

# Factor Modeling for Volatility

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**Abstract:** Under a high-frequency and high-dimensional setup, we establish a framework to estimate the factor structure in idiosyncratic volatility, and more importantly, stock volatility. We provide explicit conditions for the consistency of conducting principal component analysis on realized volatilities in identifying the factor structure in volatility. Empirically, we confirm the factor structure in idiosyncratic volatilities of S&P 500 Index constituents. Furthermore, with strong empirical evidence, we propose a simplified single factor model for stock volatility, where volatility is represented by a common volatility factor and a multiplicative lognormal idiosyncratic component. We further utilize the simplified single factor model for volatility forecasting and show that our proposed approach outperforms various benchmark methods.