

# How Volatilities Nonlocal in Time Control the Price Dynamics in Complex Financial Systems

*Bo Zheng, Zhejiang University*

We briefly review our progress in financial dynamics, and then focus on the recent results on the volatility-return correlation. What is the dominating mechanism of the price dynamics in financial systems is of great interest to scientists. The problem whether and how volatilities affect the price movement draws much attention. Although many efforts have been made, it remains challenging. The usual volatility-return correlation function, which is local in time, typically fluctuates around zero. Here we construct dynamic observables nonlocal in time to explore the volatility-return correlation, based on the empirical data of hundreds of individual stocks and 25 stock market indices in different countries. Strikingly, the correlation is discovered to be non-zero, with an amplitude of a few percent and a duration of over two weeks. This result provides compelling evidence that past volatilities nonlocal in time affect future returns. Further, we introduce an agent-based model with a novel mechanism, that is, the asymmetric trading preference in volatile and stable markets, to understand the microscopic origin of the volatility-return correlation nonlocal in time.

Keywords: statistical physics, econophysics, complex systems

## References

1. J.J. Chen, B. Zheng and L. Tan, Agent-based model with multi-level herding in complex financial dynamics, *Sci. Rep.* 5 (2015) 8399.
2. L. Tan, B. Zheng, J.J. Chen and X.F. Jiang, How volatilities nonlocal in time control the price movement in complex financial systems, *Plos One* 10 (2015) e0118399.
3. F.Y. Ouyang, B. Zheng and X.F. Jiang, Intrinsic multi-scale dynamic behaviors of complex financial systems, *Plos One* (2015).
4. X.F. Jiang, T.T. Chen and B. Zheng, Structure of local interaction in complex financial systems, *Sci. Rep.* 4 (2014) 5321.
5. J.J. Chen, B. Zheng and L. Tan, Agent-based model with asymmetric trading and herding in complex financial dynamics, *PloS One* 8 (2013) e79531.
6. X.F. Jiang and B. Zheng, Anti-correlations and subsectors in financial systems, *EPL* 97 (2012) 48006.