65	76	84	100	56	45	46	45
Retirement 2015 Fund	62	77	86	100	56	44	53	42
Retirement 2020 Fund	63	83	86	100	67	54	52	52
Retirement 2025 Fund	58	85	87	100	62	47	54	44
Retirement 2030 Fund	65	90	88	100	65	54	51	51
Retirement 2035 Fund	62	87	91	100	63	48	54	46
Retirement 2040 Fund	63	88	89	100	64	54	51	51
Retirement 2045 Fund	52	86	91	100	59	48	56	41
Retirement 2050 Fund	53	91	89	100	57	60	51	23
Retirement 2055 Fund	51	92	89	100	57	60	52	22

Sources: Bloomberg Barclays, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Figure A7

Fund Inceptions Through
December 31, 2016

Excess Returns Contributed by Out-of-Benchmark Allocations (Basis Points)

Rolling periods

Fund	1-Year	3-Year	5-Year	10-Year
Retirement 2005 Fund	2	-7	-4	-8
Retirement 2010 Fund	15	0	-4	-3
Retirement 2015 Fund	3	-10	-7	-12
Retirement 2020 Fund	16	-1	-6	-6
Retirement 2025 Fund	2	-12	-10	-14
Retirement 2030 Fund	10	-3	-7	-6
Retirement 2035 Fund	0	-11	-9	-12
Retirement 2040 Fund	8	-4	-8	-7
Retirement 2045 Fund	-7	-15	-9	-18
Retirement 2050 Fund	-7	-7	-9	-15
Retirement 2055 Fund	-8	-8	-9	-15

Sources: Bloomberg Barclays, Credit Suisse, J.P. Morgan, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

T. Rowe Price Custom Passive Benchmarks

Because glide-path effects—such as the level of equity exposure—can heavily influence relative performance versus third-party indexes, T. Rowe Price has created custom passive performance benchmarks for its Retirement Funds. These benchmarks are constructed from four indexes that reflect the broad asset classes in the underlying RF portfolios:

- U.S. Equity: Russell 3000 Index.
- Non-U.S. Equity: MSCI All Country World Index ex USA.
- Fixed Income: Bloomberg Barclays U.S. Aggregate Bond Index.
- Inflation Focused Fixed Income: Bloomberg Barclays 1–5 Year TIPS Index.

The relative weights of these asset class indexes in the T. Rowe Price custom passive benchmarks reflect where each RF stands on its glide path. Comparing RF performance with the performance of the custom passive benchmarks enables us to quantify the total contribution to RF performance from active implementation, including both tactical asset allocation at the RF level and excess returns achieved by the underlying funds.

The real assets component within equities and the high yield, international bond, and emerging markets bond components within fixed income are not represented in the indexes used to create the T. Rowe Price custom passive benchmarks. These out-of-benchmark allocations may materially affect RF excess returns relative to the custom passive benchmarks. Excess returns attributable to out-of-benchmark assets were included in [Figure 6](#) on page 4 but were not broken out separately. A table showing the

aggregate contribution of out-of-benchmark assets (positive or negative) to RF performance can be found in [Figure A7](#), page 13.

Tactical Asset Allocation

Actual returns for the 18 underlying T. Rowe Price funds in the RF portfolios, net of fees and costs, were used to calculate returns for each RF based on the strategic allocation weights in the RF glide path. These returns were then compared with actual RF returns, which reflected tactical allocation changes designed to take advantage of shorter-term valuation anomalies and other market opportunities. This comparison enabled us to isolate the contribution to performance made by the tactical allocation decisions.

Active Security Selection

Historical returns, net of fees and other costs, for the 18 underlying T. Rowe Price funds in the Retirement Fund portfolios were measured relative to their specific asset class, sector, or style benchmarks. One of these underlying funds, the Equity Index 500 Fund, is a passively managed U.S. large-cap fund with an investment objective of tracking the performance of the S&P 500 Index. The other 17 funds are all actively managed investment vehicles.

The indexes used to calculate excess returns in this analysis were the style-appropriate benchmarks used by the T. Rowe Price Asset Allocation Committee to evaluate the performance of the underlying funds in the RF portfolios (see [Figure A8](#), page 15). Because T. Rowe Price does not charge an overlay fee on its target date funds, and excess returns for the underlying portfolio funds are based on daily net asset values (i.e., net of costs), all of the RF performance numbers shown in our study represent the true after-cost results for investors. Returns were based on reported net asset values and SEC standardized returns for the underlying funds from which management fees and operating expenses were subtracted. In other words, returns for the underlying funds were based on the after-cost performance of the Investor Class for each underlying fund (which has the lowest expenses among the share classes for that fund and is the class invested in by the Retirement Funds).

Excess returns for the 18 underlying funds were aggregated for each rolling period to show the total contribution (positive or negative) made to

the performance of each RF by active security selection. Hit rates for positive aggregate return contributions (i.e., value added) and average aggregate excess returns (annualized) were calculated for each 1-, 3-, 5-, and 10-year time frame for each RF. Returns on the underlying funds were included in these aggregate performance calculations as of the date of their addition to the RF portfolio (see [Figure A2](#), page 11). Those calculations reflected the changing weights for the underlying funds as the RFs moved along their glide paths.

Performance Averages

To provide a high-level summary of the effectiveness of T. Rowe Price's target date process, we calculated performance averages for all 11 RFs in the study across all three of the metrics used in our analysis. Average performance over rolling 1-, 3-, 5-, and 10-year periods since RF inception can be found in [Figures A9, A10, and A11](#) on pages 15 and 16. To account for the differing inception dates (and thus, longevities) of each fund, these averages were time weighted—that is, the results were based on the percentage of the total performance periods in each time frame provided by each fund. Weights for each fund in each time frame are shown in [Figure A12](#), page 16. Overall, time weighting had relatively little impact on average performance results.

Data Sources

Fund and benchmark return data were taken from T. Rowe Price's internal performance database, which is used by the firm to calculate returns for quarterly, semiannual, and annual client reports; marketing materials; and regulatory disclosures. Benchmark returns in the T. Rowe Price database are collected from index managers. All results were based on total returns, including dividends reinvested.

Figure A8

As of December 31, 2016

Source: T. Rowe Price.

Benchmarks for Underlying T. Rowe Price Funds*

Fund	Benchmark
U.S. Equity	
Equity Index 500	S&P 500 Index
Growth Stock	Russell 1000 Growth Index
Value	Russell 1000 Value Index
Mid-Cap Growth	Russell Midcap Growth Index
Mid-Cap Value	Russell Midcap Value Index
Small-Cap Stock	Russell 2000 Index
New Horizons	Russell 2000 Growth Index
Small-Cap Value	Russell 2000 Value Index
Non-U.S. Equity	
Overseas Stock	MSCI EAFE Index
International Stock	MSCI EAFE Growth Index**
International Value Equity	MSCI EAFE Value Index**
Emerging Markets Stock	MSCI Emerging Markets Index
Fixed Income	
New Income	Bloomberg Barclays U.S. Aggregate Bond Index
High Yield	Credit Suisse High Yield Index
Emerging Markets Bond	J.P. Morgan Emerging Markets Bond Index Global
International Bond Fund	Bloomberg Barclays Global Aggregate ex USD Bond Index
Limited Duration Inflation Focused Bond	Bloomberg Barclays U.S. 1-5 Year Treasury TIPS Index***
Other	
Real Assets	Combined Index Portfolio****

*Not included:
Cash Reserves Fund

**The indexes shown here are the style-appropriate benchmarks used to calculate the active performance of the firm's target date portfolios. For the International Stock Fund (ISF) and the International Value Equity Fund (IVE), these benchmarks differ from the indexes used by the funds for their own performance reporting. The standard benchmark for the ISF is the MSCI All Country World Index ex USA. The standard benchmark for the IVE is the MSCI EAFE Index.

***Effective May 1, 2011, the benchmark was changed to the Bloomberg Barclays U.S. 1-5 Year Treasury TIPS Index. For time periods prior to this date, returns are measured against a linked performance benchmark composed of 100% Citigroup 3-Month Treasury Bill Index.

****As of December 31, 2016, the Real Assets Fund's combined index portfolio was composed of 25% MSCI All Country World Index Metals & Mining, 20% Wilshire RESI, 20% FTSE EPRA/NAREIT Developed Real Estate Index, 19.5% MSCI All Country World Index Energy, 10.5% MSCI All Country World Index Materials, 4% MSCI All Country World Index IMI Gold, and 1% MSCI All Country World Index IMI Precious Metals and Minerals. Prior to December 1, 2013, the Real Assets Fund's combined index portfolio was composed of 25% MSCI All Country World Index Metals & Mining, 20% Wilshire RESI, 20% FTSE EPRA/NAREIT Developed Real Estate Index, 16.25% MSCI All Country World Index Energy, 8.75% MSCI All Country World Index Materials, 5% UBS World Infrastructure and Utilities Index, 4% MSCI All Country World Index IMI Gold, and 1% MSCI All Country World Index IMI Precious Metals and Minerals.

Figure A9

Fund Inceptions Through December 31, 2016

Sources: Bloomberg Barclays, MSCI, Russell, and T. Rowe Price; data analysis by T. Rowe Price.

Hit Rates ■ (Left Axis)
Value Added ■ (Right Axis)

Time-Weighted Average Hit Rates and Value Added by Total Active Implementation

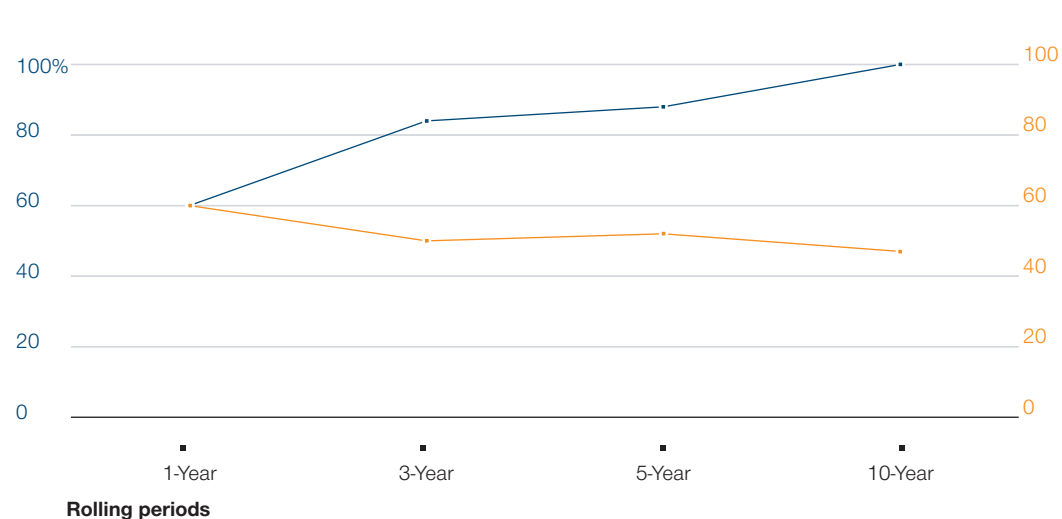


Figure A10

Fund Inceptions Through
December 31, 2016

Sources: Bloomberg Barclays,
MSCI, Russell, and T. Rowe Price;
data analysis by T. Rowe Price.

Hit Rates ■
(Left Axis)

Value Added ■
(Right Axis)

Time-Weighted Average Hit Rates and Value Added by Tactical Asset Allocation

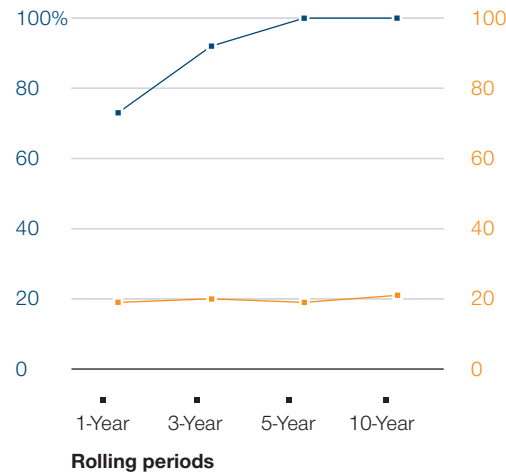


Figure A11

Fund Inceptions Through
December 31, 2016

Sources: Bloomberg Barclays,
Credit Suisse, J.P. Morgan, MSCI,
Russell, Standard & Poor's, and
T. Rowe Price; data analysis by
T. Rowe Price.

Hit Rates ■
(Left Axis)

Valued Added ■
(Right Axis)

Time-Weighted Average Hit Rates and Value Added by Active Security Selection

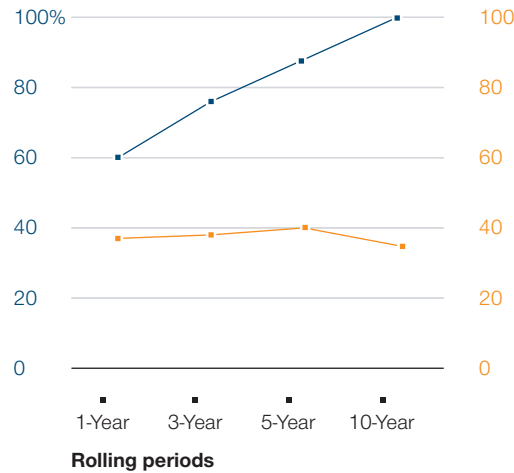


Figure A12

Source: T. Rowe Price.

Time Weights Used in Performance Averages

Percentage of total rolling performance periods

Fund	1-Year	3-Year	5-Year	10-Year
Retirement 2005 Fund	9.18%	9.20%	9.22%	9.46%
Retirement 2010 Fund	10.27	10.51	10.87	14.05
Retirement 2015 Fund	9.18	9.20	9.22	9.46
Retirement 2020 Fund	10.27	10.51	10.87	14.05
Retirement 2025 Fund	9.18	9.20	9.22	9.46
Retirement 2030 Fund	10.27	10.51	10.87	14.05
Retirement 2035 Fund	9.18	9.20	9.22	9.46
Retirement 2040 Fund	10.27	10.51	10.87	14.05
Retirement 2045 Fund	8.22	8.04	7.77	5.41
Retirement 2050 Fund	7.00	6.57	5.92	0.27
Retirement 2055 Fund	7.00	6.57	5.92	0.27

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