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Abstract

We propose an agent-based framework, based on simple piecewise linear time-invariant continuous-time dynamical systems models, as a means for describing efficient financial markets. We show by examples that many of the common agent-specific trading strategies occurring in the academic literature, including chartists and fundamentalists of various kinds, can be described in the proposed framework. We present definitions for weak and strong market efficiency and provide necessary and sufficient conditions for them to hold. We present minimal examples of strongly and weakly efficient markets to show that these concepts are natural and easy to satisfy in agent-based models, and that the models can reproduce both statistical and behavioral stylized facts of real markets. We provide examples to demonstrate that the framework can be extended for agents with delays in information processing, as well as for agents with time-varying strategies and for nonlinear market impact functions. We also provide a counterexample to show that the proposed market efficiency concepts may require modification in generalizations for nonlinear trading strategies.

Keywords: minimal agent-based models, linear dynamical system, Efficient Market Hypothesis, Adaptive Market Hypothesis, feedback

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