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1   Introduction

The aim of this paper is to compare two very different market forms: Bazaar, the typical market present in the Arab societies of Northern Africa and Middle East and the common retail markets existing in modern industrial societies, such as the Mall (shopping center).

Hayek's greatest contribution in understanding the role of market was that, behind the simple exchange of commodities and services, he saw markets allow agents interacting to each other to transmit relevant information on their preferences and, most of all, on the value they attach to goods according to preferences. In Hayek's view, market is the place where participants' dispersed knowledge is shared through the mechanism of exchange and the price system acts as a signal that coordinates such fragmented knowledge (Hayek 1945).

However, there can be several mechanisms of exchange or many price systems, which lead to different forms of market organization. This variability is due to the existence of market institutions, which represent the set of rules individuals share in order to ease their economic interaction and lower transaction costs. In other words, market institutions address the problem of the coordination of participants' dispersed information investigated by Hayek, since they shape the economic exchange mechanisms and price systems.

Some economic works (Kranton 1996) have recently examined the interaction between exchange mechanisms based either on reciprocal or impersonal market relations. These works analyse the performance of such institutions and shed light on the causes of persistence of the under-performing ones. With this regard, the Bazaar may be considered a mix of the two systems - as price mechanism and long-standing reciprocal relations are likely to coexist - and, according to North (1990), the Bazaar institutional framework seems to coordinate the knowledge of market participants at higher transaction costs than the elaborated institutional framework of modern markets in western societies.

Our goal is to test this assessment by considering some specific institutions of the two markets and by posing the following question: How do the mechanism of exchange and the price system shaped by the Bazaar institutions coordinate the knowledge of market participants?

To answer this question we analyze market institutions using an Agent Based Computational Economics (ACE) approach. The opportunity of using agent based simulation to study social phenomenon and economics in particular is discussed by Tesfatsion (2002), Gilbert & Terna (2000), Terna (1998) and Arthur, Durlauf & Lane (1997).

As a final remark, it is worth to stress that, because of the lack of real data concerning market interactions , we basically deal with two idealized types of market built upon the available literature describing the Bazaar respect to western modern markets.

The paper is organized as follows: section 2 provides a description and a theoretical analysis of the peculiar institutions characterizing the two markets; in section 3 the ACE model is described; section 4 outlines the results of the simulations; section 5 concludes.

2   Analysis of market institutions in the Mall and the Bazaar

Why do the Bazaar of Damascus and a Mall in New York appear so different?According to the anthropological economic literature (Geertz 1978, Geertz 1979, Khuri 1968, Fanselow 1990) the Bazaar shows a number of distinctive characteristics respect to the western Mall type market.

In the Mall, standards of measure and weight are formalized and well defined, traded goods are homogeneous and price information is public, since shop retailers use a posted-price mechanism. This allows buyers to know ex-ante the prices of products and to make price comparisons directly; as a consequence, transactions are mostly impersonal. In this case, if loyalty emerges, it is unidirectional, since it springs from having the buyers identified a certain seller who provides them the best opportunities (i.e. lowest price) in the market and it persists until buyers do not find better opportunities in other stores.

On the contrary, in the Bazaar there are not well defined and formalized standards of measure and weight and traded goods are often not homogeneous. Price information is not public, in the sense that retailers do not post prices of products, but show a price only when a buyer demands for the commodity. The sellers may, consequently, offer the same good at different prices to different purchasers. Transactions are mostly interpersonal since trading involves an ongoing search for specific partners, not mere offers of goods to the public.

These characteristics lead to the emergence of the two most peculiar Bazaar institutions: clientelization and bargaining. Clientelization is not simply the emergence of loyalty of some buyers for specific sellers. As in a trading relationship based on interpersonal transaction, clientship between traders is a reciprocal matter, since it ties both the buyer and the seller, one to each other.

As clientelization, bargaining usually develops in the presence of economic interpersonal transactions. Even if whatever is alterable is negotiable, price setting is the main objective of bargaining and traders try to explore in depth the offer already received, contracting along the margin of the value of the good instead of seeking for additional offers from other potential partners.

Since the two markets present different institutions for coordinating and aggregating the information of market participants (Grossman & Stiglitz 1980), economic theory suggests that agents will face different information costs dealing with the existent institutional framework and this will affect the price dynamics.

Indeed, markets can be considered as systems where agents convey information to each other and form their beliefs about the value of goods, expressed by their reservation prices. However, the situation for sellers and buyers in managing such information seems to differ: sellers are usually the information generators of the system, being price setters, whereas buyers are often price takers, acquiring such information inside the market and forming their price beliefs according to that. The price structure for a given commodity should reflect the degree by which the information on the value of the good is spread among market participants.

In the Mall, because of posted prices, buyers search extensively in the market looking for the lowest prices and their economic problem is to balance the marginal cost of protracting the search with the marginal benefit (time savings) of discovering in the next period a new lowest price (Stigler 1961). Sellers choose which price to post and their price setting strategies are affected only by consumers' decision about which shop to visit and their ability to exert the "exit" option (Hirschmann 1970). Competition among sellers comes out indirectly from consumers' choices, given their price beliefs. If consumers are responsive enough to changes in price opportunities, market prices will tend to the competitive efficient level, the lowest price every seller may offer.

In the case of the Bazaar, the presence of bargaining makes sellers able to differentiate between buyers with different reservation prices. From the buyers' viewpoint, the absence of posted prices increases the cost of acquiring and using price information in market transactions; moreover, because of clientelization, buyers are expected to face higher information costs and are more likely locked-in to specific sellers without exploiting the opportunities of a more competitive market. The naive implication is that prices do not approximate the unique minimum price attainable in the idealized perfect competitive market.

To test this hypothesis, we set a market model wherein, through an ACE approach, we simulate the performance of both the Mall and Bazaar institutions through an analysis of their effects on market prices.

3 Assumptions and Model's description

Since the aim of the paper is to compare the performance of different markets our main concern has been to create a model that could be used for both the Mall and the Bazaar. To do so, we have created a general framework[1] characterized by few parameters, which allows to shift from a strictly competitive

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[1]From a technical point of view the simulation model has been realized in Java (http://www.java.sun.com) using Swarm (http://www.swarm.org) as agent based simulation toolkit, the source code of the model is freely available at http://bazaar-abm.sourceforge.net

environment, like in the Mall, to a Bazaar type market; the model gives also the opportunity to explore intermediate conditions.

We consider a finite population of n_s sellers and n_b buyers meeting in bilateral transactions focused on the price over a single, indivisible and not perishable good. The time is discrete and counted in ticks, denoted by t. Each buyer may visit a seller at each tick and ask for a unit of good. A certain number of ticks define a period T, at the end of which the agents review their beliefs and strategies.

Agents are assumed to have a low level of rationality. Dealing with rational agents would lead to a better understanding about the effects of economic variables. However, this would have required strong assumptions on the reasoning procedures and on environmental variables that can be idyosincratic to specific cultural and institutional settings and, hence, difficult to be included in the general model devised. In our model, agents do not follow any elaborate economic reasoning procedure: they are neither budget constrained nor profit maximizers; agents simply learn how to interact within the given institutional framework according to an adaptive behavior. Following Kirman & Vriend (2001), the agents' adaptive behavior is based on a learning process, which takes place through reinforcement. The agents have a limited memory of η ticks.

Buyers search for the lowest price in the market. They form their price beliefs exploring the market and recording in their memory the final price the sellers have offered, generating an incomplete price distribution. This approach, similar to the one proposed by Rothschild (1974), has been simplified assuming that from the distribution of collected prices, buyers retain informational shortcuts of the average price $\bar{p}$ and the minimum price p_{min}. In particular, $\bar{p}$ is assumed to be the buyers' reservation price, the maximum price the buyer would pay for the good.

The selection of the seller is based on the buyers' past experiences and it is affected by the satisfaction the buyers have obtained from the seller's price offers according to a reinforcement rule. More precisely, the selection process is based on a roulette wheel technique where the probability of visiting a particular seller is proportional to the buyer's satisfaction for that seller. We assume that, if several buyers visit the same seller, the seller handles them according to a "first come first served" basis.

The sellers have access to an unlimited number of units of the good, which they obtain for a fixed unitary cost c. Therefore, sellers' unique concern is simply to choose a price setting strategy in order to compete with each other. As the buyers, sellers are driven by a learning process, which makes them choose in any period the best price setting strategy according to the revenues generated in the past. The price proposed by every seller in the market is given by the rule

$$p_i(t) = c(t)(1 + \mu_i)(1 + \nu_i)$$

where μ_i represents the markup a seller wants to obtain from the sale of one unit of commodity. The parameter ν_i represents an "unfairness" component that is added to the initial proposed price; it is specific for each seller, defined at the beginning of the simulation and constant over time. The ν_i parameter is the first element which differentiates the Bazaar from the Mall, being the unfairness component positive only in the Bazaar, whereas $\nu_i = 0$ in the Mall. A justification for this choice could be found in the fact that, during the bargaining, sellers may be willing to extract profits from buyers with a high willingness to pay if the prices are not public information. In the Bazaar, this seems a widely adopted strategy by sellers at the beginning of bargaining, as pointed out by Alexander & Alexander (1987). It is worth noting that the price given by $c(t)(1 + \mu_i)$ represents the sellers' reservation price.

The second difference between the Bazaar and the Mall type market occurs when transactions take place. Differently from Brenner (2002), where bargaining or posted price mechanisms emerge from agents' behavior, we have set such a market institution exogenously. Indeed, the parameter β defines the length of negotiation during a transaction. In the Mall, β is set to 0 denoting impersonal transactions where the buyers check the price proposed by the sellers and decide whether to accept or reject and leave. In the Bazaar β is positive, expressing the number of bids and counterbids the buyers and sellers may propose to conclude the transaction. If the traders do not converge their bids in β steps transaction fails.

In both cases, when the seller proposes the initial price, the buyer evaluates the offer with the formula:

$$\Psi_j(t) = (\Phi/p) * (p_{min}/p)$$

Where Ψ_j expresses the decision of buyer j in purchasing the commodity and Φ is a price which ranges between the p_{min} and the maximum willingness to pay $\bar{p}$. Φ increases as the time without purchasing a commodity goes on and it may be considered as a sort of dynamic reservation price that introduce a time constraint in buyers' reasoning procedure. If $\Psi_j \geq 1$ the buyer purchases the commodity, whereas

if $\Psi_j < 1$ the buyer rejects the seller's price. In the Bazaar, the rejection of the seller's initial bid leads the buyer to counter bid, so that bargaining starts, whereas in the Mall the transaction is concluded.

The bargaining process we have devised is mostly referred on the model presented by (Cassady 1968) whose main features are: the seller bids first, bids alternate and backward moves are forbidden. The buyer's initial counteroffer is given by $p_{min} \cdot \gamma$ where $0 < \gamma \leq 1$. Such buyer's strategic initial bid is essentially explained by the fact it may foster her bargaining power in the negotiation. Indeed, the bargaining power of a trader in our model is affected by two elements: the initial price the trader proposes and the willingness to converge towards the other trader's offer. Hence, as far as the bargaining model does not allow backward moves on bids it could be reasonable to assume that buyers may be willing to increase their bargaining power by setting a first bid at a lower level than their minimum price.

Considering the agents' strategies for the convergence of prices and the final outcome of bargaining, traditional literature on bargaining stresses the importance of time and bargaining costs on the negotiation process (Cross 1969). Whit regard to this approach, Moulet & Rouchier (2006) deal with rational agents maximizing expected profits and assume that the decision about carrying on the bargaining is affected by bargaining costs, as the convergence to other party's price depends on the expectation of futures opportunities. Since we keep our agents as simple as possible in order to make them act according to very different market institutions, we have neither created rational profit maximizing agents nor assumed costly time and, moreover, we have not considered feasable to appraise the buyer's transaction costs occurring in the bargaining respect to the transaction costs of extensive search.

Hence, we have adopted a different approach to shape the bargaining process: the agents' offered price converges not respect to the other agents' bid, but respect to their reservation prices, that for sellers is the price at the markup level $p = c \cdot (1 + \mu_i)$ and for the buyers is the $\overline{p}$ price. Our approach is similar to the one developed by Brenner (2002) where sellers and buyers have to decide a set of prices they are willing to propose or accept in the bargaining process. Whenever the sellers' price is equal or lower than the one the buyer is willing to accept the transactions is concluded; otherwise it fails.

The formula for the convergence of price is:

$$p(t) = p(t-1) + (p_{res} - p(t-1)) * b_i \quad where \;\; 0 < b_i \leq 1 \;\; and \;\; i = \{s, b\}$$

The parameter p_{res} is the reservation price and b_i represents the rate of convergence either for the seller ($i = \{s\}$) or for the buyer ($i = \{b\}$). For the seller, b_s is an indicator of the buyer's loyalty to the seller; to compute b_s we consider a ratio of the seller's revenue obtained from that particular buyer and the total seller's revenue. For the buyer, b_b is equal to the value of Ψ already computed. The rationale for using the same formula is that the seller's initial offer may be relevant to affect the convergence strategy of the buyer. The farther is the initial price to the buyer's price belief the smaller will be b_b, denoting a defensive convergence strategy, and vice versa.

4   Results

We study how agents learn to adapt to the different market institutions in the Bazaar and the Mall and how the institutional frameworks affect the price dynamics in market interactions. We run the simulations for 5000 ticks and the results are interpreted over time. For the sake of comparability between Mall and Bazaar, we set the majority of the parameters at the same level for the two markets in order to generate a plausible market structure and test the sensitivity of the model to alternatives. The specification of the more relevant common parameters is: $n_b = 50, T = 10, \mu \in [0.2, 0.8], c = 1000, \eta = 50, \gamma = 0.7$

The two parameters differentiating the Mall and the Bazaar (unfairness component and length of Bargaining) have been set respectively to $\nu = 0$ and $\beta = 0$ in the Mall and $\nu = 1$ for every seller and $\beta = 10$ in the Bazaar. The specification of these parameters in the Bazaar is helpful in order to study the informational role of the existent market institutions. In particular, keeping the ν equal for every seller prevents buyers from discriminating in the first periods among less and more "fair" sellers, blurring in the long term the dynamics yielded by the bargaining process and clientelization.

Moreover, we focus our analysis on one parameter whose specification and changes affect the results of the simulations. This parameter is $\theta = \dfrac{n_s}{n_b}$. Keeping $n_b = 50$, we ran several simulations with n_s from 5 to 50. Even if a market with a $\theta = 1$ (meaning 1 seller for each buyer) is neither plausible nor realistic, as it will be clearer further, it provides the most interesting insights especially for the interpretation of the role played by Bazaar market institutions.

4.1 The Mall

The results obtained in the simulation of the Mall type market are consistent with economic theory and are to be used as a benchmark for the analysis of the results in the Bazaar. With every specification of θ, sellers adopt quite immediately and maintain the price setting strategy with the lowest markup level ($\mu = 0.2$) and ask the buyers for the minimum price ($p = 1200$).
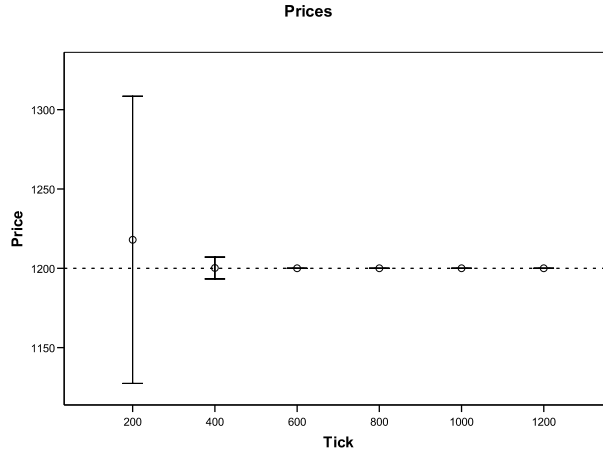
Prices

Figure 1: Average price $\pm 2 \cdot \sigma$ for concluded transaction over time

This result is easily explained by the fact that in the ACE model sellers compete *à la* Bertrand, that is on price. The slight differences with the classical Bertrand competition are that in the model buyers are not fully informed individuals but instead learning agents who have to acquire information and update their beliefs on price through market interactions. The responsiveness of buyers in changing their price beliefs is affected both by their learning process and, most of all, by the extent to which institutions are able to convey information about the actual lowest price in the market.

In this way, the posted price mechanism and the impersonal transactions, joint with the extensive search in the market, are likely to conduce to buyers in any period the information about the existing lowest price. In turn, the sellers, in order to make revenues and attract buyers, are constrained in each period in choosing among the possible price setting strategies that lie below the actual lowest price. Eventually, in the long-run, the set of possible price setting strategies for the sellers becomes even more restricted until the time when every seller will consider the only profitable strategy as the one with $\mu = 0.2$.

4.2 The Bazaar

The price dynamic in the Bazaar is strongly affected by θ. According to the simulations in the Bazaar agents reach the same minimum price of the Mall type market only when $\theta = 1$; this very unrealistic condition deserves a detailed understanding that could provide useful insights on the different logic governing the Bazaar. A trivial explanation of this result could be found in the neoclassical macroeconomic analysis whereby, keeping the demand fixed (n_b), an increase of the supply (n_s) leads to a reduction of the equilibrium price.

However this seems an indisputable argument, one may wonder why this happens in a market where price information is private and the final price of transactions is affected by bargaining and clientelization.

During the bargaining process the traders negotiate according to their reservation prices and their bargaining power, that is represented by b_i, the convergence rate. With this regard, clientelization, if emerges, plays a pivotal role in the final outcome of the negotiation because, during the bargaining process, a seller facing a client is assumed to be willing to decrease quickly her bids, so that the final price will benefit the buyer.

The clientelization with a specific buyer is expressed by the increase of the seller's b_s, which raises as the buyer's contribution to the seller total revenue increases. It is straightforward that a "perfect clientelization" ($b_s = 1$) is reached ideally when the $\theta = 1$ because with $n_b = n_s$ in the market the likelihood that each buyer establishes a unique commercial relation with only one seller is high and, consequently, each seller may reward the loyal client with the maximum convergence rate b_s.
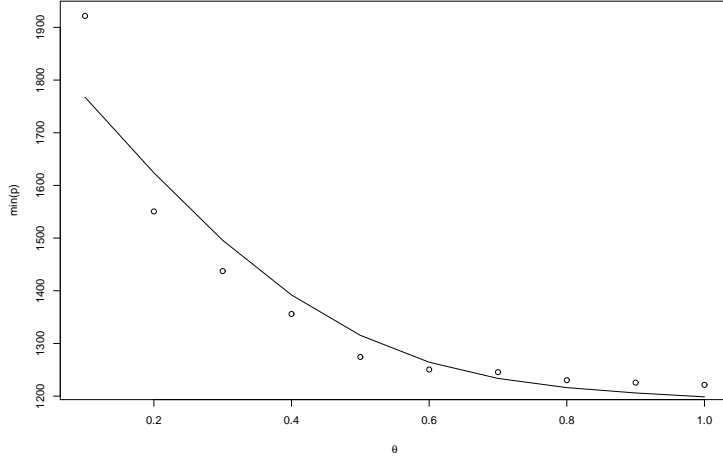
Figure 2: Minimum price dependent on θ

This result elicits a better assessment of the meaning and role played by "perfect clientelization" in real Bazaar markets. As Geertz (1978) pointed out for the Maroccan Suq of Sefrou, within the Bazaar buying and selling are virtually undifferentiated, essentially a single activity. Considering how bargaining and clientelization have been devised in the model, when $\theta = 1$, this is the unique case where selling and buying are undifferentiated, having the seller and the buyer the same bargaining power during the negotiation. In any case, simulations where sellers can keep "perfect clientelization" relations with more than one buyer at the same time are easily attainable slightly modifying the assumptions on b_s.
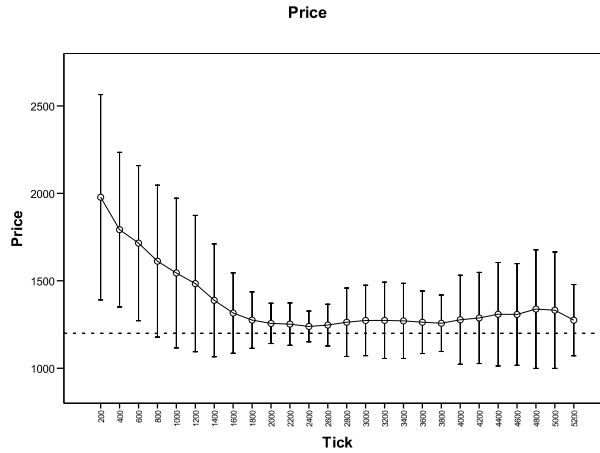

Figure 3: Average price $\pm 2 \cdot \sigma$ for concluded transaction over time

Focusing on the price dinamyc of the Bazaar, figure 3 shows both the informational virtues and drawbacks of bargaining and clientelization. Indeed, bargaining process and clientelization lead to a reduction of the average price over time reaching a minimum ($p = 1200$) at $t = 2400$ tick, that is the price level attained in the Mall type market. However, for $t > 2400$, the price of the commodity does not keep stable, as happened in the case of the Mal,l with the average price fluctuating, above the minimum price.

The informational virtues of Bazaar institutions have been partly explained with the previous result. In the first periods, buyers use a mix of extensive search (surveying competitors) and intensive search (bargaining) to form their price beliefs and the resulting reservation prices. Similarly to the Mall, in the first stage, the mix of bargaining process and extensive search allows buyers to acquire information on the lowest prices in the market at any period.

On the one hand, the extensive search mechanism exerted by buyers fosters competition and encourages sellers to use low markup level strategies, that is to reduce their reservation price ($c(t)(1 + \mu_i)$). On the other hand, the bargaining process helps buyers in discovering sellers' reservation prices. In this way, buyers' price beliefs and their reservation price ($\bar{p}$) is reduced, but it hardly gets close to the minimum

price level seen in the Mall.

In order to complete the reduction of price close to the Mall price level, perfect clientelization has to occur. Indeed, when clientelization emerges, the price set by the seller in the transactions decreases because of the additional lessening in the seller's bids, given by the reinforcement mechanism that leads b_s to approximate to 1. At the same time, the buyer benefits from his loyal behaviour with reductions in price and goes on updating downwards her price belief until the case $\bar{p} = p_{min} = 1200$.

At $t = 2400$, the Bazaar may be seen as a sum of reciprocal and exclusive trading relations wherein the couple of traders is strongly locked-in. It is exactly the exclusivity of such reciprocal trading relations that makes the traders reach a final price that is closer to the one of the Mall type market.

This situation may be described as an equilibrium of a collectively shared, self-sustaining system of agent's beliefs (Aoki 2001) where the buyer has formed a belief on the price that is sustained as long as the seller plays the same price setting strategy. This equilibrium yields also to the maximum benefits for both the parties, since the commodity is traded. The informational drawbacks of Bazaar institutions, beyond $t = 2400$, could be interpreted as a departure from that equilibrium. If the seller chooses to "defect" and sets a higher price setting strategy, the buyer is locked-in and hardly will shift to other vendors. In this way, as long as the seller does not return to the previous equilibrium strategy, no transaction will be concluded between the traders, making them loose potential opportunities of economic exchanges.

However, since our agents are not budget constrained and decide without taking into account the potential economic losses and benefits of their behaviors, the main implication of seller's defection is that the buyer's price belief moves upwards. For the period the seller chooses a higher price setting strategy, the locked-in buyer, even without purchasing the commodity, will register the information of increased price and will update upwards her price belief. This allows the seller in the next periods to reduce the price to fit buyer's price belief, but not necessarily at the lowest level, if buyer's price belief has increased enough. The same could not occur in the Mall type market, where buyers are not locked-in, because they can quickly exert the "exit" option and punish the seller's defection.

In this perspective, fluctuations of price above the minimum for $t > 2400$ are easily explained by the fact that our ACE model of the Bazaar lets the sellers benefit from their position of price information generators and harms the buyers, being price information takers. In any case, it is worth to note that in the real world, sellers are not the only price information generators, as the prices set in the market may be affected by external changes in the costs of production factors. The increased uncertainty for both sellers and buyers on the value of the commodity and the resulting fluctuation of price could make sellers more cautious in defecting from the institutional equilibrium, preferring more durable cooperative relations with clients.

5   Conclusion

We have presented an ACE model to analyse how agents adapt their price beliefs to the mechanism of exchange and price system within two very different market institutional frameworks: the middle-eastern Bazaar and the western Mall type market. The Mall is characterized by posted price mechanism and impersonal transactions. In the Bazaar, where prices are not public information, bargaining and clientelization are the most peculiar market institutions.

For the sake of comparability between the results, our approach is unusual in the sense we developed a unique model that can simulate the two markets, with few changes in the parameters. In addtion, agents are driven in their decision by learning process and are assumed to not follow any elaborate economic reasoning procedure that could be idyosincratic to a specific cultural and institutional environment.

In the case of the Mall, the price dynamic led to the competitive price, since the sellers competed a la Bertrand. In the case of the Bazaar, the price dynamics prove that bargaining and clientelization may be effective communicative mechanisms for coordinating information among market participants as the Mall institutions. However, to obtain such result "perfect clientelization" between traders is required and this happens in our simulations only when the bizarre condition of the identity between the number of sellers and buyers in the market holds. Such condition is explained as the only one that gives sellers and buyers the same bargaining power in the negotiation process and it highlights a deeper understanding of "perfect clientelization" phenomena in further empirical researches.

Eventually, Bazaar institutions proved to affect negatively the stability of the market minimum price, once reached. This drawback sheds light on the information costs of lock-in effects burdening the buyers within stable client relations.

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