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Assessing Portfolio Diversification via Two-Sample Graph Kernel Inference.

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In this work we seek to enhance the frameworks practitioners in asset management and wealth management may adopt to assess how different screening rules may influence the diversification benefits of portfolios. The problem arises naturally in the area of Environmental, Social, and Governance (ESG) based investing practices as practitioners need to select subsets of the total available assets using screening rules of ESG ratings and to compare the subsequent risk and return profile of the portfolios created from different selective portfolios. We propose a novel method to compare the diversification relationships of assets in different portfolios based on a machine learning hypothesis testing framework called the kernel two-sample test. The objective of the test is to determine whether two samples come from the same underlying probability distribution. In the case of asset management, the samples are sequences of graph-valued data points that represent a dynamic portfolio obtained by a certain ESG screening rule and certain portfolio optimization criteria such as the global minimum variance or max Sharpe. The fact that the sample data points are graphs means that one needs graph testing frameworks to compare diversification benefits. The problem is natural for kernel two-sample testing as one can use so-called graph kernels to work with samples of graphs. The objective is then to determine if the two dynamic portfolios have the same generating mechanism. A failure to reject the null hypothesis would indicate that ESG screening does not affect diversification while rejection would indicate that ESG screening does have an effect. The article describes the graph kernel two-sample testing framework, further, it provides a brief overview of different graph kernels. We then demonstrate the power of the graph two-sample testing framework under different realistic scenarios. We finally apply the framework to demonstrate the workflow one can use in asset management to test for structural differences in diversification of portfolios under different ESG screening rules.

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