Volume, Volatility, and Disagreement in Market Index Options

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#1 Disagreement and Options

- Understand the behavior of disagreement in the options market
- Why research disagreement:
  - Hong & Stein (2007, JEP): "Disagreement models [...] speak directly to the joint behavior of stock prices and trading volume."
  - Cochrane (2016): "Volume is the great unsolved problem of financial economics."
- Options market:
  - Large number of assets
  - Two interesting dimensions: moneyness and maturity
- Questions:
  1. Do investors disagree more about rare events?
  2. Do investors disagree more about events farther in the future?

#2 A Disagreement Model

- Kendal & Pearson (1995, JPE): model where investors disagree about interpretation of new information

Period I — Period II

- Two types of investors
- Different priors: $\mathcal{N}(X_i, s_i^{-1})$
- Competitive equilibrium
- Observe public signal: True Payoff + Noise
- Different interpretation: $\mathcal{N}(\text{truth} + \mu_i, h^{-1})$
- New equilibrium

- Model conclusion:

$$\text{Volume} = |\beta_0 + \beta_1 \cdot \text{Price Change}|$$

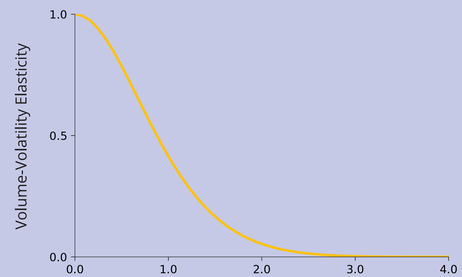
$$\beta_0 = r\alpha(1-\alpha)h\underbrace{(\mu_1 - \mu_2)}_{\text{disagreement}} \qquad \beta_1 = r\alpha(1-\alpha)\underbrace{(s_1 - s_2)}_{\text{prior beliefs}}$$

#3 Volume-Volatility Elasticity

- Bollerslev, Li & Xue (2018, RESTUD):
  - Kandel-Pearson volume equation should hold on average
  - Derive expression for volume-volatility elasticity

$$\text{Volume-Volatility Elasticity} = \frac{1}{1 + \psi\left(\frac{h}{\sigma} \cdot \underbrace{\frac{|\mu_1 - \mu_2|}{|s_1 - s_2|}}_{\text{relative disagreement}}\right)}$$

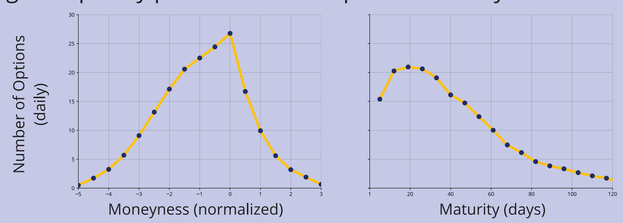
- Volume-volatility elasticity is decreasing in the relative disagreement



- Interpret elasticity as disagreement between investors

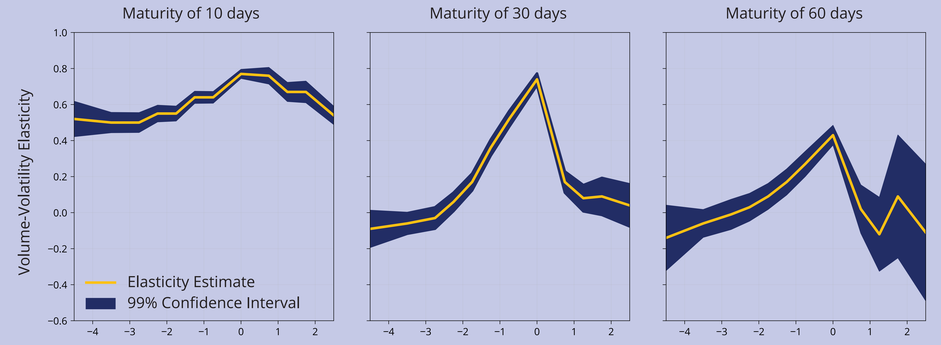
#4 The SPX Options Market

- SPX options: underlying S&P 500 index
  - High number of options and high liquidity
  - Insurance against market crashes
- Moneyness speaks to different parts of the index distribution
  - Price of an out of the money option: driven by tail probabilities
- Maturity speaks to index distribution at different horizons
- Moneyness and maturity likely related to disagreement
  - Estimate elasticity for varying moneyness and maturity
- Options prices are driven by volatility: disagreement in options is about volatility
- Study relies on high-frequency options data
  - Data spans 2007-2016 with sampling frequency of 1-minute
  - High-frequency prices: estimate options volatility

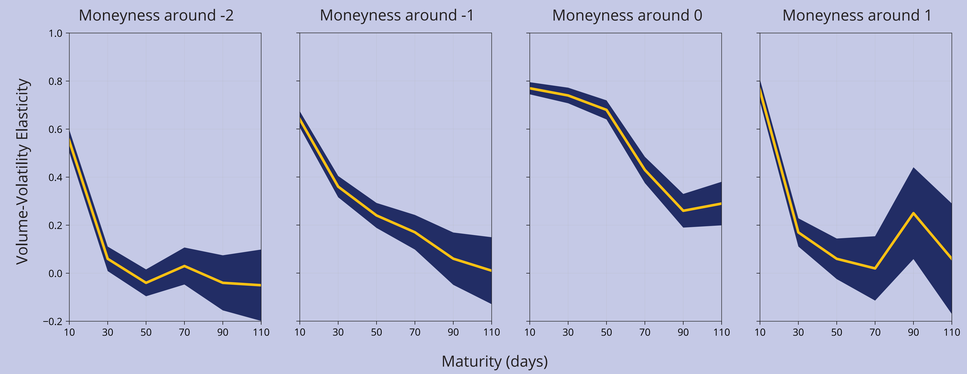


#5 Results: Disagreement About Tails and the Future

- Estimate volume-volatility elasticity via linear regressions:
  - Flexible estimation: allow elasticity to change with moneyness and maturity
  - Divide sample into groups by moneyness and maturity
  - For each group, estimate the elasticity (log-log regression)
- Elasticity interpreted as disagreement among investors: higher elasticity, lower disagreement



- Elasticity below unity: disagreement in options market
- Elasticity increases as moneyness moves away from zero: higher disagreement about tails
- Highest elasticity for moneyness close to zero: lower disagreement about average



- Elasticity is highest for short maturities: lower disagreement about the short-run
- Elasticity decreases as maturity increases: higher disagreement about future times

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