# Computational Finance

### 18 Feb 2020

#### Returns

We can evaluate returns based on a time series of prices, denoted as . For instance,

We can consider returns as . It is important to note the asymmetry here, as if we were to take an example, with , then consequently if we were to flip the values for .

#### Multiperiod Returns

Returns over multiple time steps are a product rather than a sum, and this could be demonstrated with an example over 4 time steps, where . The returns would yield . This does not sum to 0.6, but in fact the product still yields the correct values.

#### Return on a Portfolio

Assuming assets (google, gold, USD, etc...) with an allocation of where , and

Presuming as capital, your set up is , which evaluates to

#### Annualizing Returns

This creates a standard to compare return rates. You can consider monthly vs yearly.

Where , where

Or you can do . Note here that instead of 365, 300 is used. This is a variation within the field, having values such as 250, 275, 300, 365, etc... (My best guess to why this is the case is because we are going off the presumption that we are not trading every day)

Notice that we use exponential to take into account the notion of compounding.

#### Value of Money

To answer the question of “how much is one dollar today worth tomorrow?” We need to look at the frequency of returns.

Consider:

, the future value, denoted

, the future value, denoted

, the future value, denoted

Generalized as , where is the current value.

There is a theoretical consideration here where we consider the returns to be continuous, allowing us to use limits, which results in our calculations to come to:

(We can kind of remember vaguely something similar to this when we originally calculated compounding interest)

It is not considered realistic in practice however.

Note that this formula also allows for a symmetry (whereas the multiperiod returns before do not).

Multiperiod Continuous returns are additive.

#### Book-keeping

It is done in the format , for instance, or . The indicates the BUY, and the indicates the SELL.

Note that in the market, there is not a singular price for any given item, but rather a ASK and a BID price. Meaning that BUY and SELL prices are marked differently. The difference between the ASK and BID price is called the spread.