Module 1:
Return & Risk for Individual Assets

Investment Return & Risk

Investors look at two key statistics when assessing financial investments:

The *rate of return* of the investment

The *riskiness* of the investment

Let's examine each of these in detail.

Step 1: Calculating the Rate of Return

An asset's ***rate of return***: percentage change in that asset's value over a specified time period.

Rate of return is calculated as: $r_{n+1} = \frac{P_{n+1} - P_n}{P_n}$

Where: P_n = Price at time period *n*

P_{n+1} = Price at time period *n+1*

r_{n+1} = rate of return from period *n* to period *n+1*

All else equal, investors would like their *rate of return* to be as *high* as possible

Step 1: Calculating the Rate of Return
Example 1

Today, you purchase shares in a company at \$15 / share. $P_0 = 15$

One year from now: $P_1 = 18$

The **Rate of Return r_1 =** $\dfrac{18 - 15}{15}$ = **20%**

Two years from now: $P_2 = 12$

Rate of Return r_2 = $-$ 33%

Step 2: Calculating *Average* Rate of Return

If we would like to know the rate of return over *multiple* time periods, we simply calculate the average.

Example:

Suppose we observe historic returns on a particular asset to be as follows:

$r_1 = 2.2\%$ $r_2 = 2.5\%$ $r_3 = -1.0\%$ $r_4 = 1.1\%$

Then the average return: $r_{avg} =$ **1.2%**

Note:

- For average rate of return: specify the *frequency* of the data
  - Average *annual* rates of return are different from average *monthly* returns, for example
  - Typically we report *annual* returns unless otherwise specified

Step 2: Calculating Risk

In finance, an asset's ***riskiness*** is measured by *standard deviation of returns*, and is often referred to as *volatility* (using the lower case Greek letter "sigma": σ).

Given a series of returns on an asset over time, we calculate the asset's volatility as:

$$\sigma = \{ \frac{1}{(n-1)} \Sigma_i [r - r_{avg}]^2 \}^{1/2}$$

Where: n = number of observations

r_i = the i^{th} return observation

r_{avg} = the average return across all n observations

"Σ" (*upper* case sigma) means "summation"

All else equal, investors would like their *risk* to be as *low* as possible

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Step 2: Calculating Risk
Example

Suppose we observe historic returns on a particular asset as follows:

$r_1 = 2.2\%$ $r_2 = 2.5\%$ $r_3 = -1.0\%$ $r_4 = 1.1\%$

(1) calculate the average return: $r_{avg} = 1.2\%$

(2) Calculate the standard deviation of the returns

$$\sigma = \{1/3\ [(2.2\% - 1.2\%)^2 + (2.5\% - 1.2\%)^2 + (-1.0\% - 1.2\%)^2 + (1.1\% - 1.2\%)^2\}^{1/2}$$

The *risk* (or *volatility*) is $\sigma =$ **1.59%**

Concept Check

You just got lucky and won a slightly unusual lottery. As the winner, you are invited to make a selection between one of these two options:

(1) A guaranteed payment of $1,000,000

(2) A 50% chance of getting $2,000,000, and 50% chance of getting zero

Which outcome do you prefer? (1) or (2)?

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Concept Check

Why do investors want high rates of return on their investments?

(1) The higher the rate of return, the greater the increase in the value of the investment

(2) The higher the rate of return, the more money the investor will receive, relative to the initial purchase price, when the investment is sold

(3) The higher the rate of return, the lower the risk

(A) (1) is correct
(B) (1) & (2) are correct
(C) (2) & (3) are correct
(D) (1) & (3) are correct
(E) All three of the above statements are correct

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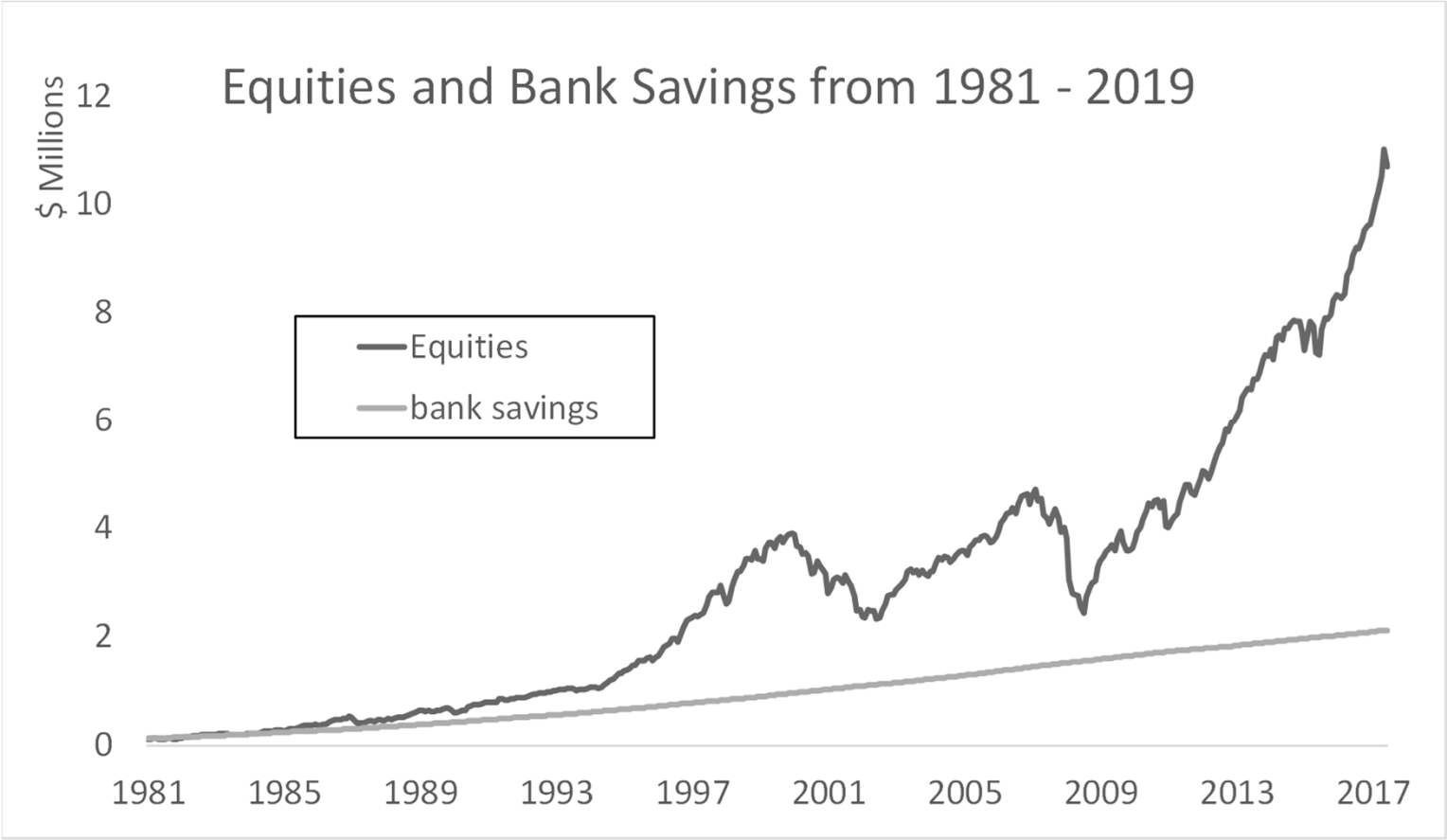
Return & Risk: Equities & Bank Savings



- Rate of return for equities is far higher than that of a savings account in a US bank (approximately 13% vs 8% on an annual basis)
- Equity *volatility* is also considerably higher on equities: 12.3% vs 1.2%