

USC Department of Mathematics
PROBABILITY & STATISTICS SEMINAR
JOINT MATH FINANCE SEMINAR

3:30 PM, Friday 4.Sep.09
146 Kaprielian Hall
(Tea beforehand in 116)

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Risk assessment and asset allocation with gross exposure constraints for vast portfolios

Markowitz (1952, 1959) laid down the ground-breaking work on the mean-variance analysis. Under his framework, the theoretical optimal allocation vector can be very different from the estimated one for large portfolios due to the intrinsic difficulty of estimating a vast covariance matrix and return vector. This can result in adverse performance in portfolio selected based on empirical data due to the accumulation of estimation errors. We address this problem by introducing the gross-exposure constrained mean-variance portfolio selection. We show that with gross-exposure constraint the empirically selected optimal portfolios based on estimated covariance matrices have similar performance to the theoretical optimal portfolios and there is no error accumulation effect from estimation of vast covariance matrices. This gives theoretical justification to the empirical results in Jagannathan and Ma (2003). We also show that the no-short-sale portfolio is not diversified enough and can be improved by allowing some short positions. As the constraint on short sales relaxes, the number of selected assets gradually increases and finally reaches the total number of stocks when tracking portfolios or selecting assets. This achieves the optimal sparse portfolio selection, which has close performance to the theoretical optimal one. Among 1000 stocks, for example, we are able to identify all optimal subsets of portfolios of different sizes, their associated allocation vectors, and their estimated risks. The utility of our new approach is illustrated by simulation and empirical studies on the 100 Fama-French industrial portfolios and the 600 stocks randomly selected from Russell 3000. This is joint work with Jinjing Zhang and Ke Yu, Princeton University.