Topic 11: Risk and Return (*Copyright © 2021 Joseph W. Trefzger*)

I. The Basic Idea

A. Expected Return Based on Stand-Alone Risk

Investors are thought to be *risk-averse*, in that they will not accept higher risk unless there is an acceptable likelihood of earning higher financial returns. In earlier discussions, we have represented the required rate of return based on the "stand-alone" risk of a single asset as

$$k = k_{rf} + IP + DP + LP + MP + FP \ ,$$

or more technically correct as

$$(1 + k) = (1 + k_{rf}) \times (1 + IP) \times (1 + DP) \times (1 + LP) \times (1 + MP) \times (1 + FP) \ ,$$

such that the rate of return expected in a given transaction is the real risk-free rate plus premiums to compensate for the risks of inflation, default, illiquidity, committing for a longer maturity, and foreign currency fluctuations. We have viewed this total as the interest rate that a lender would charge. Of course, holders of common stock do not receive "interest" payments, but their return on equity should also provide compensation for all risks faced. How do we compute a stockholder's annual rate of return?

Let's say you bought a share of XCorp stock a year ago, when its market value was \$30. During the past year you received \$1.50 in dividends, and today the stock is worth \$32 (a \$2 gain). We can measure your annual rate of return, after observing these values, as

$$\frac{\text{Dividends received during period} \quad + \quad \text{Change in value during period}}{\text{Value at beginning of period}}$$

$$= \quad \frac{\$1.50 + \$2.00}{\$30.00} = \quad 11.6\%.$$

So you earned an 11.6% annual rate of return. That 11.6% return (measured after the fact) may make you happy or unhappy, depending on whether you see 11.6% as a good return for the risk you faced owning the stock. The return you *expect* to earn should be high enough to compensate for all of the risks you perceive, but the return you actually earn depends on what has happened in the economy, the stock market, *etc*.

We like to state percentage rates of return on an annualized basis (so if we have a partial-year return we convert it to an annual equivalent), in order to make consistent comparisons across investments. [Be sure you see why, if the stock price had fallen rather than risen by \$2.00 per share, your annual rate of return would have been

$$\frac{\$1.50 - \$2.00}{\$30.00} = \quad -1.667\%.]$$

(Question: How would our computation of your annual rate of return over the past year change if you had instead bought the stock several years ago for $10 per share?)

All of the various premiums that lenders expect to receive as compensation for accepting risks are expected by stockholders, as well. The real risk-free rate and various premiums are incorporated into the *dividend yield* (the expected annual dividend as a proportion of the current price) and the *capital gain yield* (the expected percentage change in price over the coming year, as a proportion of the current price) that the stockholder expects to receive. For any type of investment, the combined effect of the various risk premiums is seen in the variance or, more typically, the *standard deviation* of returns that an investment might be expected to generate.

Risk is present if an expected outcome might not be realized. The "expected" return is the mean of a distribution of possible outcomes, so there is more risk if the possibilities cover a wide range (Investment A with 50% chance of 20% annual return, 50% chance of 0% annual return = 10% expected annual return) than if the possibilities cover a narrow range (Investment B with 50% chance of 11% annual return, 50% chance of 9% annual return = 10% expected annual return, also). [We could note that a risk-neutral investor would be indifferent between A and B, but a more-typical risk-averse investor would choose the more predictable B if their costs were the same. A risk-averse investor would choose an investment with a more uncertain range of possible payoffs only if the price were sufficiently low to cause the uncertain dollar payoffs to represent a higher expected annual percentage return.] Here Investment A would have the higher standard deviation (actual outcome will likely be farther from the mean, or expected, return), and thus would be seen as the riskier investment – and a higher annual rate of return would be expected. Another way to think about it is that an investment is riskier if its cash flows are likely to differ unpredictably (not based on predictable seasonal or cyclical factors) from period to period in the future.

B. Return Based on Risk in a Portfolio Context

But now we move to considering the return required by a common stockholder who is appropriately diversified. Like the holder of a single asset, the holder of a diversified *portfolio* of common stocks must also receive the real risk-free rate and the various risk premiums. (Again, think of risk, in a general sense, as the volatility in possible outcomes, such that there is a greater chance that the *actual* cash flows – from buying productive equipment, or buying stock in a company – will be less than the average *expected* cash flows.) In fact, the premiums for things like default and foreign exchange risk are *higher* for the common stock investor than for the same company's bondholders, because stockholders receive no returns until the lenders are fully compensated (common stockholders face more *business* risk than bondholders do).

A diversified portfolio, which a stock market investor in today's world is expected to have, contains different stocks (held either directly or through a *mutual fund*) that can be expected to respond differently to changes in the economy. A mix of stocks is called a "portfolio" because investors used to keep their paper stock certificates in leather port-folios; today companies keep computerized records of who their owners are rather than issuing paper stock certificates, but a combination of stocks or other securities is still called a portfolio. [Bondholders are likely to diversify as well, so thinking of required rates of return on bonds as based on stand-alone risk may be oversimplifying a little.]

So we should compute the rate of return required by a common stockholder (for our use in valuation models) in a manner that reflects both the return we have computed earlier (risk-free rate plus risk premiums) *and* the diversification effects of a portfolio. Perhaps a useful way to think about it is that when someone buys common stock, her required total premium above the risk-free rate (obviously higher than the company's bondholders expect) is *lower* than it would *otherwise* be because of the diversification. What if the stockholder is *not* diversified? Too bad for her! Because most investors *are* diversified, the returns available in the competitive marketplace are not high enough to compensate you for being *un*diversified. In other words, if you had to be compensated for the risks of being undiversified, you would offer such a low price for the stock (in return for the expected financial benefits, to force the percentage return to be high) that you would always be *outbid* in the market by diversified investors.

For example, XCorp's expected dividend is $2.00/share/year forever (a perpetuity). If you owned XCorp common stock, you would require a 20% annual return to compensate for all risks, including those you could have diversified away. You are willing to pay only $2.00/.20 = $10 per share. But diversified investors would require only a 10% return, and would always outbid you, offering a price of $2.00/.10 = $20 per share.

II. <u>The Nature of Diversification</u>

To diversify, the common stock investor selects a group of stocks (the number needed was long said to be less than 20; recent research suggests it might be as high as 40) across different sectors of the economy: technology, heavy manufacturing, automotive, airlines, financial services, consumer goods, retailing, broadcasting, *etc*. Added diversification benefits *may* come from including stocks of non-US companies as well, although recent studies suggest that foreign stocks may not behave as differently from US stocks as was once thought (probably because large US firms have extensive international operations).

The key is to find stocks whose annual rates of return are not likely – based on historical observation and on expectations of the future – to follow the same patterns (think of our stock *M* and stock *W* example from class). When we have diversified in this manner, the risks that relate to individual companies (floods, product liability lawsuits, labor problems) no longer are of concern to us. After all, unexpected losses through a production shutdown at one company might be offset by unexpected gains through a technological breakthrough at another.

A. Computing Expected Return on a Portfolio

The expected annual rate of return on a portfolio is simply the weighted average of the expected annual returns of the individual assets (stocks) in the portfolio. We represent this idea symbolically as

$$\mathrm{E}(k) = \sum P_i k_i$$

with $\mathrm{E}(k)$ representing the expected return on the portfolio, k_i representing the expected return k_e on stock i, and P_i representing stock i's percentage weighting in the portfolio.

For example, assume that 45% of the portfolio is invested in stock 1, which has a 15% expected annual return; 35% is invested in stock 2, which has a 12% expected annual return; and 20% is invested in stock 3, which has a 9% expected annual return.

$$E(k) = (.45)(.15) + (.35)(.12) + (.20)(.09)$$
$$= .0675 + .042 + .018 = .1275 \text{ or } 12.75\%.$$

Note that this weighted average expected annual return must be somewhere above the expected annual return on the lowest-return stock (9%) and somewhere below the expected annual return on the highest-return stock (15%).

B. Measuring Risk for a Portfolio
The total risk of a portfolio can be measured by the standard deviation of its returns, as is true of the risk of a stand-alone asset. However, the standard deviation of returns on a portfolio is computed very differently than is the standard deviation of returns for a stand-alone asset. A lower variability in portfolio returns arises from the benefits of diversification, which are greatest when asset (stock) returns are *negatively correlated*, such that their annual returns (based on history, and on likely future outcomes) can be expected to move in opposite directions over time. A portfolio might have a fairly small standard deviation in its expected returns, even if the individual stocks' expected returns have high standard deviations, as long as the individual stocks' returns would not be expected to move closely together over time. (Again, think of stocks *M* and *W*.)

In the real world we don't tend to find many W's to offset changes in returns of the M's; the best we typically can hope to find are stocks whose returns have not, in the past, been highly positively correlated (and are not expected to be in the future). After all, a rising (falling) economic tide tends to raise (lower) the fortunes of most companies, but at least by spreading investment dollars over the common stocks of firms in different economic sectors we could expect to avoid lock-step movements in returns across the portfolio. (Returns earned by an owner of Dell, Apple, and Intel might move more closely together than returns earned by an owner of Caterpillar, McDonald's, and Home Depot.)

III. <u>Systematic and Unsystematic Risk</u>
Covariance (or the related idea of correlation) is a statistical concept that relates past or expected movements in one variable to past or expected movements in another. In analyzing common stock returns, we examine co-movement in a particular stock's annual returns with that of the stock market as a whole by computing a measure of the stock's risk called its *beta* (β), computed as the covariance between the stock's annual rates of return and the market's average annual rates of return, divided by the variance in the market's average return.

We say that beta is a measure of a stock's *systematic* risk. When we are diversified, we have eliminated *unsystematic* (company-specific) risk and are left only with the risk that you can *not* diversify away: the system-wide, or systematic, risk of being in the market. If company-specific risk is not a concern, then you seek to be compensated only for the degree to which the stock in question is subject to the ups-and-downs of the market/economy overall (some companies are more subject to this systematic risk than others, for reasons that include the stability of their revenues and their use of borrowed money).

So the relevant question is: how much additional risk does a particular firm's common stock add to the risk of an investor who is already well diversified (holds a portfolio that includes exposure to the broad market)?

According to the *capital asset pricing model* (CAPM), whose output is the *security market line* (which we saw in our weighted average cost of capital discussion), a stockholder's expected annual rate of return can be measured as

$$k_e = k_{rf} + (k_m - k_{rf})\ \beta.$$

Here, k_{rf} is simply the risk-free rate of return (*i.e.*, the short-term T-bill rate) that we saw in our interest rate analysis. The various premiums for risk are contained in the term $(k_m - k_{rf})\ \beta$. [Some analysts say that k_{rf} should be the long-term T-bond rate, which would give a slightly different answer. Let's say the short-term T-bill rate is 3%, the longer-term T-bond rate is 5%, the stock market average return is 11%, and the stock's beta is 1.2. Depending on which risk-free rate measure is used, we compute either

$$k_e = .03 + (.11 – .03) \cdot 1.2 = 12.6\% \text{ or}$$
$$k_e = .05 + (.11 – .05) \cdot 1.2 = 12.2\% \quad .$$

The shorter-term rate would seem more consistent with the idea of a risk-free rate plus premiums, but some studies have shown that the longer-term rate provides a measure that is more consistent with actual observed stock market returns.]

Under the logic of this model, the risk attendant to owning shares of common stock in individual companies (floods, lawsuits, labor problems) already has been diversified away through the holding of shares issued by different types of companies. With this unsystematic (company-specific) risk gone, the only risk to be compensated for is the company's exposure to systematic (market-wide) risk, measured by β (beta) as applied to the market risk premium $(k_m - k_{rf})$.

In other words, the buyer of common stock should expect to receive, as a total return, the sum of

- the T-bill (or T-bond) rate, plus an added amount that equals
- the risk premium for the stock market as a whole $(k_m - k_{rf})$, tempered by the degree (β) to which the stock in question faces more/less systematic risk than the average stock (which, by definition, has a $\beta = 1$).

We get k_m and k_{rf} from results of macroeconomic studies. We get β from studies of historic year-to-year returns on the stock in question relative to the market's average return. But CAPM is controversial; all of these figures are subject to question, depending on the time period chosen for analysis and our definition of what constitutes the stock "market." In fact, some analysts believe it is unrealistic to think that a single measure, β, could embody all risk relevant to common stock valuation analysis. (One famous study found essentially no relationship between β and stocks' actual returns from the early 1960s to the early 1990s.) [Some adherents of a newer approach to risk analysis, called *arbitrage pricing theory* (APT), posit that we might better understand a common stock's risk by examining multiple measures, including β and broad economic variables like income and interest rate levels.]

Note that if k_{rf} = 3%, k_m = 11%, and β = 1.0 (such that the stock's systematic risk is equal to that of the market on average), then the stock's expected return is

$$k_e = 3\% + (11\% - 3\%) \cdot 1 = 11\% \quad .$$

(The expected return on a stock of average risk is equal to the expected market average return, a not-too-surprising result.) A riskier-than-average stock has a β greater than 1 (let's say 1.5), and an expected return, in this case, of

$$k_e = 3\% + (11\% - 3\%) \cdot 1.5 = 15\% \quad .$$

A stock of less-than-average risk has a β less than 1 (let's say .75), and an expected return, in this case, of

$$k_s = 3\% + (11\% - 3\%) \cdot .75 = 9\% \quad .$$

When we compute the intrinsic value of a company's common stock, we will be given a k_e figure to use as the discount rate. The ideas summarized in this discussion should help us to better understand the reasons why the k_e discount rate might differ from one situation to the next. (Also recall from our Topic 5 discussion that the beta we work with is called the "levered" or "equity" beta. An "unlevered" or "asset" beta that separates the financial risk of required debt payments from the business risk of the firm's asset holdings might be preferred by a party thinking of buying *all* of a company's shares of common stock, since the combined firm's optimal capital structure might well have a different proportion of debt than the acquired firm had as a stand-alone business.)

IV. <u>The Efficient Markets Hypothesis</u>

A long-held view in Finance is that information drives the stock market: the price that investors are willing to pay for a company's common stock should change as truly *new* (unexpected) and *relevant* information becomes available. Many financial theorists believe, at least to some degree, in the *Efficient Markets Hypothesis* (EMH), which posits that such information gets incorporated into stock prices *efficiently* because analysts at large "Wall Street" firms spend all day looking for, and acting on, new and relevant information on the small number of firms they examine. It follows logically that prices for such companies' common stocks generally should already reflect all available relevant information, so we can not consistently "beat the market" no matter how much effort we devote to studying companies' annual reports and watching the financial news. (Indeed, the Capital Asset Pricing Model, discussed earlier, rests on an assumption that the stock market is efficient, such that investors can not expect to consistently earn market-beating returns merely by buying a diversified portfolio of common stocks that have fairly high degrees of diversifiable risk.)

Thus, the logic goes, the big "smart money" players act on new, relevant information so quickly (immediately seeking out the stock and buying it if the news is positive, thereby driving up its price, and selling or avoiding the stock if the news is negative, thereby driving down its price) that the price we observe in the market generally should be the fair price to pay – based on currently-known risks of owning that stock – for the expected returns. So the theory is *not* that you and I as small investors will go *broke* by putting our money in the stock market; it is that we will not consistently be able to find true bargains that we can buy and expect to become rich. A more formal financially-oriented statement of the idea is that all good or bad information should already have been *discounted* into the observed price of the stock by the time you and I gain access to that information.

Not all market observers believe in the efficient markets theory. [Many Wall Streeters do not, nor do *behavioral finance* adherents in academics, who believe that a widespread fear or euphoria on investors' part often causes stock prices to fall far below, or rise high above, what an objective analysis of available information would prescribe; they caution that the "smart money" may be prevented by market forces or economic conditions from playing an "arbitrage" role and quickly buying or selling to correct the mispricing. Those who accept the behavioral finance model argue that such "bubbles" could not occur if markets truly were efficient, and that studying the psychology of investor behavior might help us develop strategies to exploit inefficiency.] And some express what we call only a "weak" belief in the idea. Those who believe in only the *weak form* of the Efficient Markets Hypothesis feel that you can not use charts of past stock price movements ("technical analysis") to "beat the market" (earn returns higher than would be expected based on the attendant risks).

Some observers go a step farther and accept the *semi-strong form* of the EMH: that by the time relevant information is publicly available (*Wall Street Journal*, *CNBC*, on-line, or even in obscure technical journals) the "smart money" already knows about it and has acted on it. If the semi-strong form is valid, then you can not earn superior returns even by doing careful "fundamental analyses" of companies' earnings, management, *etc.* Most academic observers tend to believe in the weak form of the EMH, and many believe in the semi-strong form, at least with regard to *large* companies – GE, Microsoft, Coca Cola – whose shares are regularly bought and sold in large quantities, and whose activities are very carefully followed by professional analysts at major investment firms.

The *strong form* of the EMH states that even a company's most knowledgeable insiders can not earn returns that "beat the market" (*i.e.*, that are greater than would be justified based on the perceived level of investment risk). Hardly anyone would believe the markets could be *that* efficient – such that even those who are the first to know about new product breakthroughs, lawsuits, or profit figures could not earn extraordinary returns by strategically choosing when to buy or sell shares. For that reason, we have laws against *insider trading*: it is *illegal* for a firm's directors, officers, outside auditors, company legal advisors, *etc*. to buy or sell shares on the basis of *material* (important) information that is not yet available to the public (but note that information is "public" even if people would have to dig for it in obscure technical journals or web sites; it does not have to be *commonly-known* information to be *publicly available*).

If top management fears that various insiders are trying to transact in the company's common stock based on new and material, but not-yet-public, information, they call a press conference and publicly disclose the news. The NYSE or other exchange might halt trading until the public has had a chance to learn and digest the new information.

Some analysts feel that the insider trading laws actually are bad for the broad investment markets, because they hinder stock prices from quickly and efficiently adjusting to new information; after all, who would better know the best time to buy and sell a company's shares than corporate insiders? For example, if a large company were engaging in ill-advised or inappropriate business practices, some among its large group of managers would sell their shares, if they were legally permitted to, and thereby signal the market that problems had arisen.

In fact, even if the insider trading laws perform as supporters of the laws expect them to, they can prevent unwanted activity only half of the time. Insiders potentially can benefit from their access to material, non-public information in four scenarios: buying corporate shares just before unexpected good news becomes known to the public, selling shares just before unexpected bad news becomes known, choosing *not to sell* shares just before unexpected good news comes out, and choosing *not to buy* just before unexpected bad news becomes known. The latter two cases would be impossible to monitor or punish; we can not sanction people for actions they *avoid* taking. ✍