



Do sellers exploit biased beliefs of buyers? An experiment [☆]

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ABSTRACT

I study experimental markets in which sellers interact with buyers who have biased beliefs about characteristics of the product sold. I examine whether such buyers can be exploited by sellers through the use of specifically designed pricing structures. Theoretically, I show that a necessary condition for exploitation is consumer naiveté about their belief bias, otherwise they infer their biased beliefs from the sellers' actions. My main experimental result establishes that whether exploitation arises depends on how difficult it is for buyers to make such inferences. When sellers can only make take-it-or-leave-it offers, no exploitation arises. If, however, contracts are agreed upon by bilateral bargaining, sellers earn higher profits compared to the case with unbiased beliefs. I present evidence that in the former case buyers anticipate and prevent exploitation. In the latter case, the richer interaction structure makes it harder for buyers to infer the sellers' incentives, leading to exploitation.

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1. Introduction

When purchasing a product or signing up for a service, a consumer needs to form an accurate assessment of the product characteristics, contractual terms, or his own predicted usage to find the best deal available. An increasingly large literature documents that consumers often struggle with this, and instead hold *biased beliefs* about important aspects of their environment. For example, consumers may neglect or discount the relevance of add-on charges such as shipping costs (Hossain and Morgan, 2006), underestimate borrowing costs on credit cards (Ausubel, 1991), or misperceive future energy costs for cars (Allcott, 2013). Also, consumers may be biased about their ability to avoid overdraft penalties on bank accounts (Stango and Zinman, 2014), unable to accurately forecast their mobile phone usage (Grubb and Osborne, 2015), or their likelihood of exercising (DellaVigna and Malmendier, 2006).

An important question for competition authorities and regulators is whether and to what extent firms will exploit these biases by designing contracts that directly cater to these biases. Models in behavioral industrial organization have been developed to show how a number of real-world pricing strategies by firms could be explained by the presence of consumers with biased beliefs (see Spiegel, 2011 and Köszegi, 2014, for comprehensive overviews). For example, DellaVigna and Malmendier (2004) show how flat rate tariffs for gym memberships can be thought of as exploiting consumers' mistaken belief

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that they will exercise more than they actually do.¹ Grubb (2009) shows how three-part tariffs for mobile phone plans can be understood as the firms' response to consumers having wrong beliefs about their calling behavior.²

This paper uses laboratory experiments to explore what effect behavioral biases have on market outcomes. Unlike the aforementioned studies, the controlled environment of the lab allows me to isolate the effect of consumers' biased beliefs on the firms' pricing strategies and their profits. Moreover, I can directly manipulate the degree of the belief bias across the experimental conditions. Hence, I examine whether—as suggested by the literature cited in the previous paragraph—buyers indeed suffer from their biased beliefs through higher prices.

The basic setup of the experiment is best illustrated through a simple example. Consider a (very stylized) version of a credit card market. A consumer pays a monthly fee for using a credit card, but will potentially incur a variety of add-on costs, such as late payment fees while using his card. If buyers underestimate how likely it is that they incur such add-on fees, sellers can sell products with low base prices but high add-on fees. To buyers with biased beliefs, such offers seem more attractive than they actually are.

The experiment seeks to analyze under what conditions buyers fall prey to such exploitative offers and when, despite their wrong perceptions of the market environment, there are no adverse effects on their welfare. In particular, I show theoretically that the strategic sophistication of the buyer regarding his belief bias is important. To see why, consider that in order for firms to profitably use contracts with high add-on fees, buyers not only need to underestimate the likelihood that they incur the add-on fee, they also need to be strategically naive about the sellers' incentives. That is, they cannot become suspicious when being offered contracts with high add-on fees, because otherwise this would lead them to question their beliefs.³ Hence, if consumers are sophisticated in the sense that they entertain the possibility of biased beliefs, contracts with high fees fail to be profitable for sellers and have no negative effect on buyers.⁴

To vary how difficult it is for sophisticated buyers to make correct inferences, I consider two different types of markets. In the first experiment, a buyer only receives one single offer from a seller in each period. In the second, I employ a bilateral double auction (or, equivalently, unstructured bargaining) in which both buyers and sellers can make offers. This comparison is important because the feasibility of exploitation is likely to be affected by the strategic environment. In particular, for buyer sophistication to play a role, the buyer needs to be able to make inferences based on the seller's behavior. If a seller only makes one binding offer, as in the first experiment, this is relatively easy. On the other hand, if a seller can make multiple offers and—by observing offers made by the buyer—can respond to the buyer's offers, inference is much harder.

The results support the theoretical prediction that whether exploitation arises depends on buyer sophistication. When sellers only make take-it-or-leave-it offers, they do not earn higher profits when interacting with buyers who have biased beliefs compared to the case where beliefs are unbiased. A more detailed analysis of behavior suggests that this is due to buyer sophistication as described above. In particular, I show that buyers with biased beliefs systematically reject exploitative offers. In the bilateral offers experiment, however, I do find a sizable exploitation effect. Once buyers have biased beliefs, sellers earn about 7% more compared to the unbiased benchmark. This suggests that the market characteristics are important for the emergence of exploitation. When sellers' incentives are more opaque, buyers are not sophisticated enough to prevent exploitation.

The rest of the paper is structured as follows. The next section provides a general framework for the role of biased beliefs in strategic settings. Section 3 describes the design and predictions of the single offer experiment in more detail and I present the corresponding results in section 4. Analogously, sections 5 and 6, respectively, present the bilateral offers experiment and its results, while in section 7 I relate my findings to the existing literature. Section 8 concludes.

2. Theory

This section introduces a simple trade environment with one buyer and one seller (both assumed to be risk neutral) and analyzes how differences in beliefs may affect pricing strategies and profits. Importantly, this section focuses on how buyers that are naive about their belief bias differ from sophisticated buyers that are aware of the possibility that their beliefs might be wrong.

Suppose that there is a seller and a buyer who, by agreeing on a price p , can trade a product which the buyer values at x . If buyer and seller do not agree on a mutually acceptable transfer, they receive their respective outside options $y \geq 0$. I assume that $x > y$, so trade is always efficient. I define \hat{p} as the price that buyer and seller would agree upon, absent any possibilities to write more complicated contracts. In this section, I do not consider the specific type of mechanism that

¹ Eliaz and Spiegler (2006) consider more generally the incentives of sellers to screen consumers according to their time-inconsistency. They use their model to provide explanations for pricing practices such as credit cards with low "teaser rates" followed by higher standard rates aimed at consumers who mis-predict their borrowing behavior.

² These papers mainly concentrate on the incentives of a monopolist to price optimally in the presence of consumer biases, which is also the focus of my paper. In competitive markets, Gabaix and Laibson (2006) and Armstrong and Vickers (2012) analyze settings where consumers under-appreciate add-on fees, and Heidhues and Köszegi (2010) consider borrowers with naive beliefs about their loan-repayment probability.

³ The alternative assumption is that they are aware of the belief difference, but maintain that their belief, rather than the firm's is the correct one. This "agreeing to disagree" behavior can also be thought of as a manifestation of overconfidence in one's own belief.

⁴ In fact, this result links to work on "No-Trade Theorems" (Milgrom and Stokey, 1982; Tirole, 1982) that provide theoretical arguments as to why there should be no mutually beneficial trade based on differences in private information. As I will show in section 2, when buyers are sophisticated, a similar logic applies to the (possibly) exploitative part of the offered contract.

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