

Asymmetric Information

Asymmetric information, as the adjective indicates, refers to situations, in which some agent in a trade possesses information while other agents involved in the same trade do not. This rather self-evident premise has nevertheless revolutionized modern economic thought since the 1970s. Take, for example, two major results in the economics and finance literature, the *first fundamental theorem of welfare economics* and the *Modigliani-Miller theorem*. The first welfare theorem states that in a competitive economy with no externalities, prices would adjust so that the allocation of resources would be *optimal* in the Pareto sense.¹ A key assumption for the theorem to hold is that the characteristics of all products traded on the market should be equally observed by all agents. When such assumption fails to hold, i.e. when information is *asymmetric*, prices are distorted and do not achieve optimality in the allocation of resources. Standard government interventions such as regulation of monopolies to replicate a competitive environment, or fiscal policy to alleviate the effects of externalities, are no more sufficient to restore optimality. Similarly, in the finance literature, the Modigliani-Miller theorem concluded that the value of a firm is independent of its financial structure. The acknowledgment of asymmetric information within organizations shifted the debate on optimal financial structure from fiscal considerations, to the provision of incentives to align the interests of managers and workers with the interests of stakeholders.

When two (or more) individuals are *about to* agree on a trade, and one of them happens to have some information that the other(s) do not have, this situation is referred to as *adverse selection*. Seminal contributions include Akerlof (1970), Spence (1973), and Rothschild and Stiglitz (1976). In 2001, the Nobel Prize in Economic Science was awarded to Akerlof, Spence and Stiglitz “for their analyses of markets with asymmetric information”. Each of the three quoted papers investigates the implications of adverse selection on the product, labor and insurance markets respectively. Akerlof (1970) considers the example of a seller who has private information about the quality of a used car. A buyer would like to acquire a car, but is keen on paying a “fair” price for it, i.e. a price that is consistent with the quality of the car. To make things more concrete, suppose that there are nine different cars, each car having “fair” values, 100\$, 200\$... 900\$ respectively. As the buyer cannot observe quality, owners of low quality cars will always claim they are selling a high-quality product worth 900\$. A fair price will then reflect the average quality of the market, in this case 500\$. However, under such circumstances, sellers whose cars are worth more than 500\$ find such price too low, hence exiting the market. The average price must then drop to 300\$, inducing more exits, and so forth. Consequently, at the exception of worst-quality cars worth 100\$, no seller is willing to sell a car that a buyer is willing to buy! Spence (1973) refers to a similar mechanism when workers “sell” their labor to firms and have private information about their skills, while Rothschild and Stiglitz (1976) analyzes the insurance market in which private

¹ An environment is *competitive*, when the action of one single agent does not affect prices. There is an *externality* in the economy, when the action of one single agent directly affects the welfare of other agents. Finally, an allocation is said to be *Pareto optimal*, if there does not exist any other allocation that makes at least one individual strictly better-off without affecting the welfare of other agents in the economy.

information is instead on the side of the buyer who is better aware of her health condition, or driving skills than the insurer is.

The literature on adverse selection then investigates arrangements that allow segmentation of the market according to unobserved quality, i.e. how insurance companies and banks *screen* their customers with the use of deductibles and collateral requirements (Rothschild and Stiglitz, 1976), sellers *signal* the quality of their products by offering product-warranties to customers, or workers *signal* their ability by getting academic degrees (Spence, 1973), etc. It is important to emphasize that market segmentation does not primarily come from some information inherent to, say, warranties or deductibles, but rather from a *menu of contracts* offered to agents that leads to self-selection, revealing their private information. In the examples mentioned above, such menus would be of the form (low insurance premium; high deductible) or (high insurance premium; low deductible), and in the product market example, of the form (low price, no warranty) or (high price, one-year warranty). Such menus then induce careful drivers to opt for a (low premium; high deductible) contract, while less careful drivers prefer to pay a high premium and face a low deductible in case of accident. Similarly, sellers of high-quality goods will want to charge a high price but offer in exchange a one-year warranty to customers; a policy that low-quality-good sellers are not willing to mimic.

On the other hand, the case in which the information asymmetry occurs *after* an agreement is obtained between individuals, is called *moral hazard*. The framework often used to analyze moral hazard situations is the *principal-agent problem*, whereby one individual – the principal – wants to hire another individual – the agent – to perform a given task. However, once the contract has been signed, the agent can either take an action that is non-observable for the principal (hidden action), or obtain information about some characteristics of the environment that the principal cannot acquire (hidden information). As opposed to the previous case, in which agents were offered a menu of contracts, moral hazard situations imply that every agent is given the same contract; the contract must therefore take into account future information asymmetries, and hence address the *incentives* problem. Mirrlees (1999), Holmström (1979) and Grossman and Hart (1983) were key contributions to this literature.² To illustrate this phenomenon, let's consider the car insurance market developed in Mirrlees (1999): a driver – the agent – wants to buy insurance from an insurance company – the principal. The source of concern is that once the insurance contract is signed, the insurance company cannot observe whether the driver is careful enough.³ Suppose that the insurance company can put in every single car a camera to monitor how the driver behaves. Then, it could convene with the driver that she would henceforth drive carefully (after agreeing on the definition of what “carefully” means). In exchange, the insurance covers all the costs due to any traffic accident. In this hypothetical world of perfect information, such contract would be optimal in that it transfers all uncertainty from risk-averse drivers on to risk-

² Mirrlees (1999) was completed in 1975 but never previously published.

³ Note that this situation differs from the adverse selection case in an important way: in the previous environment, drivers were having some innate driving skills; the purpose of the screening exercise was to give different insurance contracts for each type of drivers. In the present case, for all types of drivers, the objective of the contract is to make them financially accountable for their misbehavior, so to induce careful driving.

neutral insurance companies. However, putting a camera in every car is not (yet) feasible. If insurers keep offering the same contract, drivers are fully insured against risks that are independent of their driving but also against risks arising from their own misbehavior. This would lead to a less careful driving, an increase in the number of accidents and a larger risk-premium. In this situation, drivers are the first to be harmed by such outcome. Thus, a departure from full coverage is desirable to create the incentives to drive carefully. In short, an optimal contract in an environment with moral hazard must tradeoff insurance and the provision of incentives. The application of deductibles, and the prospects of increased insurance premiums following repeated accidents are examples of measures to induce careful driving. Holmström (1979) and Grossman and Hart (1983) made determinant methodological contributions to the understanding and analysis of the principal-agent paradigm.

The principal-agent problem framework is now widely used to address issues ranging from public economics to corporate finance. What is quality control if it is not the alleviation of information asymmetries between management and employees by making actions observable, or more precisely contractible? Stock-options, salaries paid in cash and in stocks, merit-based salary increases, are examples of instruments that aim at providing the right incentives to constituencies of an organization, aligning their own objectives with the objectives of stakeholders. An augmented version of the principal-agent problem can, for example, involve several agents: a seller (the principal) wants to sell a good to several buyers (the agents), but does not have information on how much buyers are willing to pay for the good; the design of the appropriate contract in this particular environment is nothing less than the starting point of the theory of auctions. Another modification could consist of considering one agent but several principals. Such *common agency* framework is useful to analyze a large set of situations including voters choosing their representatives, producers selling their goods through intermediaries, or even parents educating children!

Asymmetric information considerations have encompassed all fields of economics and finance. Recognizing that the presence of information asymmetries could be the source of large economic inefficiencies, focus is put on the characterization of mechanisms or institutions that could alleviate the information asymmetry. The economics of information has opened new venues for research and policy in the social sciences, which surely contributed to a better understanding and management of our economic and social environment.

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