Critical price impact and the intrinsic fragility of financial markets

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How does the very fact of buying (or selling) an asset modify its price? This is a fundamental question, not only to understand how financial markets operate and whether they are stable, but also to shed light on the still active debate on market "efficiency" (as highlighted by the split 2013 Nobel Prize in Economics).

One can measure, as for a physical system, the "response" of the price to a small perturbation, for example a buy of total volume Q. The surprise is that the average impact of such a transaction is not linear in Q (as one would naively guess) but behave as the square-root of Q. This implies a formal divergence of the linear response, as for a critical system. Interestingly, the square-root behaviour is universal, i.e. independent of the market, the epoch and the trading style.

We will present a consistent theory for such an effect, confirmed by numerical simulations and further experimental observations, in particular on the Bitcoin market. Our scenario suggests that markets are intrinsically fragile and turbulent.