



General equilibrium in markets for lemons[☆]

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ABSTRACT

This paper studies exchange economies in which agents have differential information about the goods that the other agents bring to the market. To study such a setting, it is useful to distinguish goods not only by their physical characteristics, but also by the agent that brings them to the market. Equilibrium is shown to exist, with agents receiving the cheapest bundle among those that they cannot distinguish from the truthful delivery. An example is presented as an illustration.

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1. Introduction

Economic agents usually trade goods without having perfect knowledge of their characteristics. This applies to firms hiring workers with unknown productivity, to consumers buying used cars with unknown quality and to financial institutions buying assets with unknown return. Each trader enters the market with specific prior knowledge and observation abilities concerning the characteristics of the goods being traded. This is a particular kind of asymmetric information (adverse selection), famous since the seminal contribution of Akerlof (1970).

General equilibrium models with adverse selection have been developed by Prescott and Townsend (1984a,b), Gale (1992, 1996), Bisin and Gottardi (1999, 2006) and Rustichini and Siconolfi (2008), among others. In these models, agents enter the market having private information about their endowments and preferences in each of the possible states of nature. Here, an alternative formulation is considered. Each agent's private information is described by a partition of the set of commodities, such that

the agent can only distinguish goods that belong to different sets of the partition. This formulation, in the spirit of Akerlof (1970), was proposed by Minelli and Polemarchakis (2000) and Meier et al. (2011).

The distinctive feature of the work of Meier et al. (2011) is the consideration of what they designate as two-sided private information: agents are allowed to have differential information about the goods that the other agents bring to the market (instead of being equally uninformed).¹ This contrasts with what is assumed in all the previous literature. For example, in the model of Dubey et al. (2005), in which sellers of an asset may or may not default on their promises of future payments, all the buyers receive the same payoff (because deliveries are pooled). If one recognizes that some buyers have superior abilities to identify the sellers who are more likely to default, then it becomes essential to study how and to what extent they are able to exploit their informational advantage.

The model of Meier et al. (2011) is intended for the pursuit of such an investigation. A drawback of their formulation is that it only allows for the opening of markets for classes of goods that everyone can distinguish. For example, if there is an agent in the economy that does not distinguish red cherries from green cherries, then the other agents cannot trade red and green cherries at different prices. The existence of a single uninformed buyer

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¹ Agents are assumed to have perfect information about their endowments, and only have differential information about the characteristics of the goods that are brought to the market by the other agents. This is a natural assumption, based on the observation that the owner of a good typically has superior information about its characteristics.

implies that the sellers of red cherries must charge the same price as the sellers of green cherries.²

Here, an alternative framework is proposed. There are markets for each of the goods, which may, therefore, be traded at different prices. Nevertheless, an agent that buys red cherries, and is not able to distinguish red cherries from green cherries, may end up receiving green cherries instead of red cherries (or any mixture of green and red cherries).³ Instrumental to this treatment of trade with adverse selection is the concept of delivery rate, adapted from the work of Dubey et al. (2005). If an agent that buys 10 tons of red cherries receives 2 tons of red cherries and 8 tons of green cherries, the corresponding delivery rates are 0.2 and 0.8. It is assumed that agents take the delivery rates as given. In equilibrium, the anticipated delivery rates must coincide with the actual delivery rates.

As in the model of Prescott and Townsend (1984a,b) and the subsequent literature, we assume that a profit-maximizing firm is responsible for trade intermediation. Taking prices as given, the firm buys the endowments and resells them to the agents. The firm can find it to be in its interest to deliver bundles that are different from those that the agents ordered. In fact, to maximize profits, the firm delivers to each agent the cheapest possible alternative among those that the agent cannot distinguish from the truthful delivery. The firm is able to do this because the abilities to distinguish goods (information partitions of the agents) are commonly known by the agents and by the intermediary firm (all the primitives of the economy are common information). This captures those situations in which sellers are able to figure out whether they are facing an informed or an uninformed buyer.

To sum up, the workings of the economy are summarized as follows. Goods are labeled not only by their physical characteristics, but also by the agent that brings them to the market. There are prices for each of these generalized goods, taken as given by the agents and by the intermediary firm. There are also personalized rates of delivery for each of these generalized goods, chosen by the intermediary firm and taken as given by the agents. An equilibrium is composed by prices, delivery rates, orders and deliveries, such that agents make orders that maximize the utility of the resulting deliveries (given the correctly anticipated delivery rates), which are feasible and maximize the profit of the intermediary firm (among those deliveries that the agents cannot distinguish from the truthful delivery).⁴

The main result of this paper is the existence of equilibrium (Section 2), under very general conditions (the utility functions must be concave and strictly increasing). A characteristic of equilibrium is that agents receive the cheapest bundle among those that they cannot distinguish from truthful delivery, and that the law of one price is verified: different sellers charge the same price for the same good, but may charge different prices for different goods even if these goods are not distinguished by some of the agents (Section 3). To illustrate the main intuitions offered by the model, an example is solved and explained (Section 4). The welfare properties of the model are studied and it is shown that the equilibrium allocation can be Pareto-improved through a system of taxes and subsidies (Section 5). The paper concludes with some remarks (Section 6).

² The differential information of the buyers is modeled as a “picking ability”. All buyers pay the same price, but the informed are able to pick the high quality goods, while the uninformed pick at random.

³ An agent guarantees delivery of one out of a set of possibilities. This is closely related to what was termed as “uncertain delivery” by Correia-da-Silva and Hervés-Beloso (2008, 2009, forthcoming), in a series of papers that study ex-ante trade of contingent goods, with agents having different abilities to verify the occurrence of the exogenous states of nature.

⁴ It would be interesting to study the implications of allowing the intermediary firm to condition trading on quantity limits, as in the work of Dubey and Geanakoplos (2002). We leave this investigation for future work.

2. The model

Consider an exchange economy in which a finite number of agents, $i \in \mathcal{I} = \{1, \dots, I\}$, trade a finite number of goods, $l \in \mathcal{L} = \{1, \dots, L\}$.

To capture the usual context in which the seller has superior information about the quality of the goods that he/she brings to the market, it is useful to consider a generalized notion of a good, incorporating in its description the name of the agent that is endowed with the good. This allows us to study markets in which agents may not have the ability to distinguish good cars from bad cars in general, but are able to observe the quality of their own cars.

We refer to good l that is in the initial endowment of agent i as the generalized good $(l, i) \in \mathcal{L} \times \mathcal{I}$. The initial endowments of agent i , defined in terms of these generalized commodities, $f_i \in \mathbb{R}_+^{\mathcal{L}}$, relate to the usual definition of endowments, $e_i \in \mathbb{R}_+^{\mathcal{L}}$, as follows:

$$f_i \in \mathbb{R}_+^{\mathcal{L}}, \quad \text{with } f_i^{(l,i)} = e_i^l \quad \text{and } f_i^{(l,j)} = 0, \forall l, i, j \neq i.$$

Similarly, the utility functions in terms of these generalized commodities, V_i , can be obtained from the usual utility functions, $U_i : \mathbb{R}_+^{\mathcal{L}} \rightarrow \mathbb{R}$, as follows:

$$V_i : \mathbb{R}_+^{\mathcal{L}} \rightarrow \mathbb{R};$$

$$V_i(x_i) = U_i(z_i), \quad \text{where } z_i^l = \sum_{j \in \mathcal{I}} x_i^{(l,j)}.$$

Agents wish to maximize their utility functions, $V_i(x_i)$, which are continuous, concave and strictly increasing.⁵

Assumption 1 (Preferences). The utility functions, V_i , are continuous, concave and strictly increasing.

Each agent has specific abilities to distinguish the different goods that are traded in the market. These observation abilities are described by a partition of the set of generalized goods, P_i , such that $(l', j') \in P_i(l, j)$ if and only if agent i cannot distinguish good (l', j') from good (l, j) .⁶

The inability to distinguish between two goods, (l, j) and (l', j') , implies that an agent that buys certain quantities of (l, j) and (l', j') , say $y_i^{(l,j)}$ and $y_i^{(l',j')}$, may receive different quantities, $x_i^{(l,j)}$ and $x_i^{(l',j')}$, such that

$$x_i^{(l,j)} + x_i^{(l',j')} = y_i^{(l,j)} + y_i^{(l',j')}.$$

More generally, when buying $y_i = (y_i^{(1,1)}, \dots, y_i^{(1,I)}, y_i^{(2,1)}, \dots, y_i^{(L,I)})$, agent i will receive $x_i = (x_i^{(1,1)}, \dots, x_i^{(1,I)}, x_i^{(2,1)}, \dots, x_i^{(L,I)})$ such that (see Box 1).

The delivery matrix, k_i , is endogenous (equilibrating variable). The delivery matrices that are compatible with the abilities of agent i to distinguish commodities are such that, for each (l, j) ,

$$\sum_{(l', j') \in P_i(l, j)} k_i^{(l', j'), (l, j)} = 1 \quad \text{and}$$

$$k_i^{(l', j'), (l, j)} = 0, \forall (l', j') \notin P_i(l, j).$$

The set of matrices that satisfy these conditions is denoted K_i , and $K = \prod_{i \in \mathcal{I}} K_i$.⁷

⁵ By strictly increasing, it is meant that an increase in consumption of any of the goods is strictly desired by the agents: $x_i \geq x'_i$ and $x_i \neq x'_i$ implies that $V_i(x_i) > V_i(x'_i)$.

⁶ It is assumed that agents are not able to share information. This intends to model situations in which sellers are not able to credibly announce the quality of the goods that they bring to the market (like in the used car market).

⁷ The sum of the elements of a column must be equal to 1, and those elements that correspond to goods that can be distinguished from the good in the diagonal must be equal to 0.

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