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Evolution, efficiency and noise traders in a one-sided auction market ☆

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Abstract

Natural selection is used to examine a one-sided buyer auction market. With each trader's behavior preprogrammed with its own inherent and fixed probabilities of overpredicting, predicting correctly and underpredicting the fundamental value of the asset, informational efficiency occurs. If each buyer's initial wealth is sufficiently small relative to the market supply and if the variation in the asset's random shock is sufficiently small, then as time gets sufficiently large, the proportion of time, that the asset price is arbitrarily close to the fundamental value, converges to one with probability one. This is established under a weak restriction regarding traders' behavior. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Traditionally, in the literature, the derivation of an informationally efficient market has tended to rely on the presence of traders' rational expectations, strategic

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usage of market information or adaptive learning behavior where noise traders gradually become informed traders. However, due to individuals' limited ability to process and manage complex information, the assumption of rationality is challenged. This further calls into question the achievement of market efficiency. On the other hand, there is Friedman's (1953) well-known conjecture that, because noise traders will sooner or later lose money to the informed traders, the informed traders will come to dominate the market and drive the asset price toward the fundamental value. An intuitively appealing aspect of Friedman's conjecture is the idea of natural selection among traders.

The idea of abandoning rationality on the part of traders is consistent with a growing literature in behavioral economics and finance. The behavioral approach focuses on the behavior patterns drawn from psychological theory (e.g., Kahneman et al., 1982). Often judgmental decisions are based on cognitive rules of thumb used to simplify the decision-making process. Using such rules to assess uncertain events and make predictions, often leads to systematic errors or biases. In the context of a one-sided auction, such systematic errors take the form of consistent patterns of predicting biases, which are captured by the probabilities of overpredicting and underpredicting the asset value; these predicting probabilities become the key to modeling traders' behavior. In this paper it is assumed that traders are rather unsophisticated and each trader consistently overpredicts or underpredicts with some fixed probabilities. In an evolutionary sense, each trader is genetically preprogrammed with its own inherent and fixed probabilities of overpredicting, underpredicting and predicting correctly the asset value. Since a trader has a positive probability of overpredicting or underpredicting the asset value, the trader has a positive probability of acting upon noise as if it were information. Therefore, in this sense, traders are called noise traders in this paper.

Within the context of a double-sided auction, Luo (1998, 2001) shows that with no requirement of traders' rationality such as rational expectations and adaptive learning, natural selection among traders through redistribution of wealth is sufficient to cause the convergence to an informationally efficient market. It is noteworthy, however, that in the context of a double-sided auction, the allowance for short sales implies that the supply of the asset is virtually elastic. While the majority of financial markets adopts a double-sided auction market, there is a significant number of markets which are essentially one-sided auction markets with a perfectly inelastic supply. A key distinction between a one-sided and a double-sided auction market is that traders in a double-sided auction market are allowed to short sell. In a one-sided auction market, short sales are not possible because of the lack of a secondary market. The absence of secondary markets often occurs in the sale of short-term commercial paper, municipal notes, non-negotiable certificates of deposit and private placements and sometimes occurs in markets for bonds (e.g., Japanese corporate bonds).[1] Other examples of one-sided auctions include the leasing of mineral rights, the leasing of oil drilling permits and the leasing of timber

[1] Sometimes, secondary markets do exist for commercial paper and private placements. But usually the transaction costs of setting up these markets have proven to be prohibitive.

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