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Physica A 348 (2005) 496–504
PHYSICA A
www.elsevier.com/locate/physa

Need, greed and noise: competing strategies in a trading model

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Received 17 August 2004
Available online 30 October 2004

Abstract

We study an economic model where agents trade a variety of products by using one of the three competing rules: "need", "greed" and "noise". We find that the optimal strategy for any agent depends on both product composition in the overall market and composition of strategies in the market. In particular, a strategy that does best on pairwise competition may easily do much worse when all are present, leading, in some cases, to a "paper, stone, scissors" circular hierarchy.

PACS: 89.65.Ef; 89.65.Gh; 89.75.−k

Keywords: Agent-based models; Economic models; Strategic games

1. Introduction

Human activity often takes the form of exchanges. These exchanges typically consist of goods that can be quantified by value, but opinions or other types of

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0378-4371/$ - see front matter
doi:10.1016/j.physa.2004.09.046

information may also be traded. The former define a market economy. There have been several proposals to model such markets, for example, see the review by Farmer [1]. Most of the proposed models aim at reproducing the fat tails and volatility clustering in a stock or currency market [2–6]. Earlier we have proposed a market model (''Fat Cat'' model) where agents trade products according to individual price estimates. These estimates were dynamically adjusted as a function of the trading encounters of each agent [7]. The model mentioned above is one of the many similar models that could be considered for such a market, each model being distinguished by a strategy that defines which product a buyer should select from a seller and how he should price it later. In the present paper, we study the interplay of a few strategies. The relative performance of these strategies is quantified by the wealth of agents employing them.

We organized the paper first by reviewing the ''Fat Cat'' model in Section 2. The extension of this model to the case of other strategies is described in Section 3. Then, in Section 4 we discuss how the model could be extended to cases where agents are able to change their strategies according to their performance and give our concluding remarks.

2. Rules of the game

We picture our model as a cartoon of the trading situations found in a real market. As shown in Fig. 1, this minimalistic model consists of a system where agents trade a set of N_{pr} different products. Each agent i is assigned one of the three possible strategies selected to be either based on profit (i.e., ''greed'', which is the strategy adopted in the original ''Fat Cat'' model), on the need for a particular product, or on a random selection without regard to the level of profit or need.

Other strategies could be explored, for example, agents could act as ''garbage collectors'', buying whatever product has the lowest possible price. In this paper we limit ourselves to the three, probably most basic, strategies outlined in Fig. 1.

Each of the N_{ag} agents starts with N_{un} units of goods. The goods are randomly selected, for each agent, among the N_{pr} different products. Thereby we form the stock S of each agent that, together with some initial amount of money N_{mon}, define the initial state of the economy. We describe below the dynamics that arises from the interactions among these agents.

During the evolution time of the system, each agent i has, at each time step, an amount of money $M(i), i = 1, \ldots, N_{ag}$, and a stock of the different products $j, S(i,j)$, where $j = 1, \ldots, N_{pr}$. The prices of the different items in the stock of agent i are denoted $P(i,j)$ which initially are taken to be integers uniformly drawn in the interval [1,5]. In all cases, we have verified that the evolution of the system does not depend on this particular choice. Agents then meet and exchange products and adjust prices. Price adjustment is such that not only large differences in pricing between agents are lowered, but also price differences are induced by some noise when they are small, as in real markets.