

Modelling Fluctuations in Financial Markets: Scaling, Multi-Scaling and Their Possible Origins

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Abstract: This paper provides a selective review of research on the statistical properties of financial data with an emphasis on those features that have also been the focus of recent analyses of financial data by physicists. We highlight that many of the observations known as ‘stylised facts’ (economics terminology) of financial markets can be interpreted as ‘scaling laws’ in the sense of statistical physics. Although the latter term has been virtually unknown in the pertinent literature until recently, some ubiquitous statistical findings like the ‘fat tails’ of the distribution of returns and the phenomenon of volatility clustering can, in fact, be cast into the framework of scaling theory. Reviewing work on these empirical characteristics by both economists and physicists, we compare their respective methodology and results. Although we find that, in the end, many of the results obtained by both groups are in good *qualitative* agreement, comparison of the outcome of different test procedures also suggests that one should be cautious in attaching too much credibility on numerical parameter estimates. We also discuss the implications of scaling in finance for the theoretical modelling of the price formation process. On the one hand, the empirical scaling laws are reconcilable with traditional models of financial markets: since, in principle, we could trace back scaling of prices and returns to similar behaviour of the flow of new information, the empirical findings do not serve as evidence against perfectly efficient and unbiased information processing (the Efficient Market Hypothesis). On the other hand, the experience that scaling laws could often be explained by the working of systems of many interacting units in statistical physics suggests a different approach: from this perspective, some of the salient features of the data might be explained by the interactions of a large ensemble of heterogeneous market participants (the Interacting Agent view). Some recent models provide first steps into this direction.