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The Role of Trading Apps in Shaping Investment Behavior

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Summary: We study the connection between trading app usage and investment behavior. To this aim, we collect data from 503 participants, which are representative for German Neobroker users, Ex-Neobroker users and Neobroker usage planners. We investigate Neobroker users by a number of aspects regarding demography and investment characteristics, in particular we find that Neobroker users are significantly more risk tolerant than the general German population and Ex-Neobroker users. Trading app users have a tendency to invest in more or different products than originally planned. Low trading fees and the low minimum investment amount are the main reasons for the use of trading apps. We observe that investors who stop using trading apps mostly stop investing all together. Another worrying result is that financial literacy among all groups is low and most Neobroker users have wrong conceptions about how trading apps earn money. In general, the financial literacy of all groups considered in this study is surprisingly low.

Keywords: Neobroker, financial risk-taking, investment behavior, fintech, trading app, financial literacy

Die Rolle von Trading Apps bei der Gestaltung des Investitionsverhaltens

Zusammenfassung: Diese Studie untersucht die Verbindung zwischen der Nutzung von Trading Apps und dem Investitionsverhalten. Zu diesem Zweck wurden Daten von 503 Teilnehmenden, die repräsentativ für deutsche Neobroker Nutzer, Ex-Neobroker Nutzer und Neobroker-Nutzungsplaner sind, erhoben. Wir untersuchen Neobroker Nutzer nach einer Reihe von Aspekten hinsichtlich Demographie und Anlagecharakteristika. Insbesondere stellen wir fest, dass Neobroker Nutzer signifikant risikotoleranter sind als die deutsche Bevölkerung und Ex-Neobroker Nutzer. Trading App Nutzer weisen eine Tendenz auf, in andere oder mehr Produkte zu investieren als ursprünglich geplant. Niedrige Handelsgebühren und der geringe Mindestanlagebetrag sind die Hauptgründe für die Nutzung von Trading Apps. Neobroker Nutzer, die ihre Trading App Nutzung stoppen, hören meist ganz auf zu investieren. Ein weiteres besorgniserregendes Ergebnis ist, dass das Finanzwissen in allen Gruppen gering ist und die meisten Neobroker Nutzer keine Kenntnis über das

Geschäftsmodell von Neobrokern haben. Generell ist das Finanzwissen aller in dieser Studie betrachteten Gruppen überraschend niedrig.

Stichwörter: Neobroker, finanzielles Risiko, Investitionsverhalten, Fintech, Trading App, Finanzbildung

1. Introduction

While stock market investments used to be complex for laymen and involved high learning and transaction costs, the availability of broadly diversified exchange-traded funds, internet brokers, and robo-advisors has changed both significantly. The low or in some cases even non-existing trading fees of these providers, as well as order placement and securities account management on the individual smartphone, reduce entrance barriers and make it easy for people with low income or low wealth to start investing in the stock market. This study investigates how trading apps, particularly Neobrokers, have lowered these barriers, providing a detailed analysis of user demographics and investment characteristics. Even low trading costs have a negative impact on the stock market participation of low or moderate wealthy households (Vissing-Jørgensen, 2002). For this reason, it is surprising that in many highly developed countries the proportion of people investing in stocks (the stock market participation) is still quite low, as the entry costs to participate in the stock market are now potentially set down. Stock market investments contribute to an efficient allocation of capital (Wurgler, 2000). They also offer an investment opportunity that has much better expected returns over the long-term than fixed interest investments (Campbell & Viceira, 2005; Leibowitz & Krasker, 1988). Therefore, capital market investments are pivotal for retirement saving. The lack of willingness to invest in equities could possibly lead to huge losses in retirement savings. There is a lot of academic research on trying to understand this situation and come up with ideas on how to improve it (e.g. (Farhi & Panageas, 2007; Mckenzie & Liersch, 2019)).

Recently, companies such as Robinhood, Scalable Capital and Trade Republic have been offering trading apps that may, to a large extent, be designed to appeal to people who have not yet invested in equities. Our study finds that Neobroker users are significantly more risk tolerant than the German population and Ex-Neobroker users, a behavior potentially amplified by the gamification methods and attention triggers inherent in these apps, thus echoing findings by Arnold et al. (2022) on the impact of digital stimuli.

These apps provide users with a simple and playful way of investing via smartphone. They offer trading of financial products at low prices or without trading fees. The executing trading venue is usually predetermined and is related to the cost structure of trading apps. This is because trading apps are not primarily financed by the fees charged for an order execution but by refunds from the executing trading venue. These refunds are also called payment-for-orderflow. Trade Republic, for example, receives a payment-for-orderflow, of up to 3 EUR per customer trade they place with their cooperating executing market maker (Trade Republic Bank GmbH). Furthermore, 81 % of the revenue of Robinhood, the largest Neobroker in the U.S., was order-based income in the first quarter of 2021 (SCE, 2021).

In analyzing the demographic and behavioral aspects of Neobroker users, we contribute to the literature on financial engagement facilitated by digital platforms. This includes identifying that a notable portion of users cease investing altogether after discontinuing

app use, highlighting potential risks in user engagement strategies. Trading apps may appeal especially to novice investors because of their simplicity. They use gamification methods to give the user the impression of a real-time investment game. For this purpose, the apps use a variety of different psychological methods to reward the client in different situations. An example is a virtual shower of confetti on the Robinhood app when a new user has completed the first transaction (Tierney, 2022). On the one hand, this might have a positive effect and be especially appealing for novice investors, as they feel to get a reward for their first investment, which can help to get over initial insecurities with investing. On the other hand, gamified investing can lead to investments in financial products in which one would otherwise not invest. Furthermore, gamified investment apps, as the ones mentioned above, use psychological methods to lead their users to trade more often (Langvardt & Tierney, 2022), which results in higher earnings for the app providers (Tierney, 2022). There is already empirical evidence that the design of a trading app has an impact on the trading behavior of the users. The changes in investment behavior are, in this case, positive for the trading app provider and negative for the user (Tierney, 2022). This study seeks to investigate these dynamics further, particularly focusing on the balance between accessibility and the encouragement of potentially detrimental trading behaviors.

Therefore, it is important to investigate the long-term impact on wealth development of trading app users and the connection between trading apps and their investment behavior, also in the context of potential regulatory purposes. Trading apps have become very popular during the Corona crisis in which especially young people, who had to stay at home and had more spare time, started to speculate on the stock market with trading apps (Osipovich, 2020). Coupled with feedback loops on social media, which may primarily be used by young investors as a source of information about the capital market and investment opportunities, this has already led to at least one major bubble event, related to the GameStop stock (Lawrence, 2021). The GameStop event and the effects of smartphone investing on trading behavior especially after the GameStop event have already been analysed in detail (Welch, 2022; Kalda, Loos, Previtero, & Hackethal, 2021).

Trading apps, also known as Neobrokers, receive both very positive and negative reactions: On the one hand, they are seen as a modern and cost-efficient way to attract new investors to the stock markets. On the other hand, they are seen to induce overtrading and speculation rather than reasonable long-term investing. In combination with hidden costs, these factors might lead to losses for investors. In addition, Neobroker users (in this case Robinhood users) have been found to be affected by attention-driven trading and as a result of that tend to herd more than regular investors (Barber, Huang, Odean, & Schwarz, 2022). The increase in herd behavior underlines the assumption of more speculative, more frequent, and less reasonable trading. Periods of intensive buying of Robinhood users are followed by negative returns (Barber, Huang, Odean, & Schwarz, 2022). In line with the assumption that trading app users often pursue short-term and less reasonable investment goals, trading app users in China trade more frequently, possibly due to overconfidence. Furthermore, trading app users are significantly affected by trading apps in the way they react to short-term signals (Cen, 2023). After the GameStop event, trading apps have been described as a danger to the stability of stock markets, although other work has shown that it were institutional investors who tended to exacerbate the Covid-19 crash through fire-selling, whereas retail investors served as liquidity providers.

This means that retail investors prevented the stock markets from losing even more during the Corona crisis.

It is already clear that trading apps have led to increased participation in the stock market (Barber, Huang, Odean, & Schwarz, 2022). The question is therefore, whether this effect will be sustainable in the long-term. In the best scenario, many novice investors who started investing through a Neobroker will learn and end up with reasonable long-term stock market investments. Furthermore, these investors should avoid overtrading and underdiversification in the best-case scenario. Conversely, the worst-case scenario would lead investors to risky investments, which can result in accumulating losses and a final drop out of the stock market. In consequence, a whole generation of potential investors, who have just started investing, would be lost for the stock market, with dire consequences for the society, for example, regarding the pension gap in the German pension system.

While Neobrokers provide an accessible and often cost-effective entry point into the stock market, it is crucial for investors to have a comprehensive understanding of their cost structures. Studies have shown that the apparent low trading fees may obscure certain hidden costs that affect overall investment returns. For instance, Garvey and Wu (2010) discussed the implications of hidden transaction costs in electronic trading environments, which can erode investment returns more significantly than anticipated. In the context of Neobrokers, the concept of payment-for-order-flow, while reducing direct fees, may introduce implicit costs that affect best execution practices, as detailed by Angel et al. (2011). Understanding these dynamics is an essential component of financial literacy, particularly for novice investors engaging with Neobroker platforms.

Therefore, integrating discussions on potential hidden costs into financial literacy education could enhance investors' ability to make informed decisions. Increased awareness of these aspects may mitigate the risk of misunderstanding the true cost of transactions and promote more sustainable investment behaviors.

Additionally, Barber et al. (2009) highlighted that investor education on the intricacies of trading costs and market mechanics can contribute to more informed trading practices and improved financial outcomes. As such, introducing educational initiatives aimed at improving understanding of Neobrokers' business models and associated trading costs may lead to better investment decision-making, reinforcing long-term participation in stock markets.

In sum, this research not only confirms prior concerns surrounding trading apps, but also emphasizes the urgent need for regulatory strategies to address these challenges. Our findings underscore the critical need for financial literacy programs that can better equip investors to understand the complex cost structures of Neobrokers and mitigate potential financial risks.

2. Hypothesis development

As a result of trading apps being a recent and relatively new phenomenon, the academic literature is still scarce. Especially, there is virtually no study with representative data from users of several different Neobrokers investigating the association of trading apps with the investment behavior of Neobroker users. In this paper, we examine who uses trading apps and whether trading app usage is connected to specific risk attitudes, investment goals, levels of financial literacy and trading and app usage frequency. Secondly, we show why former trading app users stopped the use.

2.1 Trading frequency

The trading frequency describes how many trades an investor places per month on average. Cai and Lu (2019) showed that the frequency of opening financial mobile applications is positively correlated with increased trading activity. Investors who frequently use mobile applications for financial information tend to trade more actively, even after accounting for other market factors like investor sentiment and market volatility (Cai & Lu, 2019). In addition, the introduction of trading apps has been shown to increase investor attention and trading volume. Retail investors who adopt these apps tend to trade more frequently and respond more to short-term market changes, which can lead to an increased trading frequency (Cen, 2023). The rise of stock trading apps has notably changed the behavior of millennial investors, who now rely more on digital platforms for trading decisions (Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). This demographic shift towards app-based trading has contributed to an increase in trading frequency as millennials engage more actively with the stock market through these apps (Sumant, Bhavsar, Sinha, & Bhatt, 2022). With the easy portfolio access through a trading app on the own smartphone and the associated permanent availability of trading, the trading frequency could consequently increase. Thus, we expect a positive relationship between the frequency of opening a trading app and the trading frequency.

Hypothesis 1: The frequency of opening a trading app is positively related to the trading frequency of Neobroker users.

2.2 Risk tolerance

The risk tolerance shows how much risk investors are willing to take when investing. The risk tolerance can affect an investor in several regards, e.g. which investment products are bought or the respective investment goals. Arnold et al. (2022) argued that the influence of external stimuli on risk taking in everyday situations, as shown, for example, by Weber et al. (2004), Galvan et al. (2006) and Figner et al. (2009), had not been considered in the previous literature on the risk behavior of investors. They precisely investigated the impact of external stimuli on risk-taking of investors and showed that financial attention stimuli increase financial risk-taking (Arnold, Pelster, & Subrahmanyam, 2022). In addition, Freibauer et al. (2024) showed that the risk tolerance of Neobroker users is higher than that of general investors. This shows that trading apps can possibly affect the risk tolerance of their users, using gamification methods and leading the users to invest not in line with their risk tolerance and their potential investment plan. Lower risk tolerance could also be a reason to stop using a Neobroker. The influence of attention triggers, combined with the greater risk tolerance among Neobroker users relative to general online investors, suggests that the digital stimuli offered by trading applications, such as push notifications, may contribute to an increased risk tolerance among Neobroker users compared to the German population and Ex-Neobroker users.

Hypothesis 2: Neobroker users have a higher risk tolerance than the German population.

Hypothesis 3: Neobroker users have a higher risk tolerance than Ex-Neobroker users.

2.3 Business model of Neobrokers

Since the trading app providers receive a payment-for-order-flow for each customer order, they have an increased interest in customers trading frequently. Trading app users may not realize the connection between the number of trades and the amount of income of the trading app provider. Providers advertise low or no fees for trading securities. However, at the same time, trading apps contain hidden costs that most trading app users are probably unaware of. The hidden fees appear, for example, in the form of worse execution prices. These may be associated with challenges in long-term performance, particularly for smaller investment amounts. The low or, in some cases, non-existent trading fees can give the impression of free trading for trading app users. We expect that the majority of trading app users do not know how Neobrokers are financed.

Hypothesis 4: The majority of Neobroker users do not know how Neobrokers are financed.

2.4 Investment behavior

Recent research has identified that the dynamic presentation of information within trading apps can influence user decision-making processes (Frydman & Wang, 2020). In addition, Tahler and Sunstein (2008) have highlighted the profound influence platform designs can have on consumer behavior. Neobrokers, with their user-friendly interfaces, have the potential to affect trading behaviors, potentially leading to an increase in the number of financial transactions completed. The dynamic presentation of information, as noted in recent studies, can significantly influence user decision-making processes (Frydman & Wang, 2020). Features such as real-time alerts, push notifications, and the ability to view and mimic peer trading activities are embedded within trading apps, could encourage increased interaction and potentially leading to the purchase of more financial products than initially planned. Moreover, psychological factors could play a critical role, as the accessible and sometimes gamified experience offered by Neobrokers could tap into cognitive biases such as overconfidence and impulsivity, prompting users to engage in different transactions (Dhar & Zhu, 2006).

Hypothesis 5: The use of Neobrokers is associated with a tendency to purchase more financial products than initially planned by users.

2.5 Risk behavior

The proliferation of Neobrokers could possibly also introduced a shift in how users perceive and engage with risk. Risk behavior, a vital component of financial decision-making, typically involves the willingness to engage in investments with uncertain outcomes (Kahneman & Tversky, 1979). Thus, similar to the investment behavior, changes in the risk behavior of Neobroker users could also be connected to Neobroker use. This aligns with the literature suggesting that digital platforms with dynamic content could lead users to contemplate and execute more varied investment decisions than initially intended (Frydman & Wang, 2020). Neobrokers frequently incorporate interface designs that could promote risk-taking behavior among users. These platforms often emphasize riskier investment opportunities, through prominent placements or the availability of leveraged

products (Frydman & Wang, 2020). Furthermore, the social trading features inherent in many Neobrokers allow users to trace and emulate the actions of successful peers, which might inadvertently promote riskier investment choices.

This leads us to assume that the Neobroker use could be connected to a changing risk behavior of Neobroker users.

Hypothesis 6: The use of Neobrokers is associated with a tendency to change the risk behavior of their users.

The paper proceeds as follows. Section 3 presents a detailed description of our dataset. Section 4 provides the results of our study, divided into four sub-sections. Section 4.1 shows what characterizes a typical Neobroker user. Section 4.2 answers the question why Neobroker users use a trading app. Section 4.3 analyses the investment behavior of Neobrokers and the association between the trading app use and the investment goals and behavior of their users. Section 4.4 shows why former Neobroker users stopped using trading apps. Section 5 concludes and is followed by Section 6 with a discussion.

3. Data and methodology

This section provides a description of the dataset, which we collected for this study, which represents the German population regarding their current, former, or intended use of Neobrokers. The data was collected on our behalf by a company conducting representative surveys in Germany. To ensure that random and incorrect answers to the questionnaire are not included in our datasets, a test question is included in the questionnaire. Participants with a wrong answer to this question were excluded from the survey. The logic of data collection is shown in Figure 1. The three groups were filled with participants until the specified number of participants per group was reached. The survey should be completed after at least 250 Neobroker users, 125 Neobroker usage planners, and 110 Ex-Neobroker users have completed the survey. The filters shown in Figure 1 were as follows: Filter 1: "Do you currently use a trading app?"; Filter 2: "Have you used a trading app in the past and now stopped using it?"; Filter 3: "Are you currently planning to use a trading

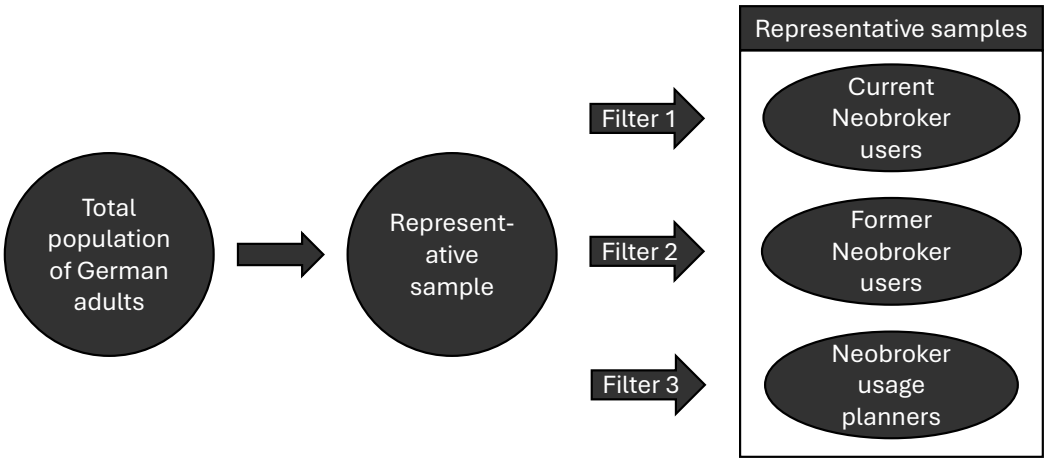

Figure 1: Logic of the data collection.

app in the future?". In total, the sample consists of 503 adults, all living in Germany. Half of the sample (51.1 %: 257 participants) were selected as current Neobroker users, and approximately one quarter each considered using them (26.2 %: 132 participants) or had previously used them (22.7 %: 114 participants).

The data was collected in the period of 08 December 2022 to 21 December 2022. The dataset collected is unique, as currently no other representative dataset exists, that reflects Neobroker usage in general, which means across several different Neobrokers. This gives the possibility of getting an insight into the characteristics and behavior of a broader group of Neobroker users. Previously, representative data from one specific Neobroker (for example, Robinhood or Trade Republic) was used to analyse the influence of Neobrokers or smartphone investing on retail investor behavior (Barber, Huang, Odean, & Schwarz, 2022; Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). This might result in a sample bias, while our data reflect the users of various Neobrokers.

Table 9 summarizes the composition of our dataset regarding gender, age, school education, and professional qualification and can be found in Section 7 (Appendix).

4. Results

We analysed the data of the 257 Neobroker users, to understand who uses Neobrokers and in which way Neobroker users display specific risk attitudes, characteristics, and behavior. The data on Ex-Neobroker users can inform us about the reasons for stopping the use of trading apps and about subsequent investment behavior. Therefore, we study whether former Neobroker users continue to invest through other brokers after the termination of Neobroker usage.

4.1 Who uses trading apps? – The distribution of Neobroker users

In the first part of our analysis, we identify typical attributes of Neobroker users: Neobroker users are predominantly male (66.5 %), which can be explained by the fact that more men than women generally invest in the stock market. Surprisingly, Neobroker users come from all age clusters. Moreover, Neobroker users are not mainly from the lower wealth distribution, as the study by Kritikos et al. (2022) suggested. Detailed personal information of Neobroker users can be found in Table 1.

Interestingly, 36.6 % of the Neobroker users have completed a vocational training for their professional qualification. The majority of Neobroker users (53.7 %) have a bachelor or master degree (or equal), meaning that the majority of Neobroker users can be considered educated. This is confirmed when comparing this result with the education of the German population. In 2019 17.3 % of the German population had a university degree[1]. The proportion of Neobroker users with a university degree (Bachelor or Master degree (or equal)) differs significantly from the proportion of the German population who have such a degree (t-test: $t(256) = 11.679$, $p<.001$). This shows that Neobroker users can be considered more educated in general than the German population. Furthermore,

1 A bachelor's degree, a master's degree and the diploma degree were counted as university degrees. For more information, please refer to https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Bildungsstand/Publikationen/Downloads-Bildungsstand/bildungsstand-bevoelkerung-5210002197004.pdf?__blob=publicationFile (Educational level of the German population – Results of the 2019 microcensus).

Table 1: Personal information of the Neobroker users (N = 257)

Variables	Groups	Number of participants (%)
Gender	Male	171 (66.5)
	Female	86 (33.5)
	Diverse	0 (0.0)
Age	18–26	23 (9.0)
	27–34	74 (28.8)
	35–48	97 (37.7)
	49–64	52 (20.2)
	> 64	11 (4.3)
School education	Hauptschule / Realschule diploma	64 (24.9)
	High school diploma (or equal)	193 (75.1)
Professional qualification	No education	6 (2.3)
	Vocational training	94 (36.6)
	Business administration	18 (7.0)
	Bachelor degree	68 (26.5)
	Master degree (or equal)*	70 (27.2)
	PhD	1 (0.4)

* The numbers are high since until around 2010 in Germany there was no bachelor degree, but only a degree equivalent to a master degree.

it should be mentioned that 136 Neobroker users (52.9 %) currently use a Neobroker exclusively, and 121 Neobroker users (47.1 %) currently use a Neobroker and another broker at the same time.

4.1.1 Age distribution of Neobroker users

The average age of Neobroker users in our data is 40.3. Table 2 shows the age distribution for five age clusters of Neobroker users of our study. Neobroker users are, in general, older than in a previous study (Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). The age distribution might have changed because trading apps attract new groups of investors and thus also new age clusters. We compared the age distribution of Neobroker users with that of the German population[2]. We expect Neobroker users to be younger than the German population when comparing the age clusters shown in Table 2.

2 We used data of 2022 of the German Federal Statistical Office (https://www-genesis.destatis.de/genesis/online) for the age distribution of the German population. Individuals aged 0–17 were excluded.

Table 2: Comparison of the age clusters of Neobroker users (N = 257) and the German population older than 17 years in %.

Groups	18–25	26–34	35–48	49–64	>64
Neobroker users (N = 257)	7.0	30.7	37.7	20.2	4.3
German population	8.5	11.4	17.5	23.7	22.1

The proportion of the respective age clusters "26–34" (t-test: $t(256) = 6.709$, $p<.001$), "35–48" (t-test: $t(256) = 6.682$, $p<.001$), and "> 64 (t-test: $t(256) = -14.086$, $p<.001$)" of Neobroker users differ significantly from those of the German population. Since the clusters "26–34" and "35–48" combined represent more than half of the Neobroker users (68.4 %) and the German population is older regarding the clusters "49–64" and "> 64", the expectation that Neobroker users are younger than the German population is confirmed.

4.1.2 Education

75.1 % of the Neobroker users have an Abitur degree (or equal), which is the German university entrance qualification. In 2019 only 33.5 % of all Germans had this degree[3]. Neobroker users have a higher school education than the German population (t-test: $t(256) = 15.39$, $p<.001$). This is contrary to the assumption that Neobrokers would address uneducated people to a large extent. In fact, most Neobroker users (54.1 %) have a university degree (Bachelor, Master or PhD, compare Table 1).

4.1.3 Financial Literacy

The financial literacy of the three groups in our survey was measured by analyzing three fundamental questions about financial literacy and Neobroker usage that were asked in our survey. These three questions are:

1. What is meant by the bid-ask spread?
2. How do Neobrokers earn money?
3. How does the value of a fixed-rate bond change when interest rates rise?

These questions cover various aspects of financial literacy: the knowledge of stock market trading, the knowledge of the business model of Neobrokers and the knowledge of the impact of changing market conditions on financial products. Questions 1 and 3 are standard measurement questions for financial literacy. Question 2 was asked to include the knowledge of the participants about the business model of Neobrokers in the financial literacy measurement. Question 3 was adapted in modified form from the 2009 SAVE survey[4]. We analysed whether the answer to the respective question was correct. For each correct answer, the participant got one point. The score is therefore based on numbers

3 For more information, please refer to the https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Bildungsstand/Publikationen/Downloads-Bildungsstand/bildungsstand-bevoelkerung-5210002197004.pdf?__blob=publicationFile (Educational level of the German population – Results of the 2019 microcensus).

4 SAVE is a representative survey on the saving behavior of private households in Germany, which was repeatedly conducted between 2001 and 2013.

between 0–3, where 0 means "not financial literate at all" and 3 means "very financial literate". The score was then used as a proxy for financial literacy. Table 3 shows the level of financial literacy of the three groups in our survey based on the three fundamental questions[5].

Table 3: Financial literacy of the three groups compared in this study.

Groups	Classification	Number of participants (%)	Average
Neobroker users	0	93 (36.2)	0.91
	1	103 (40.1)	
	2	51 (19.8)	
	3	10 (3.9)	
Ex-Neobroker users	0	47 (41.2)	0.80
	1	45 (39.5)	
	2	20 (17.5)	
	3	2 (1.8)	
Planners	0	48 (36.4)	0.80
	1	63 (47.7)	
	2	20 (15.2)	
	3	1 (0.8)	

As the average of all three groups lies between 0 and 1, all groups tend to have low financial literacy. This could lead to a higher probability to incur a loss.

In particular, the result of one of the three fundamental questions on financial education stands out. This is the question about knowledge of how Neobrokers earn money. For this question a participant was classified as correct if it was exclusively stated that Neobrokers earn money through a commission from the executing trading venue (payment-for-order-flow) and through the partially existing order fees. We expect the majority of Neobroker users not to know how Neobrokers earn money. The surprising insight is that nearly nobody of the respondents, not even the Neobroker users (7.0 %), knows how Neobrokers make money. Therefore, all groups are potentially unaware of the hidden costs of trading apps. We compared the expected 50 % with the result of the Neobroker users. The difference is statistically significant (t-test: $t(256) = -26.955$, $p<.001$, std. deviation = 0.256), which confirms Hypothesis 4.

4.1.4 Financial assets distribution

Regarding financial assets (including cash, investments in the stock market, and investments in open-end and closed-end funds, but excluding real estate assets), there is a large variation (Table 4). The majority of Neobroker users (57.9 %), can be assigned to the financial asset clusters between 5,001 – 100,000 EUR. The average financial assets of German households amounted to 77,900 EUR in 2021 (Deutsche Bundesbank). Neobroker users seem to come from all financial strata.

5 For more details about the answer options, evaluation and result of each financial literacy question, please refer to Appendix B.

Table 4: Clusters of the financial assets of Neobroker users (N = 257) of our study.

Wealth cluster (€)	Proportion (%)
0 – 5,000	9.7
5,001 – 25,000	21.4
25,001 – 50,000	16.3
50,001 – 100,000	20.2
100,001 – 250,000	12.8
250,001 – 1,000,000	8.6
1,000,001 – 10,000,000	0.4
no answer	10.5

4.1.5 First-time investors

In 2020 Robinhood released a statement that 50 % of their users are novice investors[6]. Furthermore, 47 % of the Trade Republic users surveyed for the DIW study were novice investors (Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). For our data, we expect that 50 % or more of the Neobroker users are novice investors. 133 of 257 Neobroker users (51.8 %) are novice investors. Therefore, our data is consistent with previous findings and not statistically different (t-test: $t(256) = 0.561$, $p = 0.576$) from our expectations based on the previous studies mentioned above.

We further investigated which determinants are connected to a Neobroker user being a novice investor. For the following analysis, we used the data of Neobroker users (N = 257) and created a logistic regression model with the dependent variable "novice investor". This variable is coded 1 for "novice investor" and 0 for "experienced investor". The model is statistically significant (chi-square(1) = 19.865, $p<.001$). The independent variable "age" (Wald(1) = 17.933, $p<.001$) shows a negative connection. The lower the age of Neobroker users, the higher the probability that they are first-time investors. The reason for this could be that older individuals have already had more time to start investing than younger people. The following variables have also been analysed in this regression analysis but have no significant association with Neobroker users to be novice investors: gender, school education, professional qualification, invested capital, financial assets. Nevertheless, the "age" remains significant in every model in combination with the respective variables listed above and therefore the connection is robust.

4.1.6 Investment performance

80.9 % of the Neobroker users stated that they had made a profit with their investments at a Neobroker on average, leaving 19.1 % who reported making a loss. This finding can be compared with other investment contexts. For instance, research on investment funds found that approximately 32 % of the analyzed funds reported a loss, indicating a higher percentage

6 See https://blog.robinhood.com/news/2020/5/4/robinhood-raises-280-million-in-series-f-funding-led-by-sequoia.https://blog.robinhood.com/news/2020/5/4/robinhood-raises-280-million-in-series-f-funding-led-by-sequoia.

of losses compared to Neobroker users (Atkinson, Riani, & Corbellini, 2020). Additionally, while comprehensive statistics on individual investor losses are scarce, a study on Taiwanese investors highlighted significant aggregate losses, even though a direct percentage of individual losses was not specified (Barber, Lee, Liu, & Odean, 2009). Another study focusing on mutual fund retail investors in China showed a notable incidence of major losses impacted by financial literacy, suggesting that a substantial proportion of such investors also experience losses (Jiang, Liao, Wang, & Xiang, 2020).

A reason for the high percentage of profits could be the underreporting of losses due to social expectations. The relatively lower percentage of Neobroker users reporting losses could be attributed to underreporting due to social expectations, or the favorable market conditions since the popularity of Neobrokers surged with the launch of Trade Republic in Germany in 2019. Since 2019 the stock market has been steadily moving in a positive direction for long-term investments. This trend was only interrupted by the Covid-19 crash in March 2020, which may have provided Neobroker users who started to invest during the pandemic with advantageous entry points, potentially contributing to their average profit outcomes.

4.2 Why do investors use trading apps?

We focus on the reasons for investors to choose a Neobroker and to invest in general. Moreover, we answer the question why Neobrokers gained increasing popularity in recent years and whether Neobroker usage is connected to individual investment activities, behavior and risk assessment.

4.2.1 Reasons for using a Neobroker

According to our results (Figure 2), Neobrokers are mostly used because of low or in some cases non-existing trading fees (25.0 %). With 17.2 % the intuitive operation of Neobrokers was also frequently cited as a reason for using a Neobroker. This shows that Neobrokers attract their users, among other aspects, by being easy to log in and operate on the individual smartphone.

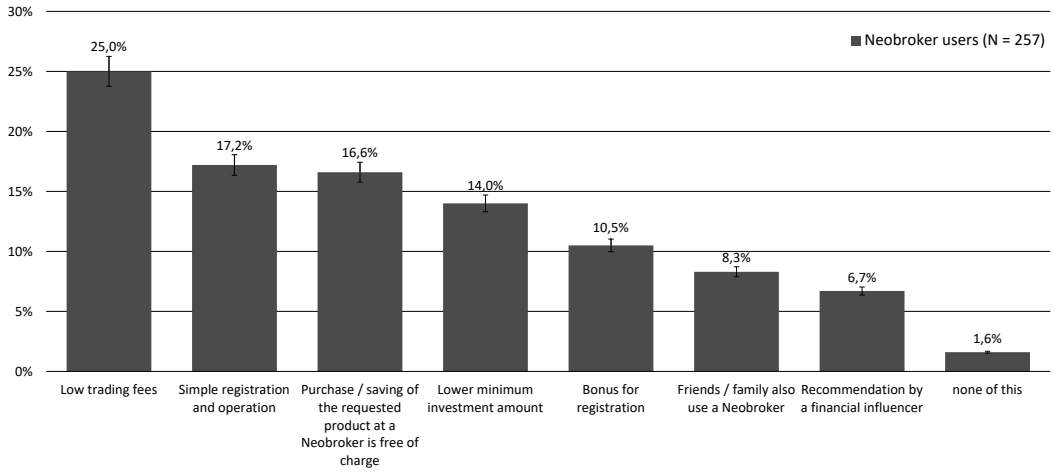

Figure 2: Reasons for using a Neobroker by Neobroker users (N = 257)

Reason 1, "low trading fees" refers to the general transactional costs incurred when buying any financial product through the app, such as a standard fee per order. In contrast, Reason 3, "purchase/saving of the requested product at a Neobroker is free of charge" highlights specific instances where certain products, like saving plans for particular ETFs, are available without traditional trading fees.

When combining the reasons "low trading fees", "purchase / saving of the requested product at a Neobroker is free of charge" and "lower minimum investment amount" to the aspect of financial fees, it is the most mentioned (55.6 %) and therefore primary reason for Neobroker users to invest through Neobrokers. This shows that Neobroker users prefer brokers with low fees and a low entry barrier for investments, represented by a lower minimum investment amount than other brokers. Thus, the results suggest that the main reasons for the Neobroker usage are related to the unique design of Neobrokers regarding their financial fee system.

4.2.2 Goal with investments in individual stocks

Next, we analysed what products Neobroker users invest in. When a Neobroker user indicated to invest in individual stocks, we asked for the respective reasons (multiple answers possible). 211 of the 257 Neobroker users (82.1 %) trade with individual stocks. The results of the question on the reasons for investing in individual stocks are shown below, divided into the five response options provided in the questionnaire. The percentages refer to the number of Neobroker users who invest in individual stocks (N = 211) and do not sum up to 100 % because multiple answers were possible.

- 57.8 % own individual stocks to earn the dividend (std. error of mean = 0.034).
- 53.1 % own individual stocks, because they are convinced of the respective company (std. error of mean = 0.034).
- 37.4 % want to build a market portfolio of individual stocks that outperforms the broad market (std. error of mean = 0.033).
- 29.9 % buy individual stocks on recommendation (std. error of mean = 0.032).
- 0.9 % have other reasons (std. error of mean = 0.007).

At first glance, the most reasonable motive to hold individual stocks is to build a market portfolio that outperforms the broad market. However, literature on retail investor performance suggests that this is on average not successful (Barber & Odean, 2000; Fjesme, 2020). On the other hand, the argument of holding individual stocks to receive the dividend is questionable, as some ETFs also pay a dividend and other ETFs reinvest the dividend. Neobroker users may not be sufficiently informed about ETFs, which is in line with our result of a low financial literacy of Neobroker users.

4.3 Investment behavior of Neobroker users

4.3.1 Changes in investment and risk behavior

According to the self-assessment of the participants (Table 5), our results show a tendency to buy more or different products than originally planned, when assuming that the traded products would not have changed without the Neobroker use. This supports Hypothesis 5. The differences between the number of answers to the four answer options regarding

the change in investment behavior are statistically significant (Friedman-test: chi-square(3) = 8.38, p = 0.039, n = 257).

Table 5: Changes in the investment behavior of Neobroker users (N = 257) in %.

Answers	I buy more products than planned (%)	I buy less products than planned (%)	I buy different products than planned (%)	Traded products have not changed (%)
mentioned	23.0	16.0	26.1	18.7

The number of percentages in Table 5 and Table 6 respectively do not amount to 100 % because multiple answers were possible.

Table 6: Changes in the risk behavior of Neobroker users (N = 257) in %.

Answers	I take more risk (%)	I take less risk (%)	My risk behavior has not changed (%)
mentioned	25.7	12.4	31.9

The same applies to taking on more risk when making investments (Table 6). Our results indicate that using Neobrokers leads to a shift towards more risk taking (Friedman-test: chi-square(2) = 23.425, p<.001, n = 257), when referring to the assumption that risk behavior would not have changed without the Neobroker use. This result supports Hypothesis 6.

Trading apps display information about stock prices or provide lists of the most traded stocks and ETFs that change daily. This information could be one of several reasons for the tendency towards the connection between trading apps and investment and risk behavior of their users. This result is further confirmed by previous work that has shown that the presentation of information affects investment behavior (Frydman & Wang, 2020).

4.3.2 Frequency of the Neobroker use

Neobrokers could entice their users to use their trading app more often, by, for example, notifications and the easy portfolio access via the app. The frequent opening of the trading app could possibly affect users in trading more often. 17.1 % of Neobroker users (N = 257) log into their Neobroker several times per day, 21.4 % one-time per day, 31.5 % several time per week and the rest less often. The frequency of depot opening is coded 1–6, where 1 means “several times a day” and 6 means “rarely or never”.

To assess the trading frequency of Neobroker users, we requested participants to indicate the average number of trades they perform manually each month, excluding the automatic execution of saving plans. In this study, the trading frequency refers to the average number of trades manually executed per month by the participants. The variable “trading frequency” is surveyed on a scale from 1 to 10, with 1 representing “0 trades” and 10 representing “>100”.

The frequency of opening the trading app correlates significantly with the trading frequency (r_s = -.362, p<.001, n = 257). More frequent opening of the trading app is connected to more frequent trading, which confirms hypothesis 1. The given correlation is negative due to the mentioned coding of the two variables, but still implies a positive

connection. A possible reason for the connection could be that Neobroker users who trade more frequently log into their trading app more often to execute trades.

4.3.3 Trading frequency

Currently, Neobroker users make on average between 3–4 trades per month. This means 3–4 manually executed transactions, without automatically executed saving plans. Regarding the distribution of the trading frequency of Neobroker users, one would assume that zero trades and a lot of trades are rare. This is confirmed by our data. Zero trades were made by 3.1 % and a lot of trades (>20 trades) by 6.6 % of the Neobroker users, which tend to trade more frequently than users of other brokers. This is already confirmed by data from Robinhood investors, who traded nine times as many shares as users of other e-brokers in the first quarter of 2020 (Barber, Huang, Odean, & Schwarz, 2022). This further shows that investment behavior, just like the risk tolerance of Neobroker users, is connected to the use of trading apps. Increasing trading frequency does not necessarily have to be negative, but trading fees could have a negative impact on long-term investment performance (Barber, Lee, Liu, & Odean, 2009). More frequent trading also entails a higher probability of losses (Busse, Lin, Qing, & Zhe, 2018) and thus might lead to myopic loss aversion and make stock market investments seem less attractive in the long run.

4.3.4 Risk tolerance

In our study, risk tolerance has been elicited on a scale from 0 to 10, with 0 representing "not at all willing to take risks" and 10 representing "very willing to take risks". With regard to the risk tolerance of Neobroker users for financial investments, which is shown in Table 7, there is a tendency towards a higher risk tolerance. This can be seen in the mean value of the risk tolerance of Neobroker users of 6.8.

We compared the risk tolerance distribution of Neobroker users with the respective distribution of the German population, which is represented by the SOEP[7] in our study. Table 7 shows the number of responses from the two samples regarding the risk tolerance in percentage terms.

Table 7: Comparison of the number of answers to the risk tolerance of Neobroker users (N = 257) and the SOEP data (N = 30,334).

In %	0	1	2	3	4	5	6	7	8	9	10
Neobroker users	0.4	1.2	4.7	8.2	6.6	26.8	14.8	17.5	11.7	2.3	5.8
SOEP data	8.1	4.1	8.7	10.7	8.6	17.8	12.0	13.5	10.3	3.4	2.8

Please note: 0 = no risk tolerance at all. 10 = high risk tolerance.

Based on our results, Neobroker users show a higher willingness to take risk when investing (mean of 6.8) than the general German population (SOEP data with a mean of 5.84) (Mann-Whitney U Test: U = 3,130,262, $p<.001$). This confirms hypothesis 2.

7 "German Socio-Economic Panel", for more information please refer to: https://www.diw.de/soephttps://www.diw.de/soep. We used SOEP data from 2020.

The respective differences between the risk tolerances 0 and 10 of the two samples are particularly striking (Table 7). 8.1 % of the SOEP respondents indicated a risk tolerance of 0, while only 0.4 % of the Neobroker users did so. The situation is the opposite for the highest risk tolerance of 10, which was indicated by 5.8 % of the Neobroker users, considerably more than the SOEP participants with 2.8 %. The higher risk tolerance of Neobroker users can moreover be caused by an initial higher risk tolerance or the impact of the trading app use on the risk tolerance. Please note that a causal relationship regarding one of the two mentioned possible reasons for the higher risk tolerance cannot be drawn with our data.

These results can be further understood through the lens of the existing literature on risk-taking behavior. Arnold et al. (2022) explore how attention triggers can influence financial risk-taking, suggesting that digital platforms can increase investor attention and subsequently increase their willingness to take risks. They found that exogenous attention triggers, such as notifications or alerts, lead to an increase in investor leverage, similar to the higher risk appetite observed among Neobroker users. This aligns with our findings, indicating that Neobrokers might indeed earn more as users engage in riskier financial behavior, potentially driven by the digital and interactive nature of their platforms, which actively captures the attention of the users.

Barber and Odean (Barber & Odean, 2001) highlight how overconfidence can lead to increased trading activity and risk-taking among individual investors. This aligns with our findings, suggesting that Neobroker users, who are typically more engaged with digital platforms, may have a higher sense of confidence in their investment decisions. Similarly, sensation-seeking behavior, as documented by Grinblatt and Keloharju (2009) might further explain the propensity to riskier trades among this group.

Arnold et al. (2022) emphasize the power of attention triggers, such as push notifications, in directing investor behavior. Although Gargano and Rossi (2018) do not explicitly focus on digital stimuli, they provide compelling evidence that increased investor attention, as measured by online account activity, is positively correlated with better investment performance. This finding is particularly relevant for users of trading apps and Neobroker platforms, where ease of access and frequent account engagement might lead to increased investor attention. Our study adds to this narrative by demonstrating how the interactive and user-friendly nature of Neobroker platforms may facilitate more engaged and potentially more informed decision-making among their users.

The dual-process theory, as discussed by Kahneman (2013) and Evans and Stanovich (2013), provides a framework to understand how exogenous stimuli, like push notifications, can trigger affective processes, leading to immediate, emotion-driven decisions. This rapid decision-making process could be a reason why Neobroker users may exhibit a higher tolerance for risk.

As Neobrokers leverage advanced technology to present information interactively and engagingly, investors may be drawn into a continuous loop of engagement. Technological advances through trading apps may transform financial markets, potentially increasing investor risk appetites by providing more immediate and dynamic market interactions.

4.4 Why do investors stop using trading apps?

This section provides information about the reasons why Ex-Neobroker users stopped using trading apps. It is thereby important to differentiate between reasons for someone

who invested with a Neobroker for the first time and someone who has already been investing before the Neobroker use. Most Ex-Neobroker users have invested before their trading app use.

4.4.1 The Ex-Neobroker users

The personal information of the Ex-Neobroker users can be found in Table 8.

Table 8: Personal information of the Ex-Neobroker users (N = 114).

Variables	Groups	Number of participants (%)
Gender	Male	72 (63.2)
	Female	41 (36.0)
	Diverse	1 (0.9)
Age	17–26	7 (6.1)
	27–34	16 (14.0)
	35–48	33 (29.0)
	49–64	48 (42.1)
	>64	10 (8.8)
School education	Hauptschule / Realschule diploma	48 (42.1)
	High school diploma (or equal)	66 (57.9)
Professional qualification	No education	3 (2.6)
	Vocational training	56 (49.1)
	Business administrator	10 (8.8)
	Bachelor degree	20 (17.5)
	Master degree (or equal)	22 (19.3)
	PhD	3 (2.6)

Surprisingly, the distribution of the professional qualification compared to those of Neobroker users changed. 49.1 %, which means that nearly the majority of the Ex-Neobroker users have done a vocational training (Neobroker users: 36.6 %). In addition to this result, 36.8 % hold a university degree. This makes Ex-Neobroker users less educated in form of their professional qualifications than Neobroker users (52.7 % hold a university degree) (Mann-Whitney U test: U = 12,449, p = 0.012.). 62.3 % of Ex-Neobroker users have financial assets up to and including 50,000 EUR (Neobroker users: 47.5 %). Regarding the reasons for investing in general, less Ex-Neobroker users (42 %) than Neobroker users (57 %) invest or have invested to improve their own retirement provision (Mann-Whitney U test: U = 12,495, p = 0.009). Interestingly, compared to Neobroker users, less participants (Ex-Neobroker users: 29 %, Neobroker users: 47 %) indicated to enjoy the thrill of investing (Mann-Whitney U test: U = 12,049.5, p = 0.001). We find that 72 Ex-Neobroker users stopped investing completely and 42 continued to invest through another broker. This suggests that 72 Ex-Neobroker users have stopped investing

completely as a result of their Neobroker use. Nevertheless, it cannot be flatly stated that Neobrokers were the only reason for the stop of investment activities of these Ex-users.

4.4.2 Ex-Neobroker users split into novice and experienced investors.

We divided Ex-Neobroker users into 23 (20.2 %) novice investors and 91 (79.8 %) experienced investors who had already invested through other brokers before starting to use a Neobroker. Overall, among all Neobroker users, 133 out of 257 (51.8 %) are novice investors, indicating that experienced investors are less prevalent in the general user base. However, this observation should not be interpreted as a definitive causation without considering the broader context of user demographics. This nuanced interpretation ensures that our analysis accounts for both the observed statistical difference and the larger demographic trends within the Neobroker user base. This broader context reveals that experienced investors are comparatively overrepresented among Ex-Neobroker users, suggesting that the likelihood of ceasing Neobroker usage might be higher for those with prior investment experience. It is crucial to interpret these results in light of this demographic distribution. The number of Ex-Neobroker users who were novice investors and those who were experienced investors differs significantly (Mann-Whitney U test: $U = 1{,}257$, $p = 0.031$). Therefore, the higher proportion of experienced investors among those who terminate Neobroker usage could reflect their increased propensity to evaluate and discontinue services that do not meet their expectations or match their more advanced investment needs.

4.4.3 Investment activity after Neobroker usage stopped.

25.4 % of Ex-Neobroker users still invest using other brokers after stopping the Neobroker use. 82.8 % of those currently still investing Ex-Neobroker users have already been invested through other brokers before their Neobroker use. We also compared novice and experienced Ex-Neobroker users regarding their investment activity after the termination of Neobroker usage. 17.4 % of Ex-Neobroker users who were novice investors and 48.8 % of the experienced Ex-Neobroker users still invest through other brokers. The difference is statistically significant (Mann-Whitney U test: $U = 791.5$, $p = 0.031$). Novice Neobroker users are more likely to stop investing altogether than experienced Neobroker users. As a result, the original idea that novice investors find an entry point and start investing in the stock market through trading apps and then switch to another, more classic brokers does not exist.

4.4.4 Risk tolerance of Ex-Neobroker users

We compared the risk tolerance of Ex-users and Neobroker users, which is represented by the same scale from 0 to 10, as mentioned for Neobroker users. The risk tolerance of Ex-users differs from that of Neobroker users. The difference between the two distributions is statistically significant, according to the results of the Mann-Whitney U Test ($U = 10{,}271$, $p<.001$). This proves that Ex-users show a lower willingness to take risks (mean of 5.38), than Neobroker users (mean of 6.80), which confirms Hypothesis 3. The result is also reflected in the percentage of Ex-users who are more often represented in the four lowest risk classes than Neobroker users. This is an indication that, among other factors, the lower risk tolerance of Ex-users contributes to the termination of Neobroker use.

We find that some Ex-users indicated a high willingness to take risks, while others indicated a very low risk tolerance. This results in 13 responses for not willing to take risks at all. All of these investors have completely stopped their investment activities.

Moreover, it is also conceivable that the two groups of Ex-Neobroker users (Ex-investors and investors) may have a different attitude towards risk. We therefore expect Ex-investors to have a lower willingness to take risks than investors. The respective distribution is shown in Figure 3. The Ex-investors are surprisingly high in the risk tolerance groups 8 and 9. Nevertheless, the Ex-investors show less willingness to take risk in general (mean of 4.96) than Ex-users who are still investors (mean of 6.10). The result of a Mann-Whitney U Test ($U = 1{,}130.5$, $p < 0.05$) proves that the difference between the risk tolerance of the two groups of Ex-users is statistically significant.

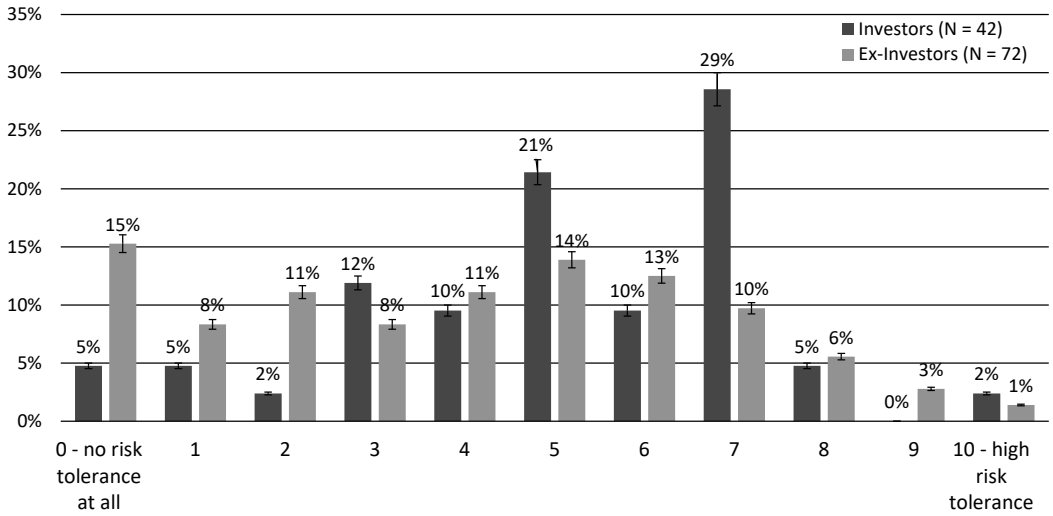

Figure 3: Risk tolerance of the two groups of Ex-Neobroker users (Investors: N = 42, Ex-Investors: N = 72).

4.4.5 Investment performance via Neobrokers

We assume that negative returns could cause the termination of Neobroker use. Thus, we expect that more Ex-Neobroker users have suffered losses with their investments at a Neobroker than Neobroker users. In total, 57 Ex-Neobroker users (50 %) stated that they had made a profit and 57 Ex-Neobroker users (50 %) stated that they had made a loss with their investments at a Neobroker. In comparison, more Neobroker users (80.9 %) indicated to have made a profit with their investments through a Neobroker. The difference between the percentages of losses is statistically significant (Mann-Whitney U test: $U = 10{,}117.5$, $p<.001$) and could be caused by the potential underreporting of losses by Neobroker users.

While analysing the investment performance of Ex-Neobroker users, we once again split the Ex-users into investors and Ex-investors. We expect Ex-investors to have experienced more losses with their investments at a Neobroker, compared to the Ex-users who continued investing. In line with the expectations, 56.9 % of the Ex-investors and 38.1 % of the

Ex-users who still invest have suffered predominantly losses with their investments at a Neobroker. The difference is statistically significant (Mann-Whitney U test: U = 1,227, p = 0.053), which confirms our expectation. We, therefore, found an indication that losses have been a reason to drop out of the stock market completely and to stop using a Neobroker for Ex-users who are now Ex-investors.

We further analyzed whether experiencing predominantly wins or losses with investments at a Neobroker is connected to the risk tolerance of Ex-users. In our analysis, the variable was coded as 1 for predominantly wins and 0 for predominantly losses. Correlation analysis revealed that gaining predominantly wins correlates significantly with the risk tolerance of Ex-users (r_s =.199, p =.034, n = 114). To control this result, we performed a linear regression with the dependent variable "risk tolerance" and the independent variable "experienced predominantly wins or losses", using data of Ex-users (N = 114). This variable is coded 1 for predominantly wins and 0 for predominantly losses. The model was statistically significant (F(1, 112) = 4.620, p = 0.034, adjusted R^2 = 0.031). Experiencing predominately wins by Ex-users is positively connected to a higher risk tolerance of Ex-users (standardized β = 0.199, p = 0.034).

This suggests that Ex-users who experienced mostly positive outcomes with their investments tended to exhibit higher levels of risk tolerance. In contrast, those who experienced predominantly losses showed lower risk tolerance. The correlation implies that past losses might contribute to the lower risk tolerance observed among Ex-users. These results are consistent with behavioral finance theories, such as loss aversion, which suggest that negative investment experiences can lead to more risk-averse behavior in the future (Kahneman & Tversky, 1979).

4.4.6 Reasons for the termination of the Neobroker use.

Ex-investors and investors within the Ex-Neobroker user group pursue different investment goals. This is confirmed by our data and results (Figure 4), especially when referring to the reasons for the termination of the Neobroker use. These reasons are to a large extent reasonable and in line with the expectations.

The three most frequently mentioned reasons by those who stopped their investments altogether were:

1. Too little knowledge of the stock market (33.3 %).
2. Invested capital was needed elsewhere (27.8 %).
3. Experienced mostly losses (26.4 %).

These three reasons can be categorized into the cluster of negative investment experiences and investment hurdles. Interestingly, Ex-investors stated more often (33.3 %) that they stopped using a Neobroker due to a lack of stock market knowledge than the investors (14.3 %) (Mann-Whitney U test: U = 1,224, p = 0.027). The lack of stock market knowledge could be a reason for Neobroker users to stop investing altogether. The reason that the invested capital was needed elsewhere was indicated by 27.8 % of the Ex-investors and therefore much higher than by the investors with 9.5 % (Mann-Whitney U test: U = 1,236, p = 0.022). Investors still invest, so the capital they invested through a Neobroker is now probably invested with another broker. In addition, the third most mentioned reason by the Ex-investors is to have mainly achieved losses (26.4 %).

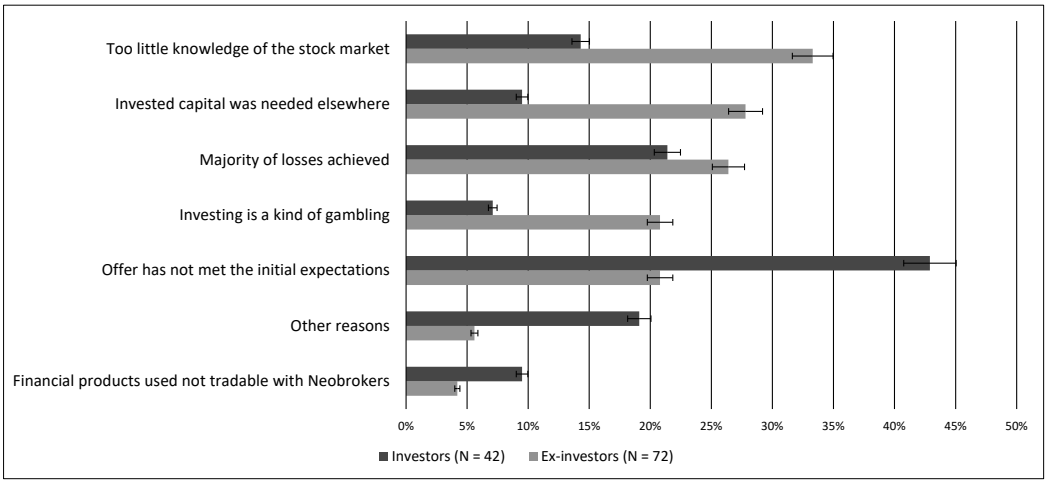

Figure 4: Reasons for dropping out of the Neobroker use of the Ex-users divided into investors (N = 42) and Ex-investors (N = 72).

The three most mentioned reasons by those who stopped their Neobroker use, but still invested elsewhere were:

1. Offer has not met the initial expectations (42.9 %).
2. Experienced mostly losses (21.4 %).
3. Other reasons (19.1 %).

The reason most mentioned by investors (42.9 %) is that Neobrokers do not meet their expectations. Since they simply switched brokers or, if they used a Neobroker and another broker at the same time, gave up using a Neobroker and continued to invest, this reasons seem logical. This is primarily a reason tailored to the specific offers of Neobrokers with their function as a broker. The second most mentioned point (21.4 %) is having mostly achieved losses with their Neobroker investments. This point is mentioned less often than by the Ex-investors (26.4 %) and does not differ significantly (Mann-Whitney U test: $U = 1{,}437$, $p = 0.555$). Surprisingly, they have continued to invest, although they have predominantly suffered losses with their investments at a Neobroker. One possible reason could be that investors make their respective Neobroker responsible for the majority of the losses incurred, maybe because they felt their trading decision being influenced or because of hidden trading costs and therefore continue to invest through another broker.

5. Conclusion

Based on unique representative data of German Neobroker users, Ex-Neobroker users, and potential future users, this work provides important insights into the investment motives and reasons to use a trading app. Additionally, this paper answers the questions of whether the use of trading apps is associated with specific user characteristics, risk attitudes, and behavior of the users. Our findings indicate that Neobrokers are associated with both positive and negative aspects of the investment behavior of Neobroker users. With our data, we can confirm all of the following hypotheses:

- Hypothesis 1: *The frequency of opening a trading app is positively related to the trading frequency of Neobroker users.*
- Hypothesis 2: *Neobroker users have a higher risk tolerance than the German population.*
- Hypothesis 3: *Neobroker users have a higher risk tolerance than Ex-Neobroker users.*
- Hypothesis 4: *The majority of Neobroker users do not know how Neobrokers are financed.*
- Hypothesis 5: *The use of Neobrokers is associated with a tendency to purchase more financial products than initially planned by users.*
- Hypothesis 6: *The use of Neobrokers is associated with a tendency to change the risk behavior of their users.*

First, we found that Neobrokers are used by all age, education, and financial classes. Neobrokers contribute to increasing stock market participation, as over half of Neobroker users are novice investors (51.8 %), which is consistent with previous research findings. Those Neobroker users who stop using them are mostly already experienced investors, as these correspond to 79.8 % of the Ex-Neobroker users.

Second, our results show that Neobroker users have low financial education and most of them do not understand the business model of Neobrokers. The use of trading apps is associated with a tendency to buy more or different products and a tendency to take more risk than originally planned. Moreover, we found that Neobroker users are more risk tolerant than the German population and Ex-Neobroker users. Individuals with a higher risk tolerance are therefore more likely to continue using a Neobroker. The more frequent opening of a trading app is associated with a higher trading frequency. In case novice investors stop using Neobrokers, they usually stop investing in the stock market altogether. Accordingly, Neobrokers do not serve as an entry platform for novice investors who then subsequently switch to other traditional brokers.

6. Discussion: Risk tolerance of Neobroker users

The findings of this study indicate that Neobroker users exhibit a higher risk tolerance compared to the general German population and Ex-Neobroker users. In the context of the revenue of Neobrokers, a higher risk tolerance of the users could be beneficial for Neobrokers, as they may indeed earn more when their users take on higher risks. Several factors could explain this phenomenon: First, Neobrokers often generate revenue through transaction fees. Higher trading frequency, driven by increased risk-taking behavior, could result in more transactions and, consequently, higher fee- and PFOF-income for the Neobrokers. Second, in the context of interest and margin accounts, many Neobrokers offer margin trading, allowing users to borrow funds to invest. Users with higher risk tolerance might be more likely to utilize margin accounts, leading to increased interest income for Neobrokers. Third, currently the revenue of Neobrokers is positively correlated with the amount of transactions of their costumers due to the PFOF. Higher trading frequency, driven by increased risk-taking behavior, might result in more transactions and, consequently, higher income from the PFOF for Neobrokers. Fourth, as highlighted by Arnold et al. (2022), attention-driven trades often involve higher leverage, amplifying potential returns and losses. Neobrokers benefit from increased trading activity and the associated fees and interest from leveraged positions. These factors underscore the importance of

understanding the economic incentives behind the Neobroker business model and their connection to the investment behavior of their users. By fostering an environment that encouraged higher risk-taking, Neobrokers can potentially enhance their profitability. However, this also raises questions about the risk to investors and the broader financial system, which warrants further investigation and regulatory scrutiny.

It may also be beneficial to explore cross-cultural influences on risk tolerance. Hofstede's cultural dimensions studies (e.g. Kahneman (2013)) on cross-cultural financial behaviors can provide insights into how cultural factors might moderate risk-taking propensity, particularly in a globalized investment environment.

7. Appendix

A Total participants

Table 9: Personal information of the participants of our trading app survey.

Variables	Groups	Number of participants (%)
Gender	Male	315 (62.6)
	Female	187 (37.2)
	Diverse	1 (0.2)
Age	18–26	42 (8.3)
	27–34	110 (21.9)
	35–48	162 (32.2)
	49–64	155 (30.8)
	>64	34 (6.8)
School education	Hauptschule / Realschule diploma	162 (32.2)
	High school diploma (or equal)	341 (67.8)
	No education	21 (4.2)
Professional qualification	Vocational training	216 (42.9)
	Business administrator	37 (7.4)
	Bachelor degree	103 (20.5)
	Master degree (or equal)*	121 (24.0)
	PhD	5 (1.0)

* The numbers are high since until around 2010 in Germany there was no bachelor degree, but only a degree equivalent to a master degree.

B Financial Literacy

To determine the financial literacy of the participants, three fundamental questions related to financial literacy and Neobroker usage were asked in our survey. The three questions and how we analysed the answers to those questions in order to divide the participants into four groups in terms of their financial education, will be shown below. The logic of analysing the financial literacy was adapted from (Freibauer, Grawert, & Rieger, 2024).

1. "What is meant by the bid-ask spread?"

For this question, participants could choose between four response options, where only one could be selected. The answer option that the bid-ask spread describes the spread between the buying and selling price is correct. If this answer was given, the participant was categorized as correct. The overall result and the results of the individual groups are shown in Table 10.

The answer options given for Question 1 were:

- □ The term "bid-ask-spread" describes the difference between the purchase price and the selling price offered on the stock exchange.
- □ The term "bid-ask-spread" describes the difference between the purchase price of a share and the value of the share at the beginning of the following trading day.
- □ The term "bid-ask-spread" describes the trading fee that has to be paid at some brokers for the purchase of a security.
- □ The term "bid-ask-spread" describes the amount of profit or loss an investor makes when selling a security.

Table 10: Number of correct answers to the first question on financial literacy divided into the three groups considered.

Groups	Answers	Number of participants (%)
Neobroker users (N = 257)	Correct	117 (45.5)
	Incorrect	140 (54.5)
Ex-Neobroker users (N = 114)	Correct	51 (44.7)
	Incorrect	63 (55.3)
Planners (N = 132)	Correct	68 (51.5)
	Incorrect	64 (48.2)
Total (N = 503)	Correct	236 (46.9)
	Incorrect	267 (53.1)

2. "How do Neobrokers earn money?"

For this question, participants could choose between five answer options, with multiple answers possible. We assume that the main sources of income for Neobrokers are the payment-for-order-flow in combination with the order fees charged by some brokers. According to this assumption a participant was considered as correct if only the two mentioned options (payment-for-order-flow and the order fees) were given. The results can be seen in Table 11.

The answer options given for Question 2 (multiple answers possible) were:

- □ Through a commission/refund from the executing trading venue.
- □ With the low order fees.
- □ In case of a dividend payment, the Neobroker receives a certain percentage of the dividend.

- If a share is sold through a Neobroker and a profit is made, the Neobroker receives a certain percentage of the profit.
- With advertisements displayed in the app.

Table 11: Number of correct answers to the second question on financial literacy divided into the three groups considered.

Groups	Groups	Number of participants (%)
Neobroker users (N = 257)	Correct	18 (7.0)
	Incorrect	239 (93.0)
Ex-Neobroker users (N = 114)	Correct	3 (2.6)
	Incorrect	111 (97.4)
Planners (N = 132)	Correct	4 (3.0)
	Incorrect	128 (97.0)
Total (N = 503)	Correct	25 (5.0)
	Incorrect	478 (95.0)

3. "How does the value of a fixed-rate bond change when interest rates rise?"

The third question addresses general financial knowledge, in relation to changing conditions on the interest rates. For this, it was possible to choose between the price of the bond increases, the price of the bond decreases and the price of the bond does not change. Only single choice was possible. If a participant stated that increasing interest rates lead to a decrease of the bond price, the participant is correct. The results can be seen in Table 12.

Table 12: Number of correct answers to the third question on financial literacy divided into the three groups considered.

Groups	Groups	Number of participants (%)
Neobroker users (N = 257)	Correct	100 (38.9)
	Incorrect	157 (61.1)
Ex-Neobroker users (N = 114)	Correct	37 (32.5)
	Incorrect	77 (67.5)
Planners (N = 132)	Correct	34 (25.8)
	Incorrect	98 (74.2)
Total (N = 503)	Correct	171 (34.0)
	Incorrect	332 (66.0)

The answer options given for Question 3 were:

- The price of the bond increases.
- The price of the bond decreases.
- The price of the bond does not change.

Combined financial literacy

A financial literacy score was created with a scale from 0 to 3, to compare the financial literacy of different groups. The meaning of the scale is shown below. Based on the responses of the participants to the three financial literacy classification questions, they were assigned a financial literacy score, using the following logic.

1. "not financial educated" = 0: the answers to all three questions are wrong.
2. "little financial educated" = 1: one of the three questions is answered correctly.
3. "medium financial educated" = 2: two of the three questions are answered correctly.
4. "highly financial educated" = 3: all three questions are answered correctly.

The result of this classification logic can be found in Table 3.

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