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Market selection and survival of investment strategies

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Abstract

The paper analyzes the process of market selection of investment strategies in an incomplete market of short-lived assets. In the model under study, asset payoffs depend on exogenous random factors. Market participants use dynamic investment strategies taking account of the available information about current and previous events. It is shown that an investor allocating wealth across the assets according to their conditional expected payoffs eventually accumulates total market wealth, provided the investor's strategy is asymptotically distinct from the portfolio rule suggested by the Capital Asset Pricing Model (CAPM). This assumption turns out to be essentially necessary for the result.
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1. Introduction

It has long been argued that, in competitive environments, market pressures would eventually select those traders who are better adapted to the prevailing conditions. According to

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the standard paradigm of economic theory, agents maximize preferences or utilities. From the evolutionary point of view, what matters is not the utility level, but the chances of survival. The evolutionary principle leads to the consideration of the process of economic natural selection among the market participants, or among the strategies of behavior they adopt. This view has been put forward by Alchian (1950), Enke (1951), Penrose (1952) and pursued by many others.

The purpose of the paper is to elaborate on an evolutionary approach to the study of investment strategies in financial markets. This work combines ideas from economic theory and finance. We examine the process of market selection in the framework of incomplete markets with traders using dynamic investment strategies. In the model under study, it is supposed that each trader follows a portfolio rule specifying the allocation of wealth across the available assets at any moment of time and for any history of events. We retain the key feature of economic equilibrium models where a market-clearing mechanism determines prices endogenously in every period. However, we depart from individual utility maximization. Instead, we assume that trading strategies are compared with each other in terms of their abilities to survive under market selection, rather than in the conventional terms of discounted values.

We consider a market with short-lived assets that live only one time period but are identically reborn every next period. The assets are in positive supply, and their payoffs depend on the realization of exogenous states of the world described in terms of a homogeneous finite-state Markov chain. Short sales are ruled out. The focus is on the long-run dynamics of the distribution of wealth across the investors. Following Epstein and Zin (1989, 1991) the model prescribes reinvestment of total wealth and thus precludes consumption. This assumption, in particular, avoids the trade-off between the rate of consumption and the evolutionary fitness of the trading rule in a market.

In the case where only a complete set of Arrow securities is traded, the states of the world are independent and identically distributed, and all the traders use only *simple* portfolio rules (independent of time and observations), our framework reduces to the model considered by Blume and Easley (1992, Section 3). They have demonstrated the remarkable role of the portfolio rule prescribing the investor to distribute wealth between the assets according to the probability of the state in which the asset pays out—this portfolio rule is often referred to as "betting one's beliefs." Blume and Easley (1992) show that if a trader uses this rule, whereas all the others use different (simple) portfolio rules, then the trader will eventually accumulate total market wealth. In other words, the investor will be a *single survivor* in the market selection process.

Apparently, the first who stated the principle underlying the rule of "betting one's beliefs" was Kelly (1956). He showed (in a different context) that this principle leads to the maximization of the expected logarithm of the portfolio growth rate. This idea gave rise to a large body of research—see, e.g., Breiman (1961), Thorp (1971), Algoet and Cover (1988), Hakansson and Ziemba (1995). A common feature of these papers is that they study single-agent problems with exogenous prices. Blume and Easley (1992) considered an equilibrium model with prices determined endogenously. Nonetheless, due to the completeness of the market (and the special structure of Arrow securities), their result regarding the rule of "betting one's beliefs" can be reduced to the maximization of the expected logarithm of an appropriately defined relative growth rate. The Blume–Easley approach has been extended

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