An agent-based model of heterogeneity and feedback in speculative markets

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APFA 2003, Warsaw.

Abstract

There is a growing body of research on agent-based models of financial markets that explores the relation between behavior of market participants and statistical properties of aggregate markets variables such as prices and trading volume. We first consider some methodological issues related to this approach: comparison with stylized empirical facts, the distinction between generic and non-generic properties, the role of numerical simulations and the relation to the literature on "market microstructure". We argue that two main ingredients in agent-based models (and in real speculative markets) which lead to realistic behavior of prices and trading volume are:

- *heterogeneity* of anticipations: given the same source of information, different market participants do not arrive at the same anticipations about an asset's value and volatility.

- *feedback*: the individual demand of an investor for an asset is not only a function of the current price of the asset, as in microeconomic equilibrium theory, but mainly depends on the recent *history* of the market prices.

We then propose an agent-based model described in terms of a few parameters which contains these two ingredients and show that the joint effect of feedback and heterogeneity lead to a market price which fluctuates endlessly and a volatility which displays a mean-reverting behavior: the volatility goes neither to zero nor to infinity in the long run. In our model trading volume is endogenous and can be related to recent price behavior. Price histories generated from the model are then compared to empirical data in terms of stylized statistical properties. Varying model parameters enables us to distinguish generic properties from those which are not.

Keywords: market microstructure, feedback, financial markets, agent-based models, heterogeneity, numerical simulation, trading volume.