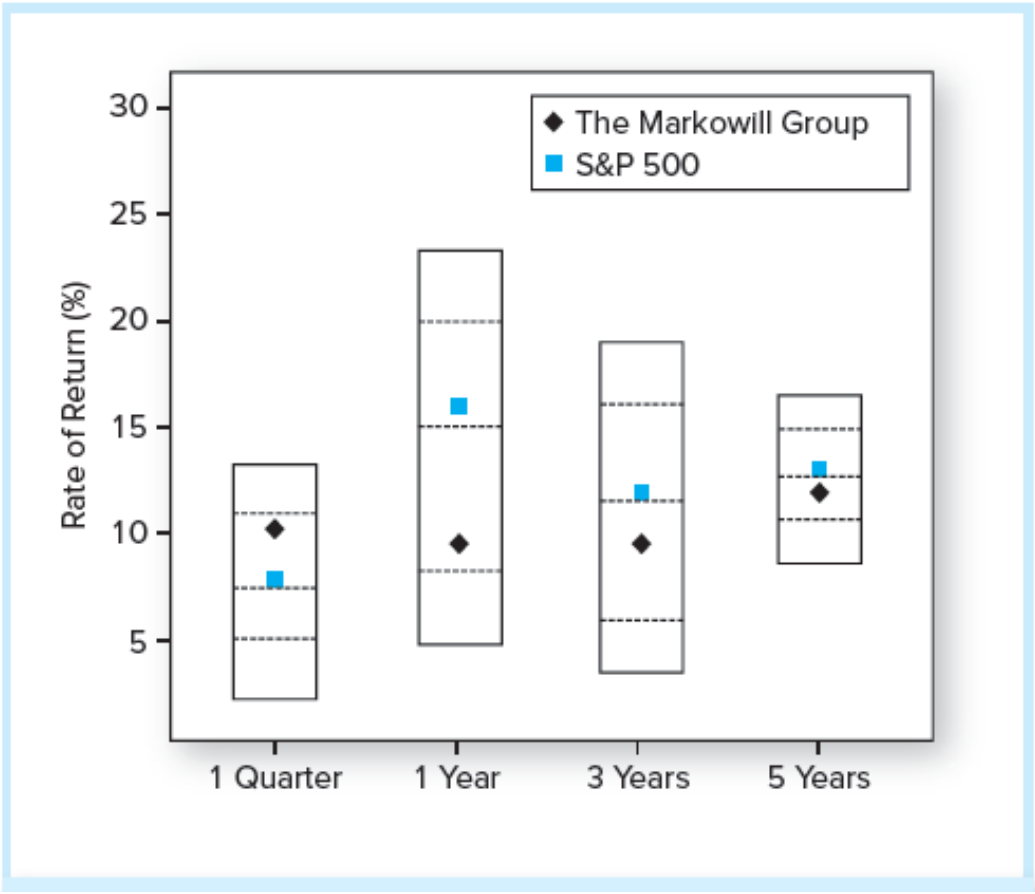
Portfolio Performance

Universe Comparison



- **Figure 24.1** Universe comparison, periods ending December 31, 2025

Risk-Adjusted Performance: Sharpe

- **Sharpe's ratio** divides average portfolio excess return over the sample period by the standard deviation of returns over that period
- Measures reward to (total) volatility trade-off

$$\left(\overline{r}_P - \overline{r}_f\right) \Big/ \sigma_P$$

Risk-Adjusted Performance: Treynor

- **Treynor's measure** is a ratio of excess return to beta, like the Sharpe ratio, but it uses systematic risk instead of total risk

$$\left(\overline{r}_P - \overline{r}_f\right) \Big/ \beta_P$$

Risk-Adjusted Performance: Jensen

- **Jensen's alpha** is the average return on the portfolio over and above that predicted by the CAPM, given the portfolio's beta and the average market return

$$\alpha_P = \overline{r}_P - \left[\overline{r}_f + \beta_P \left(\overline{r}_M - \overline{r}_f \right) \right]$$

Risk-Adjusted Performance: Information Ratio

- **Information ratio** divides the alpha of the portfolio by the nonsystematic risk of the portfolio, called “tracking error” in the industry
- Measures abnormal return per unit of risk that in principle could be diversified away by holding a market index portfolio

$$\alpha_P / \sigma(e_P)$$

M^2 Measure and the Shape Ratio

- Focuses on total volatility as a measure of risk, but its risk adjustment leads to an easy-to-interpret differential return relative to the benchmark index

$$M_P^2 = r_{P^*} - r_M$$

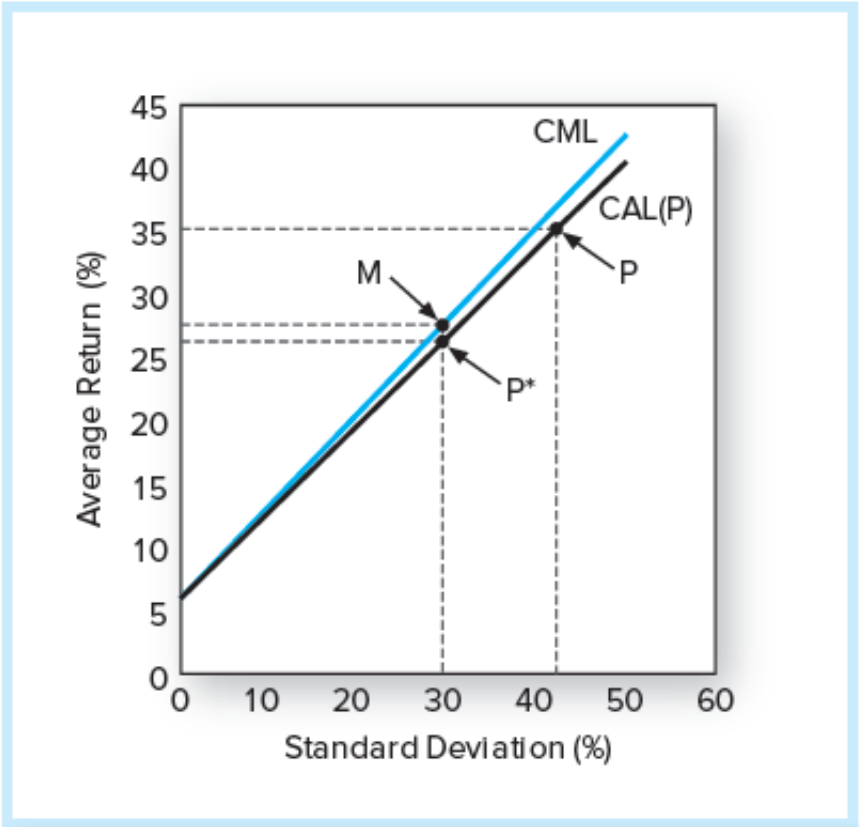
- P is the active portfolio while P* is P "adjusted" to match the volatility of a passive index such as the S&P500. P* may combine X% of the active portfolio and (1-X)% of T-bills, then P* may have the same variance than S&P500.

M^2 is positive when the portfolio's Sharpe ratio exceeds the market's. Letting R denote excess returns and S denote Sharpe measures, $R_{P^*} = S_P\sigma_M$, and therefore that

$$M^2 = r_{P^*} - r_M = R_{P^*} - R_M = S_P\sigma_M - S_M\sigma_M = (S_P - S_M)\sigma_M$$

M^2 and the Sharpe ratio therefore always rank order portfolios identically.

M^2 of Portfolio P



- **Figure 24.2** The M^2 of portfolio *P* is negative even though its average return was greater than that of the market index, *M*

Appropriate Performance Measure

Performance Measure	Definition	Application
Sharpe	$\frac{\text{Excess return}}{\text{Standard deviation}}$	When choosing among portfolios competing for the overall risky portfolio
Treynor	$\frac{\text{Excess return}}{\text{Beta}}$	When ranking many portfolios that will be mixed to form the overall risky portfolio
Information ratio	$\frac{\text{Alpha}}{\text{Residual standard deviation}}$	When evaluating a portfolio to be mixed with the benchmark portfolio

The Role of Alpha in Performance Measures

- A positive alpha is necessary to outperform the passive market index
  - Though necessary, it's not enough to guarantee a portfolio will outperform the index
- Most widely used performance measure

	Treynor (T_p)	Sharpe* (S_p)	Information Ratio
Relation to alpha	$\frac{E(r_P)-r_f}{\beta_P}=\frac{\alpha_P}{\beta_P}+T_M$	$\frac{E(r_P)-r_f}{\sigma_P}=\frac{\alpha_P}{\sigma_P}+\rho S_M$	$\frac{\alpha_P}{\sigma(e_P)}$
Improvement compared to market index	$T_P-T_M=\frac{\alpha_P}{\beta_P}$	$S_P-S_M=\frac{\alpha_P}{\sigma_P}-(1-\rho)S_M$	$\frac{\alpha_P}{\sigma(e_P)}$

Performance Statistics

- **Table 24.3** Performance statistics

	Portfolio *P*	**Portfolio *Q***	**Portfolio *M***
Sharpe ratio	0.43	0.49	0.19
M^2	2.16	2.66	0.00
SCL regression statistics			
Alpha	1.63	5.26	0.00
Beta	0.70	1.40	1.00
Treynor	3.97	5.38	1.64
T^2	2.34	3.74	0.00
σ(*e*)	2.02	9.81	0.00
Information ratio	0.81	0.54	0.00
R-square	0.91	0.64	1.00

Interpretation of Performance Statistics

- If P or Q represents the entire investment, Q is better because of its higher Sharpe measure and better M^2
- If P and Q are competing for a role as one of a number of subportfolios, Q also dominates because its Treynor measure is higher
- If we seek an active portfolio to mix with an index portfolio, P is better due to its higher information ratio

Realized Returns versus Expected Returns

- Must determine “significance level” of a performance measure to know whether it reliably indicates ability
  - To estimate the portfolio alpha from the SCL, regress portfolio excess returns on the market excess return or risk premium
  - Then, to assess whether the alpha estimate reflects true skill and not just luck, compute the *t*-statistic of the alpha estimate
- Even moderate levels of statistical noise make performance evaluation extremely difficult

Survivorship Bias and Portfolio Evaluation

- Regardless of the performance criterion, some funds will outperform their benchmarks in any year, and some will underperform
- Recall, performance in one period is not predictive of future performance
- Limiting a sample of funds to those for which returns are available over an entire sample period introduces **survivorship bias**

Style Analysis

- *Style analysis*, a tool to systematically measure the exposures of managed portfolios, was introduced by William Sharpe
  - Idea is to regress fund returns on indexes representing a range of asset classes
  - Regression coefficient on each index would then measure the fund's implicit allocation to that "style"
  - R^2 of regression would measure percentage of return variability attributable to style choice rather than security selection
  - Intercept measures average return from security selection of the fund portfolio

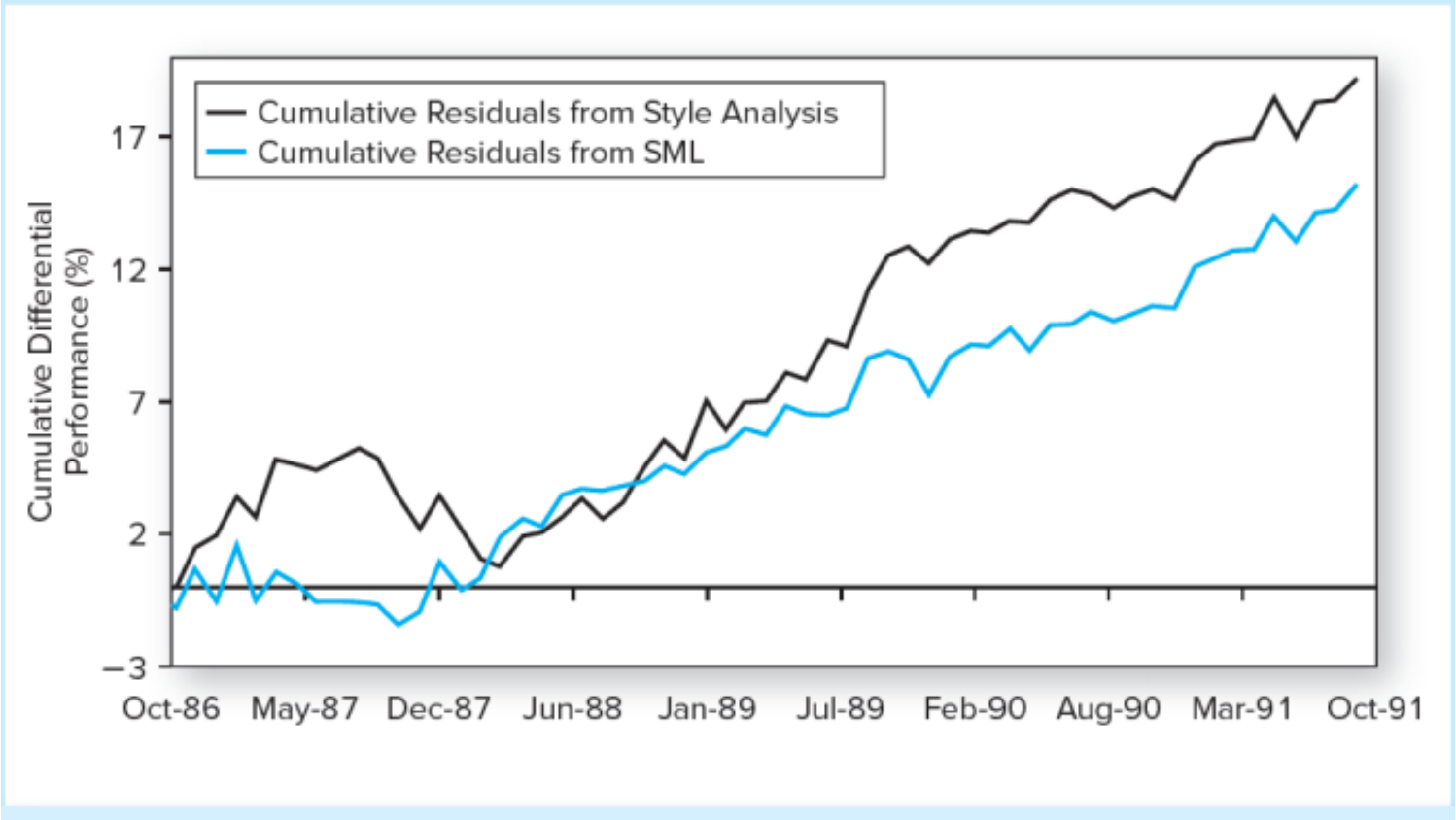
Style Analysis for Fidelity's Magellan Fund

- **Table 24.4** Style analysis for Fidelity's Magellan Fund

Style Portfolio	Regression Coefficient
T-bill	0
Small cap	0
Medium cap	35
Large cap	61
High P/E (growth)	5
Medium P/E	0
Low P/E (value)	0
Total	100
R-square	97.5

- Source: Authors' calculations. Return data for Magellan obtained from **finance.yahoo.com/funds** and return data for style portfolios obtained from the Web page of Professor Kenneth French: **mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html**.

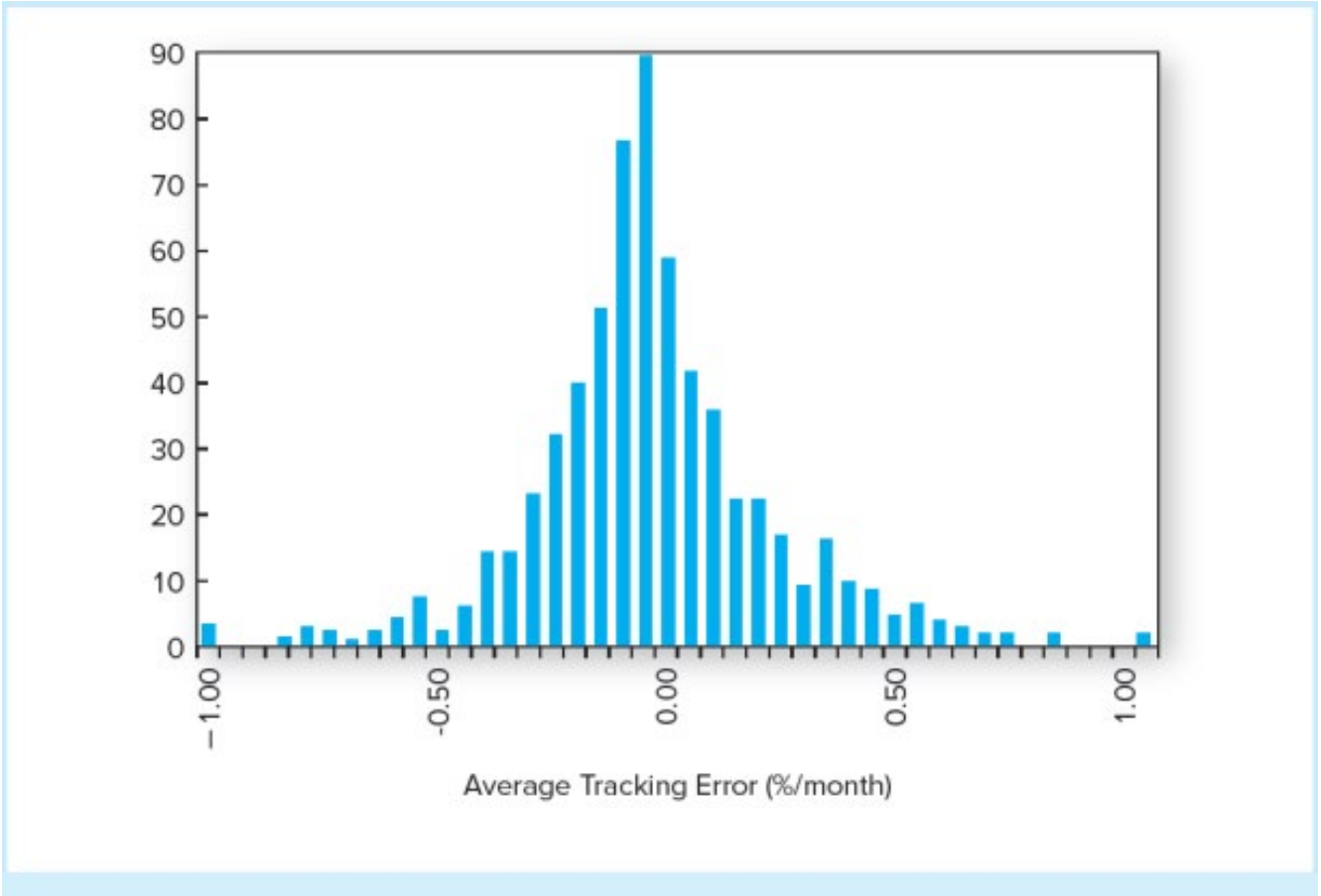
Fidelity Magellan Fund Cumulative Return Difference



- **Figure 24.4** Fidelity Magellan Fund cumulative return difference: Fund versus style benchmark and fund versus SML benchmark

- Source: Authors' calculations.

Average Tracking Error for 636 Mutual Funds, 1985 to 1989



- **Figure 24.5** Average tracking error for 636 mutual funds, 1985 to 1989

- Source: William F. Sharpe, "Asset Allocation: Management Style and Performance Evaluation," *Journal of Portfolio Management,* Winter 1992, pp. 7–19.

Performance Attribution Procedures [1]

- Performance attribution studies attempt to decompose overall performance into discrete components that may be identified with a particular level of the portfolio selection process
- A common attribution system decomposes performance into three components:

1. Broad asset allocation choices across equity, fixed-income, and money markets
2. Industry (sector) choice within each market
3. Security choice within each sector

Performance Attribution Procedures 2

- **Bogey** is designed to measure the returns the portfolio manager would earn if he or she were to follow a completely passive strategy
  - In this context, “passive” has two attributes
    1. It means the allocation of funds across broad asset classes is set in accord with a notion of “usual” allocation across sectors
    2. It means that *within* each asset class, the portfolio manager holds an indexed portfolio

Asset Allocation Decisions

- Superior performance relative to the bogey is achieved by:
  - Overweighting investments in markets that turn out to perform well
  - Underweighting investments in poorly performing markets
- Contribution of asset allocation to superior performance equals the sum over all markets of the excess weight in each market times the return of the index for each market

Sector and Security Selection Decisions

- **Table 24.9** Portfolio attribution: summary

		Contribution (basis points)
1. Asset allocation		31
2. Selection		
a. Equity excess return (basis points)		
I. Sector allocation	129	
II. Security selection	18	
	147 × 0.70 (portfolio weight) =	102.9
b. Fixed-income excess return	44 × 0.07 (portfolio weight) =	3.1
Total excess return of portfolio		137.0

- Good performance (a positive contribution) derives from overweighting well-performing sectors
- Good performance also derives from underweighting poorly performing sectors