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Portfolio Theory

Important Assumptions of Mean-Variance Analysis

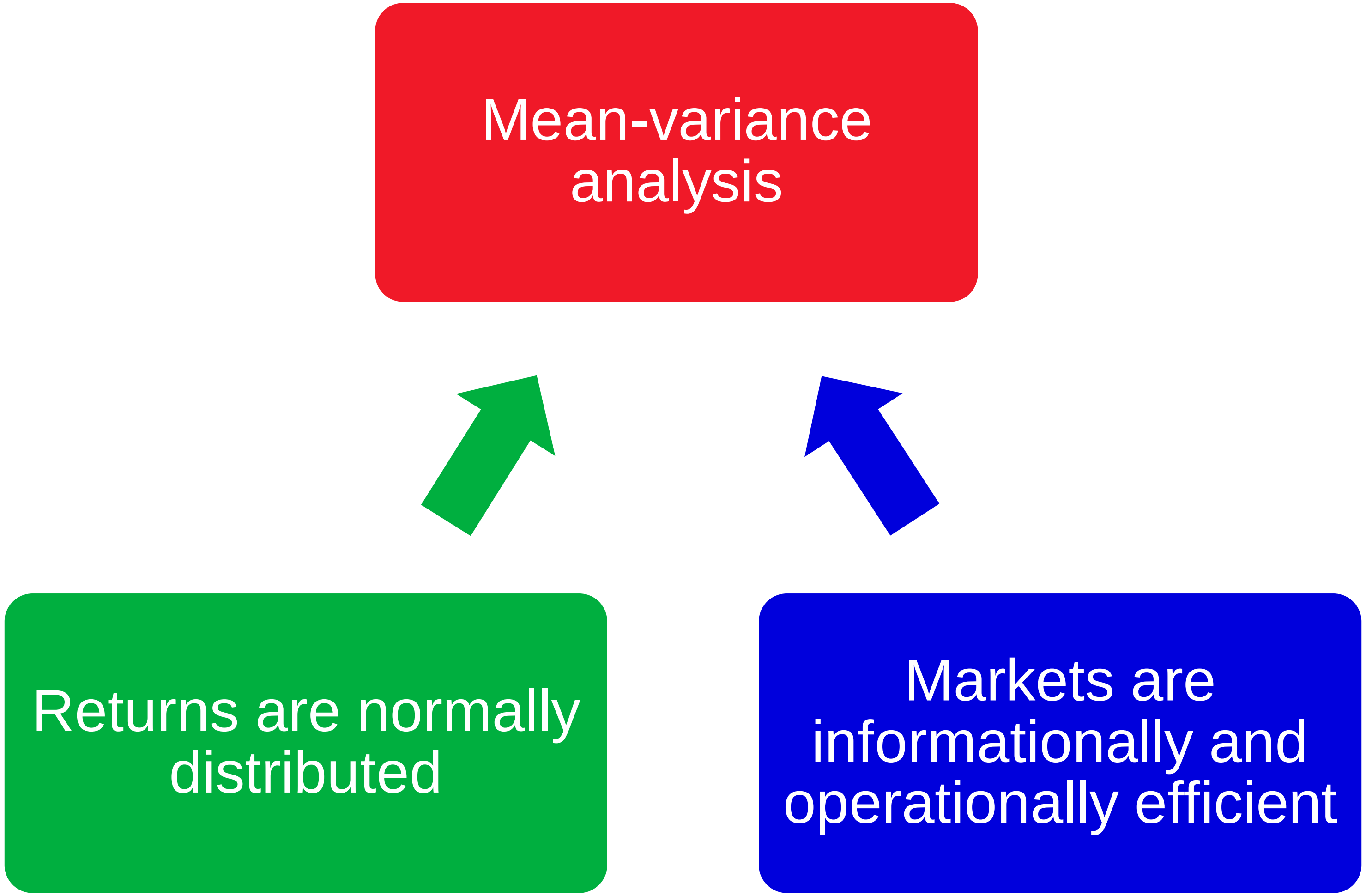


EXHIBIT 5-9 Histogram of U.S. Large Company Stock Returns, 1926-2008

Violations of the normality assumption: **skewness** and **kurtosis.**

						2006				
						2004				
				2000	2007	1988	2003	1997		
				1990	2005	1986	1999	1995		
				1981	1994	1979	1998	1991		
				1977	1993	1972	1996	1989		
				1969	1992	1971	1983	1985		
				1962	1987	1968	1982	1980		
				1953	1984	1965	1976	1975		
				1946	1978	1964	1967	1955		
			2001	1940	1970	1959	1963	1950		
			1973	1939	1960	1952	1961	1945		
		2002	1966	1934	1956	1949	1951	1938	1958	
	2008	1974	1957	1932	1948	1944	1943	1936	1935	1954
1931	1937	1939	1941	1929	1947	1926	1942	1927	1928	1933

–60 –50 –40 –30 –20 –10 0 10 20 30 40 50 60 70

Utility Theory

Expected return

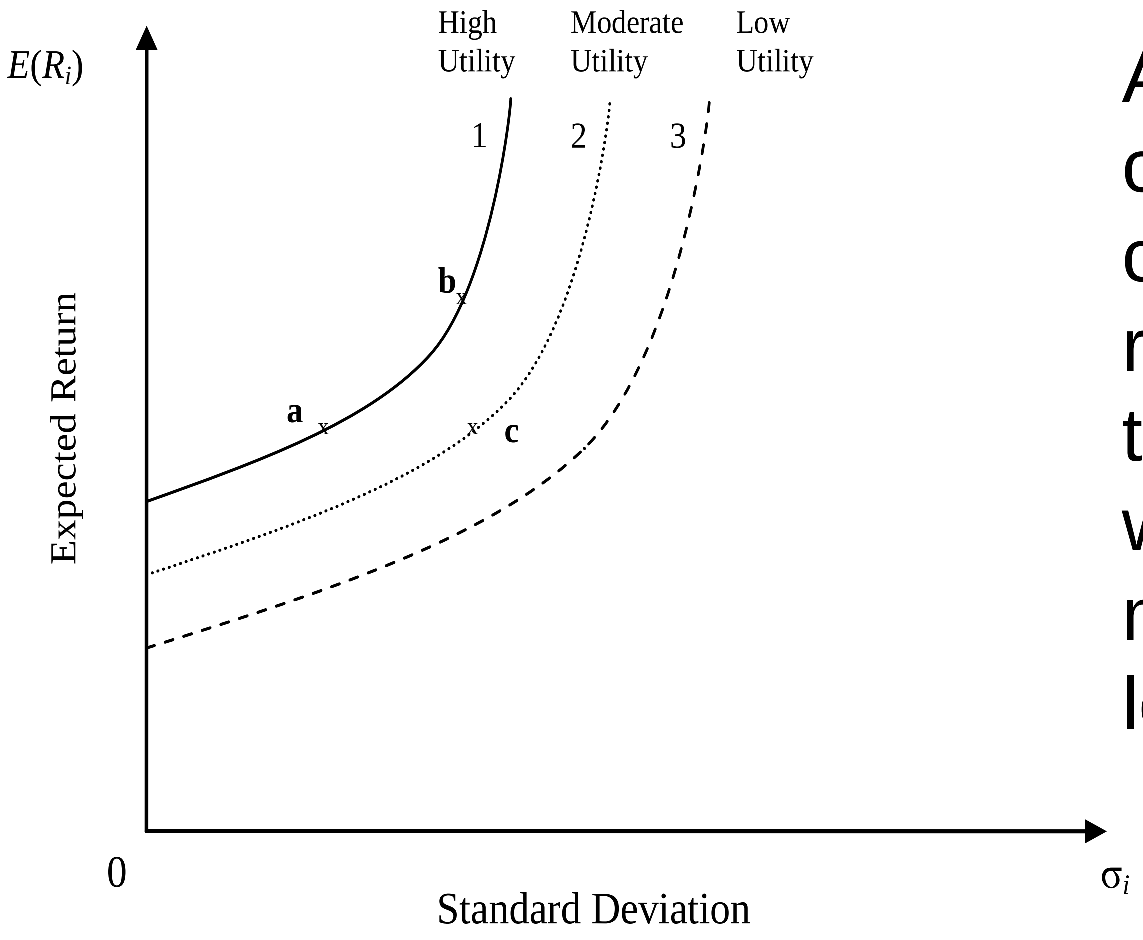
Variance or risk

$$U = E(r) - \frac{1}{2} A\sigma^2$$

Utility of an investment

Measure of risk tolerance or risk aversion

Indifference Curves



An indifference curve plots the combination of risk-return pairs that an investor would accept to maintain a given level of utility.

Portfolio Expected Return and Risk Assuming a Risk-Free Asset

Assume a portfolio of two assets, a risk-free asset and a risky asset. Expected return and risk for that portfolio can be determined using the following formulas:

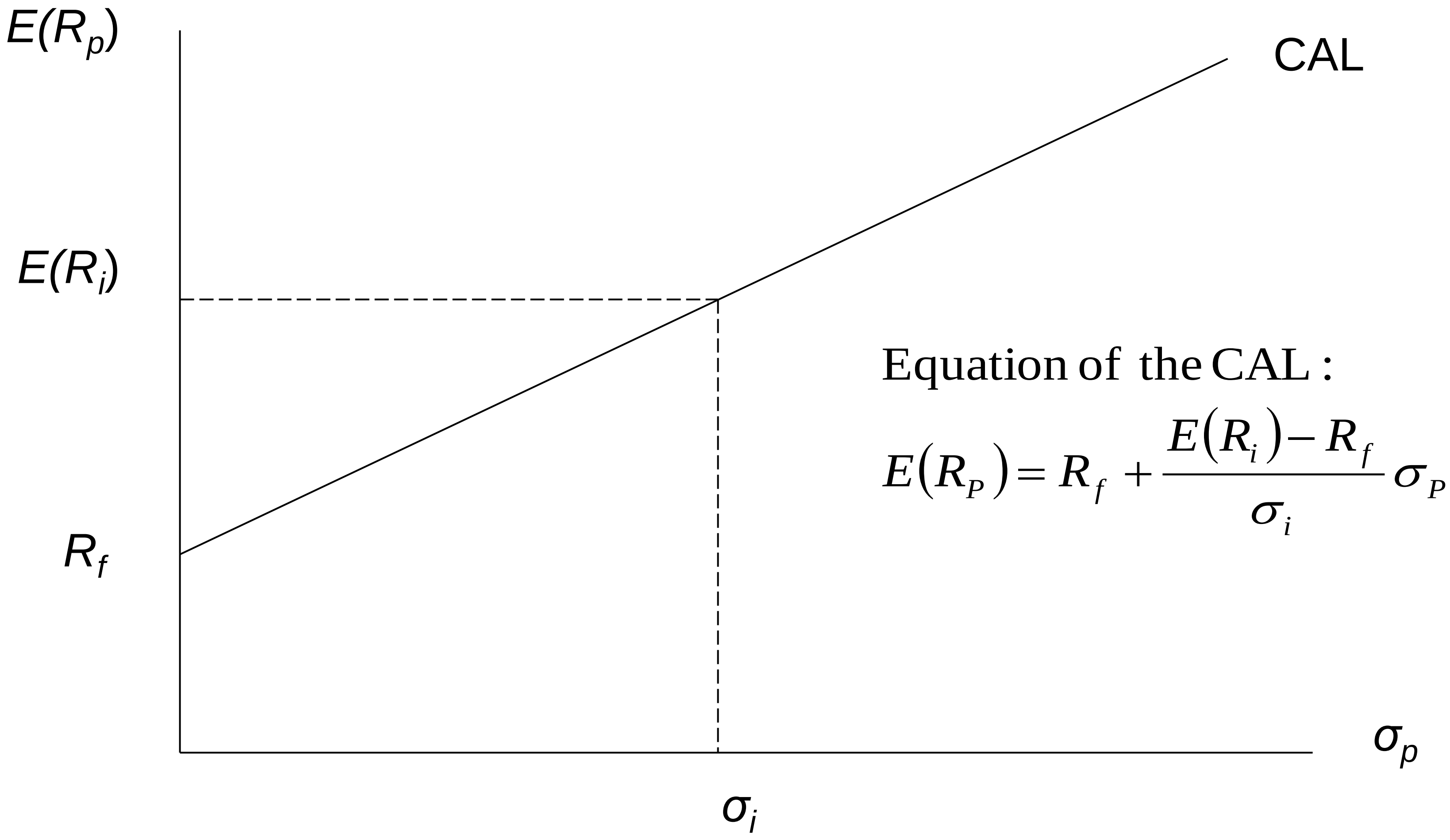
$$E(R_P) = w_1 R_f + (1 - w_1) E(R_i)$$

$$\sigma_P^2 = w_1^2 \sigma_f^2 + (1 - w_1)^2 \sigma_i^2 + 2 w_1 (1 - w_1) \rho_{fi} \sigma_f \sigma_i$$

$$= (1 - w_1)^2 \sigma_i^2$$

$$\sigma_P = \sqrt{(1 - w_1)^2 \sigma_i^2} = (1 - w_1) \sigma_i$$

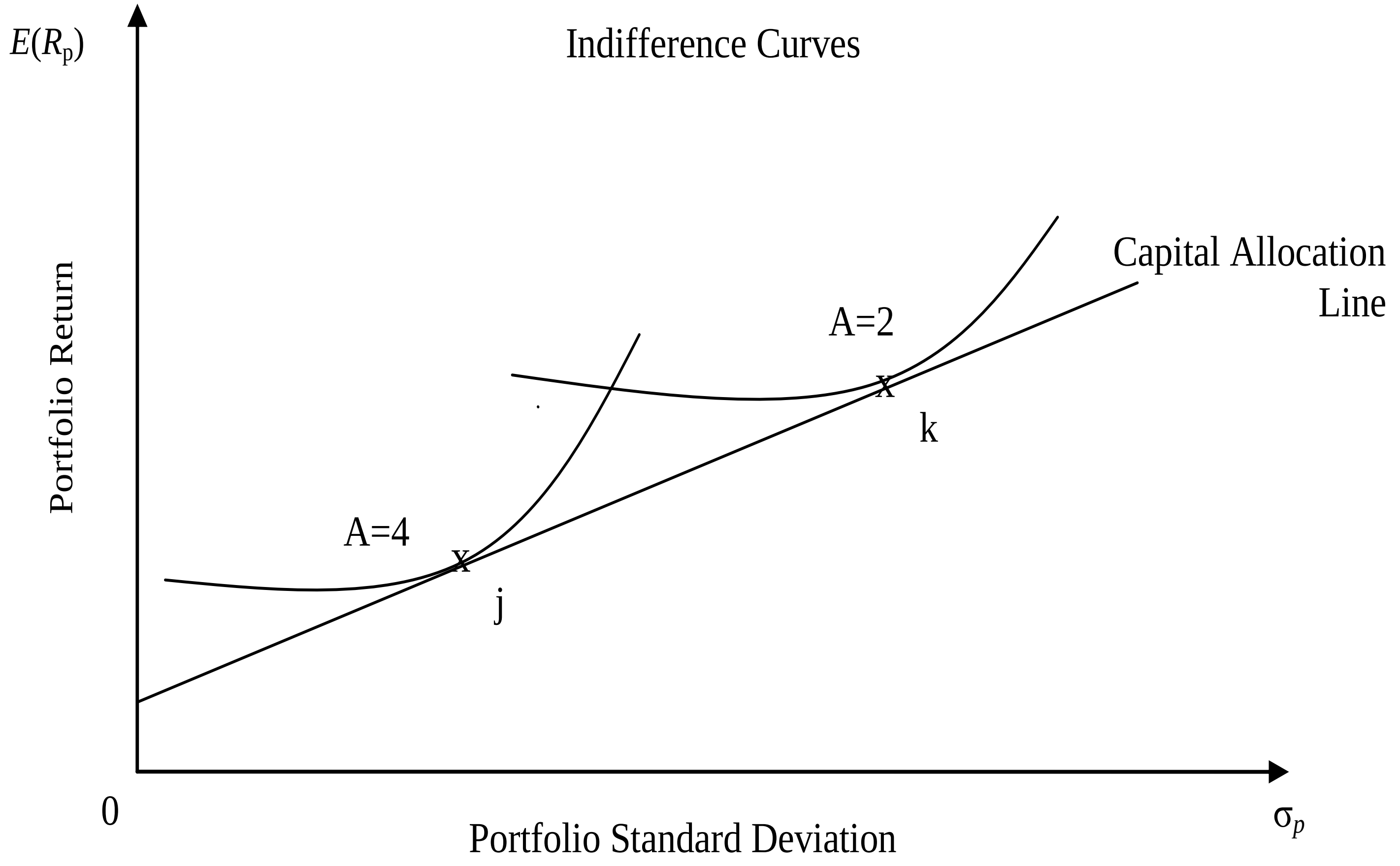
The Capital Allocation Line (CAL)



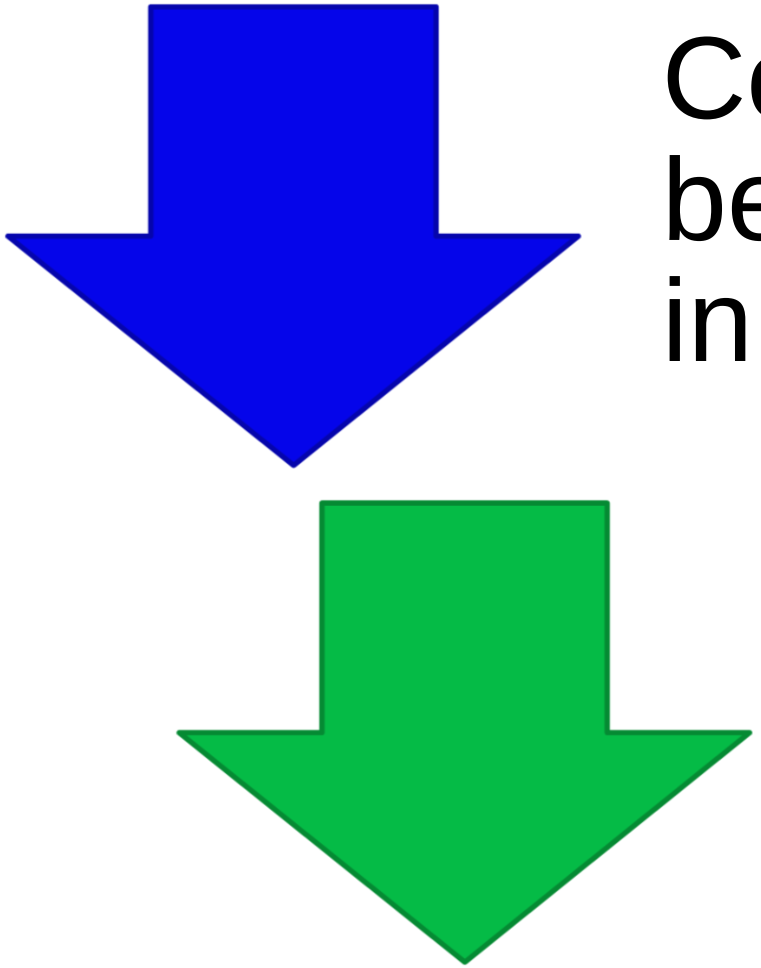
Equation of the CAL:

$$E(R_P) = R_f + \frac{E(R_i) - R_f}{\sigma_i}\sigma_P$$

EXHIBIT 5-15 Portfolio Selection for Two Investors with Various Levels of Risk Aversion



Correlation and Portfolio Risk



Correlation between assets in the portfolio

Portfolio risk

EXHIBIT 5-16 Relationship between Risk and Return

Weight in Asset 1	Portfolio Return	Portfolio Risk with Correlation of			
		1.0	**0.5**	**0.2**	**–1.0**
0%	15.0	25.0	25.0	25.0	25.0
10%	14.2	23.7	23.1	22.8	21.3
20%	13.4	22.4	21.3	20.6	17.6
30%	12.6	21.1	19.6	18.6	13.9
40%	11.8	19.8	17.9	16.6	10.2
50%	11.0	18.5	16.3	14.9	6.5
60%	10.2	17.2	15.0	13.4	2.8
70%	9.4	15.9	13.8	12.3	0.9
80%	8.6	14.6	12.9	11.7	4.6
90%	7.8	13.3	12.2	11.6	8.3
100%	7.0	12.0	12.0	12.0	12.0

EXHIBIT 5-17 Relationship between Risk and Return

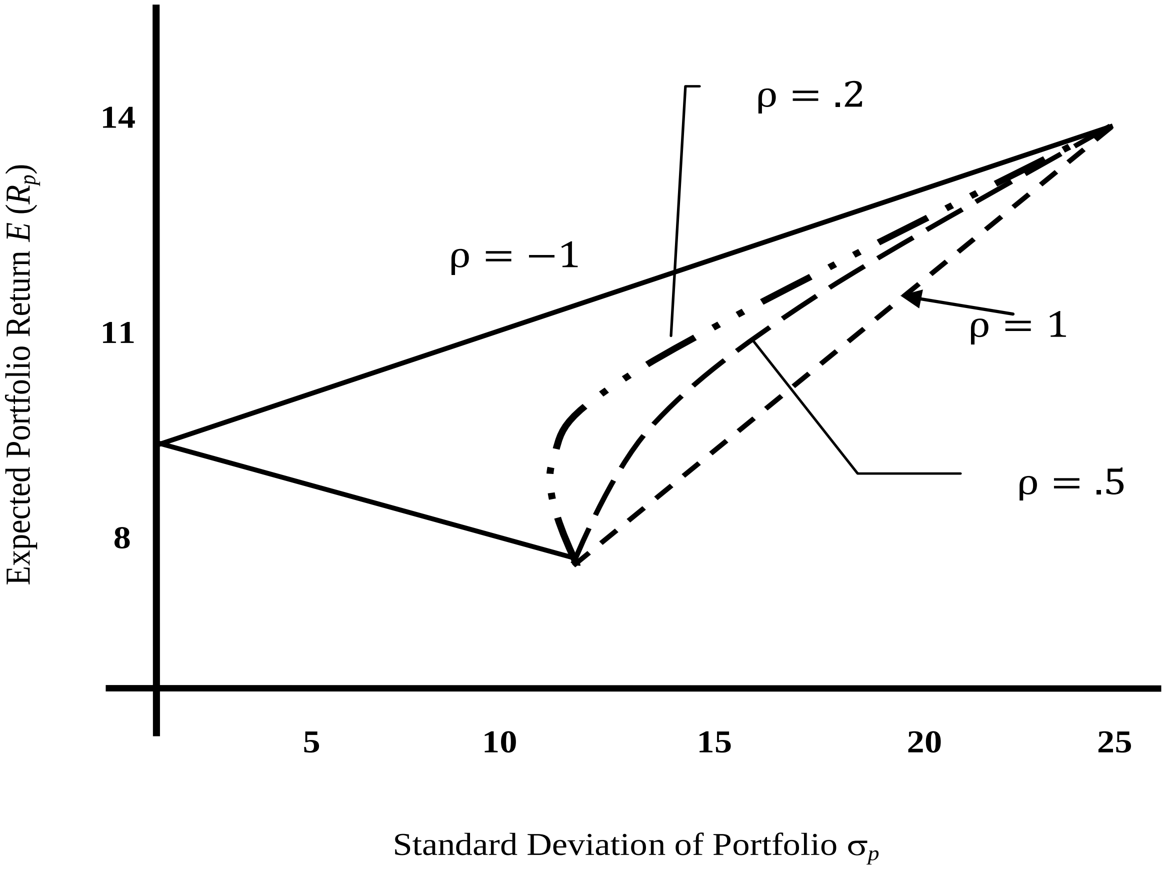


EXHIBIT 5-22 Minimum-Variance Frontier

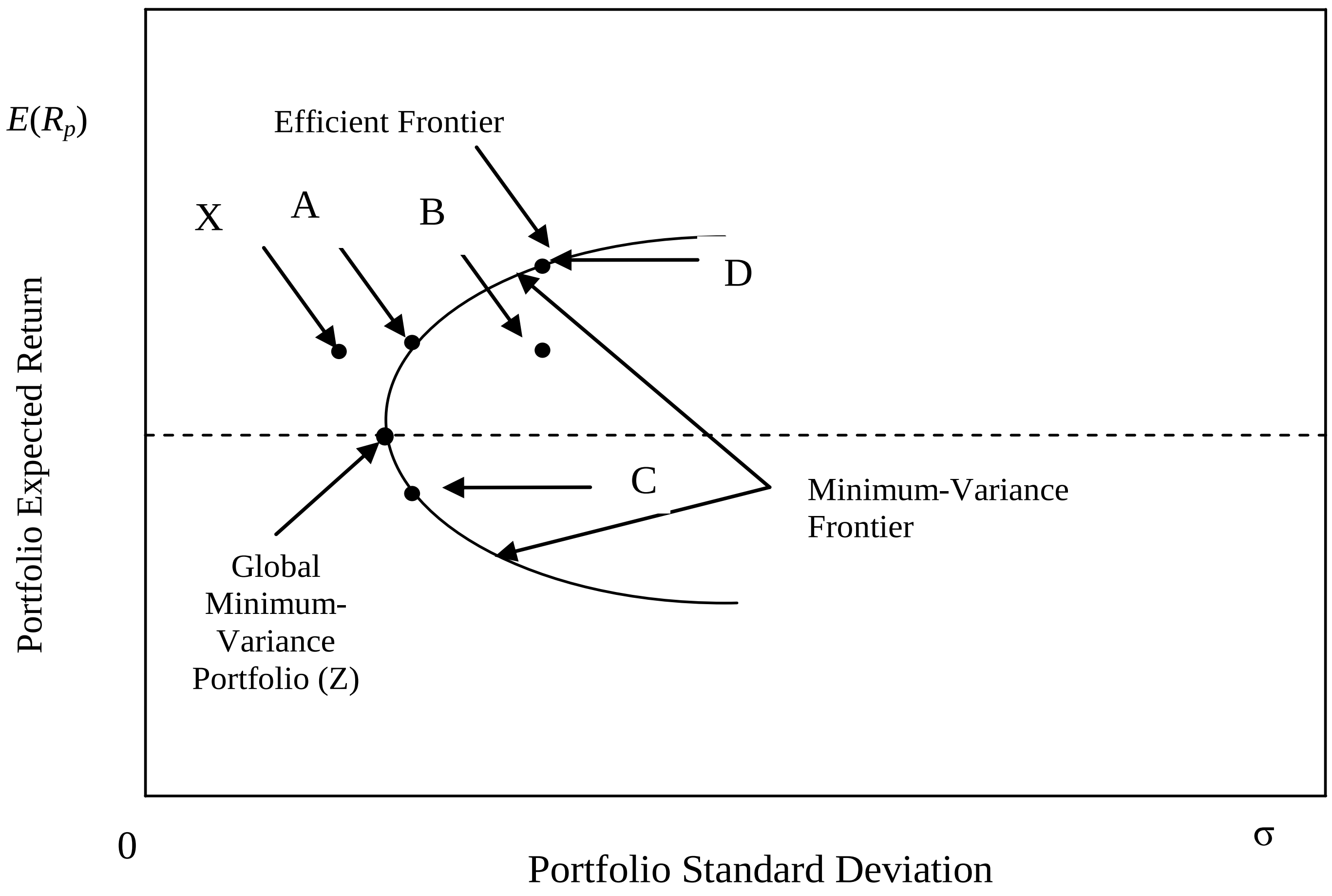
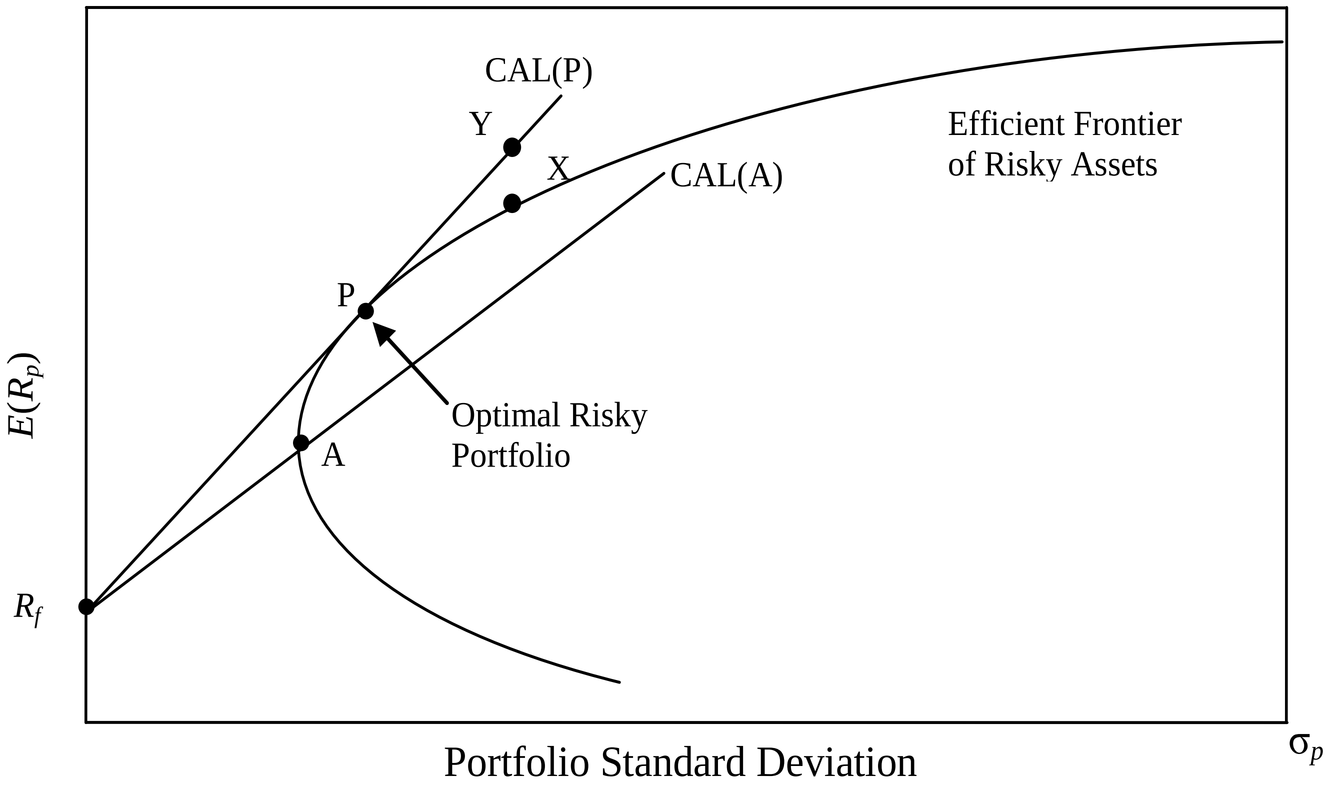


EXHIBIT 5-23 Capital Allocation Line and Optimal Risky Portfolio



CAL(P) is the optimal capital allocation line and portfolio P is the optimal risky portfolio.

The Two-Fund Separation Theorem

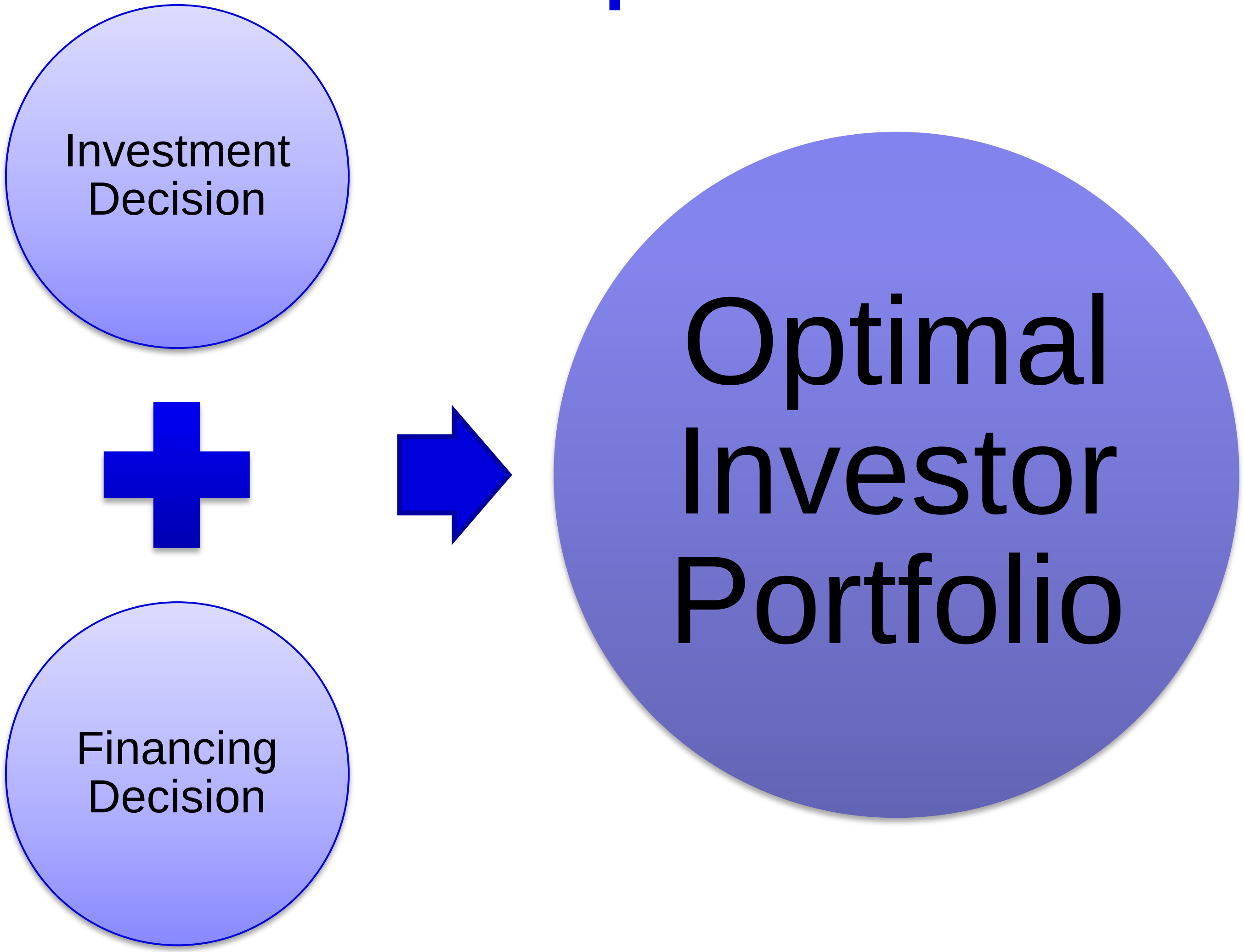
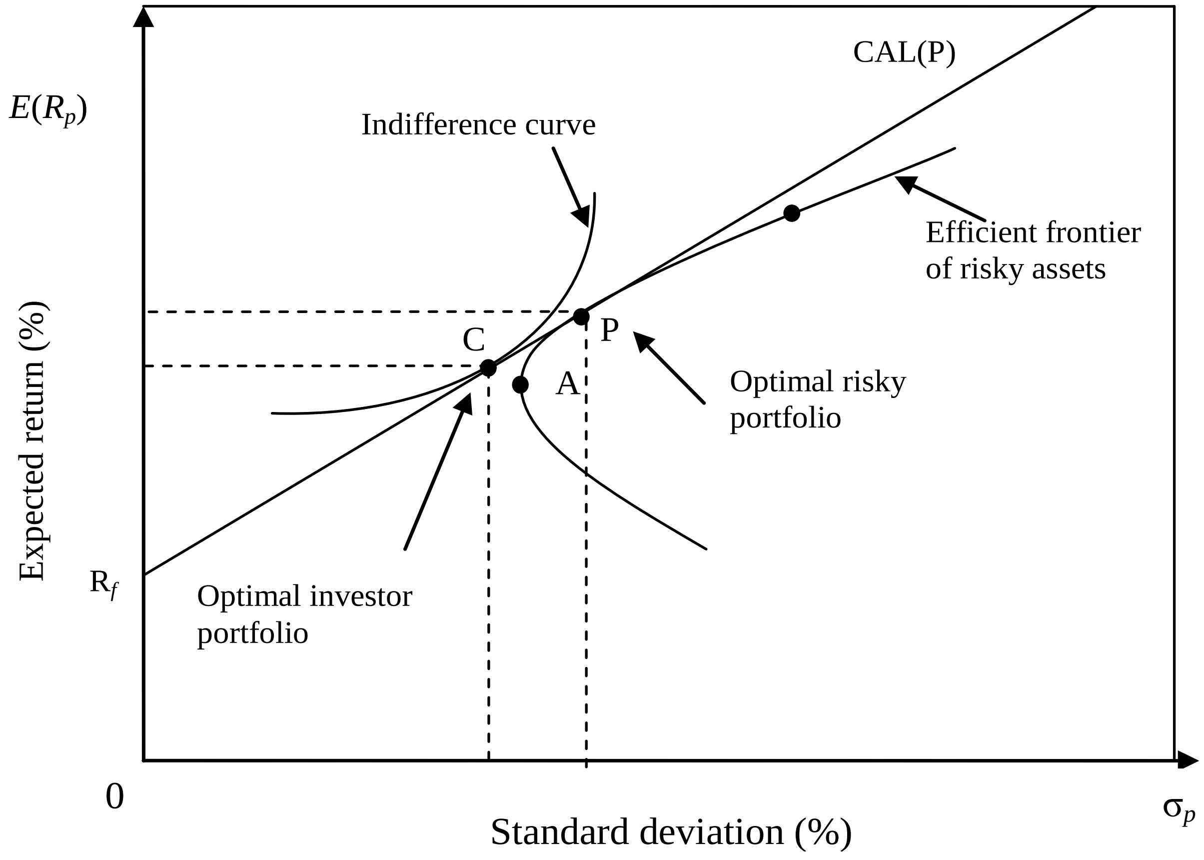


EXHIBIT 5-25 Optimal Investor Portfolio



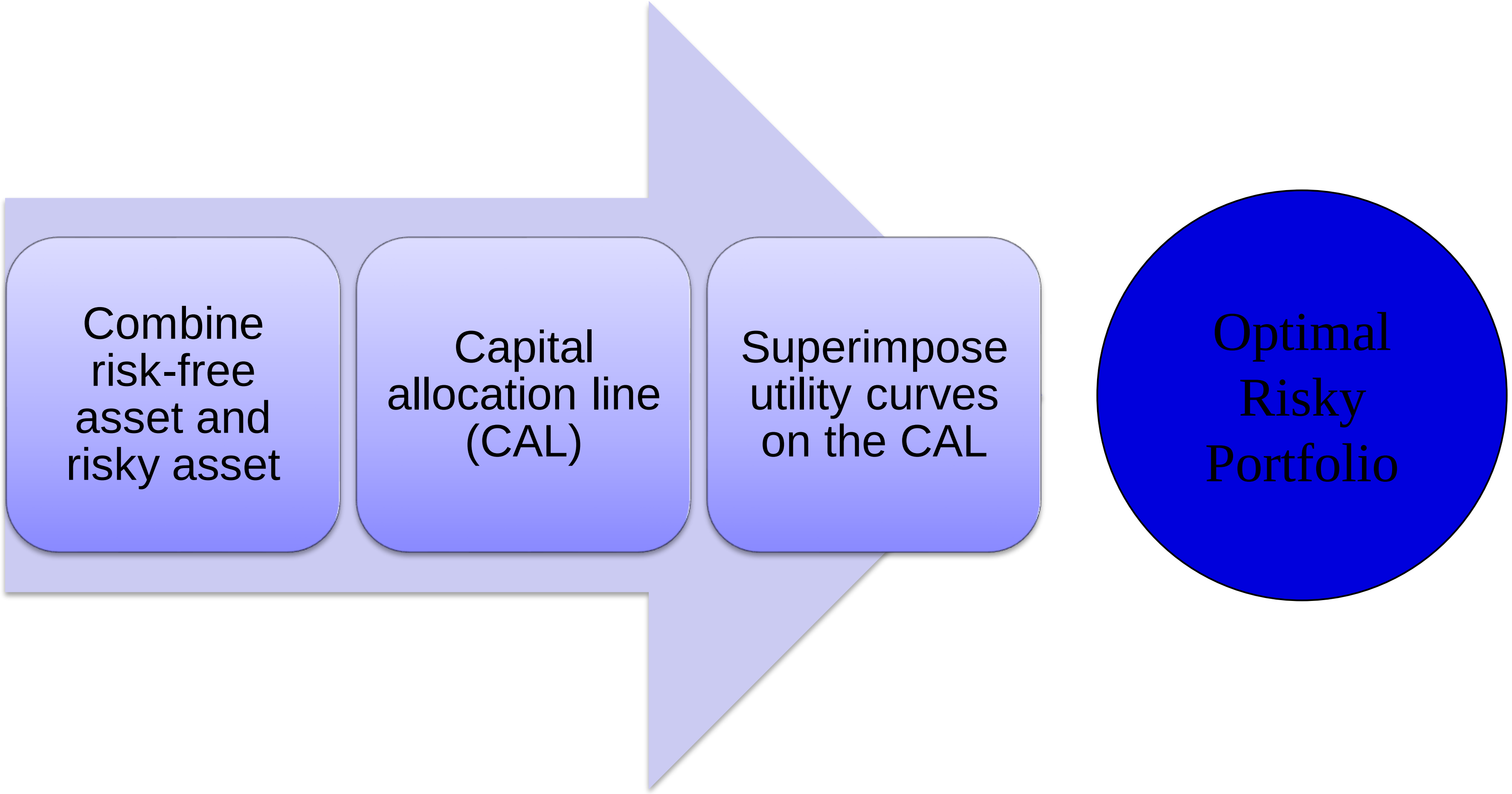
Given the investor's indifference curve, portfolio C on CAL(P) is the optimal portfolio.

EXHIBIT 6-1 Portfolio Risk and Return

Portfolio	Weight in Asset 1	Weight in Asset 2	Portfolio Return	Portfolio Standard Deviation
X	25.0%	75.0%	6.25%	9.01%
Y	50.0	50.0	7.50	11.18
Z	75.0	25.0	8.75	15.21
Return	10.0%	5.0%		
Standard deviation	20.0%	10.0%		
Correlation between Assets 1 and 2		0.0		

$$\sigma_X = \sqrt{(.25^2)(.20^2) + (.75^2)(.10)^2 + (.25)(0)(.20)(.10) + (.75)(0)(.10)(.20)} \approx 9.01\%$$

Portfolio of Risk-Free and Risky Assets



Portfolio Beta

Portfolio beta is the weighted sum of the betas of the component securities:

$$\beta_p = \sum_{i=1}^{N} w_i \beta_i = (0.40 \times 1.50) + (0.60 \times 1.20) = 1.32$$

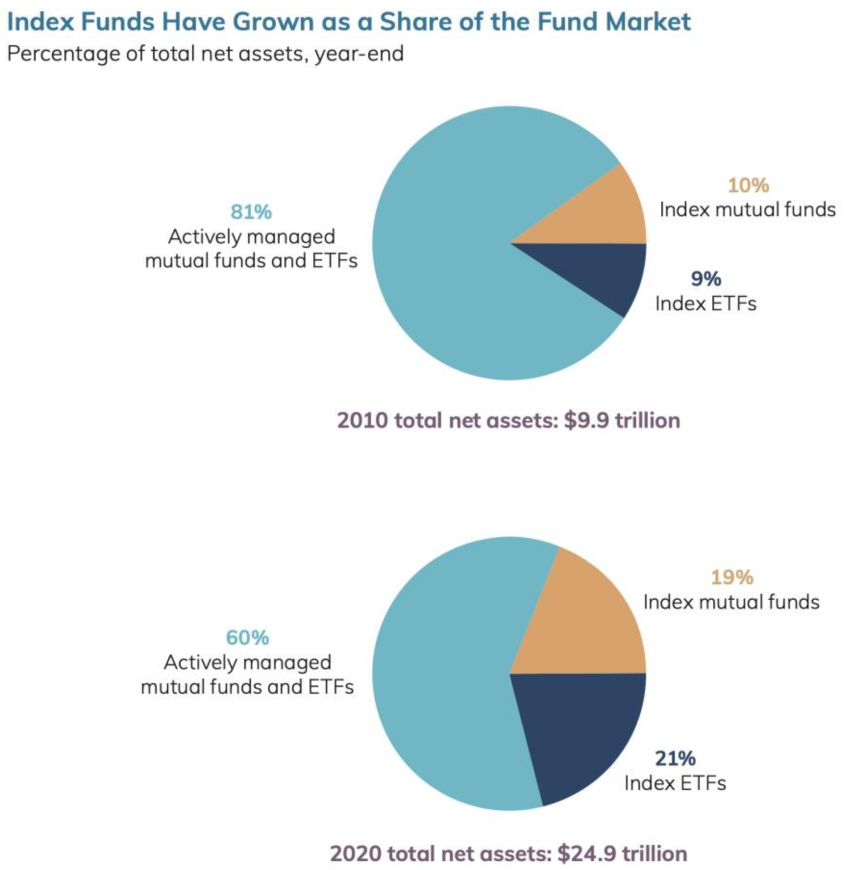
The portfolio's expected return given by the CAPM is:

$$E\left(R_p\right) = R_f + \beta_p \left[E\left(R_m\right) - R_f \right]$$

$$E\left(R_p\right) = 3\% + 1.32\left[9\% - 3\%\right] = 10.92\%$$

Camparison of funds performance

Active vs. Pasive Investing



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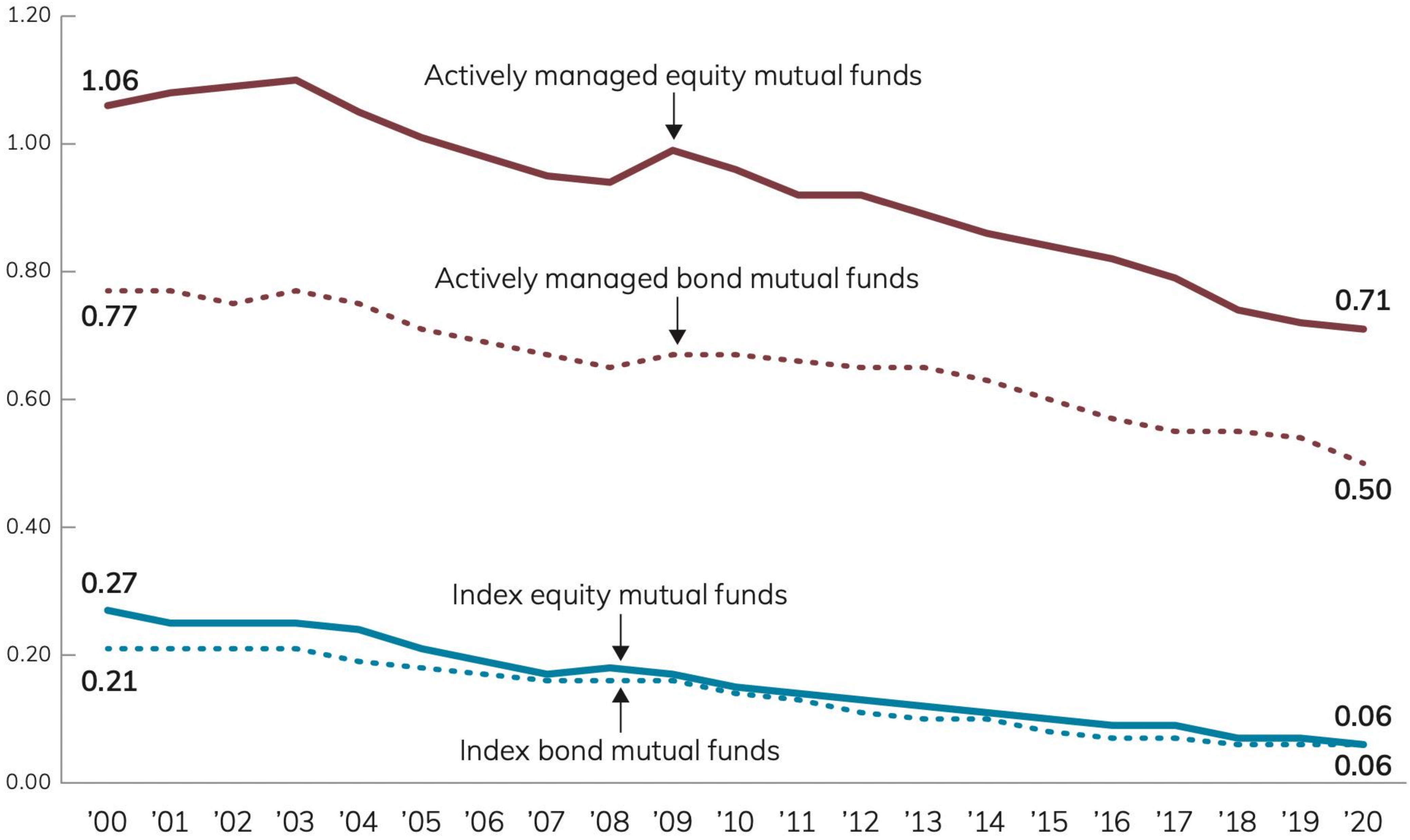
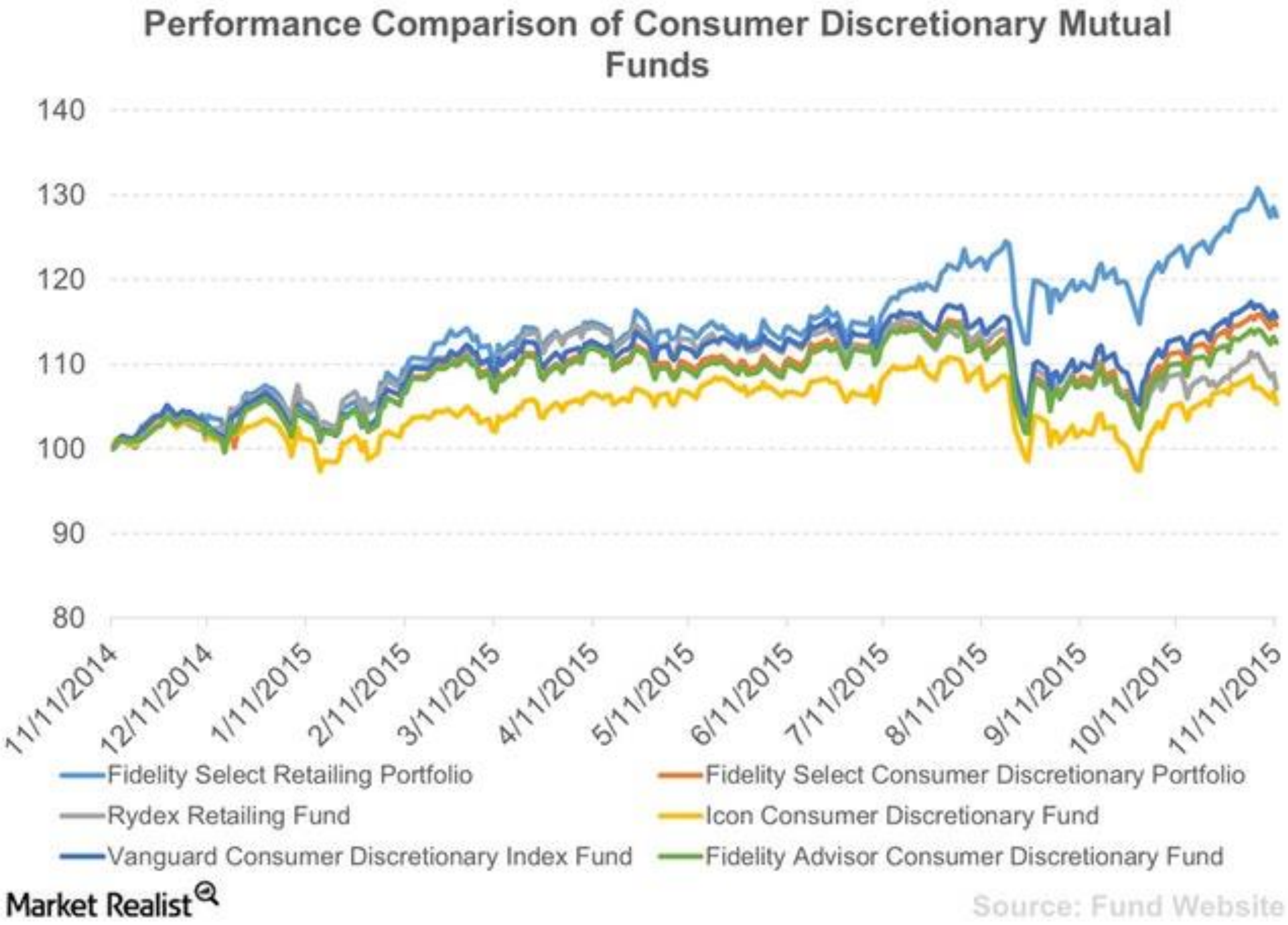
Expense Ratios of Actively Managed and Index Mutual Funds Have Fallen

Percent



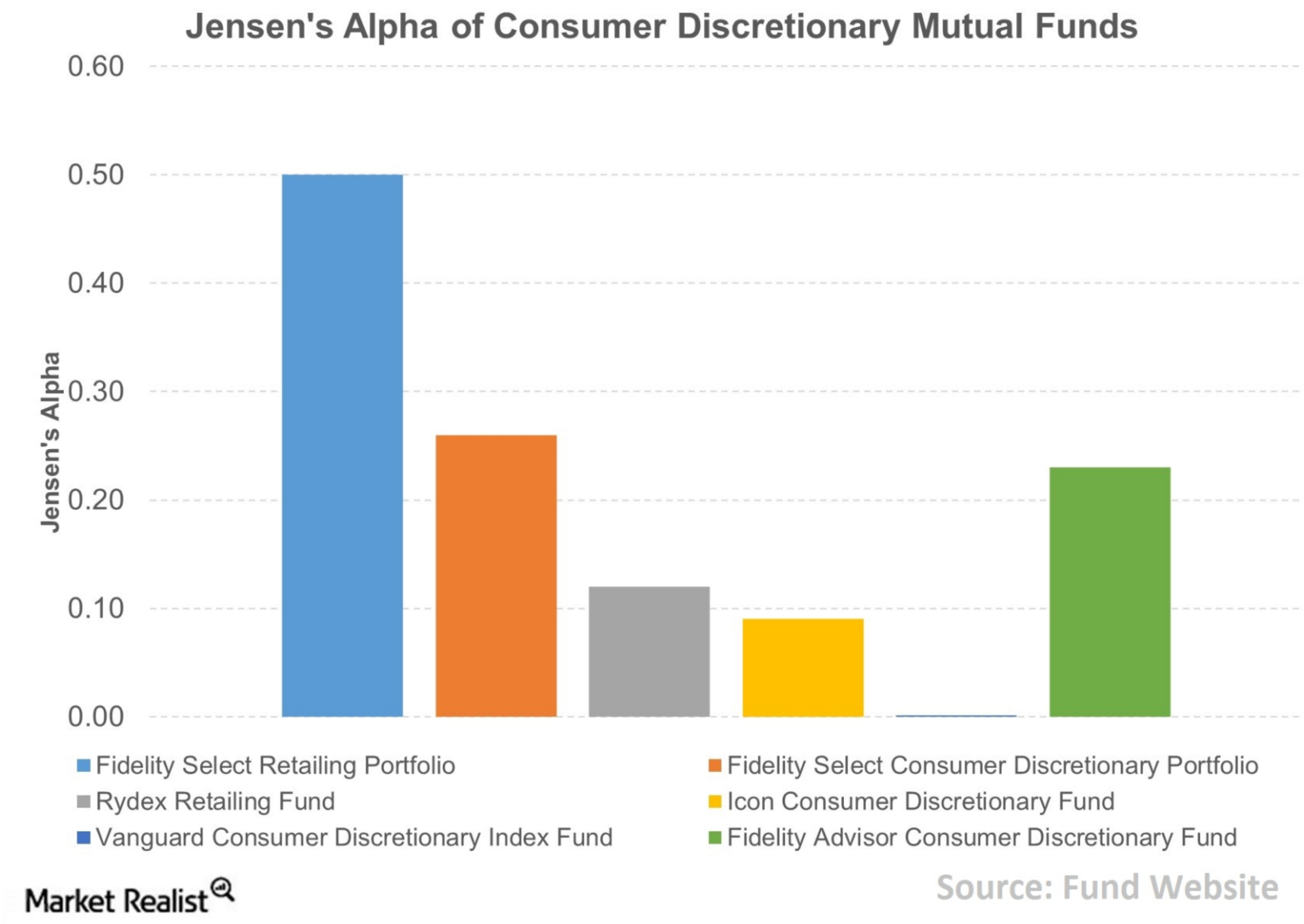


Performance Comparison of Consumer Discretionary Mutual Funds
140
130
120
110
100
90
80
11/11/2014
12/11/2014
1/11/2015
2/11/2015
3/11/2015
4/11/2015
5/11/2015
6/11/2015
7/11/2015
8/11/2015
9/11/2015
10/11/2015
11/11/2015
Fidelity Select Retailing Portfolio
Fidelity Select Consumer Discretionary Portfolio
Rydex Retailing Fund
Icon Consumer Discretionary Fund
Vanguard Consumer Discretionary Index Fund
Fidelity Advisor Consumer Discretionary Fund
Market Realist
Source: Fund Website

Jensen’s alpha

Jensen’s alpha helps an investor determine how much extra return a fund has earned above the expected return while considering the non-diversifiable risk of the market. The expected return is calculated using the CAPM (capital asset pricing model). A positive Jensen’s alpha indicates that the managers of the fund, through careful stock selection, have been able to extract higher returns than the market (which in our case is the underlying indexes). Jensen’s alpha is calculated as follows:

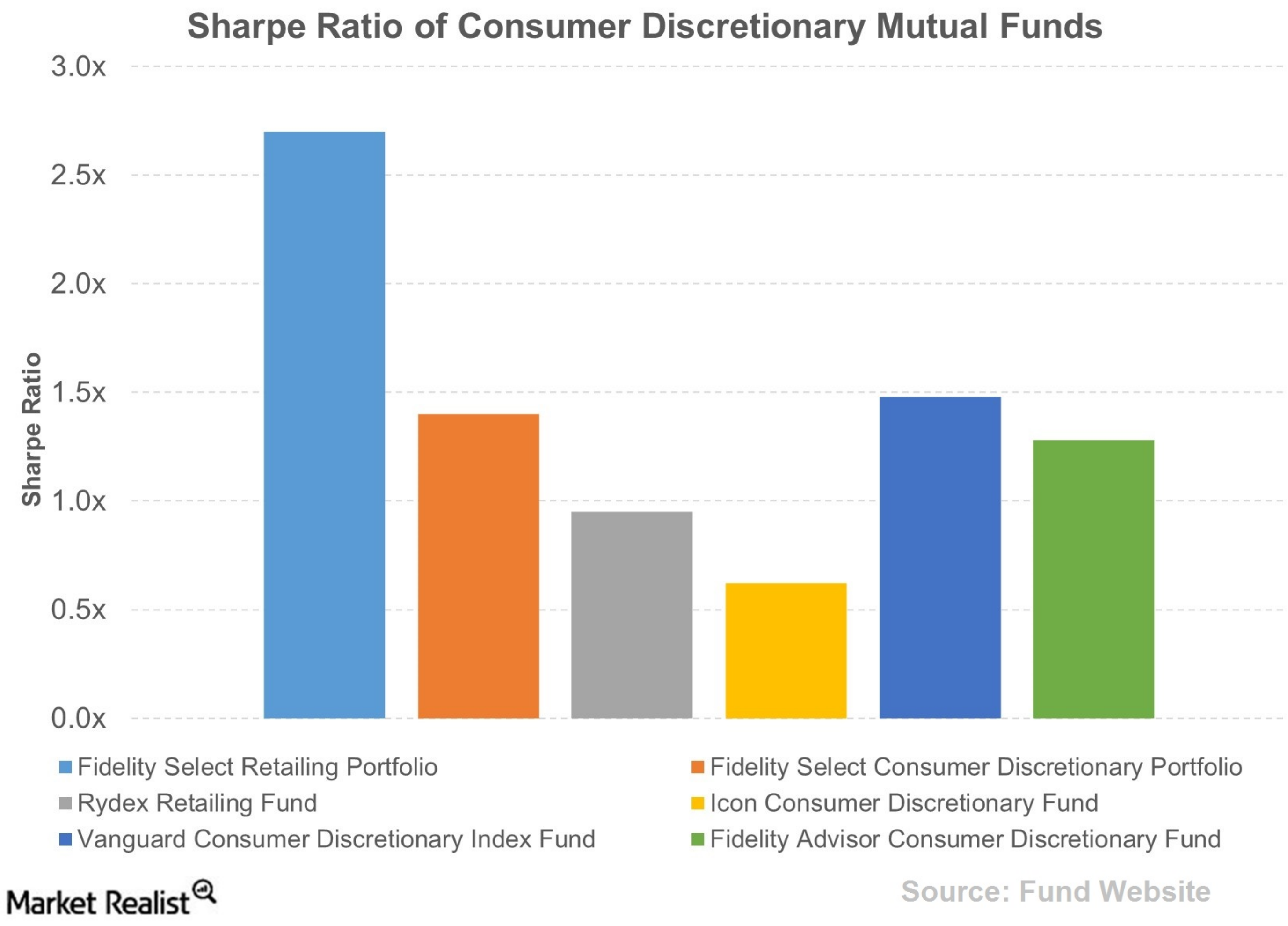
Jensen’s alpha = (portfolio return – expected return CAPM)


Jensen's Alpha of Consumer Discretionary Mutual Funds
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jensen's Alpha
Fidelity Select Retailing Portfolio
Fidelity Select Consumer Discretionary Portfolio
Rydex Retailing Fund
Icon Consumer Discretionary Fund
Vanguard Consumer Discretionary Index Fund
Fidelity Advisor Consumer Discretionary Fund
Market Realist
Source: Fund Website

The Sharpe ratio

Investors often use the Sharpe ratio to gauge the performance of investment portfolios. The Sharpe ratio measures the units of excess return earned by a portfolio over the risk-free rate for every unit of risk taken. The risk is the standard deviation of the portfolio returns. The equation for the Sharpe ratio is as follows:

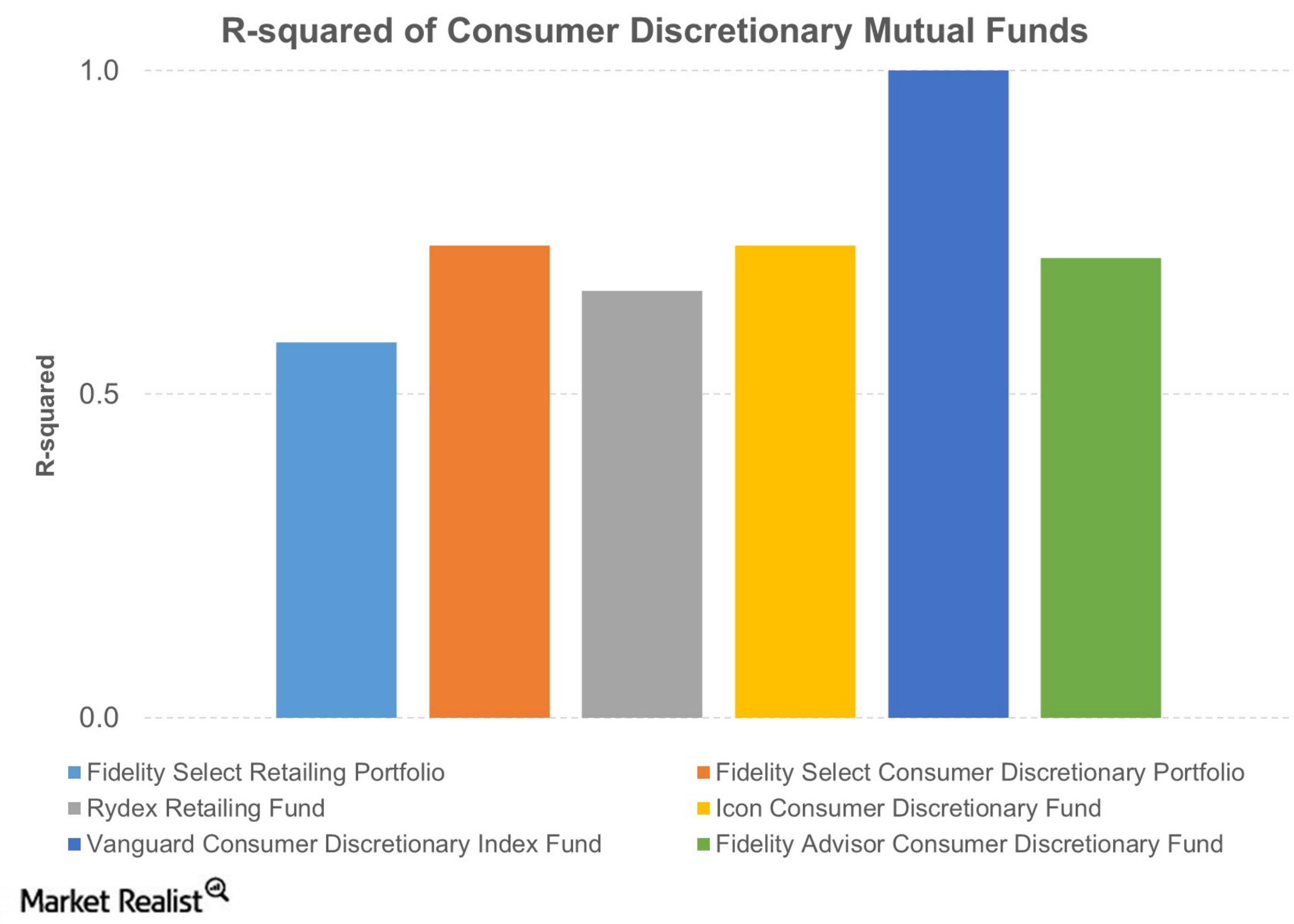
Sharpe ratio = (average return of portfolio – risk-free rate of return)/standard deviation of portfolio returns


Sharpe Ratio of Consumer Discretionary Mutual Funds
Sharpe Ratio
3.0x
2.5x
2.0x
1.5x
1.0x
0.5x
0.0x
Fidelity Select Retailing Portfolio
Fidelity Select Consumer Discretionary Portfolio
Rydex Retailing Fund
Icon Consumer Discretionary Fund
Vanguard Consumer Discretionary Index Fund
Fidelity Advisor Consumer Discretionary Fund
Market Realist
Source: Fund Website

R-squared value

The R-squared value is a statistical measure that compares the movement of a fund against that of its benchmark index. The R-squared value ranges from 0 to 1. A value closer to 1 indicates that the fund's performance follows the movement of the underlying index, whereas a fund with a low R-squared value does not closely follow the performance of the underlying index.

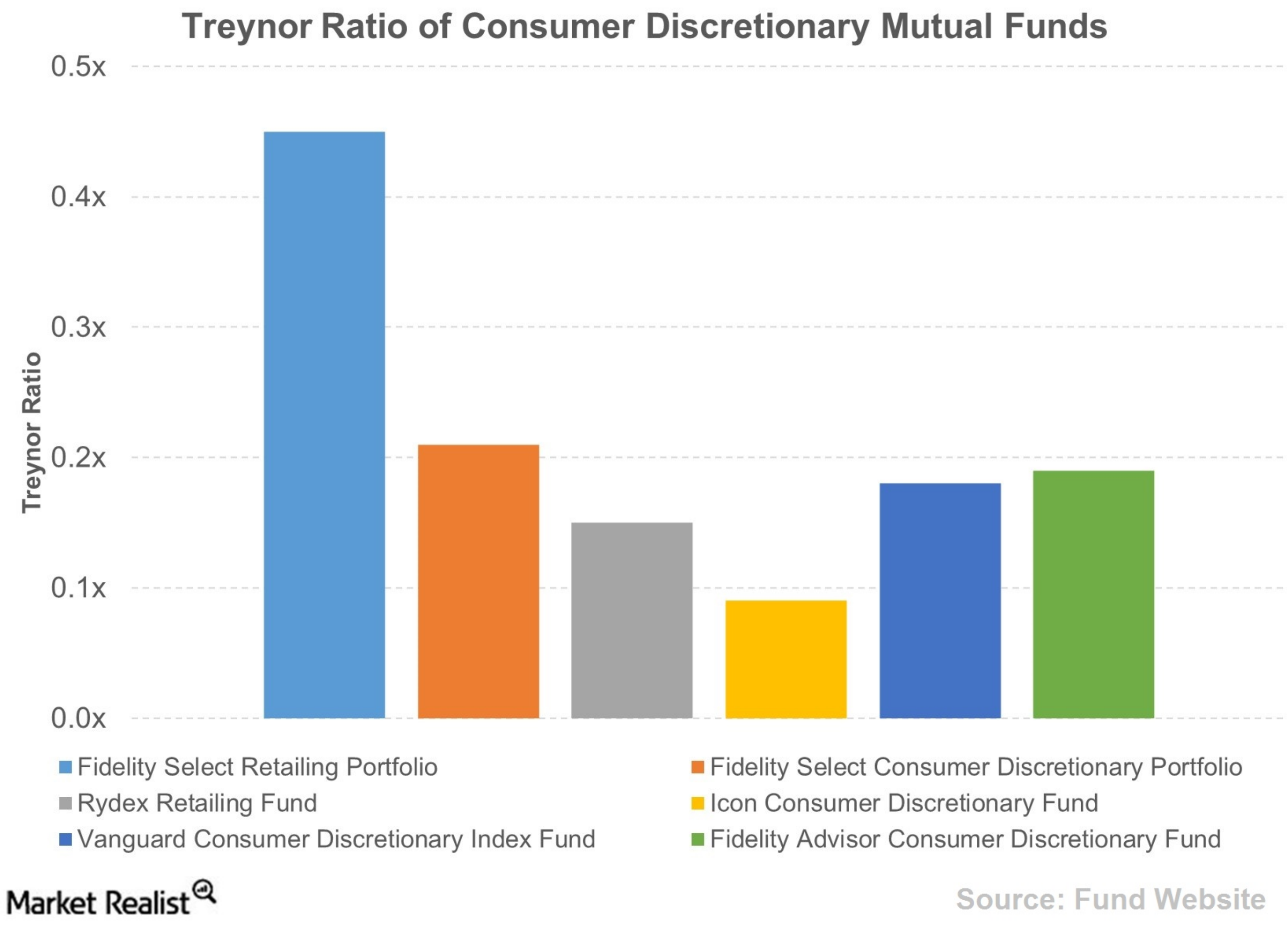
R-squared value



The Treynor ratio

The Treynor ratio calculates how much an investment has earned above the risk-free market rate for every unit of risk assumed. Although it is similar to the Sharpe ratio, its measure of risk is different. Whereas the Sharpe ratio considers the total risk of the investment, the Treynor ratio only considers the systematic risk, assuming that the non-systematic risk is fully diversified in developing the portfolio. Risk in the Treynor ratio, represented by beta, is the systematic risk or non-diversifiable risk. The equation for the Treynor ratio is as follows:

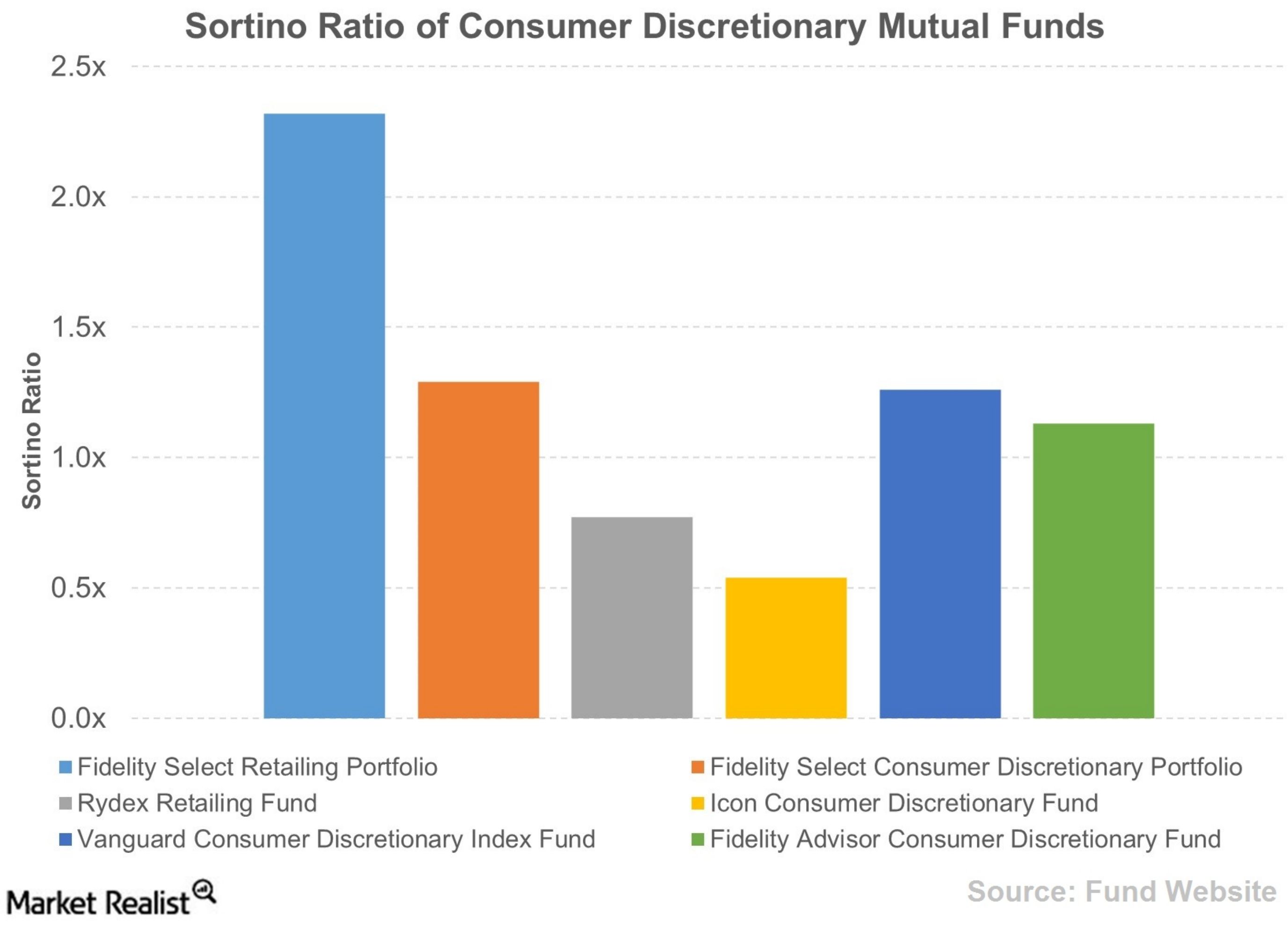
Treynor ratio = (average return of portfolio – risk-free rate of


Treynor Ratio of Consumer Discretionary Mutual Funds
0.5x
0.4x
0.3x
0.2x
0.1x
0.0x
Treynor Ratio
Fidelity Select Retailing Portfolio
Fidelity Select Consumer Discretionary Portfolio
Rydex Retailing Fund
Icon Consumer Discretionary Fund
Vanguard Consumer Discretionary Index Fund
Fidelity Advisor Consumer Discretionary Fund
Market Realist
Source: Fund Website

The Sortino ratio

The Sharpe ratio can sometimes be unfavorable for stocks that have high upside volatility. To prevent this, we can use the Sortino ratio. Although the calculation of the Sortino ratio is similar to that of the Sharpe ratio, the Sortino ratio's denominator is the downside deviation of the portfolio. The equation for the Sortino ratio is as follows:

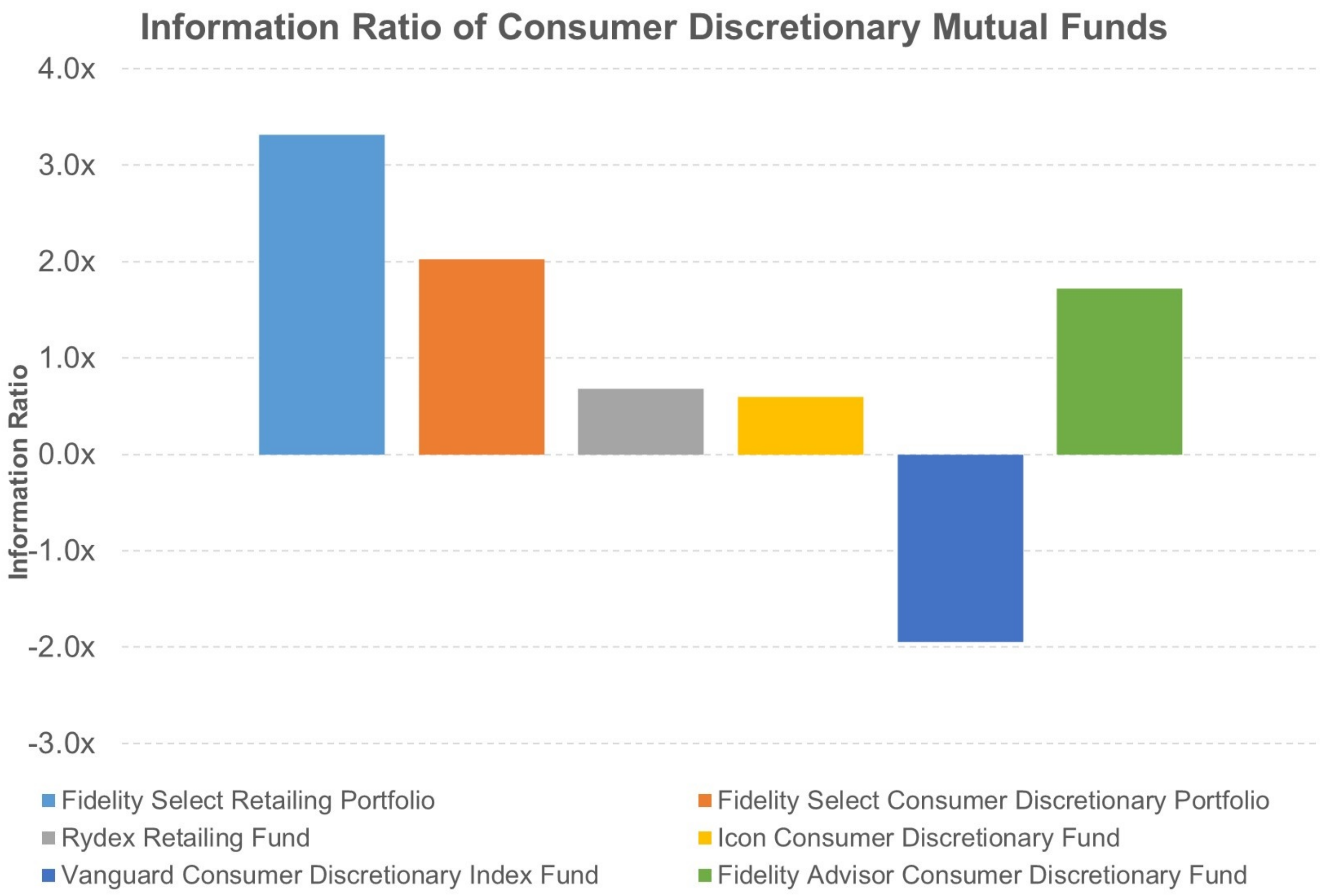
Sortino ratio = (average return of portfolio – risk-free rate of return)/downside deviation of portfolio returns



Sortino Ratio of Consumer Discretionary Mutual Funds
2.5x
2.0x
1.5x
1.0x
0.5x
0.0x
Sortino Ratio
Fidelity Select Retailing Portfolio
Fidelity Select Consumer Discretionary Portfolio
Rydex Retailing Fund
Icon Consumer Discretionary Fund
Vanguard Consumer Discretionary Index Fund
Fidelity Advisor Consumer Discretionary Fund
Market Realist
Source: Fund Website

The information ratio

The information ratio can be used to evaluate the performance of an actively managed fund. It can determine how consistently the manager of the fund has generated excess returns for its investors. In simple terms, it is the ratio of the active return generated by the manager over the index return, divided by the active risk taken. The risk taken is measured by the standard deviation of
the difference between the returns of the portfolio and the index, which is referred to as the tracking error. The equation is as follows:
Information ratio = (portfolio return – benchmark return)/tracking error



Market Realist

Source: Fund Website