7 RISK ADJUSTED RETURNS

CONTENTS	PAGE NO.

LEARNING OBJECTIVE

After studying this chapter, you should be able to:

- Understand the concept of risk adjusted return
- Describe the different methods of risk adjusted return
- Calculate the risk adjusted returns using each of the different methods
- Interpret the numerical value provided by each of the methods

KEY TERMS

This chapter features these terms which you should strive to do more research about:

Risk Adjusted Return	Jenson Index	Treynor Index
Sharpe Index	M Square	Sortino Ratio

CONCEPT OF RISK ADJUSTED RETURN

We rank assets all the time. We rank stocks, funds, countries, you name it. Problem is, most of the time we do it the wrong way. Investors focus way too often on past returns and even if these are representative of expected returns (and many times they are not), what about risk? Just about every model or relationship in finance is based on a careful balance between risk and return. And that of course also applies to the ranking of assets, which is the issue we address in this chapter. We'll discuss different ways of ranking assets taking into account both their risk and their return or, more concisely, their risk-adjusted performance.

Returns and Good Luck

It happens all the time. You open a financial newspaper or magazine and there you have it, a ranking of mutual funds based on their performance. And how is performance measured? Simply by last year's (or worse, last quarter's) returns. Actually, it gets even worse. Investors tend to pour their money into the funds at the top and withdraw it from the funds at the bottom. That flies in the face of just about everything we know in finance.

It is of course important to assess the returns delivered by different funds, but it's just as important to assess the impact of luck and risk. In fact, a careful analysis must disentangle the impact of three different factors on returns: luck, risk taking, and ability. Let's consider them one at a time. (The discussion that follows, and this chapter in general, is focused on mutual funds, but you should have little trouble generalizing the discussion to assess the performance of any type of asset.)

Suppose you walk into a casino, head straight to the roulette, bet on 17 ... and win! Would you conclude that you know how to play roulette? What if for the first time in your life you bet on a horse (the black one that looks good) and win? Would you conclude that you know about horses? You probably answered no both times. Why, then, would many investors conclude that the top-performer in a list of funds ranked by last year's return is the best fund, or that its manager is the most competent? Isn't it possible that the fund manager just got lucky with a few stock picks?

Of course it is. The bottom line is that there's very little we can say about a fund by observing its return performance over one year. Or, put differently, by observing only one year of returns, we can't rule out the impact of luck on performance. In fact, we can only do it by assessing performance over long periods of time. That's why rankings based on three-year returns and five-year returns are more useful, although longer periods would be even better, in short, the longer the evaluation period, the lower the influence of luck on performance.

And yet, even if we could safely establish that luck is not the reason for which a fund delivered the best return performance, we could still not conclude that this fund is the best, or that its manager is the most competent. In order to make an apples-to-apples comparison, we would first need to account for the impact of one other factor, and that is, precisely, the key issue we discuss in this chapter.

Returns and Risk Taking

It is a cornerstone result in finance that, in the long term, higher risk pays off with a higher return. This suggests another reason for which a fund may end up at the top of a ranking based on long-term returns: it may simply be a very risky fund. In other words, top-performing managers may be doing something that we could perfectly do ourselves: exposing their portfolios to high risk in order to earn a high return.

The risk-return trade-off is open to all participants in the market, and there is no reason to give credit to a manager for playing a game we could play ourselves. A manager that delivers high returns simply by exposing investors to a high level of risk is adding little or no value. In other words, a proper ranking of performance would need to remove from returns the impact of luck and the impact of risk taking. We can take care of the former by evaluating performance on the basis of long-term returns. And we can take care of the latter by assessing risk-adjusted (return) performance with the measures we discuss below.

So, suppose we make a ranking of funds based on their long-term, risk-adjusted performance. Can we now trust that the top-performing funds are the best, or that their managers are the most competent? The short answer is yes. Having accounted for the impact of luck and risk taking on returns, what remains is performance due to superior information or skill. And putting our money in the top-performing funds of such ranking is a smarter move than betting on 17 or on that black horse.

Example:

Take a look at Table below 7.1, which displays annual summary statistics for the returns of six Fidelity funds and the S&P500 (S&P) for the ten-year period 1994-2003. The summary statistics are the mean return (AM), the standard deviation (SD), the beta with respect to the S&P, and the semi-variance with respect to a risk-free rate of 5% (SSD). The funds are the Fidelity New Millennium (FNM), Fidelity Value (FV), Fidelity Low Priced Stocks (FLPS), Fidelity Select Defense and Aerospace (FSDA), Fidelity Real Estate Investment (FREI), and Fidelity Select Technology (FST).

Table 7.1: Statistics for Returns of Six Fidelity Funds and the S&P500

	FNM	FV	FLPS	FSDA	FREI	FST	S&P
Return (AM)	23.3%	12.7%	16.9%	16.5%	13.1%	24.6%	13.0%
Total Risk (SD)	28.9%	16.3%	13.1%	17.6%	12.4%	37.1%	15.8%
Market Risk (Beta)	1.3	0.8	0.6	0.8	0.2	1.8	1.0
Down Side Risk (SSD)	26.8%	20.4%	18.1%	21.0%	18.2%	33.1%	20.8%

Note that there is wide variability in both the return and the risk of these funds. The ten-year period for which we're calculating these summary statistics seems to be long enough to rule out the impact of luck on returns. As for risk, note that we're assessing it in three different ways: through total risk (SD), systematic risk (beta), and downside risk (SSD). Note also that, if we were to rank these funds on the basis of their return performance, FST would be at the top and FV at the bottom. Should we then put our money in FST?

Not so fast. Although we're assessing returns over a ten-year period and we can therefore virtually rule out the impact of luck, we still have not adjusted the return of these funds by their risk. And there are, in fact, different ways of doing so, the most relevant of which we discuss below.

Risk Adjusted Rate of Return for Measuring the Performance of Portfolio

Risk Adjusted Return is a measurement of how much an investment returned in relation to the amount of risk it assumed. It is frequently used to compare a high-risk, potentially high-return investment with a low-risk, lower-return investment. An investment producing higher return is not necessarily better than the investment which yields a lower rate of return, if the risk assumed by investing in security with higher return also means higher than proportionate risk reward ratio as compared to security paying lower return.

So it becomes necessary that an investor should compare risk adjusted return and just not simple return of different securities before deciding on the most appropriate security to put his money in.

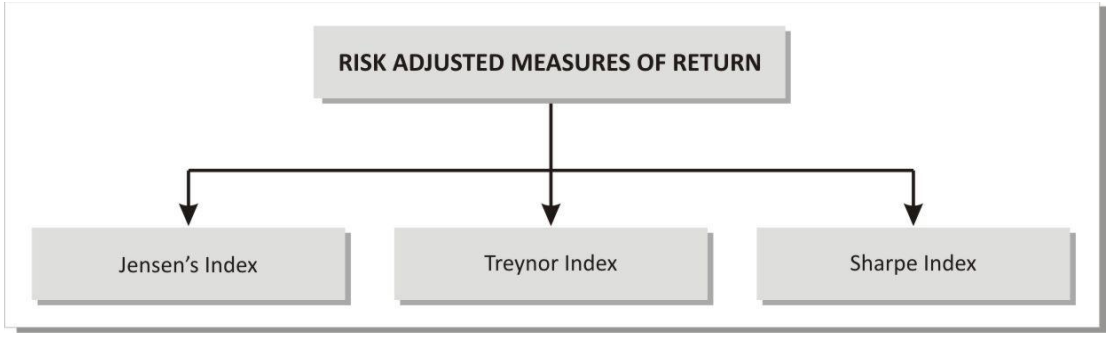

Exhibit 7.1: Risk Adjusted Measures of Return

JENSEN INDEX AS A MEASURE OF RETURN

Jensen's measure (Alpha**)** is used to determine the excess return of a stock, security, or portfolio over the security's required rate of return as determined by the Capital Asset Pricing Model (CAPM). It reflects the difference between the return actually earned on a portfolio and the return the portfolio was supposed to earn, given its beta as per Capital Asset Pricing Model. The basic tenet of the CAPM model is that a prudent investor would have diversified all his diversifiable risk so the reward an investor gets in form of returns is actually for the Systematic Risk he takes and this measures tells us what that return should be as per the systematic return one assumes by investing in a security. Jensen measures the difference between a mutual fund`s actual return and those that could have been earned on a passive benchmark portfolio with the same amount of market risk (the same beta). This model is used to adjust for the level of beta risk, so that riskier securities are expected to have higher returns.

To calculate alpha, the following inputs are needed:

- The realized return (on the portfolio),
- The market return,
- The risk-free rate of return, and α
- The beta of the portfolio.

Jensen measure (ALPHA) = Portfolio return – [Risk free rate + (market return- risk free rate) $\times$ portfolio beta]

$$\alpha_p = R_p - \{R_f + \beta_p \times [E(R_M - R_f)]\}$$

Where, α_p = Jensen measure (ALPHA)

RP = Return on the Portfolio

RF = Risk Free return.

β_P **=** Beta (Systematic Risk) of the Portfolio.

R_M = Expected Return of the Market.

The interpretation of the Jensen index is straightforward. A positive alpha indicates risk-adjusted performance above our required compensation for risk, and a negative alpha indicates the opposite. Furthermore, the larger the alpha, the better the fund's risk-adjusted performance. An alternative way of thinking about the Jensen index is as a measure of risk-adjusted performance relative to a passive (buy-and-hold) strategy of investing in the market. Therefore, a positive alpha indicates risk-adjusted performance above the passive strategy; a negative alpha indicates the opposite; and the larger the alpha, the better the fund.

Table 7.2: Top Risk Adjusted Performer

	FNM	FV	FLPS	FSDA	FREI	FST	S&P
Jensen	7.6%	1.7%	6.9%	5.2%	6.2%	5.4%	0.0%
Treynor	13.8	10.3	19.1	14.7	34.4	11.1	8.0
Sharpe	63.4	47.5	90.4	65.4	65.4	52.9	51.0
RAP	15.0%	12.5%	19.3%	15.3%	15.3%	13.3%	13.0%
Sortino	68.5	37.9	65.4	54.7	44.3	59.2	38.7

Let's apply this measure to the funds in Table 7.1. Let's assume a risk-free rate of 5%, and a market risk premium equal to the difference between the 13% mean return of the S&P in the table and the 5% risk-free rate (that is, 8%). Consider the FNM fund, which delivered a mean annual return of 23.3%. Given its beta of 1.3, the required return on this fund is 15.7% = 0.05 + 0.08 · 1.3. And, given its observed return and required return, its alpha is 7.6% = 23.3% -15.7%, which indicates that this fund performed 7.6 percentage points above the required compensation for its risk (and above the risk-adjusted performance of the market, which is, by definition, 0). In fact, as the second row of Table 7.2 shows, the FNM fund has the largest alpha and is therefore the top risk-adjusted performer.

Take a closer look at the second row of Table 7.2 and compare it with the second row of Table 7.1. Note that the best-performing fund in terms of returns (FST) is not the best-performing fund in terms of risk-adjusted returns (FNM), and the worst-performing fund in terms of returns (FV) is not the worst-performing investment in terms of risk-adjusted returns. (In the latter case, the FV fund outperforms, on a risk-adjusted basis, an investment in the market.)

The FST fund, for example, delivered mean annual returns of 24.6%, much higher than those of the FSDA fund (16.5%). But that is an 'unfair' comparison. FST has a much higher beta than FSDA (1.8 versus 0.8) and therefore a much higher required return (19.2% versus 11.3%). On a risk-adjusted basis, FST did outperform FSDA but only very slightly (5.4% versus 5.2%). In short, a proper ranking of funds should consider both the return delivered by the funds and the risk borne by investors.

Note, finally, that the funds we're dealing with performed well in the sense that they all delivered a return higher than required as compensation for their risk. Although it is not the case among our funds, at least during the time period we're evaluating them, it is perfectly possible that a fund or an asset has a negative alpha.

Example:

Following are the data given on two portfolios P and Q:

	P	Q	Market Return
Return (%)	11	15	12
Beta	0.65	1.15	12
Risk Free Rate (%)	8	8	

So Jensen ALPHA of the portfolio P = 11-[8 + 0.65(12-8)]

= 11-[8 + 0.65(4)]

= 11-(8 + 2.60)

= 11-10.60

= 0.40

So Jensen ALPHA of the portfolio Q = 15-[8 + 1.15(12-8)]

= 15-[8 + 1.15(4)]

= 15-(8 + 4.60)

= 15-12.60

= 2.40

Higher Alpha is preferable to lower alpha for a Fund or Stock as higher alpha indicates that portfolio manager has been able to beat the market by a good margin. Or we can say that the fund is giving higher return than that it should have given as per the CAPM Model.

There are two ways to look at Jensen's Alpha:

1. How much the fund has beaten its benchmark?
2. How much risk the fund manager has taken to achieve the return it has generated.

A Jensen Alpha value of just above zero indicates that the fund manager has stuck to the investment mandate, which is the same as fund objective. Higher the value above zero, higher is the risk taken by the fund manager to beat the market with his stock picks.

Jensen's alpha analyses the fund's performance against its benchmark, it's a good tool to analyze fund manager's performance.

Important Points on Jensen Alpha

1. Jensen Alpha is an absolute measure (in terms of the same units as the unit of the data) of performance and measures how well a managed portfolio performed relative to an unmanaged portfolio of equal risk.

2. It determines how much the realized return differs from the required return.
3. Jensen Alpha value indicates whether a portfolio manager is superior or inferior in market timing and stock selection. A positive alpha indicates a superior manager, and a negative alpha indicates an inferior manager.

Example: Assume a return of 15 percent with a beta of 1.2 for manager X when the market return is 14.3 percent and the risk-free rate is 7 percent. The alpha is expressed as;

a. Jensen Alpha = 0.15 - [0.07 + (0.143 - 0.07)1.2] = **- 0.0076**
b. This indicates inferior performance because it is negative. If portfolio manager Y earns a return of 12.5 percent with a beta of 0.7, then the alpha is expressed as Jensen Alpha = 0.125 - [0.07 + (0.143 - 0.07)0.7] = **0.0039**
c. This indicates superior performance because it is positive. The absolute return for manager X is higher, but the risk-adjusted return for manager Y is greater, denoting superior performance. Manager Y not only outperformed manager X but also outperformed the market return on a risk-adjusted basis. In the example, portfolio X performed 0.76 percent less than the market, whereas portfolio Y performed 0.39 percent better than the market.

TREYNOR INDEX AS A MEASURE OF RETURN

The Jensen Index is a widely used measure for assessing the risk-adjusted performance of funds but it's not free from problems. To illustrate this, consider two funds, A and B, with required returns of 10% and 40%. Assume that over a ten-year period the observed mean returns of A and B were 15% and 45%, which would yield an alpha of 5% in both cases. According to the Jensen index, then, the (risk-adjusted) performance of these two funds has been the same. But are they equally attractive to investors?

Not really. Think about it this way. Both A and B outperformed their required return by 5 percentage points. In the case of A, 5 points is 50% of its required return (5%/10%), but in the case of B, 5 points is just 12.5% of its required return (5%/40%). Which fund would you choose?

The problem with the Jensen index is that it doesn't capture appropriately performance per unit of risk (or per unit of required return). Compare, for example, the FSDA and FST funds, which have betas of 0.8 and 1.8, required returns of 11.3% and 19.2%, and alphas of 5.2% and 5.4%. Therefore, the risk-adjusted performance of FST is 0.2% better than that of FSDA. But would you really pick FST over FSDA? Does a superior performance of 0.2% a year make up for an increase in risk (beta) from 0.8 to 1.8? Or, put differently, does an outperformance of 5.4% over a required return of 19.2% look better than one of 5.2% over a required return of 11.3%?

According to Treynor measure systematic risk is measured by beta. The Treynor ratio is a Reward-to-Risk ratio that looks at systematic / market risk only. It is a ratio of returns generated by the fund over and above risk-free rate of return (e.g. return on Government securities) during a given period and systematic risk associated with it. It reflects the excess return earned per unit of risk. It implicitly assumes that the portfolio is well diversified.

It's also known as the Reward to Volatility Ratio, it is the ratio of a fund's average excess return to the fund's systematic risk (beta). The absolute risk adjusted return is the Treynor plus the risk free rate. So formula to calculate this is:

$$\text{Treynor Measure} = \frac{(\text{Return on Portfolio} - \text{Risk Free Return})}{\text{Beta of Portfolio}}$$

$$\text{Treynor Measure} = \frac{R_p - R_F}{\beta_P} \qquad (7.2)$$

Where,

R_P = Return on the Portfolio

R_F = Risk Free return

β_P = Beta of the Portfolio

The numerator of the Treynor measure is the risk premium earned by the portfolio and the denominator is the systematic risk (beta).

Important Points on Treynor Ratio

1. Relative measure (related to other variables) of the risk-adjusted performance of a portfolio based on the market risk (i.e., the systematic risk); therefore used with diversified portfolios.
2. Risk is measured by the Beta coefficient (β).
3. If the portfolio is fully diversified (all nonsystematic risk has been eliminated), then both indices (Sharpe and Treynor) should yield the same results, because diversification will eliminate all unsystematic risk from the portfolio.
4. Because this is a relative measure, the Treynor index must be used to compare alternative investments. A higher treynor measure or ratio is better as it means that the portfolio is able to generate a higher return, after accounting for the risk free return, taking the same level of systematic risk.
5. The Treynor measure or index should be computed for the market to determine whether a particular portfolio has outperformed the market. The results do not indicate by how much each portfolio outperformed the market.

Example: Let's assume that we look at a one year period of time where a portfolio returned 12%. Treasury bills earned 6%, the beta of the portfolio is 1.20

Therefore Treynor Measure = $\frac{12-6}{1.20}=5$

So, the above portfolio in the example is generating higher return by considering the risk free rate (6%) and systematic risk (1.20%), and it outperformed the market though do not indicate by how much outperformed the market.

You see the problem with the Jensen index. It is certainly an improvement over assessing funds solely on the basis of their returns, but it could also be improved upon. In fact, that is just what our next measure of risk-adjusted returns does. For any fund i, the Treynor index **(T_i)** is given by and

$$T_S = \frac{R_S - R_F}{\beta_S}$$

Measures excess returns (that is, returns in excess of the risk-free rate) per unit of risk (beta). For the sake of clarity, this expression is often multiplied by 100.

Unlike the Jensen index, which produces a number expressed in percentages and easy to grasp, the Treynor index produces a number with little intuition. Second, given its lack of intuitive interpretation, the Treynor index is used only as a tool to assess relative performance; that is, if given two funds A and B it is the case that $T_A > T_B$, the risk-adjusted performance of fund A is better than that of fund B.

Let's now go back to the FSDA and FST funds. The first has a Treynor index of 100 · (0.165 - 0.05)/0.8 = 14.7 and the second one of 100 · (0.246 - 0.05)/1.8 = 11.1. These two numbers have, as we have just argued, little intuitive meaning but put together indicate that, contrary to the result we arrived at in the previous section, FSDA outperforms FST in terms of risk-adjusted returns. To be sure, it will not always be the case that rankings of funds based on the Jensen index and the Treynor index will differ but, when they do, the latter provides the more reliable ranking. Let's see why.

At the beginning of this section we argued that the Jensen index does not capture appropriately returns per unit of risk. Another way of making the same point is to say that the Jensen index ignores the impact of leverage on performance. Take a look at Exhibit 7.2, which depicts the FSDA and FST funds as well as the securities market line (SML), which indicates required or expected returns according to the CAPM. Note that the Jensen index is measured as the vertical distance between each fund and the SML. As we had seen before, this index is 5.2% for FSDA and 5.4% for FST.

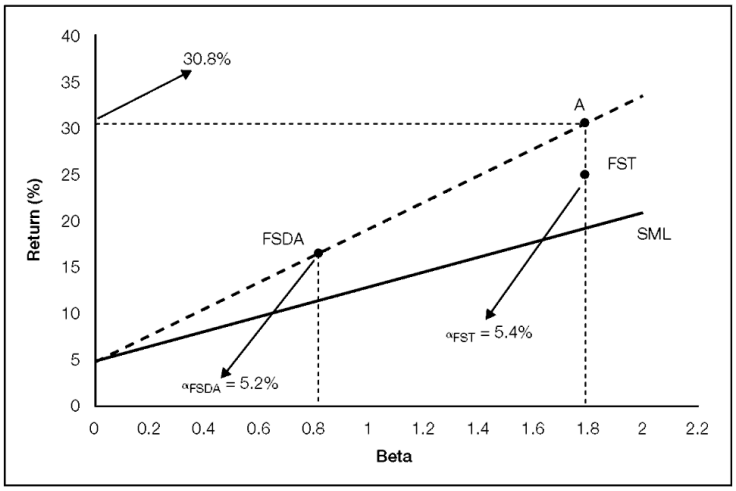

Exhibit 7.2: Return of the Fund

Jensen index vs. Treynor index

Now, here's something we could do: we could borrow money at the risk-free rate, invest that money plus our initial capital in the FSDA fund (this is of course what leverage is all about), and end up with portfolio A. By construction, portfolio A has the same risk as the FST fund (a beta of 1.8), but the interesting point is that it also has a higher return (30.8%). So, by leveraging our position in FSDA, we end up with a two-asset portfolio (a long position in the FSDA fund and a short position in the risk-free rate) that outperforms FST on a risk-adjusted basis. In short, FSDA provides better risk-adjusted returns than FST.

Three points to note. First, that graphically the Treynor index of a fund is represented by the slope of a line connecting the risk-free rate and the fund, just like the dotted line that connects the 5% risk-free rate and the FSDA fund in Exhibit 7.1. Second, note that as the Treynor indices in Table 7.2 show, although FSDA outperforms FST, it is itself outperformed by the FREI and FLPS funds. And third, note that the rankings based on the Jensen and Treynor indices differ. Whenever this is the case, given the problem with the Jensen index discussed above, the rank based on the Treynor index is more reliable. (Still, don't count out the Jensen index which, despite its flaw, is widely used in practice.)

SHARPE RATIO AS A MEASURE OF RETURN

The Sharpe Measure is similar to Treynor Measure except that it employs standard deviation and not beta. The Sharpe ratio measures the performance of a portfolio, adjusted by the return of risk free assets, over the risk of portfolio. A higher sharper ratio is better as it means that the portfolio is able to generate a higher return, after accounting for the risk free return, taking the same level of risk. The larger the Sharpe ratio is, the better the risk-to-reward trade-off.

$$\text{Sharpe Measure} = \frac{\left(R_p - R_F\right)}{\sigma_P} \qquad (7.3)$$

Where
R_p = Return on Portfolio.
R_f = Risk Free Return.
σP = Standard Deviation of the Portfolio.
To evaluate the overall performance of a portfolio, especially when it is compared to another portfolio or index such as the BSE index, Nifty etc. the Sharpe Ratio is an appropriate measure.

It tells us whether the returns of a portfolio are due to smart investment decisions or a result of excess risk. This measurement is very useful because although one portfolio or fund can reap higher returns than its peers, it is only a good investment if those higher returns do not come with too much additional risk. The greater a portfolio's Sharpe Ratio, the better its risk-adjusted performance has been.

The Treynor index adjusts returns by risk as measured by beta. This may be appropriate for investors who are diversified across funds; that is, for those who spread their capital over several funds. However, many investors diversify across stocks by putting their money into just one or two funds. Some investors, for example, buy the Index fund as a way to diversify broadly across all market stocks.

In these cases, the systematic risk of a fund does not get diversified away and beta ceases to be the appropriate measure of risk. In other words, investors that concentrate their holdings into just one or two funds bear the total risk of the fund (rather than just its systematic risk), which as we know is measured by the standard deviation of returns. That is, precisely, the insight of our third measure of risk-adjusted returns.

For any fund i, the Sharpe ratio **(S_i)** is given by

$$S_i = \frac{(R_i - R_f)}{\sigma_i}$$

where SD_i is the standard deviation of fund i. As equation clearly shows, the Sharpe ratio measures excess returns per unit of risk, the latter measured by the standard deviation of returns. For the sake of clarity, this expression is often multiplied by 100.

Note that, just like the Treynor index, the Sharpe ratio yields a number with little intuition (excess returns per unit of total risk). For this reason, the Sharpe ratio is also used only as a tool to assess relative performance; that is, if given two funds A and B it is the case that $S_A > S_B$, the risk-adjusted performance of fund A is better than that of fund B.

The calculation of Sharpe ratios, as equation (7.3) suggests, is very simple. The FLPS fund, for example, has a Sharpe ratio of 100 · (0.169 - 0.05)/0.131 = 90.4 and is, according to this measure, the top performer on a risk-adjusted basis. Note that a ranking of our six funds based on Sharpe ratios is different from a ranking based on either the Jensen index or the Treynor index. This should not be entirely surprising. These last two indices measure risk with beta and the Sharpe ratio with the standard deviation of returns. In other words, if we change the definition of risk, we're likely to change the ranking of funds.

Very often you will find that summary information about funds includes at least their mean return, volatility measured by the standard deviation, and the Sharpe ratio.

The reason that the Sharpe ratio is more widely used than the Treynor index is simple. The intention of most ranks is to assess the performance of each individual fund in isolation, from where the emphasis on total risk follows directly.

Important Points of Sharpe Ratio

1. The numerator in both the Treynor Ratio and Sharpe Ratio is same i.e. the risk premium, but the two differ with respect to the denominator. The denominator in Sharpe Ratio, is risk is measured by σ (Standard Deviation i.e. total risk), while in case of Treynor, it is measured by β (Beta i.e. the systematic risk**).**
2. Relative measure of the risk-adjusted performance of a portfolio based on total risk (= systematic + nonsystematic risk)
3. Because Sharpe Ratio uses Standard Deviation (total risk), it implies that the portfolio is not well diversified, then the portfolio return be adjusted for diversifiable risk also. So, the Sharpe Index adjusts the portfolio return for systematic as well as unsystematic risk.
4. Because this is a relative measure, the Sharpe Ratio must be used to compare alternative investments.

   Note: In comparing, higher Sharpe ratio is better. In case of equities, the larger the fund the more difficult the task and therefore more superior the performance if the Sharpe is high.
5. If the portfolio is fully diversified (all nonsystematic risk has been eliminated), then the Sharpe Ratio should yield similar results for a comparison of several investments as the Treynor Ratio.

If the portfolio is well diversified, Treynor Ratio is appropriate for evaluating the performance of a portfolio. However, if the portfolio is not well diversified, Sharpe Ratio should be used.

Finally, note that the Treynor Index and the Sharpe Ratio do not always rank funds in different order. There are at least two circumstances in which the two ranks concur. First, when for any given set of funds differences in systematic risk are roughly proportional to differences in total risk. And second, when the funds evaluated are all broadly diversified.

RISK ADJUSTED PERFORMANCE (RAP): OR M^2 OR MODIGLANI – MODIGLANI MEASURE

The Sharpe ratio is, without a doubt, one of the most widely used tools to assess the risk-adjusted performance of funds. However, as we have discussed, it has one little problem it shares with the Treynor index: the number it yields has little intuitive interpretation. This motivated Nobel-prize winning economist Franco Modigliani and his granddaughter Leah Modigliani (from Morgan Stanley) to develop the RAP, a measure that preserves the attractive characteristics of the Sharpe ratio but at the same time has a more intuitive interpretation. For any fund i, its risk-adjusted performance **(RAPJ** is given by

$$\text{RAP or } M^2 = R_F + (R_i - R_f) \times \frac{\sigma_M}{\sigma_i} \quad (7.4)$$
$$= R_F + \sigma_m \times S_i$$

Where σ_m = Standard Deviation of Market
σ_i = Standard Deviation of Security
R_F = Risk Free Return
R_i = Return on Security
S_i = Sharpe Ratio of Security (i)

The idea behind the RAP is to adjust the return of each fund in such a way that funds that are riskier than the market are 'punished' with a decrease in their mean return, and those that are less risky than the market are 'rewarded' with an increase in their mean return. Let's look at the numbers.

Let's compare the FLPS fund, which has a mean return of 16.9% and a volatility of 13.1%, with the FNM fund, which has a mean return of 23.3% and a volatility of 28.9%. Note that given the volatility of the market (15.8%), FLPS is less risky than the market and FNM is more risky. Note, also, that a simple comparison of mean returns would indicate that FNM is much more attractive than FLPS, given that it delivered a substantially higher mean return (6.4 percentage points). But we know by now that there's more to a proper comparison than just that. Let's then look at the RAPs.

The RAP of the FLPS fund is equal to

0.05 + (0.169 - 0.05) · (0.158/0.131) = 19.3%

And that of the FNM fund is equal to

0.05 + (0.233 - 0.05) · (0.158/0.289) = 15%

This indicates that FLPS outperforms FNM on the basis of risk-adjusted returns. But the RAP numbers provide some further intuition. The RAP of FLPS (19.3%) indicates that after rewarding this fund for being less volatile than the market, its mean return increases from 16.9% to 19.3%. The RAP of the FNM fund (15.0%), on the other hand, indicates that after punishing this fund for being more volatile than the market, its mean return decreases from 23.3% to 15.0%. The 4.3 percentage points difference in the RAPs, then, is a pure difference in risk-adjusted returns.

The reward and punishment imposed by the RAP on mean returns seeks to avoid a comparison between apples and oranges. Funds of different risk are not directly comparable. But once funds are punished and rewarded for being more or less volatile than the market, then they are made comparable among themselves and comparable to the market. In other words, if we compare the

returns of different funds we compare apples and oranges, but if we compare the RAPs of different funds we compare apples and apples. And we compare them in percentages, which are easier to grasp than ratios with little intuitive meaning.

Note that the RAPs in Table 7.2 indicate that all funds outperformed the market on a risk-adjusted basis. (By definition, the market's RAP is equal to its mean return, 13% in our case.) Note, also, that a ranking of funds by their RAPs and another by their Sharpe ratios are identical. This follows directly from the second equality in (7.4), which shows that the RAP is simply a monotonic transformation of the Sharpe ratio. This is just a fancy way of saying that if we multiply Sharpe ratios by a positive number (in our case, the standard deviation of the market) and then add another number (in our case, the risk-free rate), then the relative ordering of the funds 'must be the same as that produced by the Sharpe ratios.

In sum, the RAP measures risk with the standard deviation of returns just like the Sharpe ratio; it preserves the rankings produced by the Sharpe ratio; but it's expressed in percentages and therefore has a more intuitive interpretation than the Sharpe ratio.

SORTINO RATIO AS A MEASURE OF RETURN

Our last measure of risk-adjusted returns is very similar to the Treynor ratio and the Sharpe ratio but uses a different definition of risk. In this case, risk is measured by the semi-variance (or downside standard deviation of returns). Downside risk in general and the semi-variance in particular is discussed before in chapter 4 and, as argued there, is becoming increasingly popular among practitioners.

For any fund i, the Sortino ratio **(N_i)** is given by

$$N_i = \frac{R_i - B}{\text{Semi Variance}_{Bi}} \qquad (7.5)$$

Where B is a benchmark return essentially, the Sortino ratio adjusts the returns of the fund in excess of any benchmark B relevant for the investor by the volatility of the fund below that benchmark. Note that, again only for the sake of clarity, equation (7.5) is often multiplied by 100.

As equation (7.5) shows, calculating Sortino ratios is very simple. Considering a benchmark return equal to the risk-free rate ($B = R_f$), the Sortino ratio of the FNM fund is equal to $68.5 = 100 \cdot (0.233 - 0.05)/0.268$. As Table 7.2 shows, FNM is the best-performing fund according to this measure. This table also shows that the ranking of funds on the basis of their Sortino ratios is different from the rankings based on our previous measures of risk-adjusted returns. Again, this should not be surprising. Although the numerators of the Treynor index, the Sharpe ratio, and the Sortino ratio are the same (in this last case because we chose a benchmark equal to the risk-free rate), their denominators (that is, their definition of risk) are all different.

Finally, note that one of the appealing characteristics of the Sortino ratio is that it can be tailored to any benchmark return B that is relevant to each individual investor. Once this benchmark is chosen by the investor, both excess returns and downside volatility are calculated with respect to that benchmark.

Different Ways to Look At Risk

In the following TABLE Returns on five mutual fund schemes are given:

Schemes	3-years Returns	Jensen's	Sharpe	Treynor
DSP ML T.I.G.E.R	45.70	0.08	0.11	0.5
SBI-Contra	45.48	0.1	0.11	0.53
Kotak Opportunity Fund	44.40	0.24	0.14	0.66
DWS Investment Opportunity Fund	43.68	0.42	0.18	0.85
ICICI Prudential Dynamic Plan	43.54	-0.06	0.07	0.35

Returns across the above 5 schemes are high and uniform, DWS Investment Opportunity Fund has the best scores across all four ratios. ICICI Prudential Dynamic Plan scores the least.

Risk vis-à-vis Benchmark

Schemes	Benchmark	3-years Returns	5-years Return	Jensen
Taurus Starshare	BSE 200	40.13	57.07	6.35
Kotak Opportunities	S&P CNX 500	43.45	N.A.	10.11
Reliance Growth Fund	BSE 100	40.79	63.74	5.32
Sundaram BNP Paribas Select				
Midcap	BSE MID-CAP	38.58	59.45	**9.47**
Tata Infra Structure	BSE Sensex	44.33	N.A.	6.68

Sundaram Midcap has a high alpha compared to Reliance Growth in the category indicating the fund taking higher than mandated risk.

Market Risk or Total Risk

Schemes	3-years Returns	BETA	Treynor	Jensen
Taurus Starshare	40.13	1.05	0.28	0.28
Kotak Opportunities	43.45	1.00	0.33.	0.34
Reliance Growth Fund	40.79	0.91	0.29	0.29
Sundaram BNP Paribas Select				
Midcap	38.58	0.93	0.33	0.31
Tata Infra Structure	44.33	1.00	0.31	0.33

A fund with a beta greater than 1 is considered more volatile than the market, less than 1 means less volatile. With a beta of 1, Tata Infrastructure moves in sync with the market.

Some Facts: Not all the rankings of funds in the financial press are flawed. In fact, some take steps to account for the two main factors we discussed in this chapter. In order to account for the impact of luck, besides the one-year return, most rankings also provide three-year and five-year returns. And, in order to account for risk, most rankings group funds into 'styles' (such as growth, value, small cap, and large cap) with the idea that although risk is quite different across styles, it is not so different within each style. Having said that, the risk of different funds within a style may in fact vary substantially and the best way to account for this variation is to compare them on the basis of risk-adjusted returns.

Value Research, the best-known fund-rating company in India, has popularized the use of the 3 x 3 style box with three styles at the top (value, core, and growth) and three styles on the side (large cap, mid cap, and small cap). This yields a square with nine boxes, each box representing a different style. Funds are then allocated to the boxes and evaluated with respect to their peers. A fund that invests in technology stocks and another that invests in utilities have little in common. They would therefore be placed in different boxes and evaluated in relation to their respective peers. However, note that although comparing the returns of these two funds would in fact be pointless (just as comparing apples with oranges), comparing their risk-adjusted returns would be entirely appropriate and, at the end of the day, is the correct comparison to make.

Finally, a brief reference to the widely used and abused expression 'beating the market.' Hopefully by now you have realized that this expression is largely pointless. Beating the market last year means little because maybe we just got lucky. And beating the market in the long term is always possible if we're willing to take more risk than that of the market. A rightful claim to beating the market can only be made on the basis of long-term, risk-adjusted returns; that is quite different from the

context in which this expression is typically used. In sum, next time you hear someone bragging that last year he beat the market, you now have the tools to perhaps prove him wrong.

Investment opportunities should not be ranked on the basis of their returns. A proper ranking must take into account both the risk and the return of the relevant assets or, more precisely, their risk-adjusted returns. In fact, a proper ranking must disentangle the impact on returns of luck, risk taking, and ability. The impact of luck can be removed by assessing returns over long periods of time. The impact of risk can be assessed with the methods discussed in this chapter.

There exist several ways of adjusting returns by risk, largely depending on the relevant definition of risk. These different methods may yield substantially different rankings of assets, which reinforce both the ambiguity and the importance of the concept of risk. Be that as it may, it is clear that the only proper way of ranking assets is on the basis of their long-term, risk-adjusted returns.