Stock Market Return Predictability Dormant in Option Panels

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Research Question and Context

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- **Literature Review.** While there is mixed evidence that risk neutral moments forecast returns, we know that good predictors are:
  - **variance risk premiums** (Bollerslev et al. (2009), Kilic and Shaliastovich (2019), Bollerslev et al. (2015))
  - **option trading measures** (e.g., Chen et al. (2019))

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  - **option trading measures** (e.g., Chen et al. (2019))
- **Contribution of this paper.** Predict the full physical distribution of market returns with the risk neutral distribution using the functional regression methodology of Park and Qian (2012). The results show on out-of-sample R^2 of around 6%.

Out of sample Methodology

- Estimate functional regression

$$\mathbf{d}_{p,t} = \mathbf{A}\mathbf{d}_{q,t-1} + \epsilon_t$$

  where $\mathbf{d}_{q,t-1}$ and $\mathbf{d}_{p,t}$ are the (demeaned) risk-neutral and physical densities at time $t-1$ and t using data up to time t.
  - $\mathbf{d}_{q,t-1}$ is calculated at time $t-1$ from option prices from Breeden and Litzenberger (1978)
  - $\mathbf{d}_{p,t}$ is calculated at time t by bootstrapping daily returns from time $t-1$ to time t.
- The average of the estimated distribution $\widehat{\mathbf{d}_{p,t+1}} = \widehat{\mathbf{A}}\mathbf{d}_{q,t}$ is used as predictor of r_{t+1}.

Out of sample Methodology Comments

- **Notation** in the paper is different than my previous slide. Authors report that they estimate functional regression $\mathbf{d}_{p,s+1} = \mathbf{A}\mathbf{d}_{q,s} + \epsilon_{s+1}$ with $s <= t$ and use it to estimate a predictor of r_{t+1}. (typo?)

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- **Regularization.** The density function are wavelet-transformed, and only the first K principal component are used. Why the choice of wavelet basis? The methodology of Park and Qian (2012) could be applied to any basis.

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- **Risk-neutral distribution.** The risk-neutral distribution is calculated using the formula of Breeden and Litzenberger (1978)
  - The authors use only put option data. Why not use the call options too?
  - Risk-neutral distribution is calculated on the third Friday of every month with options expiring exactly on the month after. This is different than what is usually done with variance risk premium forecasts (e.g., Bollerslev et al. (2009); Kilic and Shaliastovich (2019)) in which the variance risk premium is calculated at the end of the month and options are interpolated.

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- **Physical distribution.** The physical distribution is estimated with a bootstrap technique. Why this choice? Another popular choice is to estimate a kernel density with past returns Jackwerth (2000).

Empirical Results Comments

- Out of sample R^2 (Table 3) and economic gains (Table 4) are high. The results are very interesting.
  What is the economic driver of this predictability?
  Mathematically, which of the principal component is driving the results and can we relate it to any economic insight?

- Kilic and Shaliastovich (2019) document that good and bad variance risk premium can forecast the market with very high out-of-sample R^2 (Section 3.5.3). It would be interesting to compare also with their measure.

Extension

- **Extension.** It would be interesting to see the forecasting power at longer horizons by matching the longer horizon returns with the maturity of option panel data. For longer horizons we know that risk-neutral higher moments have a more stable predictive power (Martin (2017); Chabi-Yo and Loudis (2020))

It was a pleasure to read the paper!

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