Financial Market Analysis (FMAx)
Module 5

Equity Pricing

Module Introduction

The Key Idea:

Economic enterprises can finance their activities in various ways…

- Bond Financing (already discussed)
- Equity Shares
- Extend concepts to country/macro level – economy wide equity indices.

Module Introduction

Key idea: Economic enterprises can finance their activities in various ways:

- Bond Financing (already discussed)
- Equity Shares
- Extend concepts to country/macro level – economy wide equity indices.

Key Questions:

- What is an equity share?
- What determines the price of an equity share of Firm X, Y, or Z?
- How can market participants link the market price of Firm X,Y, or Z's equity shares to the fundamental aspects of that firm? What are the key fundamentals?
- How can macroeconomists assess determinants of the overall price in a **country's** equity market?

Relevance to You

Specifically, with respect to Emerging Market countries, who are:

- Relying to an increasing degree on equity finance.
- Experiencing considerable growth in their stock markets in recent decades.

Questions:

- What determines the price of equity shares in EM countries?
- How are world equity market events transmitted to country equity markets?

Review: The Essence of Bond Finance

Firms require financing to fund their enterprise…

For example:

- Bond sales in a capital market.

Repayment (i.e, cash flows accruing to the investor**) governed by a contract.**

- Principal
- Coupons

Economic Enterprises are Risky

A firm's earnings outcomes may be:

Favorable	Unfavorable
▪ Its product may be received well in the market.	▪ Its products may fare poorly in the market.
▪ The firms' managers may be very competent.	▪ The firms' managers may be not so good.
▪ The firm may be just plain lucky.	▪ The firm may be just plain unlucky.

In Review:
Bond vrs. Equity

Bonds:

Bond holders are paid the agreed upon principal and coupons independent of the firm's outcomes.

- Bond holders… Rain or Shine, are paid the same amount
- Only in bankruptcy will payments to bondholders be modified (greatly reduced!)

Equity:

Equity holders benefit when outcome is good, and suffer when outcome is bad.

- Equity allows many in the market to participate in a firm's outcomes.
- Allows others beyond initial founders/owners to become 'residual claimants'.

In Review:
Key Questions of Equity Finance

What **determines the price** of an equity share of Firm X, Y, or Z in the market?

How can market participants **assess whether Firm X,Y, or Z's equity shares are correctly priced**?

How can macroeconomists assess whether a **country's** equity market is correctly priced?

Balance Sheets And Cash Flows

A firm's balance sheet can reveal the following:

- Value of shareholder equity.
- Price per share
- "Market-to-book" value

A Firm's Balance Sheet

Assets		Liabilities	
TOTAL	**207,000,000**	**TOTAL**	**83,451,000**
Tangible and Financial Assets	205,423,000	Long Term Debt	16,960,000
Property/Plant/Equipment	122,812,000	Current Liabilities	43,658,000
Financial (incl. cash)	40,546,000	Current Debt	0
Net Receivables	24,094,000	Payables	36,223,000
Olher	17,971,000	Other	7,435,000
Intangible "Goodwill"	1,577,000	Other Liabilities	22,833,000
		Shareholder's Equity	123,549,000
		Price per share	120
		Outstanding shares	1,029,575
		Tangible and Financial Assets	205,423,000
		Liabilities	83,451,000
		Book Value	121,972,000
		Market-to-Book Value	1.013

Balance Sheets And Cash Flows

Similarly to bonds, we will price equity by discounting future cash flows.

- We assume that the cash flows accruing to equity holders are **Dividends (D)** which are paid at some point in the future.
- Thus we, will discount all future dividends back to the present **DDM**.

Unlike bonds we need to forecast **Dividends (D)** by first projecting" **Earnings (E)**.

- **Return on Investment (ROI)**
- **Investment (I)** – "plowed back"

Key ratios: "Plowback ratio" = I/E = 1-D/E=b, Dividend payout ratio = D/E = 1 - b

Balance Sheet and Cash Flows

The dynamics of a firm's **Earnings (E)**:

$$E_t = E_{t-1} * [1 + ROI * (1 - \frac{D}{E})] = E_{t-1} * [1 + g]$$

We can further simplify the **Growth Rate of Earnings (g)** as:

$$g = ROI * (1 - \frac{D}{E}) = ROI * b$$

$$b = (1 - \frac{D}{E}) = \text{"Plowback ratio"}$$

The Intrinsic or Fundamental Value of a Share

Pricing equity according to its “intrinsic value”.

Discounted Dividend Model (DDM) is the price of the firm’s equity as the present value of all future dividends.

- Forecast dividends using available information on the firm’s **fundamentals**.
- With dividends forecasted, we need to discount them back to the present using an appropriate rate – the **Market Capitalization Rate (k)**.

Note:

- Each firm will have its own market capitalization rate **k**.
- It also represents the investor’s required rate of return form holding the equity.

Infinite Horizon DDM – 1

Abbie needs to know about tomorrow's price before she can find out today's price.

Question: How can Abbie learn about tomorrow's price in the first place?

Answer: Assume dividends are paid indefinitely; find the present value.

$$P_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \ldots = \frac{D_1}{1+k} + \frac{D_1(1+g)}{(1+k)^2} + \frac{D_1(1+g)^2}{(1+k)^3} + \ldots$$

$$= \frac{D_1}{k-g}$$

Infinite Horizon DDM – 2

Let us start with a familiar tool…

$$x^0 + x^1 + x^2 + x^3 + x^4 + \ldots\ldots$$

$$\frac{1}{1 - x}$$

For… $x < 1$

Infinite Horizon DDM – 3

Apply to evaluate discounted value of dividends over an infinite horizon.

Assume dividends grow at a constant rate (g).

$$P_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \ldots$$

$$= \frac{D_1}{1+k} + \frac{D_1(1+g)^1}{(1+k)^2} + \frac{D_1(1+g)^2}{(1+k)^3} + \ldots$$

$$= D_1 * \frac{1}{1+k} * \left[1 + \frac{(1+g)}{1+k} + \frac{(1+g)^2}{(1+k)^2} + \frac{(1+g)^3}{(1+k)^3} + \ldots\right]$$

Infinite Horizon DDM – 4

Apply to evaluate discounted value of dividends over an infinite horizon
Assume dividends grow at a constant rate (g).

$$P_0 = D_1 * \frac{1}{1+k} * \left[1 + \frac{(1+g)}{1+k} + \frac{(1+g)^2}{(1+k)^2} + \frac{(1+g)^3}{(1+k)^3} + \ldots\right] \qquad x = \frac{1+g}{1+k}$$

$$P_0 = D_1 * \frac{1}{1+k} * \frac{1+k}{k-g} = \frac{D_1}{k-g}$$

Infinite Horizon DDM
Firms with Different Growth Rates – 1

Firms can differ according to:

- Return on investment (ROI)
- Plowback ratio (b)

This means that their **Dividend Growth Rates (g)** can differ.

The **DDM** tells us how to value each firm according to its **ROI** and **b**, which determine **g**.

Infinite Horizon DDM
Firms with Different Growth Rates – 2

A note on the price/earnings ratio (P/E):

$$P = \frac{D}{k-g}$$

$$E = \frac{D}{(1-b)}$$

$$\frac{P}{E} = \frac{(1-b)}{k-g}$$

A firm will have a higher P/E ratio if:

- Dividend payout ratio is higher
- Market cap is lower
- Growth is higher

Bottom line: P/E ratio depends on firm characteristics – there is no one size fits all.

The Market Capitalization Rate (k)

We introduced the DDM as an "intrinsic value" approach to pricing equity.

- PV of all future dividends.
- We used a simple method to forecast future dividends (**g**) as a function of payout policy and return on investment.
- We discounted the dividends back to the present using **k** as the discount rate.

Question…

But, how do we determine k (expected return to the investor)?

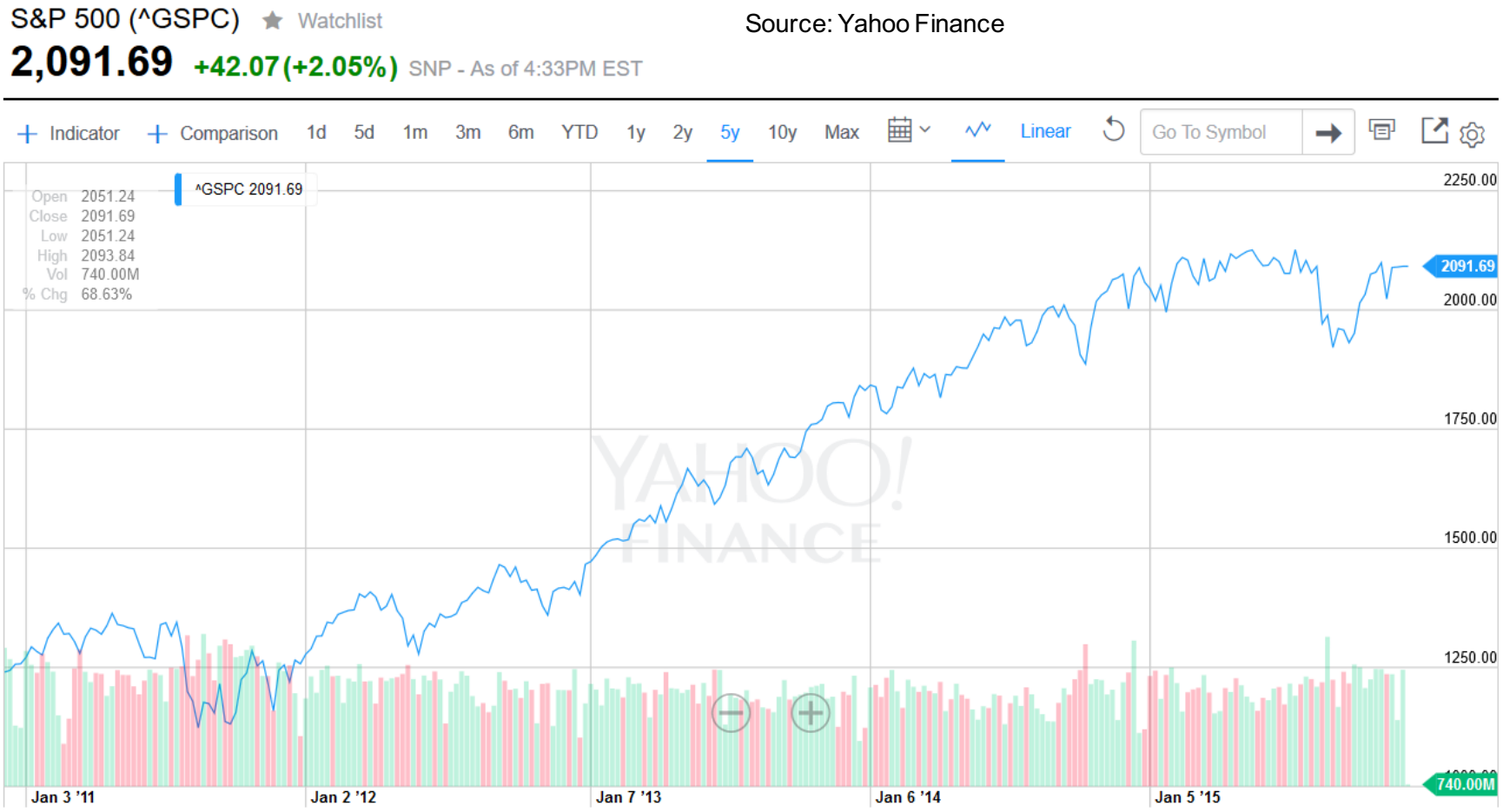
- We begin by observing that equity investment is by nature **risky.**

The DDM in a Risky Environment

Some points…

- As whole, the stock market's rate of return is risky.
- Investors are assumed to be risk averse, but much be compensated for that risk with extra return.
- Individual firms can move up and down with the market.
- Intrinsic Value – How closely a firm's earnings moves with the market will determine the return required by an equity holder and hence.

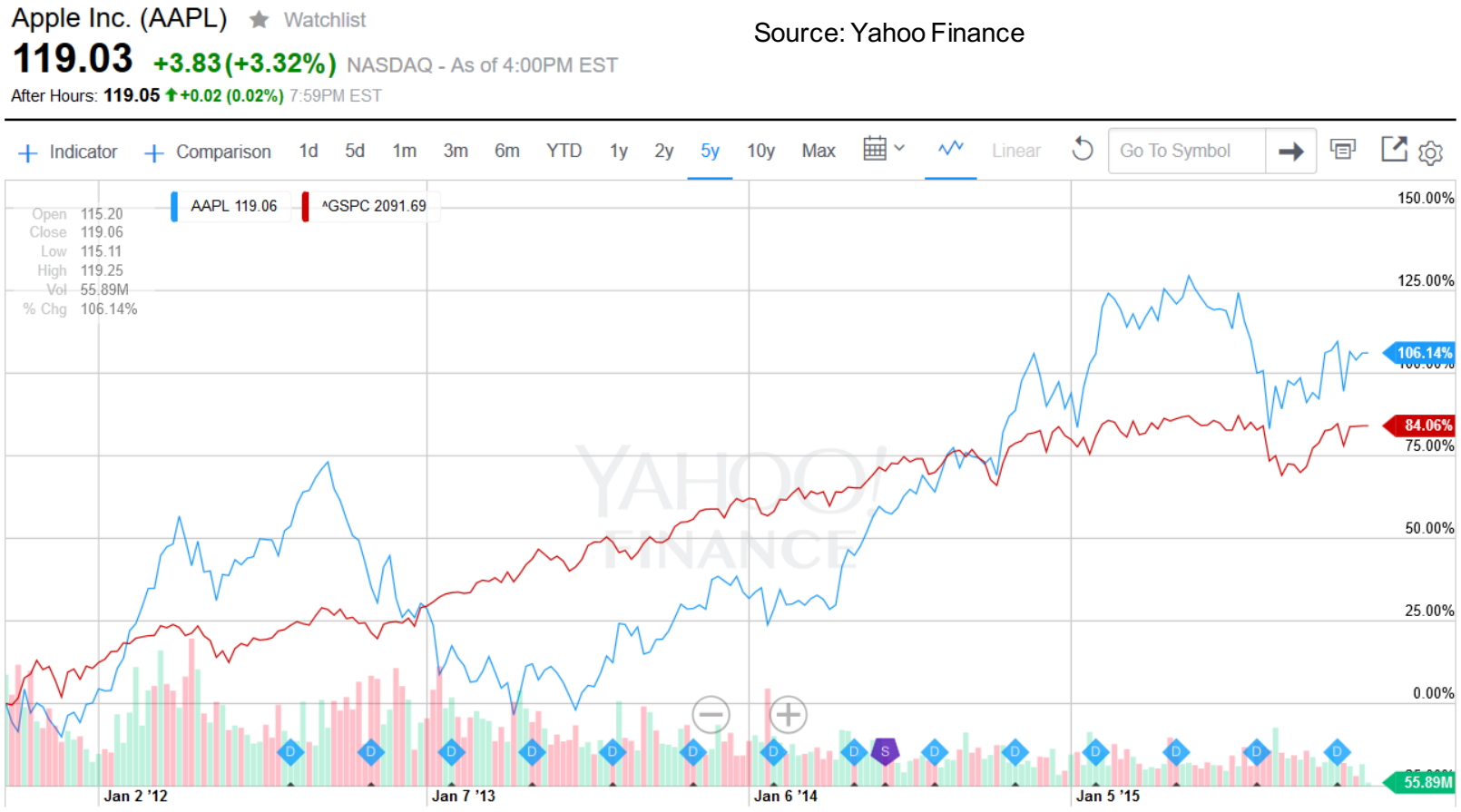
Market Movement Up and Down



Source: Yahoo Finance

Stock Indices -- Weighted by Market Capitalization					
Company	N of Shares	Price Per Share	Market Capitalization - currency units	Share of market capitalization.	Effect if a 10% increase in stock price on index.
Firm X	40000009	40	1600000360	30.0%	3.00%
Firm Y	20102891	51	1025247441	19.2%	1.92%
Firm Z	33092368	82	2713574176	50.8%	5.08%
Total			**5338821977**	**100.0%**	

Stock Movement with the Market



Source: Yahoo Finance

The market rate of return 'rM'. A weighted average of firm returns.

Firm Name	Share of market capitalization.	Firm Return
Firm X	30.0%	10.00%
Firm Y	19.2%	-5.00%
Firm Z	50.8%	3.00%
Weighted average	r_M	3.6%

Distaste For Risk and the Risk Premium – 1

There is risk associated with the market rate of return r_M.

The magnitude of this risk is gauged using the variance of the market rate of return:

$$\sigma_M^2 = \text{variance of market rate of return}$$

Risk Premium is the reward required by market participants for taking on risk.

Distaste for Risk and the Risk Premium – 2

$E(r_M) - r_F =$ risk premium:

Expected market rate of return minus risk free ("fixed") rate of return.

The market's (dis)taste for risk in relation to the risk itself (variance) is gauged by:

$$E(r_M) - r_F = f(\sigma_M^2),\ f' > 0$$

Distaste for Risk and the Risk Premium – 3

$E(r_M) - r_F =$ risk premium:

Expected market rate of return minus risk free ("fixed") rate of return.

We may gauge the market's (dis)taste for risk in relation to the risk itself (variance):

$$E(r_M) - r_F = f(\sigma_M^2),\ f' > 0$$

While distaste for risk may be non-linear, we can approximate with a linear function:

$$f(\sigma_M^2) = \rho\sigma_M^2,\ \rho > 0$$

Higher "rho" means more distaste for risk – higher risk premium required.

An Individual Firm Versus the Market

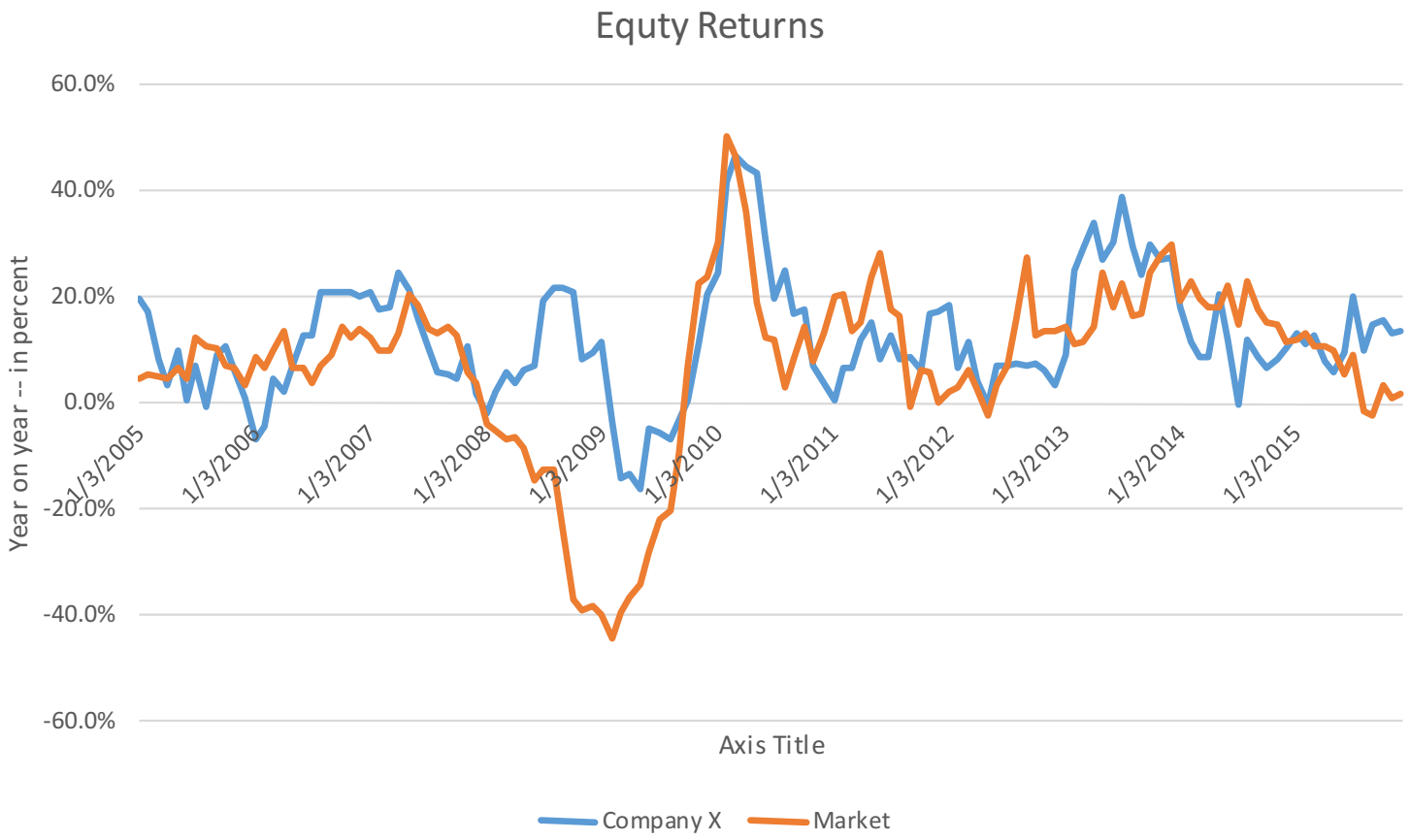
Equity returns from individual firms can move up and down with the market.

The firm's "beta" gives us an indication of how we expect its equity returns to move in relation to the market return:

$$\beta_i = \frac{\Delta r_i}{\Delta r_M}$$

$$\Delta r_i = \beta_i * \Delta r_M$$

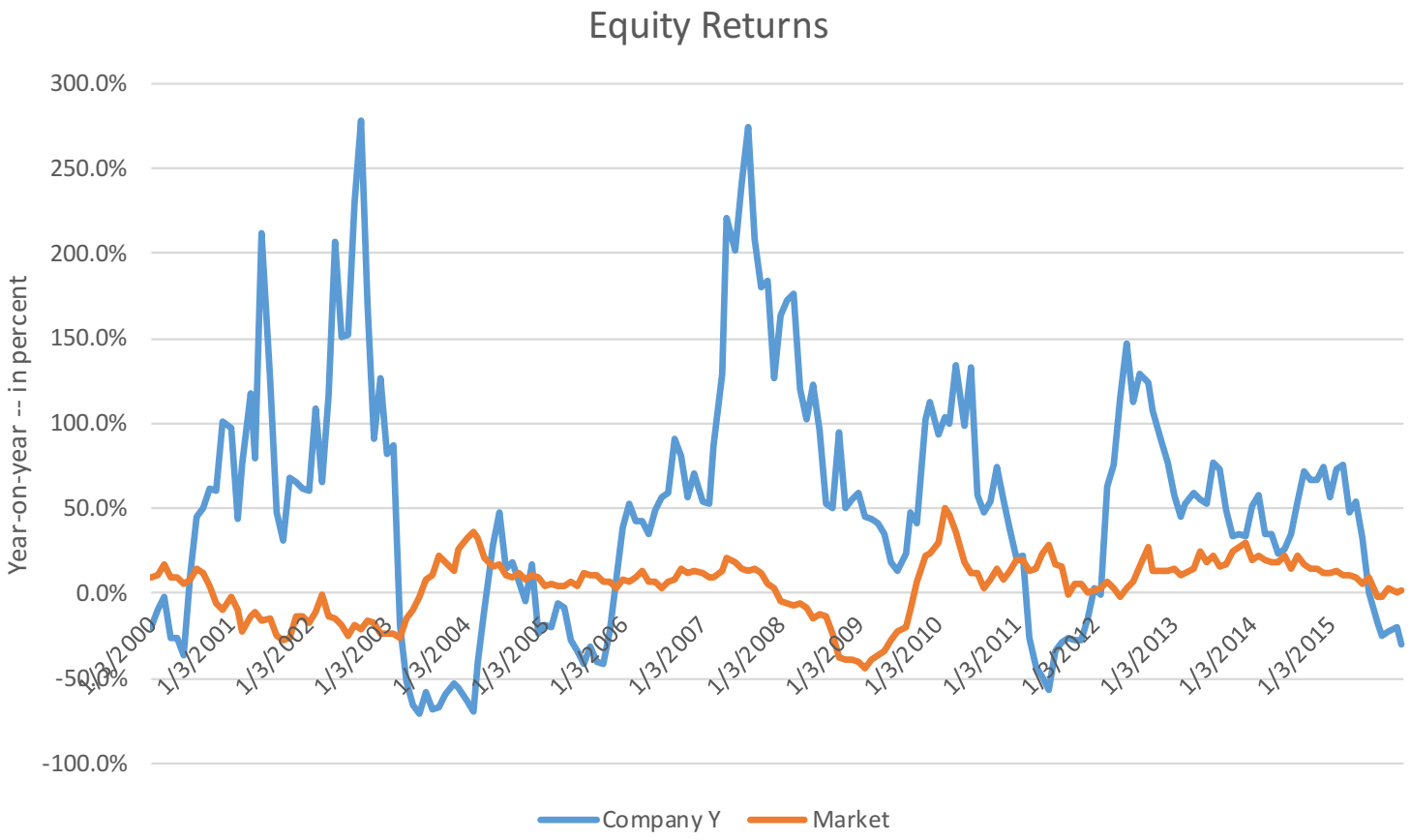
A Low Beta Firm



A 'low beta' firm – Did not drop as much as the market during the great financial crisis of 2008-09, but might not have enjoyed high market gains during certain periods.

Source: Yahoo Finance

A High Beta Firm



A 'high beta' firm – Amplifies both the high and the lows of the market.

Source: Yahoo Finance; "Market" is S and P 500

Forecasting Returns using Beta

Equity returns from individual firms can move up and down with the market.

The firm's "beta" gives us an indication of how we expect its equity returns to move in relation to the market return:

$$\Delta r_i = \beta_i * \Delta r_M$$

Interpreting beta – how any firm contributes to portfolio volatility

Recall: the “market” portfolio = weighted sum of all assets in the market

Variance of the “market” portfolio reflects the volatilities of individual stocks and their covariance.

Variance of a portfolio changes when we add a new equity.

Equity with higher variance than the market – beta greater than one – raises portfolio variance.

Equity with higher variance than the market – beta greater than one – raises portfolio variance.

Diversification and risk

Consider two Firms, A and B.

Let's think of Firm A and Firm B as moving to some extent together with one another.

Example: during an economic expansion, sales revenues for both A and B increase simultaneously.

We call this common element 'systematic' risk.

Diversification and risk

But, there may be some aspects of Firm A and firm B that are mutually unrelated.

Example: the motion picture industry makes big profits if they produce good, popular movies.

Their fortunes are independent of, say the apparel industry, which benefits if they produce more attractive clothing.

We call these the idiosyncratic risks of Firms A and B, respectively.

Diversification and risk

We can eliminate they idiosyncratic risks by holding a some of Firms A and B and all other firms in our portfolio.

When we hold shares of all firms in proportion to their market capitalization, we hold the market portfolio.

Holding a diverse portfolio cancels out the idiosyncratic risks. This is diversification.

Even so, we still have some risk – the risk of the market portfolio, sometimes called ‘systematic’ or ‘market’ risk.

The Calculation of Beta

We collect historical data on the returns to the firm and to the market: r_i, r_M

We compute the market return variance σ^2_M and the covariance between the firm return and the market return, cov(r_i, r_M).

Beta for firm *i* is defined as:

$$\beta_i = \frac{\text{cov}(r_i, r_M)}{\sigma^2_M}$$

Equivalently, we can run a regression of r_m on r_i, and Beta would be equal to the regression coefficient.

The Market Capitalization Rate (k) – Capital Asset Pricing Model (CAPM)

Developed by Markowitz and Sharpe in the 50s – 60s.

Explains where the required return comes from.

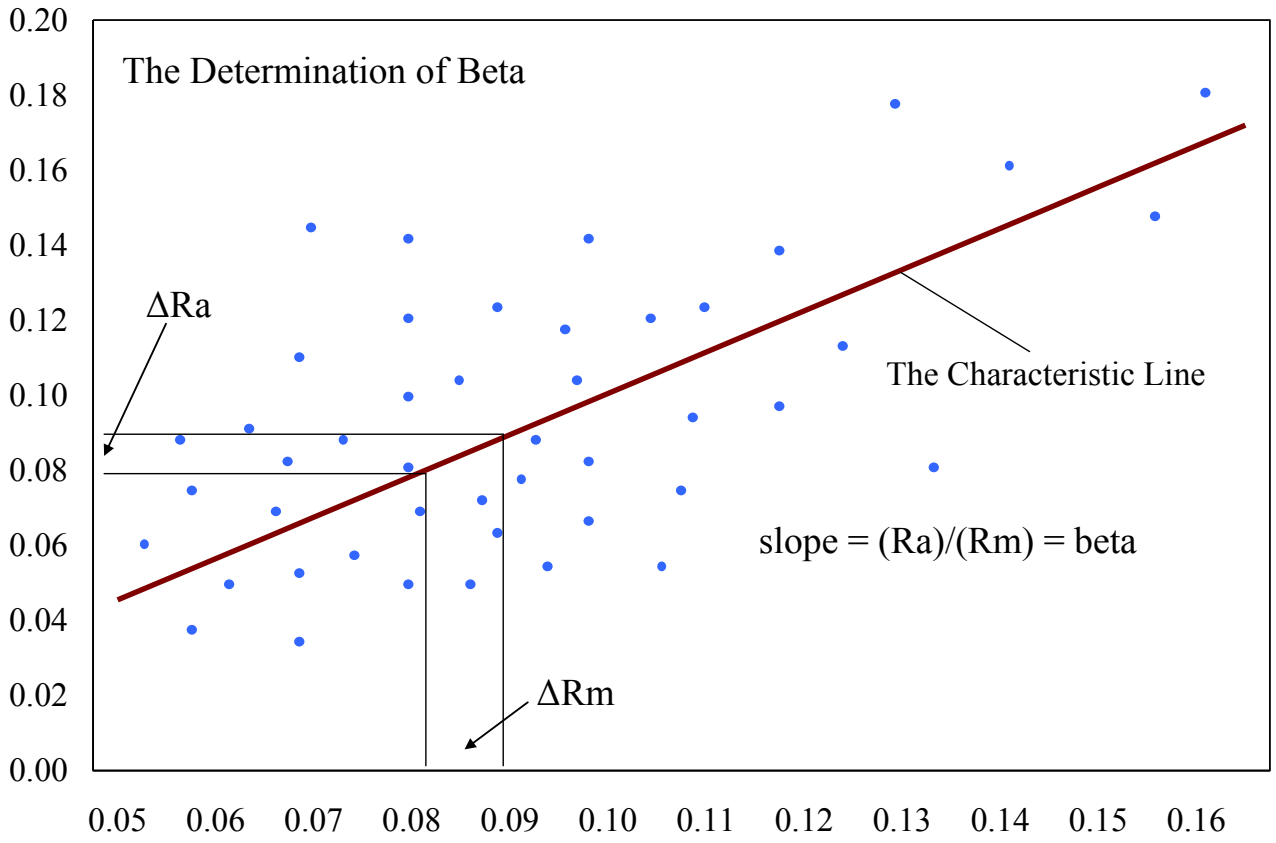
- How much extra return do investors need to take on extra risk?
- What we mean by extra: with respect to the risk-free rate r_f

Other securities must offer additional expected return to compensate for the additional risk.

Thus, the Expected Rate of Return on a stock for Firm *i* may be computed as:

$$E(r_i) = r_f + \beta_i \left[E(r_M) - r_f \right]$$

Interpreting Beta



If **Beta** is:

> 1, firm is more volatile than the market

< 1, firm is less volatile than the market

= 1, firm perfectly correlated with the market

Note:

Beta is an average historical relationship.

Returning to the DDM – 1

For firm ‘Firm i’ the market capitalization rate is its expected return:

$$k_i = E(r_i) = r_f + \beta_i \left[E(r_M) - r_f \right]$$

Returning to the DDM – 2

Now we bring the **CAPM** and the **DDM** together.

Recall the constant growth DDM using the firm-specific market capitalization rate:

$$P_{0,i} = \frac{D_{1,i}}{k_i - g_i} \Rightarrow P_0 = \frac{D_1}{k - g}$$

To simplify, hereafter we'll drop the *i* subscript, but keep in mind that ***D***, ***k***, and ***g*** are all firm-specific

Returning to the DDM – 3

Recall that we may gauge the market's (dis)taste for risk in relation to the risk itself (variance):

$$E(r_M) - r_F = f(\sigma_M^2),\ f' > 0$$

We also suggested that we may approximate with a linear function:

$$f(\sigma_M^2) = \rho\sigma_M^2,\ \rho > 0$$

Higher "rho" means more distaste for risk – higher risk premium required.

Pricing Stocks Using the DDM and the CAPM

We can now express the (intrinsic) price of an equity as a function of its main determinants:

$$P_0 = \frac{D_1}{k-g} = \frac{(1-b)E_1}{r_f + \beta(r_M - r_f) - b \cdot ROI} = \frac{(1-b)E_1}{r_f + \beta(\rho\sigma_M^2) - b \cdot ROI}$$

Note: We have both the DDM formula and the CAPM which tells us about the market capitalization.

The Price/Earnings (P/E) Ratio Using the DDM and the CAPM – 1

We can re-express these ideas in terms of the price/earnings (P/E) ratio:

$$\frac{P_0}{E_1} = \frac{D_1}{k-g}\frac{1}{E_1} = \frac{(1-b)}{r_f + \beta(r_M - r_f) - b \cdot ROI} = \frac{(1-b)}{r_f + \beta(\rho\sigma_M^2) - b \cdot ROI}$$

The Price/Earnings (P/E) Ratio Using the DDM and the CAPM – 2

There are more rigorous derivations.

Verify…

$$\frac{\partial P/E}{\partial \sigma_M^2} = \frac{-\beta\rho(1-b)}{[k-g]^2} < 0$$

Furthermore, the higher the firm-specific risk (β), the stronger the effect of market risk (σ^2_M) on the price.

Verify…

$$\frac{\partial^2 P\text{-}E}{\partial \sigma_M^2 \partial \beta} < 0$$

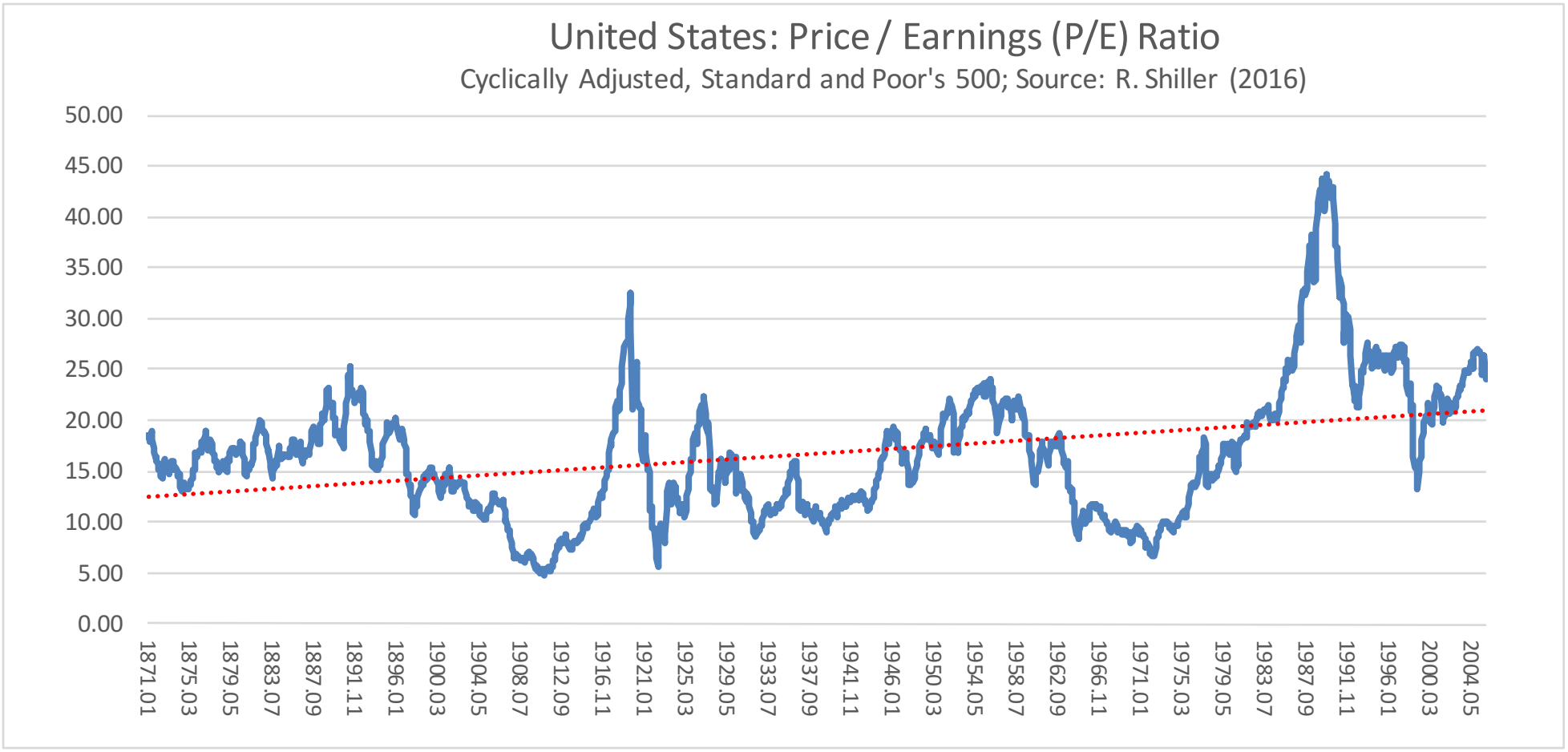
The Overvalue of the U.S. Market – 1

For the market as whole, “beta” equals unity.

The expression for the market P/E ratio would be:

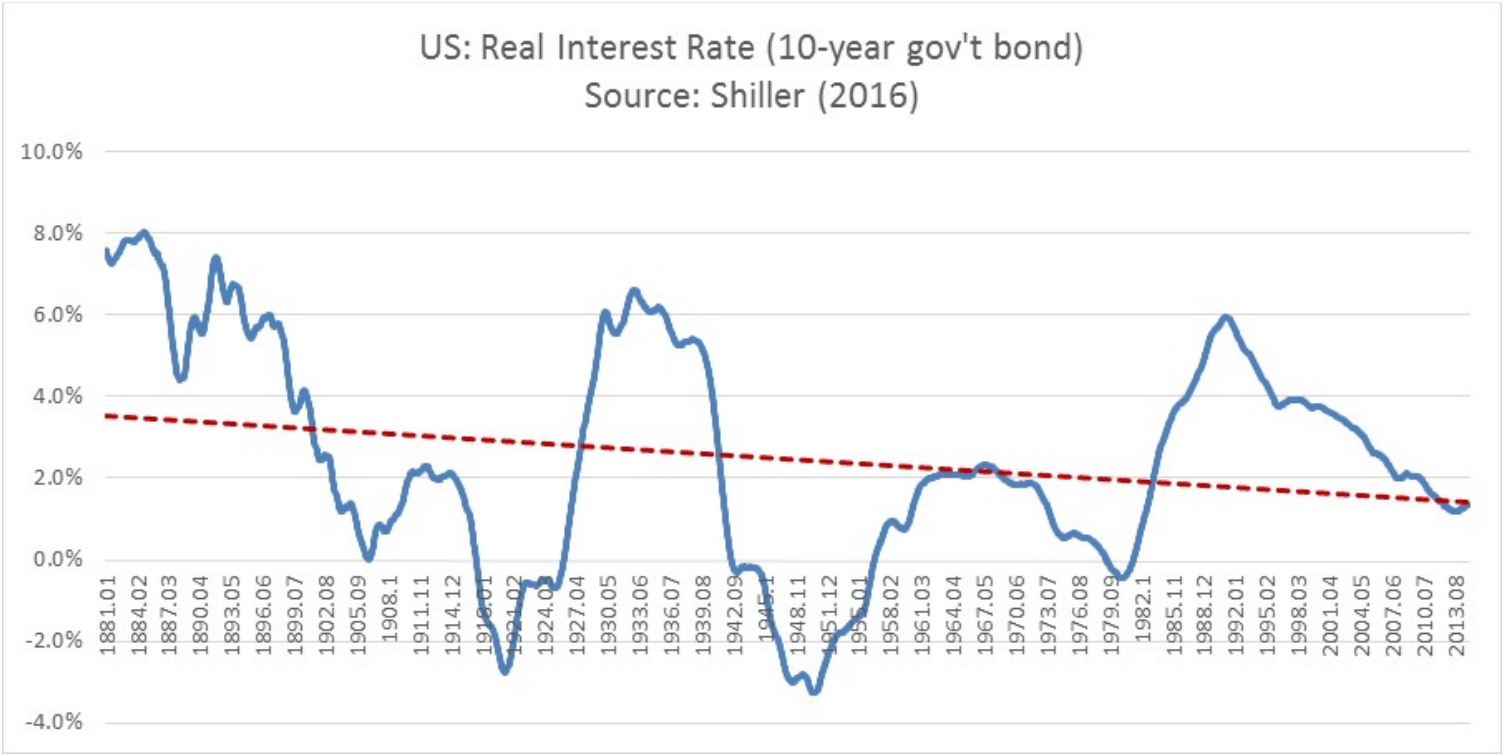
$$\frac{P}{E}(\text{market}) = \frac{D}{k-g}\frac{1}{E}(\text{market}) = \frac{(1-b)}{r_f + f(\sigma_M^2) - b \cdot ROI}$$

The Overvalue of the U.S. Market – 2



Source: Professor Robert Shiller's website, http://www.econ.yale.edu/~shiller/data.htm

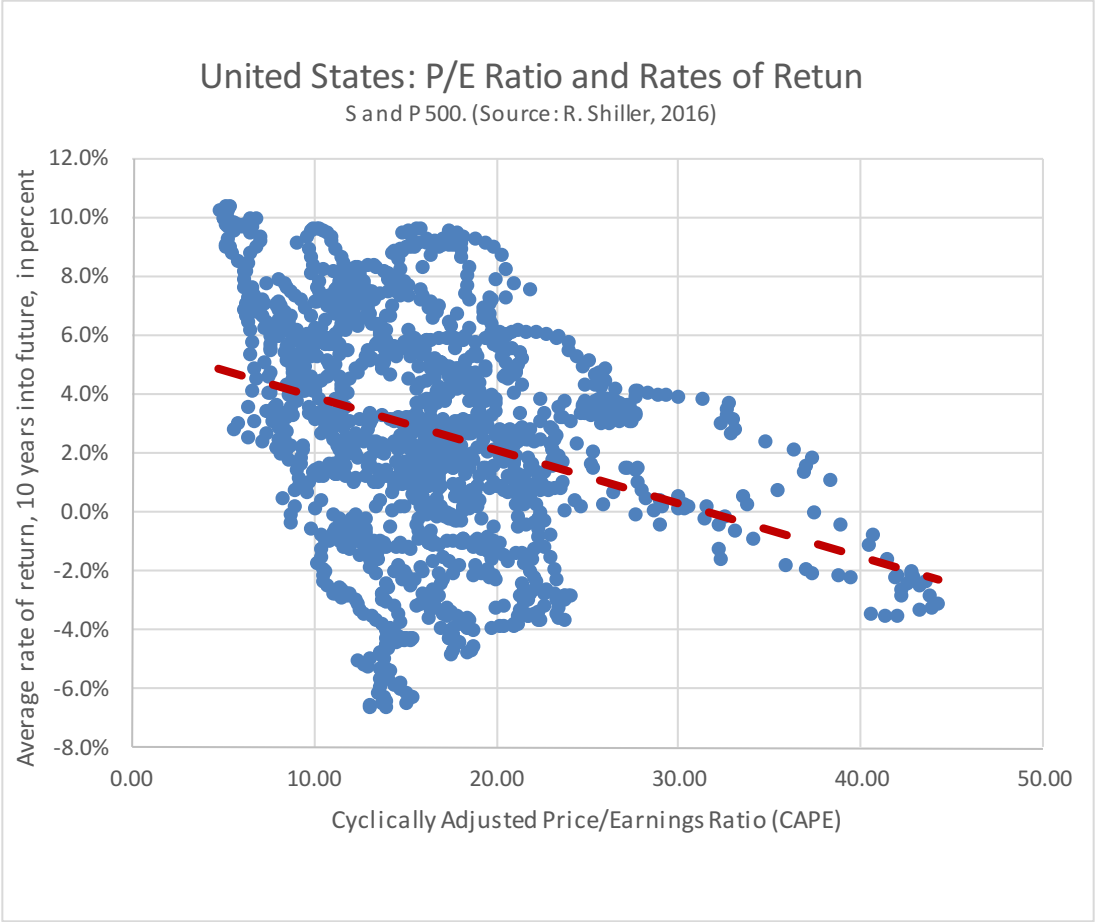
The Overvalue of the U.S. Market – 3



$$\frac{P}{E}(\text{market}) = \frac{(1-b)}{r_f + f(\sigma_M^2) - b \cdot ROI}$$

Source: Professor Robert Shiller's website, http://www.econ.yale.edu/~shiller/data.htm

The Overvalue of the U.S. Market – 4



Source: Professor Robert Shiller's website, http://www.econ.yale.edu/~shiller/data.htm

World Market Volatility and Stock Price

We can apply some principles of the DDM to a country's stock price:

$$P_0 = \frac{D_1}{k - g}$$

$k =$ rate of return for a country

$g =$ growth rate firm earnings in a country

Rarely well measured – often unobserved

Question – are there useful observable "proxies" – approximations of these variables?

World Market Volatility and Stock Price

Let's reconsider **market volatility** as a

- σ_M: volatility of market returns
- β: firm (or country-level) volatility relative to the market

$$k = r_f + \beta\left(\rho\sigma_M^2\right)$$

σ_M = Market volatility

World Market Volatility and Stock Price

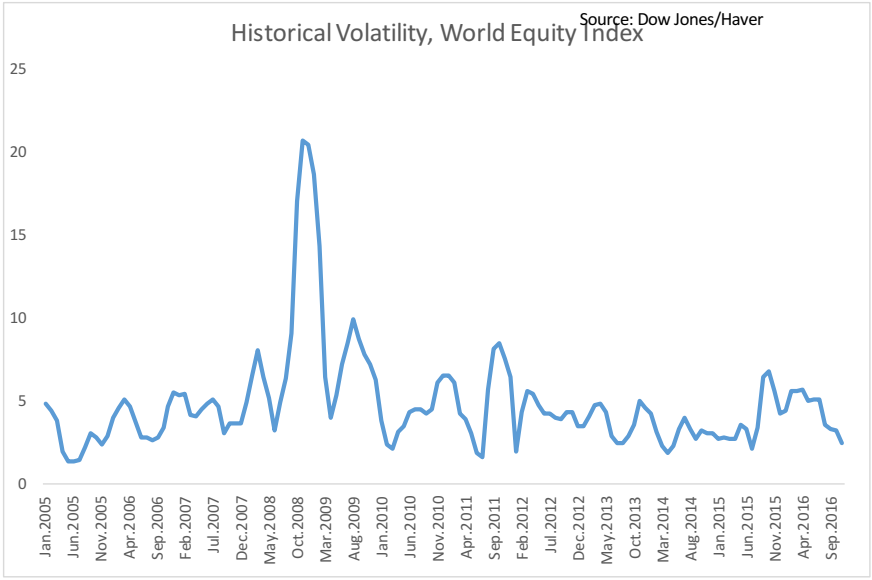
- Here, the "**market" is the "world."**
- Market volatility: volatility of a global stock index
- Weighted average of a broad sample of national stock indices.

$$\sigma_{World} = \text{Volatility of World Market Index}$$

The Dow Jones global index includes 47 countries – industrialized and emerging.

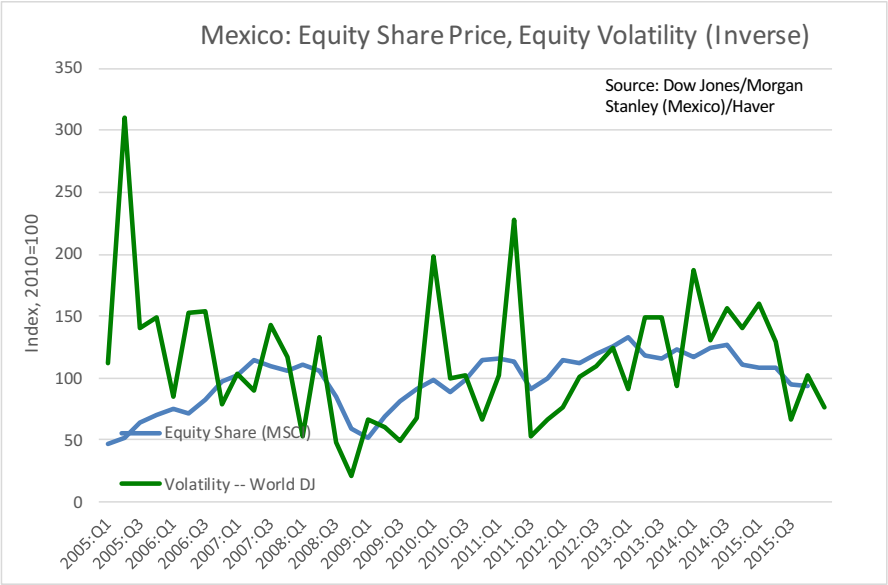
https://www.djindexes.com/globalfamily/

World Market Volatility and Stock Price



σ_{World} = Volatility of World Market Index

World Market Volatility and Stock Price



An example: Mexico's share prices seem to move closely – but not perfectly – with the (inverse) measure of world equity volatility.

World Market Volatility and Stock Price

- We might also use a ‘real time’ measure of market volatility – one that reflects the market’s own view of volatility.

- Even better, we might consider a measure that is forward looking – rather than based on historical data.

- Such a measure is the “Volatility Index” constructed by the Chicago Board of Exchange.

- The index is traded under the symbol “VIX” tells us by how many percentage point do market participants expect the stock market to go up or down.

- Indirect measure – uses options on US stock indices.

World Market Volatility and Stock Price

- Problem: there is no “world” VIX index.
- We need an ‘proxy’ – something that might move closely with world volatility.
- One strategy: US volatility and world volatility may be correlated.
- In this case, we might use the US-based VIX as a proxy for world volatility.

σ_{World}  σ_{US}

World Market Volatility and Stock Price

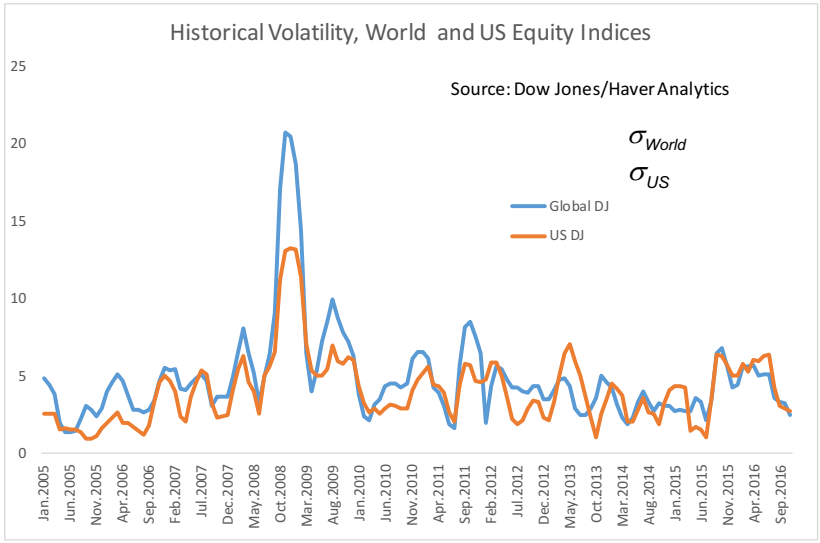
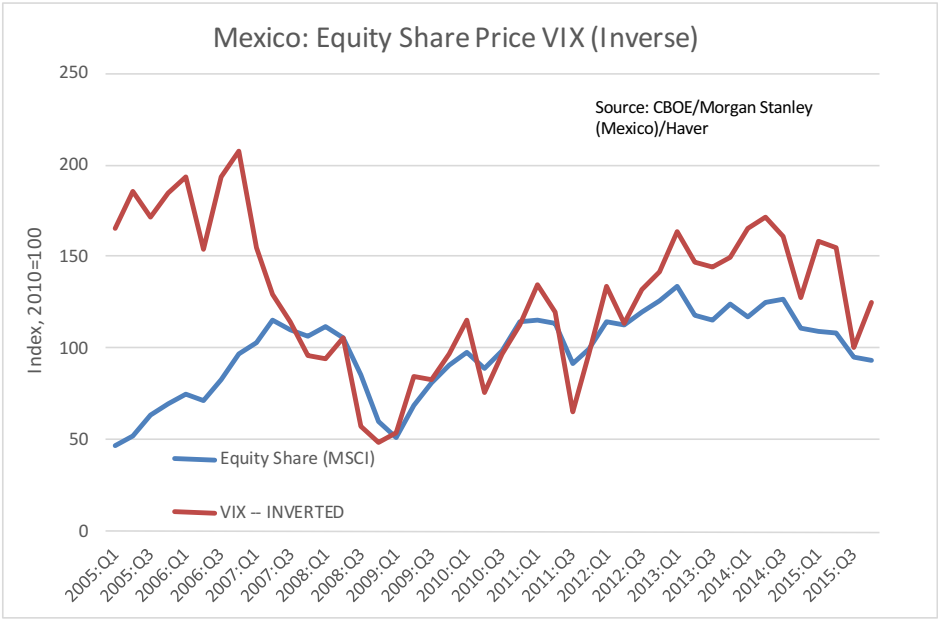


Chart: World and US volatility measures ***do*** appear to be closely correlated.

World Market Volatility and Stock Price



Mexico's share prices seem to move closely – but not perfectly – with the inverse VIX

Wrapping up the Module – 1

Key Idea:

Economic enterprises can finance their activities in various ways.

- Bond Financing (already discussed)
- Equity Shares

Key Questions:

- What is an equity share?
- What determines the price of an equity share of a Firm X?
- How can market participants assess whether Firm X's shares are correctly priced?
- How can macroeconomists assess whether a market's shares are correctly priced?

Wrapping up the Module – 2

Our general expression for the DDM:

- Price

$$P_0 = \frac{D_1}{k-g} = \frac{(1-b)\cdot E_1}{r_f + \beta\left(\rho \cdot \sigma_M^2\right) - b \cdot ROI}$$

- P-E ratio:

$$\frac{P_0}{E_1} = \frac{1-b}{r_f + \beta\left(\rho \cdot \sigma_M^2\right) - b \cdot ROI}$$

Factors that affect equity prices:

Macro interest rates (r_f)

Market volatility (σ^2_M)

Firm-specific market risk (β)

Profitability of investment (ROI)

Plowback or investment of earnings (b), but only helps if ROI > k