

## Actuarial Teachers and Researchers Conference 2015 – Abstracts

**Invited Speaker:** Prof. Phelim Boyle

**Affiliation:** Wilfrid Laurier University, Canada

**Bio:** Phelim Boyle is a professor of Finance at Wilfrid Laurier University in Canada. Boyle wrote one of the earliest papers applying Monte Carlo methods to finance problems. Together with Michael Brennan and Eduardo Schwartz, he pioneered the application of derivative pricing and hedging in actuarial science. He has published widely in finance and actuarial science journals and won several prizes for his research. Boyle began his actuarial career with Irish Life in Dublin.

**Abstract Title:** Long Only Portfolios and Perron Frobenius

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The intuition that security returns can be explained by a set of common factors is well entrenched in the finance literature. Sharpe assumed that a single factor could explain the systemic component of returns. Ross assumed that returns were generated by a set of common factors. These factors are derived from the covariance matrix where the most important factors are associated with the largest eigenvalues. The single most influential factor corresponds to the largest or dominant eigenvalue. The factor loadings are obtained from the eigenvector associated with the largest eigenvalue. This factor represents the linear combination of securities that explains the largest fraction of the total variance. Typically it is identified as the market factor. Since the first principal component of stock returns corresponds to the market factor it is of interest to know when the resulting portfolio has positive weights. Empirical studies show that portfolios based on the first principal component do not always have positive weights. This paper analyzes how the characteristics of the stock return distribution affect the signs of the weights in the dominant principal component. If all the correlations are positive then this portfolio will also have positive weights. This result follows from the Perron Frobenius theorem. In practice some of the correlations may be negative and in this case the weights on the first principal component may or may not be positive. We investigate this relationship empirically and also derive some analytical results.

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