Chapter 1

Holding Period Return: (hpr)
EV = End Value = Your Cash Flow (CF) at the end of the period.
BV = Beginning Value = Your CF (typically a cash outflow) at the beginning of the period.

\[ hpr = \frac{EV - BV}{BV} \]

or by employing algebra

\[ hpr = \frac{EV}{BV} - \frac{BV}{BV} = \frac{EV}{BV} - 1 \]

Dollar Return

\[ = EV - BV \]

Both hpr and Dollar Return can be positive or negative

For stocks

\[ EV = \text{End Price} + \text{Dividends Paid} \]

\[ BV = \text{Price you paid for the stock} \]
For Bonds

End Value = End Price (or perhaps current price) + Coupon

BV = Price you paid for the Bond.

hpr can be separated into two components

1. Dividend (or Coupon) Yield: \( \frac{\text{Dividend}}{\text{BV}} \)

2. Capital Gain Yield: \( \frac{\text{Price Increase}}{\text{BV}} \)

Example: One year ago you purchased HiJynx for $38. It paid $1 dividend and has a current price = $23

\( \text{EV} = 24 \) (i.e. 23 + 1)

\( \text{BV} = 38 \)

1. What is your $ return?
   \( \text{Ret} = \frac{\text{EV} - \text{BV}}{\text{BV}} = \frac{24 - 38}{38} = -14 \)

2. What is the hpr?
   \( \frac{\text{EV} - \text{BV}}{\text{BV}} = \frac{24 - 38}{38} = -36.84\% \)
Measuring Return Variability

- One option is just to present a table or graph of the returns and let the viewer decide about the variability.

- A more compact approach is to come up with a simple measure.

- The most common measure is the standard deviation which is a measure of the average deviation from the mean.

- It's the square root of the variance

  \[
  \text{Variance} = \frac{1}{T-1} \sum_{i=1}^{T} (R_i - \overline{R})^2
  \]

Recall the mean return is:

\[
\overline{R} = \frac{1}{T} \sum_{i=1}^{T} R_i \quad \text{(Arithmetic Mean)}
\]

\(R_i\) = individual return

Standard Deviation = \(\sqrt{\text{Variance}}\)

We will use statistics buttons on the calculator to compute these.
3. What is the dividend yield?
   \[ \text{DIV} \div \text{BV} = \frac{1}{30} = 2.63\% \]

4. What is the capital gain yield?
   \[ \frac{\text{End Price} - \text{BV}}{\text{BV}} \]
   \[ = \frac{23 - 38}{38} = -39.47\% \]

Note: The sum of the capital gain yield plus the dividend yield equals the hpr.
   \[ = 2.63\% - 39.47\% = -36.84\% \]

**Growth of An Investment**

hpr = \[ \frac{\text{EV}}{\text{BV}} - 1 \]

or: \[ 1 + \text{HPR} = \frac{\text{EV}}{\text{BV}} = \text{Wealth Relative} \]

This is true for any arbitrary division in time so we could write:

\[ \text{Val}_t = \text{Val}_{t-1} \times (1 + \text{HPR}) \]

which is similar to our basic future value formula for \( N=1 \)

\[ \text{FV} = \text{PV} \times (1+i)^N \Rightarrow \text{FV} = \text{PV} \times (1+i) \text{ if } N=1 \]
**GEOMETRIC MEAN**

\[ \text{Geomean} = \left( (1+R_1)(1+R_2) \ldots (1+R_T) \right)^{\frac{1}{T}} - 1 \]

\( T \) = # of time periods

**Example:** You buy a stock for $100 that goes up 50\% \text{ the first year and goes down 50\% the second year. What is your average and geometric return on this stock?}

\( R_1 = 0.5 \quad R_2 = -0.5 \)

\[ \bar{R} = \frac{0.5 + (-0.5)}{2} = \frac{0}{2} = 0\% \]

\[ \text{Geomean} = \left( (1.5)(0.5) \right)^{\frac{1}{2}} - 1 \]

\[ = (0.75)^{\frac{1}{2}} - 1 \]

\[ = 0.866 - 1 \]

\[ = -13.40\% \]

The geometric mean shows the long run wealth building rate. The average return shows the expected result for one period.

**Note:** Arithmetic mean ≥ Geometric mean
For the long run stock investment shown in Figure 11, page 8, if you started with $1 in Jan 1, 1926, you would have $1775.34 on Dec 31, 2002. Note: this is a 77 year period. What is the average compound interest rate you earned over that period?

\[
P \times NR = 1
\]
\[
I \times NR (FV = 1775.34, PV = -1, N = 77)
\]

= 10.2%

This is the geometric mean rate of return that you earned.

On Table 1.4 the book shows the arithmetic mean return = 12.2%. If the market had a 12.2% long run compound rate of return its value would be:

\[
P \times NR (FV = -1, I \times NR = 12.2, N = 77) = 7070.50
\]

Recall: \[ FV = PV (1+i)^N \]

\[ FV = PV (1+i)(1+i)(1+i)(1+i) \cdots (1+i) \]

\[
\frac{FV}{PV} = \left[ (1+i)(1+i)(1+i) \cdots (1+i) \right]^{N \text{ terms}} = (1+i)^N
\]

\[
\left[ \frac{FV}{PV} \right]^\frac{1}{N} = 1+i \quad \Rightarrow \quad i = \left[ \frac{FV}{PV} \right]^\frac{1}{N} - 1
\]
So we can think of it as:

$$\text{geometric} = \left(\frac{FV}{PV}\right)^{\frac{1}{n}} - 1 = \left[(1+h_{r1})(1+h_{r2})\ldots(1+h_{rn})\right]^{\frac{1}{n}} - 1$$

The Normal Distribution

- The "Bell Shape" curve that describes the distribution of many naturally occurring phenomena (e.g. height, weight, etc).

- It's symmetric about the mean.

- Stock price returns are approximately normal.

FACTS:
- About 2/3 of the observations will be within 1 standard deviation of the mean [68%]
- About 95% of the observations will be within 2 s.d. of the mean.
(1) The first lesson in investing is that there is a reward for taking on risk (i.e., stocks have higher return on average than Bonds).

(2) The second lesson is that the greater the potential reward, the greater the risk.