

Pricing and Replication of European Rainbow Maximum Options using Empirical Data for the United States

Tom W. Miller*

Department of Economics, Finance, and Quantitative Analysis

Michael J. Coles College of Business

Kennesaw State University, Georgia, USA

Abstract: This paper prices and statically replicates a European rainbow maximum option on U.S. equities, Treasury bonds, real estate, and gold. Asset return and volatility parameters are calibrated using data from Kenneth French's Data Library and Damodaran's historical datasets. Under correlated geometric Brownian motion dynamics, Monte Carlo valuation yields a price of \$125.14. An exact telescoping decomposition expressing the rainbow payoff as the underlying asset plus sequential exchange options is derived, enabling exact static replication. The replication portfolio matches the direct valuation within Monte Carlo error and is verified path-by-path across 1,000,000 simulated outcomes.

Keywords: Rainbow Options; Exchange Options; Monte Carlo Simulation; Risk-Neutral Valuation; Telescoping Decomposition

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* Corresponding author. Email: tmiller@kennesaw.edu