

The Evolution and Economic Consequences of Overconfidence

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Abstract

This dissertation examines how people form overconfident beliefs despite the presence of objective information and explores the consequences for economic behavior. While standard economic decision theory assumes rational Bayesian updating, this dissertation demonstrates with a series of controlled experiments that people systematically process information optimistically because they derive direct utility from maintaining positive beliefs. The first paper identifies that optimistic updating is more likely when uncertainty persists for a longer period, as this allows individuals to derive belief-based utility over a longer time horizon. The second paper finds that ego-relevance amplifies optimistic belief updating, with individuals downplaying negative feedback more strongly when they are deeply invested in the underlying events. The third paper uncovers hidden economic consequences of overconfidence, revealing that it leads to inefficient effort allocation by triggering a misguided learning process about returns to effort in the economic environment. Together, these findings provide a behavioral explanation for the persistence of overconfidence and its implications for economic behavior.

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What would I eliminate if I had a magic wand?

Overconfidence

Daniel Kahneman (2015), The Guardian

1 Introduction

Beliefs play a crucial role in shaping economic decisions. In financial markets, for example, investors' beliefs about future stock prices and interest rates influence their decisions to buy or sell assets, impacting overall market trends. Similarly, consumer confidence – rooted in beliefs about job security, inflation, or economic stability – affects spending and saving habits, which in turn influence economic growth. Businesses also rely on beliefs when making strategic decisions, such as expanding operations or adjusting prices, based on their expectations of future demand. Even policymakers consider public and market beliefs when implementing monetary and fiscal policies, as their effectiveness often depends on how people perceive and react to them. Thus, beliefs fundamentally shape economic outcomes by guiding the decisions of individuals, businesses, and governments alike.

Standard economic decision theory assumes that individuals process information like perfect statisticians, updating their beliefs according to Bayesian principles and making judgments unaffected by personal hopes or desires (Barron, 2021; Coutts, 2019). However, this model struggles to explain the widespread phenomenon of overconfidence – people's tendency to consistently overestimate their abilities, knowledge, or chances of success, even when objective information is readily available (see Malmendier and Taylor, 2015, for a review). Overconfidence has been linked to suboptimal economic decisions, such as excessive market entry (Camerer and Lovo, 1999) and poor managerial investment or merger choices (Malmendier and Tate, 2005). Nobel laureate Daniel Kahneman

has called overconfidence the most damaging bias in human decision-making, arguing in an interview with *The Guardian* that it leads governments to underestimate the difficulty of wars and the costs of capital projects, even when statistics predict otherwise.¹ The persistence of overconfidence is particularly striking given the increasing availability of information that – if processed according to Bayesian principles – should correct such misperceptions. This paradox raises an important question that will be addressed in this dissertation: Why does overconfidence evolve and persist, even in the face of contradictory evidence?

Behavioral economic theory suggests that individuals develop overconfident beliefs because they derive direct utility from maintaining positive views about their personal traits and future prospects (Bénabou and Tirole, 2016). These models propose that belief formation is influenced not only by a desire for accuracy in decision-making – as in traditional economic theory – but also by the desirability of certain outcomes. As a result, individuals tend to process information optimistically, giving greater weight to good news while downplaying bad news. To illustrate this concept of optimistic belief updating, consider an employee who strongly desires a promotion and initially believes he has a 60% chance of receiving it. One day, his boss gives him positive feedback on a project, prompting him to revise his belief upward to 90%. A week later, he learns that another strong candidate is also being considered. Instead of adjusting his belief downward, he downplays this information and continues to estimate his chances at 85–90%. This example illustrates how individuals may overweight positive information and underweight negative information, reinforcing their overconfident beliefs.

However, experimental evidence in economics testing the optimistic belief updating hypothesis remains inconclusive. While some studies find evidence of optimism, others

¹The interview can be accessed here: <https://www.theguardian.com/books/2015/jul/18/daniel-kahneman-books-interview>

report neutral or even pessimistic updating patterns (see Benjamin, 2019; Barron, 2021, for reviews). For instance, Eil and Rao (2011) and Möbius et al. (2022) show that individuals tend to update their beliefs optimistically, whereas Ertac (2011) and Coutts (2019) find that people assign greater weight to negative information, leading to pessimistic updates. Meanwhile, studies by Buser et al. (2018), Grossman and Owens (2012), and Schwardmann and Van der Weele (2019) report no systematic asymmetry in belief updating in response to good or bad news. Zimmermann (2020) observes neutral updating in the short run but a shift toward optimism over time, potentially due to the adaptive suppression of negative information. Despite substantial research, the persistence of overconfidence remains poorly understood, particularly with regard to the conditions that foster optimistic belief updating. To address this gap and refine theoretical models, it is essential to identify the mechanisms that drive these conflicting empirical findings. This dissertation addresses this puzzle by uncovering factors that either amplify or dampen optimism in belief formation.

The first paper in this dissertation investigates how expectations regarding uncertainty resolution influence optimism in belief formation, using a laboratory experiment with the following experimental design. Participants first completed an intelligence test and were asked to report their prior beliefs about their rank within a randomly assigned group of four participants. Subsequently, a between-subject treatment variation was introduced: one group was informed that their true rank would be revealed during the experiment, while the other group was told their true rank would remain unknown. After receiving noisy information about their rank, participants were asked to update their beliefs. The results show that individuals update their beliefs optimistically when they do not expect an imminent resolution of their true rank. In contrast, those anticipating immediate uncertainty resolution exhibit more neutral belief updating. This finding suggests that overconfidence thrives when individuals have time to derive utility from maintaining positive self-perceptions. A key implication is that overconfidence may be particularly relevant in dynamic economic

decisions, such as retirement savings, where individuals make choices based on their present beliefs about future income and spending habits, while the actual realization of these factors occurs much later.

The second paper in this dissertation examines whether belief updating becomes more optimistic when the ego-relevance of an event increases. Through a laboratory experiment, we investigate belief updating in the context of a single event – relative performance on an intelligence test – while manipulating in a between-subjects design the extent to which participants perceive performance in an intelligence test as a strong predictor of important life outcomes. This manipulation affects how much individuals care about their performance. The findings show that when an event is perceived as more ego-relevant, i.e., when individuals deeply care about their performance in the intelligence test, they assign greater weight to positive information than negative information, as maintaining favorable beliefs provides direct utility. Additionally, individuals who receive negative feedback tend to downplay the importance of performing well on the intelligence test. These results suggest that individuals use two distinct strategies to protect their self-esteem when confronted with objective but unpleasant information.

Taken together, the first two papers demonstrate that individuals process information optimistically when (i) they do not expect an immediate resolution of uncertainty, and (ii) the underlying event is sufficiently important to their self-esteem. These findings identify key factors in the environment that allow individuals to develop overconfident beliefs, even in the presence of objective information.

Overconfidence has become a central topic in economics due to its significant implications for economically relevant behavior, as highlighted by a rapidly growing body of literature. One line of this research explores the potential evolutionary advantages of overconfidence, such as its role in enhancing motivation to exert effort (Chen and Schildberg-

Hörisch, 2019), increasing persuasiveness (Schwardmann and Van der Weele, 2019; Solda et al., 2020), or fostering innovation (Galasso and Simcoe, 2011; Hirshleifer et al., 2012). In contrast, another strand of research highlights the detrimental effects of overconfidence, such as excessive risk-taking in financial markets (Barber and Odean, 2001), suboptimal managerial decisions (Malmendier and Tate, 2005), excessive competition entry (Camerer and Lovo, 1999; Niederle and Vesterlund, 2007), poor incentive scheme choices (Barron and Gravert, 2022) and polarization in politics (Ortoleva and Snowberg, 2015). A consistent theme across these studies is their focus on the *direct* impact of overconfidence on decision-making in economically relevant contexts.

In contrast, the third paper of this dissertation uncovers the *indirect* effects of overconfidence on economic behavior that arise when overconfident beliefs about one decision-relevant aspect spill over by triggering a misguided learning process about another decision-relevant aspect. Based on the theoretical frameworks of Hestermann and Le Yaouanq (2021) and Heidhues et al. (2018), we experimentally show how overconfident beliefs about personal ability influence effort provision by leading to distorted conclusions about the returns to effort when individuals receive feedback that is jointly determined by their personal ability and the returns to effort in the economic environment. In a simulated labor market, participants work in environments where earnings are determined either by chance or relative performance. They observe their earnings, form beliefs about the returns to effort, and then decide on their subsequent effort levels. The results demonstrate that overconfident beliefs about personal ability causally affect effort provision through misguided inferences about the returns to effort. These findings suggest that the negative consequences of overconfidence may arise not only from its direct impact on decision-making but also from the erroneous inferences it triggers about the economic environment.

The remainder of this dissertation is organized into four key sections. Section 2 pro-

vides the theoretical and empirical background. Section 3 outlines the research methods. Section 4 summarizes the three research papers that explore the persistence of overconfidence despite the availability of objective information and its indirect effects on economic behavior. Finally, Section 5 presents a concluding discussion and suggests potential directions for future research.

2 Background

Standard decision theory in economics employs Bayes' rule to model belief updating in dynamic decision-making under uncertainty. This model assumes that individuals consistently form the most accurate beliefs to make optimal decisions based on their preferences and the available information. Section 2.1 provides a minimal working example of Bayes' rule applied to a simple updating problem involving an event with a binary state space. It also introduces the concept of optimistic belief updating, a systematic deviation from Bayesian updating in which individuals overweight good news relative to bad news concerning their preferred state of the world. Section 2.2 presents an interdisciplinary review of experimental evidence that tests the optimistic belief updating hypothesis, drawing on research from economics, psychology, and neuroscience. Together, Sections 2.1 and 2.2 provide important background for the first two research papers in this dissertation, which identify factors that activate or suppress optimistic belief updating. Section 2.3 offers an overview of studies analyzing the economic consequences of overconfidence. It serves as crucial background for the third research paper in this dissertation, which identifies hidden consequences of overconfidence that have been unexplored in previous empirical literature.

2.1 Theory: Bayes' Rule versus Optimism

The following description of Bayes' rule and the corresponding empirical framework draws on Möbius et al. (2022) and Barron (2021). It is helpful to introduce several commonly hy-

pothesized deviations from Bayes' rule, including optimistic belief updating, which serves as the central hypothesis tested in this dissertation. Consider an agent who forms subjective beliefs about the probability of an event with a binary state space, $\theta \in \{\theta_G, \theta_B\}$, at each point in time, t . The agent strictly prefers the good state ($\theta = \theta_G$) over the bad state ($\theta = \theta_B$) and holds a prior belief $\gamma_{t-1} \in [0, 1]$ about the probability of θ_G . To fix ideas, referring back to the example in Section 1, the employee forms belief about getting a promotion and strictly prefers a promotion over not getting the promotion. Each period, the agent receives information about the true state in the form of binary signals $s_t \in \{s_G, s_B\}$, which we refer to as good news ($s_t = s_G$) or bad news ($s_t = s_B$). These signals are informative but noisy, correctly reflecting the true state with probability $q \in (0.5, 1)$, i.e., $P(s_G|\theta_G) > 0.5$ and $P(s_B|\theta_G) < 0.5$. Applying Bayes' rule, the agent updates her belief, yielding the posterior probability γ_t , after observing good news ($s_t = s_G$):

$$\gamma_t(s_t = s_G) = \frac{q \cdot \gamma_{t-1}}{q \cdot \gamma_{t-1} + (1 - q) \cdot (1 - \gamma_{t-1})} \quad (1)$$

while the Bayesian posterior γ_t in response to bad news ($s_t = s_B$) is defined as:

$$\gamma_t(s_t = s_B) = \frac{(1 - q) \cdot \gamma_{t-1}}{(1 - q) \cdot \gamma_{t-1} + q \cdot (1 - \gamma_{t-1})} \quad (2)$$

Using a logit transformation, the binary signal structure allows us to consolidate equations 1 and 2 into a single expression by incorporating an indicator variable that distinguishes between good news and bad news, respectively:

$$\text{logit}(\gamma_t) = \text{logit}(\gamma_{t-1}) + \log\left(\frac{q}{1 - q}\right) \cdot I(s_t = s_G) + \log\left(\frac{1 - q}{q}\right) \cdot I(s_t = s_B) \quad (3)$$

To test the core properties of Bayes' rule, we extend equation 3 by introducing the coefficients δ , β_G , and β_B . The resulting empirical framework, given by equation 4, allows us to compare belief updating to Bayesian updating, where setting $\delta = \beta_G = \beta_B = 1$ corresponds to standard Bayesian updating.

$$\text{logit}(\gamma_t) = \delta \text{logit}(\gamma_{t-1}) + \beta_G \log\left(\frac{q}{1-q}\right) \cdot I(s_t = s_G) + \beta_B \log\left(\frac{1-q}{q}\right) \cdot I(s_t = s_B) \quad (4)$$

Building on Barron (2021), we link different parameter values to their corresponding behavioral implications, as summarized in Table 1. The parameter δ tests the invariance assumption of Bayes' rule, which posits that changes in logit beliefs depend solely on past signals and not on prior beliefs. This assumption holds when $\delta = 1$. Deviations from invariance capture prior-biased inferences: base-rate neglect occurs when $\delta < 1$, implying that individuals update their beliefs as if their priors are closer to 0.5, whereas confirmation bias arises when $\delta > 1$, meaning individuals update their beliefs as if their priors are closer to the extremes of 0 or 1 (Barron, 2021). The parameters β_G and β_B reflect individuals' responsiveness to good news and bad news, respectively. Conservatism is indicated when individuals update too little in response to both good news and bad news ($\beta_s < 1 \ \forall s \in \{G, B\}$), while overresponsiveness occurs when they update too much in response to both good news and bad news ($\beta_s > 1 \ \forall s \in \{G, B\}$). Optimistic belief updating is identified when individuals adjust their beliefs more strongly upon receiving good news than bad news ($\beta_G > \beta_B$).

Table 1: Updating Behavior and Parameter Values

Updating Behavior	Parameter Values
Bayesian Updating	$\delta = 1, \beta_G = 1 \text{ and } \beta_B = 1$
Invariance	$\delta = 1$
Confirmation Bias	$\delta > 1$
Base Rate Neglect	$\delta < 1$
Conservatism	$\beta_j < 1 \ \forall j \in \{G, B\}$
Overresponsiveness	$\beta_j > 1 \ \forall j \in \{G, B\}$
Symmetric Updating	$\beta_G = \beta_B$
Optimistic Updating	$\beta_G > \beta_B$
Pessimistic Updating	$\beta_G < \beta_B$

Standard decision theory in economics does not predict different updating behavior following good news or bad news with respect to a person's preferred state of the world. Instead, the standard model assumes that individuals are solely concerned about accuracy, with their beliefs remaining entirely unaffected by their desired state of the world. In contrast, the theoretical literature on belief-based utility and motivated reasoning in behavioral economics posits that individuals derive direct utility from maintaining positive beliefs (e.g., Bénabou and Tirole, 2002; Brunnermeier and Parker, 2005; Caplin and Leahy, 2001, 2019; Köszegi, 2006; Kaufmann and Köster, 2024; Möbius et al., 2022) and as a potential consequence update their beliefs optimistically. For instance, the model in Möbius et al. (2022) predicts that people update their beliefs optimistically, balancing the trade-off between the direct utility of holding positive beliefs about the good state and the instrumental utility that is maximized when beliefs are most accurate.

2.2 Experimental Evidence: Optimistic Belief Updating

An expanding body of experimental research examines the optimistic belief updating hypothesis by studying belief updating in response to ego-relevant information, yielding diverse and sometimes puzzling findings. Ego-relevance describes how closely information or events align with an individual's self-concept, identity, or goals. The greater the ego-relevance, the stronger the emotional and cognitive engagement. According to behavioral economic theory, people tend to process information more optimistically when it is highly ego-relevant (Möbius et al., 2022). Table 2 summarizes experimental tests of the optimistic belief updating hypothesis (Drobner, 2022), categorized by discipline: economics (Panel A) and psychology/neuroscience (Panel B). Panel A reveals mixed findings in economic studies, including optimistic, neutral, and even pessimistic belief updating. In contrast, Panel B shows that research in psychology and neuroscience – except Shah et al. (2016) – consistently supports the presence of optimistic belief updating.

Table 2: Experimental Evidence: Optimistic Belief Updating

Panel A: Experimental Evidence from Economics	
Study	Result
Buser et al. (2018)	Neutral Belief Updating
Coffman et al. (2024)	Neutral Belief Updating
Coutts (2019)	Pessimistic Belief Updating
Eil and Rao (2011)	Optimistic Belief Updating
Ertac (2011)	Pessimistic Belief Updating
Grossman and Owens (2012)	Neutral Belief Updating
Möbius et al. (2022)	Optimistic Belief Updating
Schwardmann and Van der Weele (2019)	Neutral Belief Updating
Zimmermann (2020)	Neutral Belief Updating
Panel B: Experimental Evidence from Psychology and Neuroscience	
Study	Result
Garrett and Sharot (2014)	Optimistic Belief Updating
Garrett et al. (2014)	Optimistic Belief Updating
Garrett and Sharot (2017)	Optimistic Belief Updating
Garrett et al. (2018)	Optimistic Belief Updating
Kuzmanovic et al. (2015)	Optimistic Belief Updating
Kuzmanovic et al. (2016)	Optimistic Belief Updating
Kuzmanovic and Rigoux (2017)	Optimistic Belief Updating
Korn et al. (2012)	Optimistic Belief Updating
Korn et al. (2014)	Optimistic Belief Updating
Marks and Baines (2017)	Optimistic Belief Updating
Moutsiana et al. (2013)	Optimistic Belief Updating
Moutsiana et al. (2015)	Optimistic Belief Updating
Shah et al. (2016)	Neutral Belief Updating
Sharot et al. (2011)	Optimistic Belief Updating
Sharot et al. (2012)	Optimistic Belief Updating

Experimental Evidence from Economics. The standard experimental paradigm in economics for studying belief updating about ego-relevant information follows four steps: (1) subjects complete an ego-relevant task (e.g., an intelligence test), (2) their probabilistic beliefs about their relative performance are elicited, (3) they receive noisy but informative

feedback (a binary signal) about their relative performance, generating signal valence (good or bad news), and (4) their posterior beliefs are elicited. This setup enables a direct comparison to the normative benchmark of Bayes' rule. Optimistic belief updating is identified when individuals react more strongly to good news than to bad news about their relative performance, deviating from Bayesian predictions.

Empirical findings in economics are mixed, with some studies supporting optimistic belief updating (Eil and Rao, 2011; Möbius et al., 2022; Zimmermann, 2020). Eil and Rao (2011) explore how individuals process objective information regarding the ego-relevant traits intelligence and beauty. They find that good and bad news are integrated into existing beliefs in different ways. When receiving good news, people interpret it more clearly, with less noise, and in a way that aligns with Bayesian rationality by respecting the strength of the signal. In contrast, bad news is processed with more noise, and the signal's strength is often disregarded, causing people to downplay or discount the negative information. Möbius et al. (2022) investigate how individuals process objective information about their intelligence, uncovering two key biases. First, participants update their beliefs optimistically, responding more strongly to positive than to negative information. Second, they exhibit a conservatism bias, responding less to feedback overall than Bayesian reasoning would predict. Zimmermann (2020) explores how individuals process objective information about their intelligence. He finds no short-term asymmetry but observes a long-term tendency toward optimistic updates, potentially due to the suppression of negative information over time.

In contrast, some studies provide evidence for pessimistic belief updating (Ertac, 2011; Coutts, 2019). Ertac (2011) investigates how the degree of ego-relevance influences information processing. In the ego-relevant condition, participants receive information about their relative performance in tasks that require ability and effort. In the ego-neutral condition, there is no performance task, and participants process information about a state of

the world with no ego-relevance. The findings reveal that information processing varies notably based on ego-relevance. In ego-relevant contexts, participants disproportionately weigh negative feedback, leading to overly pessimistic beliefs – unless they have high initial self-confidence. In contrast, when information is ego-neutral, deviations from Bayesian reasoning are less predictable and generally smaller. Similarly, Coutts (2019) explores information processing in different ego-relevant and ego-neutral domains. His findings show that people tend to give more weight to negative information than positive information, regardless of its ego-relevance.

Other studies, including Buser et al. (2018), Grossman and Owens (2012), and Schwardmann and Van der Weele (2019), indicate that belief updating is generally neutral. Buser et al. (2018) investigate how individuals process information about their relative performance across a series of cognitive tests. Comparing their results to a Bayesian benchmark, they find that, on average, subjects do not exhibit optimistic belief updating. Instead, they update neutrally, assigning similar weights to both good and bad news. The study introduces individual measures of optimism in belief updating and demonstrates that these measures influence competition entry by affecting individuals' self-confidence. Grossman and Owens (2012) investigate how individuals process information about their absolute performance on an intelligence-based task. Their findings reveal that most participants react symmetrically to good and bad news, suggesting that biased updating does not drive posterior overconfidence. Schwardmann and Van der Weele (2019) examine how individuals process information about their relative performance on an intelligence test. They find that participants generally respond symmetrically to good and bad news. However, when excluding those who make no updates or update in a direction contrary to Bayesian predictions, participants tend to react slightly more to bad news. Coffman et al. (2024) explore gender differences in belief updating and find that in gender-congruent domains, participants respond similarly to both good and bad news. However, in gender-incongruent domains, participants are less responsive to good news.

Overall, the variability in economic experiments testing optimistic belief updating has been widely debated (Benjamin, 2019; Barron, 2021), yet no single explanation fully accounts for the conflicting findings.

Experimental Evidence from Psychology and Neuroscience. The standard experimental paradigm in psychology and neuroscience for studying belief updating about ego-relevant information generally follows a three-step methodology: (1) subjects provide probabilistic beliefs about future life events (e.g., the likelihood of developing a specific disease), (2) they receive base rate information from individuals with the same socio-economic background, generating signal valence (good news or bad news) depending on whether the information is better or worse than their prior expectations, and (3) their posterior beliefs are elicited. Optimistic belief updating is identified when subjects respond more strongly to better-than-expected base rates than to worse-than-expected ones.

Unlike economics, psychology and neuroscience research consistently supports optimistic updating – the tendency to respond more strongly to better-than-expected than to worse-than-expected base rates (see Sharot and Garrett, 2016, for a review). In a seminal experiment, Sharot et al. (2011) examine participants' belief updating regarding the likelihood of 80 negative life events (e.g., death before age 80). Their findings indicate that participants adjust their beliefs more in response to positive information than to negative information. Using fMRI techniques, Sharot et al. (2011) and Garrett et al. (2014) further demonstrate that optimistic updating is associated with a relative failure to encode negative information in frontal brain regions. Heterogeneity in belief updating has also been explored. Korn et al. (2014) and Garrett et al. (2014) investigate differences between healthy individuals and those with clinical depression, replicating optimistic belief updating in the former but finding no such effect in the latter. Garrett et al. (2018) report that individuals exhibit less optimistic updating when they perceive a threat. Moutsiana

et al. (2013) examine how belief updating changes from ages 9 to 26 and document that the ability to update beliefs based on negative information improves with age, while learning from positive information remains relatively unchanged. Shah et al. (2016) provide a critique of psychology/neuroscience experiments testing the optimistic belief updating hypothesis, arguing that the results may not be robust for positive life events. However, Marks and Baines (2017) and Garrett and Sharot (2017) provide evidence supporting the robustness of optimistic belief updating for positive life events.

Reconciling Differences Between Economics and Psychology/Neuroscience. Studies in economics and psychology/neuroscience reach contrasting conclusions about the optimistic belief updating hypothesis. I propose that a critical but overlooked methodological distinction may drive these inconsistencies. In psychology and neuroscience, participants form beliefs about future life events, where true outcomes remain unknown to both participants and researchers. In contrast, economic experiments typically involve assessing relative performance – often on intelligence tests – where experimenters already know the true outcomes. This difference likely shapes participants’ expectations about whether and when they will learn the truth. In economics, only Coutts (2019) explicitly informs participants that true outcomes will be disclosed by the experiment’s end, finding evidence for pessimistic updating. Other studies remain ambiguous, leaving participants to form their own expectations. Additionally, subjects may expect to learn the true state from accuracy-based incentives or performance-related payments. In contrast, psychology and neuroscience experiments deliberately prevent uncertainty resolution, as future life events cannot be determined within the study’s time frame.

Building on belief-based utility models, I propose that expectations about the timing of uncertainty resolution play a crucial role in driving optimistic belief updating. The key intuition is that people derive utility from their beliefs only when they do not expect to learn the truth imminently. When resolution is imminent, their focus may shift from enjoying a positive

belief to preparing for its consequences. For instance, a sports fan may take pleasure in believing their team will win the championship – until the final game determines the outcome. Similarly, a job seeker may feel optimistic about an offer until receiving a definitive response. In the first paper of this dissertation, I propose and test the hypothesis that belief updating tends to be neutral when resolution is near, whereas individuals update their beliefs optimistically when uncertainty resolution is deferred (Drobner, 2022). This hypothesis is also informed by studies showing that as uncertainty resolution draws near, people's outlooks in waiting periods tend to become more pessimistic (see Sweeny and Krizan, 2013, for a review). A comprehensive summary of the first paper in this dissertation is provided in Section 4.1.

Another key distinction between studies in economics versus those in psychology and neuroscience is the level of ego-relevance in belief-updating tasks. I argue that beliefs about significant future life events, commonly studied in psychology and neuroscience, likely carry greater ego-relevance than beliefs about intelligence test performance, which is the focus of many economic studies. The lower ego-relevance in economic experiments may weaken the demand for optimistic belief updating, potentially explaining why this phenomenon appears less pronounced in economics. The second paper of this dissertation addresses this issue by modifying the standard economic experimental paradigm (Drobner and Goerg, 2024). Specifically, it examines belief updating about relative intelligence test performance while manipulating the perceived ego-relevance of the test. In a between-subjects design, we either increase ego-relevance by presenting evidence on intelligence tests' predictive power for professional success or decrease it by providing evidence that questions their validity. This design offers a more rigorous test of the optimistic belief updating hypothesis by ensuring that, in one condition, participants have a strong incentive to view their intelligence test performance positively. A comprehensive summary of this paper is provided in Section 4.2.

2.3 Experimental Evidence: Economic Consequences of Overconfidence

Optimistic belief updating offers a behavioral explanation for the persistence of overconfidence despite the availability of objective information. Overconfidence has become a central topic in economic research due to its significant implications for decision-making and market outcomes. Its importance is highlighted by a symposium on overconfidence published in the *Journal of Economic Perspectives* (Malmendier and Taylor, 2015). Research on the economic consequences of overconfidence generally falls into two primary strands: one explores its potential benefits, while the other examines its costs.

On the positive side, some studies suggest that overconfidence offers evolutionary or adaptive advantages. For instance, Chen and Schildberg-Hörisch (2019) find that greater confidence in one's abilities tends to increase effort, particularly among overconfident individuals. They also demonstrate that providing information about actual ability can reduce effort in overconfident subjects, highlighting the motivational benefits of confidence. In a similar vein, Schwardmann and Van der Weele (2019) show that when individuals are financially incentivized to persuade others of their superiority, their overconfidence intensifies, which, in turn, enhances their persuasiveness. This finding suggests that overconfidence can function as an adaptive social tool for influencing others. Solda et al. (2020) further explore this idea, designing an experiment where participants are incentivized either to assess their performance accurately or to persuade others of their success. Their results reveal that participants tend to overestimate their performance more when persuasion is the goal, selectively seek positive feedback, and become more persuasive as a result. Additionally, Galasso and Simcoe (2011) find a strong positive correlation between overconfidence and citation-weighted patent counts, especially in competitive industries, suggesting that overconfident CEOs are more inclined to direct their firms toward new technological innovations. Lastly, Hirshleifer et al. (2012) document that firms led by overconfident CEOs tend to invest more heavily in innovation.

On the other hand, substantial research highlights the detrimental effects of overconfidence on individual decision-making and collective outcomes. Barber and Odean (2001) analyze account data from a large discount brokerage and suggest that overconfidence leads to excessive trading in financial markets. Malmendier and Tate (2005) define overconfident CEOs as those who consistently fail to mitigate their personal exposure to company-specific risks. Their study reveals that investments made by overconfident CEOs are highly sensitive to cash flow, especially in firms that depend on equity financing. In an experimental study, Camerer and Lovallo (1999) show that overconfidence leads to excessive market entry, as individuals overrate their likelihood of success relative to their competitors. Barron and Gravert (2022) show that overconfidence increases participants' likelihood of selecting an ability-contingent incentive scheme, which can be particularly costly for those with below-average abilities. Moreover, Ortoleva and Snowberg (2015) finds that overconfidence significantly predicts ideological extremism, voter turnout, and partisan identification in the U.S., highlighting its impact on political behavior.

A common theme in the aforementioned literature on both the benefits and drawbacks of overconfidence is its emphasis on the direct impact of overconfidence on economically relevant decision-making. The third paper of this dissertation adds to this literature by showing the indirect consequences of overconfidence for economic behavior that arise solely from triggering a misguided learning process about the economic environment (Drobner and Orhun, 2025). A comprehensive summary of this paper is provided in Section 4.3.

3 Methods

The three research papers in this dissertation are based on a series of controlled experiments, a fundamental method in economics to systematically analyze causal relationships between variables. Section 3.1 provides an overview of the history and types

of controlled experiments in economics. Section 3.2 details the procedures and sample selection used for the experiments that form the database for this dissertation. Finally, Section 3.3 explains how monetary incentives were used in the experiments to encourage truthful reporting of beliefs – the primary outcome variable of interest in this dissertation.

3.1 Controlled Experiments in Economics

While traditional empirical studies in economics primarily relied on observational data, controlled experiments provide a more rigorous framework to test hypotheses and theories. By manipulating independent variables while holding others constant, controlled experiments enable researchers to establish causality. This method, known as "experimental economics," has become increasingly influential in understanding economic behavior, market mechanisms, and policy impacts.

Over the past few decades, experimental economics has evolved from a niche field into a critical component of economic research, driving significant advancements in economic theory. This shift began in the mid-20th century with foundational contributions from scholars such as Edward Chamberlin and Sidney Siegel. By the 1960s, Vernon Smith's pioneering work on market institutions and equilibrium played a crucial role in expanding the field. The 1970s and 1980s saw further breakthroughs as Amos Tversky and Daniel Kahneman challenged traditional rationality assumptions by documenting heuristics and biases in decision-making. By the 1990s, controlled experiments had become a vital methodological tool in economics, culminating in the 2002 Nobel Memorial Prize in Economic Sciences awarded to Vernon Smith and Daniel Kahneman for integrating psychological insights into economic science through controlled experiments (see Davis and Holt, 2021; Guala, 2010, for reviews of the history of experimental economics).

Economic experiments typically fall into two categories: laboratory and field experiments,

each serving distinct research purposes. Laboratory experiments take place in tightly controlled settings, either in person or online, allowing researchers to manipulate variables with precision. This high level of control ensures strong internal validity, meaning observed effects are directly attributable to experimental interventions rather than confounding factors. However, laboratory experiments face challenges regarding external validity, as artificial settings may not fully replicate real-world conditions, and participant samples – often university students – may not be representative of the broader population. In contrast, field experiments occur in real-world environments, often without participants' awareness that they are part of a study. While field experiments offer greater external validity by capturing behavior in natural contexts, they can lack internal validity and are often costly and logistically complex to implement.

Controlled experiments have been used to test economic theories with precision, but have also revealed psychological biases, heuristics, and cognitive limitations that influence decision-making. These findings have been instrumental in the development of behavioral economics, which integrates psychological principles into economic theory and challenges the assumption of perfect rationality. This dissertation builds on a series of controlled experiments to identify systematic deviations from rational Bayesian updating when individuals receive objective information that relates to their ego, identity, or personal goals.

3.2 Procedures and Samples

The research papers of this dissertation utilize data from three controlled experiments. The first experiment was conducted in person at the ExperimentTUM – the laboratory for economic experiments at the Technical University of Munich. The computerized experiment was programmed using zTree (Fischbacher, 2007), and participant recruitment was automated through ORSEE (Greiner, 2004). The experiment was conducted in 10

sessions with a total of 200 participants. In a between-subjects design, participants were randomly assigned, at the session level, to two different treatment conditions. Participants received a completion fee of €4 and a bonus payment that varied between participants. Each session lasted approximately 30 minutes.

The second experiment, also conducted with subjects from the ExperimentTUM subject pool, included both in-person sessions at the laboratory and online sessions due to COVID-19 restrictions. The computerized experiment was programmed using oTree (Chen et al., 2016), and participant recruitment was automated through ORSEE (Greiner, 2004). The experiment was conducted in 16 sessions (2 in person and 14 online) with a total of 419 participants. In a between-subjects design, participants were randomly assigned, at the individual level, to two different treatment conditions. Participants received a completion fee of €4 and a bonus payment that varied between participants. Each session lasted approximately 45 minutes.

The third experiment was conducted online with 2,011 U.S.-based participants recruited through Prolific – a platform that enables data collection from a large and diverse sample. The computerized experiment was programmed using Qualtrics. In a between-subjects design, participants were randomly assigned, at the individual level, to four different treatment conditions. Participants received a completion fee of \$2 and a bonus payment that varied between participants. The average completion time was approximately 16 minutes.

3.3 Belief Elicitation

In all three papers of this dissertation, we examine participants' belief updating in response to objective information. Accordingly, the main outcome variable in all three experiments is based on participants' reported beliefs. Providing monetary incentives linked to the outcome variable is a foundational principle of controlled experiments in

economics. A central challenge is designing incentives that encourage participants to truthfully report their beliefs, as researchers inherently cannot observe participants' true beliefs. However, researchers have developed sophisticated methods to elicit beliefs in an incentive-compatible manner (see Healy and Leo, 2024; Trautmann and van de Kuilen, 2015; Schlag et al., 2015; Schotter and Trevino, 2013, for reviews).

In all three experiments, we used state-of-the-art belief elicitation methods to promote truthful reporting. A potential drawback of these methods is the complexity of the accompanying instructions, which can undermine behavioral incentive compatibility, even if the procedure is theoretically incentive compatible (Danz et al., 2022). To mitigate this concern, we explicitly emphasized in the instructions that participants' chances of winning an additional bonus increased with the accuracy of their belief reports.

In the first two experiments, we implemented a variation of the Becker-DeGroot-Marschak (BDM) mechanism to incentivize truthful reporting, as proposed by Grether (1981), Allen (1987), and Karni (2009). Participants were asked to report their belief $p \in [0, 1]$ about an event. A computer program then randomly selected a probability $q \in [0, 1]$ from a uniform distribution. If $q \leq p$, participants received a prize of €2 if the event occurred and 0 otherwise. If $q > p$, participants received a prize of €2 with probability q and 0 otherwise. This payoff mechanism incentivizes truthful reporting under the relatively weak assumption of statewise monotonicity (Healy and Leo, 2024).

In the third experiment, we used the binarized scoring rule (BSR) to incentivize truthful reporting, as proposed by Hossain and Okui (2013). Participants were asked to report their belief $p \in [0, 1]$ about an event. If the event occurred, they entered a lottery that paid a prize of \$1 with probability $1 - (1 - p)^2$ and 0 otherwise. If the event did not occur, they entered a lottery that paid a prize of €1 with probability $1 - p^2$ and 0 otherwise. This payoff mechanism incentivizes truthful reporting under the assumption that participants reduce

compound lotteries (Healy and Leo, 2024).

4 Motivated Belief Formation and Misguided Effort

Sections 4.1 – 4.3 provide summaries of the three research papers in this dissertation. The first paper, entitled *Motivated Beliefs and Anticipation of Uncertainty Resolution*, has been published at the *American Economic Review: Insights* in 2022 and has received both the *Schmölders Foundation Award* and the *Diligentia Prize for Empirical Research*. The second paper, entitled *Motivated Belief Updating and Rationalization of Information*, has been published at *Management Science* in 2024. The third paper, entitled *Misguided Effort*, has been presented at both national and international peer-reviewed conferences such as the annual meetings of the *German Economic Association* or the *European Economic Association*.

4.1 Motivated Beliefs and Anticipation of Uncertainty Resolution

Summary. In this solo-authored paper, I use a controlled experiment to examine how individuals' expectations about the timing of uncertainty resolution affect their belief updating regarding performance in an ego-relevant task. My findings reveal that when individuals do not anticipate an immediate resolution of uncertainty, they update their beliefs optimistically. Conversely, when they expect an immediate resolution, their updates are more neutral. This paper underscores the significant role that expectations about uncertainty resolution play in shaping motivated beliefs. The implications of this finding extend to understanding belief formation and decision-making in dynamic environments – such as healthcare and financial investments – where individuals make decisions based on current beliefs while the resolution of uncertainty occurs only in the distant future.

Methodology. The results are based on a controlled experiment with 200 participants. The experiment employs a modified belief-updating task, where relative performance on

an intelligence test serves as the ego-relevant event. Participants first state their prior beliefs about their rank within a group. Then, their expectations about uncertainty resolution are manipulated – some are told their true rank will remain uncertain, while others learn it will be revealed by the end of the experiment. Both groups receive noisy but informative feedback, and their belief updates are compared to Bayesian predictions. The results show that participants update their beliefs optimistically when they expect no uncertainty resolution, whereas those expecting immediate resolution process information more neutrally.

Contributions. This paper makes three key contributions. First, it provides an interdisciplinary literature review of experiments in economics, psychology, and neuroscience that examine the optimistic belief-updating hypothesis, highlighting the heterogeneity in how individuals form expectations about uncertainty resolution. Second, it demonstrates how these expectations influence belief updating, identifying a crucial factor that either suppresses or activates optimistic updating. Finally, it offers an explanation for empirical evidence suggesting that optimism tends to decline as the resolution of truth approaches (see Sweeny and Krizan, 2013, for a review).

Citation. Drobner, C. (2022). Motivated beliefs and anticipation of uncertainty resolution. *American Economic Review: Insights*, 4(1), 89-105.

4.2 Motivated Belief Updating and Rationalization of Information

Summary. In this joint paper with Sebastian J. Goerg, we use a controlled experiment to provide causal evidence that people update their beliefs optimistically when they derive direct utility from holding positive beliefs. By manipulating ego-relevance – that is, how much individuals care about the underlying event – we compare belief updating in

High-Ego and Low-Ego conditions. Our findings show that participants in the High-Ego condition, on average, update their beliefs optimistically, whereas belief updating in the Low-Ego condition remains, on average, neutral. Moreover, participants in the High-Ego condition are more likely to make motivated errors, updating their beliefs in the opposite direction of Bayesian predictions when receiving negative information. Our study also uncovers a pattern of ex-post rationalization in how participants perceive the ego-relevance of the underlying event, downplaying its relevance when exposed to more negative information.

Methodology. The results are based on a controlled experiment with 419 participants. In the experiment, participants take an intelligence test and estimate their probability of scoring in the top half. We then manipulate the ego-relevance of the task: in the High-Ego treatment, participants read an article emphasizing the predictive power of intelligence tests for academic and career success, whereas in the Low-Ego treatment, they read an article questioning the validity of intelligence tests. Afterward, participants receive two noisy but informative signals about their relative performance and update their beliefs. This design allows us to isolate and examine the causal impact of ego-relevance-induced direct belief utility on belief updating.

Contributions. This paper provides robust evidence for the optimistic belief updating hypothesis. Previous studies have tested this hypothesis by comparing belief updating across different events that vary in ego-relevance (e.g., Buser et al., 2018; Coutts, 2019), yielding mixed results (see Benjamin, 2019; Barron, 2021; Drobner, 2022, for reviews). However, comparing belief updating across different events introduces confounds – such as differences in prior beliefs – that obscure the causal effect of ego-relevance on belief updating. To address this methodological challenge, we introduce exogenous variation in ego-relevance within a single event while holding other factors constant. This experimental manipulation of ego-relevance provides a significant methodological contribution by of-

fering a portable paradigm to examine how direct belief utility interacts with biases in belief formation. Our findings reveal two distinct yet complementary strategies individuals use to interpret objective information in a self-serving manner. One group of participants updates their beliefs about the underlying event optimistically when it is perceived as highly ego-relevant. Another group adjusts the perceived ego-relevance of the event based on the nature of the information received, thereby modifying how much these beliefs affect their utility. These findings contribute to our understanding of how individuals maintain high self-esteem even when exposed to objective and potentially unpleasant information.

Citation. Drobner, C., & Goerg, S. J. (2024). Motivated belief updating and rationalization of information. *Management Science*, 70(7), 4583-4592.

Author Contributions. Conceptualization: Christoph Drobner, Sebastian J. Goerg; Experimental Design: Christoph Drobner, Sebastian J. Goerg; Conducting Experiments: Christoph Drobner; Data Analysis: Christoph Drobner; Writing: Christoph Drobner, Sebastian J. Goerg.

4.3 Misguided Effort

Summary. In this joint paper with Yeşim Orhun, we experimentally examine how biased beliefs about personal ability shape economic behavior through misguided inferences about the returns to effort in the economic environment. Our findings reveal that overconfident individuals misattribute poor initial labor market outcomes to low returns on effort, leading them to reduce effort in a subsequent real-effort task. Conversely, underconfident individuals draw misguided inferences in the opposite direction and adjust their effort accordingly. While prior research in psychology and economics focuses on the direct effects of miscalibrated beliefs on decision-making, our study highlights a broader consequence: biased beliefs about one aspect can distort perceptions of other key economic factors,

amplifying their overall impact.

Methodology. The results are based on a controlled experiment with 2,011 participants. In an artificial labor market setting, individuals work under conditions where their compensation is determined either by chance or by their relative performance. They observe their earnings, develop perceptions about the returns on their effort, and adjust their effort level accordingly for the next task. Our novel feedback treatment exogenously manipulates the direction of misguided inferences about returns to effort while preventing any learning about personal ability. This design enables us to isolate and establish a causal link between initially biased beliefs about personal ability and economic actions, mediated by misguided inferences about the returns to effort in the economic environment.

Contributions. Our study provides the first causal empirical evidence that miscalibrated priors about personal ability influence economic actions through misguided inferences about the economic environment. It contributes to three key strands of literature. First, it complements research on misguided learning, which largely focuses on dynamic learning processes (e.g., Galindo, 2023; Goette et al., 2020; Marray et al., 2020), by instead demonstrating the causal impact of misguided inference on economic actions. Second, it extends literature on the direct effects of overconfidence on economic decisions (e.g., Camerer and Lovallo, 1999; Barron and Gravert, 2022) by uncovering its indirect consequences – how biased priors distort perceptions of the economic environment and shape subsequent choices. Third, our experimental design provides a versatile framework for assessing the causal effects of biased beliefs on economic behavior. While prior research largely assumes that individuals act on their biased beliefs, direct evidence remains scarce. Our paradigm fills this gap by showing that individuals rely on biased beliefs when making economic decisions, even when doing so leads to suboptimal outcomes.

Citation. Drobner, C., & Orhun, A. Y. (2025). Misguided effort. Available at SSRN

5311074.

Author Contributions. Conceptualization: Christoph Drobner, A. Yeşim Orhun; Experimental Design: Christoph Drobner, A. Yeşim Orhun; Conducting Experiments: Christoph Drobner; Data Analysis: Christoph Drobner, A. Yeşim Orhun; Writing: Christoph Drobner, A. Yeşim Orhun.

5 Discussion

This dissertation contributes to the literature on belief formation and overconfidence in economic decision-making. The findings offer new insights into when individuals update their beliefs optimistically and the economic consequences of the resulting overconfidence. This section examines the broader implications of these findings, their theoretical contributions, and potential directions for future research.

5.1 Theoretical Contributions and Implications

A key contribution of this dissertation is identifying the conditions that foster optimistic belief updating, allowing individuals to maintain overconfident beliefs even when presented with objective information. The first two papers demonstrate that optimism in belief formation is most pronounced when (i) individuals do not anticipate immediate uncertainty resolution and (ii) an event is of significant ego-relevance. These findings align with theoretical models in behavioral economics, which suggest that individuals derive direct utility from sustaining positive beliefs about themselves and their prospects (see, e.g., Möbius et al., 2022).

The third paper extends the literature linking overconfidence to economically relevant decisions by illustrating that overconfident beliefs not only influence immediate choices but also distort inferences about the economic environment, potentially affecting seemingly

unrelated economic decisions. Specifically, the experimental results show that overconfident individuals form misguided beliefs about the returns to effort after receiving feedback that is jointly determined by their ability and an external fundamental, which leads to suboptimal effort provision in an unrelated future task. This finding corroborates the theoretical assumptions in Heidhues et al. (2018) and Hestermann and Le Yaouanq (2021), and highlights an indirect channel through which overconfidence shapes economic outcomes, extending beyond the well-known direct effects on behavior, such as excessive risk-taking (Barber and Odean, 2001) and competition entry (Camerer and Lovo, 1999).

5.2 Policy and Practical Implications

The persistence of overconfidence despite access to objective information carries significant policy implications, particularly in areas where accurate beliefs are essential for effective decision-making. The observation that overconfidence thrives when uncertainty resolution is delayed highlights the tendency for individuals to exhibit overconfident beliefs when making long-term decisions. This is especially pertinent in domains like education, entrepreneurship, and retirement savings, where individuals often form beliefs and make decisions based on current information, while the resolution of uncertainty unfolds over the long term. Policymakers could design interventions that provide clearer, timelier, and less ambiguous feedback, thereby reducing the likelihood of overconfident beliefs.

Additionally, the finding that optimism in belief updating is amplified when individuals care deeply about the underlying events suggests that reducing the ego-relevance of decisions could help mitigate biases in belief formation, and, in turn, lead to better decision outcomes. Another effective strategy could be the implementation of data-driven decision support systems, which are less influenced by ego-driven biases and can foster more informed and rational decision-making.

5.3 Limitations and Future Research Directions

While this dissertation advances our understanding of belief formation and overconfidence, several open questions remain. First, although the experimental settings were carefully designed to isolate causal mechanisms, the belief updating tasks are somewhat artificial and may not fully capture the complexity of real-world situations. Future research could examine whether the identified mechanisms – e.g., the importance of expectations about uncertainty resolution in activating or suppressing optimistic belief updating – persist in field settings where individuals face higher stakes and more complex information environments.

Second, this dissertation primarily investigates why individuals develop overconfidence even when presented with objective information, focusing on the demand side of belief formation. However, in the real world, people are often exposed to biased or misleading information, such as fake news on social media. Future studies could investigate the complex interplay between the supply side (the availability and quality of information) and the demand side (how individuals process that information) and how these dynamics contribute to the development and persistence of overconfidence. This topic is especially relevant in an era where individuals increasingly seek and receive information through social networks, creating echo chambers that may further reinforce biases in belief formation.

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