Weak and Strong Cross-Sectional Dependence of Stock Returns in Factor Models

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This paper introduces a framework for evaluating the cross-sectional dependence structure of asset pricing factor models using the exponent of cross-sectional dependence. This exponent governs the rate at which the variance of cross-sectional averages declines with the number of assets, with values above 1/2 indicating pervasive systematic factors and values at or below 1/2 characterising weak, localised dependence. The cross-sectional dependence exponent provides both a diagnostic for existing models and a formal criterion for evaluating newly proposed factors. Applied to S&P 500 returns over 1974–2023, we separately quantify the pervasiveness of proposed factors and the residual dependence remaining after conditioning on them. For standard Fama–French benchmarks, raw returns display near-unit cross-sectional dependence. The market factor is nearly universally pervasive, and progressively richer specifications reduce (but do not eliminate) residual co-movement, with estimate declining from 0.923 under the CAPM to 0.862 under five-factor Fama-French model extended with momentum. Extending the analysis to the 13 factor families of Jensen, Kelly, and Pedersen and the market factor, we find substantial heterogeneity in factor pervasiveness: most families retain broad cross-sectional reach in the full 14-factor specification, while short-term reversal, profit growth, and debt issuance fall below the threshold consistent with strong dependence. Even conditioning on all 14 factors leaves residual dependence at 0.76, suggesting that latent systematic variation, time-varying exposures, or non-linear factor structures remain unaccounted for by current linear models. Rolling-window estimates confirm temporal stability in these patterns alongside sharp spikes in residual dependence during market dislocations, consistent with factor models being particularly incomplete in crisis periods.