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Price dynamics in a Markovian limit order market

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We propose and study a simple stochastic model for the dynamics of a limit order book, in which arrivals of market order, limit orders and order cancellations are described in terms of a Markovian queueing system. Through its analytical tractability, the model allows to obtain analytical expressions for various quantities of interest such as the distribution of the duration between price changes, the distribution and autocorrelation of price changes, and the probability of an upward move in the price, {\it conditional} on the state of the order book. We study the diffusion limit of the price process and express the volatility of price changes in terms of parameters describing the arrival rates of buy and sell orders and cancelations. These analytical results provide some insight into the relation between order flow and price dynamics in order-driven markets.

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