MBA Teaching Note 07-06
The Capital Asset Pricing Model, Stock Pricing, and Expected and Required Returns

When we say that the Capital Asset Pricing Model is a pricing model, we often confuse people. Nowhere in the equation for the model do we see the price. Recall that the CAPM is as follows:

$$E(R) = r_f + (E(R_m) - r_f)\beta$$

where $E(R)$ is the expected return on the security, $E(R_m)$ is the expected return on the market portfolio, r_f is the risk-free rate, and β is the security's beta or systematic risk. Seeing how the CAPM is indeed a pricing model helps to clarify what the model tells us.

Note that the say that the model gives the *expected return*. What it actually gives us is the *required return*. That is, $E(R)$ is the return that investors require, given the risk as indicated by the beta. When the market is in equilibrium, meaning that all assets are correctly priced, the expected and required returns are the same. But we should never lose sight of the fact that the model gives the required return. Whether it gives the expected return depends on the dynamics of the market.

Consider a stock that is expected to pay a dividend in one year of $5 and has a constant growth rate of 6% forever. While this is a very oversimplified stock, we know that under such conditions we can obtain its price using the constant growth discounted cash flow model, as given below:

$$P = \frac{D_1}{k - g},$$

where we typically use k as the discount rate. This rate, of course, is the required rate of return necessary to justify the stock price, P. Where does this rate come from? Well, we did say that the CAPM gives us the required rate of return, so let us use it. Suppose this stock has a beta of 1.2, the risk-free rate is 4%, and the expected return on the market is 12%. Plugging into the CAPM, we obtain

$$E(R) = 0.04 + (0.12 - 0.04)1.2 = 0.136.$$

So this stock's required rate is 13.6%. That means that give its risk, a beta of 1.2 and the risk-free rate and expected return on the market, investors would require a return of 13.6% to justify buying it. Its price should be

$$P = \frac{\$5}{0.136 - 0.06} = \$65.79.$$

Thus, at a required rate of 13.6%, investors can justify paying a price of $65.79.

Suppose in the market this stock is trading for only $60. At this price, we can infer the rate of return expected by investors. Let us call this rate $\hat{E}(R)$. If we let P_m stand for the market price, we find the expected return as follows:

$$P_m = \frac{D_1}{\hat{E}(R) - g}$$

$$\hat{E}(R) = \frac{D_1}{P_m} + g$$

In this problem

$$\hat{E}(R) = \frac{\$5}{\$60} + 0.06 = 0.143$$

Thus, at a price of $60, investors expect a return of 14.3%. Using either price or return, we can see that this stock is attractive for purchase. Investors require a return of 13.6%, but the stock is

offering a return of 14.3%. Alternatively, this stock is selling for $60, but it is worth $65.79. We say that this stock is underpriced.

The CAPM is oftentimes depicted on a graph called the Security Market Line or SML. In the figure below, we see what is happening in this example.
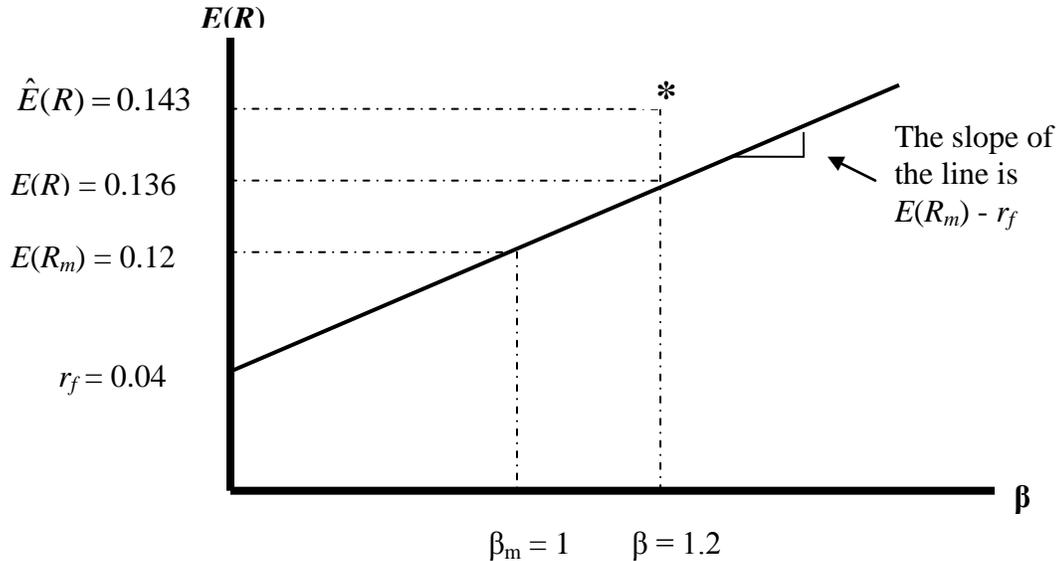
The straight line is a graphical version of the CAPM. The intersection with the vertical axis is the risk-free rate. The slope of the line is the expected return on the market minus the risk-free rate. Reading off of the line produces the required return as given by the CAPM. Thus we see that for the market, the beta of 1 gives an expected market return of 12%. For our stock, the beta is 1.2, and its expected return is 13.6%. But the stock is priced to offer an expected return of 14.3%. We denote this phenomenon by the asterisk that indicates that this stock lies above the line in expected return-beta space. The difference in the expected return and the return given by the line is called the *abnormal return*.

Assets with returns that lie above the line are underpriced. Their prices are too low, making their expected returns be more than their required returns. Overpriced assets have prices too high and lie below the line. Their expected returns are below their required returns.

If the market if functioning well and everyone has access to the same information, investors will recognize underpriced assets and start buying them. They will also recognize overpriced assets and start selling them. This buying pressure will make the prices of underpriced assets rise, and selling pressure will make the prices of overpriced assets fall. These price changes will continue to occur though buying and selling pressure until the assets reach their equilibrium prices. At that point, their expected returns will equal their required returns. Thus, in our example, this underpriced stock will be purchased, pushing up its price until it reaches $65.79. At that point, its expected return will be 13.6%, which is the required return. The stock will then line on the SML, and there will be no more buying or selling pressure.

In these note, we have used an oversimplified model, the constant growth discounted cash flow model. The point can be illustrated with a more sophisticated multi-stage model. The principle remains the same: correctly priced assets have their expected returns equal their required returns. These assets lie on the SML in expected return-beta space. When incorrectly priced, they lie off of the line, above for underpriced assets and below for overpriced assets. In well-functioning markets, mispriced assets are quickly bought and sold, thereby bringing their

prices back to equilibrium. They then lie on the line and the required and expected returns are the same.

The CAPM is an equilibrium model. It assumes that assets are always correctly priced. That is why we make reference to $E(R)$ as the expected return, when in fact it is first and foremost, the required return. When the market is in equilibrium, there is no difference between the expected and required returns. Of course, markets are not in equilibrium, but they are dynamic and constantly move toward equilibrium. The process in which markets move toward equilibrium reflects how well markets work. When such dynamics occur so rapidly that no one investor can consistently be the first to recognize mispriced assets, we say that the market is *efficient*.