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Follies subdued: Informational efficiency under adaptive expectations and confirmatory bias☆

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ABSTRACT

We study the informational efficiency of a market with a single traded asset. The price initially differs from the fundamental value, about which the agents have noisy private information (which is, on average, correct). A fraction of traders revise their price expectations in each period. The price at which the asset is traded is public information. The agents' expectations have an adaptive component and a social-interactions component with confirmatory bias. We show that, taken separately, each of the deviations from rationality worsens the informational efficiency of the market. However, when the two biases are combined, the degree of informational inefficiency of the market (measured as the deviation of the long-run market price from the fundamental value of the asset) can be non-monotonic both in the weight of the adaptive component and in the degree of confirmatory bias. For some ranges of parameters, two biases tend to mitigate each other's effect, thus increasing informational efficiency.

1. Introduction

> "Investing in speculative assets is a social activity. Investors spend a substantial part of their leisure time discussing investments, reading about investments, or gossiping about others' successes or failures in investing. It is thus plausible that investors' behavior (and hence prices of speculative assets) would be influenced by social movements"
> Shiller (1984)

In most economic interactions, individuals possess only partial information about the value of exchanged objects. For instance, when a firm "goes public", i.e. launches an initial public offering of its shares, none of the participants in financial market has complete information concerning the future value of the profit stream that the firm would generate. The fundamental question, going back to Hayek (1945), is then: To which extent the market can serve as the aggregator of this dispersed information? In other words, when is the financial market informationally efficient, meaning that the market price converges over time to the value that would obtain if all market participants had full information about the fundamental value of the asset exchanged?

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Most studies that address this question build on the assumption that individual market participants are fully rational. Under full rationality, the seminal results on the informational efficiency of centralized markets were established by Grossman (1976), Wilson (1977) and Milgrom (1981), whereas for decentralized markets they have been proved by Wolinsky (1990), Blouin and Serrano (2001) and Duffie and Manso (2007).

However, research in experimental economics and behavioral finance indicates that traders do not behave in the way consistent with the full-rationality assumption. For instance, Rabin and Schrag (1999) discuss the evidence that individuals suffer from the so-called confirmatory (or confirmation) bias: they tend to discard the new information that substantially differs from their priors. One model that captures this kind of deviation from full rationality is proposed by Brock and Durlauf (2001). They introduce a setup in which individual utility exhibits social interaction effects: the individuals desire to conform to the behavior of the social groups to which they belong. One requirement of this approach is that each agent observes the behavior of a large number of other individuals. As noted by Shiller (1984), individuals actually update their prior information in (mainly bilateral) discussions with others. Therefore conforming to some average 'social' behavior, or information, is unlikely to occur in an environment consisting of bilateral interactions.

Along a different dimension, Haruvy et al. (2007) find that traders' expectations are adaptive, i.e. they give more importance to the past realized price of the asset than the fully-rational agent would. This constitutes a deviation from full rationality because (under full rationality) past prices cannot serve as predictors of future prices.

Understanding whether (and under which conditions) the financial markets are informationally efficient when agents do not behave fully rationally remains an open question. From the policy perspective, it is important to understand if asset prices bubbles derive from incomplete information (and therefore increasing information flows would solve the problem) or from the irrationality of agents (in which case a different policy approach should be designed).

In this paper, we study the informational efficiency of a market with a single traded asset, in which agents can have both aforementioned forms of deviation from full rationality. The price, which is public information, initially differs from the fundamental value, about which the agents have noisy private information (on average, correct). A fraction of traders revise their price expectations in each period giving some weight to the past prices and also exchanging opinions about future prices in a social interaction with another agent. Integrating new information from social interaction is subject to a certain degree of confirmatory bias.

We show that, taken separately, each of the deviations from rationality worsens the information efficiency of the market. However, when the two biases are combined, the degree of informational inefficiency of the market (measured as the deviation of the long-run market price from the fundamental value of the asset) can be non-monotonic both in the weight of the adaptive component and in the degree of confirmatory bias. In other words for some range of parameters, the two biases tend to mitigate each other's effect, thus increasing informational efficiency.

The paper is structured as follows: Section 2 presents the setup of the model. Section 3 derives analytical results for each bias taken separately. In Section 4, we present the simulation results when two biases are combined. Finally, Section 5 discusses the implications of our results and suggests some future avenues for research.

2. The model

Consider a market with N participants, each endowed with an initial level of liquidity $L_0 > 0$. Time is discrete (e.g. to mimic the daily opening and closure of a financial market), denoted with $t = 0, 1, \ldots$ Market participants trade a single asset, whose price in period t is denoted with P_t. This price is public information. Prices are normalized in such a way that they belong to the interval [0, 1].

At the beginning of each period t, every agent i can place an order to buy or short sell 1 unit of the asset, on the basis of her expectation about the price for period t, denoted with $P_t^{e,i}$. Placing an order implies a fixed (small but positive) *transaction cost* c, i.e. $0 < c \ll 1$. At the end of the period, each agent i learns the price P_t at which the trade is settled (as explained below).

The agent i then constructs her price expectation for the next period and decides to participate in the trading in period $t+1$ according to the *expected next-period gain*, i.e. if

$$|P_{t+1}^{e,i} - P_t| - c > 0. \tag{1}$$

Moreover, she participates as a *buyer* if her price expectation for the next period exceeds the current price, i.e.

$$P_{t+1}^{e,i} > P_t, \tag{2}$$

or as a *seller* if, on the contrary,

$$P_{t+1}^{e,i} < P_t. \tag{3}$$

The way in which agents form their next-period price expectations differs from the standard rational-expectation benchmark in the following way. First deviation is the fact that agents give positive weight to the past public prices, i.e. they have (partially) adaptive expectations. Secondly, they can influence each other's expectations via social interactions with confirmatory bias.

Formally, in every period a fraction, $\gamma \in (0, 1]$, of the agents makes a revision of their price expectations. An agent revises her price expectation by analyzing the past price of the asset and by randomly encountering some other agent (at zero cost), and possibly sharing her own price expectation with this partner. In these encounters, the agents have a *confirmatory bias*,