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Introduction: Firms with Behavioral Biases

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Traditional neoclassical models assume that all producers, consumers, and input suppliers are perfectly rational, while behavioral economics abandons this assumption as traditional models often fail to provide accurate predictions. The contributions of behavioral economics have had a dramatic effect on all fields of economics (Grubb 2015a).

These contributions have led to a countless number of topics in behavioral industrial organization, as described in "Ellison's Matrix of Topics." Ellison (2006, 28) lays out the matrix as follows:

> Think of the set of behavioral biases as the column headings, and put all of the standard models in IO as the row headings: how will a monopolist price, how will a monopolist selling durable goods price, how will a monopolist price discriminate, how will oligopolists selling differentiated goods set prices, how will some action be distorted to deter or accommodate entry, etc. It takes little knowledge or imagination to come up with literally thousands of paper topics: Tirole's (1988) text has hundreds of IO models, each of which could be combined with dozens of behavioral-bias models.

Much of the work in this "Matrix of Topics" assumes that consumers suffer from cognitive weaknesses but that firms are fully rational entities that maximize the present value of current and future profits without error.[1] These studies show how firms exploit the weaknesses and biases of consumers in order to convert consumer

[1] See Armstrong and Huck (2010) for a review of the early literature that question whether firms maximize profits. Of the 15 articles on behavioral industrial organization in Tremblay et al. (2018), 12 assume that firms maximize profits. For further discussion of behavioral firms, see Thaler (2018).

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surplus into producer surplus. This is the general theme of the series of papers in a recent special issue of the *Review of Industrial Organization* (Armstrong 2015; Bailey 2015; Eliaz and Spiegler 2015; Grubb 2015b, c; Heidhues and Kőszegi 2015).

The papers in the current special issue complement those in the 2015 special issue by considering settings where firms—or in other words, the managers and employees that constitute firms—suffer from behavioral biases that are due to the complexity of tasks, imperfect information, or non-profit motives. The authors of these papers are among the leaders in the field of behavioral industrial organization. The papers are ordered for readers who are unfamiliar with behavioral economics and the theory of the firm. Survey and theoretical papers come first, followed by papers that are primarily applied and empirical.

The first paper by Aguirregabiria and Jeon offers an overview of the burgeoning literature on firms' biased beliefs about market conditions (demand, cost, competitor strategy, etc.). In the traditional, full-rationality benchmark, firms maximize their expected profits given their beliefs, and these beliefs coincide with the actual probability distributions of market primitives. In the real world, firms display a significant amount of heterogeneity in their ability and cost for collecting and processing information, and they are also highly heterogeneous in their beliefs and their learning processes.

This survey reviews and discusses recent work that relaxes the rational expectations assumption; the paper covers models, empirical frameworks, and notable empirical findings. Models reviewed are extensive, including: the rational expectations model; the Bayesian learning model; the adaptive learning model; the reinforcement learning model; and more. The review of empirical work focuses on how researchers use data on choices, costs, and elicited beliefs to identify the biases in firm beliefs. Aguirregabiria and Jeon then use multiple examples to illustrate that accounting for firms' biased beliefs enables us to better understand firm behavior and is crucial for us to assess the effectiveness of public policies.

The second paper by Dixon analyzes how an inability to optimize perfectly and a preference for simplicity affect firm behavior and long-run survivability. He shows how bounded rationality can be thought of as an epsilon-maximizing process, in which an action is acceptable or satisfactory as long as it produces a payoff that is sufficiently close to the optimum: no more than epsilon away. Applying this theory to a dynamic setting, Dixon demonstrates that changes in economic conditions can lead a firm to engage in erratic price behavior over time. Inertia or price rigidity can occur if there are costs that are associated with price changes or if firms have a preference for simplicity. Finally, he discusses the implication of epsilon-maximizing behavior for the likelihood that a firm will survive in the long run.

The first two papers of this special issue question the ability of firms to form rational expectation and to pursue profit maximization, while the next three document behavioral biases that are demonstrated by decision makers of firms in the real world. Although they have different contexts and consider different questions, the unifying theme of the three empirical papers that come next is that they recognize that the firm "black box" is composed of different groups of human beings, who are subject to the usual behavioral biases and inclinations as they interact collectively to make decisions on all aspects of a firm's operation. Basically, firms with behavioral biases are in fact human biases within the boundary of the firm.

The third paper by Englmaier and Leider considers whether and how firms can use gifts to incentivize workers. The idea is that workers may exert more effort in reciprocation for managerial generosity. This is an alternative to the usual means of output-linked compensation schemes, with the insight that workers may be motivated by reciprocity when allocating effort. Conducting a field experiment, Englmaier and Leider find this gift-exchange incentive scheme works only when the manager benefits strongly from workers' high effort and when workers have personalities that respond positively to the manager's gift. Englmaier and Leider argue that the effectiveness of a gift-exchange incentive scheme is highly dependent on the attributes of the task, the environment, and the parties who are involved: in this case, both managers and workers.

The fourth paper by Liu, Wei, and Xiao uses data from a leading online lending platform—Prosper.com—to study the market response to Prosper's major change in its pricing mechanism. Initially, the interest rates on loans that Prosper listed on its platform closely reflected a loan's default risk: the likelihood of default. With the switch, Prosper pooled loans into several platform-assigned rating grades, but each grade included loans that varied considerably in their default risk.

The authors' work shows that lenders reacted to this opportunity for "cherry-picking" by weighting their investment portfolios toward listings that were at the low end of the risk spectrum of each rating grade. This reaction happened gradually—and at different speeds for different investors—and slowed over a period of 16–17 months. The platform finally corrected this mispricing problem and switched again to a much finer pricing grade, which better aligned interest rates with default risk.

This paper not only highlights a situation where the investors (firms and individuals) displayed heterogeneity in decision-making but also where the market-maker/platform demonstrated a lack of perfect foresight. It took a significant period of time for both the investors and the platform to adjust their strategies to a new market environment. The documentation of these facts reveals how market participants respond to a shock to the marketplace and how the market evolves to a new long-run equilibrium.

In the final paper, F.M. Scherer discusses corporate behavior when there is considerable separation between ownership and managerial control. This separation—coupled with imperfect competition—gives chief executive officers (CEOs) substantial discretion to pursue goals that need not maximize shareholder wealth. For example, some may strive to be good citizens by choosing environmentally friendly production methods and providing fair compensation to employees. Others may pursue more narrowly selfish goals that enhance their own power, prestige, and income.

Scherer's work shows that compensation to CEOs of major corporations has dramatically risen over the last 6 decades. Compensation of top managers was 13 times that of average company employees in the 1950s but is over 200 times today. Scherer argues that the growth in managerial discretion and a revision in the federal tax law in 1993 are likely reasons for this dramatic rise in the relative compensation of top managers.

The papers in this special issue demonstrate how insights from behavioral economics contribute to our understanding of: how firms are organized and structured; how they function in the chaotic, complex real world; how they compete with each other; and how their actions shape market outcomes and industry performances.

Comparatively little research has thus far been done as we face the vast potential of the intersection of industrial organization and behavioral economics.

We hope that these papers—individually and together—serve as a call to researchers to step into this still thinly populated research area.

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