What it takes to make a market in a multi-agent world
Markets and networks

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1 Introduction

In this paper, I will first present the general approach I have on market, which is an intermediate between economics and sociology. Indeed I am interested in the economist approach in that it allows focusing on an analytic point of view, by building a model with abstract agents which communicate as little information as possible apart from the acceptability of transactions. I am however very close to the sociologists' point of view when focusing on the importance of relational ties and the representation of others in the dynamics of exchanges. The model I present in a second section has been built on a field study that was led on a fruits and vegetables wholesale market. Some of the informers also have had to comment on the model, and had an impact on its building.

2 Points of view on market

2.1 Economists' markets

The modelling of market is a very vivid issue for economists. Equilibrium theory approach has been focusing on the description of equilibrium in the cases where preferences of agents are known and information is perfectly spread among buyers and sellers. Perfect information means that one has access to the limit value of all participants (i.e: for sellers the minimum price and for buyers the maximum price not to loose money) and the equilibrium price is then the price that maximises the number of possible exchanges and the global efficiency. From this calculus, classical economists have started to realise that this knowledge, although important, would never help them understand why the equilibrium can be attained in a society where agents lack perfect knowledge of others' preferences (Kirman, 2001a). It was thus necessary to understand how economic subject treat information when they are situation in a world with decentralised information (Hayek, 1945).

One way to get deeper into the learning processes that enable to reach, on the global scale; equilibrium, is to observe the behaviour of subjects in a highly constraint environment. This is what experimental economists have been doing for some years. Of course experimental economics does not deal just with markets, but also public-good issues, strategies in game-theoretic contexts, manifestation of altruism and others. When it comes to market they studied widely different forms of market, where the institution would differ.

A market institution can be defined as the set of rules that defines: who has access to that market and which role participants can have, how the transactions are proposed, how they are accepted, what is the information that circulates freely on the market. For example, in a double-auction in a non-speculative market with single-unit exchange: each participant is either a buyer or a seller; he/she has one unit to sell or buy with a private limit price; each seller or buyer can make an offer by proposing a transaction price, which is written on a common knowledge black board; an offer made by a seller has to be lower than the standing offer (current seller's offer); an offer made by a buyer has to be higher than the standing offer. This is a very much studied institution, where maximum information is given to everyone, which enables a very good convergence to equilibrium in experimental settings.

Another institution (which is used in the model described in this paper) is pair-wise interaction: agents are either buyer or seller and can meet two by two on the market; no information circulates during a market apart from the moment when negotiation takes place between one buyer and one seller and these information are limited to offer, counter-offer, acceptation or rejection; in some cases, the

average price of transaction and/or the quantity of transactions is given at the end of the market. One can see that the quantity of information possessed at each moment by subjects in this second context is much less than in the previous one. This does not mean that the market cannot converge as well to the equilibrium price, but it takes a longer time to escape inefficient situations.
As one can see, in considering economic settings though the look of economists, individuals themselves are summarised by the good they possess and the initial price of this good. Some elements can be added when studying financial markets, like the relation to risk ("risk-friendly" for example), but the relations of the economic subject is still limited to a relation to an abstraction, to income, to goods. When dealing with markets, economists rarely focus on the relations among men. On real market, this element seems however very important.

2.2 Sociologists' market

When dealing with market, sociologists focus strongly on interactions among humans. These analysis help characterise more precisely the set of processes that lead to price formation. It is usual to refer to these studies as the observation of *concrete* markets (Callon, Muniesa, 2004) or *real* markets (Hassoun, 2003). These field studies enable to take into account some situations that are usually summarised by economists as signs of "market imperfection". The recognition of these data in theory is very difficult to integrate and they are often not taken into account. These imperfections can be due to asymmetries among actors that are supposed to be initially homogeneous – in terms of access to information or to market or supply chains. For example, it is common to observe situations of « market power » where some wealthier agents can influence prices without being subjected to the law of offer and demand. As a result, local particularities of the market structure have a very strong influence on global prices and good circulation, and seem to be very legitimate to study (Callon, Muniesa, 2004).

The main result of the analysis of real exchange structure enables to put forward the importance of links among actors: it can have a huge influence on the final value of goods. In Tarrius (Tarrius, 2002) or Geertz (Geertz, 2003), social links give access to products, and hence set the quantity of goods that are available on the market. This has an impact on sellers' possibility to manipulate prices facing clients who are more or less in need. In Hassoun (2003), describing financial markets, the situation is even different, since the « belief » in the value of product is even more important than « objective » data, and the influence of networks of information is even more crucial for price setting (Orléan, Tadjeddine, 1998). In these places, a charismatic individual can change the value of a good, only by being imitated by others for all actions performed. Charisma and reputation themselves have usually been acquired through long term interactions, links that are build and destroyed along the time.
Numerous authors have shown the importance of ties and of their dynamics on the competition of the market. It thus seems interesting to observe these phenomena in the case of a concrete market, well defined physically. In our study of the Marché d'Intérêt National (National Interest Market) in Marseille, we then focused our observations and interviews on the influence of inter-individual links on price arbitrage and conversely the importance of financial and economic exchanges on the continuation of relations and of reputation.

2.3 As balanced approach: Hirschmann's proposal

In a very important book, "Exit, Voice and Loyalty" (1970), Hirschmann demonstrates that two forces exist in the relation between sellers and buyers. One force is the market dynamics, where an unsatisfied individual abandons his supplier to go and transact with one who will better meet its needs. This attitude is referred to as "exit". The other one is the possibility to negotiate and influence the characteristic of the supply, such as the quality and quantity that is provided. This is what he calls "voice".

The exit attitude implies that a free market exists. The big problem with it is that when buyers go away, sellers have no idea why (is it quality, price, or just bad relations) and cannot know how to improve their offer. A minimum of regularity is needed so that the seller can establish an image of what is appreciated or not by the buyers. The voice attitude cannot exist on its own. If there is no free market, then there is no risk for the buyer to exit, and hence the seller does not need to worry about

complains. Also, if too much exit can be observed, the seller has no interest to follow the buyer's request because he has no certitude that he will come at the next time-step.

Hence both voice and exit need to compensate each other, and a slowing dynamics (which he calls loyalty) has to be present so that both attitude can convey some information and incentive through the interaction.

This model is very interesting since, on the market, I witnessed both attitudes from buyers: some who were loyal and complaining, and others who were opportunistic and whose complains were not taken into account (but they had the opportunity to just walk away when dissatisfied). Realizing that the equilibrium between both is absolutely not clear in Hirschman's description, I turned to wondering if the influence of the number of agents having each attitude could have an impact on a market dynamics. The centre of my multi-agent model, as is described in the following section, is about the quantities that are requested by agents.

3 Main data for a model based on observations

The studies in artificial markets try to stress the idea that motivations for economic actions are not necessarily close to the optimising rationality of economic theory and that it can be interesting to study the actual process of choice and learning (Brenner, 1999, 2001), be it to act on the system or because the emergence of global data are really dependent on the individual actions (Janssen and Jager, 2001). Some papers describe settings with an exchange game where it is possible to calculate a rational solution for agents (Brenner, 2002), or quite complex abstract systems with several interacting layers of production and exchange (Sallans et al., 2003). Others try to describe exchanges by taking inspiration in quite directly gathered data (Galtier et al. 2002;. We are closer to this second part of the literature, in that we decided to take the example of the wholesale fruits and vegetables market of Marseille which is one of the central nodes for the supply of Marseille in terms of fresh products. Since the 70's, this market has been seriously professionalized and has been established as a "Marché d'Intérêt national", a National Interest Market (I will refer to it as MIN). We led observations and interviews on that markets, so that to identify the mechanism of price formation by the wholesale sellers and to evaluate the influence of both their suppliers (importers and producers) and their clients (retailers).

The Arnavaux market takes place every morning apart from Sundays, in the suburb of Marseille, from 3:30 until about 9:00. Linked by motorways to the commercial harbour and the airport, it has been established in the 70's to represent a centralised and safe place where wholesale sellers and retailers meet to exchange. It represents a vital node in the circulation of fruits and vegetables in the city, but also in the whole region.

Most buyers that I have interviewed come at least three times a week to get their goods, if not every day[1]. A lot of transactions also take place by telephone and fax, especially when the relation is well stabilised, for example for catering services who think about their buying strategy only once a year. Apart from very few exceptions, all retailers first go and have a look at the producers' offers. Observing the producers' market enables them to see what is available, buy the best quality products (producers are supposed to be more expensive but display better quality - harvested more recently, hence having grown in the fields rather than in trucks or ships), and get an idea of prices. After this, two different behaviours can be observed. Some retailers go and see one wholesale seller, whom they know and trust to give some correct prices. When the favourite wholesale seller does not have all that is needed, the retailer goes and fetch it afterwards in other shops. This loyal attitude can be recognised as the one described by Alan Kirman on the fish market in Marseille (Kirman, 2001b). Another attitude among retailers is to use the advantages of the market, by looking for the best price and thus build the cheapest basket. Some of the retailers clearly have this behaviour, and it is usually associated to a different use of negotiation and pressure put on the wholesale seller. Indeed when the retailer have more information about the "real price" of the market (or pretends to have the information) he can bargain with a much firmer demand. It is however difficult to judge if this bargaining is really useful, since wholesale sellers tend to have very firm pre-conceived ideas of the discount they are ready to

[1] I'll refer to both retailers and wholesale sellers as « he », since a huge majority of retailers are male and not a single wholesale seller is female.

make to a given retailer, and they mainly use the information to eventually change their strategy during the day with the most faithful customers, not the ones they don't care about.

In the model, we stress the importance of relationships between wholesale sellers and retailers, and distinguish between agents who consider cheap products as the main element of exchange and those who care about good relations. The relations are important for retailers for two reasons. First the idea of *continuity* is fundamental for retailers who have to sell the same products all the time during the season. The quality aspect is also taken into account, where the retailers know how well the products will last with one or another wholesale seller, and sometimes base their bargaining on this aspect (Dimitri, 2003). Hence, they have to trust a wholesale seller to provide them with this product (category, quality, origin) so that the final clients are satisfied. The other aspect is the problem of short term credit (or micro-credit), which we are not dealing with here but which has its importance in this context. For wholesale sellers, good relations are obviously important since they are their chance of selling goods. Indeed, they are not the ones who choose, but in some respect, the ones who are chosen. Even if a retailer does not buy goods one day, the fact that he comes in, talks about product or about the day market is much appreciated. It means that he will come back, if everything goes well, and might buy some other day; it also shows a form of respect which is very important to exhibit in this context of male surrounding.

From what my main contact says, there are about 100 to 150 retailers coming on an everyday basis, among which about 50 are "regular". When a retailer is well known, it usually gets the best price products and even some cheaper prices when he takes a bunch of different products.

4 Model, simulations, indicators, results

In this part we describe the model that has been implemented, using SmallTalk with the programming interface VisualWork 7.0. From now on, artificial agents will be referred to will capital letter at start, whereas humans are represented with the common spelling (ie: WholesalSeller for the artificial agent). The model is an evolution of a preceding one and underwent a few changes I will not describe here (Rouchier and Hales, 2003).

4.1 Agents, environment, interactions, organisation

The market is constituted of agents of two kinds: WholeSaleSellers and Retailers. There is also a Centralising agent that gathers the data about the average selling price for each product. The market opens every day, and retailers come and look for a given list of goods. They make choices about the interactions they want, according to their need and the information they can gather. They send their requests to the WholeSaleSellers and get answers from them, after which they can either stay on the market or carry on searching for the goods. At the end of the day, WholeSaleSellers decide which goods they need to purchase again to wait for their buyers the next day.

A day is divided in 3 periods, which is the minimal unit of time for activity. At each moment, retailers can either make requests to WholesaleSellers or gather information, as we can see in figure 1.

WholesaleSellers

A WholesaleSeller is characterised by:

- its normalSupply, which represents its desirable stock: the quantity of each product it wants to have in store: every time it "gets a good", it fills its stock up to this value. The normalSupply evolves in time as will be seen in the list of actions.
- its prices: each time it buys a product, the WholeSaleSeller has to pay a price per unit, that depends on the day of purchase; since different units are bought on different days, each unit can have a different price; when it sells a good, the unit is considered with its own price; however when it is asked for its prices, either by the Centralising agent or by Retailers, it gives the average price for a given good[2];
- a list of regular relations.

He uses these characteristics in its choices:

[2] For example, if a wholesale seller has three units of tomatoes, respectively at 3, 5 and 7 money unit, it has an average price of 5, but sells the units at either 3, 5 or 7.

Dealing with the stock:

- request supply: every day, the WholeSaleSeller makes a request for all the goods for which the quantity he possesses does not reach his normalSupply. The request is fulfilled if the random throw is favorable to the WholeSaleSeller, otherwise he stays with the former quantity;
- a price is given for each good when purchased, all WholeSaleSeller multiply this value by 1.5 to get to their basic price.
- throwing units of goods: a good turns into garbage when it is older than 4 days, getting too old without being sold;

Dealing with requests:

- treats requests at each moment when they arrive, and agrees for the transaction for each product he has in stock, with . The price to be paid is the sum of individual goods, with a 10% discount if the retailer gets more than three goods;
- a regular retailer is better treated in transactions than those who are not: he is served before, is given the cheapest unit of the requested product and gets 10% discount.

WholeSaleSellers see their characteristics evolve:

- the NormalSupply evolves depending on the requests of retailers that could not be fulfilled and on the quantity of thrown units. When a good has been requested 5 times while missing, the WholeSaleSeller increases its normalSupply by 1; when a good has been thrown away, the WholeSaleSeller decreases its normalSupply for this good by 1.
- Regular list evolves with requests by retailers: a retailer who comes and buys on average one product every day for the previous 10 days (20% of his purchases) is considered as regular relations[3].

Retailers

A Retailer is characterised by:

- its attitude: either “selfish” or “loyal”;
- the time it can stay on the market: either it is there for a “long” time or a “short” time;
- the list of goods it must get for the day, which is randomly chosen everyday as 5 goods (one unit each), out of the goods of the market;
- a regular WholesaleSeller;
- a memory of satisfaction levels after an interaction with the WholesaleSeller

A Retailer can:

- gather information about prices and availability, which requires one “period” (sub-time-unit);
- know which WholesaleSeller to go and see;
- make requests;
- treat the answers and then deduce if they can leave the market or go and get more products.

Table 1: Here are the possible actions taken by the agents along the 4 negotiation period and the calculus they perform in-between. L* retailer is short for Loyal, S* for Selfish. In bracket is given the number of wholesale seller the retailer is going to visit at one negotiation period. During a simulation, Retailers go and see WholesaleSeller everyday. On the first moment, only loyal Retailers get into shops, then on the second period only selfish ones get in, and eventually on the third period all Retailers which have not fulfilled their needs do go to shops.

Periods		**1**	**2**	**3**	
Loyal retailer		Buy (1)	Info Gath.	Buy (1)	Evaluates deals and sellers
Selfish retailer		Info Gath.	Buy (1 to 5)	Buy (1 to 5)	Evaluates deals and sellers

The way agents interact and get information depends on their attitude and the time they can spend on the market, and it is a step by step process:

[3] By this we want to represent the expectations of wholesale sellers, who react differently with agents depending on the regularity of relation and on the amount bought.

- ❖ Loyal agents:
  - o At the first period, a loyal agent goes to visit his regular wholesale seller and asks him for the whole list he needs to gather; then if he is satisfied, he goes away, if not,
  - o At the second period, he gathers information on availability of products for 5 wholesale sellers. This enables him to decide which agent can fulfil his needs the best,
  - o At the third period, he goes to this wholesale seller and asks him for all the remaining items. Satisfied or not, he goes away.
- ❖ Selfish agents:
  - o A selfish agent spends the first period gathering information. This enables him to decide which agents could provide him with the goods he is looking for at the cheapest price;
  - o At the second time-step, he makes requests to all the WholesaleSellers who have been selected. If he is satisfied he leaves the market, if not:
  - o The agent makes a second best market oriented request based on his previous knowledge[4], then gets an answer and leaves the market, whatever the answer.

A day

Prices: Prices of all products evolve from one time-step to another, and are different for each wholesale sellers[5]. The prices evolution and initial diversity are limited by a percentage P and are such that:

- A initial ***general price*** is randomly chosen for each product, ranging from 50 to 100 per unit;
- The evolution of the *general price* stays in a range of P% more or less of the previous basic price;
- WholesaleSellers get the product at a ***price*** that is randomly chosen in a range of P% more or less of that general price. It deduces the ***base price***, by adding its own share.
- When a product is 3 days old, it looses 20% of its price, when it is 4 days old, 40%, before being potentially thrown away.

Availability: Every day, each product has a new uniform probability to be available to WholesaleSellers, ranging from supplyMin to supply Max. Then each WholesaleSeller draws from this uniform probability to know if he can get to his normalSupply or not.

4.2 Simulations and observed indicators

The simulations are conducted over 100 days: this is usually enough to have had notable differences emerge among WholeSaleSellers and stabilisation of the different observed data. We have set the number of WholesaleSellers to 10, the number of Retailers to 100, the number of products to 10 and memory length for all agents to 10 days.

In the simulations the parameters are:

- differences in price
- probability of availability for a product
- ratio of loyal agents and selfish agents.

The choice is here to decide that the degree of stability of the environment has to be tested. We represent it in the variations (in price or in availability for products), referring mainly to the work of Galtier in that respect (Galtier et al., 2002; Galtier, 2002). Table 2a and 2b give the different simulations that were performed.

Table 2a and 2b: all simulations depending on the three main parameters: difference in prices, availability and number of agents of each kind. In the rest of the paper, simulations will be refered to with their name in this table.

Simulations on prices	Sim1	Sim2	Sim3	Sim4	Sim5	Sim6	Sim7	Sim8	Sim9
Difference in prices	20	20	20	5	5	5	40	40	40
Probability of availability for a product	60-80	60-80	60-80	60-80	60-80	60-80	60-80	60-80	60-80
Ratio of loyal agents and selfish agents	50-50	100-0	0-100	50-50	100-0	0-100	50-50	100-0	0-100

[4] At this occasion, he can go and ask a WholesaleSeller who has rejected him to ask for another product

[5] To represent the idea that wholesale sellers do not have the same sources of supply.

Simulations on availability	Sim10	Sim11	Sim12	Sim13	Sim14	Sim15	Sim16	Sim17	Sim18
Difference in prices	20	20	20	20	20	20	20	20	20
Probability of availability for a product	40-50	40-50	40-50	70-90	70-90	70-90	80-100	80-100	80-100
Ratio of loyal agents and selfish agents	50-50	100-0	0-100	50-50	100-0	0-100	50-50	100-0	0-100

In this set of simulations, observed data are such that:

For the Retailers: Average age of the products that were bought; quantity of products found on average at each time-step; money earned for the whole simulation. We globally compare the two last elements for selfish and loyal retailers.

For WholesaleSellers: Average number of products that end up being thrown per Wholesale Seller; number of products acquired on average; average money (to check there is no budget getting negative); average normalSupply (desirable stock) for the simulation; number of regular relations.

5 Results and discussion

Loyal agents spend on average more money than selfish agents when they are on the market. But loyal agents usually leave the market earlier and have led much less transactions. Those results are true when both types of agents coexist, but also when they is only one type of each. This is a logical conclusion from the model, since at each period selfish agents can go and see up to five different WholesaleSellers (see Table 3). Even if we don't take the approach that defines loyalty as a solution to reduce transaction costs, it is important that our system produce a setting where much more energy is use in negotiation by the selfish Retailers. Along the time the quantity of goods that each WholesaleSeller tries to get (its normalSupply) increases up to a value that does not change too much after the 40th day. On average, we consider that the system equilibrates around that time. From the dynamics, one can see that selfish Retailers have a disadvantage, in that they always get served after the loyal ones. However, with the adaptation of the WholesaleSellers through normalSupply, all Retailers have chances of getting goods after a few periods.

Table 3: Number of transactions over 100 days (average for 30 simulations) . The more selfish Retailers in the population, the more exchanges take place**.**

	Sim1	Sim2	Sim3	Sim4	Sim5	Sim6	Sim7	Sim8	Sim9
Global number of transactions	13193	6715	26699	13605	6530	26768	13013	6486	27201
	Sim10	Sim11	Sim12	Sim13	Sim14	Sim15	Sim16	Sim17	Sim18
Global number of transactions	16043	7549	26321	12594	5970	27006	11338	5602	27098

Table 4a and 4b: Values of normal supply depending on the type of simulation. The values are average numbers over 30 simulations (shown to be relevant).

	Sim1	Sim2	Sim3	Sim4	Sim5	Sim6	Sim7	Sim8	Sim9
Normal Supply	12,7	12,8	12,4	12,3	13,1	12,7	12,7	12,6	12,7
Minimum Supply	7	8	9,2	7	8	8,5	8	6	8,5
Maximum Supply	18	16	14,2	17	20	13,7	16	18,9	20
	Sim10	Sim11	Sim12	Sim13	Sim14	Sim15	Sim16	Sim17	Sim18
Normal Supply	12,7	21,1	19,4	5,2	11,21	10,46	4,5	8,84	8,74
Minimum Supply	4	12	16	2,5	3	7	2	6	6
Maximum Supply	15	34	22	8	14	16	7	12	11

What can be observed with Table 4 and 4b is the fact that the normal supply for WholesaleSellers is dependent on the value of availability of products and that the lower availability, the more products are purchased. The difference is mainly clear in simulations 10, 11 and 12 when the availability is really low. This is due to the fact that agents rarely get the goods they want, and then they get requests that they cannot fulfil and increase consequently their normal supply. As a consequence of this increase of normal supply, there is an increase in the quantity of garbage linked to the low demand (Figure 2). One interesting point in that case is that the presence of loyal Retailers in parallel of selfish Retailers helps the disappearing of products before they are thrown away (Figure 1). This is due to the fact that loyal Retailers get the cheapest products and that the price decreases after the 3rd day of a

unit: the old goods that could be thrown are eliminated by the loyal Retailers. Figure 3 also shows that the presence of loyal Retailers increases the average age of sold products.

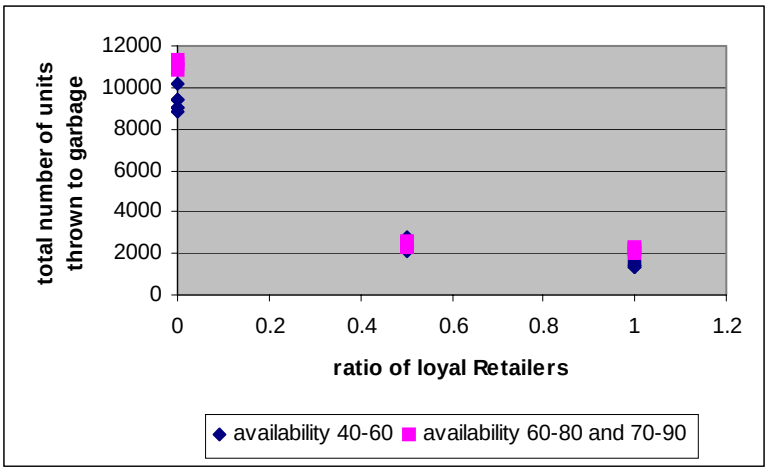

Figure 1: Total quantity of garbage for a simulation, linked to the ratio of loyal retailers in the society. Each dot represents the average value over 30 simulations (the values of Mean Square Deviation is not given for the first line, but it always shows that the average over 30 simulations is relevant).

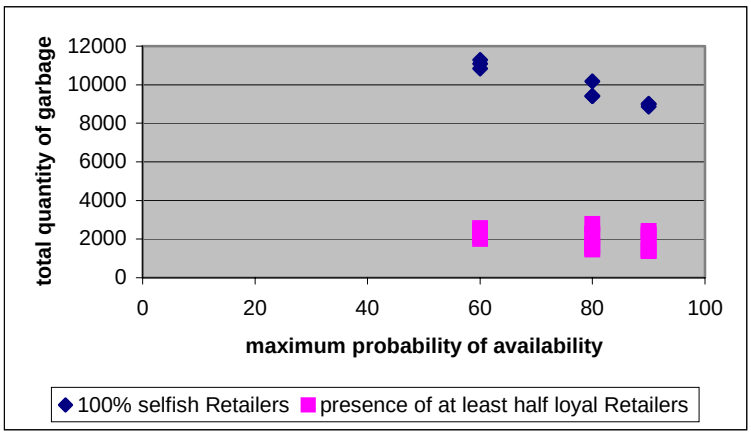

Figure 2: Total quantity of garbage for a simulation, linked to the availability in the society. Each dot represents the average value over 30 simulations.

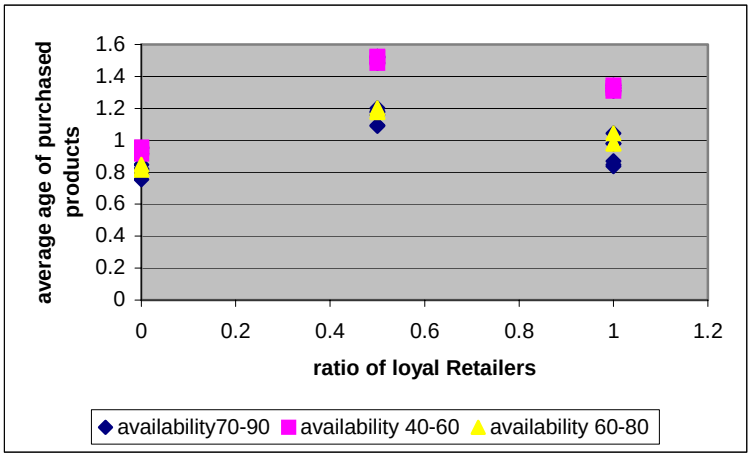

Figure 3: Average age of good sold. Each dot represents the average value over 30 simulations.

What we realise is that in our system, the difference of prices has an impact only when there are mainly selfish Retailers. This can be seen in Table 4a, where there is a significantly bigger gap between maximum and minimum supply in sim6 than in sim3 or sim9. This is an indicator that some WholesaleSellers receive more requests. When the selfish Retailers are mixed with loyal, the gap says more constant. The logic behind it is that some of the selfish agents succeed in getting cheap products,

then get a lot of request and increase their normal supply. If they get again cheap products, they get even more requests, since their average price is lower than the others' average price. If they get to a huge number of cheap products that are not bought right away, they store cheaper products than the others and then have a cheaper average price. This cannot happen with such importance when there are loyal Retailers since the WholesaleSellers sell them the cheapest units first, which increases their average prices as a consequence. Even if the process is certainly different from the ones taking place in real life, it is good to get to an intuitive result of that sort, where prices don't matter so much for interactions when some loyal Retailers are in the market.

We do not consider the other data in this model, since we still have to analyse the relations between Retailers and WholesaleSellers. For the moment, we are mainly satisfied by the coherence between what we wanted to represent and the global results we get. It is clear that, in our model, the presence of only selfish agents leads to real problems in the use of goods on the market: much more are asked for and much more are spoilt. At the same time, the systems exhibits a too specific type of global behaviour when only loyal agents are in, since the relations with an WholesaleSeller who is not a regular is very scarce, and WholesaleSellers adapt so that to fulfil a very predictable needs, their regular Retailers' ones (completely equivalent need for all products over the long run).

6 Conclusion

We decided to take into account the fact that we witnessed two patterns of behaviour for these buyers: either they are mainly loyal to one retailer or they are behaving following a market logic, comparing all prices before choosing. These characteristics have been observed, and are consistent with other types of information on real markets, like the ones gathered and analysed in a multi-agent model by Alan Kirman on a fish market (Kirman, 2001b; Kirman A. and Vriend N. 2001). In the domain of fruits and vegetables exchanges, on the side of suppliers-wholesale sellers' interactions, these two interactions can apparently also be observed (Brousseau and Codron, 1998). We had already analysed the influence of different rationality and information treatment in a previous work (Rouchier et al., 2001), but the setting was quite different: buyers were of only one kind for one simulation whereas here there are mixes of loyal and selfish; the sellers didn't display different reactions depending on who they met, whereas here they do.

The paper represents an attempt to link field observations to a formal (computer) model. This field implication makes it harder to stick to a very strict theoretical context, but the modelling process offers an intermediate step between classical representation and pure description. It is also a way to describe a relational and lexicographic rationality that cannot be captured by linear equations. The assessment by the partner, who has been interviewed and observed, is also a way to check that the model is relevant regarding the way individuals identify their practices. Our choice is indeed to try to express in a formal way the motivational aspects of an everyday life activity – which is far from one shot meetings, but also from monetary preferences, since individuals sometimes value other dimensions of their experience. On the MIN market, stable relations are recognised as important on both sides, and we wanted to capture this element.

To test how the local motivations could have an impact on global results, we hence built a multi-agent system in which to perform simulations. The conclusion that we can draw is of several dimensions: first, one can recognise that the individual behaviours do have an impact on the performance of individuals and on the functioning of the market as a whole. The presence of too many selfish agents pushes to a very important destruction of products. Maybe one can then understand why the wholesale seller we interviewed declared that it is a very important to push retailers to loyalty. And one can see how the degree of stability of the environment (variations of prices and of supply) can have an impact on the good functioning, as well as on a emerging heterogeneity.

Following this work a few other steps need to be reached. First, it is necessary to study the relation dynamics among agents, and even transform the rules a bit. It would indeed be interesting to conduct the same experiments with loyal Retailers who would be able to evaluate their relation to their regular, and potentially change their relation in the long term (in which case they would need information to compare the average offered price). On the other side, one could consider that the selfish agents could at some point decide to stay with one agent who could fulfil its needs in most of the case.

A more theoretic difference that interests us is the taken into account of quality by the agents and

how this could be incorporated in the model. Indeed, the influence of the suppliers is here simplified a lot and we represent it as an exogenous input, where all agents have an access to products with diverse prices chosen through random processes. This does not represent properly the actual work of the wholesale sellers, who adapt much more to the demand.

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