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Evolving market structure: An ACE model of price dispersion and loyalty☆

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Abstract

We present an agent-based computational economics (ACE) model of the wholesale fish market in Marseille. Two of the stylized facts of that market are high loyalty of buyers to sellers, and persistent price dispersion, although it is every day the same population of sellers and buyers that meets in the same market hall. In our ACE model, sellers decide on quantities to supply, prices to ask, and how to treat loyal customers, while buyers decide which sellers to visit, and which prices to accept. Learning takes place through reinforcement. The model explains both stylized facts price dispersion and high loyalty. In a coevolutionary process, buyers learn to become loyal as sellers learn to offer higher utility to loyal buyers, while these sellers, in turn, learn to offer higher utility to loyal buyers as they happen to realize higher gross revenues from loyal buyers. The model also explains the effect of heterogeneity of the buyers. We analyze how this leads to subtle differences in the shopping patterns of the different types of buyers, and how this is

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related to the behavior of the sellers in the market.

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1. Introduction

We study the working of the wholesale fish market in Marseille (France), and in particular we focus on the following two stylized facts that characterize this market: a widespread high loyalty of buyers to sellers, and persistent price dispersion. Our real interest as economists is not in fish markets per se, and unlike the Scots we would not question the relevance of any story just heard with the standard expression '*but what's it got to do with the price of fish*?'. But casual observations suggest that these stylized facts are common to many other markets,[1] we do believe that some of the insights developed in this study might be carried over to such markets.

More in general, we believe that if we want to understand the dynamics of interactive market processes, and the emergent properties of the evolving market structures and outcomes, it might pay to analyze explicitly how agents interact with each other, how information spreads through the market, and how adjustments in disequilibrium take place. As we argued elsewhere (e.g., Kirman, 1994; Vriend, 1994, 1995, 1996, or Vriend, 1999), a natural way to do this is following an agent-based computational economics (ACE) approach.

Two additional reasons why we were attracted to studying this specific market are, first, that we have a unique data set containing the records for all single transactions that have taken place in this fish market over a number of years. This is a very rich data set, but at the same time it has some severe limitations, as there are, for example, no data concerning market interactions that did not lead to transactions. Second, this wholesale fish market is a relatively simple, well-defined, and well-structured market (cf. the '*market*' for second-hand cars). Moreover, fish is a perishable commodity, implying that the issue of the strategic use of inventories does not arise (cf. the early literature on market microstructures in finance; see, e.g., O'Hara, 1994).

The paper is organized as follows. In Section 2, we will sketch the Marseille fish market, and discuss the two not easily explained stylized facts. In Section 3,

[1] For example, according to Royal Mail (1999) "*more than 25 percent of all people do not consider themselves loyal to any business*", implying that about 75% is loyal to some business.