***Capital Asset Pricing Model (CAPM)***

The CAPM separates total variance into two types:

**Systematic variance**

* Also called market or undiversifiable variance. This risk can not be avoided and affects all assets except treasury bonds.
* Caused by macro-economic events such as interest rate changes, the government’s budget, a financial boom or crisis, a natural disaster, a currency crisis, or a statistics release.
* Only systematic risk should affect an asset’s expected return or price since it cannot be diversified away.

**Idiosyncratic variance**

* Also called residual, firm-specific, diversifiable, non-systematic or non-market variance.
* Caused by events such as an oil company’s discovery of a new oil field, the death of a firm’s CEO, tax breaks for a specific industry, or fraud or rogue-trading losses at a bank.
* Idiosyncratic risk can be diversified away to zero by investing in a large enough portfolio of assets. Therefore it should not affect an asset’s expected return or price.

***CAPM – Beta (β)***

Systematic risk can be measured using beta ().

Where is the beta of stock i, is the return of stock i and is the return of the market portfolio. The higher the beta of a stock, the more sensitive it is to movements in the market.

**Interpretation:** If a stock’s beta is **2**, then a sudden **1**% increase in the price of the market portfolio would be expected to cause a **2**% increase in the stock’s price.

The beta of the market portfolio equals one.

* This makes sense since the covariance of with itself equals its variance, .

The beta of the risk free security is zero.

* This makes sense since the risk free rate is a constant and the covariance of a constant with any variable is zero.

Note: variance () can also be used to measure systematic risk as well as beta (). The relationship, which we’ll examine later, is:

***The CAPM Equation***

Where: is the return of stock i, it’s a variable,

is the risk-free rate, it’s a constant,

, which is the systematic risk factor of stock i, it’s a constant,

is the market portfolio’s return, it is a variable and is the **source of market risk**.

is the residual return of stock i. It is the unpredictable random error which averages zero. It is the **source of idiosyncratic risk**. It’s a variable.

***The Security Market Line (SML) Equation***

Taking the expectations of both sides of the CAPM equation, which is the same as taking the average,

Where: is the expected or average return of stock i. It can also be written as . Note that it’s ok to just use instead of or in this course.

is the expected return of the market. It can also be written as .

is a constant so , so we just write .

Notice that the error term , also known as the residual, drops out because its average is zero. ie, .

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| **SML Equation & Graph** | **CML Equation & Graph** |
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