Cost of Capital Analyses

presented by:
Philip S. Borba, Ph.D.
Milliman, Inc.
New York, NY

March 20, 2012

Casualty Actuarial Society, Ratemaking & Product Management Seminar, Session: "Practitioner's Guide to Cost of Capital/Profit Provisions," Philadelphia, PA

Milliman

Casualty Actuarial Society -- Antitrust Notice

The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.

Under no circumstances shall CAS seminars be used as a means for competing companies or firms to reach any understanding – expressed or implied – that restricts competition or in any way impairs the ability of members to exercise independent business judgment regarding matters affecting competition.

It is the responsibility of all seminar participants to be aware of antitrust regulations, to prevent any written or verbal discussions that appear to violate these laws, and to adhere in every respect to the CAS antitrust compliance policy.

Milliman

The Rate of Return Measure:
Starting Considerations

- The economic rate of return on equity capital is the proper rate of return measure:

    - Theory: standard corporate finance textbooks present the economic return on equity as the proper measure for evaluating investment opportunities

    - Pragmatism: it is a measure of profitability used by insurance regulators. Regulators also use statutory surplus to measure returns.

- For regulated entities, both economic theory and judicial rulings have validated the opportunity cost of equity capital to be the reasonable economic rate of return on equity.

Milliman

Overview

- Models for Estimating the Cost of Capital
  - Discounted Cash Flow Analysis
  - Capital Asset Pricing Model
  - Fama-French 3-Factor Model (FF3FM)

- Estimation Considerations
  - Discounted Cash Flow Analysis
  - Capital Asset Pricing Model
  - Fama-French 3-Factor Model (FF3FM)

- Results
  - Results from DCF and CAPM
  - High Correlation Between Cost of Capital and US Treasury Interest Rates
  - Summary – Two Time Periods Covered 1989-2008
  - Summary – Results for 2008-present

Milliman

Limitations

- Results in this presentation are for demonstration purposes only.

- Data are from public sources and have been reviewed for consistency but have not been audited.

- The analyses and results statistics are intended to demonstrate the principles of cost of capital estimation methodologies. Presented methodologies and results may not be appropriate for all applications in the property-casualty insurance industry. Users are strongly advised to review the underlying methodology and data sources when performing a cost of capital estimation.

Milliman

Cost of Capital:
Models for Estimating Cost of Capital (COK)

Presentation presents two commonly used models with long histories in regulatory proceedings and one model with a shorter history.

1. Discounted Cash Flow (DCF)
    –   Most commonly used methodology in utilities regulation and one of the most commonly used in insurance regulation.

2. Capital Asset Pricing Model (CAPM)
    –   The modern academic model of risk pricing.
    –   One of the most commonly used models in utilities and insurance regulation.

3. Fama-French 3-Factor Model (FF3FM)
    –   Extension of CAPM and APT models.

Milliman

Discounted Cash Flow Analysis -- Concepts

- The DCF analysis produces the interest rate that equates the net present value of future earnings from an investment to the cost of the investment.

- In practice, the DCF cost of capital is the sum of the current dividend yield plus the expected growth rate in dividends.

- A commonly used expression for the DCF model:
  - $COK = D_1 + g$
    - where D_1 is the current dividend yield
    - g is the expected growth in dividends

Milliman

Discounted Cash Flow Analysis (DCF): Estimation

Price of stock equals present value of future cash flows

$$\sum_{i=1}^{\infty} Di \ /(1 + r)^i$$

If D grows at constant annual rate, g, then

$$Po = \frac{Do(1 + g)}{1 + r} + \frac{Do(1 + g)^2}{(1 + r)^2} + \ ......$$

$$r = \frac{Do(1 + g)}{Po} + g$$

Milliman

Capital Asset Pricing Model -- Concepts

- Under the CAPM, investors expect to be compensated for the risk of an investment opportunity – the greater the risk, the higher the return required by the investor.

  - The starting point is a "risk-free" investment – a US Treasury security.

  - The "risk premium" is the average difference between the return on the market and the risk-free rate.

  - The "relative risk" - β – measures the volatility of the investment's return compared to the return on the equity market.

Milliman

Capital Asset Pricing Model -- Estimation

- Common expression for the CAPM:

  - COK = r_f + β (r_m − r_f)

  - where

    - Rf is the risk-free return (US Treasury)

    - β is the relative risk measure

    - (r_m − r_f) is the difference between the return on equity investments and the risk-free return

Milliman

Fama-French 3-Factor Model -- Concepts

- Fama- French findings: CAPM does not adequately explain cross-sectional variation in average stock returns

- Fama-French developed a 3-factor model:
  - Risk-free rate continues to be starting reference point
  - CAPM retained for systematic risk
  - Risk-premium added for size effect (smaller companies have higher capital costs)
  - Risk-premium for book-to-market ratio (high-ratio companies have higher capital costs)

Milliman

Fama-French 3-Factor Model -- Estimation

- Starting expression for the FF3FM:
  - $COK = r_f + \beta_m \cdot rp_m + \beta_{ss} \cdot rp_{ss} + \beta_{fd} \cdot rp_{fd}$
  - where
    - r_f is the risk-free return (US Treasury)
    - β is the relative risk measure
    - rp refers to a risk premium
    - "m" refers to the market
    - "ss" refers to small stock
    - "fd" refers to financial distress

Milliman

Estimation Considerations – Present Analyses

- DCF and CAPM are standard approaches described in corporate finance texts and frequently used in regulatory proceedings to estimate the models. FF3FM is less used in regulatory proceedings.

- Used data for a sample of property-casualty insurers.

- Relied on data from widely used, publicly available data sources (eg., Federal Reserve, Value Line Investment Survey, CompuStat).

Milliman

Estimation Considerations – Judgments and Selections

- Each cost of capital estimation methodology requires careful judgments and selections concerning:
  - Covered period
    - Such as monthly, quarterly, annual
  - Methodology
    - Example: choice of growth factors in DCF
  - Included companies
  - Data sources
  - Smoothing strategies

- Some of the points in these judgments and selections are illustrated or discussed later in this presentation.

Milliman

Cost of Capital:
Discounted Cash Flow Analysis -- Estimation

- Expression for the cost of capital using the DCF model:

  - $COK = D_1 + g$, where

    - D_1 is the current dividend yield
    - g is the expected growth in dividends

- An illustration using data for 2008.

  - Data as of July 2008
  - 22 property-casualty insurance companies
  - Source: Value Line Investment Survey

- Estimated cost of capital for July 2008:

  - Current dividend yield = 2.2%
  - Expected growth in dividends = 10.66%
  - Estimated cost of capital = 12.86%

Milliman

Cost of Capital:
Capital Asset Pricing Model -- Estimation

- Expression for the cost of capital using the CAPM:

  - $COK = r_f + \beta (r_m - r_f)$, where

    - r_f is the risk-free return (US Treasury)

    - β is the relative risk measure

    - $(r_m - r_f)$ is the difference between the return on equities and the risk-free return

- An illustration using data for 2008:

  - Data as of July 2008

  - Sources: Value Line, Federal Reserve, and Ibbotson

- Estimated cost of capital for July 2008 (for short-term equity-risk premium):

  - Risk-free investment (short-term): 1.52%

  - B = 0.93

  - $(r_m - r_f) = 8.5\%$

  - Estimated cost of capital = 1.52% + 0.93 x 8.5% = 9.38%

Milliman

Cost of Capital: Results from DCF and CAPM

Year	DCF	CAPM	Cost of Capital
1989	15.44	16.26	15.85
1990	16.17	16.19	16.18
1991	16.04	14.80	15.42
1992	15.18	13.80	14.49
1993	14.90	12.64	13.77
1994	13.62	13.79	13.70
1995	13.44	13.75	13.59
1996	12.83	13.67	13.25
1997	12.31	13.48	12.90
1998	12.97	13.18	13.07
1999	11.94	13.53	12.73
2000	11.79	14.50	13.14
2001	11.42	12.54	11.98
2002	10.10	11.58	10.84
2003	9.08	10.22	9.65
2004	9.76	10.92	10.34
2005	10.18	11.17	10.67
2006	10.94	12.64	11.79
2007	10.96	12.35	11.66
2008	12.86	10.21	11.53

Milliman

Cost of Capital: Summary
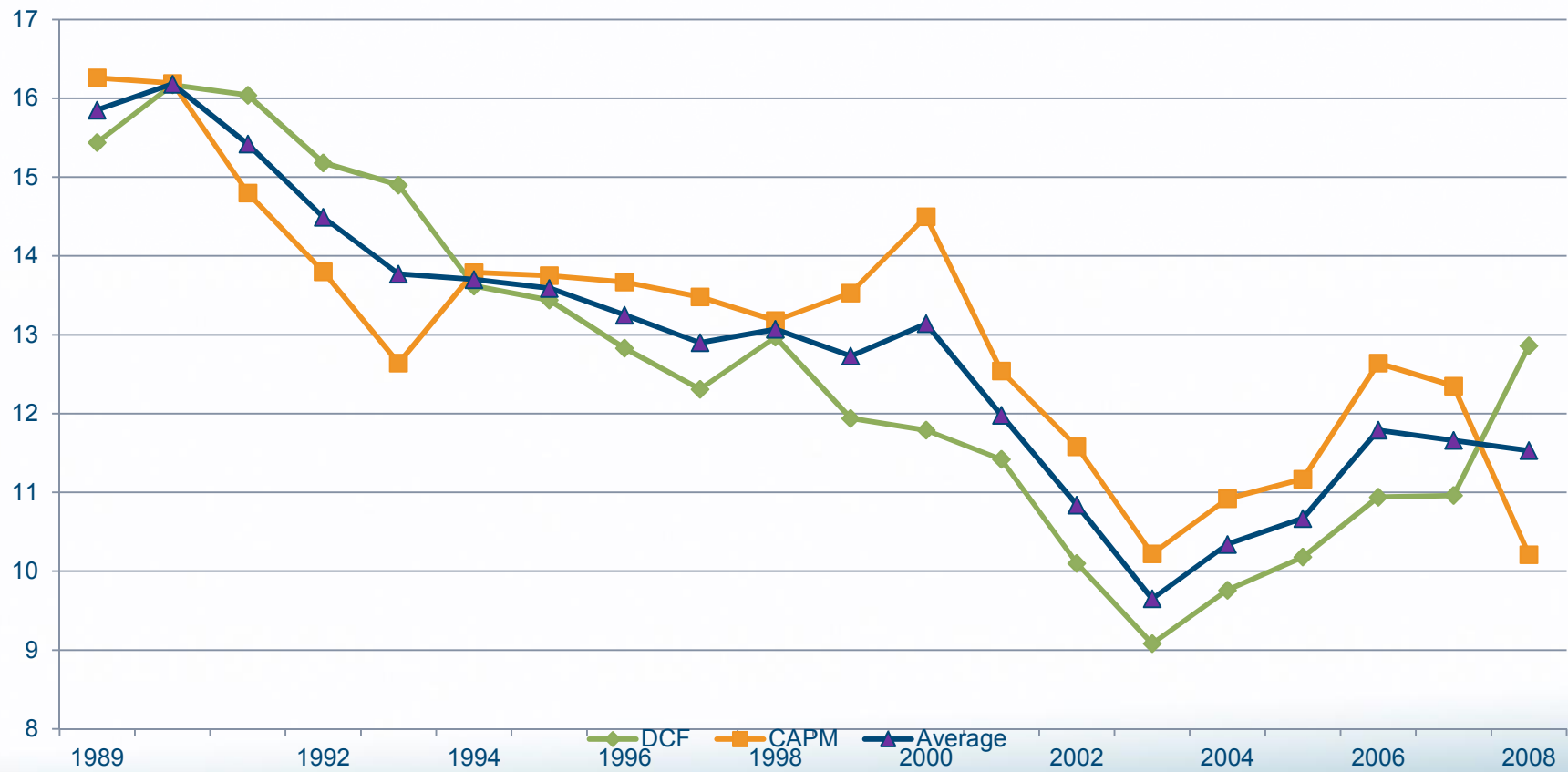
Cost of Capital:
High Correlation Between Cost of Capital and US Treasury Interest Rates

Milliman
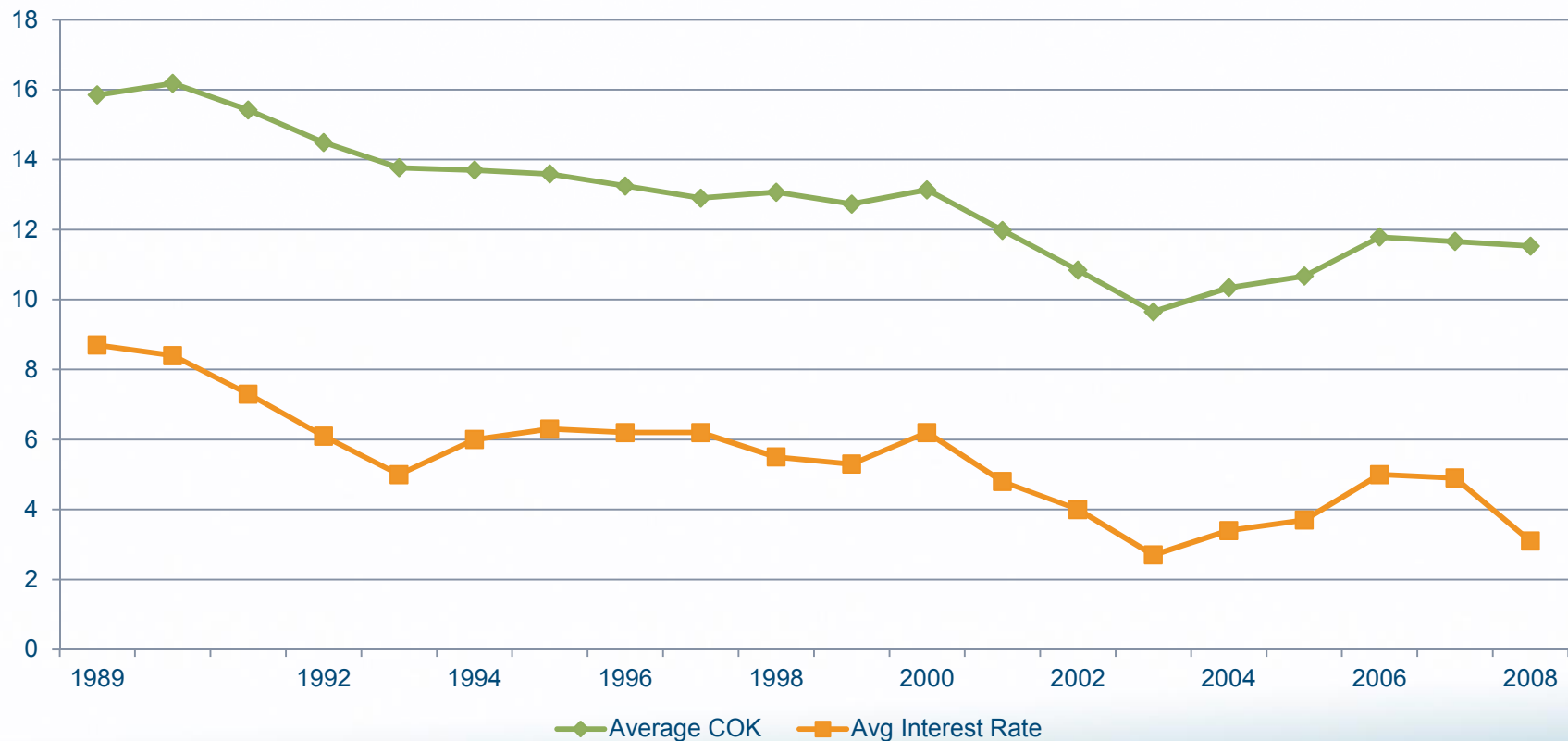
Cost of Capital:
Summary – Two Time Periods

- For each year between 1989 and 2000:

    - Cost of Capital higher than 12%

    - Average interest rate on US securities 5% or higher

- For each year between 2001 and 2008:

    - Cost of Capital lower than 12%

    - Average interest rate on US securities 5% or lower

Period	Cost of Capital	Average Interest Rate
1989 – 2000	14.0	6.4
2001 – 2008	11.1	4.0
Difference	-2.9	-2.4

Milliman

Cost of Capital: January 2008-present

- Expanded the number of property-casualty companies captured in the analyses:
  - Expansion includes companies from Value Line Small and Mid-Cap companies, CompuStat, and Yahoo
  - Number of companies increased from approximately 22 to approximately 90

- Two methodologies:
  - DCF
  - CAPM

- Volatile financial markets

Milliman

US Treasury Yields – 1990-2011

- US Treasury yields can be considered a reference point in cost of capital estimations.
  - US Treasury yields provide a "risk-free" benchmark.
  - Explicitly used in CAPM, implicit in DCF.

- Over the 1990-2011 period (points illustrated in following charts):
  - The position of US Treasury Yield curves has been pushed down.
  - For all maturities, US Treasury yields have decreased.
  - Yield spreads are volatile and tied to the position in the economic cycle.

Milliman

US Treasury Yields – 1990-2011

- The position of US Treasury Yield curves has been pushed down over the 1990-2011 period

Milliman
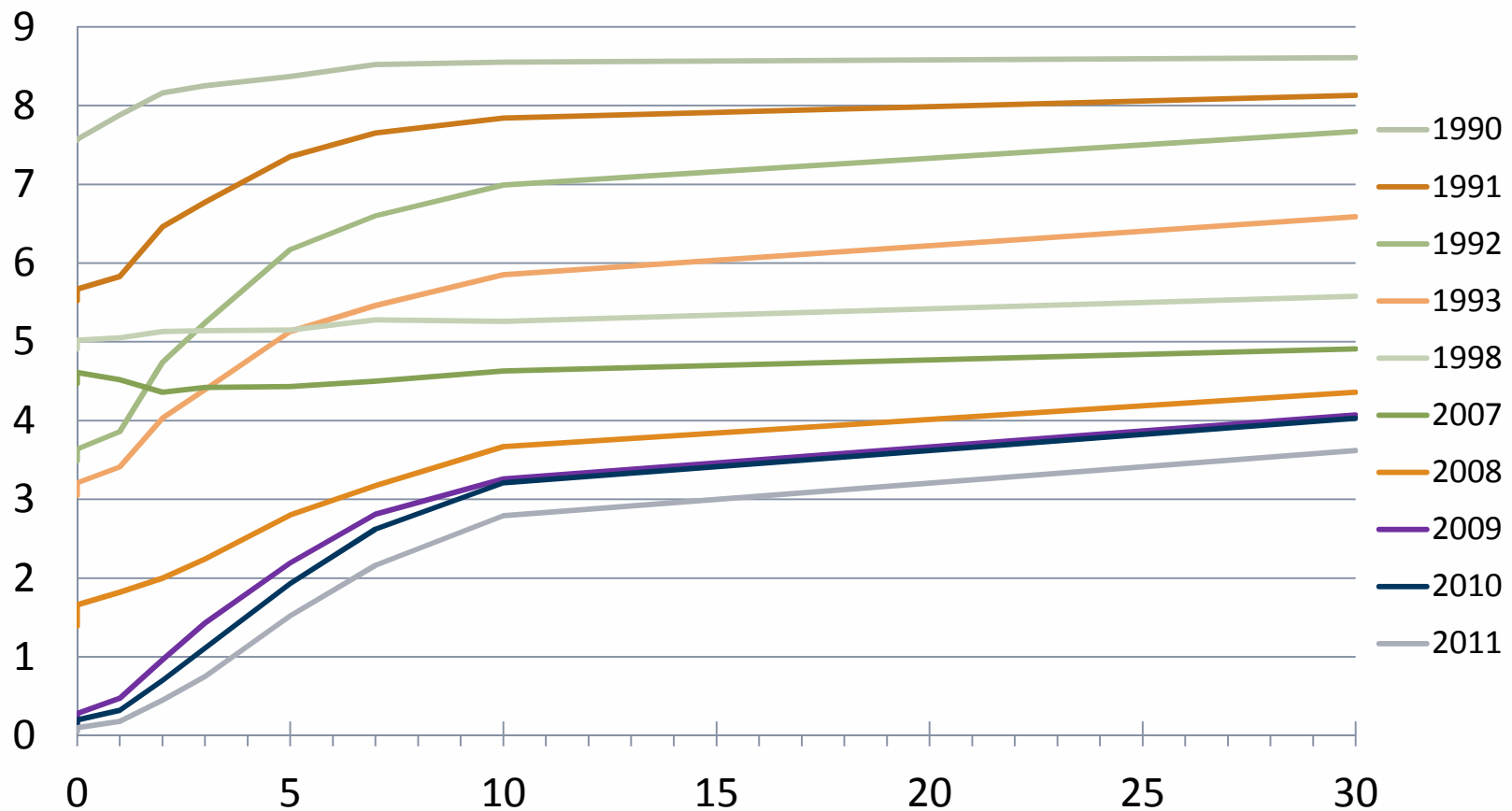
US Treasury Yields – 1990-2011

- For all maturities, US Treasury yields have decreased
  - Yields most volatile for 3-month maturities

Milliman
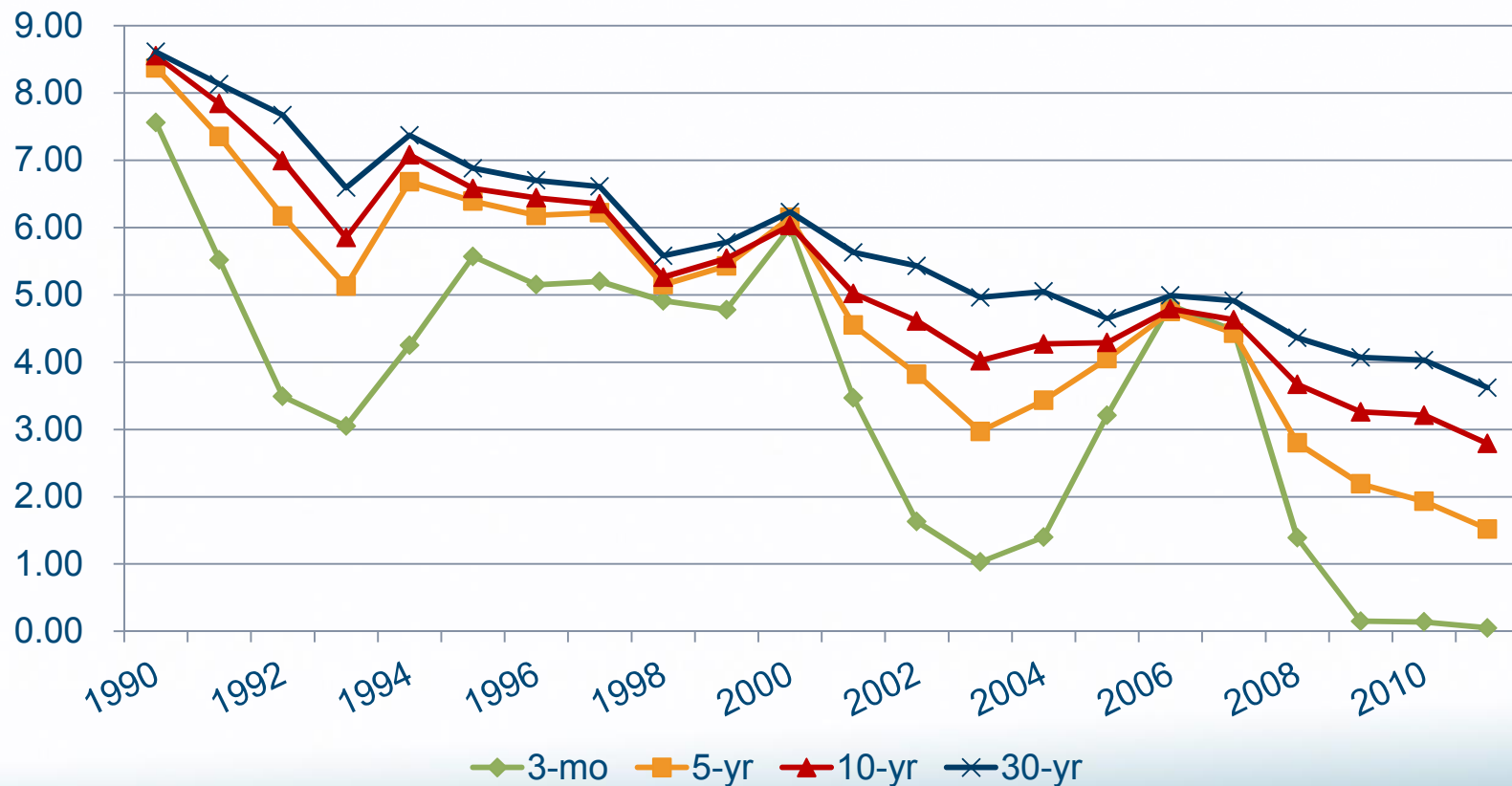
US Treasury Yields – 1990-2011

- Yield spreads are volatile and tied to the position in the economic cycle.
  - Size of spread related to volatility in short-term Treasury yields.

Milliman
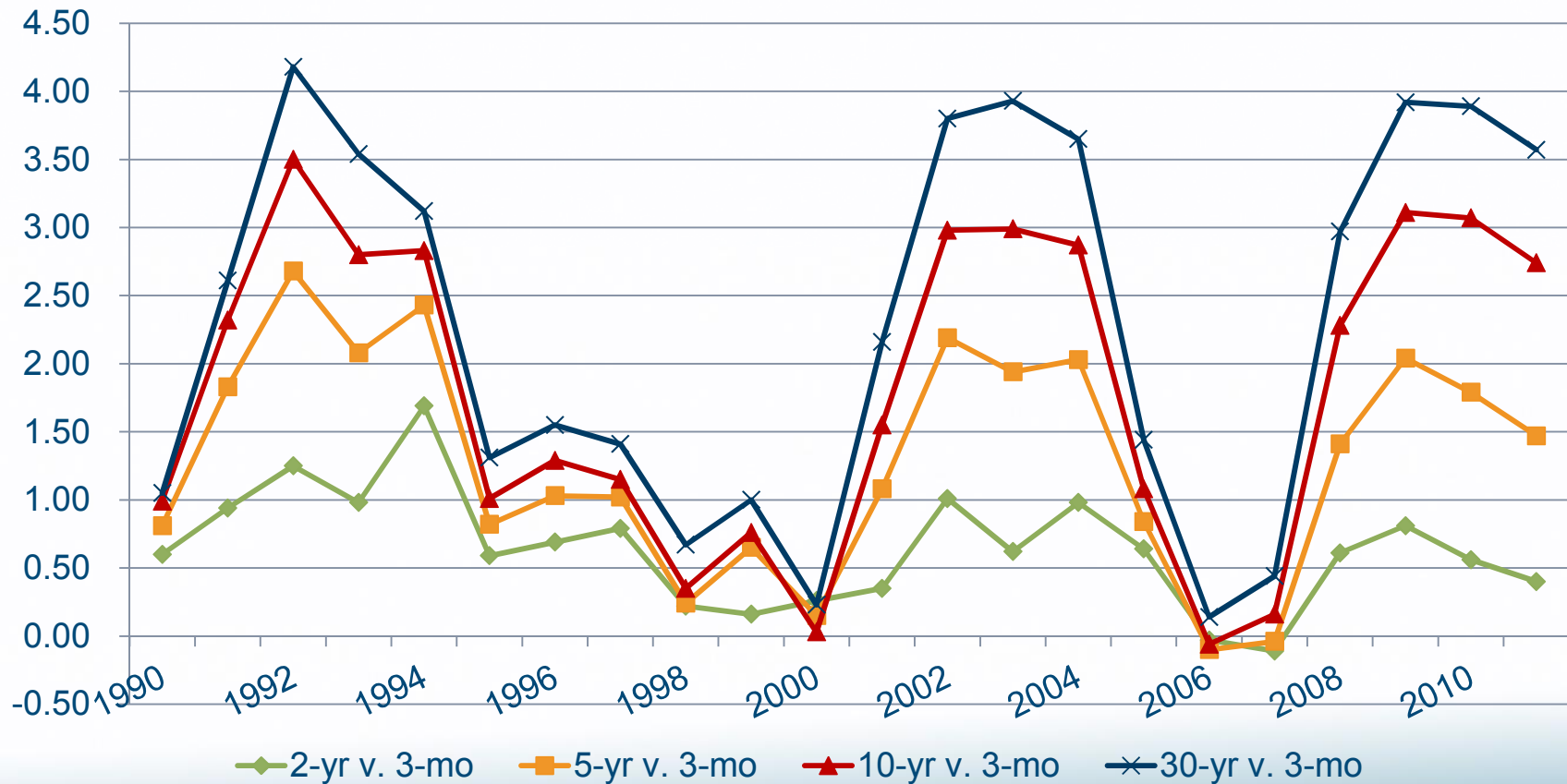
Cost of Capital:
Discounted Cash Flow Analysis -- Estimation

- An illustration using data for January 2012.
    - Data as of January 2012
    - 89 property-casualty insurance companies
    - Principal sources: Value Line Investment Survey, CompuStat, Yahoo
- Estimated cost of capital for January 2012:
    - Current dividend yield = 2.25%
    - Expected growth in dividends = 7.93%
    - Estimated cost of capital = 10.18%

| Discounted Cash Flow Analysis	10-year historical	5-year historical	5-year future	Average
Current Dividend Yield	-----	-----	-----	2.25
Dividends per Share	8.11	5.29	7.12	6.84
Earnings per Share	5.25	2.32	9.68	5.75
Average growth rate	-----	-----	-----	6.29
Fundamental Analysis	-----	-----	-----	9.56
Dividend Growth Rate	-----	-----	-----	7.93
Estimated Cost of Capital	-----	-----	-----	10.18

Milliman

Cost of Capital:
Capital Asset Pricing Model – Estimation

- An illustration using data for January 2012.

  - Data as of January 2012

  - 89 property-casualty insurance companies

  - Principal sources: Value Line Investment Survey, CompuStat, Ibbotson, Fed Reserve

- Estimated cost of capital for January 2012:

  - Beta = 1.03

  - Estimated cost of capital = 8.84%

CAPM Analysis	Risk-Free Return	Beta / Risk Premium	Estimated Cost of Capital
Beta	----	1.03	----
Short term	0.01	8.20	8.47
Medium term	0.95	7.20	8.39
Long term	2.75	6.70	9.67
Average	----	----	8.84

Milliman

Cost of Capital: January 2008-present

- DCF, CAPM, and DCF-CAPM average
  - Following interest rates, COK has decreased since mid-2008
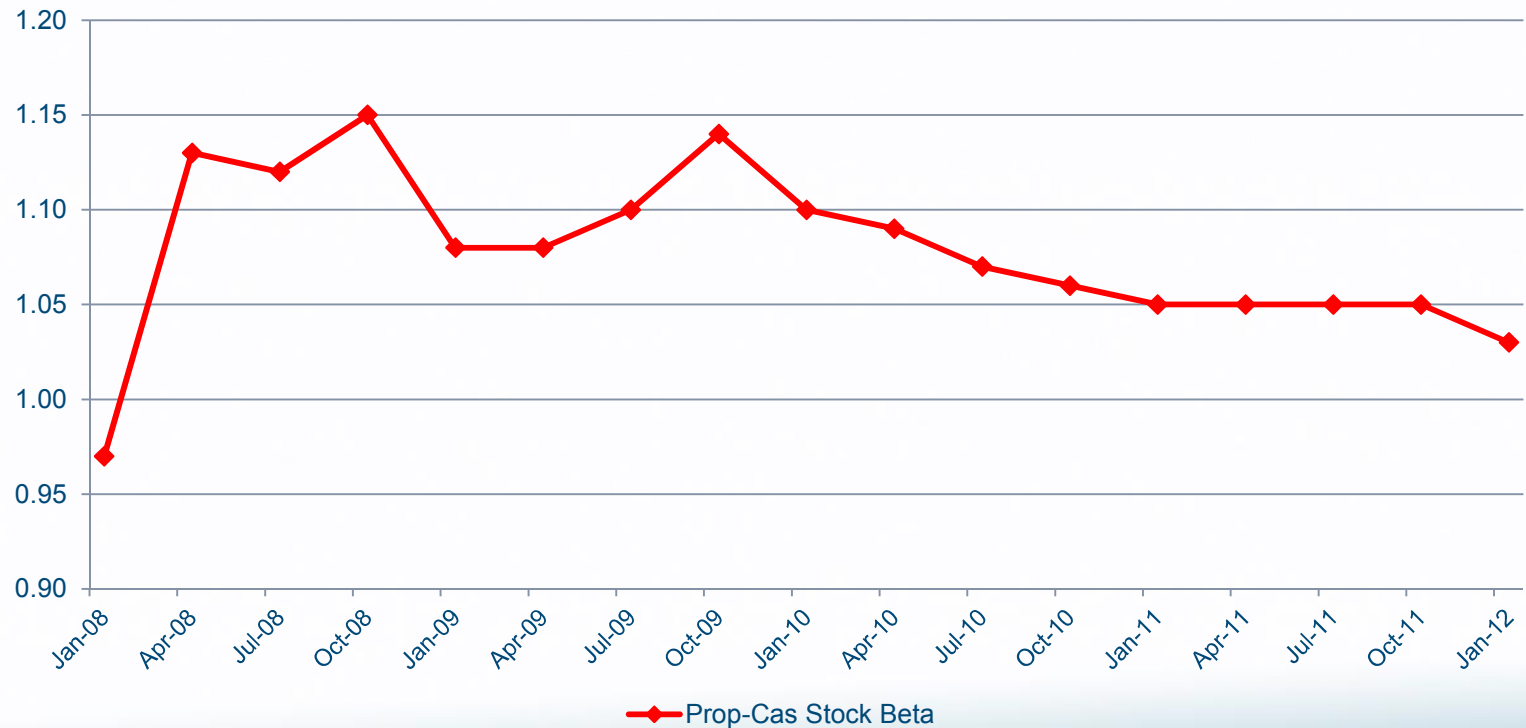 - Presently, COK approximately 9.5%

Milliman
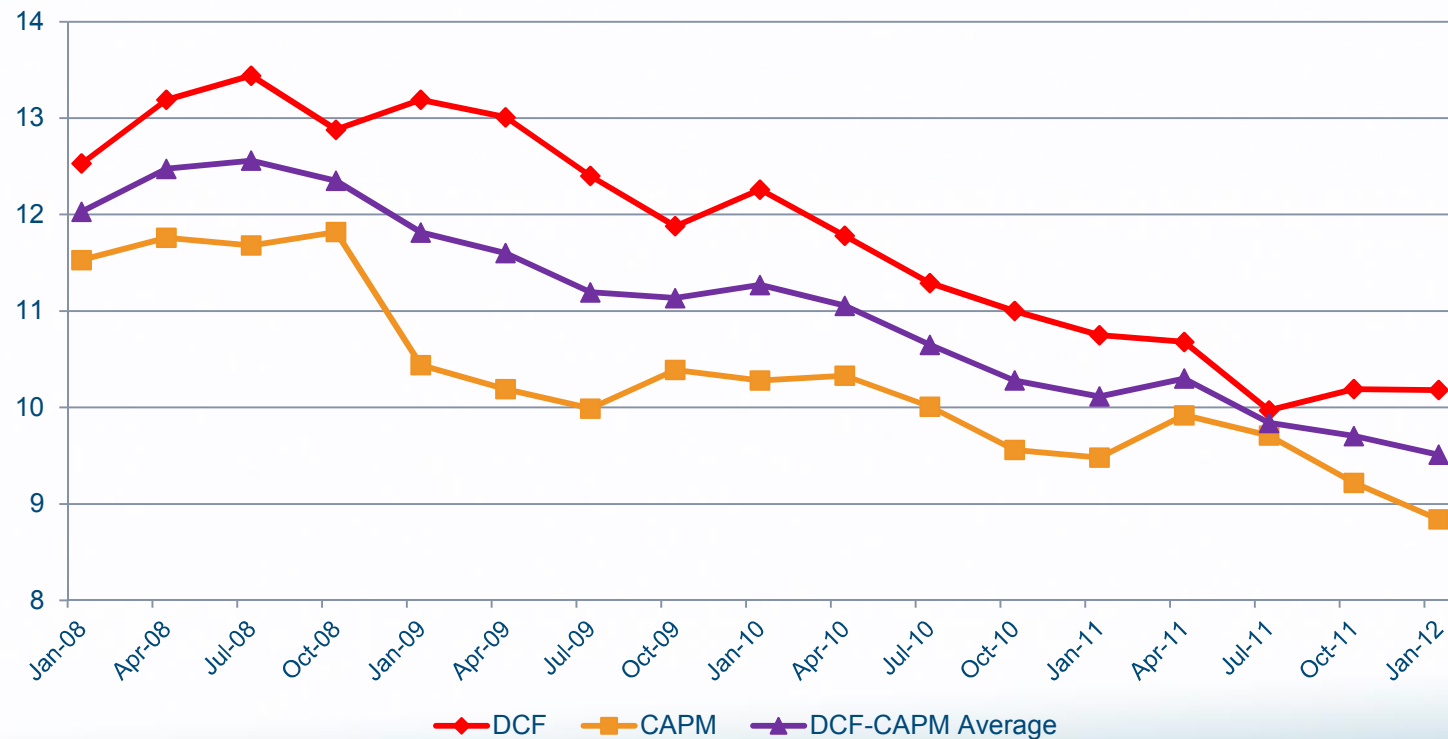
Cost of Capital: January 2008-present

- DCF components for property-casualty stocks
  - Dividend yields: approx 2%
  - Expected growth rates: between 9% and 11.5%
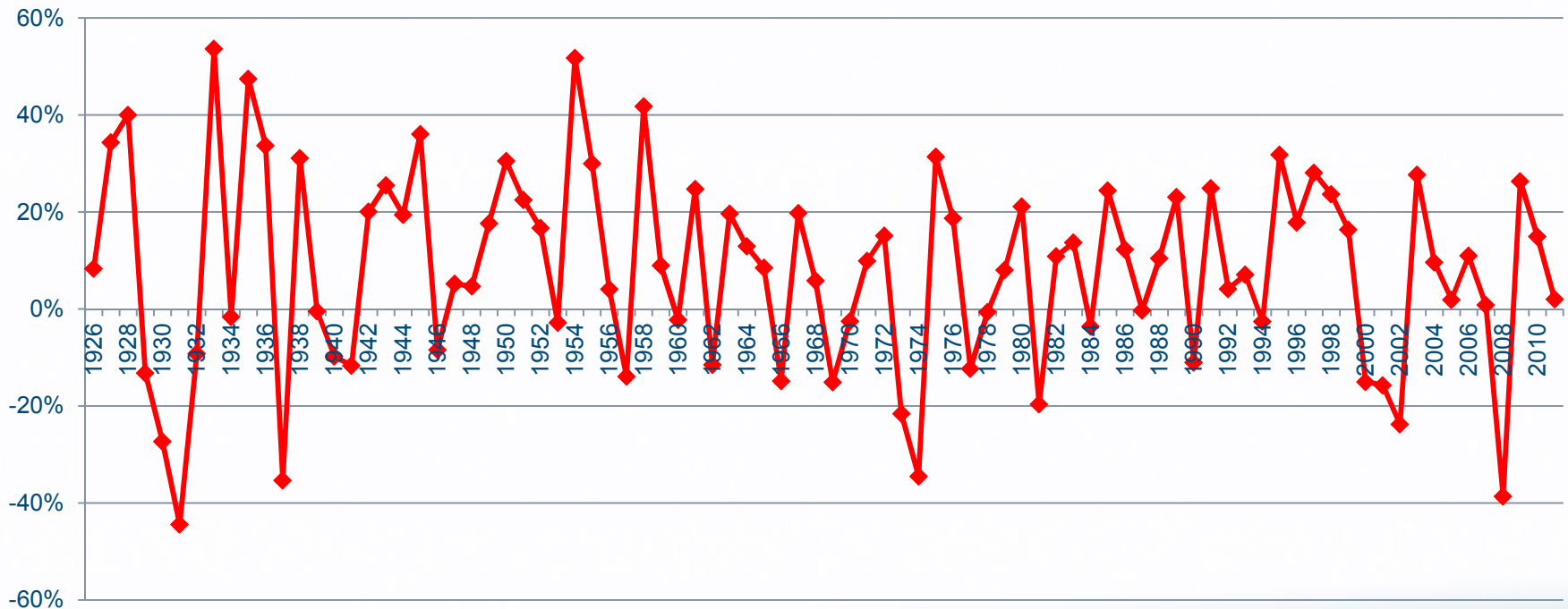 - Higher COK for prop-casualty stocks usually due to higher expected growth in dividends (without changing yields because stock prices are bid up)

Legend: ■ Div Yld ■ Growth Rate

Milliman
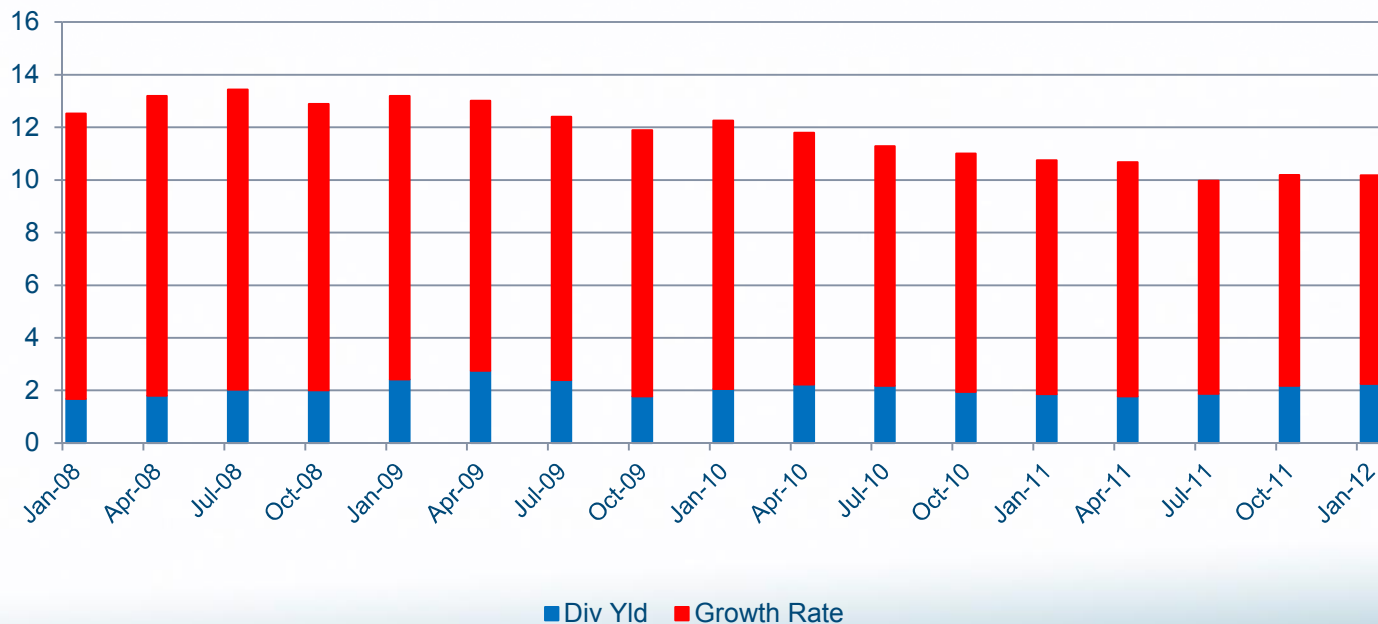
Cost of Capital: January 2008-present

- CAPM: beta coefficients for property-casualty stocks
  - Stable between 1.05 and 1.15
  - Most of changes in estimated CAPM are due to changes in interest rates
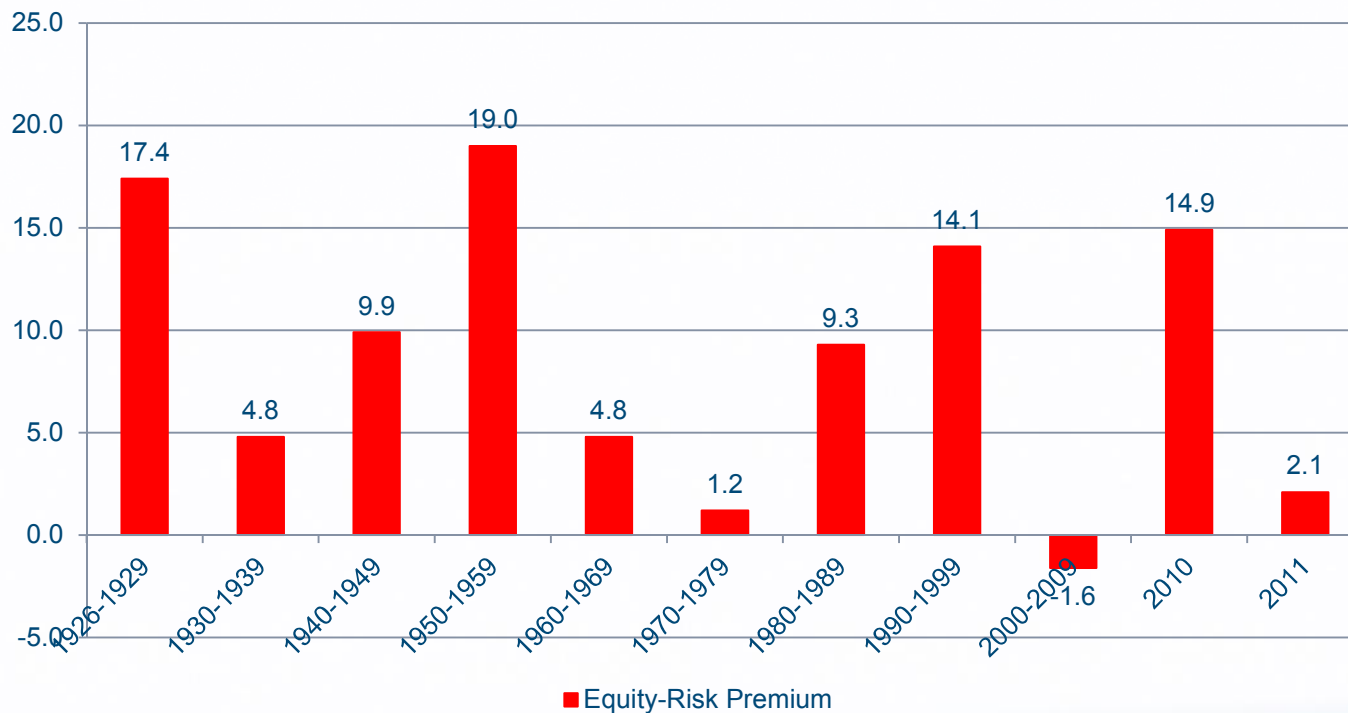

Prop-Cas Stock Beta

Milliman

Cost of Capital: January 2008-present

- CAPM: key components are the equity-risk premium
  - Chart presents short-horizon equity-risk premia: differences between annual return on large cap stocks and short-term US Treasuries
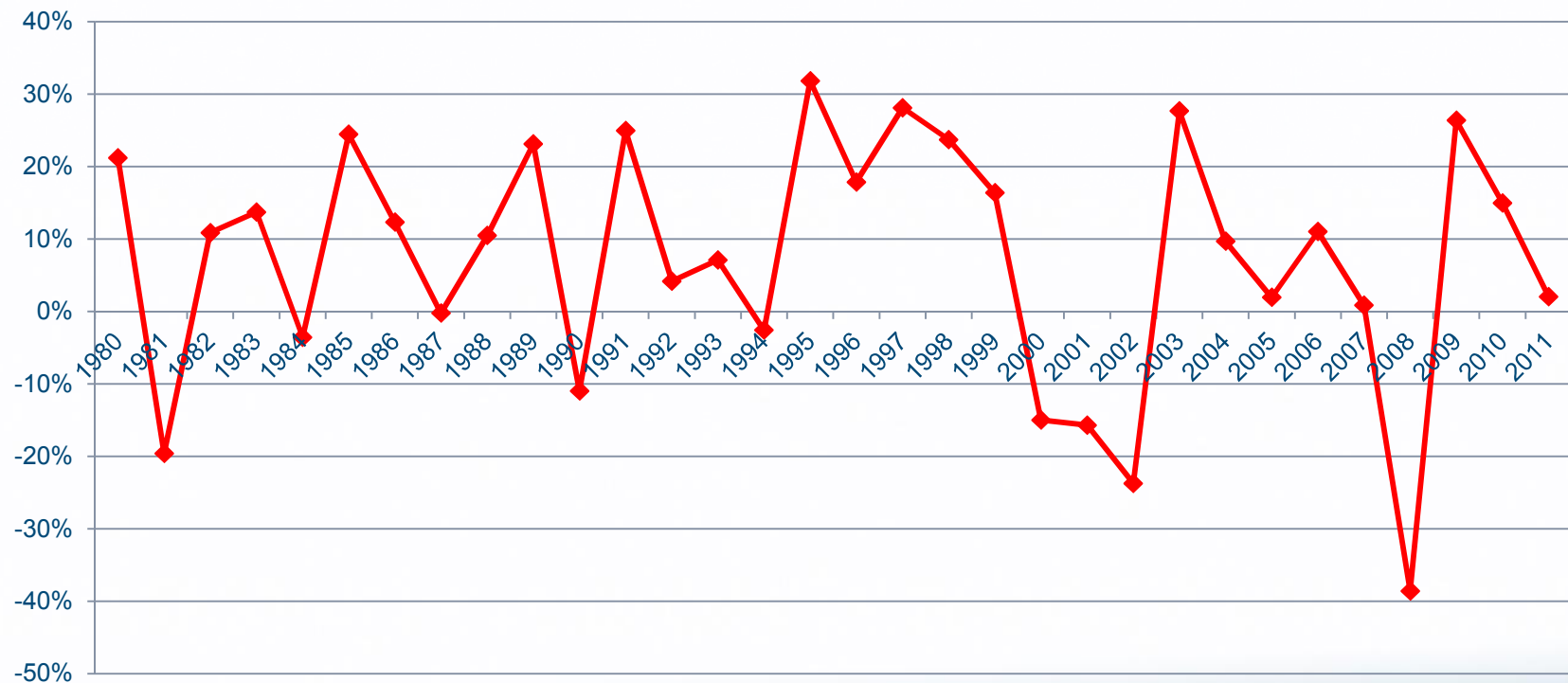
Milliman

Cost of Capital: January 2008-present

- CAPM: key components are the equity-risk premium
  - Chart presents short-horizon equity-risk premia by decade

Milliman

Cost of Capital: January 2008-present

- CAPM: key components are the equity-risk premium
    - Chart presents short-horizon equity-risk premia: differences between annual return on large cap stocks and short-term US Treasuries
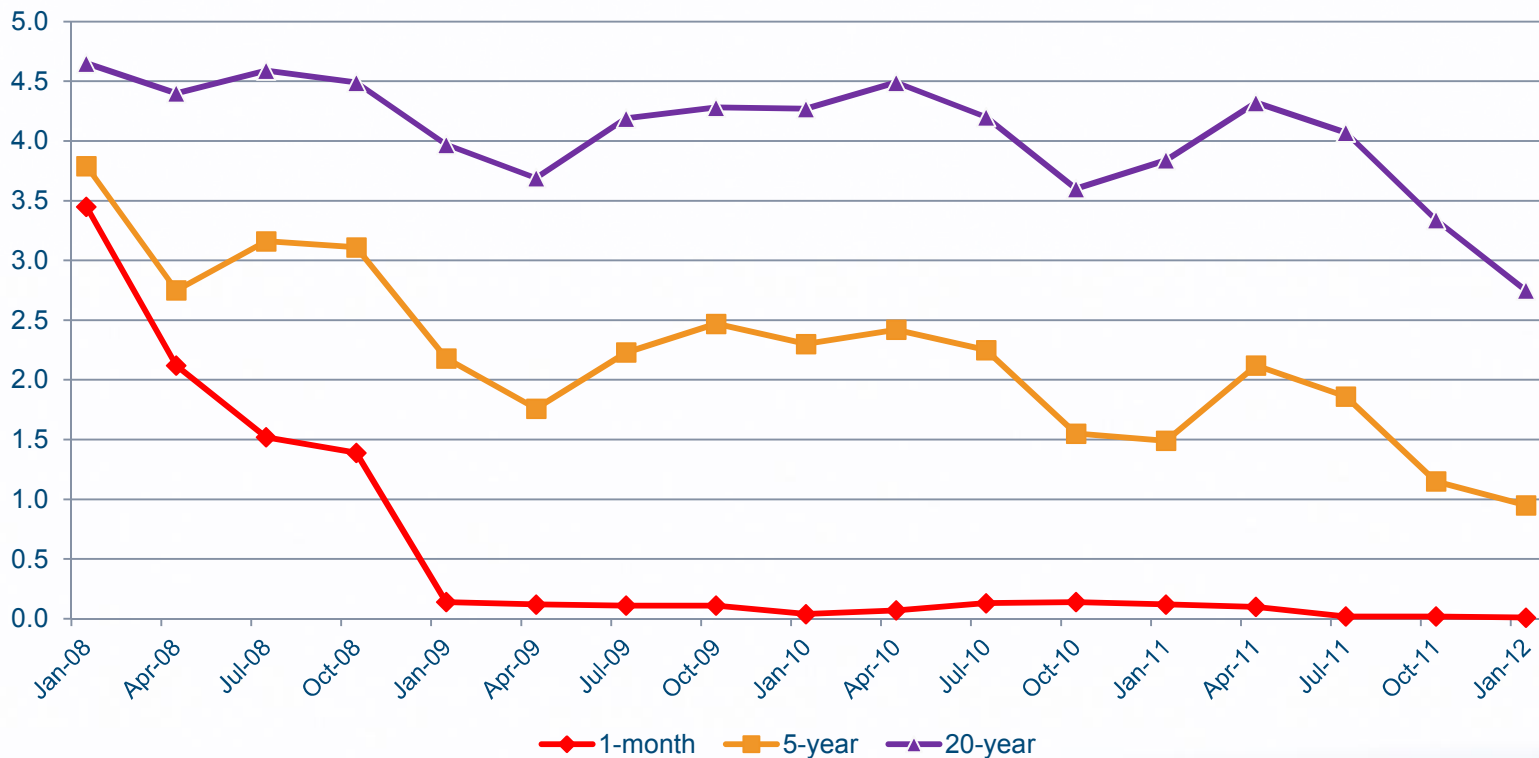
Milliman

Cost of Capital: January 2008-present

- CAPM: key components are the equity-risk premium
  - Equity-risk premium is the difference between the annual return on large-cap stocks and a US Treasury
  - Alternative US Treasury "risk-free" securities;
    - Short: 1-month US Treasury bill
    - Intermediate: 5-year US Treasury bond
    - Long: 20-year US Treasury bond
  - Chart presents short, intermediate-, and long-term horizon equity-risk premia by decade
  - Recent volatility has caused 80+-year risk premium to move more than usual
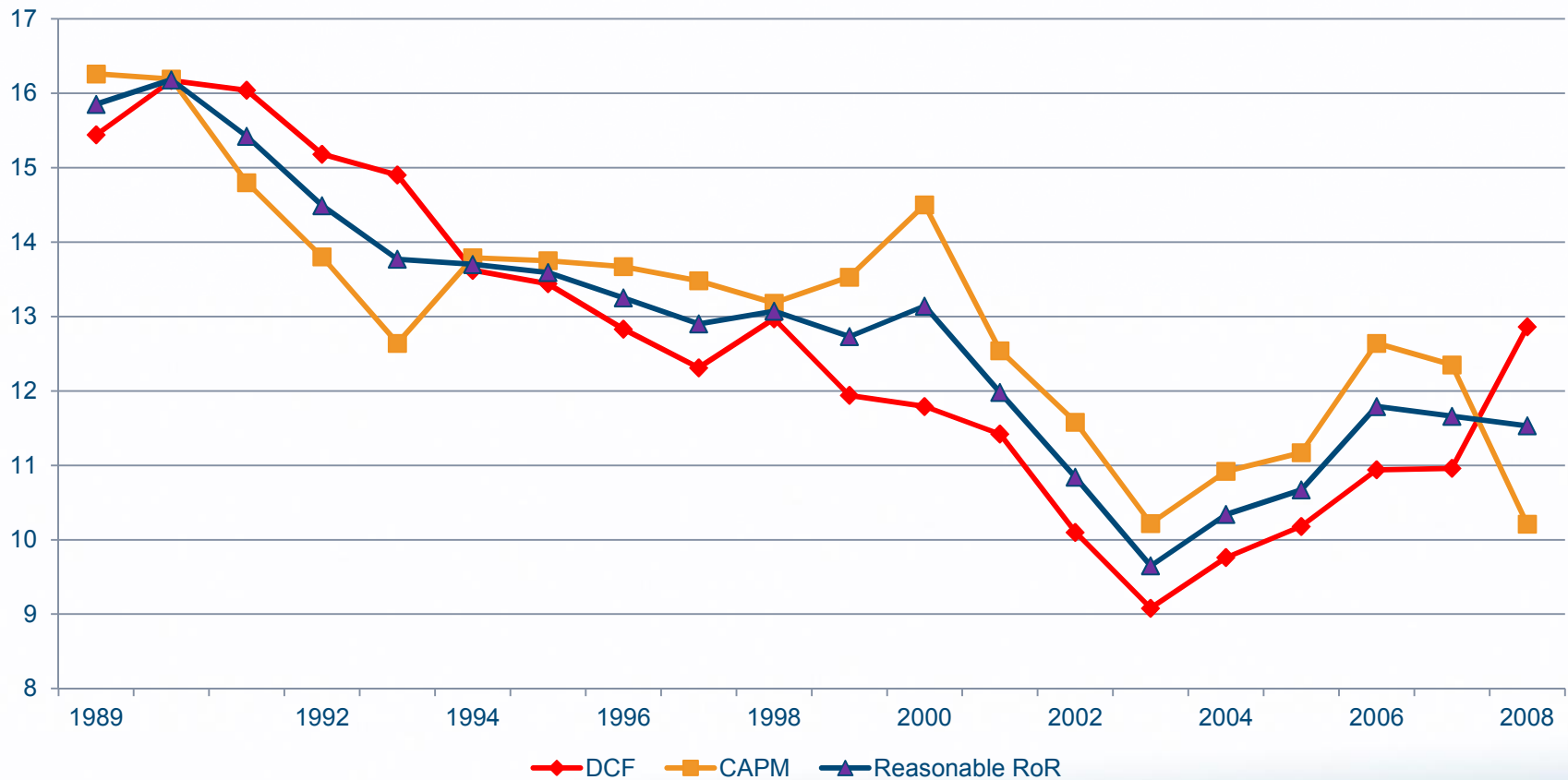
	Horizon Risk		
	Short	Intermediate	Long
1926-2007	8.5	7.5	7.1
1926-2008	7.9	6.9	6.5
1926-2009	8.1	7.2	6.7
1926-2010	8.2	7.2	6.7
1926-2011	8.1	7.1	6.6

Milliman

US Treasury Rates for Three-Month Periods

- US Treasury rates for three months ending
  - 1-month, 5-year, and 20-year returns
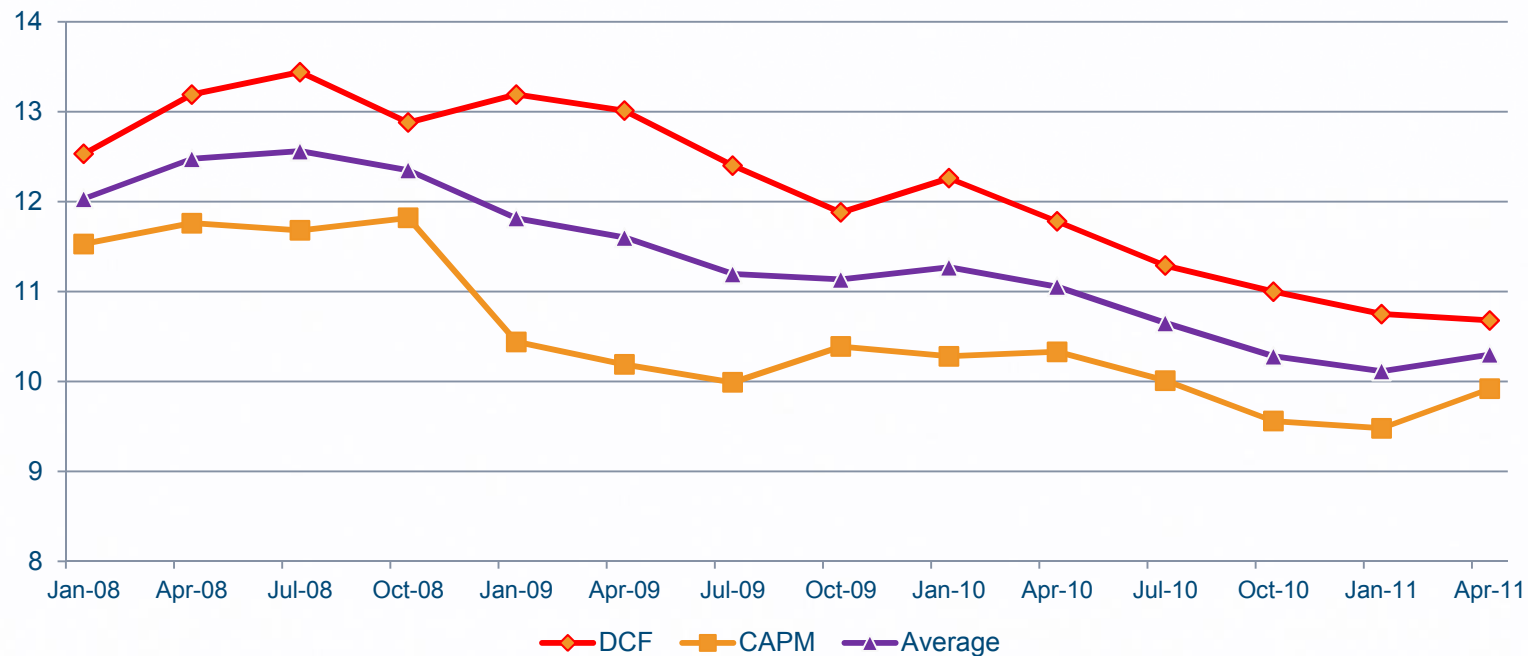
Milliman

Cost of Capital:
Summary

Cost of Capital: January 2008-present

- DCF, CAPM, and DCF-CAPM average
  - Following interest rates, COK has decreased since mid-2008
  - Presently, COK approximately 9.5%

Milliman

Cost of Capital:
Summary of Estimations and Findings

- Two widely-used models: DCF and CAPM

- Cost of Capital estimated with widely used, publicly available data sources

- 23 years of Cost of Capital

- Most of estimated COK under DCF due to expected growth in dividends

- US Treasury yields have decreased over 1990-2011 period, with yield spreads following the economic cycle

- High correlation between Cost of Capital and US Treasury securities

- US Treasury securities and Cost of Capital lower since 2001, and then lower again since 2008

Milliman