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Essays in Financial Econometrics and Machine Learning

Can the Premium for Idiosyncratic Tail Risk be Explained by Exposures to its Common Factor?
(Job Market Paper)

Stocks in the highest idiosyncratic tail risk decile earn 8% higher average annualized returns than in the lowest. I propose and test a risk-based explanation for this premium, in which shocks to intermediary funding cause idiosyncratic tail risk to follow a strong factor structure, and the factor, common idiosyncratic tail risk (CITR), comoves with intermediary funding. Consequently, if firms with high idiosyncratic tail risk have high exposure to CITR shocks, then they earn a risk premium due to their low returns when intermediary constraints tighten. To test my explanation, I create a novel measure of idiosyncratic tail risk that is estimated using high-frequency returns, and theoretically prove its time-aggregation properties. Consistent with my explanation, CITR shocks are procyclical, correlated to intermediary factors, priced in assets, and explains the idiosyncratic tail risk premium. Volume tail risk also earns a premium, follows a strong factor structure, and its common factor is priced. This duality of idiosyncratic tail risk and volume tail risk provides evidence for my risk-based explanation, and further supports the hypothesis that intermediaries' large trades cause idiosyncratic tail risk and volume tail risk from Gabaix et al. (2006).

Regulatory Capital and Incentives for Risk Model Choice under Basel 3
(with Lars Stentoft) *Journal of Financial Econometrics*, forthcoming. Invited to be presented at the ECB.

In response to the Subprime Mortgage crisis, the Basel Committee on Banking Supervision (BCBS) has spent the previous decade overhauling the regulatory framework that governs how banks calculate minimum capital requirements. In 2019, the BCBS finalized the Basel 3 regulatory regime, which changes the regulatory measure of market risk and adds new complex calculations based on liquidity and risk factors. This paper is motivated by these changes and seeks to answer the question of how regulation affects banks' choice of risk-management models, whether it incentivizes them to use correctly specified models, and if it results in more stable capital requirements. Our results show that, although the models that minimize regulatory capital for a representative bank portfolio also result in the most stable requirements, these models are generally rejected as being correctly specified and tend to produce inferior forecasts of the regulatory risk measures.

Intraday Market Predictability: A Machine Learning Approach
(with Dillon Huddleston and Lars Stentoft) *Journal of Financial Econometrics*, invited for submission

The predictability of intraday market returns is studied by conducting the largest analysis of such returns, using state-of-the-art machine learning models trained on lagged returns to forecast five-minute S&P 500 exchange-traded fund returns. Lasso, elastic nets, and random forests are consistently found to be the best-performing models, yielding an out-of-sample R^2 of 0.24% from 2001 to 2016. This predictability translates to economically significant profits: A market-timing strategy using random forest predictions earns 58% (8%) annualized returns before (after) transaction costs, and Sharpe ratio equal to 1.86 (0.73). The ensemble median is found to outperform individual model predictions, yielding an out-of-sample R^2 of 0.26% and after-transaction cost return of 10% with a Sharpe ratio of 1.20. This strong predictability of intraday market returns provides evidence against market efficiency over short time horizons. Consistent with trader inefficiency, market returns are more predictable during the middle of the day, days with high volatility or illiquidity, and years of financial crisis. These empirical findings suggest an investigation into the economic mechanisms driving such short-horizon predictability.