



Asymmetric information and overinvestment in quality



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ABSTRACT

In a standard adverse selection world, asymmetric information about product quality leads to quality deterioration in the market. Suppose that a higher investment level makes the realization of high quality more likely. Then, if consumers observe the investment (but not the realization of product quality) before purchase, they can infer the probability distribution of high and low quality that may be put on the market. We uncover two effects that may lead the firm to overinvest in quality compared to a market with full information: first, an adverse selection effect according to which a sufficiently large investment can avoid adverse selection and, second, an efficiency effect according to which a larger investment reduces the probability of having in the market low quality products that are not socially valuable.

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1. Introduction

We examine the effects of asymmetric information on a firm's incentive to invest in the quality of its product. Asymmetric information prevails because consumers cannot ascertain the quality of the product before they buy it. Asymmetric information may then lead to adverse selection because a firm upon learning its type has the option to exit the market. Prior to learning its quality, the firm decides on a risky investment: a higher investment increases the probability that product quality is high. Consumers can observe the investment level and thereby obtain information about the expected quality in the market. Using a simple model, we show that in such a situation, firms might end up investing *more* in quality under asymmetric information than under full information. However, if it is very costly to increase the probability that product quality is high, our model features the standard underinvestment result under asymmetric information.

Inspired by previous work that alludes to the adverse selection problem arising from an unmodeled investment in quality (see, e.g., Milgrom and Roberts, 1986), we explicitly model that the level of the investment affects the probability distribution over quality and we provide two simple arguments that support overinvestment in quality. First, if it is sufficiently likely that the firm's quality is low, the expected willingness to pay of a consumer is less than the marginal cost of high quality (which is larger than the cost of low quality). In such a situation the high-quality firm would exit the market so that there is adverse selection. At the investment stage, the firm foresees this problem: it can overinvest compared to the full information benchmark to avoid adverse selection — we call this effect the *adverse selection effect*. Second, since a larger

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investment gives evidence of a probability distribution with a higher probability of high quality, incentives to invest are stronger under asymmetric information if low-quality production is not socially valuable, that is, if the unit cost of production exceeds the willingness-to-pay for this unit. Overinvestment (relative to full information, where only valuable products are offered in the market) here serves to limit the probability of socially non-valuable products being sold in the market – we call this effect the *efficiency effect*. Each effect on its own may lead to overinvestment under asymmetric information relative to the full information benchmark (which, in our benchmark model, implements the socially efficient allocation).

Key requisites for our result are that (i) the firm incurs a higher opportunity cost selling high than low quality and (ii) consumers are able to draw inferences from investment levels on expected product quality. We postulate that higher quality comes with a (weakly) higher opportunity cost to produce and deliver the product. While the opposite may hold true in some instances, we consider the present setting to be more common. In particular, if the investment has resulted in a high-quality product, its production may require more costly inputs, e.g., more skilled workers. Alternatively, as we briefly explore in the concluding section, higher quality may simply increase the value of the outside option, which makes selling the product in the market under consideration more costly for the firm.

Consumers can be informed about certain business practices and about the investments in certain inputs or technologies. Concerning business practices, the type of investment we have in mind can be exemplified by a firm's effort to meet standards for quality management systems, such as ISO 9000. The ISO 9000 certification does not guarantee the quality of end products and services; rather, it certifies that consistent business processes are being applied. That is, it proves that the firm (actually, any type of organization) has put in place the necessary processes (i.e., a quality management system) "to fulfill the customer's quality requirements, and applicable regulatory requirements, while aiming to enhance customer satisfaction, and achieve continual improvement of its performance in pursuit of these objectives."¹ Cole (1998, p. 68) confirms our view by suggesting that firms may make ISO 9000 "their primary instrument for signaling quality to their customers."² ISO 9000 thus enables a firm to convince consumers that the probability of a failure is low; yet, it cannot exclude the possibility of a failure and thus applying ISO 9000 does not constitute a minimum standard on product quality. Our analysis directly applies if consumers not only observe the certificate, but also the underlying efforts to comply with the standard, presuming that these efforts positively affect the likelihood that the underlying product is of high quality.

Para-pharmaceutical companies provide information about their input in research and development for a particular dermo-cosmetic or nutritional supplement, apparently to make consumers (correctly) believe that their product is likely to be successful (and thus justify high margins). Investments in R&D are also communicated in the cosmetics industry. For instance, the leading company, L'Oréal, emphasizes in its advertisement campaigns the large number of patents it files every year (over 600 in 2011) and how much it invests in cosmetic and dermatological research (3% of sales or 721 million Euros in 2011), arguably to convince consumers of its commitment to market high-quality products. Producers of wines, organic food and other food products invest in production processes (e.g., the traditional method in the production of sparkling wines) and inform consumers about these investments with the idea that, on average, the adoption of such processes leads to better products. This information is often transmitted by the use of certain labels provided by producer organizations that guarantee specific production processes and inputs. Furthermore, for tax advisors, financial advisors, personal advisors, private consultants, osteopaths, etc., degrees and diplomas play an important role to inform clients about the undertaken educational investments, which tend to have stochastic outcomes.

Concerning information about inputs, we note that in various industries products consist of a collection of inputs of uncertain quality. Let us take a particularly simple view on how product quality is determined: suppose that consumers only care about price and the probability that the product is experienced to be of high quality; this probability is determined by the share of high-quality inputs. According to this view, the investment decision refers to the decision to which extent to procure high-quality components. Then by advertising the brands of some of the inputs, the firm informs consumers that the product's overall performance is likely to be good.³ Examples abound: equipment manufacturers use certified components (e.g., Leica lenses in optical equipment); bike manufacturers advertise the components produced, e.g., by Shimano; Hollywood studios hire well-liked actors partly with the idea that these actors lead to better movies on average. Presuming that better actors make it more likely that consumers enjoy the movie, our theory suggests that studios overinvest in these well-liked actors when the adverse selection effect comes into play (even ignoring the competition at the box office).

While there is an abundant economic literature on quality in asymmetric information situations, we are not aware of work that uncovers the adverse selection and efficiency effects described above. This literature starts with Akerlof's (1970)

¹ Taken from www.iso.org (ISO 9000. *Understanding the basics*).

² However, firms may also seek certification simply in compliance with requirements of major customers or regulators. To disentangle the relative importance of these two motivations, Anderson et al. (1999) estimate a probit model of ISO 9000 certification. They show that the "signaling" motivation is indeed important: the desirability of communicating quality outcomes to external parties provides incremental explanatory power for the certification decision (even after including compliance motivations for seeking certification). Quality management systems seem thus to correspond to the type of investments we refer to in our model.

³ According to this view, there is no signaling taking place. Signaling motives can be an alternative reason for the use of certified inputs if they are complements to each other.

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