Chapter 4: CAPITAL ASSET PRICING MODEL.

Why the CAPM

The CAPM what trues us to explain the properties in the market equilibrium. An equilibrium between the **expected rate of return** and **the required rate of return.**

Basically, this portfolio which is the most representative of the market is composed by all the different stocks in the market weighted in a way which makes them representative of the market. This portfolio is different from an index.

In the end, being that representative, the CAPM draws a **Capital Market Line**.

Characteristics (Assumptions)

1. **Many investors:** There are many of them in the market and none of them can influence heavily in the price of the stocks.
2. **Single period model:** Self-explanatory.
3. **Investors can lend and borrow whatever money they desire:** See topic 3.
4. **Fixed rate:** So, rates of borrowing and lending are the same.
5. **No taxes or transaction costs are considered:** So, optimization can be for all the investors in the market, can be global.
6. **Rational Behavior:** As the Markowitz's model explains.
7. **Homogeneous expectations for investors:** Remember, the CAPM is for everybody.

Capital Market Line

The Capital Market Line expresses the expected return on a portfolio as a function of its total risk. According to the CML, investors allocate their funds between the risk-free asset and the market portfolio in combinations of lending and borrowing. In this model there is no diversification, that is why the **risk premium** needs to be calculated.

Formula

$$E(R_p) = r_f + \frac{E(R_M) - r_f}{\sigma_M} \cdot \sigma_p$$

Note: This formula is pretty similar to the one we were seeing in the previous topic.

The Security Market Line

The Security Market Line expresses the required rate of return on stock so that this stock becomes part of M (Market line). In this model the **diversification** is considered.

Formula

$$E(Rj) = rf + E(RM) - rf \cdot \beta j$$

BETA

The Beta is an indicator of the volatility of the security we are analyzing compared to the market. If the beta is **higher than 1** we call it "aggressive" security, if it is **lower than 1** we call it "defensive".

When the beta is aggressive it means that it reacts more intensively than the M to the changes in the market.

Resume

Required return = r_f + risk premium	
CML	SML
$E(R_p) = r_f + \frac{E(R_M) - r_f}{\sigma_M} \cdot \sigma_p$	$R_{required\ j} = r_f + [\ E(R_M) - r_f\ ] \cdot \beta_j$
Required return on a portfolio *p* that combines *M* and the *RFA* efficiently expressed as a function of the portfolio's total risk σ_p	Required return on a security *j* to be part of *M* (therefore, in a context of good diversification) expressed as a function of the level of systematic risk or coefficient beta β_j
	The SML can also be used to calculate the required return on a portfolio *p* with any β, aggressive or defensive: $R_{required\ p} = r_f + [\ E(R_M) - r_f\ ] \cdot \beta_p$ where $\beta_p = \sum_{j=1}^{n} x_j \cdot \beta_j$
Required return on a stock *j* when there is no diversification and therefore the risk premium has to be calculated as a function of total risk: $E(R_j) = r_f + \frac{E(R_M) - r_f}{\sigma_M} \cdot \sigma_j$ $R_{req\ CML} - R_{req\ SML}$ = additional premium for no diversification	

Systematic risk versus specific risk

Types of risk affecting financial assets

- **Total Risk or volatility of the expected return:** The las variable in the previous formula.
- **Systematic risk:** That risk which cannot be eliminated by diversification.
- **Specific risk:** Which is nonsystematic and can vanish with diversification.

Learning from all this.

- ✓ **Total risk² =** (Systematic risk)² + (Specific risk)²
- ✓ **M:** It has no risk as it is perfectly diversified.
- ✓ **Coefficient beta of the market:** Is 1 as it would represent the market.

The end

https://youtu.be/O0UsNrW8gp4 - Again