

# CHAPTER 11

# EQUITY MARKET VALUATION

Presenter

Venue

Date



**CFA Institute**

# NEOCLASSICAL APPROACH TO GROWTH ACCOUNTING

Cobb-Douglas production function

$$Y = AK^\alpha L^\beta$$

Assuming constant returns to scale,  $1 - \alpha = \beta$ , and taking the natural logarithm of both sides of first equation gives

$$\ln(Y) = \ln(A) + \alpha \ln(K) + (1 - \alpha) \ln(L)$$

Taking first differences of second equation and using a property of logarithms results in this approximation:

$$\frac{\Delta Y}{Y} \approx \frac{\Delta A}{A} + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$$

# GROWTH ACCOUNTING FORMULA

$$\Delta Y/Y$$

- Percentage growth in real output (GDP)

$$\Delta A/A$$

- Percentage growth in total factor productivity

$$\Delta K/K$$

- Percentage growth in the capital stock

$$\Delta L/L$$

- Percentage growth in labor

$$\alpha$$

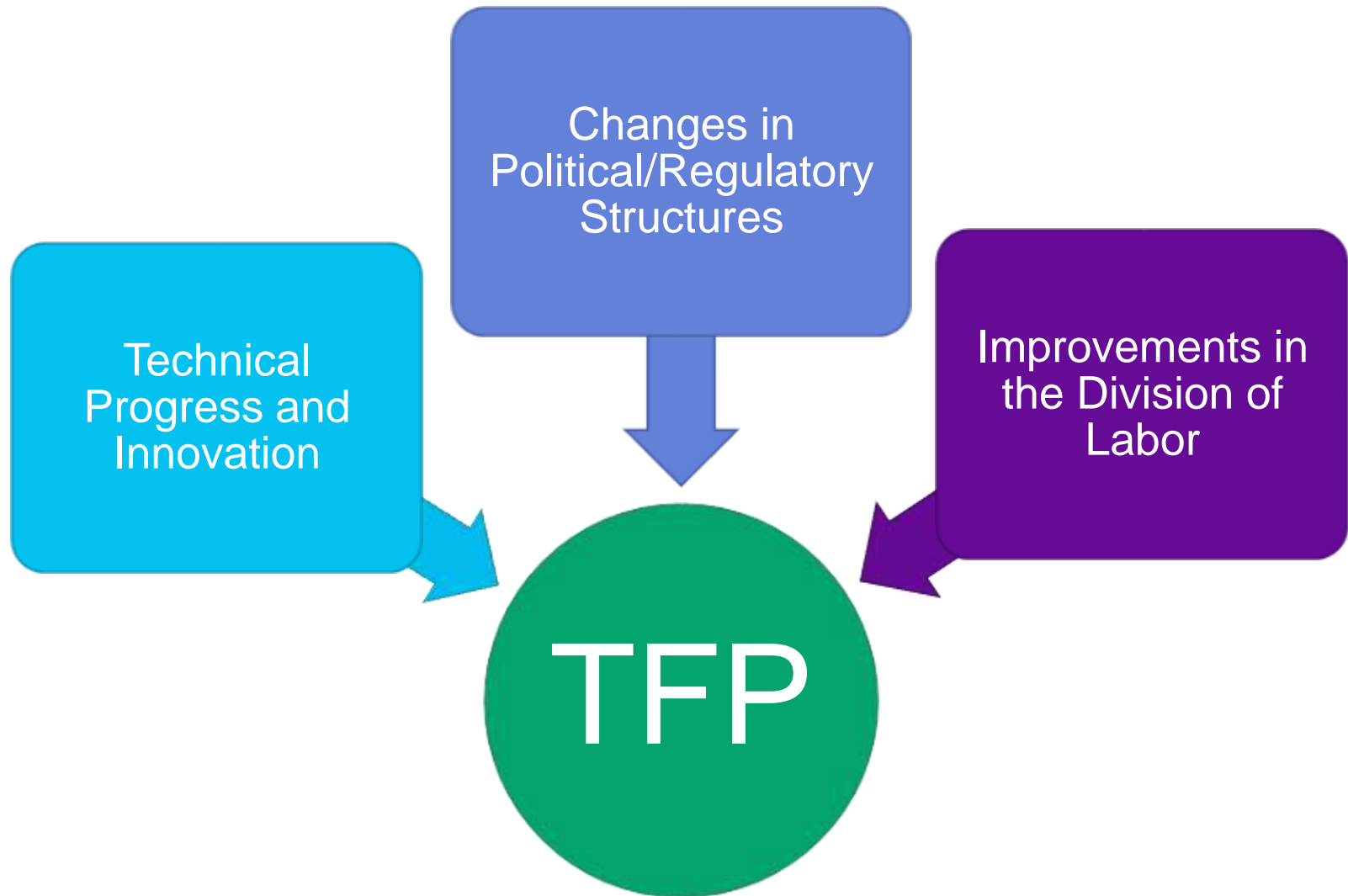
- Output elasticity of capital

$$1 - \alpha$$

- Output elasticity of labor

$$\frac{\Delta Y}{Y} \approx \frac{\Delta A}{A} + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L}$$

# TOTAL FACTOR PRODUCTIVITY (TFP)



# THE CHINA ECONOMIC EXPERIENCE

Countries	Time Period	Real GDP growth $\Delta Y/Y$	Growth in total factor productivity $\Delta A/A$	Growth in capital stock $\Delta K/K$	Growth in labor input $\Delta L/L$
China	1978–1995	10.11%	3.80%	9.12%	3.49%
	1995–2007	9.25%	1.45%	12.81%	2.78%
Soviet Union	1950–1970	5.4%	1.6%	8.8%	1.8%
	1970–1985	2.7%	−0.4%	7.0%	1.1%
United States	1950–1972	3.9%	1.6%	2.6%	1.4%
	1972–1996	3.3%	0.6%	3.1%	1.7%
	1996–2004	3.6%	1.5%	2.6%	0.7%
European Union	1960–1973	5.1%	3.2%	--	4.8%
	1973–2003	2.2%	1.0%	0.5%	2.8%

*Source:* Zheng, Hu, and Bigsten (2009). China's output elasticity for capital ( $\alpha$ ) and output elasticity for labor ( $1 - \alpha$ ) were both estimated to be 0.5.

# QUANTIFYING CHINA'S FUTURE ECONOMIC GROWTH

$\Delta A/A$

- Reform measures?
- Productivity?

$\Delta K/K$

- Government policies?
- Price controls?
- High savings rates?

$\Delta L/L$

- Population growth?
- Labor force participation rates?

# EXHIBIT 11-2 GROWTH PROJECTIONS (2009–2030)

Country	Real GDP growth, $\Delta Y/Y$	Growth in total factor productivity, $\Delta A/A$	Output elasticity of capital, $\alpha$	Growth in capital stock, $\Delta K/K$	Output elasticity of labor, $1 - \alpha$	Growth in labor input, $\Delta L/L$
China	8.0%	2.5%	0.5	8.0%	0.5	3.0%
United States	2.75%	1.2%	0.3	4.0%	0.7	0.5%
European Union	2.2%	1.0%	0.4	3.0%	0.6	0.0%

*Source:* Zheng, Hu, and Bigsten (2009).

# GROWTH FORECAST FOR CHINA

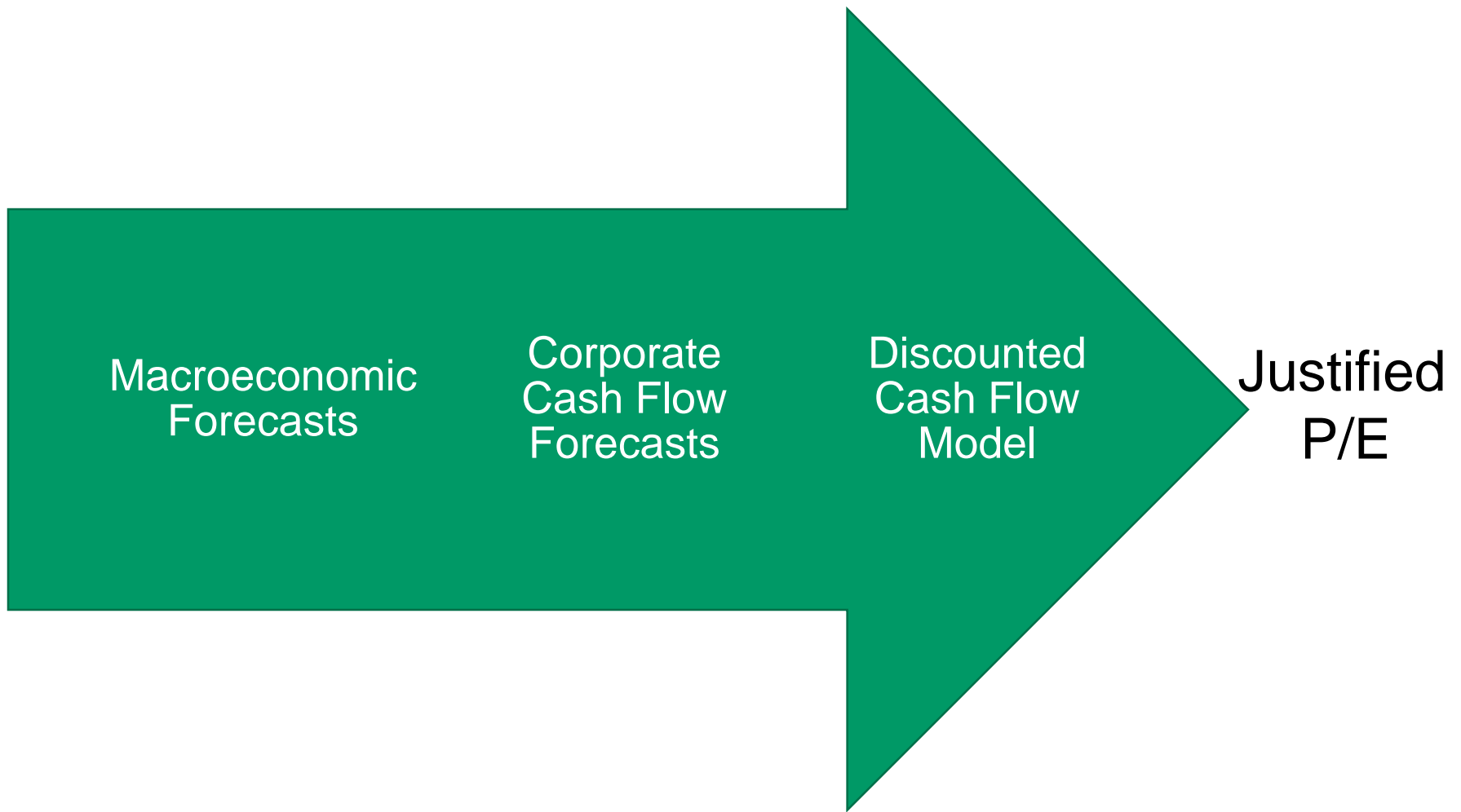
Total factor productivity + Growth in capital stock  
+ Labor force growth = Real GDP growth

Near-term growth forecast:  $2.5\% + (0.5 \times 12\%) + (0.5 \times 1.5\%) = 9.25\%$

Sustainable economic growth rate:  $1.25\% + (0.5 \times 6\%) + (0.5 \times 0.0\%) = 4.25\%$



# EQUITY MARKET VALUATION



# USING THE H-MODEL TO ESTIMATE A JUSTIFIED P/E

The H-model:

$$V_0 = \frac{D_0}{r - g_L} \left[ (1 + g_L) + \frac{N}{2} (g_S - g_L) \right]$$

Assumptions:

- Dividend growth declines linearly from rate  $g_S$  to rate  $g_L$  over  $N$  years.
- After  $N$  years, dividends grow at rate  $g_L$  into perpetuity.

$$\text{Justified P/E} = \frac{\text{H-model estimate of intrinsic value}}{\text{Year-ahead expected earnings}}$$

# EXHIBIT 11-3 JUSTIFIED P/E RATIOS FOR CHINESE EQUITY MARKET AT MID-YEAR 2009

Terminal Real Growth Rate	Real Equity Discount Rate							
	6.00%	6.50%	7.00%	7.50%	8.00%	8.50%	9.00%	9.50%
3%	26.8	23.0	20.1	17.9	16.1	14.6	13.4	12.4
4%	37.3	29.9	24.9	21.3	18.7	16.6	14.9	13.6
5%	69.0	46.0	34.5	27.6	23.0	19.7	17.2	15.3

*Note:* Chinese equity market justified P/Es: 30-year transition from 9.25% real dividend growth to various terminal growth rates to perpetuity.

# EXHIBIT 11-6 RETURN AND VOLATILITY DATA, 31 DECEMBER 2001–31 DECEMBER 2008

	S&P China BMI	MSCI China	S&P 500
Annualized nominal total return (1)	14.7%	16.6%	-1.5%
Annualized standard deviation of total returns (2)	29.4%	29.4%	14.3%
Annualized inflation rate (3)	3.7%	3.7%	2.6%

*Notes:*

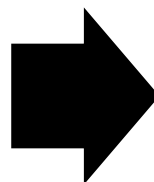
(1) In RMB for Chinese composites, USD for S&P 500

(2) Based on monthly observations

(3) Data through 2007, reflect changes in GDP deflator

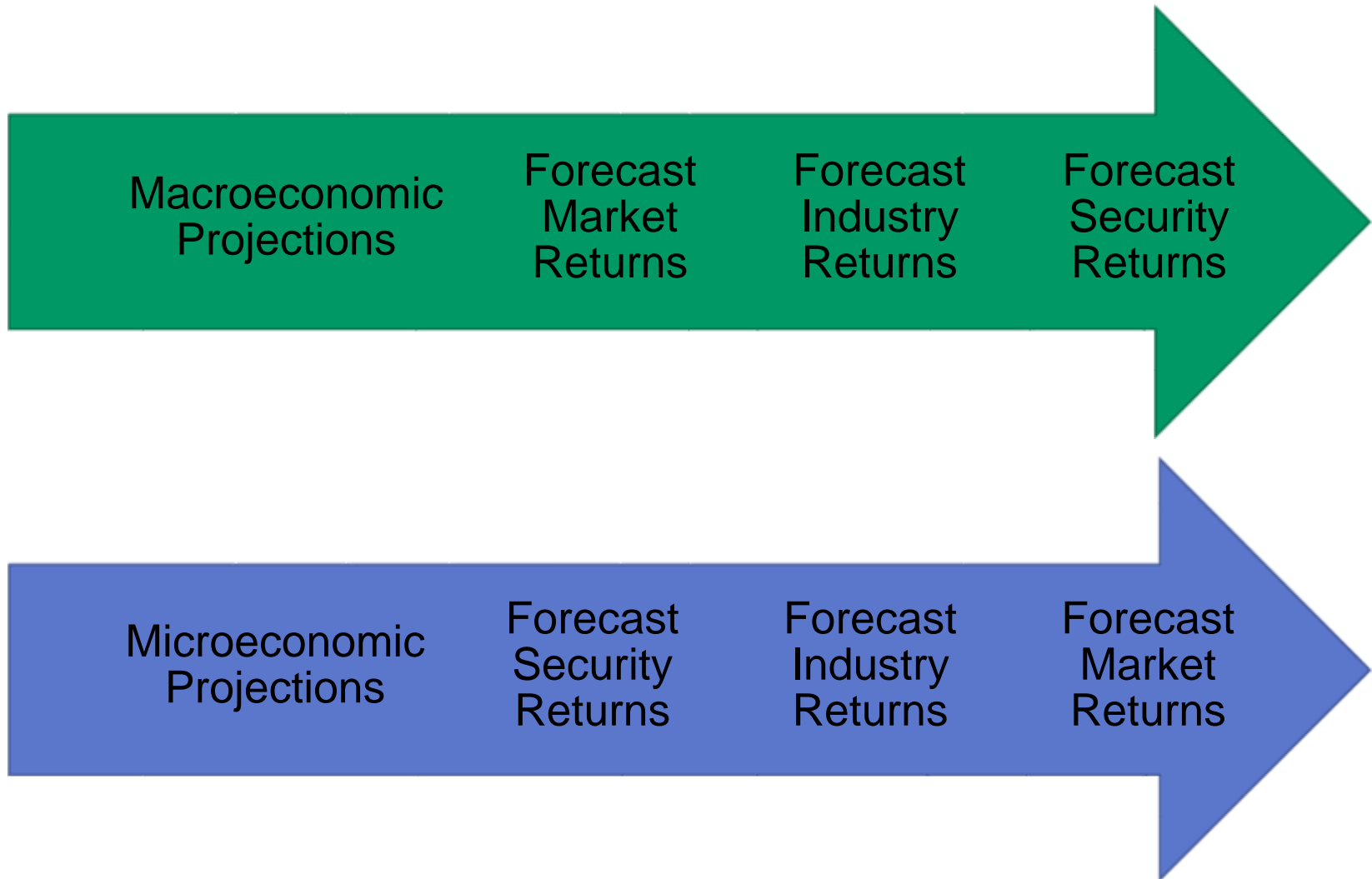
*Sources for data:* Standard & Poor's, Morgan Stanley, Bloomberg, World Bank.

U.S. real equity  
discount rate =  
6–7%?



Chinese real  
equity discount  
rate = 7.5–8.5%?

# TOP-DOWN AND BOTTOM-UP FORECASTING



# TYPICAL APPROACH TO TOP-DOWN ANALYSIS

## Market Analysis

Examine valuations in different equity markets to identify those with superior expected returns.



## Industry Analysis

Evaluate domestic and global economic cycles to determine those industries expected to be top performers in the best-performing equity markets.



## Company Analysis

Identify the best stocks in those industries that are expected to be top performers in the best-performing equity markets.

# TYPICAL APPROACH TO BOTTOM-UP ANALYSIS

## Company Analysis

Identify a rationale for why certain stocks should be expected to outperform, without regard to the prevailing macroeconomic conditions.



## Industry Analysis

Aggregate expected returns for stocks within an industry to identify the industries that are expected to be the best performers.



## Market Analysis

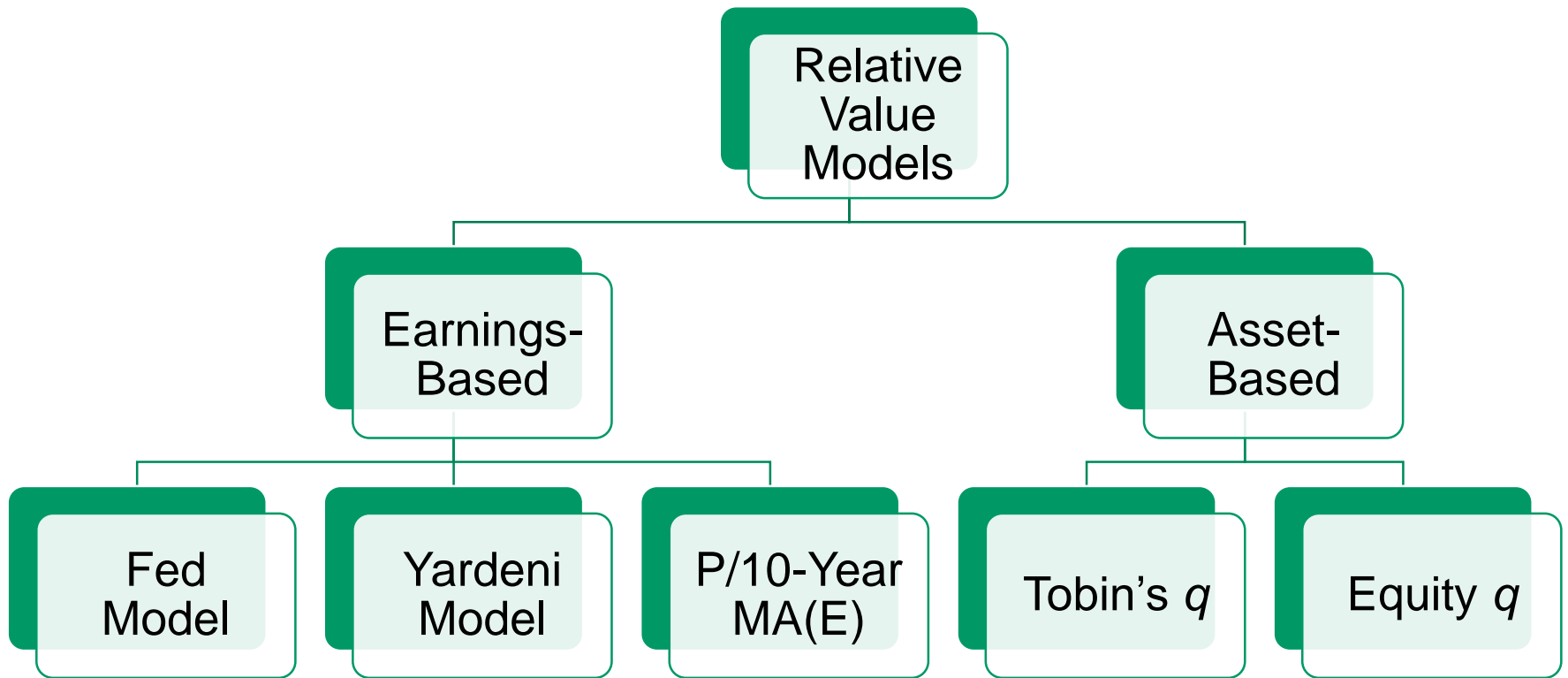
Aggregate expected industry returns to identify the expected returns for every equity market.

# EXHIBIT 11-8 STANDARD AND POOR'S FORECASTS, JULY 2009

Quarter Ending	Operating Earnings per Share (estimates are bottom-up)	Operating Earnings per Share (estimates are top-down)	Difference
31 Dec 2010	\$20.39	\$12.50	\$7.89
30 Sep 2010	19.11	11.42	7.69
30 Jun 2010	18.00	11.18	6.82
31 Mar 2010	16.59	10.86	5.73
31 Dec 2009	16.25	11.72	4.53
30 Sep 2009	15.05	11.68	3.37
30 Jun 2009	14.06	11.05	3.01



# RELATIVE VALUE MODELS



# FED MODEL

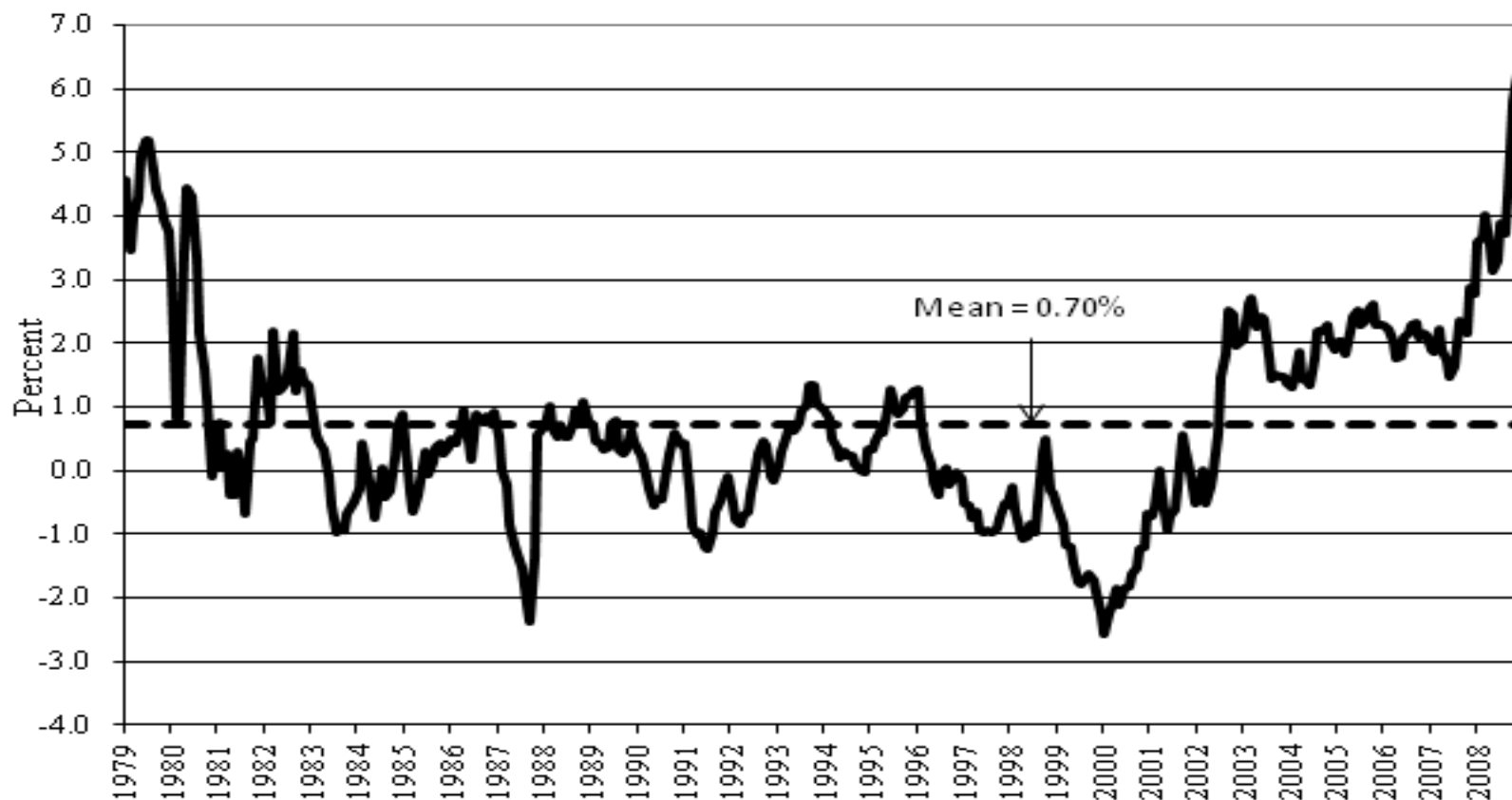
## Predictions of the model:

- Stocks are undervalued if their forward earnings yield is greater than the yield on government bonds.
- Stocks are overvalued if their forward earnings yield is less than the yield on government bonds.

## Limitations:

- Ignores the equity risk premium.
- Compares a real variable with a nominal variable.
- Ignores earnings growth.

# EXHIBIT 11-10 THE FED MODEL: DIFFERENCE BETWEEN THE S&P 500 FORWARD EARNINGS YIELD AND YIELD ON 10-YEAR T-NOTES (MONTHLY DATA: JANUARY 1979–DECEMBER 2008)

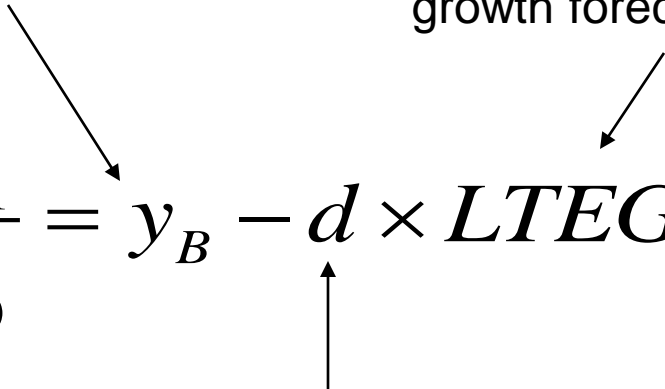


Source for data: [www.yardeni.com](http://www.yardeni.com).

# YARDENI MODEL

Moody's A-rated corporate bond yield

Consensus five-year earnings growth forecast for the S&P 500

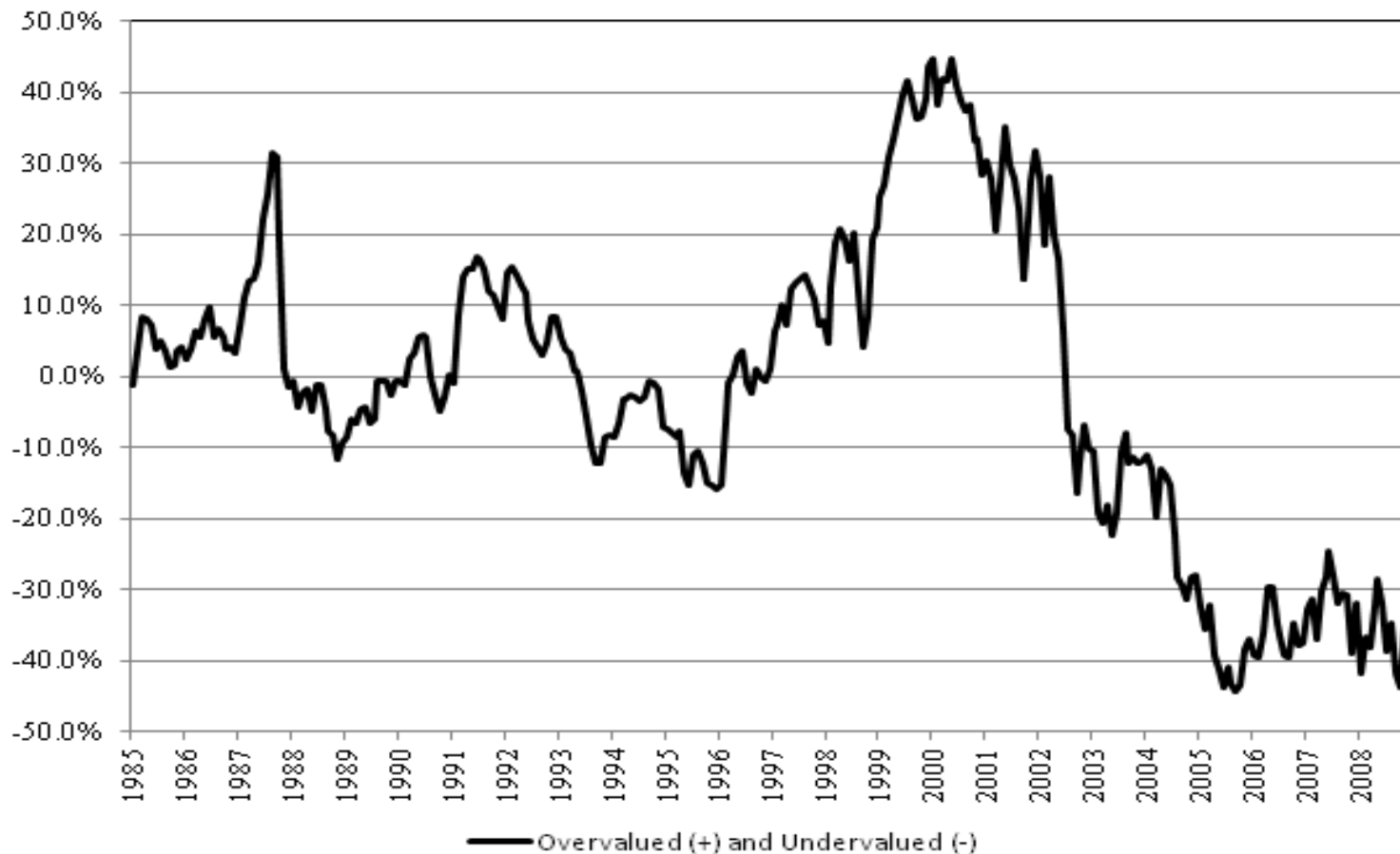
$$\frac{E_1}{P_0} = y_B - d \times LTEG$$


Weighting factor measuring the importance the market assigns to the earnings projections (average is about 0.10)

Concerns:

- 1) The risk premium captured by the model is largely a default risk premium and not the future equity risk premium, which is unobservable.
- 2) The consensus five-year earnings growth forecast for the S&P 500 from Thomson Financial may not be sustainable.
- 3) Evidence suggests that the weighting factor varies significantly over time.

EXHIBIT 11-12 OVERVALUATION (+) AND UNDERVALUATION (-) OF S&P 500 INDEX VS. FAIR VALUE ESTIMATE USING YARDENI MODEL WITH  $D = 0.10$   
(MONTHLY DATA: JANUARY 1985–DECEMBER 2008)

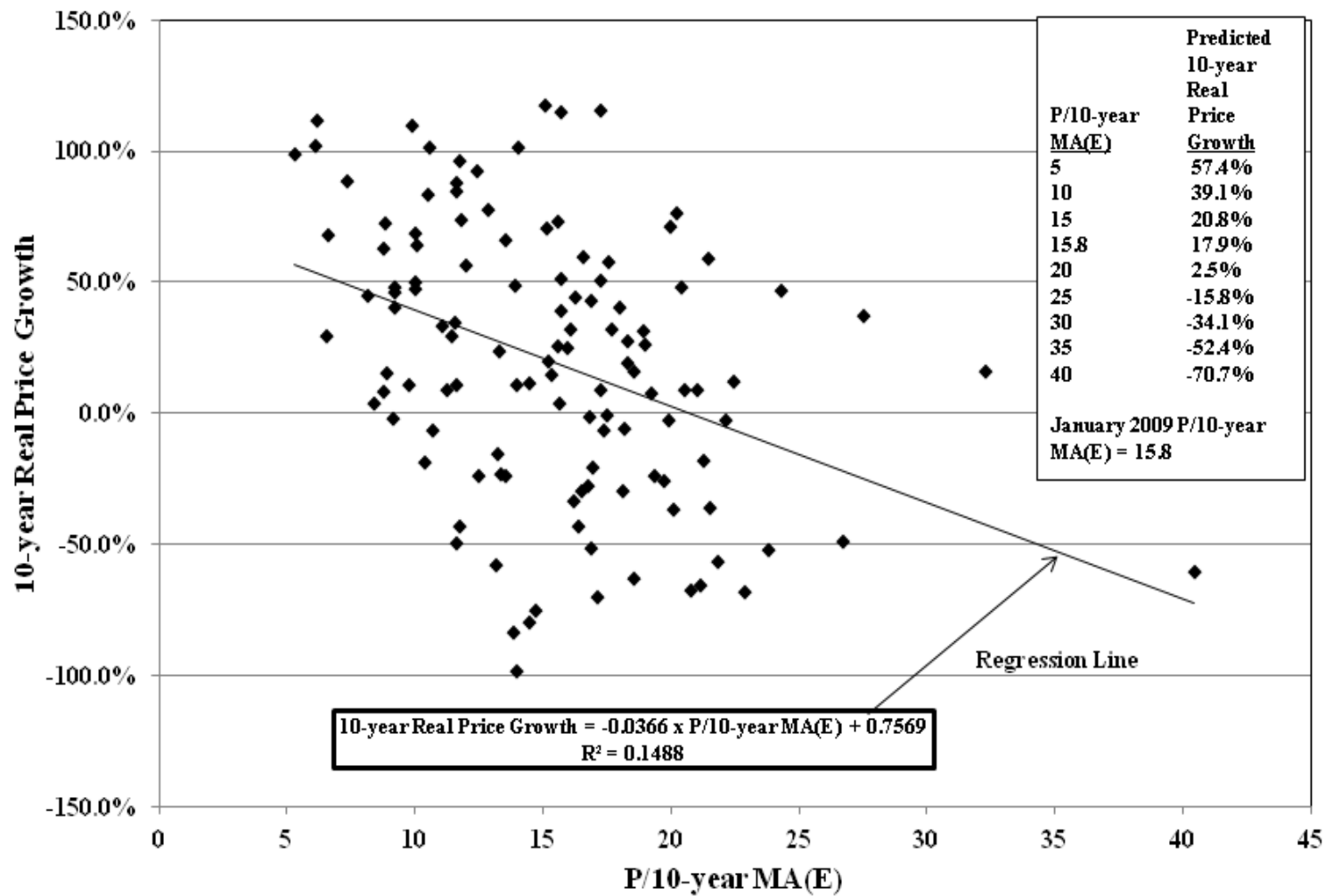


# P/10-YEAR MA(E)

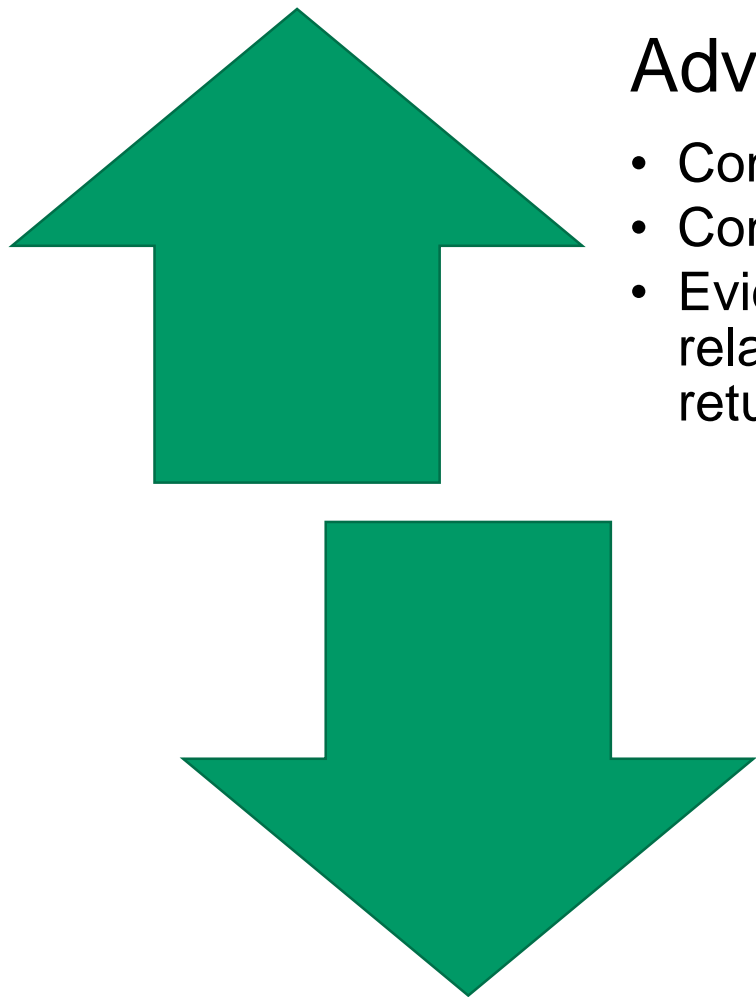
Campbell and Shiller's (1998, 2005) 10-year Moving Average Price/Earnings [P/10-year MA(E)] has become a popular measure of market valuation:

- Numerator of P/10-year MA(E) is the real S&P 500 price index.
- Denominator is the moving average of the preceding 10 years of real reported earnings.
- Stock index and earnings are adjusted for inflation using the Consumer Price Index (CPI).
- Purpose of the 10-year moving average of real reported earnings is to control for business cycle effects on earnings.

# EXHIBIT 11-15 P/10-YEAR MA(E) AND PREDICTED 10-YEAR REAL PRICE GROWTH



# P/10-YEAR MA(E): ADVANTAGES AND DISADVANTAGES



## Advantages

- Controls for inflation
- Controls for business cycle effects
- Evidence supports a negative relationship with future equity returns

## Disadvantages

- Changes in accounting methods may lead to comparison problems
- Current period data may provide better estimates of value
- Evidence suggests high and low levels can persist for long time periods



# ASSET-BASED MODELS: TOBIN'S $q$ AND EQUITY $q$

<u>Assets at Market Value or Replacement Cost</u>	<u>Liabilities</u>	<u>Market Value of Equities Outstanding</u>
28,277.33	12,887.51	9,554.05

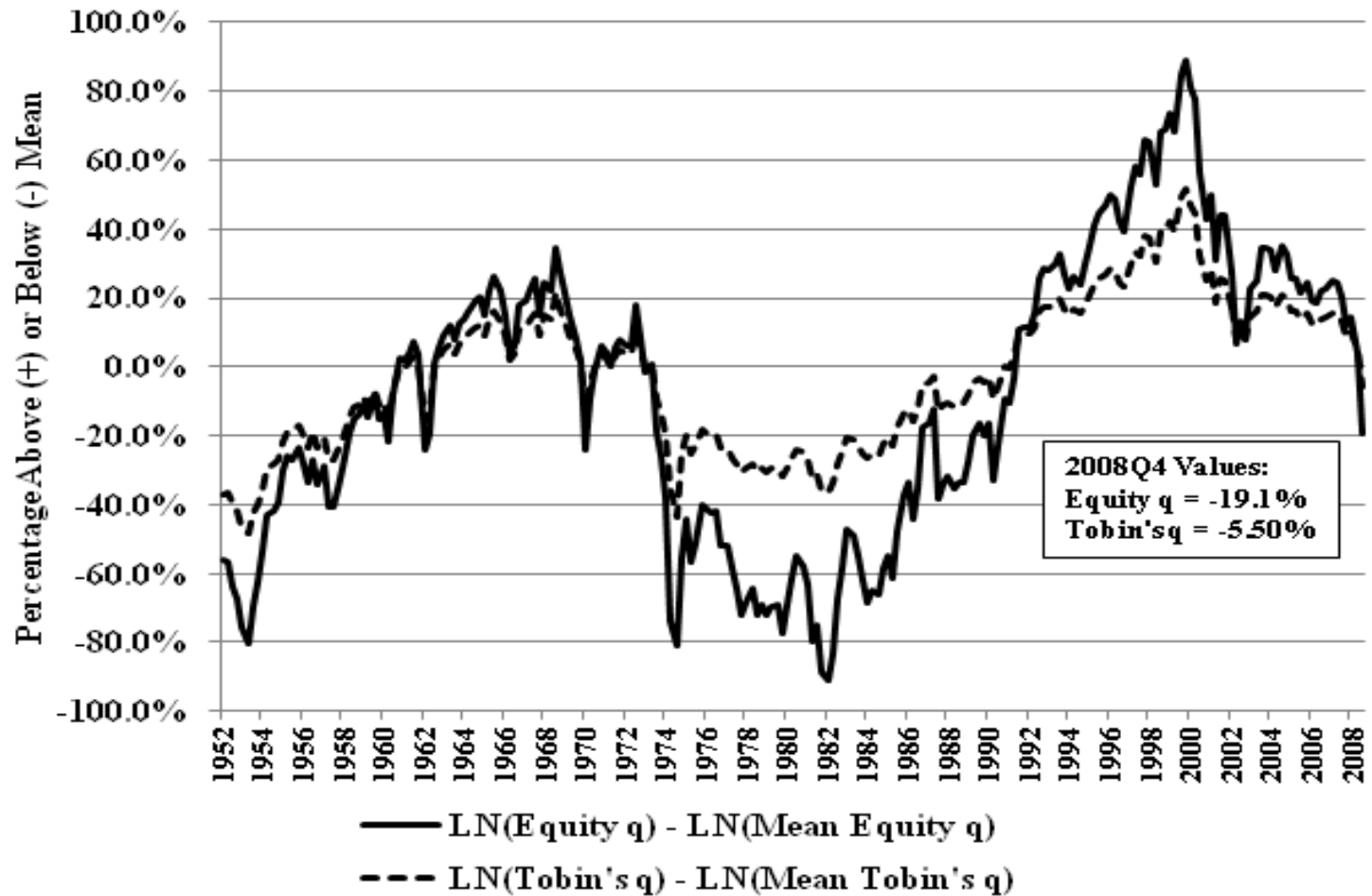
*Data source:* [www.federalreserve.gov/releases/z1/](http://www.federalreserve.gov/releases/z1/).

Fourth quarter 2008

Tobin's  $q$  = Market value of a company  $\div$  Replacement cost of assets =  $(12,887.51 + 9,554.05) \div 28,277.33 = 0.79$

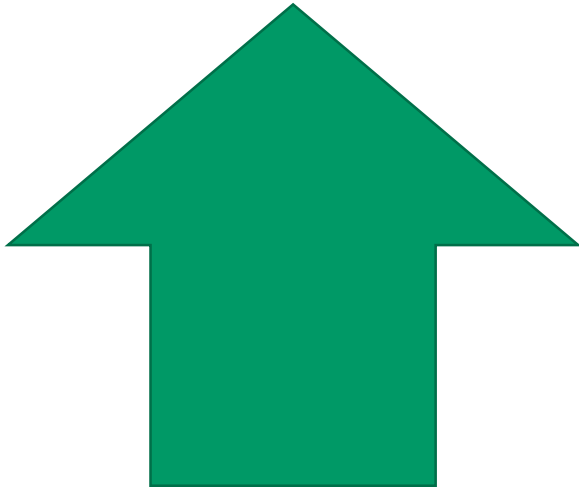
Equity  $q$  = Equity market capitalization  $\div$  Net worth measured at replacement cost =  $9,554.05 \div (28,277.33 - 12,887.51) = 0.62$

# EXHIBIT 11-16 EQUITY $q$ AND TOBIN'S $q$ QUARTERLY DATA: 1952 Q1–2008 Q4



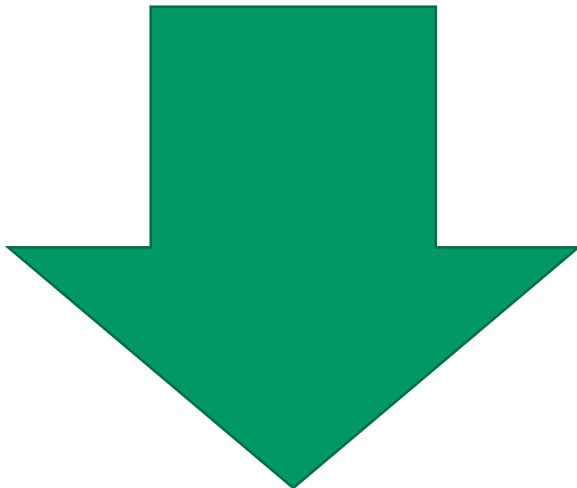
Data source: [www.federalreserve.gov/releases/z1/](http://www.federalreserve.gov/releases/z1/).

# TOBIN'S $q$ AND EQUITY $q$ : ADVANTAGES AND DISADVANTAGES



## Advantages:

- Rely on a comparison of security values with asset replacement costs and theory suggests the relationship is mean-reverting
- Evidence supports a negative relationship with future equity returns



## Disadvantages:

- Difficult to accurately measure replacement cost for many assets
- Evidence suggests high and low levels can persist for long time periods

# SUMMARY

- Cobb-Douglas production function
- Growth accounting formula
- Total factor productivity, capital stock, labor input
- H-model estimate of equity market value
- Top-down and bottom-up analysis
- Earnings-based equity market valuation models
- Asset-based equity market valuation models