



Confirmation bias with motivated beliefs [☆]

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ARTICLE INFO

Article history:

Received 3 May 2015

Available online 21 March 2017

JEL classification:

C91

D03

D80

G02

Keywords:

Confirmation bias

Motivated beliefs

Bayesian updating

Experiment

ABSTRACT

We investigate whether the confirmation bias is mitigated in signal-extraction environments by outside financial interests. We include a background strategic consideration leading to ‘motivated beliefs’ for people in one role, as they receive higher equilibrium payoffs in a background game in one of two states, while people in the other role receive the same equilibrium payoffs in both. We find systematic differences in beliefs and our results suggest that players with motivated beliefs deviate less from Bayesian updating. However, such players still exhibit a confirmation bias in that they place additional weight on confirming information, in contrast to Bayesians.

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1. Introduction

Confirmation bias (CB), defined as an agent’s tendency to seek, interpret and use evidence in a manner biased toward confirming her existing beliefs or hypotheses, presents a particular challenge to economic models that employ Bayes’ law. In the event that information arrives as costless signals, such an agent will be non-Bayesian in that she will update beliefs in a manner biased in the direction of her original belief, leading to systematic errors in judgment. That is, when the CB is viewed as a signal-extraction issue, she gives more weight to signals that confirm her initial beliefs than to other signals.¹ We ask if background economic pressures that increase the attention an agent pays to the updating exercise can mitigate the CB in a signal-extraction environment. Our focus on this particular bias arises from theoretical considerations that suggest that the bias is particularly pernicious in not allowing for learning to occur.² If belief biases persist despite the existence of background economic pressures to pay attention and learn, we are left with the prediction that ‘animal spirits’ and ‘confidence shocks’ can lead economic behavior away from its pure classical foundations for long periods of time.

Our empirical investigation is best suited to an experimental environment in which incentives to update correctly and to pay attention to the task at hand can be cleanly designed and manipulated. We conduct laboratory experiments to

[☆] We thank seminar participants at the Paris School of Economics and New York University (Abu Dhabi), Sheryl Ball, Catherine Eckel, David Grether, Kyle Hyndman, Dan Levin, Gilles Saint-Paul, Andrew Schotter, Mariya Tsyglakova, Jonathan Rogers and Leeat Yariv for invaluable help, comments and feedback. Kristzian Kovacs provided excellent research assistance. The usual disclaimer applies.

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¹ Note that this approach abstracts away from the possibility that the individual has a preference for a particular state or states of the world. It is only the belief that one state is more likely that drives the asymmetric updating that is the hallmark of the confirmation bias.

² We discuss below the formal literature that suggests a lack of learning due to the CB.

investigate this question, since field environments are noisy and present considerable difficulties in testing for the presence of CB. Such tests would have to confront a multitude of confounding factors. While there is some debate about the empirical validity of laboratory data (see [Charness and Kuhn, 2011](#) for a more in-depth discussion of this issue), we suspect that any effect that we identify is likely to reflect a lower bound, as laboratory experimental environments are typically much more transparent than field environments.

Three models of beliefs and actions point out the potential for the CB to persist in economic decision-making. [Rabin and Schrag \(1999\)](#) show that someone with this bias can believe in an incorrect hypothesis even with an infinite amount of information, thereby limiting learning in signal-extraction environments.³ [Yariv \(2005\)](#) suggests a model of preferences over beliefs such that the CB can arise from a taste for consistency. In her model, individuals are inclined to interpret new evidence in ways that confirm their pre-existing beliefs; furthermore, they tend to change their beliefs to enhance the desirability of their past actions. Finally, [Wilson \(2014\)](#) models the decision-maker as being constrained by a finite memory capacity. Specifically, she must summarize all signals into one of finitely many memory states (information sets), coarsening Bayes rule into a finite transition rule in response to new information. Wilson finds that when one has a strong prior bias in favor of one (of two) states of the world, there is stickiness with respect to movement away from this prior. Thus two individuals with different priors may optimally move in opposite directions upon seeing the same information, each growing more convinced that her initial view is correct.

Even if one were to put theory aside, there is still a great deal of economic relevance for the CB in the field. Applications to financial markets are clear; [Pouget et al. \(2016\)](#) apply the [Rabin and Schrag \(1999\)](#) model to an asset-pricing environment and find that the bias may explain characteristics of financial markets such as excess volatility and momentum trading. Confirmation bias can lead to polarization of opinion and the persistence of discredited beliefs. People in a position of authority (e.g. teachers) evaluating their charges (e.g. students) may misread performance signals as supporting initial impressions, a bias that when extended to a context involving stereotypes can lead to sub-optimal decisions. Professionals such as medical researchers may misinterpret data as supporting hypotheses; [Pines \(2006\)](#) notes the relevance of the bias in emergency care leading to inaccurate diagnoses and inappropriate actions. More speculatively, the CB may even impact mental health.⁴

Given the various models that in some way deal with the bias and its relevance to field environments, what of our question? In this paper we pursue evidence of the CB in otherwise classic updating environments in which an additional consideration leads participants in one of two roles to prefer one of two states; however no action can be taken to realize a particular state of the world. Specifically, in our environments subjects receive signals with replacement about one of two states of the world. At the end of a sequence of signals the state of the world is revealed to subjects.

Our key innovation is to introduce background considerations, both strategic and non-strategic, that form our experimental conditions and lead people in one of two roles to have a preference for a state of the world. We investigate whether and how these induced preferences affect updating behavior and the presence of the CB by making comparisons to those who do not have such motivations. The design therefore induces various types of background economic pressures that increase the attention that an agent pays to the updating exercise. Whether or not the two conditions enhance or attenuate the CB is of course an empirical question. While a form of the CB has been documented with individual non-strategic decisions, many (or most) evaluations in the field are embedded in strategic environments; thus, it is important to test how such background considerations affects this decision error. We are unaware of any previous work involving the CB in a strategic environment, or with any form of what we term ‘motivated beliefs’ (which could also apply with pure individual decision-making).⁵

As mentioned, we make use of a signal-extraction task in which people are shown whether a black or a white ball has been drawn from a container. The task consists of reporting which of two states is more likely; in one case there are seven black balls and three white balls in a container, while these numbers are reversed in the other case. Participants observe a sequence of six draws; after each draw, they state the likelihood that a particular state has been realized.

After the end of this sequence, the true state is revealed and (in our Strategic condition) randomly-selected pairs of people play one of two binary matrix games; which matrix is in force depends on which state has manifested. After receiving each signal, one makes incentivized guesses as to the likelihood that one state or the other has been realized, knowing that one will play the corresponding matrix game after the signal sequence has been realized and the true state of the world revealed. Those individuals in the “Odd” role receive the same equilibrium payoff in both games, while those individuals in the “Even” role receive a higher equilibrium payoff in one of the two games. In our Non-Strategic condition we replace the matrix games with fixed payoffs such that subjects in the Even role receive a higher fixed payoff in one state versus another, but those in the Odd role receive the same fixed payoff regardless of which state has manifested.

One can imagine at least three possible outcomes *ex ante*. First, there is the null hypothesis that the background environment has no effect on updating behavior across experimental conditions. Second, the strategic element in the Strategic condition could serve to *exacerbate* updating errors for the interested party, particularly when the observed draws favor her

³ They model the bias as resulting from a particular signal-extraction procedure in which a person will sometimes “psychologically misread” a signal as the opposite signal due to her original beliefs.

⁴ For example, [Beck \(1972\)](#) argues that biased information processing is a factor in depression; he developed cognitive behavioral therapy to treat depression.

⁵ There is an important literature (e.g., [Eil and Rao, 2011](#)) that examines ego-relevant beliefs. A key feature of our environment is that beliefs are influenced by payoff considerations such that differential payoffs attached to states of the world are financially *unrelated* to updating behavior.

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