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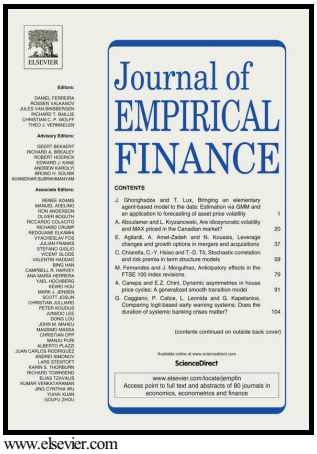

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Displaced Relative Changes in Historical Simulation: Application to Risk Measures of Interest Rates with Phases of Negative Rates

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Abstract

In this paper we introduce the displaced historical simulation model which is designed to handle negative and close-to-zero risk factors. This is an issue of recent and major interest to the financial sector, both from a regulatory and financial institutions perspective, especially in light of observed negative values for major bond yield and interest rate spread time series. In historical simulation a common approach is to consider log returns (that is, relative changes), given that the risk factors remain positive. If a risk factor allows for negative values, log returns cannot be applied and one either ignores such scenarios or switches to considering absolute changes. The latter approach implies an abrupt model change. Our displaced historical simulation model strongly improves the historical simulation by "displacing" the shifts such that negative values can be handled, smoothly moving to the limit case of using absolute shifts instead of relative shifts of the original data. Our empirical results show that compared to other models presented in the literature, models equipped with our proposed displacement feature handle situations of close-to-zero or negative risk variables particularly well.

JEL Classifications: C53, G17, G20

Keywords: Risk Management, Historical Simulation, Displacement Model, Negative Risk Factors, Value-at-Risk