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Scale invariance in heavy tails of the S&P 500 stock index using the fractional Laskin model

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In this work, we study the time scale invariance for the heavy tails of the minute log returns time series of the S&P 500 stock index for three different time periods (January 2011 – October 2015, November 2015 – December 2019, January 2020 – October 2023), considering minute, hour, and day time series for each case. Using the symmetric fractional Laskin model, which describes the dissipative effects of the financial market through a shot noise type stochastic dissipative force that is similar for positive and negative log returns, we calculate the fitting parameters of the heavy tails for each of the considered time periods and for each of the studied time scales. We contrast these fitting parameters with the power law exponents calculated for the high log returns time series (data above a certain threshold), for both positive and negative log returns, showing the existence of asymmetry for each of the cases. The asymmetries found in the heavy tails are consistent with those observed through the Lévy distribution fitting parameters of the low and medium time series log returns.

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