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**Confidence, Overconfidence, and  
Exposure in Financial Market  
Decisions – Experimental Evidence  
from the U.S. Stock Market**

# Confidence, Overconfidence, and Exposure in Financial Market Decisions – Experimental Evidence from the U.S. Stock Market

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**Key Words:** Confidence, overconfidence, stock market forecasting, portfolio choice, gender differences, behavioral economics, experiments.

**JEL Codes:** C91, D81, D84, D91, G17, G41, J16.

**Abstract:** In an online experiment involving 402 participants from the United States, actual ex-ante stock price forecasts and actual ex-ante investment decisions are compared to the participants' levels of confidence and overconfidence. The results show that confident and overconfident participants are more inclined to leaving themselves exposed by expressing strong opinions when forecasting stock prices. Furthermore, the results indicate that women and men differ in their levels of confidence and exhibit varying degrees of overconfidence. Finally, it can be concluded that confidence is a better predictor of subjects' forecasting behavior than overconfidence.

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## Introduction

A high level of confidence or overconfidence can influence the behavior of financial market participants. This study examines whether a high degree of confidence or overconfidence is associated with an increased willingness to leave oneself exposed by taking a bold stance in financial market decisions. This is investigated in an online experiment focusing on the forecasting behavior and diversification behavior of 402 participants from the United States.

The participants provide actual ex-ante forecasts of the price performance of large, well-known U.S. stocks. They also select an investment option (individual stocks or stock portfolios with varying degrees of diversification).

Measuring confidence and any overconfidence ultimately allows us to determine if a high degree of confidence and/or a high degree of overconfidence is associated with participants strongly leaving themselves exposed when making capital market forecasts and specific investment decisions. In this context, leaving themselves exposed means that the participants allow their confidence and/or overconfidence to lead them to decisions that disregard the given probabilities of success.

Based on previous research findings, we expect that confident and/or overconfident subjects are more inclined to be opinionated in capital market decisions and therefore tend to disregard the given probabilities. Also based on the existing literature, we expect this effect to be more pronounced among men than among women.

When considering confidence and overconfidence in absolute terms, it appears that there is a significant positive correlation with the willingness to leave oneself exposed when forecasting stock prices.

When examining two different approaches to relative confidence and relative overconfidence, a more nuanced picture emerges. The “better-than-average” approach reveals a significant positive correlation between relative confidence and the willingness to leave oneself exposed in stock price forecasts. In the case of relative overconfidence, however, this correlation remains well below the threshold of statistical significance. The same pattern is also observed when classifying responses into relative success intervals. There is a significant positive correlation between relative confidence and the willingness to leave oneself exposed in stock price forecasts. In the case of relative overconfidence, however, this correlation remains well below the threshold of statistical significance.

Differences between men and women become evident. Some of these are as expected, while others are quite surprising. For example, the overconfidence revealed by the “better-than-average” question is primarily attributable to men’s behavior. This finding is not surprising. In investment decisions, however, it is exclusively women who, in the face of high absolute confidence, move away from safer diversification decisions and thereby leave themselves exposed. This is a thoroughly surprising finding.

## Literature Review

Overconfidence is one of the most thoroughly researched behavioral anomalies in the field of behavioral economics (comprehensive literature reviews can be found in Filiz et al., 2026; Dewi, Syaifuddin & Arifin, 2024; Singh et al., 2024; Singh, Malik & Jha, 2024; Kumar & Chaurasia, 2024; Kumar & Prince, 2023; Grezo, 2021; Skala, 2008).

### *Overconfidence among capital market participants*

The potential effects of overconfidence on the behavior of capital market participants have also been widely discussed. For example, Dittrich, Güth, and Maciejovsky (2005) show that subjects with a high degree of overconfidence are more likely to deviate from optimal investment decisions. Biais et al. (2005) note that overconfidence leads to a deterioration in investment returns. Cheng (2007) arrives at similar conclusions. Guiso & Jappelli (2005) show that investors suffering from overconfidence overestimate the quality of their own information and achieve a lower Sharpe ratio with their investments. Glaser & Weber (2007) find that investors who overestimate their investment competence carry out transactions on the financial market noticeably more frequently. Statman, Thorley & Vorkink (2006), Deaves, Lüders & Luo (2009), Abbes, Boujelbene & Bouri (2009), Inaishi et al. (2010), Abreu & Mendes (2012), Metwally & Darwish (2015), Michailova & Schmidt (2016), Islam Khan, Tan & Chong (2016), Zia, Sindhu & Hashmi (2017), Breitmayer, Mensmann & Pelster (2018), Mushinada & Veluri (2018), Hassan, Youssef & Kazim (2025), and Mehra (2025) find similar results. Opposing conclusions are made by Fellner-Röhling & Krügel (2014) and Bonaparte (2024). Haslem (2010) finds that experienced investors with above-average investment assets believe they select the best actively managed investment funds, which also outperform index funds. However, it turns out that these experienced investors are not superior, but simply overconfident. Palomino & Sadrieh (2011) conclude that overconfidence in delegated portfolio management generates high trading volumes solely through excessive information gathering. Durand et al. (2013) discover a close link between overconfidence and overreaction in financial markets. Biais, Nasic & Weber (2009) arrive at similar findings. Xia, Wang & Li (2014) note that subjects who overestimate their financial knowledge are more likely to become active in the stock market. Breuer, Riesener & Salzmann (2014), Chu et al. (2017), and Adielyani & Mawardi (2020) also arrive at similar findings. Li (2020) notes that a high level of confidence leads to a higher proportion of assets invested in the stock market. Daniel & Hirshleifer (2015) view overconfidence as a microeconomic foundation for behavioral economics models that can explain why some investors exhibit aggressive trading behavior and thereby take on unnecessary risks. McCannon, Asaad & Wilson (2016) find that individuals who overestimate their financial competence invest larger amounts and take on greater risks. Markets with participants exhibiting a high degree of overconfidence exhibit higher price volatility and are more prone to the formation of price bubbles. Scheinkman & Xiong (2003), Dumas, Kurshev & Uppal (2009), and Michailova (2010) arrive at similar conclusions. Pikulina, Renneboog & Tobler (2017) find that the willingness to trade in financial markets is higher when there is significant overconfidence. Adebambo & Yan (2018) show that overconfidence among investors can lead to mispricing of stocks. Khan et al. (2019) identify the risk of poor investment decisions due to overconfidence particularly among retail investors. Barber et al. (2020) find that overly confident investors engage in securities transactions more frequently, use higher leverage, and achieve poorer results. Foo, Wahidudin & Chie (2020) interpret the trend toward passive investing as a consequence of declining overconfidence. Huasheng, Shi & Zhao (2021) show that the favorable outcome of a random event can be sufficient to lead to overconfidence among

investors, which can then result in increased trading activity and greater risk-taking. Baek & Cho (2022) find that U.S. investors who overestimate their investment knowledge are more likely to buy securities on margin and invest in microcap stocks, derivatives, and cryptocurrencies. Zhang & Chatterjee (2025) note that overconfidence increases the likelihood of investing in derivative instruments. Zhao, Wang & Cao (2025) show that overconfidence leads to excessive allocation to high-risk investments. Portia et al. (2025) identify overconfidence as a cause of suboptimal investment decisions. Nabeshima, Khan & Kadoya (2025) find that overconfidence can significantly reduce investors' loss tolerance. Grohmann et al. (2025) note that overconfidence is associated with a greater willingness to take out a loan.

#### *Overconfidence in forecasting financial market trends*

Several studies have examined the relationship between overconfidence and financial market forecasts. For example, Gordon & Kammen (1996) show that even short-term (one-day) forecasts of S&P returns are associated with systematic overconfidence. Fagerström (2008) arrives at similar conclusions. Arkes (2001) notes that overconfidence is a phenomenon frequently observed in forecasting and leads people to ignore decision-making aids and make forecasts that contradict the base rate. Stotz & von Nitzsch (2005) show that financial analysts overestimate their abilities and forecast earnings and stock prices with a positive bias. Kogan (2009) finds that overconfidence influences the information aggregation process and thus increases the dispersion of forecasts. Ishikawa & Takahashi (2010) find that managers with excessive confidence tend to make inflated profit forecasts. Deaves, Lüders & Schröder (2010) note that market forecasters are generally overconfident. Kinari (2016) reaches similar conclusions but also identifies a dependence on the forecast horizon. Broihanne, Merli & Roger (2014) show that financial market experts overestimate the reliability of their stock price forecasts. Van de Venter & Michayluk (2008) find that Australian financial planners frequently overestimate their own abilities and present a significant number of inaccurate predictions. Spiwoкс & Bizer (2018b) identify a significant degree of overconfidence in forecasting stock market developments. Deaves, Lei & Schröder (2019) show that bad German stock market forecasters tend toward overconfidence and make extreme forecasts. Liu & Tan (2021) discover a negative relationship between forecast accuracy and the degree of confidence. Aljifri (2023) concludes that excessive confidence has a significant positive impact on firm valuation in the Saudi Arabian stock market. Chandna (2024) also shows that overconfidence is often accompanied by an overestimation of one's own forecasting abilities. Pham & Do (2024) identify a positive influence of overconfidence on firm valuations in the HOSE Index (Vietnamese benchmark index). Filiz et al. (2026) note that subjects are all the more confident in their stock price forecasts the less specialized knowledge and experience they possess regarding capital market developments.

#### *Overconfidence and Diversification Behavior*

The effects of overconfidence on diversification behavior are discussed in several studies. For example, Nasic & Weber (2007) show that investors' risk behavior in portfolio selection is determined, among other things, by overconfidence. Frijns, Koellen & Lehnert (2008) note that self-assessment of financial competence, along with several other factors, influences portfolio design. Choi & Lou (2010) find that overconfidence often leads to suboptimal portfolio decisions and poor performance. Gaudecker (2015) notes that overconfidence often results in underdiversified portfolios and below-average investment returns. Pak & Chatterjee (2016) show

that the tendency toward overconfidence increases with age and results in heightened risk exposure when designing retirement portfolios. Spiwoks & Bizer (2018b) find that overconfidence and correlation neglect are frequently observed and that diversified investment instruments can mitigate the consequences of overconfidence. Guiso & Jappelli (2020) find that overconfidence can contribute to less efficient portfolios. Broekema & Kramer (2021) note that inadequate portfolio diversification correlates positively with overconfidence. Awalakki (2023) identifies suboptimal asset allocation as a consequence of overconfidence.

### *Overconfidence and Gender*

The literature on overconfidence provides clear evidence that women and men exhibit different levels of confidence and overconfidence. For example, Barber & Odean (2001) note that men enquire about capital market developments more frequently and also rebalance their securities portfolios significantly more often than women. Precisely because of this, men achieve lower average returns than women. Barber & Odean (2001) attribute this to a higher degree of overconfidence among men. Guiso & Jappelli (2005) show that overconfident investors overestimate the quality of their own information and achieve a lower Sharpe ratio. They further note that the portfolio's Sharpe ratio is negatively correlated with investments in information and that this negative correlation is more pronounced among men than among women. Evidence that men are more affected by overconfidence than women can also be found in Pulford & Colman (1997), Bhandari & Deaves (2006), Endres, Chowdhury & Alam (2008), Santos et al. (2010), Dahlbom et al. (2010), Zaiane & Abaoub (2010), Prasad & Mohta (2012), Hassan, Khalid & Habib (2014), Mishra & Metilda (2015), Tekçe & Yilmaz (2015), Yang & Zhu (2016), Kumar & Goyal (2016), Baker et al. (2019), Wilaiporn, Nongnit & Surachai (2021), Aristei & Gallo (2022), Chhatwani (2025), Neha (2025), and Li et al. (2025). Beckmann & Menkhoff (2008) find only a slightly higher tendency toward overconfidence among men. Hardies, Breesch & Branson (2013) show that the differences in overconfidence between women and men are less pronounced than the differences in risk-taking. Men exhibit a significantly higher willingness to take risks than women. D'Acunto (2015), on the other hand, finds that men exhibit both significantly more overconfidence and a greater willingness to take risks than women. Ifcher & Zarghamee (2014) find that men in a positive mood are prone to heightened overconfidence. In women, however, this effect does not occur. Spiwoks & Bizer (2018a) determine in an experiment on stock price forecasting that men are significantly characterized by overconfidence, while women are significantly characterized by underconfidence. Piehlmaier (2025) demonstrates, using representative investor data from 2,000 U.S. consumers, that men's greater tendency toward overconfidence – particularly regarding investment decisions – can be explained by the fact that women are more willing to seek additional opinions, which makes them more likely to feel uncertain and, consequently, less prone to overconfidence. Hardies, Breesch & Branson (2011) find no difference between the genders among auditors regarding their tendency toward overconfidence. No differences in the extent of overconfidence between the genders were found for participants in the Indonesian (Kufepaksi, 2011) or Indian (Kansal & Singh, 2018; Maji, 2025) capital markets either. García, Gómez & Vila (2022) arrive at similar results. Grosch & Fischer (2024) find no gender-specific difference in the occurrence of overconfidence in Ghana. Nguyen, Lawrence & Wick (2024), Schiel (2023), and Kim, Lee & Kim (2022) conclude that women are even more prone to overconfidence than men. Michailova, Mačiulis & Tvaronavičienė (2017) determine that individual trading activity and investment performance were influenced by overconfidence only among female participants. Although no consistent picture emerges, there is, in some cases, very compelling empirical

evidence that the tendency toward overconfidence is less pronounced among women than among men.

### **Research Approach, Experimental Design, and Hypotheses**

Most of the studies presented are based on the results of laboratory experiments, the administration of surveys, and the analysis of real-world data from banks and online brokers regarding the past investment behavior of subjects. These are well-suited methods for gaining insights into the occurrence and consequences of overconfidence.

We aim to broaden the spectrum of scientific approaches by conducting an online experiment in which forecasts regarding the performance of major, well-known U.S. stocks are actually made *ex ante* and diversification decisions regarding the U.S. stock market are actually made *ex ante*. We assume that these particularly realistic decision-making situations, in which the success of each individual decision is uncertain in advance for both the participants and the researchers, will lead to results that are especially close to reality. Furthermore, we consider both confidence and overconfidence as potential factors influencing the willingness to leave oneself exposed. In doing so, we primarily build upon the studies by Arkes (2001), Deaves, Lei & Schröder (2019), and Liu & Tan (2021).

Arkes (2001) notes that overconfidence is a phenomenon frequently observed in forecasting and leads people to ignore decision aids and make predictions that disregard base rates. Predictions must also be made in the present study. We also provide participants with decision aids based on historical frequencies. We expect that a high degree of confidence and/or overconfidence will lead to these decision aids (based on probabilities) being neglected more frequently.

Deaves, Lei & Schröder (2019) show that stock market forecasters who tend toward overconfidence are characterized by making extreme forecasts. We address this aspect by setting the probability-based decision aids in such a way that they counteract extreme forecasts (sharp price increases or sharp price decreases). Therefore, anyone wishing to forecast sharp price movements must disregard these decision aids and the underlying base rates.

Liu & Tan (2021) explore the relationship between forecast accuracy and confidence. We build on this idea by measuring not only the degree of overconfidence but also the degree of confidence. Both overconfidence and confidence are then related to the willingness to leave oneself exposed when making stock forecasts and choosing a level of diversification.

Specifically, the experiment is designed as follows (see also Appendix 1):

The participants are asked to forecast the price development of the 25 largest stocks (by market capitalization) in the Dow Jones Industrial Average Index (DJIA) over the course of the coming trading week (percentage change in the closing price of the respective stock on the previous Friday compared to the closing price of the respective stock on the Friday of the coming week). As information on these stocks, the participants receive a brief note indicating the industry in which the company operates. Furthermore, the normalized and adjusted price history (including stock splits and dividend payments) for the past 100 weeks is presented graphically (see Fig. 1).

The participants do not have to provide point estimates. Instead, they must choose one of five given price range options. These price range options are determined based on the past 100 weeks. A distinction is made between a particularly favorable price trend (Option 1), a favorable price

trend (Option 2), a moderate price trend (Option 3), an unfavorable price trend (Option 4), and a particularly unfavorable price trend (Option 5).

These five segments are determined separately for each of the 25 stocks. The segment boundaries are chosen such that the particularly favorable and the particularly unfavorable price trends (i.e., Option 1 and Option 5) have each occurred in 19% of the weeks over the past 100 weeks. The favorable and unfavorable price trends (i.e., Option 2 and Option 4) are defined such that they each occurred in 20% of the weeks over the past 100 weeks. The average price trend (i.e., Option 3) is defined such that it has occurred in 22% of the weeks over the past 100 weeks (see Fig. 1).

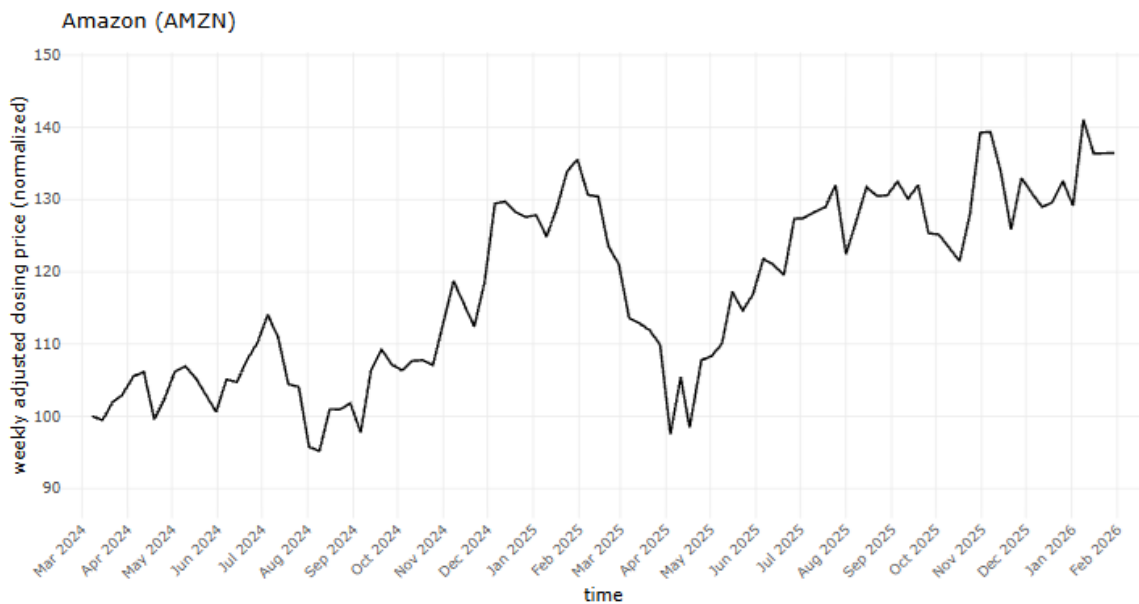
There are good reasons to assume that forecasting a stock's price movement over a one-week horizon is a very difficult task – if it is possible at all. In this respect, the five price movement corridors and their probabilities, which were determined based on the past 100 weeks, can be regarded as solid decision-making aids. Opinionated participants who rate their forecasting ability highly or even overestimate it, and who may believe they recognize patterns in the price chart, might be tempted to disregard the probabilities of price developments over the past 100 weeks and base their forecasts within the price development corridor of Option 1 or Option 5. If so, they expose themselves with their forecasts because they disregard the base rates of the past 100 weeks. Participants who assess their forecasting ability more cautiously are more likely to orient themselves toward the historical frequencies of price developments and opt for one of the middle price development corridors.

**Task 1: Weekly price forecasts 1/25 for Amazon (AMZN)**

**Brief company profile:**

Amazon.com, Inc. engages in the retail sale of consumer products, advertising, and subscription services through online and physical stores in North America and internationally.

**Development of adjusted and normalized closing prices over the last 100 weeks since March 08, 2024:**



**Please now forecast the percentage change of the closing price for Amazon (AMZN) between Friday, January 30, 2026, 4 p.m. EST and Friday, February 06, 2026, 4 p.m. EST:**

Your Choice	Option	Expected % change in the stock price over the course of the next trading week	Relative frequency (approx.) of this % change over the last 100 weeks
<input type="checkbox"/>	Option 1	+3.69% or more	19%
<input type="checkbox"/>	Option 2	Between +0.72% and +3.68%	20%
<input type="checkbox"/>	Option 3	Between -0.60% and +0.71%	22%
<input type="checkbox"/>	Option 4	Between -2.36% and -0.61%	20%
<input type="checkbox"/>	Option 5	-2.37% or worse	19%

**Fig. 1:** Illustration of Task 1 in the experiment

Participants are informed that they can receive up to USD 25 in compensation for successful forecasts in this task. This amounts to USD 1.00 per correct prediction. Only after the submission of forecasts for all 25 stocks from the Dow Jones Industrial Average Index has been completed will participants be offered a possible alternative to this compensation structure. They can choose between performance-based compensation (USD 1.00 for each correct forecast and USD 0.00 for each incorrect forecast) or a fixed compensation (USD 0.23 for each of the 25 forecasts, resulting in a total of USD 5.75).

Assuming that stock price movements over a one-week horizon are virtually unpredictable and generally follow the distribution of price movements over the past 100 weeks, selecting the price range for Option 1 or the price range for Option 5 results in an expected value of USD 0.19. Choosing the price range of Option 2 or the price range of Option 4 yields an expected value of USD 0.20. Choosing the middle price range (Option 3) is associated with an expected value of USD 0.22. Choosing the fixed reward results in USD 0.23 for each of the 25 prediction tasks.

We interpret the willingness to take a bold stance and thus to assume exposure when making price forecasts as follows: Those who choose the fixed compensation do not accept any exposure. These participants are assigned an exposure value of 0. Those who choose the middle price range (Option 3) accept an exposure of 1. Those who forecast a favorable (Option 2) or unfavorable (Option 4) price trend accept an exposure of 2. And the participants who bet on a particularly favorable (Option 1) or particularly unfavorable price trend (Option 5) expose themselves the most. They are assigned an exposure value of 3. At the end, the exposure values for all 25 forecasts are summed up, so that each participant receives a total value for their willingness to leave themselves exposed between 0 and 75.

This first task, in which 25 stock forecasts are submitted, is followed by a second task in which participants must assess their own performance level with regard to these 25 forecasts. First, they are asked how many of the 25 forecasts they submitted will prove to be accurate. This task also offers an incentive. Those who accurately estimate their forecasting success receive a reward of USD 5.00.

This question is used to assess the participants' confidence. It ranges from 0 to 25. At the end of the following week, the participants' actual forecasting success can be determined. At that point, their absolute overconfidence can also be calculated. It ranges from +25 (maximum overconfidence) to -25 (maximum underconfidence). A value of +25 is reached when a participant assumes that all 25 of their predictions will prove to be correct, but in reality, not a single one of the five price movement ranges they selected was correct. A value of -25 occurs when a participant assumes that not a single one of their 25 forecasts will be correct, but in reality all 25 forecasts submitted turn out to be correct.

Based on the existing literature, we expect that the participants' willingness to leave themselves exposed when making forecasts (from 0 to 75) is positively correlated with the degree of confidence (from 0 to 25).

Hypothesis 1a is therefore: There is a significant positive correlation between absolute confidence and the willingness to leave oneself exposed when forecasting stock prices.

Furthermore, based on previous research findings (see literature review in the previous chapter), we expect that the participants' willingness to expose themselves when making a forecast (from 0 to 75) is positively correlated with the degree of overconfidence (from +25 to -25).

Hypothesis 1b is therefore: There is a significant positive correlation between absolute overconfidence and the willingness to leave oneself exposed when forecasting stock prices.

After asking how many of the 25 forecasts will prove to be accurate, the participants are asked whether they assess the extent of their forecasting success – compared to the other participants – as above average or below average. This question is also incentivized. Those who correctly assess their relative success receive an additional reward of USD 1.00.

Those who assess their forecasting success as above average can be described as the confident group. Those who assess their forecasting success as below average can be described as the reserved group.

At the end of the one-week forecasting period, it is also possible to determine who accurately assessed their forecasting success. The participants then divide into three groups: 1. Those who rated their forecasting success as above average but actually achieved only below-average forecasting success. These are participants who suffer from overconfidence. 2. Those who accurately assessed their relative forecasting success. 3. Those who rated their forecasting success as below average but actually achieved above-average forecasting success. These are participants who suffer from underconfidence.

Based on previous research findings (see literature review in the previous chapter), we expect that in the group of the confident subjects and in the group of the overconfident subjects, forecasts associated with greater exposure are made more frequently than in the group of the reserved subjects and in the group of the underconfident subjects respectively.

Hypothesis 2a is therefore: The level of forecast exposure is significantly higher in the group of confident subjects (better than average) than in the group of reserved subjects.

Hypothesis 2b states: The level of forecast exposure is significantly higher in the group of overconfident subjects (better than average) than in the group of underconfident subjects.

The next step involves a more nuanced examination of relative confidence and relative overconfidence. Participants are asked to rank their forecasting performance relative to that of other participants within one of 20 quantiles. One selects quantile 20 if one has the impression that one belongs to the top successful 5% of all participants. One selects quantile 19 if one has the impression that one has made fewer successful forecasts than the top 5% of participants, but at the same time has made more successful forecasts than the bottom 90% of participants. This logic continues step by step until quantile 1, which is selected by participants who believe they belong to the 5% least successful forecasters. The entire range of success is thus divided into 20 sections, each comprising 5% of all participants. This task is also incentivized separately. Those who correctly estimate which of the 20 quantiles they belong to receive a reward of USD 4.00 for this task.

The participants' relative confidence ranges from 1 to 20. The lowest possible confidence level (value 1) is achieved when the participant places themselves in quantile 1. The highest possible confidence level (value 20) is achieved when the participant places themselves in quantile 20 of the relative range of success.

Once the forecast horizon has elapsed – that is, at the end of the trading week following the survey – the participants' actual relative success can be determined. Comparing the presumed and actual relative forecast success provides insight into the extent of any overconfidence. The value range extends from +19 (highest possible level of overconfidence) to -19 (highest possible level of underconfidence). A value of +19 is assigned to participants who expected to be in the top quantile of relative forecasting success but who, in reality, are in the bottom quantile with very poor forecasting success. A score of -19 is assigned to participants who expected to be in the lowest quantile of relative forecasting success but who, in reality, are in the top quantile with very good forecasting success. For example, if a participant had assumed they would be in the 4th quantile of relative forecasting success and this later turned out to be true, that participant receives an overconfidence score of zero.

Based on the existing research literature, we expect that the willingness to assume exposure when making stock price forecasts (on a scale of 0 to 75) will be higher the stronger the relative confidence (on a scale of 1 to 20) or the relative overconfidence (on a scale of -19 to +19) is.

Hypothesis 3a is therefore: There is a significant positive correlation between relative confidence (by quantiles) and the willingness to leave oneself exposed when forecasting stock prices.

Hypothesis 3b states: There is a significant positive correlation between relative overconfidence (by quantiles) and the willingness to leave oneself exposed when forecasting stock prices.

Following the first task (stock price forecasting) and the second task (assessing absolute and relative forecasting success), the third task focuses on the participants' diversification behavior. Participants are asked to choose an investment for the upcoming trading week. They can choose either one of the 25 individual stocks or one of three stock portfolios with varying degrees of diversification. Portfolio 1 consists of an equal amount of Apple and Coca-Cola stock. Portfolio 2 consists of an equal amount of Apple, Coca-Cola, Goldman Sachs, and Caterpillar stock. Portfolio 3 consists of an equal amount of Apple, Coca-Cola, Goldman Sachs, Caterpillar, Amgen, and Walmart stock.

Participants must choose either one of the 25 individual stocks or one of the three portfolios. The goal is to achieve the highest possible risk-adjusted return over the course of the next trading week. This means that the price performance of the selected stock or portfolio is divided by the standard deviation of the investment's hourly price movements. This task is also incentivized separately. The participants who rank in the top 50% of all participants (based on risk-adjusted return) will receive a reward of USD 2.00. Therefore, no outstanding result is required to receive the reward. It is sufficient to achieve a solid result, that is, to achieve a risk-adjusted return that is better than that of the bottom 50% of participants.

No one can know exactly how the prices of the 28 investment alternatives will develop in the coming trading week or what price fluctuations will occur with these investment alternatives in the coming week. But one can keep in mind that diversified investments generally entail lower price volatility (= lower standard deviation) than non-diversified investments. Among the diversified investments, there is a portfolio composed of two stocks from two industries (Portfolio 1). There is also a portfolio composed of four stocks from four industries (Portfolio 2). And there is a portfolio composed of six stocks from six industries (Portfolio 3). Since the standard deviation of the investment's hourly price movements plays a significant role in the overall result, there is a strong case for diversifying as broadly as possible. It is reasonable to assume that Portfolio 3 will exhibit the lowest standard deviation in hourly price movements.

Based on previous research findings (see literature review in the previous chapter), we expect that confident and overconfident participants are more inclined to take a bold stance and therefore to leave themselves exposed by selecting individual stocks. The willingness to expose themselves is rated 4 if the participant chooses one of the 25 individual stocks. If the participant selects Portfolio 1 (two stocks from two sectors), their willingness to leave themselves exposed is rated 3. If the participant selects Portfolio 2 (four stocks from four sectors), their willingness to assume exposure is rated 2. If the participant selects Portfolio 3 (six stocks from six sectors), their willingness to leave themselves exposed is rated as 1.

Hypothesis 4a is therefore: The willingness to leave oneself exposed in investment decisions by neglecting diversification opportunities is significantly positively correlated with the degree of absolute confidence.

Hypothesis 4b states: The willingness to leave oneself exposed in investment decisions by neglecting diversification opportunities is significantly positively correlated with the degree of absolute overconfidence.

Based on previous research (see literature review in the preceding chapter), it must be assumed that, particularly in the context of capital market issues, different levels of confidence or overconfidence may occur among women and men. Accordingly, when testing all hypotheses, we do not only consider the entire sample population, but we also consistently examine whether different results emerge for women and men.

The online experiment was programmed in oTree (Chen, Schonger & Wickens, 2016).

## **Results**

The online experiment was conducted on the Prolific participant platform from Friday, January 30, 2026, starting at around 5:15 p.m. Eastern Standard Time (EST, roughly one hour and fifteen minutes after the close of trading on the New York Stock Exchange [NYSE]) until Sunday, February 1, 2026, at around 12:30 p.m. EST. About 92% of all participants took part on Saturday, January 31, 2026, between 3:00 a.m. and 5:00 p.m. EST. Approximately 400 participants living in the United States were planned to be recruited. We deliberately did not select only individuals with capital market experience or even just those with professional experience in the investment sector as participants. This is because, in order to investigate the effect of confidence and overconfidence on certain behaviors in a financial context, it is necessary to include participants who, given their limited experience in the investment sector, may not be very confident or overconfident. Instead, we opted for a representative composition of our participants. This representativeness applies to gender, age structure, and ethnicity. Of the total 402 participants, 205 are female (51.0%) and 197 are male (49.0%). 48 participants (11.9%) are in the 18-24 age group. 70 participants (17.4%) are between 25 and 34 years old. 71 participants (17.7%) are in the 35-44 age group. 64 participants (15.9%) are in the 45-54 age group. 149 participants (37.1%) are 55 years old or older. 259 participants (64.4%) are of “White” ethnicity. 48 participants (11.9%) are of “Black” ethnicity. 43 participants (10.7%) are of “Mixed” ethnicity. 24 participants (6.0%) are of “Asian” ethnicity. 28 participants (7.0%) are of other ethnicities.

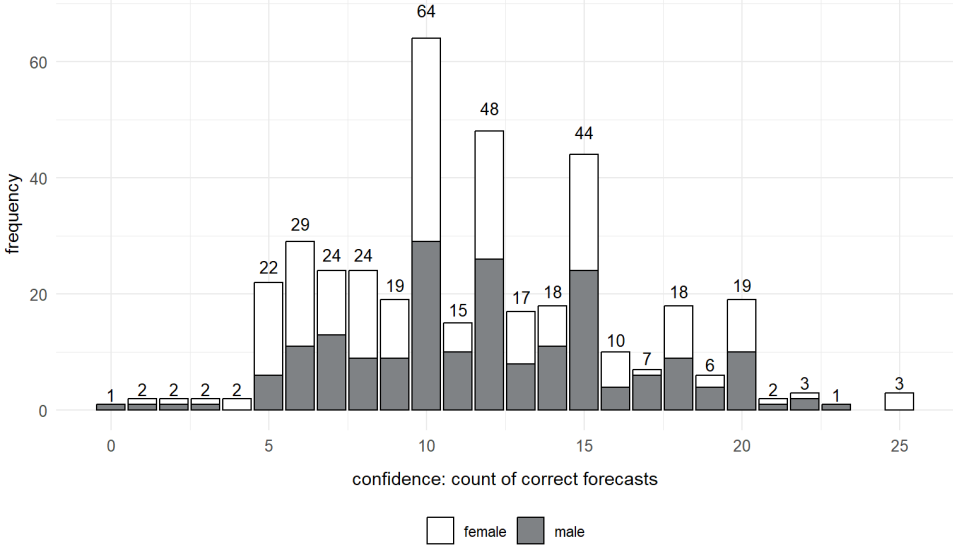
394 participants (98.0%) are U.S. citizens. 365 participants (90.8%) were born in the U.S. 378 participants (94.0%) speak English as their native language. 18 participants (4.5%) hold a doctoral degree. 65 participants (16.2%) hold a graduate degree (MA/MSc/MPhil, etc.) as their highest level of education. 165 participants (41.0%) hold an undergraduate degree (BA/BSc, etc.). 59 participants (14.7%) earned a degree from a technical or community college. 88 participants (21.9%) have a high school diploma as their highest level of education. 6 participants (1.5%) have a secondary education (e.g., GED/GCSE). And 1 participant (0.2%) has no formal qualifications.

Thus, our sample group reflects U.S. society quite well and can generally be considered representative (see also: Prolific, n.d., and U.S. Census Bureau, n.d.).

## *Confidence*

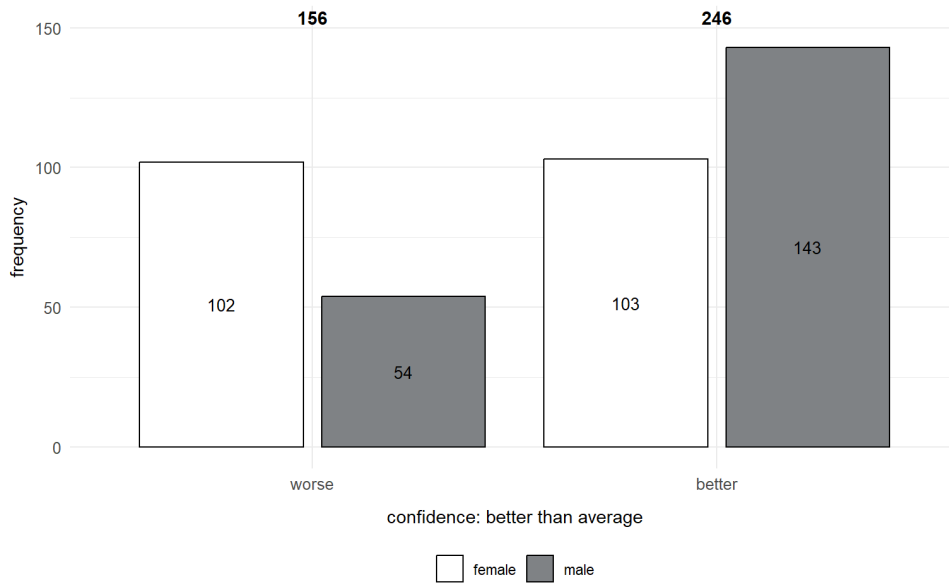
In terms of confidence, the participants span the full spectrum (see Fig. 2). A single participant suspects that none of his 25 forecasts will come true. Three participants suspect that they are correct on all 25 forecasts. The majority of self-assessments of forecasting success fall between

five (22 participants) and 20 (19 participants). Men generally prove to be somewhat more confident (median 12) than women (median 10). Incidentally, this difference proves to be significant in the Wilcoxon-Mann-Whitney test at a probability of error of less than five percent ( $p$ -value = 0.021).

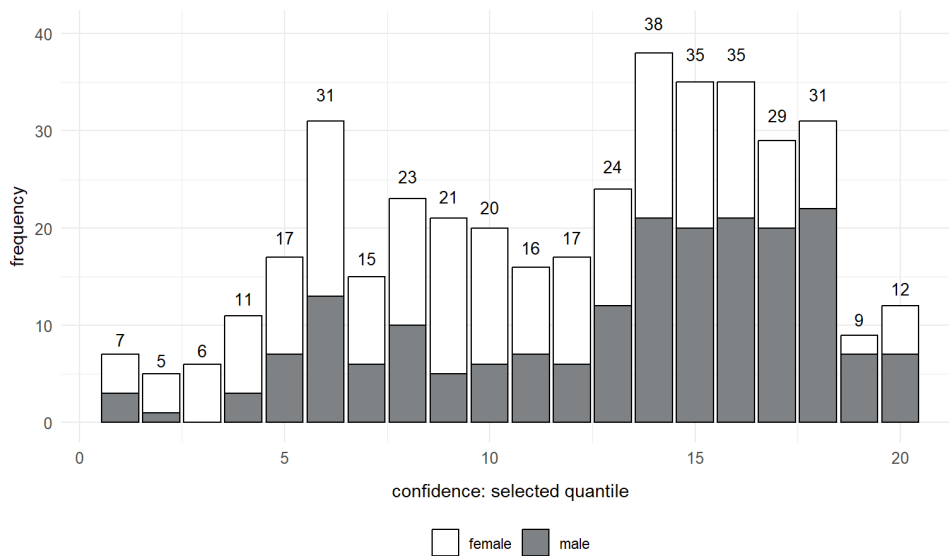


**Fig. 2:** Self-assessment of the participants (number of successful forecasts)

When asked whether their own forecasting success is likely to be better or worse than average, the usual pattern emerges (Fig. 3). 246 participants (61.2%) assume that their predictions will prove to be above-average in success. Only 156 participants (38.8%) rate their own forecasting success as below average. This reveals a slight tendency toward overconfidence, which, however, originates exclusively from the male participants. 103 out of 205 female participants (50.2%) believe that their predictions are above-average in success. In contrast, 143 out of 197 male participants (72.6%) believe that they are better than average at making forecasts. This difference between the genders is highly significant according to the Pearson chi-square test ( $p$ -value < 0.001).



**Fig. 3:** Self-assessment of the participants in comparison to the average

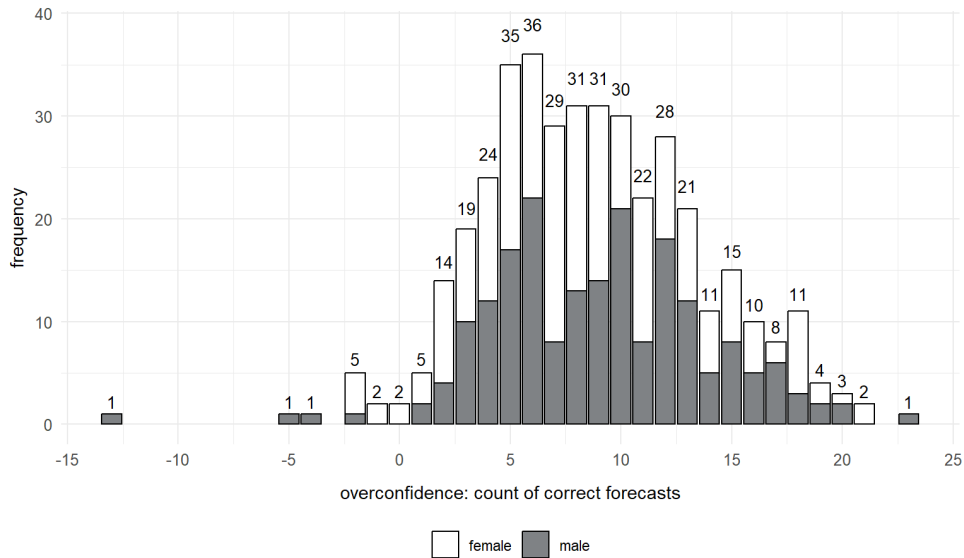


**Fig. 4:** Relative self-assessment of the participants within one of 20 quantiles

When asked which of the 20 success quantiles they place themselves in, the full range is also utilized (Fig. 4). Twelve participants believe they belong to the top 5% of participants (quantile 20). Nine participants assume that the success of their forecasts is lower than that of the top 5% of participants, but at the same time higher than that of the bottom 90% of participants (quantile 19). Seven participants expect that their forecasting success is low and that it ranks among the bottom 5% of all participants (quantile 1). Women chose the 11th quantile at the median, while men assigned themselves to the 14th quantile at the median. Thus, also when examining relative confidence by quantiles, men tend to exhibit higher confidence. The difference proves to be highly significant in the Wilcoxon-Mann-Whitney test ( $p\text{-value} < 0.001$ ).

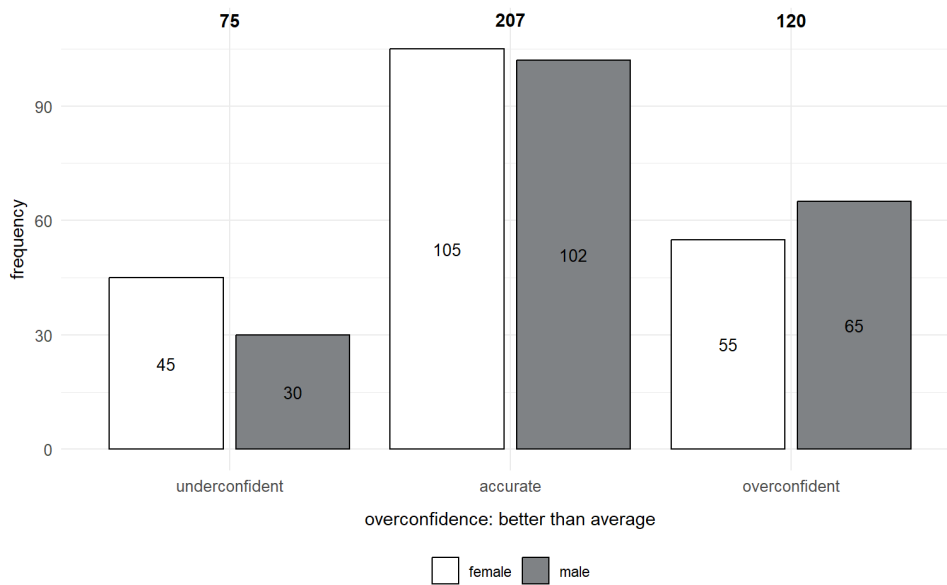
## Overconfidence

When we compare self-assessment with actual forecasting success, we gain insight into the extent of overconfidence. Figure 5 shows a notable degree of overconfidence.



**Fig. 5:** Absolute overconfidence (estimated number of correct forecasts minus actual number of correct forecasts)

Two out of 402 participants (0.5%) accurately estimated the number of their successful forecasts (value 0 on the x-axis in Fig. 5). Ten out of 402 participants (2.5%) underestimated their performance level (to the left of the value 0 on the x-axis in Fig. 5). 390 out of 402 participants (97.0%) overestimated the absolute extent of their forecasting success (to the right of the value 0 on the x-axis in Fig. 5). This represents a remarkable degree of absolute overconfidence.



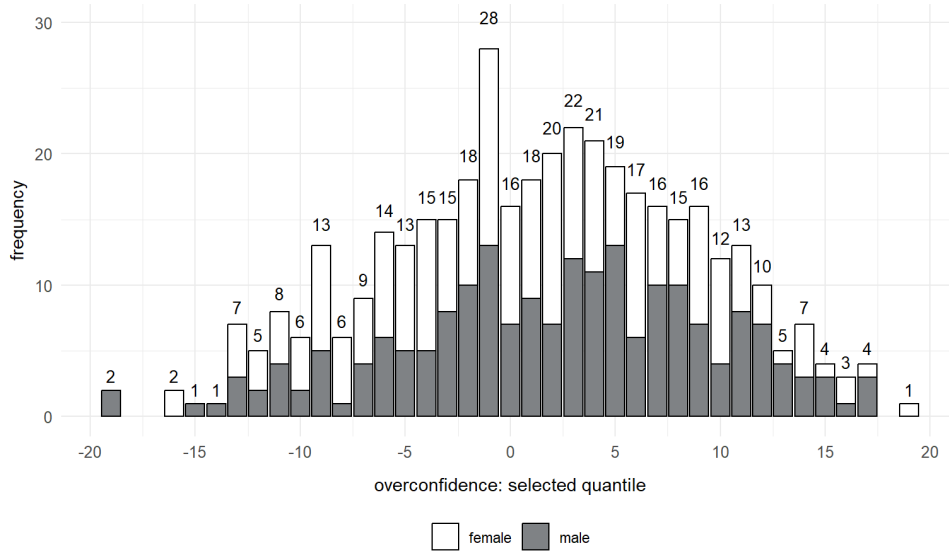
**Fig. 6:** Relative overconfidence regarding the “better-than-average” question

The extent of relative overconfidence is far less dramatic. Figure 6 shows who classified themselves accurately and who inaccurately as above- or below-average.

207 out of 402 participants (51.5%) classified themselves correctly. 75 out of 402 participants (18.7%) assumed they would be below-average at forecasting, but actually performed above average. This represents the opposite of overconfidence, namely underconfidence. 120 out of 402 participants (29.9%) assumed they were above-average at forecasting, while in reality they were below-average. This group exhibits relative overconfidence.

There are clear differences between male and female participants. Among the 75 participants who exhibit underconfidence (left bars in Fig. 6), 45 (60.0%) are female. Only 30 of the 75 participants (40.0%) are male. Among the 120 participants characterized by overconfidence (right bars in Fig. 6), 55 are female (45.8%) and 65 are male (54.2%). Among the 207 participants who assessed themselves accurately (middle bars in Fig. 6), there are only marginal differences between the genders. 105 women (50.7%) and 102 men (49.3%) accurately classified themselves in response to the “better-than-average” question.

Figure 7 shows relative overconfidence by quantiles. The x-axis plots the difference between the estimated and actual quantile. The two participants found at the far left of the histogram (x-axis value = -19) assume they belong to the least successful 5% of the forecasters, but in fact belong to the most successful 5% of the participants. These are thus participants who exhibit the maximum possible relative underconfidence. The one participant found at the far right of the histogram (x-axis value = +19) assumed they belonged to the top 5% of all participants, but in reality belongs to the bottom 5% of all participants. This participant exhibits the maximum possible relative overconfidence.



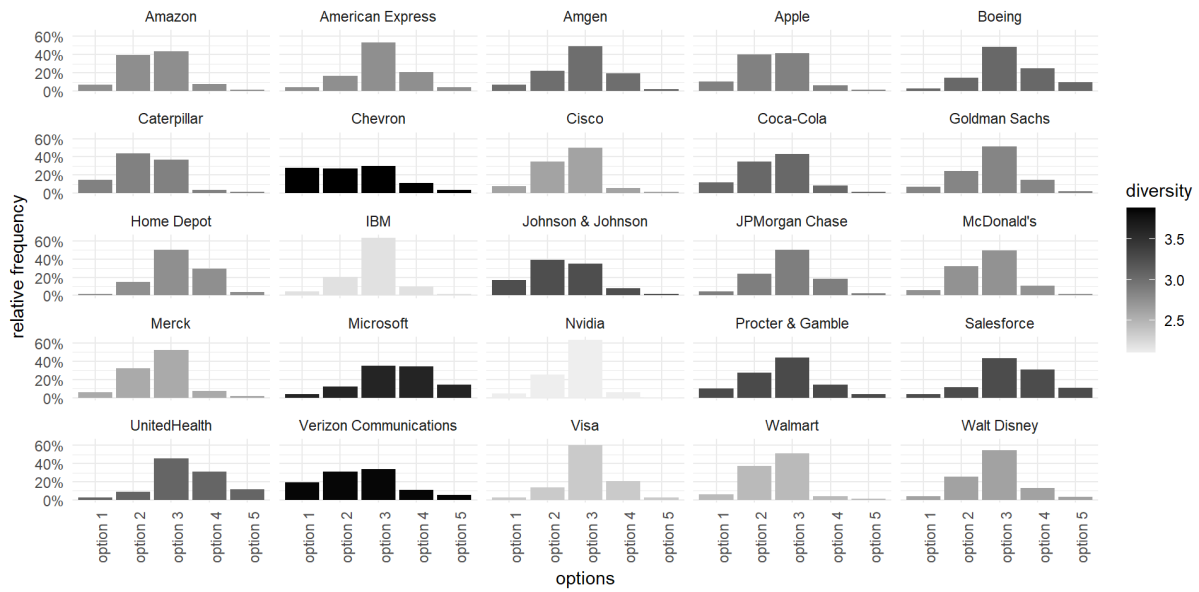
**Fig. 7:** Relative overconfidence in the quantile analysis

It can be seen that the distribution is slightly skewed to the right. The median is 2. This means that a slight overconfidence can be observed. The median participant thus rated themselves two quantiles higher than is actually the case. Differences between men and women are evident as well. While the median for women is 1, the median for men is 3. This means that the median female participant rates herself one quantile higher than is actually the case. The median male participant, on the other hand, rates himself three quantiles too high.

Overall, male participants showed a greater tendency toward overconfidence than female participants across all of the different perspectives on self-assessment accuracy examined above. However, this was statistically significant only in the case of self-assessment accuracy based on quantiles (Wilcoxon signed-rank test,  $p$ -value = 0.038). A greater tendency toward overconfidence among male participants can be partly attributed to the fact that they rated themselves as high performers significantly more often than women on all self-assessment questions.

*Hypothesis 1*

Particularly confident subjects may be inclined to make opinionated decisions, to disregard decision-making aids, and to ignore the available base rates.



**Fig. 8:** Distribution of forecasts across the five forecast corridors by stock

When examining the selected price trend corridors, it can first be observed that the participants' decisions frequently align with what the decision aids suggest – based on the historical distributions of weekly price trends over the past 100 weeks (Fig. 8). It appears that the middle price trend option 3, which occurred most frequently over the past 100 weeks, is also most frequently selected as the forecast for the following week. For 23 of the 25 stocks, the middle price trend option 3 is the most frequently selected forecast. Only for Caterpillar and Johnson & Johnson is a different price trend corridor the most frequently forecast.

Regardless of this, there is a positive correlation between the willingness to leave oneself exposed when making a forecast, on the one hand, and the respondents' absolute confidence, on the other. Absolute confidence is measured by asking how many of their 25 forecasts each respondent expects to be successful.

**Tab. 1:** Relationship between absolute confidence and forecast exposure

Subjects	n	Kendall's tau	p-value	Alternative
Women	205	0.188	0.0001	greater
Men	197	0.181	0.0003	greater
Total	402	0.186	<0.0001	greater

The expected correlation proves to be highly statistically significant (Table 1). For both men and women, the probability of error is well below one percent. The null hypothesis for Hypothesis 1a must therefore be clearly rejected. There is a significant positive correlation between absolute confidence and the willingness to take a bold stance, i.e., to leave oneself exposed, when making stock price forecasts.

Next, we examine the relationship between absolute overconfidence on the one hand and the willingness to assume exposure when making a forecast on the other (Table 2). Absolute

overconfidence is measured by the difference between the number of estimated forecast successes and the number of actual forecast successes.

Here, a more nuanced picture emerges. For the total sample of 402 participants, the presumed positive correlation between absolute overconfidence and willingness to leave oneself exposed when making stock price forecasts is found to be statistically highly significant. The probability of error is less than one percent. Among the 197 men, however, this correlation proves to be statistically insignificant. Among women, the positive correlation is statistically significant, though with a probability of error of less than five percent.

**Tab. 2:** Relationship between absolute overconfidence and forecast exposure

Subjects	n	Kendall's tau	p-value	Alternative
Women	205	0.115	0.0117	greater
Men	197	0.047	0.1839	greater
Total	402	0.084	0.0099	greater

The null hypothesis for Hypothesis 1b must be rejected when considering the entire group of participants. There is thus a significant positive correlation between absolute overconfidence and the willingness to leave oneself exposed in stock price forecasting. However, this correlation is quite weak, as can be seen from the low values of Kendall's tau. A large number of observations is required to reach this conclusion.

### *Hypothesis 2*

Relative confidence becomes apparent quickly in response to the “better-than-average” question. Those who consider their forecasting performance to be above average are confident relative to the other participants. Those who rate their forecasting success as below average are more reserved relative to the other participants. For these two groups of participants (confident participants on the one hand and reserved participants on the other), the forecast exposure values are now compared and examined for significant differences using the Wilcoxon-Mann-Whitney test (Table 3).

**Tab. 3:** Differences in forecast exposure between confident and reserved participants

Subjects	n	Confident participants*	Reserved participants*	Wilcoxon-Mann-Whitney test p-value (one-tailed)
Women	205	38.0 (28.94)	26.0 (22.32)	0.0158
Men	197	37.0 (30.20)	0.0 (17.91)	0.0020
Total	402	37.0 (29.67)	25.0 (20.79)	0.0001

\* Median (mean) of forecast exposure

There is a statistically significant difference between the confident and the reserved participants regarding their willingness to leave themselves exposed when making stock price forecasts. The confident participants are more willing to take a bold stance when making forecasts than the

reserved participants. This difference is highly statistically significant for all participants, with a probability of error well below one percent. The same applies to the male group of participants (Table 3). Among women, the difference is also statistically significant – with a probability of error of more than one percent, but far less than five percent (p-value = 0.0158). The null hypothesis for Hypothesis 2a must be rejected.

Now let us again consider overconfidence, which differs from confidence in that it takes into account not only self-assessment but also actual forecasting success. Again, based on the “better-than-average” question, the participants are divided into three groups: 75 participants exhibit underconfidence, 207 participants assess themselves accurately, and 120 participants exhibit overconfidence (Fig. 6). The participants who assess themselves accurately are not included in this comparison. Do the participants who exhibit overconfidence differ from those who exhibit underconfidence in terms of their willingness to leave themselves exposed in stock price forecasts? This question is again examined using the Wilcoxon-Mann-Whitney test (Table 4).

**Tab. 4:** Differences in forecast exposure between overconfident and underconfident participants

Subjects	n	Subjects with overconfidence*	Subjects with underconfidence*	Wilcoxon-Mann-Whitney test p-value (one-tailed)
Women	100	32.0 (25.93)	0.0 (20.02)	0.3631
Men	95	34.0 (28.69)	0.0 (21.90)	0.4806
Total	195	33.5 (27.42)	0.0 (20.77)	0.3428

\* Median (mean) of forecast exposure

The majority of participants who exhibit underconfidence chose the fixed compensation option. As a result, the median of their forecast exposure metrics is zero. Naturally, the situation is different for those who are overconfident. Here, the median forecast exposure score is 33.5 for all overconfident participants, 32 for all female overconfident participants, and 34 for all male overconfident participants. The average of the forecast exposure metrics is also notably higher for participants with overconfidence (27.42) than for those with underconfidence (20.77). It is surprising that the Wilcoxon-Mann-Whitney test nevertheless does not indicate the differences between the forecast exposure indices of the overconfident participants and the underconfident participants as significant. Only a permutation test for differences in means (one-sided) reveals a certain difference between the two groups. However, this applies only to the total group (all 195 participants) and reveals significance at a probability of error of less than one percent (p-value = 0.0098).

Overall, it must be concluded that the null hypothesis for Hypothesis 2b cannot be rejected. Although the forecast exposure is higher in the group of overconfident subjects (better than average) than in the group of underconfident subjects, as measured by the median and the mean, this difference is not statistically significant in the Wilcoxon-Mann-Whitney test.

### *Hypothesis 3*

Relative confidence can be assessed in a more nuanced way than with the “better than average” question. In the present experiment, participants were asked in which of 20 quantiles of

forecasting success they saw themselves. The top 5% of participants reach the highest quantile (quantile 20). Quantile 19 comprises participants who believe they forecast worse than the top 5% but better than the bottom 90%. Participants' self-assessment of their position within one of these 20 quantiles of relative forecasting success can be interpreted as relative confidence.

An interesting question is whether the degree of relative confidence correlates significantly with the willingness to leave oneself exposed by taking a bold stance in stock price forecasts. This is determined using Kendall's tau. The results show that higher relative confidence is also associated with a greater willingness to assume exposure in stock price forecasts (Table 5). For all participants, this relationship is statistically highly significant. The probability of error is well below one percent. The same applies to the male participants. The statistical significance is slightly less pronounced among the female participants. Here, the probability of error is more than one percent but well below five percent.

**Tab. 5:** Relationship between relative confidence based on quantiles and forecast exposure

Subjects	n	Kendall's tau	p-value	Alternative
Women	205	0.107	0.0178	greater
Men	197	0.175	0.0004	greater
Total	402	0.142	<0.0001	greater

The null hypothesis for Hypothesis 3a must be rejected. There is thus a significant positive correlation between relative confidence (by quantiles) and the willingness to leave oneself exposed in stock price forecasting.

If we take into account not only self-assessment but also actual forecasting success, the analysis shifts away from confidence and toward overconfidence. Relative overconfidence, which arises from self-classification into one of 20 quantiles and comparison with actual relative forecasting performance, should also be positively correlated with the willingness to leave oneself exposed in stock price forecasts. In fact, there is a weak negative correlation (Table 6). However, this correlation is so weak (Kendall's tau at -0.069 for all participants) that hardly any conclusions can be drawn from it. In any case, the expected positive relationship is not present.

**Tab. 6:** Relationship between relative overconfidence based on quantiles and forecast exposure

Subjects	n	Kendall's tau	p-value	Alternative
Women	205	-0.070	0.9184	greater
Men	197	-0.085	0.9520	greater
Total	402	-0.069	0.9736	greater

The null hypothesis for Hypothesis 3b cannot be rejected. Thus, there is no statistically significant positive correlation between relative overconfidence (by quantiles) and the willingness to leave oneself exposed in stock price forecasts.

This is a surprising result. We assume that estimating which of the 20 quantiles one belongs to is anything but trivial. Accordingly, many random results may occur when subtracting the actual quantile achieved from the presumed quantile to determine overconfidence. Under certain

circumstances, this noise may contribute to the expected relationship being observable but not proving statistically significant.

In this respect, it must be noted that confidence, in the context of the division into 20 quantiles, is better suited to providing indications of the willingness to take a bold stance and thus to expose oneself in stock price forecasting than overconfidence.

Another interesting aspect of relative self-assessment in quantiles emerges when five of the quantiles are grouped together to form a quartile. The comparison of presumed relative ability and actual relative success shows clear parallels to the results of Kruger & Dunning (1999) (see Appendix 2).

#### *Hypothesis 4*

At its core, this study examines the willingness to take on or accept exposure when forecasting stock prices. Another aspect to consider is the tendency toward diversification. Confident subjects may be inclined to be completely convinced of a stock's potential and to forego opportunities for diversification. Confident and/or overconfident participants might therefore be inclined to stick their neck out – that is, to leave themselves exposed – not only in stock market forecasting but also in investment decisions.

This aspect is also addressed in the present online experiment. In diversification tasks, it is generally necessary to determine risk preferences (risk-seeking, risk-neutral, or risk-averse), which is, however, a time-consuming process (see Filiz et al., 2020). Therefore, we have designed a task aimed at maximizing the risk-adjusted return. The risk-adjusted return is defined as the normalized percentage change in price over the coming week divided by the standard deviation of this price change on an hourly basis. This ensures that the objective is the same for risk-loving, risk-neutral, and risk-averse subjects, so that it is no longer necessary to record which risk preference applies to which subject.

Investors can choose to invest in one of the 25 stocks whose price performance was previously forecast. These are investments without any diversification. In addition, three stock portfolios with varying degrees of diversification are available for selection. Since the standard deviation of the hourly price performance is of great importance for the outcome, any deviation from the highest possible level of diversification represents an exposure.

In fact, however, it turns out that there is no stable correlation between confidence or overconfidence on the one hand and exposure in the context of diversification decisions on the other (Table 7).

**Tab. 7:** Relationship between absolute confidence and willingness to leave oneself exposed by neglecting diversification opportunities

Subjects	n	Kendall's tau	p-value	Alternative
Women	205	0.151	0.0032	greater
Men	197	-0.019	0.6303	greater
Total	402	0.073	0.0322	greater

For women, the presumed correlation holds true. The higher the absolute level of confidence, the greater the willingness to assume exposure by neglecting diversification opportunities. This correlation is even highly statistically significant. The probability of error is well below one percent. For men, however, no significant correlation is evident (Kendall’s tau = -0.02).

One possible explanation could be a broader understanding of the benefits of diversification among the male participants. Since they have more frequent direct contact with capital markets and more often make investment decisions within the household (see, e.g., Gu, Peng & Zhang, 2024; Wagner & Walstad, 2023; Fonseca et al., 2012; Meier, Kirchler & Hubert, 1999), this could indicate learning effects that result in more rational diversification decisions.

When considering the entire sample, the expected relationship emerges once again. The higher the absolute confidence, the stronger the tendency to leave oneself exposed through low diversification. This relationship is statistically significant at a probability of error of less than five percent.

The null hypothesis for Hypothesis 4a must therefore be rejected. The willingness to leave oneself exposed in investment decisions (i.e., to diversify less) is significantly positively correlated with the degree of absolute confidence. Possible reasons for the observed difference between women and men should be examined more closely in future research.

If, in addition to confidence, actual forecasting performance is also taken into account, then absolute overconfidence becomes the focus. The expected number of successful forecasts minus the actual number of successful forecasts can be used as a measure of absolute overconfidence. The larger this difference, the greater the absolute overconfidence. Does the tendency to assume exposure by neglecting diversification opportunities grow as absolute overconfidence increases? This is the case for women, but not for men. However, the relationships are so weak that the correlation are not statistically significant for women, men, or the entire sample group.

**Tab. 8:** Relationship between absolute overconfidence and willingness to leave oneself exposed by neglecting diversification opportunities

Subjects	n	Kendall’s tau	p-value	Alternative
Women	205	0.068	0.1082	greater
Men	197	-0.069	0.8926	greater
Total	402	0.005	0.4497	greater

Therefore, the null hypothesis for Hypothesis 4b cannot be rejected. The willingness to leave oneself exposed in investment decisions (through less diversification) is not significantly positively correlated with the degree of absolute overconfidence.

Overall, it can be concluded that the presumed relationship between overconfidence and diversification behavior cannot be substantiated using the present research approach.

## Summary

In an online experiment involving 402 participants from the United States, we investigate whether a high degree of confidence and/or a high degree of overconfidence is associated with a high willingness to leave oneself exposed in stock price forecasts and diversification decisions.

A high willingness to leave oneself exposed is evident in stock price forecasting if a participant deviates from probability-based decision aids when making forecasts and predicts strong upward or downward price movements. A high willingness to leave oneself exposed is evident in diversification decisions when diversification opportunities are foregone, even though a high risk-adjusted investment return (return on investment divided by the standard deviation of price movements) is the goal.

The participants first provide actual ex-ante forecasts for the 25 largest stocks (by market capitalization) in the Dow Jones Industrial Average Index. They forecast the price performance of these stocks over the course of the coming week (price change from last Friday's closing price to the closing price of the following Friday). However, the participants do not provide point forecasts. Instead, they must choose one of five possible price performance ranges. These price performance ranges (very favorable price performance, favorable price performance, average price performance, unfavorable price performance, and very unfavorable price performance) are determined separately for each of the 25 stocks based on the weekly price performance over the past 100 weeks.

The boundaries of the price movement corridors are chosen such that the very favorable and very unfavorable price movements each have a probability of 19% (based on the past 100 weeks), the favorable and unfavorable price movements each have a probability of 20% (based on the past 100 weeks), and the average price trend has a probability of 22% (based on the past 100 weeks). This provides the participants with a probability-based decision-making aid.

Subsequently, the participants' confidence and overconfidence are measured in three different ways:

1. First, the participants estimate how many of their 25 forecasts will turn out to be correct. This reflects the participants' absolute confidence (from 0 to 25). After one week, it becomes evident how many accurate forecasts each participant made. Subtracting the actual number of accurate forecasts from the expected number yields a metric for absolute overconfidence or absolute underconfidence (from -25 to +25).
2. Then the "better-than-average" question is asked. The participants who consider their forecasting performance to be above average demonstrate relative confidence. After one week, it becomes evident which participant actually forecast better or worse than average. Those who considered their forecasting success to be above average but are actually only below average in success exhibit relative overconfidence. Those who considered their forecasting success to be below average but are actually above average in success exhibit relative underconfidence.
3. Finally, the relative approach is refined. The participants assess how successful their forecasts are compared to those of the other participants. In doing so, they place themselves in one of 20 quantiles (ranging from the top 5% of the most successful participants to the bottom 5% of the least successful participants). This self-assessment reflects the participants' relative confidence (from 1 to 20). After one week, it becomes evident which participant has reached which quantile. Subtracting the actual quantile

from the expected quantile yields a metric for relative overconfidence or relative underconfidence (from -19 to +19).

Not only the forecasts but also the self-assessments are incentivized individually.

Finally, the participants make an investment decision. The goal is to achieve the highest possible risk-adjusted return within one week. Investment options with varying degrees of diversification are available. The less diversification is employed, the greater the participants' exposure.

Essentially, the following results are obtained:

1. Absolute confidence and the willingness to leave oneself exposed when forecasting stock prices show a significant positive correlation.
2. Absolute overconfidence and the willingness to leave oneself exposed when forecasting stock prices show a significant positive correlation.
3. Relative confidence (better than average) and the willingness to leave oneself exposed when forecasting stock prices show a significant positive correlation.
4. Relative overconfidence (better than average) and the willingness to leave oneself exposed when forecasting stock prices appear to show a weak positive correlation, although this is not statistically significant.
5. Relative confidence (by quantiles) and the willingness to leave oneself exposed when forecasting stock prices show a significant positive correlation.
6. Relative overconfidence (by quantiles) and the willingness to leave oneself exposed when forecasting stock prices do not show the expected positive correlation.
7. Absolute confidence and the willingness to leave oneself exposed in diversification decisions show a significant positive correlation among women. However, this is not the case among men. This is a rather surprising finding.
8. Absolute overconfidence and the willingness to leave oneself exposed in diversification decisions show no significant correlation.
9. Overall, the participants show a clear tendency toward overconfidence.
10. Male and female participants show noticeable differences in the degree of confidence, and overconfidence as well as in these traits' relationship with forecasting exposure and diversification behavior.
11. The overconfidence evident in the "better-than-average" question is primarily attributable to men's behavior. Also with other forms of measurement, men show a stronger tendency toward overconfidence than women.

Overall, it can be concluded that confident and overconfident subjects are more inclined to express strong opinions and thus to assume exposure when forecasting stock prices.

Furthermore, it can be concluded that the concept of confidence is better suited to characterizing the forecasting behavior of subjects than the concept of overconfidence.

## **Acknowledgement**

We express our gratitude for the valuable feedback from the participants in the doctoral seminar organized by Kilian Bizer at the University of Göttingen in October 2025 and March 2026.

Artificial Intelligence (AI) was used in two parts of the research process: First, the oTree programming of the experiment in the integrated development environment (IDE) PyCharm was supported by JetBrains' AI Chat feature, which primarily utilized the Gemini 3 Flash AI model. Second, after the manual drafting of this manuscript by the authors, DeepL Pro was used for English language editing and grammar enhancement. The authors thoroughly reviewed and edited all AI-generated output and take responsibility for its accuracy and consistency.

## **Data availability**

The replication data (experimental results data and oTree programming files) for this study can be found here: <https://doi.org/10.25625/QLGE57>

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## **Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix 1: Presentation of the online experiment

[The informed consent form came right before this screen]

### Task 1: Instructions and Control Questions

#### Instructions

**In this first task, you will be asked to forecast the percentage change in the stock market price of 25 different stocks from the Dow Jones Industrial Average (DJIA) over the course of a week (period: from Friday, January 30, 2026, 4 p.m. EST, to Friday, February 06, 2026, 4 p.m. EST).**

However, you do not have to predict these percentage changes exactly. Instead, you can choose from five different options for each stock, which represent different forecast ranges for the percentage changes in the respective weekly prices.

The forecast ranges offered correspond to possible price developments based on the historical data of each stock's last 100 weekly closing prices. The relative frequency (approx.) of the price development observed in these past 100 weekly closing prices is communicated to you for each forecast option. For each stock, you will also see a chart that graphically displays the historical development of its last 100 weekly closing prices.

Please note that the price information provided for all 25 stocks has been normalized to a uniform value of 100 at the first of the 100 weekly closing prices (Friday, March 08, 2024). Therefore, the following screens do not show the actual price developments, but rather those that the respective stocks would have undergone over the course of the 100 weeks if all 25 stocks had started at a price of 100 USD on Friday, March 08, 2024. Moreover, the prices were adjusted in order to include dividend payments and stock splits. This is to make a comparison of the different stocks easier for you.

**You submit your forecast for the percentage change of the respective stock price by selecting one of the five given forecast options and confirming this by clicking on the "Submit forecast" button.**

**After you have made all 25 forecasts, you can choose between two different compensation models for this task 1. While you will get to know the details of these two models only after you have made all forecasts, please be ensured that submitting your best forecasts possible will allow you to earn up to 25 USD in remuneration for this task 1.**

We will determine whether your forecasts are correct or not as soon as the weekly closing prices are available.

**Please note that Task 1 is primarily about making accurate forecasts.** In the following task 2, however, under certain rather unlikely circumstances, which we will explain in more detail in the instructions for task 2, the speed with which you submitted your forecasts in task 1 may also play a role. Therefore, your main focus in task 1 should be on submitting accurate forecasts, but you should also not entirely neglect the time factor.

**Control questions** [were displayed on the same screen right below the instructions]

**How many forecasts do you have to submit?**

- 15
- 25 (Correct!)
- 50

*[In case of an incorrect answer:] Hint: In this first task, you will be asked to make one forecast for each of 25 different stocks from the Dow Jones Industrial Average (DJIA).*

**What is the forecast period?**

- The coming trading week (until Friday, February 06, 2026, 4 p.m. EST) (Correct!)
- The coming month (until Friday, February 27, 2026, 4 p.m. EST)
- The current year (until Thursday, December 31, 2026, 4 p.m. EST)

*[In case of an incorrect answer:] Hint: In this first task, you will be asked to forecast the percentage change in the stock market price of 25 different stocks from the Dow Jones Industrial Average (DJIA) over the course of a week (period: from Friday, January 30, 2026, 4 p.m. EST, to Friday, February 06, 2026, 4 p.m. EST).*

**What type of forecast is expected from you?**

- I have to give forecasts for the actual prices that are accurate to the cent.
- I have to define a price range in which I expect the respective price to be.
- I have to select a forecast option from five predefined forecast ranges. (Correct!)

*[In case of an incorrect answer:] Hint: You do not have to forecast the percentage changes exactly, but you have five different options to choose from for each stock, which correspond to different forecast ranges for the percentage changes in the respective weekly prices.*

**What is the maximum remuneration you can earn for this task?**

- I will not receive any remuneration for this task.
- I can earn a maximum reward of 25 USD. (Correct!)
- I can receive a maximum reward of 10 USD.

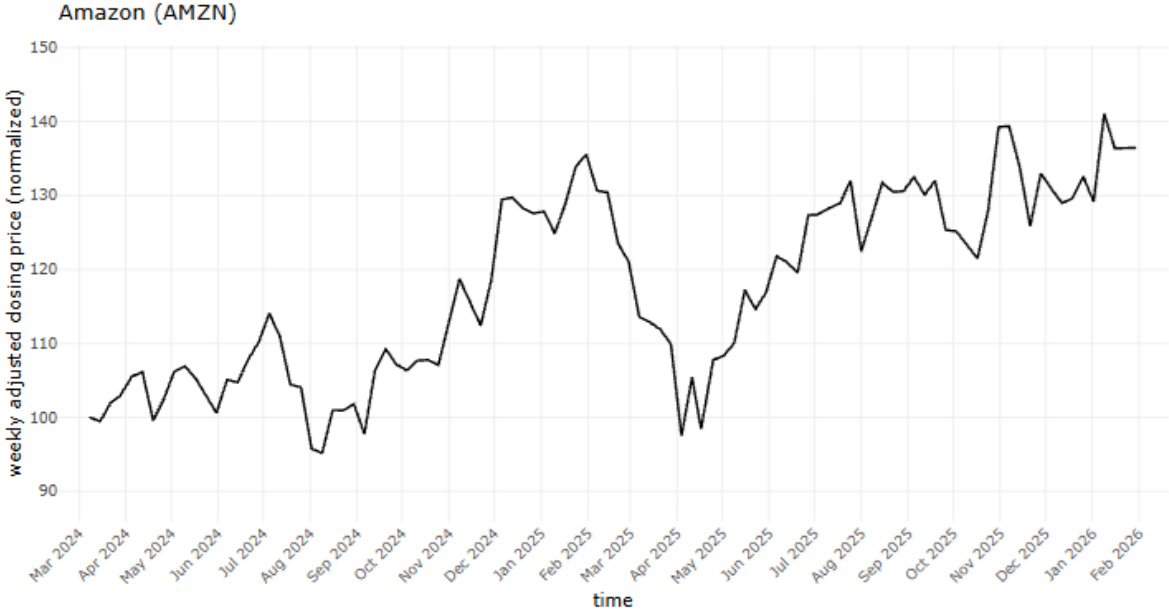
*[In case of an incorrect answer:] Hint: After you have made all forecasts, you can choose between two different compensation models. While you will get to know the details of these two models only after you have made all forecasts, please be ensured that submitting your best forecasts possible will allow you to earn up to 25 USD for this task 1.*

**Task 1: Weekly price forecasts 1 / 25 for Amazon (AMZN) [Example of one forecast screen]**

**Brief company profile:**

Amazon.com, Inc. engages in the retail sale of consumer products, advertising, and subscription services through online and physical stores in North America and internationally.

**Development of adjusted and normalized closing prices over the last 100 weeks since March 08, 2024:**



**Please now forecast the percentage change of the closing price for Amazon (AMZN) between Friday, January 30, 2026, 4 p.m. EST and Friday, February 06, 2026, 4 p.m. EST:**

Your Choice	Option	Expected % change in the stock price over the course of the next trading week	Relative frequency (approx.) of this % change over the last 100 weeks
<input type="checkbox"/>	Option 1	+3.69% or more	19%
<input type="checkbox"/>	Option 2	Between +0.72% and +3.68%	20%
<input type="checkbox"/>	Option 3	Between -0.60% and +0.71%	22%
<input type="checkbox"/>	Option 4	Between -2.36% and -0.61%	20%
<input type="checkbox"/>	Option 5	-2.37% or worse	19%

### Task 1: Select your form of remuneration

Now, please choose one of the following remuneration models for task 1:

- Model 1:** You receive **1 USD for each successful forecast** and 0 USD for each unsuccessful forecast. A forecast is considered successful if you have selected the correct one of the five forecast options. This means that you can receive **between 0 and 25 USD** in remuneration for this task 1, depending on your success.
- Model 2:** You receive a **flat rate of 0.23 USD for each of the 25 forecasts** you have submitted, regardless of the actual success of your predictions. This means you will receive **exactly 5.75 USD** in remuneration for this task 1.

## Task 2: Instructions and Control Questions

### Instructions

**In the second task, you will be asked to provide three different estimations of the success of your forecasts from task 1.**

**In task 2.1, you are asked to estimate the exact number of your successful forecasts from task 1.** A forecast is considered successful if you have selected the correct one of the five forecast options. You will receive an additional payment of **5 USD** for an accurate estimate. If your estimated number does not match the actual number of your successful forecasts exactly, you will not receive any additional payment for this task 2.1.

**In task 2.2, you are asked to estimate whether you belong to the top or bottom 50% of all participants in this experiment who made the most or fewest successful forecasts in task 1.** You will receive an additional payment of **1 USD** for an accurate estimate. If your estimate is inaccurate, you will not receive any additional payment for this task 2.2. **Please be aware that your choice in this task 2.2 will also define which options (quantiles) will be available to you in task 2.3!** If you estimate top 50% in task 2.2, you can choose between the 1st and 11th quantiles<sup>1</sup> in task 2.3. If you estimate bottom 50% in task 2.2, you can choose between the 11th and 20th quantiles in task 2.3.

**In task 2.3, you are asked to estimate which quantile (sections of 5% each) of all participants in this experiment you belong to in terms of the number of successful weekly stock price forecasts in task 1.** Example: If you believe that you are among the top 5% of all participants in this experiment with the most accurate stock price forecasts in terms of forecast success, select the 1st quantile. If you believe that you are among the least successful 5% of all participants in terms of forecast success, select the 20th quantile. For an accurate estimation, you will receive an additional payment of **4 USD**. In case of an inaccurate estimation, you will not receive any additional payment for this task 2.3.

Please also note the following regarding remuneration for tasks 2.2 and 2.3: If, based on the number of accurate forecasts, more participants would be assigned to a particular group than that group is allowed to have (e.g., the top 50 out of 100 participants should include exactly 50 people, but not 48 or 53), the ranking of the affected participants will be determined by a second, subordinate sorting criterion, namely who submitted all 25 forecasts in a shorter time. In the very unlikely event that there would still be ties between certain participants afterwards, their final ranking will be determined at random.

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<sup>1</sup> The numbering of the quantiles has been reversed in both the analysis and the main text to enhance their comprehensibility.

**Control Questions** [were displayed on the same screen right below the instructions]

**Which estimation of the success of your weekly price forecasts from task 1 is NOT expected of you?**

- Estimation of how many of my forecasts will be accurate.
- Estimation of whether I belong to the top or bottom 50% with the most or fewest successful forecasts.
- Estimation of which quantile (sections of 5% each) of all participants in this experiment I belong to in terms of the number of successful predictions.
- Estimation of how quickly or slowly I made the forecasts compared to others. (Correct!)

*[In case of an incorrect answer:] Hint: In the second task, you will be asked to provide three different estimations of the success of your forecasts from task 1: 1) The exact number of your successful forecasts, 2) whether you belong to the top or bottom 50% of all participants in this experiment who made the most or fewest successful forecasts, and 3) to which quantile (sections of 5% each) of all participants in this experiment you belong in terms of the number of successful forecasts.*

**How much remuneration can you earn for this task?**

- 2 USD for each correct estimation.
- 5 USD for the correct number of accurate forecasts, 1 USD for correctly guessing whether I am in the top or bottom 50% of the most successful participants, and 4 USD for correctly guessing which quantile I am in in terms of my forecasting success. (Correct!)
- I will not receive any remuneration for this task.

*[In case of an incorrect answer:] Hint: You will receive a reward of 5 USD for a correct estimate of the exact number of your successful forecast. For a correct estimate of whether you are in the top or bottom 50% of the most successful participants, you will receive a reward of 1 USD. For a correct estimate of which quantile (sections of 5% each) of all participants in this experiment you belong to in terms of the number of successful forecasts, you will receive a reward of 4 USD.*

**Task 2.1: Estimation of your forecasting success (1/3)**

**Now, please estimate how many of the 25 stock price forecasts you just made will be correct!**

I estimate that \_\_\_\_\_ of my 25 stock price forecasts will be correct.

## **Task 2.2: Estimation of your forecasting success (2/3)**

**Please now estimate whether your forecasting success is above or below average compared to the other participants in this experiment.**

I believe that, compared to the other participants, my stock price forecasting success is

- above average (top 50% of all participants with the most accurate forecasts)
- below average (bottom 50% of all participants with the fewest accurate forecasts)

### Task 2.3: Estimation of your forecasting success (3/3)

Please now estimate which quantile (sections of 5% each) of all participants in this experiment you belong to in terms of the number of successful forecasts.

[Available response options if “above average” was selected in task 2.2:]

- 1st quantile:** I am among the most successful 5% of all participants.
- 2nd quantile:** I am less successful than the top 5%, but more successful than the bottom 90% of all participants.
- 3rd quantile:** I am less successful than the top 10%, but more successful than the bottom 85% of all participants.
- 4th quantile:** I am less successful than the top 15%, but more successful than the bottom 80% of all participants.
- 5th quantile:** I am less successful than the top 20%, but more successful than the bottom 75% of all participants.
- 6th quantile:** I am less successful than the top 25%, but more successful than the bottom 70% of all participants.
- 7th quantile:** I am less successful than the top 30%, but more successful than the bottom 65% of all participants.
- 8th quantile:** I am less successful than the top 35%, but more successful than the bottom 60% of all participants.
- 9th quantile:** I am less successful than the top 40%, but more successful than the bottom 55% of all participants.
- 10th quantile:** I am less successful than the top 45%, but more successful than the bottom 50% of all participants.

[Available response options if “below average” was selected in task 2.2:]

- 11th quantile:** I am less successful than the top 50%, but more successful than the bottom 45% of all participants.
- 12th quantile:** I am less successful than the top 55%, but more successful than the bottom 40% of all participants.
- 13th quantile:** I am less successful than the top 60%, but more successful than the bottom 35% of all participants.
- 14th quantile:** I am less successful than the top 65%, but more successful than the bottom 30% of all participants.
- 15th quantile:** I am less successful than the top 70%, but more successful than the bottom 25% of all participants.
- 16th quantile:** I am less successful than the top 75%, but more successful than the bottom 20% of all participants.
- 17th quantile:** I am less successful than the top 80%, but more successful than the bottom 15% of all participants.
- 18th quantile:** I am less successful than the top 85%, but more successful than the bottom 10% of all participants.
- 19th quantile:** I am less successful than the top 90%, but more successful than the bottom 5% of all participants.
- 20th quantile:** I am among the least successful 5% of all participants.

### Task 3: Instructions and Control Questions

#### Instructions

**In this third and final task, you will be offered four different options for making a theoretical investment. You will be asked to select the one of the four investment options offered that you expect to generate the highest risk-adjusted return in the coming trading week** (period: from Friday, January 30, 2026, 4 p.m. EST, to Friday, February 06, 2026, 4 p.m. EST). For the purposes of this experiment, risk-adjusted return is defined and understood as follows:

$$\text{Risk-adjusted return} = \frac{\text{percentage change in the price of the stock or stock portfolio}}{\text{standard deviation of the hourly price changes}}$$

**All participants in this experiment who achieve one of the top 50% of all risk-adjusted returns with their choice in this task will receive an additional reward of 2 USD.** The others (bottom 50%) will not receive any additional reward for this task.

In the event that the top 50% threshold is crossed by a group of participants with the same risk-adjusted return, the ranking of the affected participants will be determined by a second, subordinate sorting criterion, namely who made their investment decision for this task in a shorter time. **Accordingly, you should focus primarily on making the best decision, but also pay attention to the time factor.** In the very unlikely event that there are still ties between certain participants for the top 50% after sorting for risk-adjusted return and time, their final ranking will be determined at random.

**Control Questions** [were displayed on the same screen right below the instructions]

**What is expected of you in task 3?**

- I have to forecast monthly returns for 25 stocks from the NASDAQ.
- I have to determine which stocks have performed best over the last 100 weeks.
- I have to make a selection for a theoretical investment. (Correct!)

*[In case of an incorrect answer:] In this third and final task, you are asked to make a theoretical investment by selecting one from the investment options offered.*

**How many options are available to you?**

- 4 options (Correct!)
- 10 options
- 25 options

*[In case of an incorrect answer:] Hint: In this third and final task, you are offered four different options for making a theoretical investment.*

**Which key figure shall you maximize with your decision?**

- The return in the coming trading week.
- The volatility in the coming month.
- The risk-adjusted return in the coming trading week. (Correct!)

*[In case of an incorrect answer:] Hint: In this third and final task, you will be offered four different options for making a theoretical investment. You will be asked to select the one of the four investment options offered that you expect to generate the highest risk-adjusted return (percentage change in the price of the stock or stock portfolio divided by the standard deviation of the hourly price changes) in the coming trading week.*

**What reward can you achieve in this task?**

- 3 USD if I submit my decision within 60 seconds.
- 2 USD if my choice is among the top 50% of all participants with the highest risk-adjusted return. (Correct!)
- 1 USD in any case, regardless of my decision.

*[In case of an incorrect answer:] Hint: All participants in this experiment who achieve one of the top 50% of all risk-adjusted returns with their choice in this task will receive an additional reward of 2 USD. The others will not receive any additional reward for this task.*

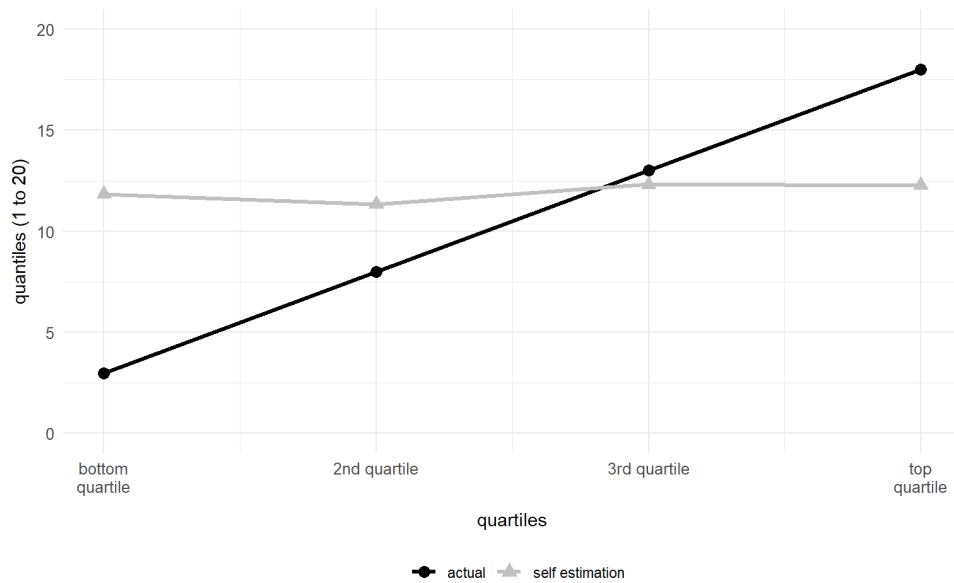
### Task 3: Theoretical investment opportunity

Please now make your choice for a theoretical investment from the following options:

- Option 1:**  
Please select a stock by yourself from the 25 stocks just forecast from the drop down-menu:  
[ -- Select a stock -- ]
- Option 2:**  
Contains the following stocks in equal proportions:
  - Apple (AAPL)
  - Coca-Cola (KO)
- Option 3:**  
Contains the following stocks in equal proportions:
  - Goldman Sachs (GS)
  - Caterpillar (CAT)
  - Apple (AAPL)
  - Coca-Cola (KO)
- Option 4:**  
Contains the following stocks in equal proportions:
  - Amgen (AMGN)
  - Walmart (WMT)
  - Goldman Sachs (GS)
  - Caterpillar (CAT)
  - Apple (AAPL)
  - Coca-Cola (KO)

[Last screen with experimental content. It was followed by a debriefing and return link to Prolific.]

## Appendix 2: Dunning-Kruger Effect



When examining the subjects' perceived and actual relative performance, the pattern described by Kruger and Dunning (1999) emerges. To this end, the actual performance quartiles are first plotted on the X-axis. These are then compared on the Y-axis with the performance quantiles (1 to 20) based on self-assessment (gray line with triangular data points) and actual performance (black line with round data points) as averages. It becomes apparent that the relative self-assessment does not correspond to the actual relative performance. The presumed relative performance hardly differs between the actually relatively successful and the actually relatively unsuccessful participants. Therefore, it can be concluded that the actually relatively successful participants underestimate their abilities, while the actually relatively unsuccessful participants overestimate their abilities.