FINANCIAL ENGINEERING

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BONDS

BONDS

Relevant questions:

(1) What is a **financial market**? What are the **two fundamental types** of financial markets?

(2) What is the difference between **primary and secondary financial markets**?

(3) What are **bonds** and **stocks**?

(4) What are the main components of a bond: **bond certificate**, **maturity date**, **time left to maturity (term)**, **coupon**, **face value**, **coupon rate**?

(5) What is the difference between **Treasury bills**, **Treasury notes**, and **Treasury bonds**?

(6) What is the **yield to maturity (YTM)** of a bond? What is the **current yield**?

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Activity in class: *solve the following problems and discuss the results!*

Problem 1. Consider a five-year bond with face value $1,000 and a 5% coupon rate with semiannual coupons. If this bond is currently trading for a price of $957.35, what is the **bond's YTM and current yield**?

Problem 2. For the same bond described before, what would be its market price if its YTM is 6.7% APR?

What is the **main risk** in bonds investment? What is the relationship **between interest rates and bond prices**?

BONDS

Activity in class: *solve the following problem and discuss the results!*

Plot the market price of two bonds with face value of $1,000 as a function of YTM (range between 2% and 15%):

Bond #1: maturity date 30 years with coupon rate 7% (semiannual coupons)

Bond #2: maturity date 5 years with coupon rate 5%.

What do you observe in terms of **sensitivity to market interest rates**?

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Bond ratings:

Bond Ratings from Various Rating Agencies

Bond Ratings	Moody's	Standard & Poor's	Fitch	Risk	Grade
High grade	Aaa	AAA	AAA	Highest quality	Investment
	Aaa	AA	AA	High quality	Investment
Medium grade	A	A	A	Strong	Investment
	Baa	BBB	BBB	Medium grade	Investment
Speculative grade	Ba,B	BB, B	BB, B	Speculative	Junk
	Caa,Ca,C	CCC/CC/C	CCC/CC/C	Highly speculative	Junk
Default danger	C	D	D	In default	Junk

Source: Ravindran, A. R., Griffin, P. M., & Prabhu, V. V. (2018). Service Systems Engineering and Management. CRC Press.

BONDS

Relevant questions:

(7) What is **duration of a bond**? How is it affected by **time left to maturity**, **coupon rate**, **and interest rate**?

(8) What is the **yield curve**? What are **the three main types**?

Activity in class: search on the internet current yield curves for USA and Colombia.

$$D = \frac{\sum_{1}^{n} \frac{t.CF_t}{(1+i)^t}}{P}$$

BONDS

Activity in class: *solve the following problems and discuss the results!*

Problem. Consider a three-year bond with face value $1,000 and a 5% coupon rate with semiannual coupons. If this bond is currently trading at a yield of 3%, what is its duration?

What is the approximated change in bond price if yield increases 1%?

Make the following sensitivity analysis for duration:

- What if **time left to maturity** increases?
- What if **coupon rate** increases?
- What if **yield** increases?

STOCKS

STOCKS

Relevant questions:

(9) What is **market capitalization**?

(10) What are **stock indexes**?

Activity in class: search on the internet stock indexes in Colombia and worldwide (DowJones, S&P500, NASDAQ, Nikkei, FTSE). Download monthly prices of four different companies in the last five years.

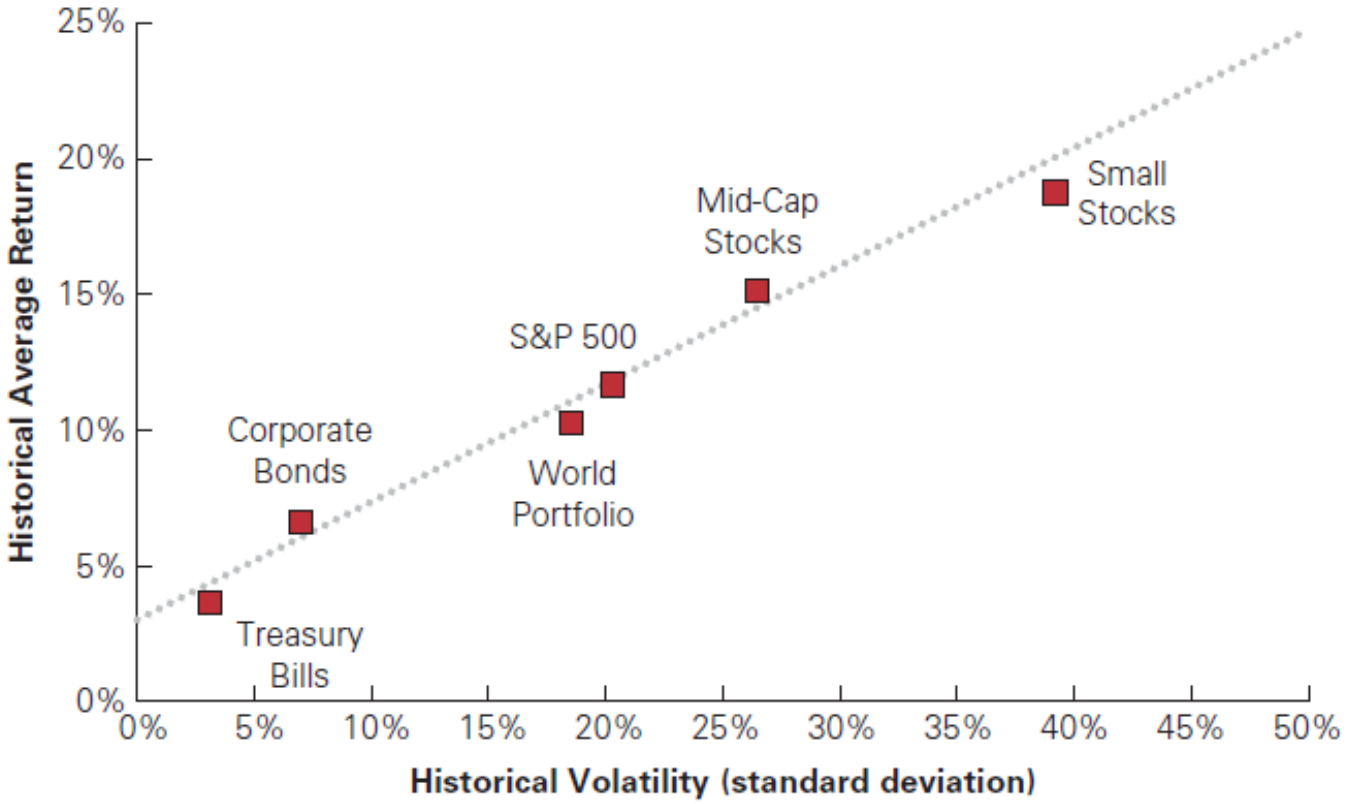
(11) How are stocks' statistics calculated based on historical market prices? Why is **logarithmic return** a preferred measure of return?

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right)$$

(12) What is **volatility** and how is it calculated?

STOCKS

Behavior of stocks and bonds in the USA (1926-2011)



Source: Berk, J., & DeMarzo, P. (2011). Corporate Finance, global ed. Essex: Person Education Limited.

STOCKS

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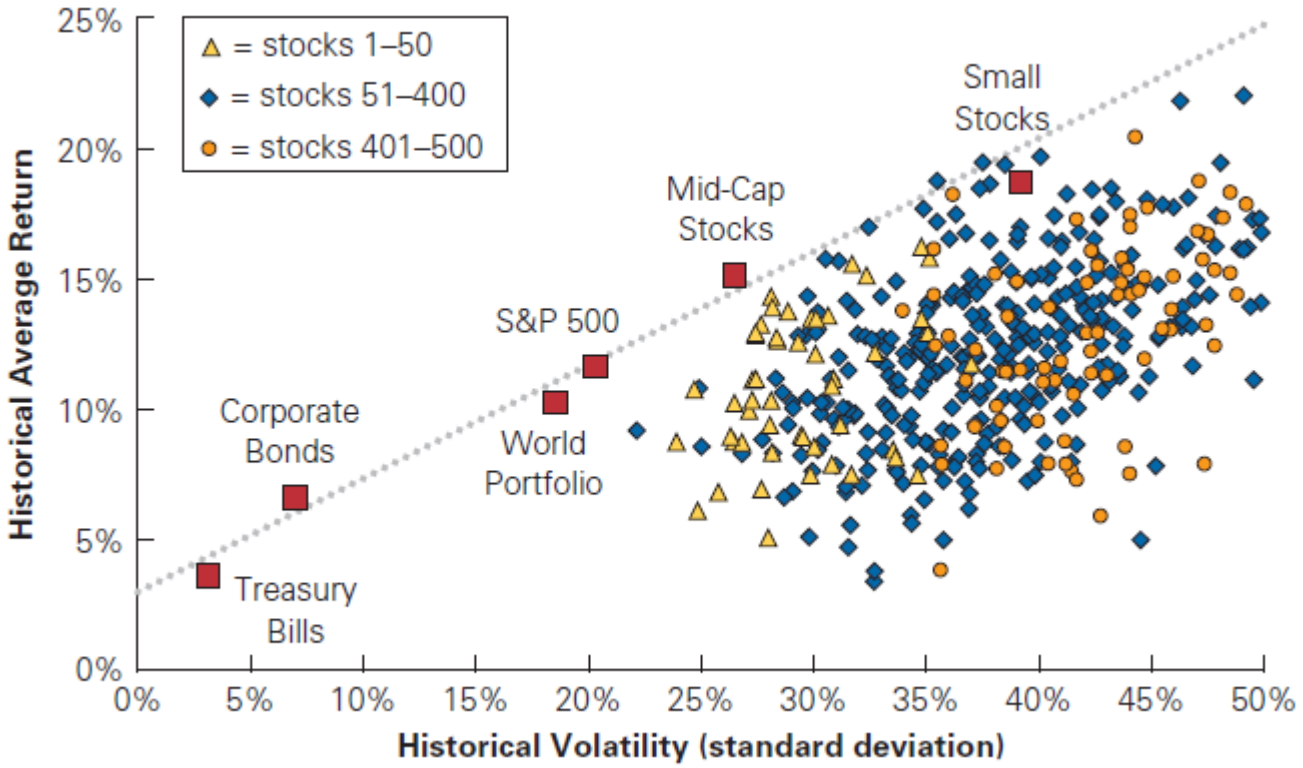

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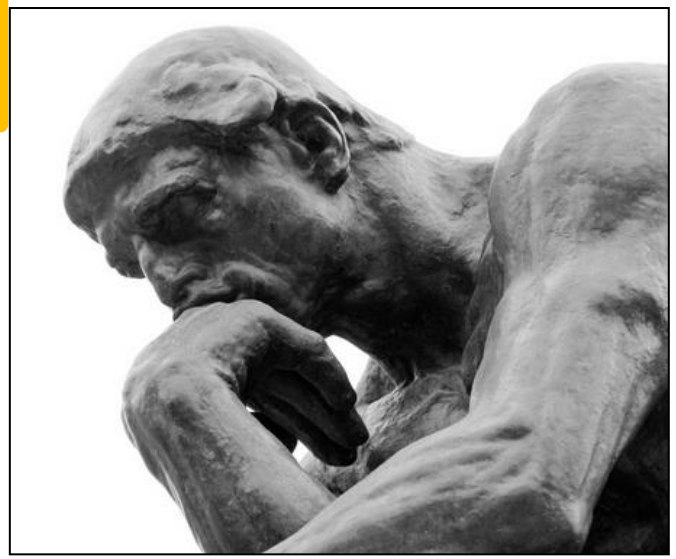
STOCKS

Activity in class: Summarize your observations from the previous charts!



Think about:

(1) Size of companies

(2) Indexes vs individual stocks

(3) Stocks vs Bonds

(4) Type of bonds

(5) Risk and Return

STOCKS

Relevant questions:

(13) Why is the **risk of an index lower** than the risk of individual stocks?

(14) What is the difference between **firm-specific** (aka idiosyncratic, unique, diversifiable) risk and **systematic** (aka undiversifiable, market) risk?

(15) What is a **portfolio**?

(16) What is **diversification**?

Activity in class: Build a portfolio of four stocks, investing 25% in each of them, and calculate its return and volatility based on historic prices.