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K-MEANS AND AGGLOMERATIVE HIERARCHICAL CLUSTERING ANALYSIS OF ESG SCORES, YEARLY VARIATIONS, AND STOCK RETURNS: INSIGHTS FROM THE ENERGY SECTOR IN EUROPE AND THE UNITED STATES

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Abstract

This study employs k-means clustering and agglomerative hierarchical clustering techniques to visually examine the potential relationship between Environmental Social and Governance (ESG) scores, their year-over-year variations, and annual stock returns for a sample of 34 energy sector companies operating in Europe and the United States. While the agglomerative hierarchical clustering dendrogram suggests two clusters, the elbow method of the k-means algorithm suggests 2-4 clusters. The results indicate that neither ESG scores nor their year-on-year variations had an impact on the annual returns of the stocks. The conclusion is further confirmed by the Pearson correlation coefficient. However, the ESG scores of European energy companies show a tighter dispersion and smaller year-over-year change, making them more predictable ESG score-wise and thus, potentially, more attractive to ESG-driven investors.

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