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A new equilibrium in the one-sided asymmetric information market with pairwise meetings

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ABSTRACT

We reconsider the model used by Serrano and Yosha (1993) who were interested in information revelation in markets with pairwise meetings. We prove that there exists an additional equilibrium not detected in the original paper and show that this equilibrium is characterized by incomplete revelation of information which was not the case of the other already identified equilibria of the model.

Introduction

In his seminal paper, Wolinsky (1990) introduced the issue of information revelation in a market with pairwise meetings. The qualitative question was: *to what extent is the information revealed to uninformed agents through the trading process, when the market is in some sense frictionless*? More precisely, *does the decentralized process give rise to full revelation results as derived by the literature on rational expectations for centralized and competitive environments*? The main message was rather pessimistic since it turned out that the information is not fully revealed to uninformed agents, even when the market is in some sense approximately frictionless.

Some papers have tested the robustness of this result. The variation of assumptions are mainly around the presence of uninformed agents on both sides or only on one side of the market and about the modeling of market entry. In all the concerned frameworks, one can distinguish two sides of the market: sellers on one side and buyers on the other. In Wolinsky (1990), uninformed agents are present on both sides. Serrano and Yosha (1993) studied a one-sided asymmetric information market, i.e. a market where one finds uninformed agents only among the buyers while all the sellers are informed.

Wolinsky (1990) and Serrano and Yosha (1993) use a constant entry flow model. At each period, a certain number of new agents enter the market. Another modeling of entry is used in Blouin and Serrano (2001) which is a one-time entry model.[1] At the first period, all the agents are present and nobody enters the market in the following periods. Blouin and Serrano (2001) consider the one-sided case as well the two-sided one.

Blouin and Serrano (2001) provide a message similar to Wolinsky (1990). Serrano and Yosha (1993) is the only one which is optimistic in the sense that all the equilibria found are characterized by a complete revelation of information. However, Serrano and Yosha (1993) restrict their analysis to steady states and one can wonder if this restriction is really harmless. Isaac (2010) confirms the result of Serrano and Yosha (1993) (i.e. the existence of an equilibrium with full information revelation) in a dynamic context by introducing an initial period and without assuming a priori the stationarity of the equilibria.

In this paper, we prove the existence of a new equilibrium in the framework of Serrano and Yosha (1993). This new equilibrium is characterized by an absence of information revelation when the market becomes approximately frictionless. So, we reduce the gap between the messages conveyed by the model of Serrano and Yosha (1993) (which seemed quite optimistic) and by the other

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[1] For a discussion of these two hypothesis (constant entry flow and one-time entry) in the perfect information case see Gale (1987).

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frameworks (which provide a rather pessimistic conclusion). In a certain sense, we confirm the intuition present in the literature: *the pairwise meetings market is a procedure with bad revelation properties* (only in some equilibria of the steady-state version of the one-sided model do some *right* equilibria show up). Gottardi and Serrano (2005) provide a general discussion of this and related issues.

In the first section, we present the model. The second section provides some characterizations of the equilibria that are useful in the following sections. The third section introduces the new equilibrium. The properties of this equilibrium are analyzed in Section 4. In the last section, we conclude.

1. The model

We consider the model of Serrano and Yosha (1993).

Time runs discretely from $-\infty$ to ∞. Each period is identical. On one side, there are sellers who have one unit of an indivisible good to sell. On the other side, there are buyers who want to buy one unit of this good. In each period, a continuum of measure M of new sellers and the same quantity of buyers enter the market. The agents quit the market when they have traded. Hence, the number of sellers is always equal to the number of buyers.

There exist two possible states of the world, which influence the payoff of the agents. If the state is low (L), the cost of production (c_L) for the sellers but also the utility (u_L) of the buyers are low. If the state is high (H), the corresponding parameters (c_H and u_H) are high. The state remains identical during all the periods.

All sellers know the state of the world, whereas not all buyers are perfectly informed. Among the newcomers, there is only a fraction x_B of buyers who are perfectly informed. The remaining buyers are uninformed and possess a common prior belief $\alpha_H \in [0, 1]$ that the state is H and $(1-\alpha_H)$ that the state is L.

At each period, all the agents are randomly matched with an agent of the other type.[2] At each meeting, the agents can announce one of two prices: p^H and p^L. It is convenient to say that a seller (resp. a buyer) plays *soft* when he announces p^L (resp. p^H) and *tough* when he announces p^H (resp. p^L).

Trade takes place at p^H if both traders announce this price, at p^L if both traders announce this price, at an intermediate price p^M if the seller announces the low price and the buyer the high price (i.e., when both play *soft*), and there is no trade if both play *tough*. The different parameters are assumed to be ordered such that:

$$c_L < p^L < u_L < p^M < c_H < p^H < u_H. \tag{1}$$

Remaining on the market implies a zero payoff. The instantaneous payoff when a transaction occurs is the price minus the cost for a seller and the utility minus the price for a buyer. All agents discount the future by a constant factor $\delta \in (0, 1)$.

In state H, we call p^H the *right* price because trade at other prices implies an ex-post loss for the sellers. Similarly, the price p^L is the *right* price in state L because trade at other prices involves ex-post loss for the buyers.

After each meeting with a seller who announces p^H, a buyer will update his belief α_H according to Bayes' rule. If an uninformed buyer meets a seller who announces p^L, he will know that the state of the world is L, but it does not really matter any more, since this buyer will trade and leave the market.

When an agent plays *soft*, he is ensured to trade and to quit the market. Hence, to describe completely the strategy of an agent, it is sufficient to give the number of periods in which he plays *tough*. A priori, the strategy of an agent might depend on the period of entry on the market. It will not be the case since the analysis is restricted to steady states. We note n_{SH} the number of periods during which a seller plays *tough* when he enters on a market which is in state H. Similarly, we define n_{SL}, n_{BH}, n_{BL}. Finally, we define n_B as the strategy of an uninformed buyer, which is independent of the state of the world.

An equilibrium is a profile of strategies where each agent is maximizing his expected payoff, given the strategies of the other agents. All parameters $(p^H, p^M, p^L, c_H, c_L, u_H, u_L, x_B, \delta, \alpha_H)$ are common knowledge.

We define now the proportions of agents who play *tough* when the state is L. The proportion of the total number of buyers in the market who announce p^L is called B_L^l. Similarly, S_L^h is the proportion of sellers who announce p^H. These values are known to all agents. Naturally, B_H^l and S_H^h are the equivalent proportions when the world is in state H. Let K_H and K_L be the total number of sellers (and therefore for buyers) in the market in state H and in state L. We are at a steady state when K_H, K_L and the four proportions — B_L^l, B_H^l, S_L^h and S_H^h — are constant.

2. Characterization of the equilibria

This section largely repeats the equilibrium analysis in Serrano and Yosha (1993).

In the following claim, we characterize the equilibrium strategies of informed buyers and of sellers in state H.

Claim 1. *In any equilibrium $n_{SH} = \infty$, $n_{BL} = \infty$ and $n_{BH} = 0$.*

Proof. An informed seller in state H knows that his payoff will be negative if he trades at another price than p^H. Since the payoff of perpetual disagreement is 0, he will always prefer to play *tough* even if it implies a long delay before trading. The reasoning is identical for an informed buyer in state L. An informed buyer in state H will understand that $n_{SH} = \infty$ and thus will never trade while he plays *tough*. Playing *tough* only delays the payoff. So, it is better for this kind of buyer to play immediately *soft*. □

Concerning notations, $V_{SL}(n; B_L^l)$ indicates the expected payoff for a seller in state L when he plays *tough* during n periods. By definition, the optimal strategy for an agent maximizing its expected payoff. So, an equilibrium has to satisfy

$$n_{SL} \in \arg\max_n V_{SL}(n; B_L^l). \tag{2}$$

Similarly, we denote $V_B(n; \alpha_H; S_L^h; S_H^h)$ the expected payoff for an uninformed buyer and the following condition has to be satisfied at any equilibrium:

$$n_B \in \arg\max_n V_B(n; \alpha_H; S_L^h; S_H^h). \tag{3}$$

The focus on steady-state imposes the following restrictions:

$$M = K_H(1 - S_H^h B_H^l) \tag{4}$$

$$M = K_L(1 - S_L^h B_L^l) \tag{5}$$

$$K_L(1 - B_L^l) = M[x_B(S_L^h)^{n_{BL}} + (1 - x_B)(S_L^h)^{n_B}] \tag{6}$$

$$K_H(1 - S_H^h) = M(B_H^l)^{n_{SH}} \tag{7}$$

$$K_H(1 - S_L^h) = M(B_L^l)^{n_{SL}} \tag{8}$$

$$B_H^l = \frac{(1 - x_B)n_B}{(1 - x_B)(n_B + 1) + x_B}. \tag{9}$$

The two first equations are the steady state conditions for the market size in the two states of the world. M is the number of entering buyers (resp. sellers). This number has to be equal to the

[2] See Duffie and Sun (2007) for a rigorous proof of the existence of independent random matching between two continua.