

DAY 7 VERDICT : STYLIZED FACTS VALIDATION

The simulated market successfully reproduces the two key empirical stylized facts examined in this study.

First, **volatility clustering is clearly observed**. The time-series plot of log returns shows extended periods of low volatility followed by bursts of large price movements, indicating that volatility is not randomly distributed over time. This observation is reinforced by the autocorrelation function (ACF) of absolute returns, which exhibits strong positive autocorrelation at short lags and a slow decay across higher lags. This confirms that while raw returns themselves are weakly correlated, volatility remains persistent over time, consistent with real financial markets.

Second, the **return distribution exhibits fat-tailed (leptokurtic) behaviour**. The empirical return histogram displays a sharper central peak and significantly heavier tails compared to a Gaussian distribution with the same mean and variance. Extreme return values occur more frequently than predicted by the normal distribution. The empirical kurtosis is greater than 3, quantitatively confirming the presence of heavy tails and elevated tail risk.

Overall, these results demonstrate that realistic macro-level statistical properties emerge naturally from micro-level agent interactions in the simulator. The presence of volatility clustering and fat tails establishes the **statistical legitimacy** of the simulated market, indicating that it captures essential dynamics observed in real-world financial markets.

