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Lost in transactions: The case of the Boulogne s/mer fish market

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ABSTRACT

Starting from some regularities of the Boulogne s/mer fish market, the model proposed here shows that in many circumstances the collective behavior may be 'reasonable' whereas the individuals may not be so. The properties which are empirically clear at the aggregate level are not necessarily derived from similar properties at the individual level. Thus, the macroscopic outcomes of the Boulogne s/mer fish market are not directly derived by any of the individual component involved, but are the self-organized outcomes of the agents' interaction. The simple interaction of noisy and myopic agents leads the system to stabilize itself.

1. Introduction

One of the main goal of economics is to understand how the myriad of disparate individual economic activities is coordinated. In order to achieve a coherent behavior, *a representative agent framework* is usually adopted in most macro-models. This approach reduces, via reductionism, aggregate entities to concepts and knowledge for the lower-level domain of the individual agent [1]. By doing so, the reductionist paradigm blocks from the outset any understanding of the interplay between the micro and macro levels. As a consequence, the differences between the overall system and its parts remain simply incomprehensible from the viewpoint of this approach, which assumes equilibrium and rules out any coordination problem.

In order to understand how a macro coherent behavior may emerge from 'irregular' individual behavior economists began to allow for the interactions of agents. Since interaction depends on differences in information, motives, knowledge and capabilities, this implies heterogeneity of agents and, as a consequence, for externalities. This globally; thus the organization is achieved in a way that is parallel and distributed (no element acts as a central coordinator). *Self-organization* [2], i.e. a process where a structure appears in a system without a central authority or external element imposing it, replaces the *invisible hand*.

According to this view, a market economy can be analyzed as a self-organizing entity ([3]; F. Hayek's catallaxy describes a 'self-organizing system of voluntary co-operation'.) In many complex systems in nature, there are global phenomena that are the irreducible result of local interactions between components whose individual study would not allow us to see the global properties of the whole combined system. Thus, a growing number of researchers show that many macro properties of the economic system are not directly encoded by any of the single components involved, but are the self-organized outcomes of the interactions of the components. Thus, given the presence of imperfections in the markets organization, economic dynamics is the result of the communication and interaction of a myriad of heterogeneous agents and not the fruit of some invisible hand optimal process. The properties, which are empirically evident at the aggregate level, are not derived from

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Table 1
Statistical facts of the Prices' Distribution.

Negotiated Market
Mean 4.5
Median 2.6
Std.dev 4.7
Kurtosis 1.4
Skewness 1.5

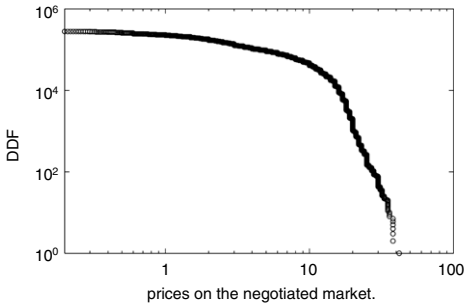

Fig. 1. Decumulative distribution function (DDF) of the transaction prices on the negotiated market.

similar properties at the individual level: the macro or aggregate behavior cannot be simply derived from underlying rational microfoundations.

The Boulogne s/mer fish market constitutes an ideal environment for studying the coordination problem. In fact, 2 sub-markets exist (auction and negotiated), where suppliers and buyers meet, setting quantities and prices in a very decentralized way. Aggregate relationships (such as the ratio of the participants to the 2 markets and the price-quantity relationship) are globally stable, but do not to reflect the behavior of individual agents, which is indeed very heterogeneous and erratic.

Anticipating some conclusions, we might say that:

- The market reaches a satisfying position, that is on average the quantity of unsold fish is less than 2%;
- The system achieves a stable aggregate behavior even if individual behavior is very erratic[1] (similarly to Ref. [7]).
- The stable aggregate relation can be defined as efficient. It does not reflect the behavior of individual agents, whose behavior is indeed very heterogeneous and, sometime, inefficient.
- There is not 'one price', such as the neoclassical equilibrium price, (see Ref. [8]), but still a negative relationship between price and quantities holds true.

The rest of this paper is organized as follows. In the next sections we describe the Boulogne s/mer fish market and its stylized facts; in Section 3 we present the model, the agents' behavior and the results of the simulation. Section 4 concludes.

2. The Boulogne s/mer fish market

The database we exploit concerns eighteen months (from March 2006 to December 2007), which represent half a million daily transactions in Boulogne s/mer fish market. For each transaction, the date and the type of the fish exchanged, the buyers and sellers' identity, the type of trade mechanism (auction or negotiated), the quantity exchanged and the price are known.

200 boats/sellers and 100 buyers are registered. Most of them are present on both sub-markets and trade regularly.

Each day, sellers can decide if they sell all their quantity through one single market (auction or negotiated) or if they share their production (and in which amount) between the two markets. Once they have decided, they can't change their strategy until the next market day. They offer heterogeneous quantities and different product quality.

A first important evidence is that the prices' distribution[2] in the negotiated market[3] is not normally distributed, as kurtosis and skewness indicate (see Table 1).

A simple way to check the shape of the prices' distribution is to show the decumulative distribution function (DDF). Fig. 1 displays the DDF of transaction prices on the negotiated market. The DDF is well fitted by an exponential law.[4]

[1] In financial literature, several artificial markets have been developed to explain the influence of traders' behaviors on the aggregate outcome (see, for instance, Refs. [4–6]. In particular, these models have focused on some mechanisms of behavioral switching and the effect of the coordination of traders' strategies via market mediated interactions (for example when agents follow common chartist trading rules).

[2] The analysis considers the prices of all transactions.

[3] The analysis shows similar results on the auction market.

[4] The Kolmogorov–Smirnov test does not reject the null hypothesis, proving the goodness of fits.