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General model for limit order book and market orders

We introduce a general model for the structure and the dynamic of the limit order book in continuous time which includes the properties of depth, tightness and resilience. Our starting point is using random processes with value in the space of continuous functions to model the cost of transactions instead of modeling the behaviour of the asset price. The portfolio value takes into account the opposing forces between market orders, which deplete the limit order book, and the arrival of new limit orders. We prove that the existence of some equivalent probability measure is sufficient to rule out arbitrage and that the converse cannot hold in general. This result generalizes similar non-arbitrage theorems found in the literature on limit order book as well as the sufficiency part of the first fundamental of asset pricing.