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Scaling and criticality in a stochastic multi-agent model of a financial market

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Abstract

Financial prices have been found to exhibit some universal characteristics^{[1](#)[2](#)[3](#)[4](#)[5](#)[6](#)} that resemble the scaling laws characterizing physical systems in which large numbers of units interact. This raises the question of whether scaling in finance emerges in a similar way – from the interactions of a large ensemble of market participants. However, such an explanation is in contradiction to the prevalent ‘efficient market hypothesis’^{[7](#)} in economics, which assumes that the movements of financial prices are an immediate and unbiased reflection of incoming news about future earning prospects. Within this hypothesis, scaling in price changes would simply reflect similar scaling in the ‘input’ signals that influence them. Here we describe a multi-agent model of financial markets which supports the idea that scaling arises from mutual interactions of participants. Although the ‘news arrival process’ in our model lacks both power-law scaling and any temporal dependence in volatility, we find that it generates such behaviour as a result of interactions between agents.

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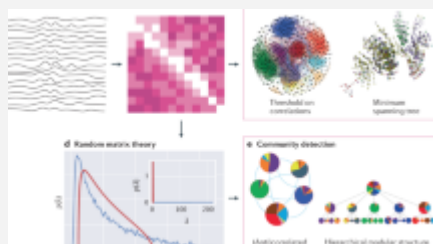
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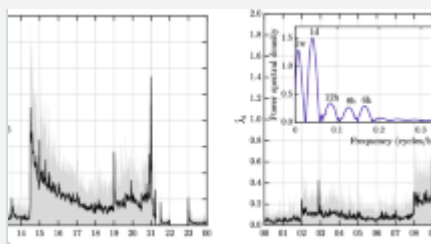
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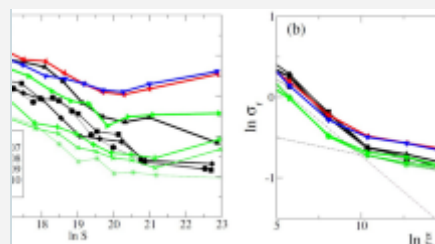
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