

**IRVS Analysis: SPY vs GLD Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2021:10 2025.06 2023.08 2017.04 2018.03 2019.02 2024.01 2016.05 2020-27 Panel 2: GLD Implied Vol 0.3 Realized Vol IRVS (Spread) 0.2 **Annualized Volatility** 0.1 0.0 -0.12017.04 2018.03 2015.01 2019.02 2020-22 2020.01

**IRVS Analysis: SPY vs XLK Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.01 2021.20 2022.09 2023.08 2025.06 2019.02 2017.04 2018-03 2024.07 2016.05 2020-11 Panel 2: XLK 8.0 Implied Vol Realized Vol IRVS (Spread) 0.6 Annualized Volatility 0.4 0.2 0.0 -0.2 -0.4-0.6 2017.04 2019.02 2018.03 2015.01 2020-22 2020.01 Time (Monthly)

**IRVS Analysis: SPY vs IWM Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2021.20 2023.08 2025.06 2018.03 2022.08 2017.04 2019.02 2020-22 2024.07 2016.05 Panel 2: IWM 8.0 Implied Vol Realized Vol IRVS (Spread) 0.6 **Annualized Volatility** 0.4 0.2 0.0 -0.2-0.42019.02 2017.04 2018.03 2015-01 2024.01 2020-12 2020.01 Time (Monthly)

**IRVS Analysis: SPY vs EFA Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.01 2022.20 2023.08 2025.06 2019.02 2016.05 2017.04 2018-03 2020-22 2024.01 Panel 2: EFA 0.6 Implied Vol Realized Vol IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42017.04 2018.03 2015.01 2019.02 2020-22 2020.01 Time (Monthly)

**IRVS Analysis: SPY vs XLF Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2022.20 2023.08 2025.06 2019.02 2017.04 2018-03 2020-22 2024.01 2016.05 Panel 2: XLF Implied Vol 8.0 Realized Vol IRVS (Spread) 0.6 **Annualized Volatility** 0.4 0.2 0.0 -0.2-0.4-0.6 2018-03 2015.01 2017.04 2019.02 2020-22 2020.01

**IRVS Analysis: SPY vs TLT Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2021.20 2023.08 2019.02 2025.06 2017.04 2018-03 2016.05 2020-11 2024.07 Panel 2: TLT Implied Vol Realized Vol IRVS (Spread) 0.3 Annualized Volatility
0.0
0.0
1.0 -0.2-0.32018.03 2015.01 2019.02 2020-12 2020.01 Time (Monthly)

**IRVS Analysis: SPY vs DIA Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2021.20 2023.08 2025.06 2019.02 2016.05 2017.04 2018-03 2020.01 2020-22 2024.01 Panel 2: DIA 8.0 Implied Vol Realized Vol 0.6 IRVS (Spread) Annualized Volatility 0.4 0.2 0.0 -0.2-0.4-0.62017.04 2018.03 2019.02 2015.01 2020-22 2020.01

**IRVS Analysis: SPY vs IEF Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 -0.2-0.42015.01 2022.20 2019.02 2022.09 2025.06 2016.05 2017.04 2018.03 2020:22 2024.07 2020.01 Panel 2: IEF Implied Vol 0.15 Realized Vol IRVS (Spread) 0.10 **Annualized Volatility** 0.05 0.00 -0.052016.05 2020.01 2020:11 Time (Monthly)

**IRVS Analysis: SPY vs LQD Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2022.20 2022.09 2023.08 2025.06 2018-103 2019.02 2024.07 2016.05 2017.04 2020.01 2020-22 Panel 2: LQD 0.4 Implied Vol Realized Vol IRVS (Spread) 0.3 **Annualized Volatility** 0.2 0.1 0.0 -0.1-0.22018.03 2019.02 2015.01 2020-22 2020.01 Time (Monthly)

**IRVS Analysis: SPY vs XLE Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 -0.2 -0.42015.01 2022.20 2023.08 2025.06 2029.02 2022.09 2016.05 2017.04 2018.03 2024.07 2020.01 2020-11 Panel 2: XLE Implied Vol 1.00 Realized Vol IRVS (Spread) 0.75 Annualized Volatility
0.00
0.00
0.25 -0.50-0.752016.05 2015.01 2020.01 2020:11

**IRVS Analysis: SPY vs XLY Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2022.20 2023.08 2025.06 2018-103 2019.02 2017.04 2024.07 2016.05 2020-11 Panel 2: XLY Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42019.02 2017.04 2018.03 2015.01 2016.05 2024.01 2020-22 2020.01

**IRVS Analysis: SPY vs XLI Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2022.20 2022.09 2023.08 2025.06 2019.02 2017.04 2018-03 2020.01 2020-22 2024.07 2016.05 Panel 2: XLI 8.0 Implied Vol Realized Vol 0.6 IRVS (Spread) Annualized Volatility 0.4 0.2 0.0 -0.2-0.42017.04 2018.03 2019.02 2015.01 2020-22 2020.01 Time (Monthly)

Implied Vol Realized Vol IRVS (Spread)

0.6

0.4

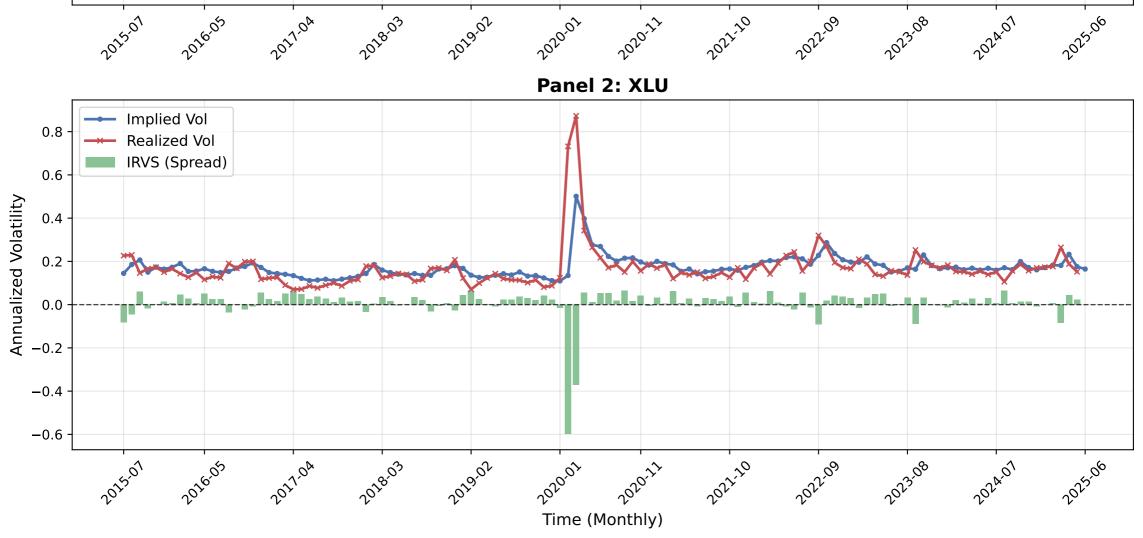
0.2

0.0

-0.2

-0.4

**Annualized Volatility** 



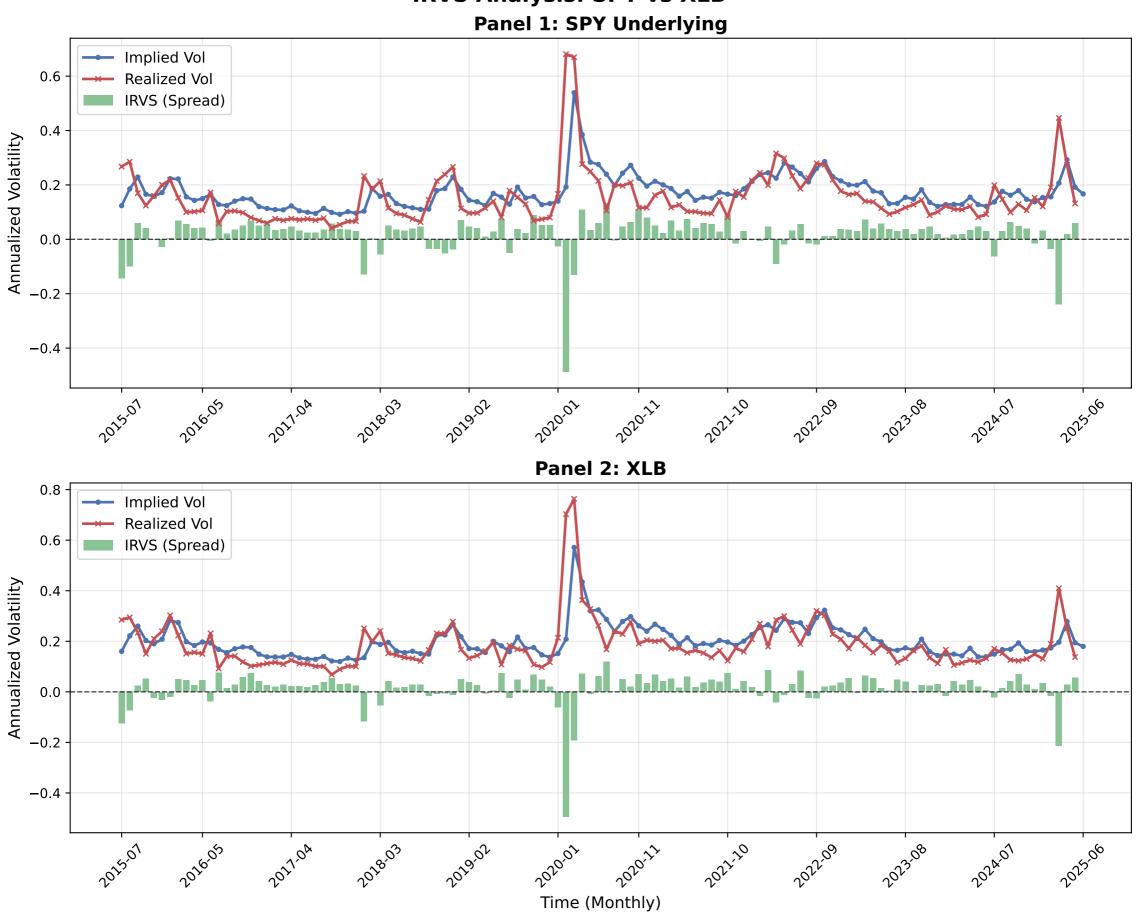
**IRVS Analysis: SPY vs EEM Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2021.20 2023.08 2025.06 2019.02 2017.04 2018-03 2024.07 2016.05 2020-11 Panel 2: EEM Implied Vol 0.6 Realized Vol IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42017.04 2018.03 2015.01 2019.02 2020-22 2020.01 Time (Monthly)

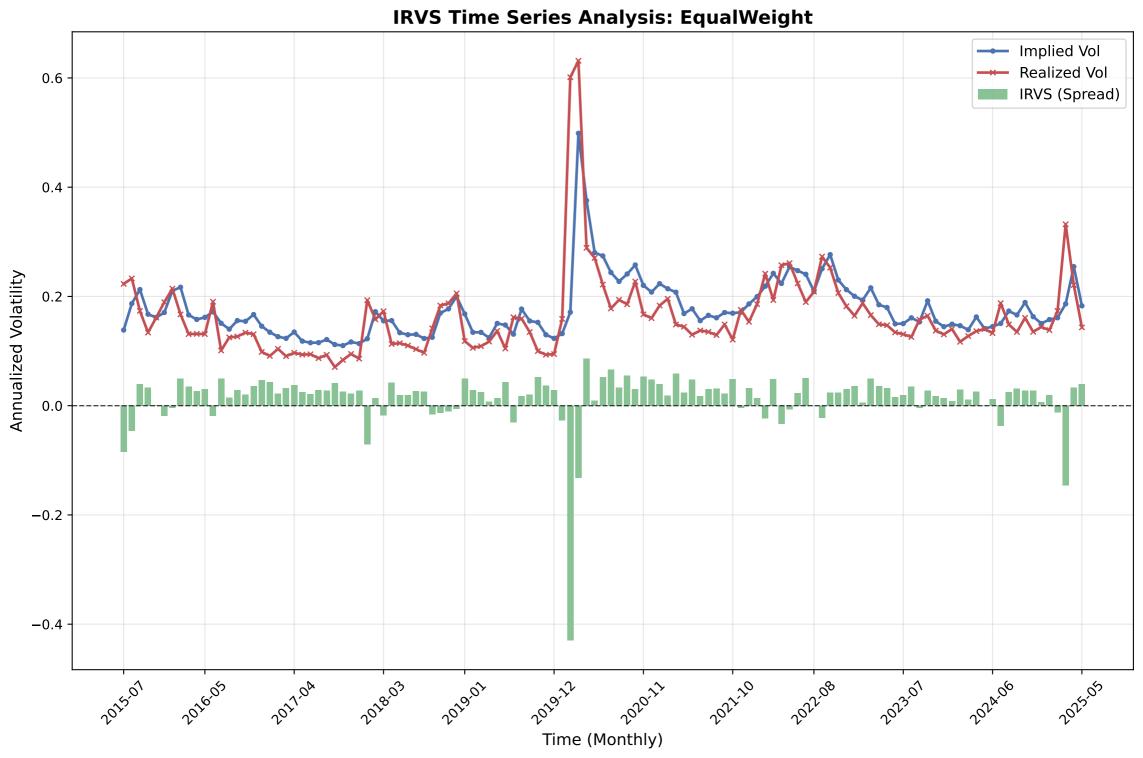
**IRVS Analysis: SPY vs SLV Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2021.20 2023.08 2025.06 2018.03 2017.04 2019.02 2024.01 2016.05 2020-11 Panel 2: SLV Implied Vol Realized Vol 0.6 IRVS (Spread) **Annualized Volatility** 0.4 0.2 0.0 -0.22017.04 2019.02 2018.03 2015.01 2020-22 2020.01

**IRVS Analysis: SPY vs HYG Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.01 2021.20 2022.09 2023.08 2025.06 2018.03 2019.02 2016.05 2017.04 2020.01 2020-22 2024.01 Panel 2: HYG Implied Vol 0.4 Realized Vol IRVS (Spread) 0.3 **Annualized Volatility** 0.2 0.1 0.0 -0.1-0.22017.04 2018.03 2019.02 2015.01 2020-22 2020.01 Time (Monthly)

**IRVS Analysis: SPY vs XLP Panel 1: SPY Underlying** Implied Vol Realized Vol 0.6 IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42015.07 2022.20 2023.08 2025.06 2019.02 2017.04 2018-03 2020.01 2020-22 2024.07 2016.05 Panel 2: XLP Implied Vol 0.6 Realized Vol IRVS (Spread) 0.4 **Annualized Volatility** 0.2 0.0 -0.2-0.42019.02 2018.03 2015.01 2020-22 2020.01

**IRVS Analysis: SPY vs XLB Panel 1: SPY Underlying** 





## Cross-Sectional Analysis: IV, RV, and IRVS Spreads by Ticker



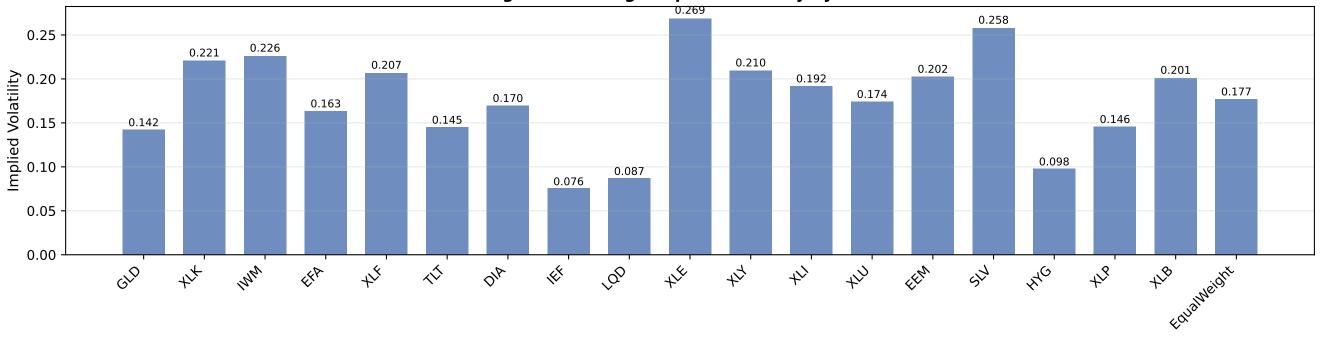


Figure 4: Average Realized Volatility by Ticker

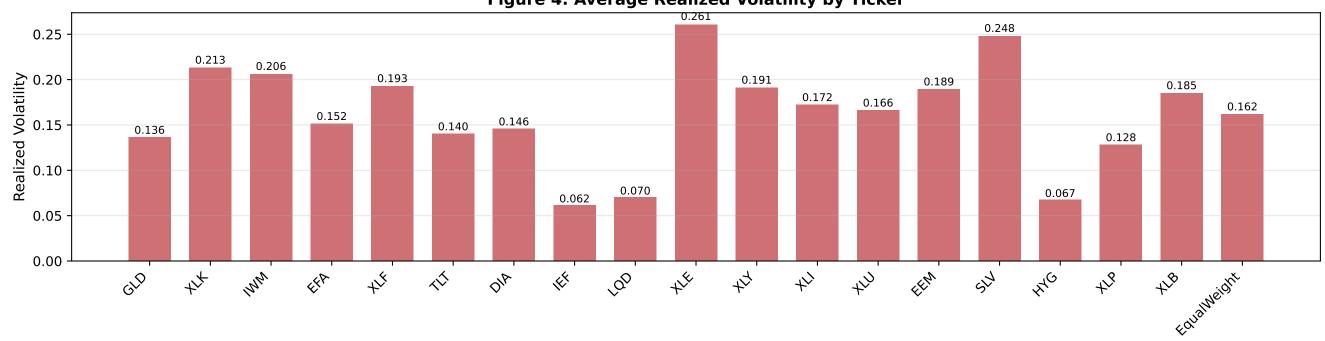


Figure 5: Average IRVS Spread (IV - RV) by Ticker

