# Formelark - Begrepsforklaring

Finans for teknisk-naturvitenskapelige studenter (Norges teknisk-naturvitenskapelige universitet)

# Formula Sheet for Finans

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## 1 Introduction

This document serves as a formula sheet for the subject of Finans.

## 2 Formulas

Geometric sum formula:

$$\sum_{k=0}^{n} q^k = \frac{1-q^{n+1}}{1-q} \tag{1}$$

### Efficent market hypothesis

The Efficient Market Hypothesis (EMH), proposed by Eugene Fama in the 1960s, asserts that financial markets are "informationally efficient." According to this hypothesis, stock prices fully reflect all available information. EMH is categorized into three forms based on the extent and type of information considered to be reflected in asset prices. These forms are:

**1. Weak Form Efficiency**:

Definition: In weak form efficiency, current asset prices are believed to fully reflect all historical market data, such as past prices, trading volume, and short interest. Implication: This means that past price movements and patterns (like trends and seasonal changes) cannot be used to predict future price movements. Technical analysis, which primarily uses past price and volume data, is not expected to yield consistent excess returns above the market. Testing: Tests for weak form efficiency typically involve analyzing the predictability of stock returns using historical price and volume data.

**2. Semi-Strong Form Efficiency**:

Definition: Semi-strong form efficiency posits that current asset prices not only reflect all historical market data but also all publicly available information. This includes, for example, news, financial reports, economic data, political events, and other public disclosures. Implication: The key implication is that investors cannot achieve consistently higher returns than the average market return using any publicly available information. Fundamental analysis, which relies on evaluating such public information to estimate an asset's value, is

deemed ineffective in generating excess returns. Testing: To test for semi-strong form efficiency, researchers look at how quickly and accurately stock prices adjust to new public information.

**3. Strong Form Efficiency**:

Definition: Strong form efficiency asserts that stock prices fully reflect all information, both public and private (or insider information). Implication: Under strong form efficiency, no group of investors, including insiders with undisclosed information, can consistently achieve excess returns. In essence, market prices are said to be perfectly set to reflect all known and unknown information. Testing: Testing for strong form efficiency typically involves examining the returns of insider trades or other private information not available to the public.

**Practical Implications**: While EMH provides a foundational framework for understanding market dynamics, real-world markets may not fully adhere to these idealized forms of efficiency. Anomalies, behavioral biases, and market irregularities often challenge the EMH. The degree of market efficiency has significant implications for investment strategies. In a perfectly efficient market, passive investment strategies (like index fund investing) would be more favorable, as active strategies relying on information analysis would not provide an edge. The debate about market efficiency is ongoing, with evidence supporting and contradicting the theory. Financial markets are complex and influenced by a myriad of factors, making the concept of market efficiency a central and continuously evolving topic in financial economics.

## Cost of equity

The cost of equity refers to the return that a company is expected to provide to its equity investors to compensate them for the risk of investing in the company's stock. It represents the expected rate of return that investors demand for owning and bearing the risk of holding the company's equity. The cost of equity is a critical component in the valuation of companies and in making financial decisions.

- **Risk and Return**: The cost of equity is fundamentally linked to the concept of risk and return. Higher risk associated with a company's stock typically requires a higher cost of equity, as investors expect greater returns for taking on more risk.
- **Capital Asset Pricing Model (CAPM)**: One of the most common methods to estimate the cost of equity is the CAPM, which calculates it as follows:

  $$\text{Cost of Equity} = \text{Risk-Free Rate} + \beta \times (\text{Market Return} - \text{Risk-Free Rate}) \tag{2}$$

  Here, the risk-free rate is the return on risk-free investments (like government bonds), $\beta$ (beta) measures the stock's volatility relative to the market, and the market return is the average return of the market.

- **Dividend Discount Model (DDM)**: Another approach is the DDM, which is used for companies that pay dividends. The model calculates the cost of equity by dividing the annual dividends per share by the current market value per share and adding the dividend growth rate.

In summary, the cost of equity is a fundamental metric in finance that not only indicates the expected return required by investors but also plays a crucial role in corporate finance decisions, investment analysis, and company valuation.

# Cost of Capital

The cost of capital is a key financial concept that represents the rate of return a company needs to generate to justify the cost of a particular investment or project. It measures the cost of the funds used for financing a business, whether these funds come from debt, equity, or a combination of both.

## Components of Cost of Capital:

- **Cost of Debt**: The effective interest rate a company pays on its debts, such as loans and bonds. Denoted as $r_d$, it is calculated after considering tax savings due to the tax-deductibility of interest payments:

$$r_d = \text{Interest Rate} \times (1 - \text{Tax Rate}) \tag{3}$$

- **Cost of Equity**: The return required by equity investors to compensate for the risk of investing in the company. Denoted as $r_e$, it is often calculated using models like CAPM:

$$r_e = \text{Risk-Free Rate} + \beta \times (\text{Market Return} - \text{Risk-Free Rate}) \tag{4}$$

- **Weighted Average Cost of Capital (WACC)**: The average rate a company expects to pay to finance its assets, calculated by weighting the cost of each capital type by its proportion in the company's capital structure:

$$\text{WACC} = \frac{D}{V} \times r_d + \frac{E}{V} \times r_e \tag{5}$$

where $D$ is the total debt, $E$ is the total equity, and $V$ is the total value of financing $(D + E)$.

## What the Cost of Capital Tells You:

1. It serves as a benchmark for making investment decisions, indicating the minimum return that should be generated from an investment.

2. Reflects the riskiness of the company's operations, influencing the investor's required rate of return.

3. Used as the discount rate in DCF analysis for company valuation.
4. Helps in optimizing the capital structure to minimize capital costs.
5. Used for performance evaluation by comparing the company's return on investment against it.

In summary, the cost of capital is a fundamental financial metric crucial in the strategic planning of capital allocation and financial management.

# Black-Scholes Formula for Call and Put Options

The Black-Scholes formula is a mathematical model for pricing European-style options, developed by Fischer Black, Myron Scholes, and Robert Merton.

## Call Option Formula

The formula for a European call option is:

$$C = S_0 N(d_1) - X e^{-rt} N(d_2) \tag{6}$$

where:

- $C$ is the price of the call option.
- $S_0$ is the current price of the stock.
- $N(d)$ is the cumulative distribution function of the standard normal distribution.
- $X$ is the strike price of the option.
- $e^{-rt}$ is the present value factor for risk-free interest rate $r$ over the time to maturity $t$.
- $d_1 = \frac{\ln(\frac{S_0}{X}) + (r + \frac{\sigma^2}{2})t}{\sigma\sqrt{t}}$
- $d_2 = d_1 - \sigma\sqrt{t}$
- $\sigma$ is the volatility of the stock's returns.

## Put Option Formula

The formula for a European put option is:

$$P = X e^{-rt} N(-d_2) - S_0 N(-d_1) \tag{7}$$

where:

- $P$ is the price of the put option.

- The other variables are as defined above.

These formulas provide theoretical estimates for the prices of European-style options, highlighting the influence of factors such as stock price, strike price, volatility, and time to expiration.