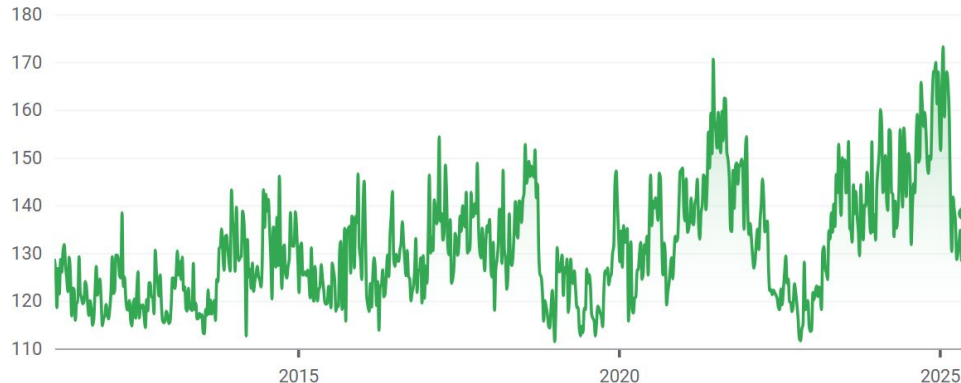


# An Analysis of Market Factors and Investor Sentiment as Determinants of the CBOE SKEW Index

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# Introduction - What is the SKEW Index?

- Measures perceived "tail risk" in the S&P 500
- "Volatility Smirk":
  - Higher implied volatility for out-of-the-money put options
- SKEW quantifies this asymmetry
  - Higher SKEW = greater market apprehension of significant downward price movements
- Why study it?
  - Important for understanding market dynamics, risk pricing, and investor expectations



# Research Question & Literature Insights

What are the principal market-based and behavioral factors that explain daily variations in the CBOE SKEW Index, and what are their statistical significance and quantitative impacts?

- Key Literature:
  - Xing et al. (2010): Option smirk has predictive power for returns
  - Onan et al. (2014): Macro announcements affect VIX and skew
  - Baker & Wurgler (2006): Investor sentiment impacts asset valuation

# Methodology

- Data:

- Daily, Feb 2011 - Oct 2019  
(2,165 observations)

- Analysis:

- Multiple Linear Regression  
(Levels & Log-Log models)

- Diagnostics:

- Revealed autocorrelation and heteroscedasticity
- Newey-West HAC standard errors were applied for robust inferences

The dependent variable, the daily closing value of the CBOE SKEW Index (SKEW), was obtained from historical records of the CBOE. The independent variables include:

- **VIX<sub>*t-1*</sub>**: Lagged daily closing value of the CBOE Volatility Index (VIX).
- **VIX\_sq<sub>*t-1*</sub>**: Lagged squared daily VIX, to capture potential non-linear effects of market volatility.
- **RealizedVol<sub>*t-1*</sub>**: Lagged S&P 500 realized volatility, calculated as the annualized standard deviation of daily logarithmic S&P 500 returns over a trailing 21-trading day window.
- **MarketReturn<sub>*t-1*</sub>**: Lagged recent S&P 500 market performance, calculated as the cumulative logarithmic S&P 500 return over the preceding 21 trading days.
- **Sentiment<sub>*t-1*</sub>**: Lagged investor sentiment, proxied by the weekly Bullish Sentiment Percentage from the American Association of Individual Investors (AAII) Sentiment Survey. This weekly data was converted to a daily series by applying the most recent weekly observation to each subsequent trading day using a forward-fill method.
- **PC\_Ratio<sub>*t-1*</sub>**: Lagged daily S&P 500 Index Put-Call Ratio, obtained from CBOE historical statistics.
- **VIX\_Sent\_Interact\_centered<sub>*t-1*</sub>**: A lagged interaction term between VIX and Sentiment. To mitigate potential multicollinearity arising from standard interaction terms, this variable was constructed by first mean-centering both the VIX and Sentiment series (subtracting their respective sample means) and then multiplying these centered series.

All predictor variables were lagged by one trading day ( $t - 1$ ) to ensure that only past information is used to explain the SKEW Index at time  $t$ , thereby mitigating concerns of simultaneity bias. The final analytical dataset, after cleaning, merging, variable derivation, and lagging, comprised 2,165 daily observations.

# Key Findings

- Preferred Model: Log-Log specification with HAC errors (explained ~17.7% of SKEW variation)
- Statistically Significant Drivers:
  - Lagged VIX (-): A 1% increase in lagged VIX associated with a ~0.043% decrease in SKEW
  - Lagged Realized Volatility (-): A 1% increase in lagged realized volatility associated with a ~0.038% decrease in SKEW
  - Lagged Put-Call Ratio (+): A 1% increase in lagged Put-Call Ratio associated with a ~0.020% increase in SKEW
  - Insignificant in Robust Model: Market Returns, AAll Sentiment, VIX-Sentiment Interaction

Significant Results from Model 2b (Log-Log with HAC SEs). Adjusted R-squared (OLS): 0.177.

Variable	Coefficient	Significance
log_VIX_lag1	-0.043	**
log_RealizedVol_lag1	-0.038	***
log_PC_Ratio_lag1	0.020	*

# Discussion & Implications

- **VIX & Realized Volatility:**
  - The negative relationship suggests a nuanced interplay
  - High general volatility might lead to pricing of a wider, more symmetric range of outcomes, or liquidity effects could distort SKEW calculation during extreme stress
- **Put-Call Ratio:**
  - Directly reflects hedging/speculative pressures in the options market, logically pushing SKEW higher
- **AAll Sentiment:**
  - Its lack of significance (in the robust full model) might mean this retail-focused weekly proxy doesn't capture dominant institutional flows, or its effects are subsumed. (Sub-period analysis did show it significant earlier)
- **Cross-Validation:**
  - Showed limited out-of-sample predictive power, common for financial time-series

# Limitations & Future Research

- Limitations:

- Modest R-squared (other factors at play)
- Weekly sentiment proxy (AAll) might not capture higher-frequency dynamics
- Study period is pre-COVID; dynamics might have changed

- Future Research:

- Explore higher-frequency or institutional sentiment indicators
- Incorporate macroeconomic surprise variables
- Utilize more sophisticated time-series models (e.g., GARCH, VAR, machine learning) or models allowing for dynamic coefficients

# Conclusion & Reflection

- Conclusion: SKEW is influenced negatively by general market volatility (VIX, RealizedVol) and positively by options market hedging (Put-Call Ratio). The role of sentiment appears complex and time-varying
- Reflection:
  - Importance of rigorous diagnostic testing (OLS assumptions)
  - Value of HAC robust standard errors for valid inference
  - Challenges in data wrangling and merging diverse financial data
  - Deeper understanding of options markets and tail risk