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# Supply and demand law under limited information

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## Abstract

We present a model for the supply-demand law with quality and limited information capability. We postulate that imperfect information permeates in almost all economic transactions to varying degrees. Through a simple model we outline a research agenda that re-examines many standard issues in economics. Our analysis shows that whereas imperfect information can be improved, it leads to new uncertainties so that the perfect information limit can never be reached. As a corollary neoclassical perfect equilibrium can never be attained.

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## 1. Introduction

The standard supply and demand law in economics relates price and quantity; equilibrium is achieved when the consumers' downward demand curve and the firm's upward supply curve intersect. When Alfred Marshall more than a century ago first systematically studied the law and its applications, he used it merely as a convenient technical device [1]. Neoclassical economics since has made it the most important theoretical pillar. The core content of the supply–demand law has remained the same over the past century, in which the world economy has undergone dramatic transitions. However, products in the modern economy are much more complex a

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century later, and hence the capability to ascertain their quality from the consumers' side has paramount importance in purchase decisions.

In the days of Mill and Ricardo there were already vocal critiques by well-known thinkers like Charles Babbage [2] and Cliffe Leslie [3], questioning the assumption of classical economics of perfect information capability. Fast forward to 1970, Akerlof's work [4] on the 'Lemons Problem' clearly pointed out that strong information asymmetry about the product's quality can lead to 'market failures'. Mutually beneficial deals between sellers and buyers may not happen, if the buyers cannot reliably determine the quality of the objects under transaction. Despite much current research on many other interesting areas of Information Asymmetry [5,6], the fundamental insight of Akerlof is not yet adequately incorporated into mainstream economics. In standard textbooks one encounters 'price' and 'quantity', rarely 'quality' is adequately modeled.

In this work we shall consider an alternative version of the supply–demand law, with *quality* and *imperfect information* as the key ingredients. We consider a continuously varying degree of imperfect information, with the Akerlof 'Lemons Problem' as a special, extreme case. We posit that in all economic transactions, some degree of information imperfection always exists. In the modern economy, especially in affluent societies, the conduct of daily life necessitates a myriad of products and services, which become ever more complex in their visible and invisible features. On the other hand a consumer as a 'generalist' [18] in consumption cannot possibly spend sufficient time and resources to determine what she is buying each time. Our position is anticipated by Kenneth Arrow [7]: "Market failure is not absolute; it is better to consider a broader category, that of transaction costs, which in general impede and in particular cases block the formation of markets".

## 2. Quality and information

### 2.1. Demand side

Let us denote by  $Q$  the quality of a product (to be distinguished from the usual notation quantity—hereafter denoted by  $q$ ); by  $1/\varepsilon$  information capability for a consumer to see through the quality.  $\varepsilon = \infty$  implies she is totally ignorant of the product's quality;  $\varepsilon = 0$ , she has perfect clairvoyance, i.e., no errors made. The information capability depends on her ability and effort of detecting the quality as well as on the producer's marketing strategies of either facilitating or hindering such detection. Thus  $\varepsilon$ , a relational parameter, depends on both sides rather than consumers' innate capability alone. A consumer may be good at ascertaining quality for one type of product while being ignorant for many other types.  $\varepsilon$  can also serve as a measure of the severity of information asymmetry.

Note that quality  $Q$  cannot be a priori measured in monetary terms: it must be priced through market transactions. Price  $p$  and quality  $Q$  should be treated as independent variables. From daily economic life we can observe that quality and price are always more or less correlated, sometimes to an astonishing degree. This

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