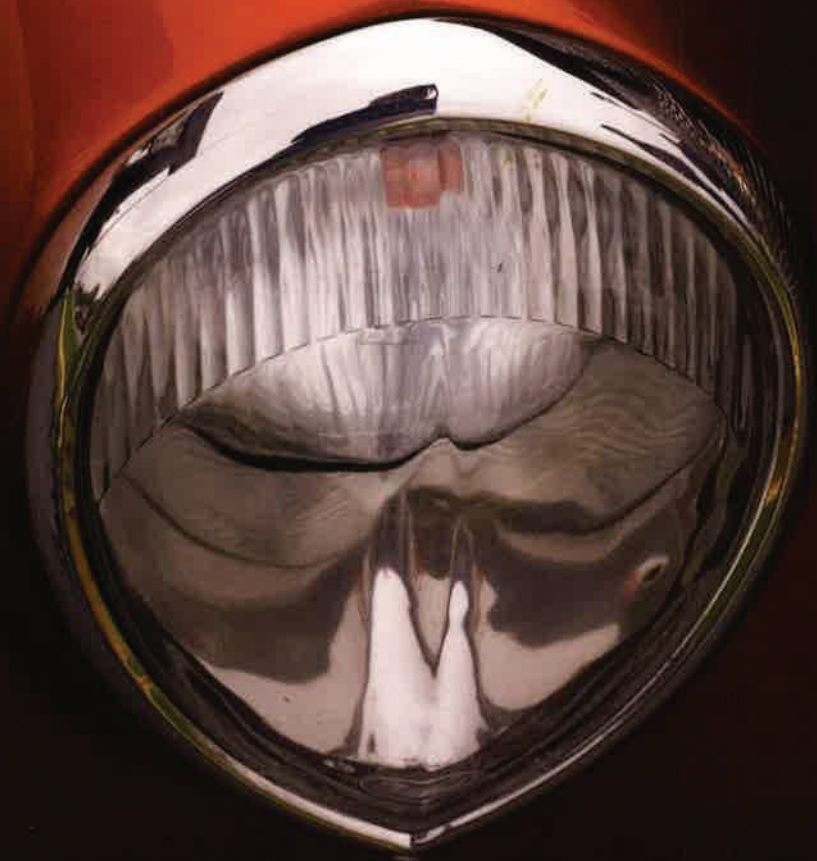


LAURENCE BOOTH | SEAN CLEARY
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CORPORATE FINANCE



CORPORATE FINANCE

FINANCIAL MANAGEMENT
IN A GLOBAL ENVIRONMENT

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PROBLEM

- a. Calculate the Sharpe ratio for each of the following securities, assuming a risk-free rate of 3 percent:

<i>Security</i>	<i>Expected Return</i>	<i>Standard Deviation of Returns</i>
A	4%	3%
B	5%	5%
C	4.5%	7%
D	3.5%	2%

- b. Which security has the best reward-to-risk ratio?

EXAMPLE 9.4
Sharpe Ratios**Solution**

a.

<i>Security</i>	<i>Sharpe Ratio</i>
A	0.33
B	0.40
C	0.21
D	0.33

- b. Security B has the highest Sharpe ratio.

stock has return of 6 percent and a standard deviation of returns of 7 percent. If the return on the risk-free security is 2 percent, the Sharpe ratio of the stock is 0.5714:

$$\text{Sharpe ratio} = \frac{0.06 - 0.02}{0.07} = 0.5714$$

1. What is the market price of risk according to the CML?
2. If the expected return on a diversified portfolio lies above the CML, should an investor buy or sell it?
3. When is the expected return equal to the required return?
4. Why is the Sharpe ratio frequently referred to as a "risk-adjusted" measure of performance?

Concept Review Questions**9.3 THE CAPM AND MARKET RISK**

The CML provides a method of estimating the required return on equity assets relative to their risk, but it applies only to efficient portfolios and not to individual securities. In addition, the risk premium is based on portfolio risk, as measured by the standard deviation of the return on the portfolio. In financial management, we are usually concerned with the risk associated with individual firms and the required return for investing in them. From the principles of diversification, we know that as the number of securities included

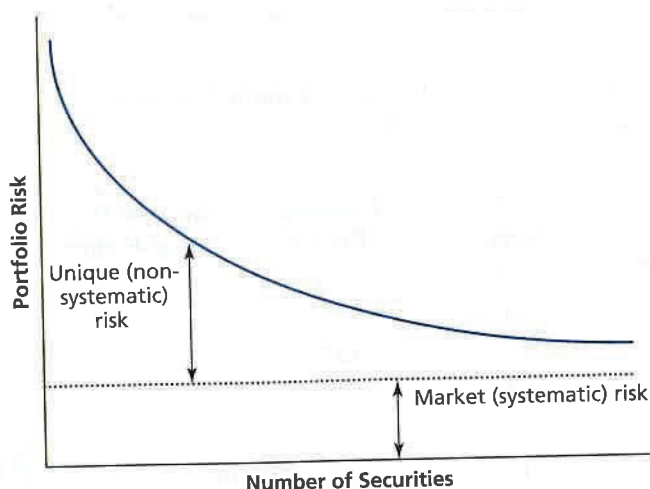


FIGURE 9-8 Portfolio Risk and Diversification

in a portfolio increases, unique (nonsystematic or diversifiable) risk is eliminated, and only market (systematic or nondiversifiable) risk remains. We depict this relationship in Figure 9-8.

We show the average risk of an individual security in Figure 9-8, where the curve gets very close to the vertical axis, that is, a one-stock portfolio. Therefore, by randomly building diversified portfolios, the risk of a portfolio falls until it reaches a baseline, and we cannot reduce risk below this market level. What this means is that part of an asset's risk is diversifiable. Further, if it can be diversified away by holding a portfolio of more than, say, 20 different assets, it is not important to rational investors. This is the key insight of the CAPM.

GLOBAL PERSPECTIVE | Is There Still a Benefit from International Diversification?

The implication of modern portfolio theory and the capital asset pricing model is that investors can benefit from holding a well-diversified portfolio. Investing internationally has been seen as one way to enhance diversification, reducing the level of market risk below the level available domestically. This is because different countries have different economic growth and different timing and extent of expansions and contractions in their business cycle.

But is this still true? With market integration on a global scale, increased international trade and flow of funds, and increased cooperation among central banks in times of economic stress, is there still diversification benefit from investing internationally?

Much of the evidence suggests that there is a little benefit from international diversification in developed markets, but some diversification benefit remaining in emerging markets, where an emerging market is a market in an economy in which there is low to middle per capita income.⁹ Therefore, an investor in the U.S. is not likely to achieve much diversification by investing in Germany or Japan. But a U.S. investor may achieve diversification by investing in Morocco or Indonesia.

So, yes, it is possible to reduce risk by investing internationally, but the benefit depends on which country.

⁹ Peterson Christoffersen, Vihang R. Errunca, Kris Jacos, and Xisong Jin, "Is the Potential for International Diversification Disappearing?" working paper, March 16, 2010, Available at SSRN: ssrn.com/abstract=1573345.

Beta

In the CAPM, rational investors are not compensated for unique or diversifiable risk because it can be eliminated through diversification. This implies that market risk is the appropriate measure of risk to determine the risk premium required by investors for holding a risky security. We now introduce a new term, **beta (β)**, which is a commonly used measure of market risk that relates to the extent to which the return on an asset moves with that on the overall market.

We typically estimate beta by first plotting the returns on an individual security on the vertical axis relative to the returns for the market, which we plot along the horizontal axis, and then fitting a line through the observations, as we show in Figure 9-9. The line is the **characteristic line**, and we determine it by using a statistical technique called regression analysis. Regression is a statistical method of determining the best fitting line that depicts the relationship between two variables; in this case, between the return on an asset and the return on the market portfolio. The slope of the line is the asset's beta coefficient. For example, in Figure 9-7, the slope coefficient is 0.85, which indicates that if the return on the market portfolio goes up or down by 1.0 percent, the return on this asset is expected to go up or down by 0.85 percent, respectively; that is, it changes by 0.85 of the return on the market.¹⁰

Estimating beta coefficients is tricky because we are interested in the extent that an asset's returns move with the market over a future period. We typically estimate beta coefficients by using historical data, which assumes that what has happened in the past is a good predictor for the future. Typically, betas for securities are estimated by using 60 months of monthly returns, but sometimes 52 weekly returns are used. Betas change through time as the risk of the underlying asset or portfolio changes. This is particularly important for individual securities, for which betas can change quite dramatically over relatively short periods. Conversely, betas estimated for large portfolios or for industries are much more stable because of averaging over many assets. Therefore, estimates of portfolio betas show less change from period to period and are much more reliable than are the estimates for individual assets.

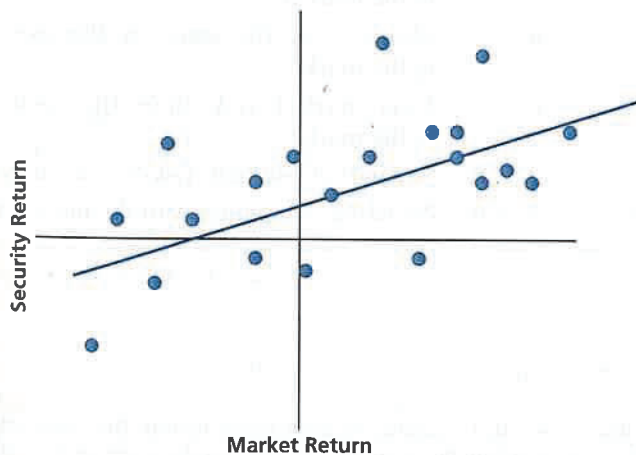


FIGURE 9-9 The Characteristic Line for Security A

beta (β) measure of market risk, or performance volatility, that relates the extent to which the return on an asset moves with that on the overall market; the covariance between an investment and the market divided by variance of the market

characteristic line line of best fit through the returns on an individual asset, plotted on the vertical axis, relative to the returns for the market, plotted along the horizontal axis

¹⁰ The characteristic line is also often estimated by using excess returns. The excess return is calculated by subtracting the risk-free rate from both the return on the stock and the return on the market. In excess return form, the same analysis applies.

Under some common statistical assumptions, we can estimate betas by using Equation 9-7:¹¹

$$\beta_i = \frac{\text{Covariance of returns in security } i \text{ with the returns on the market portfolio}}{\text{Variance of the market portfolio's returns}} = \frac{COV_{i,M}}{\sigma_M^2} = \frac{\rho_{i,M}\sigma_i}{\sigma_M} \quad (9-7)$$

In Equation 9-7, we can see that the beta of an individual asset is the ratio of the covariance of that asset's return with the market, compared to the total variance of the market portfolio's returns.

Beta is a measure of the risk of an individual asset, stock, or portfolio relative to the market portfolio. A beta of 1 implies that if the market return increased (or decreased) by 1 percent, the return on the security (or portfolio) would, on average, increase (decrease) by 1 percent. Therefore, the market portfolio, by definition, has a beta of 1. An asset with a beta of 1.2 has returns that are 1.2 times as volatile as market returns, both up and down. In other words, if the market increased 10 percent, that security's returns would increase by 12 percent, and so on.¹²

Consider an example. Stock One has a beta of 0.8, whereas Stock Two has a beta of 1.2. If the returns on the market increase by 3 percent, we expect:

- Stock One returns to increase by $0.8 \times 0.03 = 0.024$ or 2.4%
- Stock Two returns to increase by $1.2 \times 0.03 = 0.036$ or 3.6%

If the returns on the market decline by 3 percent, we expect:

- Stock One returns to decline by $0.8 \times 0.03 = 0.024$ or 2.4%
- Stock Two returns to decline by $1.2 \times 0.03 = 0.036$ or 3.6%

**SUMMARIZING:
BETAS AND
MARKET RISK**

<i>Beta</i>		<i>Market Risk</i>
Greater than 1.0	$\beta_i > 1$	More market risk than the average security in the market
Equal to 1.0	$\beta_i = 1$	Market risk the same as the average security in the market
Less than 1.0	$\beta_i < 1$	Less market risk than the average security in the market
0	$\beta_i = 0$	No market risk (e.g., risk-free security)
Less than 0.0	$\beta_i < 0$	Negative correlation with the market return ¹³

¹¹ The characteristic line is also often estimated by using excess returns. The excess return is calculated by subtracting the risk-free rate from both the return on the stock and the return on the market. In excess return form, the same analysis applies.

¹² You may notice that beta is an elasticity measure: It captures the sensitivity of the return on the stock to changes in the return on the market.

¹³ According to Equation 9-7, negative betas can only occur if an asset has a negative correlation coefficient with market returns, which is uncommon. This is the only way a negative beta is possible because the standard deviation terms in Equation 9-7 are always positive. Gold stocks have sometimes had negative betas because the price of gold tended to go in the opposite direction of the market; investors would invest in gold when they were nervous about future market movements. However, this relationship is not as strong as it used to be, and negative betas rarely occur, even for gold stocks.