Economics Letters 152 (2017) 96–99

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

# Desirability and information processing: An experimental study

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## HIGHLIGHTS

- Biased overweighting of good news relative to bad news is tested in the lab.
- News are related to financially desirable but ego-irrelevant events.
- No evidence of asymmetric updating in favor of good or bad news is found.

ARTICLE INFO

*Article history:*
Received 14 September 2016
Received in revised form 28 December 2016
Accepted 13 January 2017
Available online 16 January 2017

*JEL classification:*
C9
D8

*Keywords:*
Optimism
Wishful thinking
Belief updating
Bayes' rule

ABSTRACT

I study, in an experimental setting, how individuals process news regarding the likelihood of an event that is desirable, but not ego-relevant. I hypothesize that individuals biasedly favor good news over bad news, but find no support for this hypothesis.



## 1. Introduction

A better understanding of how individuals form and update their beliefs is important if we want to understand how they make choices. In standard models of decision making under uncertainty, a decision maker updates her beliefs using Bayes' rule whenever new information arrives. Then, using those beliefs, she makes choices that maximize her expected utility. Whether news are good or bad does not play a role in how beliefs are updated. All that matters is their informativeness. My hypothesis in this paper is that individuals, when updating their beliefs, favor news that support a desirable event (good news) over news that contradict that event (bad news), deviating from the symmetry prescribed by Bayes' rule. I test this hypothesis using experimental data. Since many decision situations involve updating beliefs about desirable events, this is an issue that deserves attention.[1]

Experimental research has found that individuals biasedly process good and bad news regarding their relative performance in tests. Eil and Rao (2011) and Möbius et al. (2014) provide evidence in favor of relative overweighting of good news, while Ertac (2011) finds asymmetric updating in favor of bad news. As opposed to these papers were events are both ego-relevant and desirable (one would like to perform well relative to others), in my experiment desirability is exogenously induced and is unrelated to participants' abilities. Thus, this paper also provides evidence on the importance of information being ego-relevant in previous work.

Sharot et al. (2011) and Wiswall and Zafar (2015) also find evidence of asymmetric updating in favor of good news, but in contexts where individuals are able to make choices that could affect the chance of the future event occurring. Sharot et al. (2011) provide their subjects with information about the chance of facing different adverse events, while Wiswall and Zafar (2015) provide their subjects with information about the distribution of earnings conditional on a subjects' chosen major. Even though they examine belief updating in very important contexts, it is possible that asymmetric updating occurred because individuals were optimistic about their ability to make choices that would lead

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[1] Consider, for example, a manager whose task is to choose a level of production based on information that he receives about future demand. He receives a mix of equally informative good and bad news supporting an increase in demand, a desirable event. Will the manager optimistically update his beliefs and increase production?

http://dx.doi.org/10.1016/j.econlet.2017.01.012

to better outcomes. In the design that I present here, individuals cannot exert any influence on the final outcome.

Closest to this paper are Coutts (2016) and Barron (2016), who also study belief updating regarding events with financial stakes. Neither of them find support for the asymmetric-updating hypothesis, which is consistent with the results that I present here. Coutts (2016) considers desirable events that are relatively unlikely and, as a consequence, good news are relatively uncommon. In this paper, the desirable event has a considerably greater chance of occurring (50%) and signals that support the desirable event are overall equally frequent. Barron (2016) exogenously varies priors about the desirable event, while in this paper, there is only one exogenously given prior. There are, however, two important features in this paper that complement (Barron, 2016). First, randomization is more transparent. The random selection of an event is always done mechanically and in such a way that the realized event is desirable for half of the participants and undesirable for the other half. This is done to avoid suspicion about the experimenter's intentions and a potential effect on how participants form and update beliefs. Barron (2016) randomizes using a computer program. Second, in Barron (2016), subjects basically face a series of lotteries over two events (one of which is desirable) and then receive for each lottery, signals regarding the realized event. However, only one of those lotteries is randomly chosen to be the relevant lottery in terms of payoffs. Thus, the unconditional probability of a particular "desirable" event being payoff-relevant is relatively small, which may diminish the saliency of its desirability. In this paper the desirable event has a 50% chance of occurring.

## 2. Experimental design

### *2.1. Basic features*

All subjects taking part in the experiment were exogenously endowed with a stake in one of two possible states of the world. The experiment was implemented as follows:

At the beginning of the experiment, participants were shown a box containing a marked ball and a blank ball. Then, the experimenter randomly selected one ball from this box and placed it in another empty box, previously shown to the participants. The selected ball was called the "Original Ball". Subjects did not know whether the "Original Ball" was marked or blank. Next, subjects were given a participant number. They were told that participants with odd subject numbers would be assigned a marked ball and participants with even subject numbers a blank ball. Subjects were told that if their assigned ball matched the original ball they would be given \$7.[2] Thus, for each participant, the two states of the world were "Match" (good state) and "No Match" (bad state). The "Original Ball" was shown to everyone at the end of the session. The experiment was programmed and conducted with z-Tree (Fischbacher, 2007).

Subjects received information about the Original Ball in the form of signals. Signals were binary ("Match" or "No Match") and each signal was correct with probability 0.75.[3] Signals were displayed in subjects' screens. Each participant sequentially received four signals and all received signals were visible on their screens at all times. Subjects were explicitly told that the ex-ante probability of a match was 0.5. After each signal, participants were asked to report their belief about the probability of a match. Since subjects received \$7 if their ball matched the Original Ball, the signal "Match" was good news and the signal "No Match" was bad news.

One of the four reported beliefs was randomly selected to be evaluated using a quadratic scoring rule: A participant that reported $r$ as the probability of a match received, in addition to the match-contingent payment, \$$3(1-(1-r)^2)$ if a match occurred and \$$3(1-r^2)$ if a match did not occur. This rule rewards beliefs that are "closer" to the true event: The maximum payoff (\$3) can be obtained when one reports that a match will occur with certainty ($r = 1$) and it indeed occurs, or when one reports that a match will not occur ($r = 0$) and it does not occur. The rule also has the property that it is optimal to honestly report beliefs to maximize one's expected payoff.[4] Participants were made aware of this fact.

Since, theoretically, a quadratic scoring rule is only incentive compatible for expected-payoff maximizing individuals (i.e. risk neutral individuals), I ran a small additional experiment with 27 participants to gauge whether strategic misreporting of beliefs could be an issue of concern. Of concern is the fact that since a match yields a relatively large payoff, participants may want to under-report their belief of a match in order to hedge against the risk of a mismatch. In the additional experiment, subjects were asked to report their beliefs about 34 events: The probability of a 100-sided die rolling a number less or equal to $x$, for 34 different values of $x$. Since the objective probabilities of these events are salient, they can be compared against the reported probabilities to determine whether beliefs are being under- or over-reported. Once all reports were made, one of the 34 values of $x$ was randomly selected and the die was rolled. To mimic incentives in the main experiment, participants were paid \$7 if the die rolled a number less or equal to $x$. Additionally, the reported belief was evaluated using the quadratic scoring rule described above. I found no evidence of strategic misreporting.[5]

### *2.2. Data*

I ran a total of 6 sessions at the Ohio State University Experimental Lab in May 2012. 93 students took part in the experiment. All results will be shown for the complete sample, as well as the subset of participants that never updated in the "wrong" direction and updated at least once.[6] This subset consists of 60 participants.

## 3. Results

### *3.1. Optimism in the population?*

Fig. 1 shows, for each round, the average belief about the good state if all participants had updated their beliefs according to Bayes' rule. Since both types of signals ("Match" and "No Match") were equally precise and about half of all the participants were in the good state and half were in the bad state, the average belief about the good state using Bayes' rule is always very close to 0.5. If overweighting of good news is strong and prevalent in the population under study, the average reported belief should drift away from 0.5, favoring the good state. Fig. 1 also shows that this is not the case. For neither round (and sample) is the average reported belief significantly different than 0.5 nor is it significantly different than the average Bayesian belief, using Wilcoxon signed-rank tests.[7]

2 This procedure guarantees that once a ball has been randomly chosen, half of the signals will be good news and half will be bad news on average. Additionally, it should further reduce suspicion about the experimenter trying to minimize participants' payoffs.

3 The information structure resembles that of Möbius et al. (2014).

4 See for example Selten (1998).

5 Let $d = r - p \in [0, 1]$ be the deviation of the reported probability $r$ from the true probability $p$. A positive deviation means over-reporting, while a negative deviation means under-reporting. Taking the average deviation of one participant over the 34 events as the variable of interest, the median was 0.002 and the average was −0.0002. A Wilcoxon signed-rank test pairing true and reported probabilities yields a $p$-value of 0.46.

6 Following Möbius et al. (2014).

7 Out of the corresponding 16 $p$-values, the lowest is 0.20, comparing Bayesian and reported beliefs in the last period of the restricted sample.