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Price distortions under coarse reasoning with frequent trade ☆

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Abstract

We study the effect of frequent trading opportunities and categorization on pricing of a risky asset. Frequent opportunities to trade can lead to large distortions in prices if some agents forecast future prices using a simplified model of the world that fails to distinguish between some states. In the limit as the period length vanishes, these distortions take a particular form: the price must be the same in any two states that a positive mass of agents categorize together. Price distortions therefore tend to be large when different agents categorize states in different ways, even if each individual's categorization is not very coarse.

JEL classification: D53; D84

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1. Introduction

Forecasting prices in financial markets is notoriously difficult. Prices depend on so many factors that it is seemingly impossible to identify all of them or to perfectly assess the influence of each one. Agents therefore must use simplified theories of the world to predict prices—theories that are likely to feature some disagreement about what the relevant factors are. How does the use of simplified theories affect the ability of the market to efficiently aggregate information? We present a model to show that, if agents' theories are sufficiently precise, prices tend to be close to rational expectations prices when opportunities to trade are infrequent. However, if the time between trades is small, heterogeneity in agents' theories leads to large distortions even when every individual agent uses a precise (but imperfect) theory.

We study pricing of a single risky asset that is traded at discrete times. The asset pays a flow dividend that depends on the current state, which is publicly observed and evolves according to a Markov process. In choosing prices, agents consider both the current dividend and the resale price in the next period. A key assumption of our model is that, when forming price forecasts, some agents employ a simplified model of the world in which they fail to distinguish among some states. These agents group states into categories and form forecasts in each state that are correct on average for the category containing that state.

We show that whenever two states are categorized together by a positive mass of agents, the price in those two states becomes identical in the limit as the time between trading periods vanishes. This result implies that prices are identical whenever two states are connected by a chain of states along which adjacent states are categorized together (possibly by different agents); prices may be identical even across states with different fundamentals that *no* agent groups together. Thus distortions tend to be large when categorization is heterogeneous. Moreover, if agents' demands take a particular simple form, limiting prices admit a characterization as rational expectations prices associated with a coarsened process—one in which each state corresponds to a set of states in the true process, and dividends and transition probabilities are convex combinations of those in the true process.

Convergence of prices across large sets of states generates a particular pattern of price behavior over time exhibiting sudden large adjustments. Much of the time, prices do not respond to new information, but occasionally there is an overreaction to small changes in fundamentals. These relatively large price jumps occur when the state transitions between two sets of states with differing prices. The net effect on price volatility is ambiguous.

Coarse prices arise from a combination of two effects. First, despite using different theories, agents' expectations of the asset value become identical in each state as the period length vanishes. Second, each agent's expectation becomes constant on each of her own categories. Together, these two effects imply that all agents' expectations are constant on sets of states that are larger than each individual's categories. More precisely, expectations are constant on each element of the finest common coarsening of all agents' categorizations.

Both effects arise when the period length becomes short. In the limit, the per-period dividend becomes negligible and the perceived value of the asset to each agent is based entirely on her forecast of the resale price. This gives rise to the second effect since price forecasts are constant on individual categories.