

## Part I - Dependent Variables

- **Stock Returns** (return is a **ratio**):

Definition: The total stock return is the **appreciation in the price** plus any **dividends** paid, divided by the **original price** of the stock.

$$\text{Total Stock Return} = \frac{(P_1 - P_0) + D}{P_0}$$

$P_0 = \text{Initial Stock Price}$

$P_1 = \text{Ending Stock Price(Period 1)}$

$D = \text{Dividends}$

The income sources from a stock is dividends and its increase in value.

- **Risk-free Rate:**

Definition: The risk-free rate of return refers to the theoretical rate of return of an investment **with zero risk**.

In practice, however, a truly risk-free rate does not exist because even the safest investments carry a very small amount of risk. Thus, the interest rate on a **three-month U.S. Treasury bill** is often used as the risk-free rate for U.S.-based investors.

p.s. 在这篇paper里，由于缺乏1871 - 1919年的短期美国国债利率，作者用1920 - 1971年的“商业票据利率”做了一个regression:

$$\text{Treasury-bill rate} = -0.004 + 0.886 \times \text{Commercial Paper Rate}$$

## Part II - Stock Characteristics

- **Dividends:**

Definition: A dividend is the distribution of a **portion** of the company's **earnings**, decided and managed by the company's board of directors, and paid to a class of its **shareholders**.

Although **cash** dividends are the most common, dividends can also be issued as **shares of stock** or other property.

- Dividend Price Ratio (d/p): Annual dividends per share ÷ Price per share

Mature companies are the most likely to pay dividends.

- Dividend Yield (d/y): Annual dividends per share ÷ Lagged Price

Lagged Price经常被用于长期分析中

以上两项指标可以用于反映一家公司的分红情况

- **Earnings:**

Definition: Earnings typically refer to after-tax net income, sometimes known as the bottom line or a company's profits.

- Earnings Price Ratio (e/p): EPS ÷ Price per share →反映一家公司的盈利能力

EPS refers to Earning Per Share: (Net Income - Preferred Dividends) ÷ End-of Period Common Share Outstanding

End-of Period Common Share Outstanding: 流通股

- Dividend Payout Ratio (d/e): Dividend per share ÷ EPS

Several considerations go into interpreting the dividend payout ratio, most importantly the company's level of maturity. A new, growth-oriented company that aims to expand, develop new products, and move into new markets would be expected to reinvest most or all of its earnings and could be forgiven for having a low or even zero payout ratio.

- **Stock Variance (svar):**

Variance is a measure of volatility because it measures how much a stock tends to deviate from its mean. The higher the variance, the more wildly the stock fluctuates. Accordingly, **the higher the variance, the riskier the stock.**

- **Cross-Sectional Premium (csp):**

Definition: The cross-sectional beta premium measures the relative valuations of high-beta and low-beta stocks.

β: Beta is a measure of a stock's volatility in relation to the overall market. By definition, the market, such as the S&P 500 Index, has a beta of 1.0, and individual stocks are ranked according

to how much they deviate from the market. A stock that swings more than the market over time has a beta above 1.0. If a stock moves less than the market, the stock's beta is less than 1.0. High-beta stocks are supposed to be riskier but provide higher return potential; low-beta stocks pose less risk but also lower returns.

- **Book Value:**

Definition: Book value refers to the total amount a company would be worth if it liquidated its assets and paid back all its liabilities. →  $\text{Assets} - \text{Liabilities}$

- Book-to-Market Ratio (b/m):  $\text{Book value} \div \text{Market value}$

The book-to-market ratio helps investors find the value of a company by comparing the firm's book value to its market value. High book-to-market ratios can be interpreted as the market valuing the company's equity cheaply compared to its book value.

When  $b/m > 1$ , the company's stock is undervalued.

When  $b/m < 1$ , the company's stock is overvalued.

- **Corporate Issuing Activity:**

Definition: An issue is the process of offering securities in order to raise funds from investors. Companies may issue bonds or stocks to investors as a method of financing the business.

- Net Equity Expansion (ntis): 文中作者所使用的是“the ratio of 12-month moving sums of net issues by NYSE listed stocks divided by the total end-of-year market capitalization of NYSE stocks”

$\text{Net Issue}_t = \text{Mcap}_t - \text{Mcap}_{t-1} \times (1 + \text{vwret}_t)$ , where Mcap is the total market capitalization, and vwret<sub>t</sub> is the value weighted return (excluding dividends) on the NYSE index.

- Percent Equity Issuing (eqis): the ratio of **equity issuing activity** as a fraction of **total issuing activity**.

### Part III - Interest Rate Related Variables

- **Treasury Bills (tbl):**

Definition: A Treasury Bill (T-Bill) is a short-term debt obligation backed by the U.S. Treasury Department with a maturity of one year or less. **p.s.** 美国短期国债利率通常被试作无风险折现率

- Treasury bills are usually sold in denominations of \$1,000 while some can reach a maximum denomination of \$5 million.
  - The longer the maturity date, the higher the interest rate that the T-Bill will pay to the investor.
  - <https://www.investopedia.com/terms/t/treasurybill.asp>
  - 1. Lack of risk
  - 2. exempt from local/state tax
- **Yield (y):**  
Yield refers to the earnings generated and realized on an investment over a particular period of time.
    - <https://www.investopedia.com/terms/y/yield.asp>
    - long-term / short term
- **Rate of Returns (ltr):**  
A rate of return (RoR) is the net gain or loss of an investment over a specified time period, expressed as a percentage of the investment's initial cost. When calculating the rate of return, you are determining the percentage change from the beginning of the period until the end.
    - <https://www.investopedia.com/terms/r/rateofreturn.asp>
    - Long-term / short term
- **Yield Curve**  
A yield curve is a line that plots yields (interest rates) of bonds having equal credit quality but differing **maturity date** (the date on which the principal amount of a note, draft, acceptance bond or other debt instrument becomes due)
    - <https://www.investopedia.com/terms/y/yieldcurve.asp>
    - **Takeaways: measure of expectation of the economic activities**
    - **EX:**  
<https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield>
- **Yield Spread:**  
A yield spread is the difference between yields on **differing debt instruments of varying maturities**, credit ratings, issuer, or risk level, calculated by deducting the yield of one instrument from the other
    - <https://www.investopedia.com/terms/y/yieldspread.asp>
- **Term Spread or Interest rate spread (tms):**  
the size of the interest rate spread measures the difference between interest **rates at two different maturities**. This difference is also called the **slope** for the bond yield

curve. The higher the value of the spread, the steeper the yield curve. If the spread is positive, the long-term rate is higher than the short-term rate and the yield curve is said to be "normal". If the spread is negative, the yield curve is inverted.

- **Corporate Bond Returns (tbl):**

Definition: A corporate bond is a **type of debt security** that is issued by a firm and sold to investors. The company gets the capital it needs and in return the investor is paid a pre-established number of interest payments at either a fixed or variable interest rate. When the bond expires, or "reaches maturity," the payments cease and the original investment is returned.

hello!

Summary:

- 公司可以藉由發方債券來提高資本。
- 當投資者向公司買債券時，等同於是投資者借錢給公司，並且成為公司的債主。公司有義務要在一定的時期內支付利息。而當債券到期時 (maturity)，公司必須向債主還清本金 (principal)。
- 因為伴隨著的是比政府債券還要高的風險，所以通常利率也高
- 當公司無法償還債主時，債主有權利令公司將名下的資產兌現成現金 (liquidate asset) 來償還 (PS: 如果是stock的話，則公司沒有這個義務)
- Corporate Bond Return 就是投資債券的回報率

Background:

- 由於在paper裡corporate bond比較少被提起，因此不多加說明。

Why is Interest Rate Important to Corporate Bond

- 利率對於公司債券來說**非常非常**的重要
- 利率會影響債券對於投資者的吸引力。

(最重要的部分)

- 債券的投資報酬率跟債券的價值有inverse的關係，詳情請看以下這個example:

Let's say we buy a 20 year Ford Motor Company bond. At issuance, we buy the bond at a par value of \$1,000 with a stated interest rate of 5%. Let's also assume that 5% is the prevailing interest rate for corporate bonds for companies like Ford. As time progresses, interest rates undoubtedly change. Let's say in 3 years interest rates are now at 8%. If we want to sell our Ford 5% bond in the secondary market, do you think we can sell it for the \$1,000 we originally paid for it? No. Anyone in the bond market can simply buy a new bond from another company (or sometimes the same) at the prevailing market rate of 8%. To make our bond attractive to the market, we need to drop the price of our bond from \$1,000. We could likely find a buyer if we offered our bond at \$900. Remember, the issuer will still pay principal back to the holder of the bond at maturity. In this example, if

we sold our bond at \$900, the buyer would get a bond at a lower interest rate, but would also benefit on \$100 capital gain from our price drop. This example works exactly the same in the opposite manner.

Video:

<https://www.youtube.com/watch?v=luyejHOGCro>

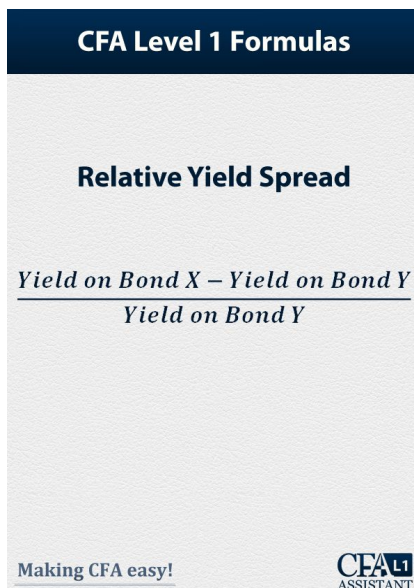
- **Default Yield Spread (dfy):**

A yield spread is the **difference between yields** on differing debt instruments of varying maturities, credit ratings, issuer, or risk level, calculated by deducting the yield of one instrument from the other. p.s.作者在文中用到的是“Moody’s 评级”Aaa和Baa的債券，对标“标普评级”的AAA和BBB.

Summary:

- 很簡單，把剛才的inverse關係概念帶到這裡。
- 比較兩種不同bond的return

Formula:



The image shows a formula card from the CFA Level 1 Formulas book. The title is 'Relative Yield Spread'. The formula is 
$$\frac{\text{Yield on Bond X} - \text{Yield on Bond Y}}{\text{Yield on Bond Y}}$$
. At the bottom, it says 'Making CFA easy!' and 'CFA ASSISTANT'.

**CFA Level 1 Formulas**

**Relative Yield Spread**

$$\frac{\text{Yield on Bond X} - \text{Yield on Bond Y}}{\text{Yield on Bond Y}}$$

Making CFA easy! CFA ASSISTANT

- **Default Return Spread (dfr):** 作者文中的dfr指代 the difference between long-term corporate bond and long-term government bond *returns*.

Summary:

- 一樣的觀念，只是現在是將公司債券拿來跟政府債券做比較。

## Part IV - Macroeconomic Indicators

- **Inflation (infl):**

Definition: Inflation is a quantitative measure of the rate at which the average **price level** of a basket of selected goods and services in an economy increases over some period of time. It is the rise in the general level of prices where a unit of currency effectively buys less than it did in prior periods. Often expressed as a percentage, inflation thus indicates a decrease in the **purchasing power** of a nation's currency. 本文作者使用的是来自Bureau of Labor Statistics 的 CPI (Consumer Price index).

- **Investment to Capital Ratio (i/k):**

Definition: The investment to capital ratio is the ratio of aggregate (private nonresidential fixed) **investment** to aggregate **capital** for the whole economy. 可以体现一个国家经济的投资情况（储蓄情况）