**Asset Pricing Models**

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**Cryptocurrency**

A cryptocurrency a digital asset designed to work as a medium of exchange that uses cryptography to secure its transactions. Cryptocurrencies are classified as a subset of digital currencies and are also classified as a subset of alternative currencies and virtual currencies.

**Bitcoin:** Bitcoin is the first decentralized digital currency, as the system works without a central bank or single administrator. It has the highest market cap, its coins generally trade at the highest cost of all cryptocurrencies. Bitcoins are created as a reward for a process known as mining.

**Figure 1: Bitcoin Close Price and Daily Return**

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**Market Portfolio:** Bitcoin is the first decentralized digital currency, as the system works without a central bank or single administrator. It has the highest market cap, its coins generally trade at the highest cost of all cryptocurrencies. Bitcoins are created as a reward for a process known as mining.

**Figure 2: NASDAQ Close Price and Daily Return**

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**Capital Asset Pricing Model**

The Capital Asset Pricing Model (CAPM) gives an answer to the question asking what can be said of the market by aggregating the rational investors' decisions. All investors will hold the same portfolio of risky assets, which is the market portfolio. The market portfolio contains all securities and the proportion of each security is its market value as a percentage of the total market value. The risk premium on the market depends on the average risk aversion of all market participants. The best-known consequence of the resulting equilibrium is a linear relationship between market risk premium and the individual security's risk:

E(ri) − rf = βi [E(rm) – rf]

* E(ri) is the expected return of a certain security
* rf is the risk-free return
* E(rm) is the expected return of the market portfolio.

The risk in CAPM is measured by the beta βi, which is a function of the individual security's covariance with the market and the variance of the market return. Beta has numerous interpretations. On the one hand, beta shows the sensitivity of a stock's return to the return of the market portfolio and, on the other, a certain security's beta shows how much risk that security adds to the market portfolio. The CAPM states that the market gives a higher return only in cases of higher systematic risk since unsystematic risk can be diversified, so no risk premium can be paid after that:

βi = Covi,m / Varm

* Covi,m is the covariance between the given security's return and the market return
* Varm is the variance of the market return.

We can use linear regression in order to estimate beta, where the explanatory variable is the Market Risk Premium (MRP), while the dependent variable will be the risk premium of the security. So, the regression equation has the following form, which is the formula for the Security Characteristic Line (SCL). The intercept of the characteristic line is α, the part of the stock return unexplained by the market factor. The slope of the function shows the sensitivity toward the market factor, measured by beta.

Ri = α + βi Rm + ei

Beta Calculations (Approach 1):

riskpremium <- function(x) logreturn(x) - rft

logreturn <- function(x) log(tail(x, -1) / head(x, -1))

cov(logreturn(G) - rft, logreturn(SP500) - rft) / var(logreturn(SP500) - rft)

Beta Calculations (Approach 2):

(fit <- lm(riskpremium(G) ~ riskpremium(SP500)))