# USD Fixed Income Valuation: Getting Ahead of the Curve

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# Outline

- Quick overview of USD fixed income market
- Outlook for US economy and current market conditions
- Results from corporate credit model empirical analysis

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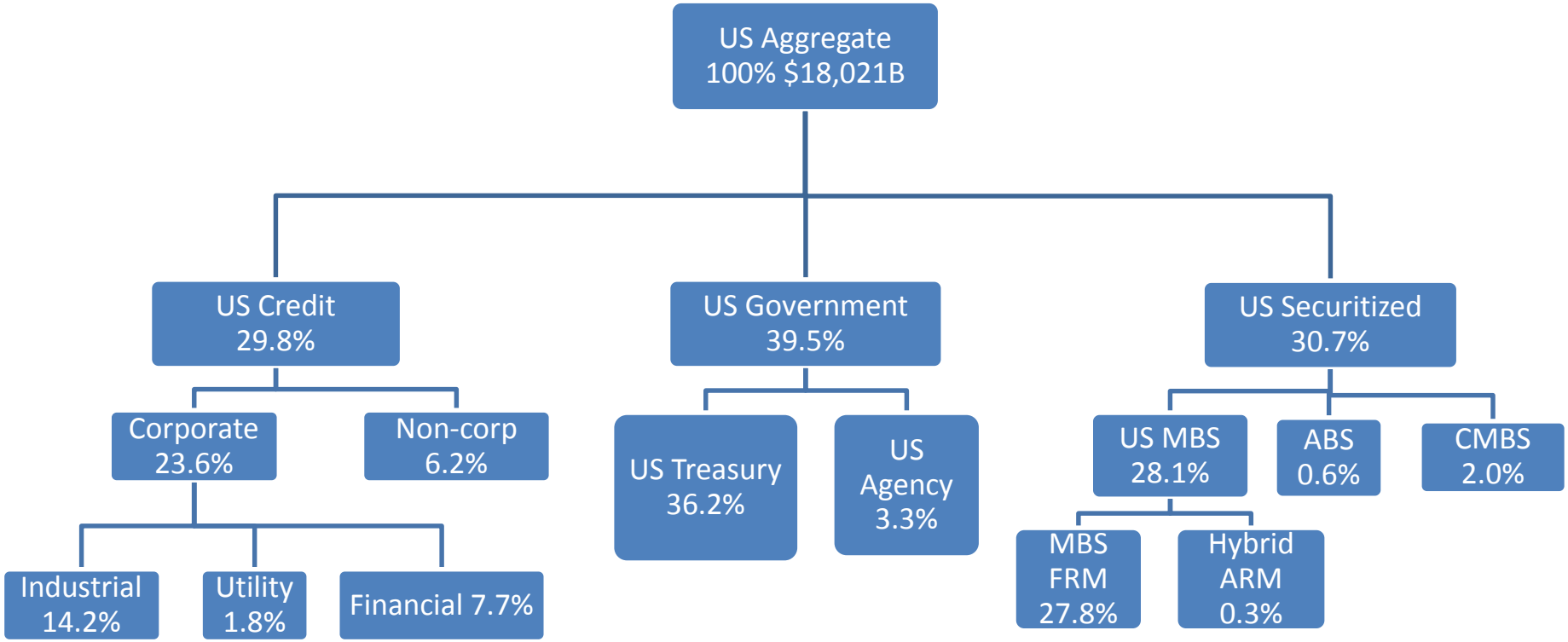
# U.S. Dollar Bond Market Index Detail



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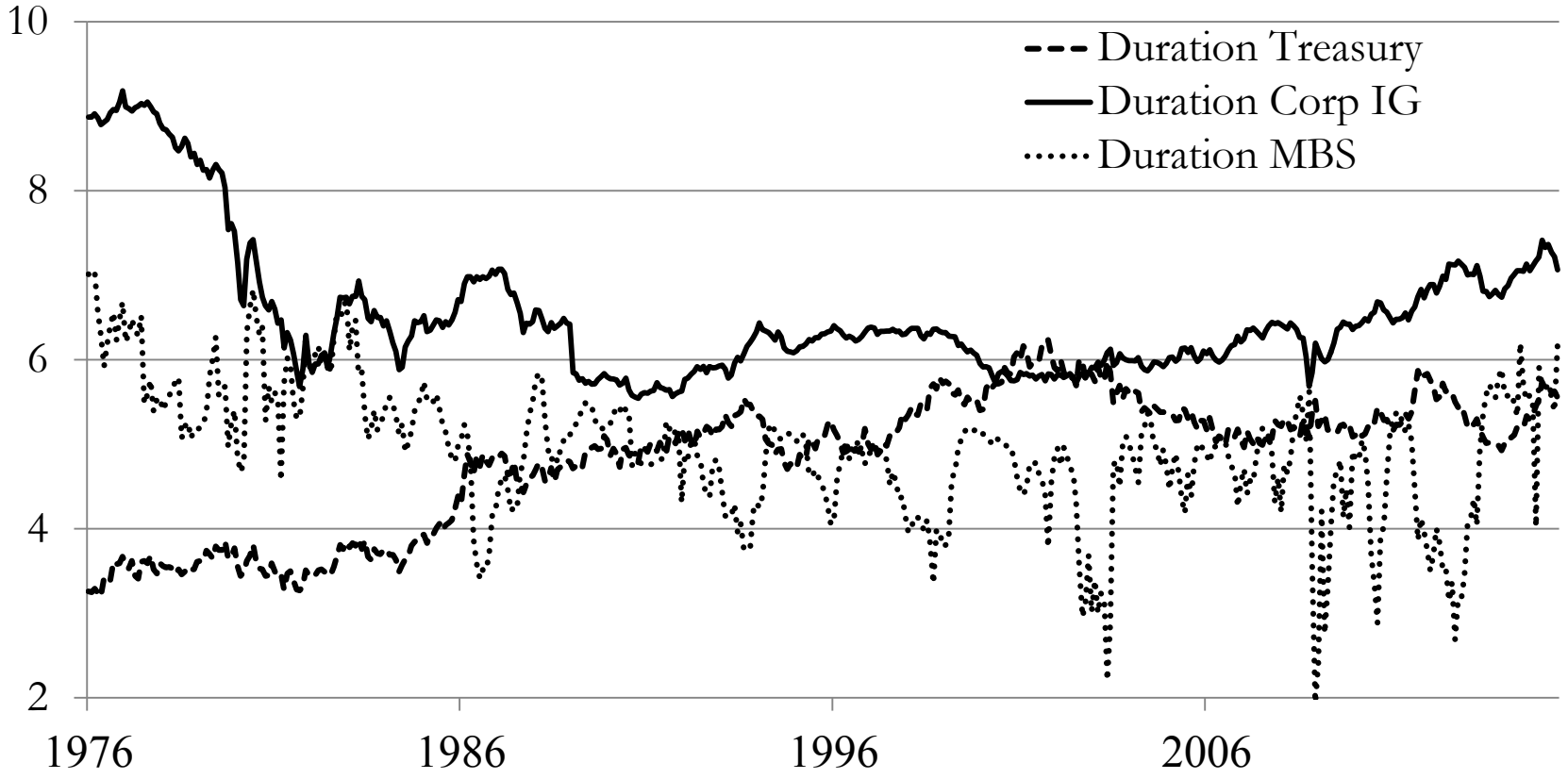
# Index Duration




Duration is calculated by Barclays based on their analytics and prepayment and default models. Due to data availability, Macaulay duration-to-worst is used, which is the longest duration series. Bond callability does not have a big impact on duration at portfolio level.

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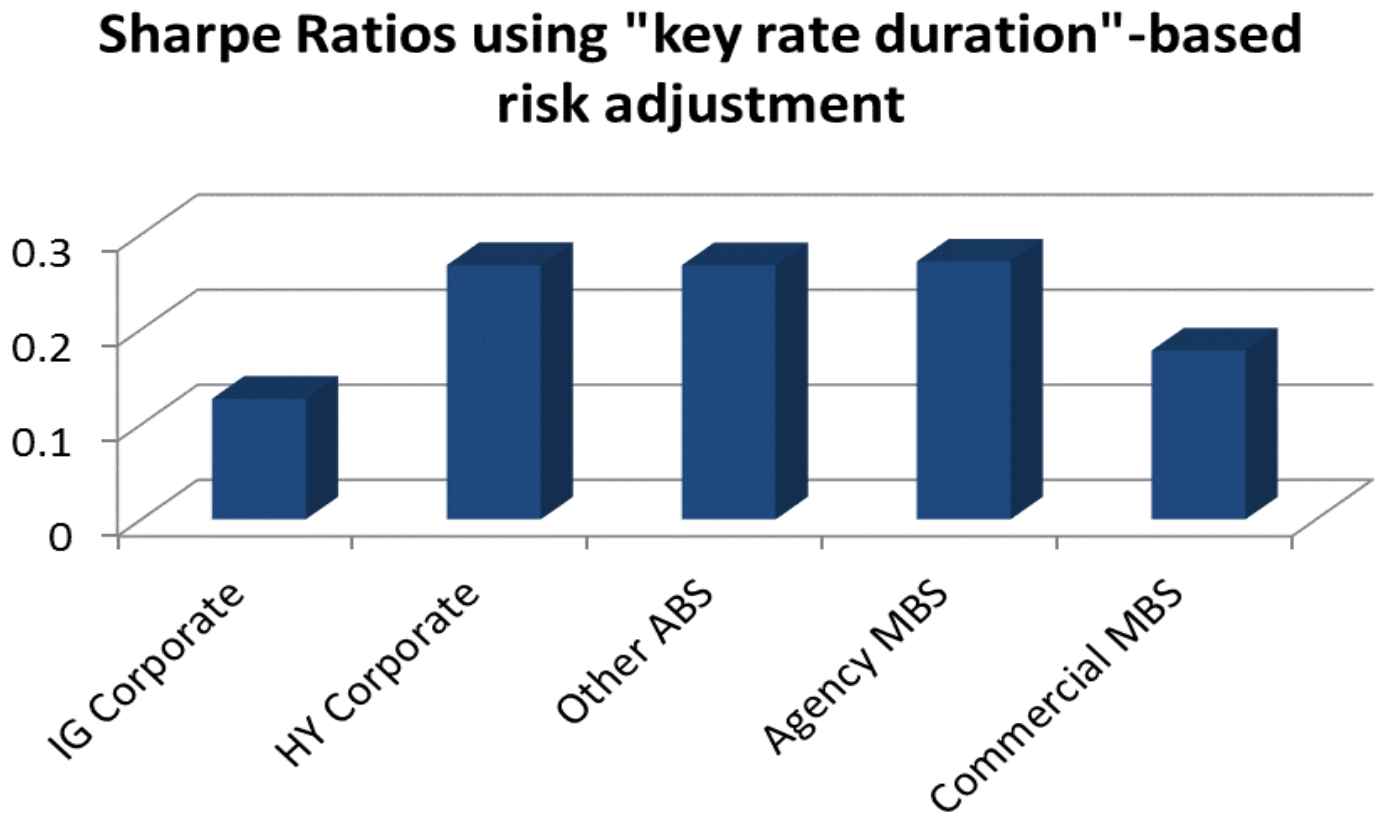
# Historical Returns and Risk of USD Fixed Income Sectors (1999-2014)

| | U.S. Treasuries | Investment Grade Corporate | Agency MBS | Commercial MBS | Other ABS |
|---|---|---|---|---|---|
| Return (annualized) | **4.59%** | **6.38%** | **5.43%** | **6.44%** | **3.87%** |
| Volatility (Ann Std. Dev.) | 3.26% | 5.30% | 3.16% | 7.40% | 1.12% |
| **Sharpe Ratio** | **0.79** | **0.83** | **1.08** | **0.60** | **1.66** |
| Duration | 3.56 | 6.19 | 3.40 | 4.39 | 1.09 |
| Correlations | UST | 0.858 | 0.804 | 0.406 | 0.580 |
| | CORP | | 0.774 | 0.480 | 0.490 |
| | MBS | | | 0.474 | 0.498 |
| | CMBS | | | | 0.248 |

# Previous slides show importance of adjusting for interest rate risk when comparing returns




These are excess return Sharpe Ratios vs. UST. Key rate duration process is used to measure risk at many points on the yield curve and  is very important for MBS and ABS markets.

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# Agency MBS vs. UST

**Barclays Indices**
**As of November 30, 2015**

| | Agency Fixed Rate MBS | U.S. Treasury Intermediate |
|---|---|---|
| **Annualized Total Return (%)** | | |
| 1 Year | 1.71 | 1.10 |
| 3 Year | 2.08 | 0.79 |
| 5 Year | 2.87 | 1.84 |
| 10 Year | 4.78 | 3.84 |
| 15 Year | 5.04 | 4.15 |
| **Annualized Monthly Standard Deviation (%)** | | |
| 1 Year | 1.49 | 2.33 |
| 3 Year | 2.37 | 2.01 |
| 5 Year | 2.09 | 2.22 |
| 10 Year | 2.66 | 2.99 |
| 15 Year | 2.69 | 3.17 |

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# Discussion Point: Why would anyone hold U.S. Treasuries?

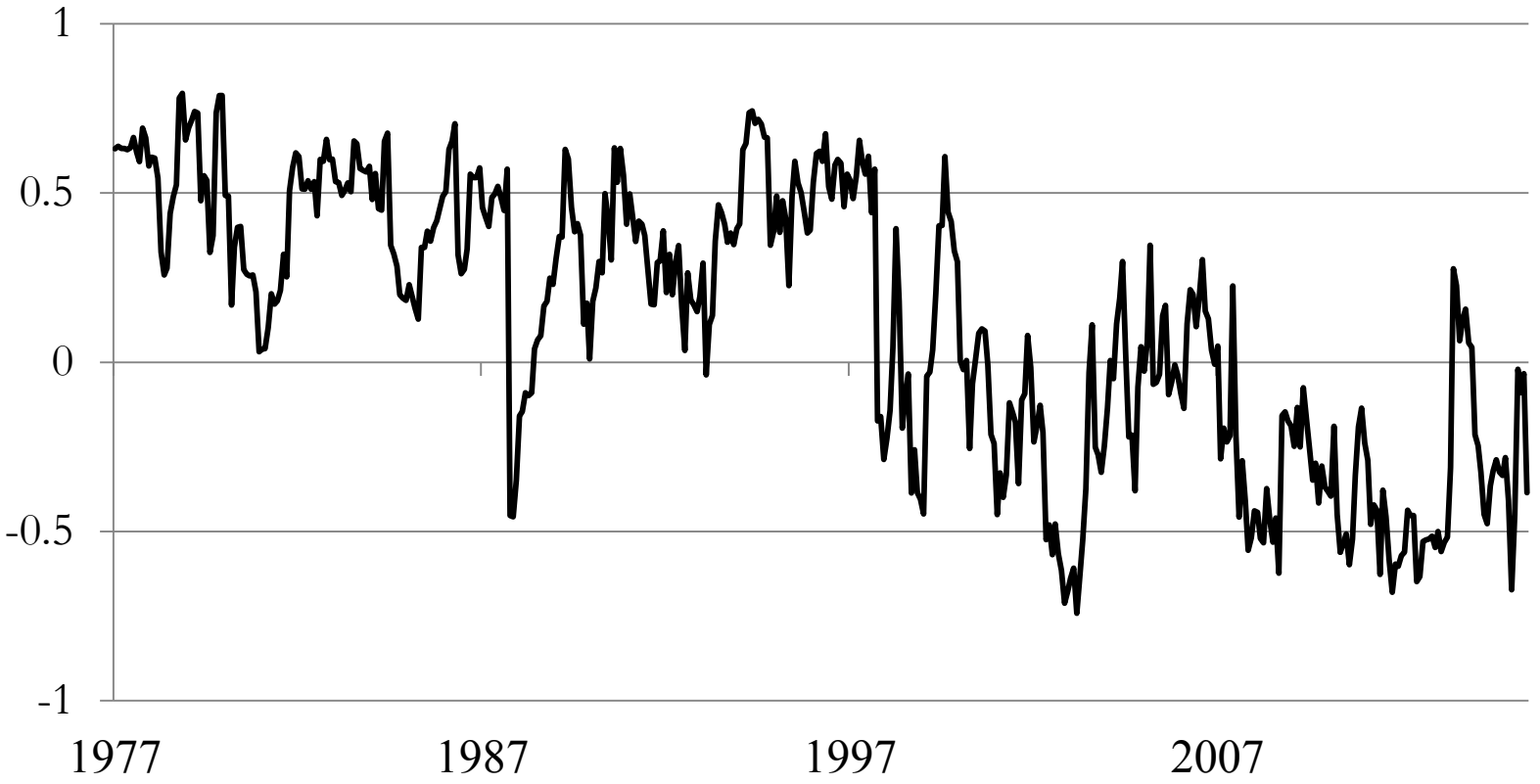
- U.S. Treasuries have lower return per unit of risk than any other sectors of USD fixed income (especially MBS)

  ➔consistently low Sharpe ratios

- Why?
  - Market segmentation – some market participants must own them
  - Liquidity – active traders pay for more liquid market

- Do they have any role in institutional investment portfolios?
  - Correlations

# Correlation between Returns on U.S. Equities and UST




This graph shows the correlation between US stock and Barclay US Agg Index. For post-1989, when daily data is available, 3-month exponentially weighted moving (EWM) correlation is calculated. Before that , 12-month EWM correlation with monthly data is used.

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# Current Macro Outlook for U.S.

- GDP: ~2.0-2.5% in 2016
  - Recovery continues at a slow rate relative to the average of previous cycles.
  - Unusual factors led to uneven GDP growth in 2015, but outlook for domestic final sales is fairly healthy.
- Core inflation: ~1.7% in 2016
  - Inflation will firm as effects from energy price declines and strong dollar abate.
  - I believe there is a larger risk to the upside than downside in the U.S.
- Job growth appears to remain strong.
  - Longer-term outlook for the unemployment rate is less certain because of the potential for large numbers of workers to re-enter the labor force.
    - Much of decline in the U-rate though 2014 came from labor force exits.
    - This provides an incentive for the FOMC to move slowly.
- Recent reports suggest improvements in wage growth in 2016.

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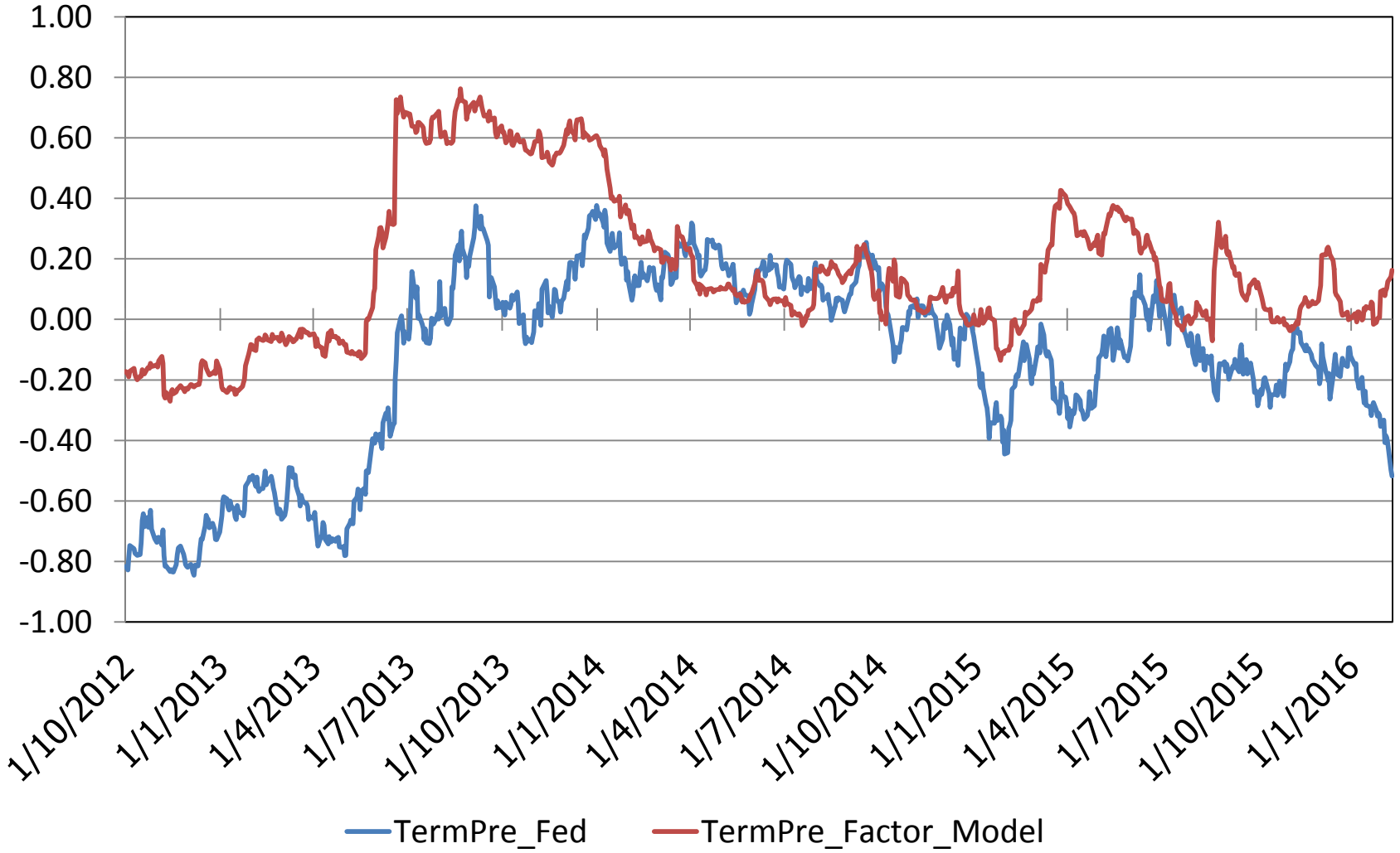
# UST 10-year Term Premium Estimates



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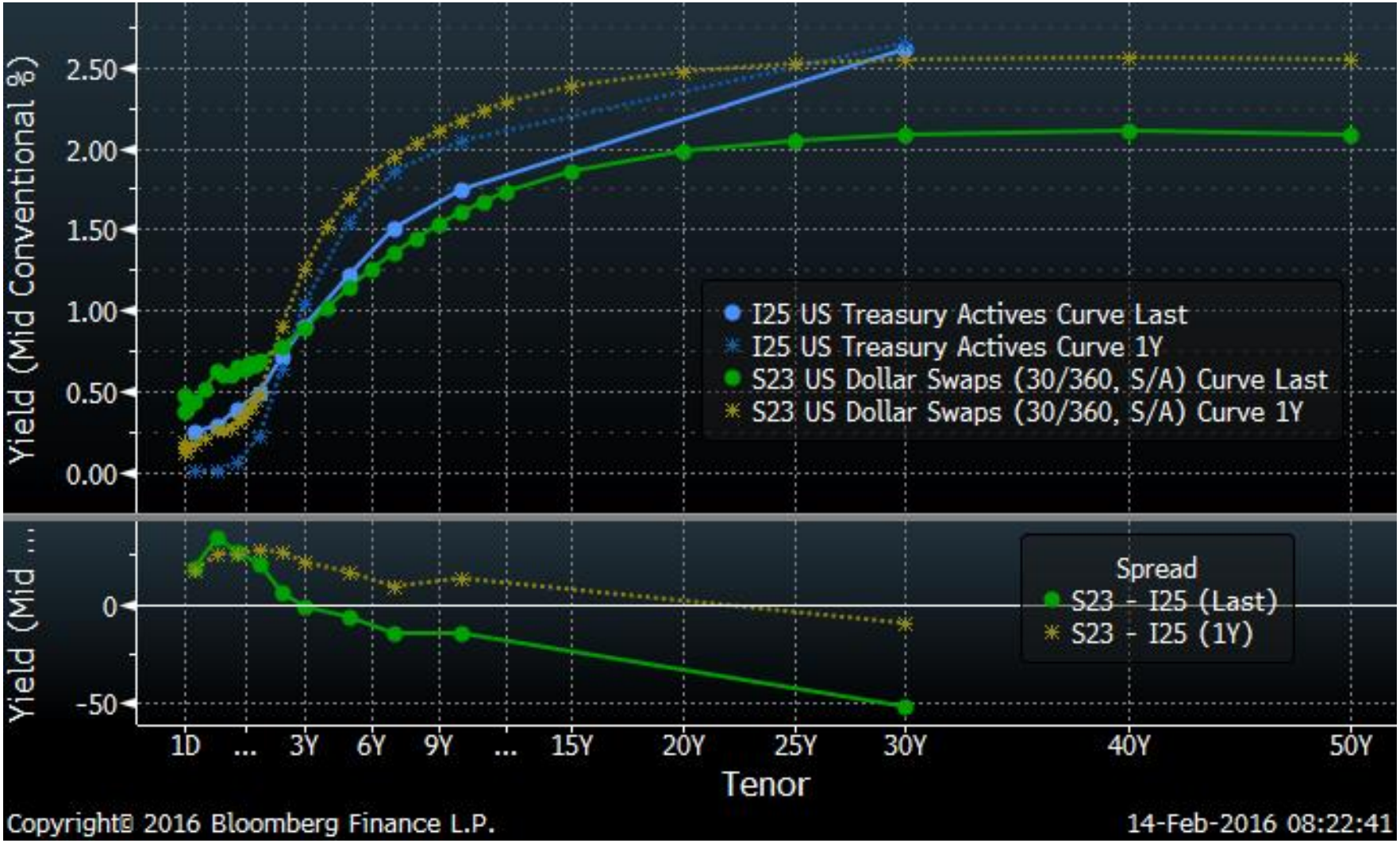
# UST and SWAP Curves



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# Outlook for USD Fixed Income

**FOMC median projection of 100bp of rate increases in 2016 is unlikely to be realized.**

- Fed has sufficient reason to continue raising rates, but other factors will keep pace slow.
- Risk that inflation may continue lower than policy goal of 2%.
- A stronger dollar, lower equities, or wider bond spreads have tightened financial conditions and reduced the amount of rate hikes required for macro policy.

**Corporate bond markets are at cross-roads.**

- Corporate credit fundamentals point to a U.S. credit cycle that is at a "late-ish" stage.
- Subsectors are at different stages of the credit cycle—energy is late, banks are earlier.
- High-yield default rate expected to rise to the ~5% over the next 12+ months.
- Credit spread compensation is high relative to economic expectations (IG looks good).

**Securitized markets offer attractive relative value.**

- Agency MBS valuations reflect a transition in the marginal buyer (Fed vs. private).
- A re-opening of the U.S. non-agency residential mortgage-backed securities (RMBS) market offers alternatives to higher yielding credit markets.
- CMBS, ABS, and non-agency MBS offer attractive spreads relative to other fixed income sectors with continued positive trends in credit performance.

# Finding Value in Corporate Credit

- In theory, it should be easy to determine relative value among corporate bonds:
  - Estimate a model for credit risk for each bond.
  - Use that model to estimate expected cash flows
  - Discount at the appropriate discount rate
  - Compare model price to market price

- In practice, modeling the appropriate spread for corporate bonds is very complicated:
  - Feldhutter and Schaefer (2015), The Credit Spread Puzzle: Myth or Reality?
  - Multiple sources of (path-dependent and time-varying) risk
  - Complicated capital structures
  - Imbedded options

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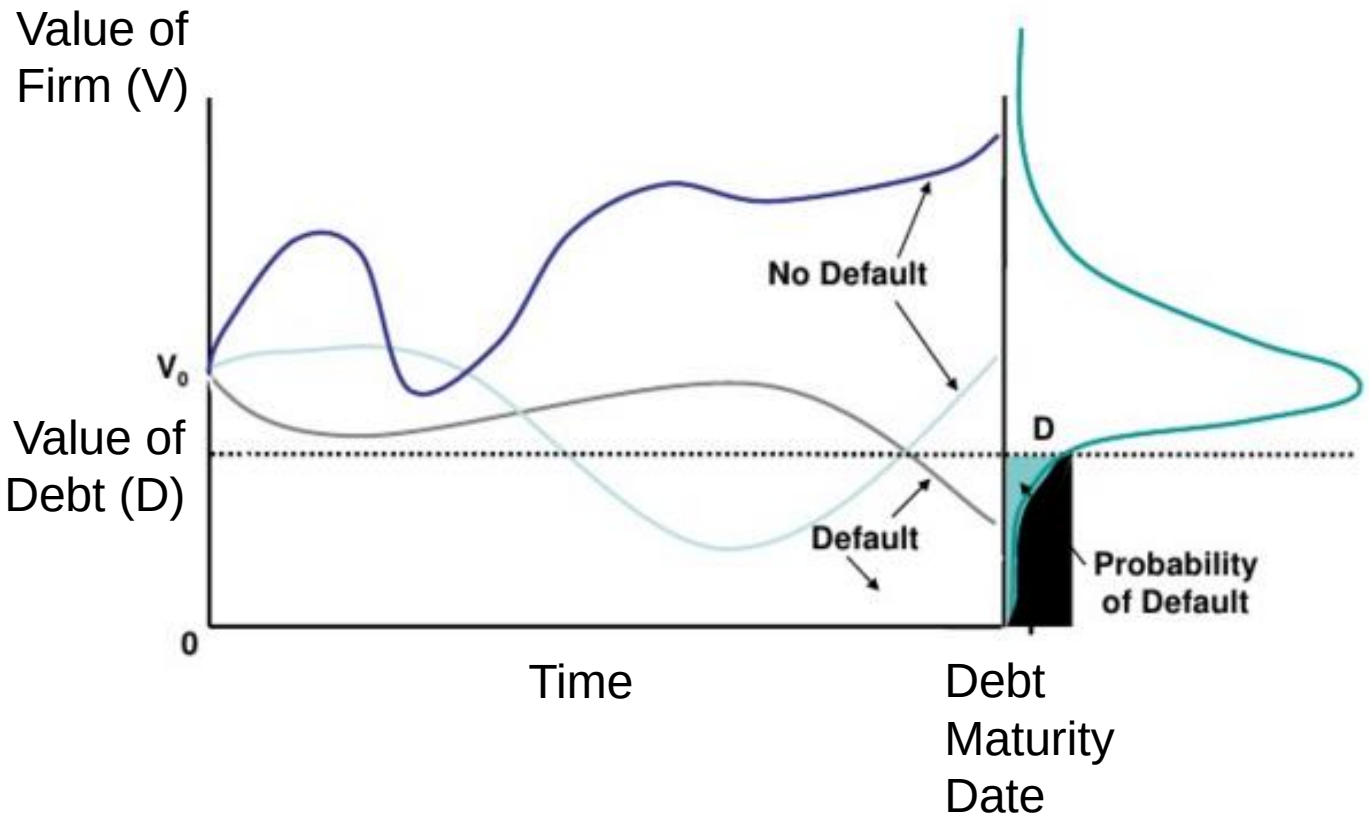
# ASB Credit Option Adjusted Spread (COAS) Model

- Merton/KMV type model
  - Base model was developed by Brennen and Schwartz about 15 years ago.
  - COAS is an estimate of mispricing



# COAS Model Features

- Asset volatility
  - Systematic component follows HNGARCH process calibrated to SPX options
  - Issuer-specific component follows GARCH process calibrated to historical idiosyncratic equity returns
- Stochastic interest rates
  - 2-factor Hull & White model
  - Calibrated to LIBOR/swap curve
- Random jump to default
  - Calibrated to historical default probabilities
    - includes cycle, firm, and industry effects
  - Allows for “Enrons”
- Dynamic capital structure model for new issuance
  - Re-cap risk: Empirically there are risks from large changes to capital structure

# Data

- We examine December 1996 through March 2014.
  - Bank of America - Merrill Lynch IG and HY indices
  - Equity prices and shares outstanding are from the Center for Research in Securities Prices (CRSP).
  - Dividends, preferred stock outstanding, book value of long-term and short-term debt, and other capital structure data from CompuStat.
  - Data on the distribution of debt across maturities is from the Mergent Fixed Income Securities Database (FISD).
  - Bond ratings from Moody's Default and Recovery Database (DRD).

- COAS were generated for over 200,000 bond-months from December 1996 to March 2014 for 11,192 unique bonds.

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# Primary Methodology

$$r_{i,\{t,t+n\}} = COAS_{i,t} + Financial_j \times COAS_{i,t} + HighYield_i \times COAS_{i,t} + Controls_{i,t} + \varepsilon_{i,\{t,t+n\}}$$

- Regression tests:
  - Dependent variable are holding period returns (1, 3, 6, or 12 months)
  - Model *COAS* is primary variable of interest
  - *Financial* is a binary variable equal to 1.0 if the bond issuer is a financial firm
  - High Yield is a binary variable equal to 1.0 if the bond is rated below Baa
- Additional controls include:
  - Credit Cost is a measure of credit risk (e.g., spread duration)
  - Measures of the hedgeable portion of returns,
    - Duration x 10-year UST Yield
    - Duration x 10-year UST Yield x HighYield
  - Industry fixed effects,
  - Various other things in a battery or robustness tests

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# Regression Results
## (Optimally Duration Hedged)

| | 1M | 3M | 6M | 12M |
|---|---|---|---|---|
| COAS | 0.2863*** | 0.5423*** | 1.0695*** | 1.7359*** |
| Financial × COAS | 0.0169 | −0.0243 | −0.1215* | 0.1386 |
| High Yield × COAS | 0.0175 | −0.0321 | −0.0354 | −0.1797* |
| Credit Cost | 0.2648*** | 0.4182*** | 0.7891*** | 1.4638*** |
| Credit Cost × Δ Credit Spread | −1.1039*** | −1.0402*** | −1.3644*** | −1.0669*** |
| Duration × Δ 10-yr Yield | −0.7373*** | −0.5627*** | −0.5658*** | −0.0668 |
| Duration × Δ 10-yr Yield × High Yield | 0.1613*** | 0.4068*** | 0.4211*** | −0.7053*** |
| High Yield | −0.0032*** | −0.0056*** | −0.0107*** | −0.0179*** |
| Industry FEs | Yes | Yes | Yes | Yes |
| Number of Observations | 198,858 | 189,642 | 178,588 | 158,131 |
| Adjusted R-square | 0.2301 | 0.1728 | 0.2454 | 0.2482 |
| Marginal Effects: | | | | |
| COAS | 0.5927% | 1.1210% | 2.1966% | 3.4970% |
| Financial × COAS | 0.6827% | 1.1632% | 2.1130% | 4.0983% |
| High Yield × COAS | 0.6370% | 1.0669% | 2.1458% | 3.1503% |

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# Regression Results
## (Full Duration Hedged Returns)

| | 1M | 3M | 6M | 12M |
|---|---|---|---|---|
| COAS | 0.1211*** | 0.4344*** | 0.7631*** | 2.2383*** |
| Financial × COAS | 0.0668** | 0.0449 | 0.0625 | −0.1273 |
| High Yield × COAS | 0.0628* | −0.0024 | 0.0766 | −0.1430 |
| Credit Cost | 0.1325*** | 0.3523*** | 0.6596*** | 1.6361*** |
| Credit Cost × Δ Credit Spread | −0.9120*** | −0.2609*** | −0.5713*** | −2.2939*** |
| High Yield | −0.0010** | −0.0056*** | −0.0103*** | −0.0277*** |
| Industry FEs | Yes | Yes | Yes | Yes |
| Number of Observations | 198,858 | 189,642 | 178,588 | 158,131 |
| Adjusted R-square | 0.0283 | 0.0171 | 0.0409 | 0.2793 |
| Marginal Effects: | | | | |
| COAS | 0.2508% | 0.8979% | 1.5675% | 4.5092% |
| Financial × COAS | 0.4231% | 1.0762% | 1.8404% | 4.6154% |
| High Yield × COAS | 0.3857% | 0.9032% | 1.7425% | 4.2417% |

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# Monthly Returns in Double-Sort Portfolios

| COAS Quintile | Credit Cost Quintile | | | | | |
|---|---|---|---|---|---|---|
| | 1 (Low) | 2 | 3 | 4 | 5 (High) | High-Low |
| 1 (Low) | 0.0010 | 0.0019 | 0.0006 | 0.0024 | 0.0047** | 0.0046** |
| 2 | 0.0021 | 0.0016 | 0.0019 | 0.0039 | 0.0075** | 0.0054** |
| 3 | 0.0033** | 0.0030 | 0.0040 | 0.0050 | 0.0072** | 0.0040 |
| 4 | 0.0046** | 0.0049* | 0.0057* | 0.0062* | 0.0061 | 0.0014 |
| 5 (High) | 0.0070*** | 0.0081*** | 0.0088*** | 0.0110*** | 0.0121*** | 0.0051 |
| High-Low | 0.0066*** | 0.0068** | 0.0080*** | 0.0086*** | 0.0074** | |

# Results by Liquidity

1M returns separated by trading volume in month of CSM estimation

| | No Trades | Below Median Volume | Above Median Volume |
|---|---|---|---|
| COAS | 0.1299*** | 0.2912*** | 0.4598*** |
| Financial × COAS | 0.0037 | −0.0533* | 0.0431 |
| High Yield × COAS | 0.0951** | 0.0144 | −0.0444 |
| Credit Cost | 0.0678 | 0.1818*** | 0.4692*** |
| Credit Cost × Δ Credit Spread | −1.4589*** | −1.7433*** | −0.6843*** |
| Duration × Δ 10-yr Yield | −0.7360*** | −0.7676*** | −0.7074*** |
| Duration × Δ 10-yr Yield × High Yield | 0.0576* | 0.2605*** | 0.2852*** |
| High Yield | −0.0026*** | −0.0019*** | −0.0046*** |
| Industry FEs | Yes | Yes | Yes |
| Number of Observations | 73,552 | 62,928 | 62,946 |
| Adjusted R-square | 0.2394 | 0.2923 | 0.2166 |
| Marginal Effects: | | | |
| COAS | 0.2690% | 0.5701% | 0.9866% |
| Financial × COAS | 0.2636% | 0.5871% | 1.1580% |
| High Yield × COAS | 0.4771% | 0.6085% | 0.8947% |

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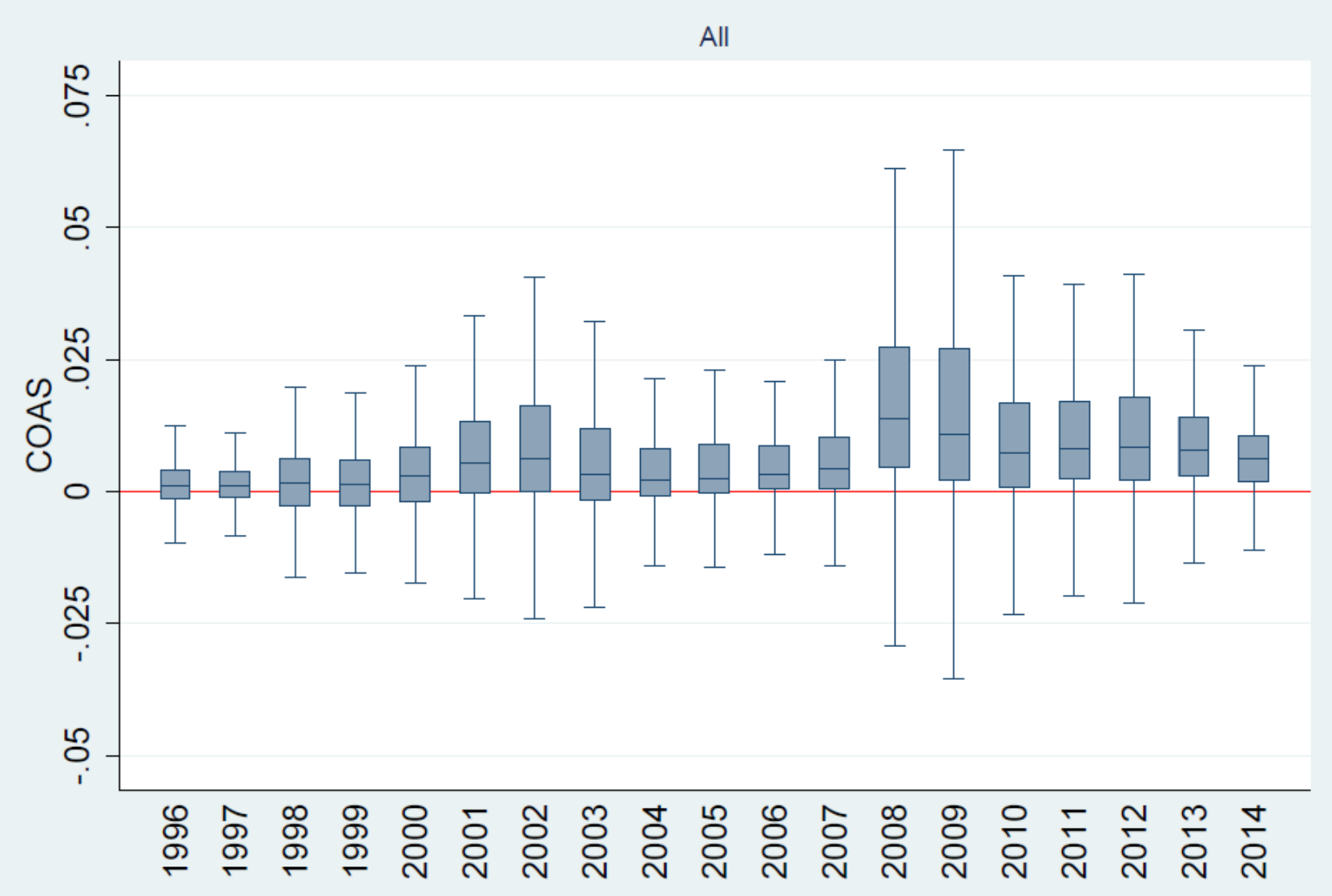
# COAS Over Time
## (End of Year Estimates)



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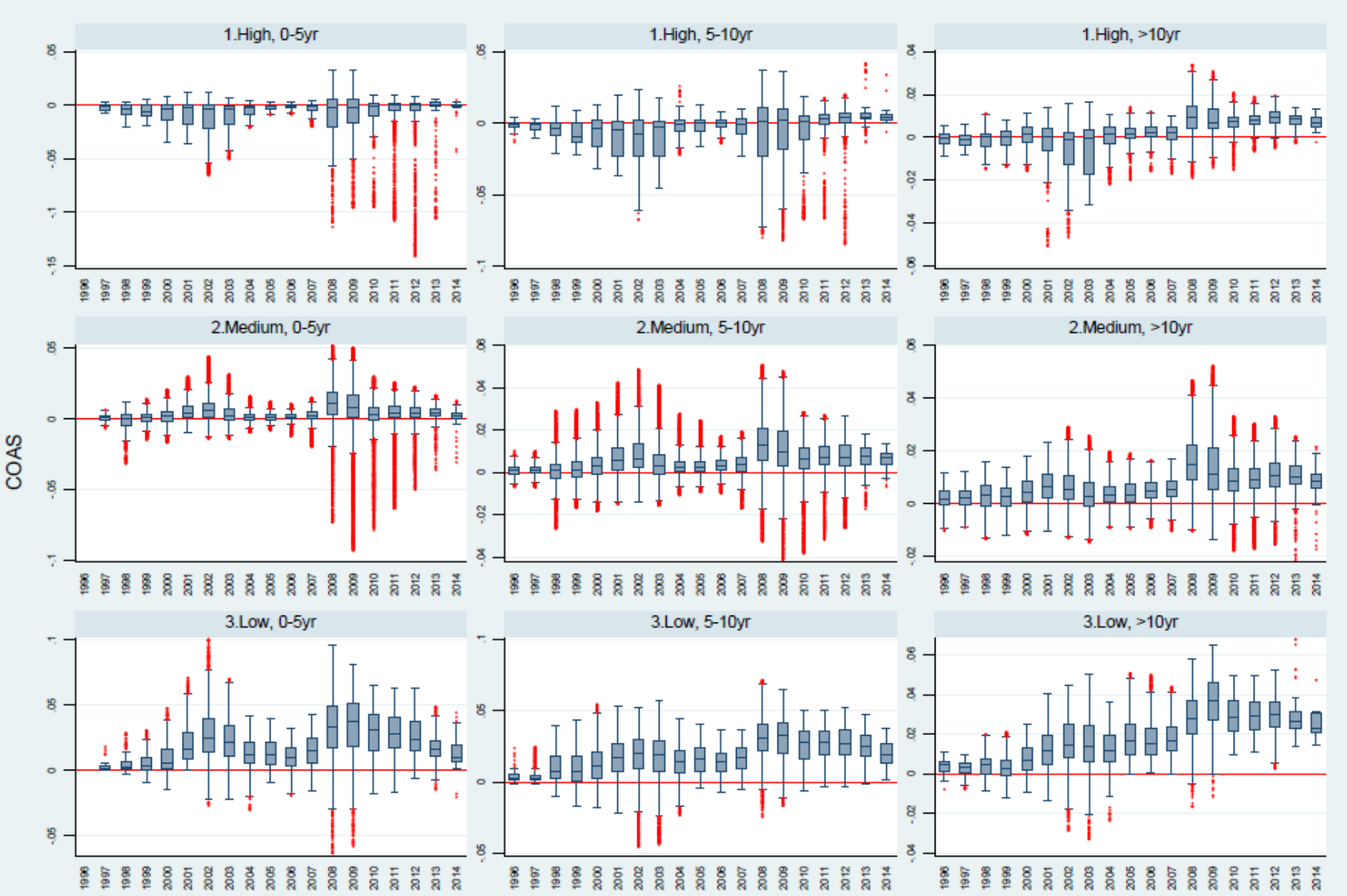
# COAS by Time, Quality, and Maturity



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# Conclusions

- USD fixed income markets are diverse
  - Historically there have been persistent relative value opportunities at the sub-asset class level
- Unusual current conditions make asset allocation difficult though
  - Better opportunities at security selection level
  - Some parts of ABS and IG Corporate Credit appear mispriced
- Results from large scale empirical analysis of corporate credit indicate persistent (and actionable) mispricing at the security level.