Introduction:

Since the rise of Modern Portfolio Theory, or mean-variance investing, began in 1952 by Harry Markowitz, the relationships between and within asset classes (i.e., stocks, bonds, commodities, etc.) has been a fundamental building block of many portfolios. These relationships have been traditionally measured using Pearson’s correlation, a non-directional, symmetric, and temporal metric which stores useful information but is both unstable as economic conditions change and subject to noise. The aim of this paper is to investigate the use of a novel metric, transfer entropy, in order to help define and model these financial relationships with asset allocation applications in mind.

Transfer entropy differs from correlation in two main ways: it is both directional and conditional. More specifically, the transfer entropy from security X to security Y is not equal to the transfer entropy from security Y to security X. Moreover, whereas correlation represents how two series, X and Y, vary together above or below their respective sample averages, transfer entropy captures how the past values of series Y affect the future values of series X, accounting for the information already in X’s past with no care to sample averages. Past studies have used transfer entropy to model financial networks and investigate leading relationships but have not outlined any methodology for applying this metric towards portfolio engineering (Sandoval, 2014).