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ORIGINAL ARTICLE

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Investor attention and the use of leverage

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Abstract

We investigate the effects of using different sources of investment leverage, that is, securities with embedded leverage and traditional margin accounts, on the portfolio performance of retail investors, recognizing that these effects may be conditional on investor attention. We find that investors who trade on margin underperform those who do not have margin accounts; we also find that investors trading securities with embedded leverage show even poorer performance than investors trading on margin. The negative effect of leverage usage, however, decreases with greater investor attention, measured by portfolio monitoring frequency. Results suggest that more attentive investors gain more from using investment leverage.

KEYWORDS
embedded leverage, investment leverage, investor attention, margin trading, portfolio performance

JEL CLASSIFICATION
G11, G29, G40

1 | INTRODUCTION

Financial leverage has been extensively used by investors to amplify the anticipated benefits from stock price fluctuations. It enables arbitrageurs and informed traders to exploit opportunities in mispriced securities while their activities should presumably contribute to market efficiency. Hence, it is not surprising that the appetite for financial leverage

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has recently broken a new record with margin debt reaching an all-time high in the United States and elsewhere.[1] Such remarkable growth can be also partly attributed to the ease of access to financial leverage via the evolving trading platforms for retail investors such as "Robinhood." The ready availability of margin debt on favorable terms[2] for investors on Robinhood has resulted in an astonishing increase in the amount of Robinhood's margin lending, which grew by more than five times during 2020 alone.[3] Clearly, such growth is associated with the increased riskiness of retail investors' portfolios, which may affect their overall performance.

While margin debt is subject to certain regulatory requirements and limitations that put some constraints on margin use, the recent developments in financial instruments have allowed investors to alleviate these constraints by investing in widely available leverage-embedded securities such as Exchange Traded Funds (ETFs) or Certificates. These securities sometimes increase market exposure by up to 20 times and limit potential losses to 100% without the need to actively rebalance leveraged positions. The attractiveness of these features may be tempting for retail investors even if they are unable or unwilling to use outright margin debt. However, recent empirical studies show that retail investors often perform poorly when they trade with leverage (see e.g., Barber et al., 2020; Heimer & Imas, 2022). Such findings have important regulatory implications for the protection of retail investors. This study explores one potential mechanism to explain the variation in the performance of levered retail trading: the role of investor attention.

In this paper, we first explore the determinants of usage of different sources of leverage, that is, embedded leverage securities and traditional margin accounts, in a rich and unique dataset on retail investors. Next, we assess the effects of leverage on portfolio performance, accounting for investor-specific characteristics and for differences in trading behavior. A growing body of research suggests that leverage may contribute to poorer trading decisions caused by behavioral bias (see e.g., Bailey et al., 2019; Barber et al., 2020; Ben-David, 2019; Heimer & Imas, 2022). Another stream of the literature suggests that investors make better investment decisions by paying more attention and by acquiring more information (e.g., Gargano & Rossi, 2018; Peress, 2004). Dierick et al. (2019), for instance, suggest that more attentive investors gain a comparative advantage from understanding and incorporating financial information into their investment decisions. As a result, these investors' trading is increasingly less exposed to the disposition effect. Thus, if more attentive investors can process financial information better, they should be able to benefit from employing leverage in their investment decisions, regardless of the behavioral bias associated with the usage of leverage. Building on these two strands of literature, we empirically test whether the joint effect of investor attention and the use of leverage has a positive effect on portfolio performance. Our main objective is to assess whether the impact of using margin accounts and instruments with embedded leverage on investment performance is conditional on portfolio monitoring frequency.

In line with the recent evidence of Heimer and Imas (2022), and Barber et al. (2020), we find that the use of leverage in any form, through the margin account or securities with embedded leverage, is associated with poorer investment performance. However, we also find that investors are better off trading on margin compared to trading securities with embedded leverage. This finding is consistent with Frazzini and Pedersen (2014, 2022), who suggest that leverage-constrained investors underperform on average. The observed difference in performance between the users of the two sources of leverage also adds to previous findings that connect the use of investment leverage with a lack of investor patience (Cremers & Pareek, 2016) and self-control (Uhr et al., 2019). Finally, our main results show that more attentive investors are better users of leverage compared to less attentive ones. However, this finding does not apply to the most aggressive traders of embedded leverage securities.

We contribute to the previous literature in the following ways: first, we differentiate between investors who trade on margin and those who use securities with embedded leverage. To the best of our knowledge, none of the previous

[1] As of February 2021, US investors had borrowed over $813 billion, which is almost 50% more than the year before, according to the Financial Industry Regulatory Authority (FINRA)https://www.finra.org/investors/learn-to-invest/advanced-investing/margin-statistics

[2] As of March 2021, investors on Robinhood could borrow up to $1000 for just $5 a month and 2.5% for anything above $1000.

[3] According to the company's filing with the SEC, Robinhood's net margin loans to their customers increased from approximately $638 million in 2019 to $3.35 billion in 2020 https://www.sec.gov/edgar/browse/?CIK=1699855

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studies have compared the effects of the sources of leverage on investor performance. This analysis synthesizes two research streams on leverage usage. It is related to the recent studies of D'Hondt et al. (2021) and DeVault et al. (2021) who show that investor exposure to leveraged exchange-traded products is associated with poor investment performance. It is also related to Barber et al. (2020) who examine whether investment performance is different for those who use margin and those who do not use it. It is noteworthy that the analysis in Barber et al. (2020) is based on a different investment environment, as their sample covers the period of 1991–1996. Obviously, technological advancement, novel financial instruments with embedded leverage, and reduced trading costs have made retail trading simpler and more accessible since that period. Our analysis covers the more recent period from 2016 to 2018 and is based on a unique dataset of approximately one million observations made on over half a million individual investors.

Second, we add to a growing number of studies that consider investor attention as an important determinant of financial market outcomes by positing that it plays a key role in determining retail investors' ability to benefit from the usage of leverage. Several studies show how changes in investor attention can affect stock prices and/or volatility (Andrei & Hasler, 2015; Da et al., 2011; Vlastakis & Markellos, 2012). In a closely related study, Gargano and Rossi (2018) show evidence that greater investor attention is associated with better investor performance. We extend this finding by showing that more attentive investors not only perform better but also benefit relatively more from using leverage. In relation to Heimer and Imas (2022) who suggest that restrictions on providing leverage to retail investors discipline their behavioral bias, we show evidence that less attentive investors in particular may want to avoid using the leverage.

The remainder of our study is organized as follows: We review the related literature and present the hypotheses concerning the effects of leverage usage and investor attention in Section 2; we describe our study's data and methodology in Section 3 and present the empirical results in Section 4; Section 5 concludes our study.

2 | RELATED LITERATURE AND HYPOTHESES

2.1 | Leverage and investment performance

The Capital Asset Pricing Model (CAPM) implies that investors should be able to increase their expected returns by increasing their exposure to systematic risk by using leverage without sacrificing their risk-adjusted returns. However, Frazzini and Pedersen (2022) show that asset classes with high embedded leverage offer low risk-adjusted returns, as leverage-constrained investors may bid up the prices of securities with embedded leverage. Thus, leverage-constrained investors who trade securities with high embedded leverage earn lower risk-adjusted returns. According to Frazzini and Pedersen (2014), investors who use financial leverage unconstrainedly can, in turn, exploit the low-risk anomaly and earn higher returns at the same level of risk by investing in low-beta stocks using financial leverage. In contrast, Cederburg and O'Doherty (2016) show that low-beta stocks do not necessarily outperform high-beta stocks when controlling for conditional market risk.

While this evidence indicates that having access to investment leverage can have a positive influence on investment outcomes, the recent empirical literature suggests that investment leverage may lead to poorer investment performance. Heimer and Simsek (2019), for example, study the effects of leverage constraint regulations in the US retail foreign exchange market and show that investors are better off with less leverage. Their model and empirical results show that the 2010 leverage constraints policy improved traders' expected returns by reducing their intermediation costs via bid-ask spreads. Another strand of the literature related to investor behavior documents that leverage may be associated with individual optimism, which may result in excessive risk-taking. Using the US housing market as a natural laboratory, Bailey et al. (2019) document that individual beliefs affect leverage choices by showing that more pessimistic homebuyers use less leverage to buy smaller houses. Ben-David (2019) reaches similar conclusions by showing that homebuyer optimism is associated with higher leverage in the US housing market.

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Behavioral bias other than optimism can also be problematic when taken together with using leverage. Heimer and Imas (2022) study the effects of regulatory restrictions on the amount of leverage in financial decisions. They find that leverage restriction results in a smaller disposition effect, which is the behavioral bias of holding onto losing investments for too long and selling winning investments too quickly, and in improved market timing. Consistent with the disposition effect, Li et al. (2022) document strong downward pressure on stock prices after good news due to intensive margin-covering trades of retail investors in China. Barber et al. (2020), in turn, find that investors who use margin debt are more overconfident, leading to more speculation and poorer investment decisions. Overall, the existing literature suggests that leverage usage is not associated with better performance due to behavioral biases and excess trading. Following this discussion, our first hypothesis for margin investors is:

H1a: Investors who trade on margin underperform relative to investors who do not use investment leverage.

In the case of margin trading, it is up to investors to decide which securities they want to combine with leverage, while securities with embedded leverage, in turn, offer preset combinations of leverage and underlying investments. Therefore, investing in securities with embedded leverage may not enable investors to exploit the observed low-risk anomaly (Frazzini & Pedersen, 2014) as in margin trading because securities with embedded leverage typically follow broad market indexes. This difference implies that investing in securities with embedded leverage as the choice of using investment leverage may be inferior to trading on margin.

Several studies focus on the performance of leveraged exchange-traded products, which are increasingly popular securities with embedded leverage among investors. Frazzini and Pedersen (2022), for example, show evidence that embedded leverage lowers risk-adjusted returns. Charupat and Miu (2011) study the performance of leveraged ETFs that they characterize as actively traded securities with short holding periods and find that the tracking errors of leveraged ETFs increase with longer holding periods. Charupat and Miu (2014) disentangle the effects of three factors that affect the performance of leveraged ETFs: daily return compounding, financing costs, and management factors.[4] Their results show that the compounding effect is a major contributing factor influencing the tracking errors of leveraged ETFs while the financing and management effects also play a role in explaining the tracking errors.

Other studies examine the performance of investors who invest in leveraged products. For example, D'Hondt et al. (2021) find that users of leveraged exchange-traded products underperform other investors who invest in vanilla exchange-traded products. This underperformance can be explained by poor market timing and active trading of leveraged exchange-traded products, which results in higher trading costs. They argue that the typical user of these products looks like an overconfident gambler. Farkas and Váradi (2021) study the performance and trading strategies of individual investors in leveraged warrants. They find evidence suggesting that investors follow contrarian strategies and open large positions when the time-varying leverage of these instruments is high leading to poorer performance. DeVault et al. (2021) show evidence that institutional holdings of leveraged ETFs predict a weak future performance of institutional investors, which according to the authors can be related to managerial hubris and lack of management skill. Thus, besides the documented tracking errors and poor returns of securities with high embedded leverage (Charupat & Miu, 2011; Frazzini & Pedersen, 2022), the empirical evidence on the use of leveraged products suggests that investors trading leveraged products underperform due to poor trading outcomes. Based on this literature on embedded leverage, we hypothesize that:

H1b: Investors who trade securities with embedded leverage underperform relative to investors who do not use investment leverage.

[4] The compounding effect arises from rebalancing the exposure of a leveraged ETF on a daily basis.

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2.2 | Leverage usage and investor attention

If the use of leverage by an average investor should be associated with poorer investment performance, as Hypotheses 1a and 1b state, are there any benefits from leverage at all? We postulate that investors may offset any negative effects by paying more attention when using investment leverage. There are at least two reasons why more attentive investors may gain from using leverage. First, one of the key perspectives of Dierick et al. (2019) is that more attentive investors are likely to be more sophisticated investors who have a comparative advantage in understanding and incorporating financial information into their decision-making processes. The idea is that more sophisticated investors have a greater payoff from allocating attention to their portfolio as their optimal point where the marginal benefits equal to the marginal costs of attention is relatively higher. Thus, more attentive investors who are also more sophisticated should be able to make more informed investment decisions whereas leverage enables them to make more use of their informational advantage.

Second, previous studies suggest that investors make better investment decisions by paying more attention and acquiring more information. Peress (2004) proposes that wealthier investors acquire more information, thus leading to a higher Sharpe ratio. In addition, Gargano and Rossi (2018) show evidence that investor attention is positively related to investor performance and that those who pay more attention tend to buy attention-grabbing and well-performing stocks. Furthermore, the recent evidence of Subrahmanyam et al. (2021) suggests that skilled investors are more likely to benefit from the use of leverage than unskilled investors. Therefore, broader information acquisition by more attentive investors can result in more informed decision making, which may offset the negative behavioral effects of leverage usage. Building on this evidence, we hypothesize that more attentive investors should be relatively better off from using leverage:

H2: *The performance of leverage users improves with greater investor attention.*

3 | DATA AND METHODOLOGY

We obtain the data from the Internet-based bank "Avanza," which is the largest bank in Sweden for retail investors. According to Avanza's disclosures, almost every fifth savings krona in Sweden ends up on their trading platform. The data include 981,242 investor-year observations for the years 2016–2018. The sample covers the portfolio performance and demographic characteristics of more than 525,000 individual investors, implying that we are dealing with an unbalanced panel dataset.

We consider the Sharpe ratio, the annualized standard deviation of returns, and the annual return as performance indicators. Because Sweden's short-term market interest rates were negative during the study period, we assume a zero risk-free rate when calculating the Sharpe ratio. Negative risk-free rates do not reflect the real risk-free rate for retail investors at Avanza as they are not offered deposit accounts with interest rates below zero. We clean the data by removing the following observations from the data for each year: (1) investors with a missing value for annualized standard deviation or annual return, (2) investors with a zero value for standard deviation,[5] and (3) investors with values for annualized standard deviation and/or annual return at the 0.5 and 99.5 percentiles of the distribution.

To measure investor attention, we follow the prior literature and count the number of days the investor was logged into their investment account in a year (see e.g., Davydov et al., 2021; Gargano & Rossi, 2018). In contrast to other types of investor attention measures, such as search engine volumes or Wikipedia articles (e.g., Boulton et al., 2021), our variable represents overall attention to portfolio information rather than attention to firm-specific information.

[5] Investors with zero values for standard deviation are identified as inactive investors because even passive investing would lead to a nonzero standard deviation.

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Given that investors have to log in every time they want to check on their portfolios,[6] we postulate that our measure is a good approximation of general investor attention to portfolio information.

For our variable of margin use, we consider investors who have traded on margin during a given year. To be able to use the margin debt at Avanza, investors must apply for the margin and sign a credit agreement with the broker. All applications are subject to creditworthiness assessment based on a credit history report (in Swedish: *Kreditupplysning*). When an investor buys on margin, securities in the portfolio are pledged as collateral to the broker, which alleviates the broker's risk of providing margin to investors. The borrowed amount can exceed neither an individually-specified credit limit nor the credit value of eligible securities on the margin account. The rate of interest on margin loans depends on the loan amount, securities traded, and customer status, and it typically increases with the amount-used leverage. Any margin account is subject to margin calls, and the broker has a right to sell securities in the portfolio if the margin account does not meet the requirement.

For our variable of embedded leverage usage, we consider turnover in leveraged ETFs and leveraged certificates as the indicator for using products with embedded leverage. Trading products with embedded leverage does not require investors to apply for credit as in the case of margin accounts, thereby creating a considerable difference between investing in securities with embedded leverage and the use of margin. However, to be able to trade certain products, including leveraged ETFs, investors are required to pass a financial aptitude test within the brokerage's platform.

3.1 | Descriptive statistics

As can be seen in Table 1, which presents our data's summary statistics, the absolute majority of our sample investors are male (70%). An average trader is slightly over 43 years old with approximately 6 years of account tenure (2242 days). We also observe large heterogeneity across investors in most of their investment activity characteristics. For example, the average number of trades is approximately 70 per year, varying from 0 to 111,316 per year, while the average trade size ranges from SEK 0 to 103 million with a mean value of almost SEK 37,500. The maximum number of trades of 111,316 a year suggests that the sample includes several accounts that rely on automated trading. It is also noteworthy that the average annual return (*Return)* on individual investors' portfolios is relatively low, only about 0.2% p.a. In turn, the average riskiness of individual investors' portfolios measured as the standard deviation of returns is 19%, while the Sharpe ratio is 0.28.

Regarding the variables of interest, the statistics for our proxy for investor attention, *Logins*, suggest that an average investor is logged into their account for 111 days a year. The measures of leverage usage indicate that relatively few investors rely on investment leverage. In particular, *AnyLev use*, a measure of the use of any leverage (embedded or margin) has a mean value of 0.07, implying that only 7% of our sample investors trade on margin and/or trade securities with embedded leverage. Nevertheless, given the large scale of our dataset, 7% of the observations suggest that there are over 67,000 observations for more than 44,000 individual investors who use investment leverage.

Notably, the number of investors who trade on margin in our sample is much lower than the corresponding numbers documented in previous studies. For example, in the sample of Barber et al. (2020), 65.9% of investors had margin accounts while the corresponding number in our data is only 3% of all the observations. However, it should be noted that the study of Barber et al. (2020) used records for only approximately 43,000 investors while our dataset covers more than half a million individual investors. Hence, 3% of the observations provide approximately 20,000 individual investors who trade on margin, which is comparable to the sample of Barber et al. (2020).

Finally, the number of investors who trade instruments with embedded leverage is marginally higher than those who trade on margin. Approximately 4% of our observations contain records of positive turnover in instruments with embedded leverage. The ratio of turnover in embedded leverage securities to total turnover has a value of 0.01,

[6] The brokerage system logs out inactive users automatically and disallows the "keep me logged in" option for security reasons.

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TABLE 1 Summary statistics

	N	mean	min	p25	p50	p75	p95	max	sd
Gender	982,878	0.70	0.00	0.00	1.00	1.00	1.00	1.00	0.46
Age (years)	982,878	43.27	18.00	31.00	40.00	54.00	72.00	111.0(	15.46
Account tenure (days)	981,235	2242.30	3.00	775.00	1459.00	3374.00	6285.00	7024.00	1836.50
Trade size (SEK)	982,878	37,462.74	0.00	1662.20	7613.67	26,596.63	145,696.70	103,000,000.0(	216,830.60
Number of trades p.a.	982,878	69.36	0.00	7.00	22.00	67.00	246.00	111,316.00	289.74
Sharpe ratio	982,878	0.28	−1.75	−0.26	0.14	0.79	1.86	3.8<	0.87
Return	982,878	0.002	−0.90	−0.04	0.02	0.09	0.25	1.61	0.21
StDev	982,878	0.19	0.00	0.08	0.12	0.22	0.60	22.3:	0.25
Logins p.a.	982,878	111.39	0.00	19.00	73.00	199.00	300.00	366.00	103.98
AnyLev use	982,878	0.07	0.00	0.00	0.00	0.00	1.00	1.0(	0.25
Margin use	982,878	0.03	0.00	0.00	0.00	0.00	0.00	1.00	0.17
EmbedLev use	982,878	0.04	0.00	0.00	0.00	0.00	0.00	1.0(	0.20
Loan to value ratio (on margin accounts)	939,131	0.004	0.00	0.00	0.00	0.00	0.00	1.00	0.04
Turnover in EmbedLev/Total turnover	982,878	0.01	0.00	0.00	0.00	0.00	0.00	1.0(	0.08

The table presents the descriptive statistics for the common sample of the variables used in this study. *Age* is investor age. *Gender* is the dummy variable for the investors' gender (male = 1). *Margin use* is the dummy variable for trading on a margin during a year. *EmbedLev use* is the dummy variable for the use of embedded leverage products during a year. *Account Tenure* is the number of days an investor is a customer of the bank. *Number of trades* is the number of trade transactions made by an investor in a year. *Trade size* is the average value of transactions made by an investor in a year. *Logins* is the number of days an investor was logged into an investment account during a year. The variables *Return*, *StDev* and *Sharpe* are the annual return, annualized standard deviation and Share ratio, respectively, denoted in decimals.

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suggesting that securities with embedded leverage account for approximately 1% of all trading. These statistics suggest that investors generally do not prefer to trade securities with embedded leverage.

3.2 | Methodology

Given that our sample includes a relatively small proportion of investors who trade with leverage, the choice of using investment leverage in retail trading may not be exogenous. More experienced, less risk-averse, or sensation-seeking investors may choose to use leverage more often, which, in turn, may affect the results in the analysis of the role of attention and leverage usage in portfolio performance. Therefore, in order to understand the relationship between individual investor characteristics and the use of investment leverage, we first investigate the determinants of leverage product usage and trading on margin with the following logistic regression model:

$$Leverage_{i,t} = \alpha_{i,t} + Demographic_{i,t} + Activity_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $Leverage_{i,t}$ includes three of our measures of using investment leverage: (i) $Margin_{i,t}$, a dummy variable for trading on margin account by investor *i* during the year *t*; (ii) $EmbedLev_{i,t}$, a dummy variable for using products with embedded leverage by investor *i* during the year *t*; and (iii) $Margin\&EmbedLev_{i,t}$, a dual variable indicating both types of investors who trade on margin and/or use products with embedded leverage during a year. $Demographic_{i,t}$ includes the natural logarithm of age in years for investor *i* ($Age_{i,t}$) and a dummy variable for the gender of investor *i*, where male = 1 ($Gender_{i,t}$). $Activity_{i,t}$ includes the natural logarithm of the account tenure of investor *i* in days ($AccountTenure_{i,t}$), the natural logarithm of an average value of transactions made by investor *i* in year *t* ($TradeSize_{i,t}$),[7] and the number of trades made by the investor during the year ($Trades_{i,t}$). Clearly, past investment performance may affect retail investors' decisions on whether to use leverage. Therefore, in some specifications, we also include a lagged by 1-year Sharpe ratio to account for the previous performances of individual investors. In all the regression specifications, we control for the time-fixed effect.

We proceed with our analysis by turning to our study's hypotheses and investigating how the investor attention and leverage use variables explain investor performance with the following regression model:

$$F_{i,t} = \alpha_i + Demographic_{i,t} + Activity_{i,t} + Login_{i,t} + Leverage_{i,t} + Leverage_{i,t} \times Login_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where the dependent variable $F_{i,t}$ is either the Sharpe ratio, the annualized standard deviation of returns, or the annual return for an investor *i*. $Demographic_{i,t}$ *and* $Activity_{i,t}$ are the same variables as in Equation (1) and include an investor's age, gender, account tenure, number of trades, and trade size. Following Davydov et al. (2021), we use $Login_{i,t}$ as a proxy for general investor attention to portfolio information, which is defined as the natural logarithm of the number of days an investor was logged into their investment account in a year. $Leverage_{i,t}$ includes two of our measures of investment leverage usage: (i) a dummy variable for trading on margin account by investor *i* during the year, $Margin_{i,t}$, and (ii) a dummy variable for using products with embedded leverage by investor *i* during the year, $EmbedLev_{i,t}$. $Margin_{i,t}$, $EmbedLev_{i,t}$, and $Login_{i,t}$ are the primary variables of interest in this study. Similar to the analysis of the determinants of leverage usage, we also include dummy variables for the years 2017 and 2018 in all specifications of Equation (2). Hypotheses 1a and 1b suggest that we should expect the coefficients for $Leverage_{i,t}$ in Equation (2) to be negative and significant. In addition, we estimate different specifications of Equation (2), where we test our variables of interest with and without the interaction effects: $Leverage_i \times Login_i$, which are meant to test our second hypothesis that *the performance of leverage users improves with greater investor attention*.

[7] As investment income in Sweden is public information, it can be used to identify individual investors. In line with the General Data Protection Regulation (GDPR), this feature restricts our access to portfolio values, and therefore, we consider *TradeSize* as a proxy for investor size.

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4 | RESULTS

4.1 | Univariate analysis

We begin our analysis with simple mean comparisons between traders based on their usage of leverage during our sample period. The statistics reported in Table 2 suggest that the majority of investors in our sample are leverage averse, as more than 92% have neither traded on margin nor invested in securities with embedded leverage. Nevertheless, we identify over 67,000 observations for more than 44,000 individual investors (Column 2) who traded on margin or securities with embedded leverage during our sample period. Comparing these investors with those who do not use leverage (Column 1), we observe significant differences in all characteristics, which suggests that the users of investment leverage are a quite distinct group of investors. In particular, we see that older, more experienced male investors are more likely to trade with leverage. Barber et al. (2020) suggest that investors who have margin accounts are more speculative and demonstrate poorer investment performance compared to investors who do not have margin accounts. Our results in Table 2 are consistent with this idea, as the average number of trades by the leverage users (Column 2) is significantly higher than the corresponding number for investors who do not use leverage (Column 1), 226.76 versus 57.77 per annum.

Given that the source of leverage may define a particular type of investor, we split the sample further into three types of leverage users: (i) Investors who trade on margin and do not use embedded leverage (Column 4); (ii) investors who trade products with embedded leverage and do not use margin accounts (Column 6); and (iii) investors who use both sources of leverage simultaneously (Column 9). Several interesting findings emerge from this subsample analysis. First, we observe that there are relatively more investors who trade products with embedded leverage (26,988 (Column 6)) than investors who trade on margin (16,933 (Column 4)), and only a small fraction of investors use both types of leverage simultaneously (2615 (Column 9)). These statistics imply that investors in general tend to choose only one type of leverage if they decide to use investment debt.

Second, the differences between margin users and embedded leverage users (Columns 4 and 6) also suggest that they are two very different groups of investors. Investors who trade on margin as the only source of leverage have 1079 days longer account tenure, they are more than 9 years older, and their average trade size is SEK 53,435 higher than in the case of investors who only access leverage by investing in securities with embedded leverage. These statistics suggest that margin debt relative to embedded leverage is more often used by, on average, older and more experienced investors who make larger transactions. In addition, the statistics show that embedded leverage users trade more than twice as much as investors who trade on margin as their only source of leverage, 270.52 versus 130.26 trades per annum.

Third, there are interesting patterns in individual investor attention behavior. Specifically, the users of both sources of leverage (Column 9) seem to be logged into their accounts for around 239.3 days per year, which is more than 95% of all trading days and more than 2.2 times higher than for the nonleverage users in Column 1.[8] Given that these investors also have the highest number of trades and the largest trade size relative to all the other investors, such frequent account access can be attributed to active trading rather than intentional attention and portfolio monitoring. The further comparison suggests that margin traders pay more attention even though they trade less frequently than embedded leverage users. This feature may indicate investor patience (Cremers & Pareek, 2016) and self-control (Uhr et al., 2019), as documented in the previous literature. Overall, a sub-sample comparison reveals that leverage users monitor their portfolios much more often, while investors who prefer margin debt to embedded leverage pay the most attention, apart from very active investors who trade both on margin and securities with embedded leverage.

Turning to the comparison of performance across investors, Table 2 shows that investors who use either of the two sources of leverage, embedded or margin, as in Column 2, have an average Sharpe ratio of 0.22, which is slightly less than for investors who opt out from investment leverage (0.29 in Column 1). The leverage-free investors also have

[8] The average number of trading days on the Stockholm Stock Exchange was 251.3 in 2016–2018.

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TABLE 2 Mean comparison across traders

	No leverage users	Any leverage (margin or embedded) users	Diff in means (2)-(1)	Margin account users, no embedded leverage	Diff in means (4)-(1)	Embedded leverage users, no margin accounts	Diff in means (6)-(1)	Diff in means (6)-(4)	Margin and embedded leverage users	Diff in means (9)-(1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
N. of obs.	915,506	67,372		24,365		39,642			3365	
N. of investors	509,534	44,119		16,993		26,988			2615	
Gender	0.69	0.88	0.19***	0.87	0.18***	0.88	0.19***	0.01***	0.93	0.24***
			(150.2)		(84.5)		(120.2)	(4.9)		(56.4)
Age	43.06	46.02	2.96***	51.62	8.56***	42.44	−0.62***	−9.18***	47.72	4.66***
			(48.3)		(86.1)		(8.4)	(75.5)		(18.8)
Account tenure	2173.84	3172.45	998.60***	3808.92	1635.10***	2729.53	555.68***	−1079.39***	3774.19	1600.34***
			(130.2)		(130.2)		(56.3)	(69.6)		(49.7)
Trade size (SEK)	33,966.52	84,972.28	51,006.09***	116,122.70	82,156.51***	62,687.60	28,721.41***	−53,435.10***	121,949.90	87,983.71***
			(32.1)		(21.0)		(26.7)	(13.2)		(13.9)
Number of trades p.a.	57.77	226.76	168.98***	130.26	72.49***	270.52	212.75***	140.26***	409.95	352.18***
			(49.6)		(32.5)		(39.7)	(24.2)		(18.7)
Sharpe ratio	0.29	0.22	−0.07***	0.46	0.17***	0.08	−0.21***	−0.38***	0.23	−0.06***
			(18.7)		(27.1)		(46.9)	(50.5)		(3.9)
Return	0.004	−0.02	−0.02***	0.03	0.03***	−0.05	−0.05***	−0.08***	−0.01	−0.01***
			(19.4)		(16.8)		(35.6)	(36.5)		(3.6)
Standard deviation	0.19	0.27	0.09***	0.24	0.05***	0.29	0.10***	0.05***	0.29	0.10***
			(58.2)		(30.7)		(47.7)	(20.4)		(19.4)
Logins p.a.	105.33	193.70	88.37***	200.67	95.34***	185.54	80.21***	−15.13***	239.30	133.97***
			(58.3)		(140.2)		(150.2)	(17.5)		(86.4)

The table presents comparisons between investors based on their use of leverage. *Age* is investor age. *Gender* is the dummy variable for the investors' gender (male = 1). *Account Tenure* is the number of days an investor is a customer of the bank. *Number of trades* is the number of trade transactions made by an investor in a year. *Trade size* is the average value of transactions made by an investor in a year. *Logins* is the number of days an investor was logged into an investment account during a year. The variables *Return*, *StDev* and *Sharpe* are the annual return, annualized standard deviation and Share ratio, respectively, denoted in decimals. *** indicate statistical significance at the 1% level.

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an approximately two-percentage point higher average annual return on their investments than the leverage users while the standard deviation is nine percentage points lower. These statistics imply that investors are better off both in terms of profitability and riskiness of their portfolios if they do not use leverage.

However, when considering investors who trade only on margin and do not trade products with embedded leverage (Column 4), we observe that the average Sharpe ratio of this group is 0.46, which is significantly higher than for any other group of investors. On the other hand, investors who trade securities with embedded leverage but do not use margin (Column 6) exhibit a poorer performance with an average Sharpe ratio of 0.08, an annual return of −5%, and a standard deviation of 29% compared to both margin users (Column 4) and to investors who do not use any leverage (Column 1). Thus, the poorer performance associated with the use of leverage appears to be related more to users of embedded leverage products. These differences highlight the importance of differentiating between the sources of leverage and other investor-specific characteristics in the multivariate analysis.

Taken together, the results in Table 2 suggest that the observed difference in performance between users and nonusers of leverage may be driven by a group of investors who use only embedded leverage or by a small group of very active investors who use both sources of leverage. These results are broadly consistent with the prior empirical evidence, which suggests that products with embedded leverage offer low risk-adjusted returns (Frazzini & Pedersen, 2022). The outperformance of margin investors relative to other groups of investors is also consistent with the idea that leverage-constrained investors bid up the prices of securities with embedded leverage and, therefore, underperform by holding these securities. Alternatively, the poorer performance of investors who use securities with embedded leverage may be attributed to the compounding effect in leveraged ETFs (e.g., Charupat & Miu, 2014).

It is also possible that margin trading and products with embedded leverage are used by different types of investors, which can explain the difference in the performance of margin users and users of securities with embedded leverage. For example, sensation-seeking investors, who are also more likely to make poorer investment decisions, may choose to use embedded leverage securities instead of margin trading. As younger investors tend to be more sensation-seeking (see, e.g., Zuckerman et al., 1978), this idea is consistent with the statistics in Table 2 showing that leverage users who have chosen only margin debt (Column 4) are on average 9.18 years older than those who have only chosen to trade products with embedded leverage (Column 6). These results for embedded leverage can also be related to the findings of D'Hondt et al. (2021), which explain the poor performance of users of leveraged exchange-traded products by their motivation to use these securities more for gambling. On the other hand, this finding may be linked to the evidence of Korniotis and Kumar (2011), which suggests that older investors are less effective at applying new investment knowledge even though they may benefit from their wider experience. Many leveraged investment products such as leveraged ETFs are relatively new, so older investors may not be inclined to trade these products, as new knowledge has to be acquired for that.

4.2 | Analysis of leverage usage

The univariate tests in Table 2 indicate that, in addition to the significant differences between leverage users and nonusers, there are substantial differences between the users of margin accounts and embedded leverage. Given that the choice to rely on a particular source of leverage may not be exogenous, a natural first step is to examine what investor characteristics determine leverage usage and the preferences of the source of leverage. Related to the streams of the literature on the two types of leverage usage: (i) research on embedded leverage (see, e.g., Frazzini & Pedersen, 2022) and (ii) research on margin trading (see, e.g., Barber et al., 2020; Heimer & Imas, 2022), this analysis aims to shed more light on how the users of these two types of leverage are different. These estimations are reported in Table 3.

The results suggest that men are more likely to use leverage than women regardless of the source. The coefficient on $Gender_{i,t}$ is positive and highly statistically significant in every regression specification. As more leverage increases portfolio risk, this result is consistent with prior studies (e.g., Barber & Odean, 2001; Davydov et al., 2017), showing

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TABLE 3 Determinants of leverage usage

	(1)	(2)	(3)	(4)	(5)	(6)
	AnyLev	AnyLev	Margin	Margin	EmbedLev	EmbedLev
Gender	0.861***	0.810***	0.841***	0.804***	0.790***	0.757***
	(0.017)	(0.021)	(0.025)	(0.032)	(0.021)	(0.027)
Ln (Age)	−0.076***	−0.121***	0.767***	0.587***	−0.701***	−0.610***
	(0.018)	(0.023)	(0.027)	(0.036)	(0.022)	(0.029)
Ln (Account tenure)	0.611***	0.672***	0.932***	0.899***	0.393***	0.480***
	(0.007)	(0.011)	(0.012)	(0.017)	(0.009)	(0.014)
Ln (Trade size)	0.166***	0.183***	0.087***	0.104***	0.246***	0.245***
	(0.004)	(0.006)	(0.006)	(0.009)	(0.004)	(0.006)
Ln (Number of trades)	0.522***	0.527***	0.315***	0.293***	0.660***	0.663***
	(0.004)	(0.006)	(0.006)	(0.008)	(0.005)	(0.007)
Lagged Sharpe ratio		−0.257***		−0.074***		−0.330***
		(0.007)		(0.011)		(0.008)
Constant	−10.516***	−11.273***	−15.720***	−14.877***	−8.325***	−9.805***
	(0.066)	(0.092)	(0.106)	(0.143)	(0.079)	(0.112)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo *R*-squared	0.155	0.141	0.151	0.112	0.165	0.160
N. of obs.	981,235	447,072	981,235	447,072	981,235	447,072
N. of traders	527,876	321,433	527,876	321,433	527,876	321,433

The table presents the estimates of the analysis of the determinants of leverage product use and trading margin account. The logistic model of the analysis is as follows:

$Leverage_{i,t} = \alpha_i + Demographic_{i,t} + Activity_{i,t} + \varepsilon_{i,t}$,

where $Leverage_{i,t}$ is one of the three dummy variables for the use of leverage: $Margin_{i,t}$ is a dummy variable for trading on margin account by investor *i* during a year, $EmbedLev_{i,t}$ is a dummy variable for the use of products with embedded leverage by investor *i* during a year, or $AnyLev_{i,t}$, a dual variable indicating both trading on margin and/or use of products with embedded leverage by investor *i* during a year. $Demographic_{i,t}$ includes the natural logarithm of age in years for investor *i* ($Age_{i,t}$), and a dummy variable for the gender of investor *i* (male = 1) ($Gender_{i,t}$). $Activity_{i,t}$ includes the natural logarithm of the account tenure of investor *i* in days (*Account Tenure*$_{i,t}$), the natural logarithm of an average value of transaction made by investor *i* in a year (*TradeSize*$_{i,t}$) and the natural logarithm of the number of trades by the investor during a year (*Number of Trades*$_{i,t}$). *Lagged Sharpe ratio* is the measure of investor performance in a previous year. All models include dummy variables for the years 2017 and 2018 to control for time effects (In unreported robustness tests, we re-estimate all the models without time effects as including time dimension may adversely affect the magnitude of standard errors and obtain virtually the same results). Robust, clustered at individual investor level standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

evidence that women take less risk than men. Furthermore, the results for $AccountTenure_{i,t}$ show that more experienced investors are more likely to use leveraged products and have a margin account. While Nicolosi et al. (2009) report that investment performance increases with investors' trading experience, the finding that leverage usage is associated with investor experience is, to the best of our knowledge, novel to the literature on investor experience. We also find that investors with larger than average trade sizes and higher numbers of trades are more likely to trade on margin and to trade securities with embedded leverage.

Remarkably, the coefficient estimates for $Age_{i,t}$ suggest that there is a negative relationship between investor age and the decision to use leverage. However, once we decompose the leverage source on margin debt and embedded

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leverage, we observe a significant inverse relationship relative to the overall negative effect for margin debt users. Specifically, the positive and significant coefficients for $Age_{i,t}$ in Models 3 and 4 in Table 3 imply that older investors are more likely to trade on margin, while the negative and significant coefficients in Models 5 and 6 suggest that younger investors are more likely to trade products with embedded leverage. This pattern may be due to the tendency that younger investors do not necessarily have equally good access to margin debt as older investors because young investors typically have a shorter credit history, less secure employment, and lower income, all of which may adversely affect their creditworthiness assessment required for trading on margin.

Table 3 also reveals that prior investment performance significantly affects the decision to use leverage regardless of the source of debt. The coefficient estimates for the Sharpe ratio in Models 3, 4, and 6 are negative and highly statistically significant, suggesting that individual investors are less likely to use leverage after a successful investment year.

4.3 | Use of leverage, attention and investment performance

Next, we test the hypotheses of our study by estimating the different specifications of Equation (2), where the dependent variable is investor performance measured by the Sharpe ratio, annual return, or standard deviation of returns. The results of these estimations are presented in Table 4. The key explanatory variables are the two dummy variables for leverage usage, $Margin_{i,t}$ and $EmdebLev_{i,t}$, and a proxy for investor attention, $Login_{i,t}$. The dummy variables for leverage usage have a value of one if an investor has a margin account or trades products with embedded leverage, respectively, while the proxy for attention is the average number of days an investor is logged into their trading account during a year. The evidence from the univariate tests in Table 2 supports the view that margin users and users of embedded leverage are rather different groups of investors, whereas a very small group of investors use both sources of leverage. Thus, we consider investors who trade on margin and those who trade securities with embedded leverage as two distinct groups of leverage users.[9] To gauge the effects of investor attention and leverage usage on performance, we interact the attention variable with the measures of trading activity and leverage usage.

In Models 1, 3, and 5 in Table 4, we analyze the effects of the different sources of leverage on portfolio performance while controlling for investor demographics and trading characteristics. The coefficient estimates for $Margin_{i,t}$ provide evidence that supports our Hypothesis 1a and indicate that investors who trade on margin tend to underperform compared to those who do not use investment leverage. Although the overall effect on the Sharpe ratio is negative and statistically significant, we observe that this effect is primarily driven by a higher standard deviation of returns (Model 5) while the total return is not affected by using a margin (Model 3). Moreover, the magnitude of the coefficient suggests that margin users, on average, obtain a 0.04 lower Sharpe ratio than nonusers after controlling for investor characteristics (Model 1). The magnitude of the coefficient for $Gender_{i,t}$, in turn, is more economically significant, suggesting that males, on average, obtain a 0.124 lower Sharpe ratio. Nevertheless, this evidence is consistent with Barber et al. (2020), who find that investors with margin accounts have a poorer investment performance than those who do not have margin accounts.

A much more sizable economic effect can be observed for the users of embedded leverage. Models 1, 3, and 5 in Table 4 show that investors who trade securities with embedded leverage obtain, on average, a 0.25 lower Sharpe ratio, a 5.6 percentage-point lower return, and a 10.2 percentage-point higher standard deviation of returns than those who do not invest with embedded leverage. These results provide evidence in support of our Hypothesis 1b that *investors who trade securities with embedded leverage underperform relative to investors who do not use investment leverage*. The F test indicates that the difference in magnitudes of coefficients for $Margin_{i,t}$ (−0.04) and $EmbedLev_{i,t}$ (−0.251) from Model 1 is highly statistically significant (F stat = 774.87), suggesting that investors are still better

[9] In additional unreported robustness tests, we also exclude a small group of investors who use both sources of leverage. The results remain virtually unchanged.

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TABLE 4 Leverage usage, investor attention, and portfolio performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Sharpe ratio	Sharpe ratio	Return	Return	StDev	StDev
Margin use	−0.040***	−0.232***	−0.001	−0.044***	0.054***	0.129***
	(0.006)	(0.022)	(0.002)	(0.007)	(0.002)	(0.011)
Ln (Logins) × Margin use		0.044***		0.009***		−0.017***
		(0.004)		(0.001)		(0.002)
EmbedLev use	−0.251***	−0.559***	−0.056***	−0.124***	0.102***	0.215***
	(0.005)	(0.020)	(0.001)	(0.006)	(0.002)	(0.015)
Ln (Logins) × EmbedLev use		0.068***		0.015***		−0.025***
		(0.004)		(0.001)		(0.003)
Ln (Logins)		0.005***		0.002***		0.004***
		(0.001)		(0.000)		(0.000)
Gender	−0.124***	−0.089***	−0.026***	−0.021***	0.057***	0.042***
	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)
Ln (Age)	0.117***	0.119***	0.020***	0.020***	−0.043***	−0.044***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Ln (Account tenure)	0.064***	0.065***	0.015***	0.015***	−0.005***	−0.005***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Trade size)	−0.007***	−0.003***	−0.000	0.000***	0.006***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Number of trades)	0.046***	0.129***	0.006***	0.017***	−0.012***	−0.042***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Ln (Logins)×Ln(Number of trades)		−0.017***		−0.002***		0.005***
		(0.000)		(0.000)		(0.000)
Constant	−0.699***	−0.823***	−0.154***	−0.172***	0.324***	0.356***
	(0.010)	(0.011)	(0.003)	(0.003)	(0.003)	(0.004)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.185	0.190	0.042	0.044	0.033	0.043
N. of obs.	981,235	981,235	981,235	981,235	981,235	981,235
N. of traders	527,876	527,876	527,876	527,876	527,876	527,876

The table presents the estimates of the analysis of the effects of investors' attention and leverage use on the Sharpe ratio, annualized standard deviation of returns and annual return. The empirical ordinary least squares (OLS) model is as follows:
$F_{i,t} = \alpha_i + Demographic_{i,t} + Activity_{i,t} + Login_{i,t} + Leverage_{i,t} + Leverage_{i,t} \times Login_{i,t} + \varepsilon_{i,t}$,
where the dependent variable $F_{i,t}$ is either the Sharpe ratio, annualized standard deviation of returns or annual return for an investor *i*. $Demographic_{i,t}$ includes the natural logarithm of age in years for investor *i* ($Age_{i,t}$) and a dummy variable for the gender of investor *i* (male = 1) ($Gender_{i,t}$). $Activity_{i,t}$ includes the natural logarithm of the account tenure of investor *i* in days ($AccountTenure_{i,t}$), the natural logarithm of an average value of transaction made by investor *i* in a year ($TradeSize_{i,t}$) and the natural logarithm of the number of trades made by the investor during a year ($Number\ of\ Trades_{i,t}$). $Login_{i,t}$ is the natural logarithm of the number of days an investor was logged into an investment account in a year. $Leverage_{i,t}$ includes a dummy variable for trading on margin account by investor *i* during a year ($MarginUse_{i,t}$) and a dummy variable for using products with embedded leverage by investor *i* during a year ($EmbedLevUse_{i,t}$). All models include dummy variables for the years 2017 and 2018 to control for time effects. Heteroskedasticity robust, clustered at individual investor level standard errors, are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

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off trading on margin than investing in securities with embedded leverage even though neither is associated with a better performance relative to investors who do not use leverage. This difference between securities with embedded leverage and margin is consistent with the results in Table 2.

Regarding the role of investor attention in using leverage, in Models 2, 4, and 6 we include our proxy for attention and interaction terms with leverage and trading activity. In every specification, we observe that portfolio monitoring frequency has a statistically highly significant but economically modest positive effect on investment performance. One standard deviation increase in $Logins_{i,t}$ (the standard deviation of Ln $(Logins_{i,t})$ in our sample is 1.51) leads to a 0.76% increase in the Sharpe ratio (Model 2), a 0.3% increase in annual return (Model 4), and a 0.6% increase in the annualized standard deviation of returns (Model 6). Nevertheless, these results indicate that investor attention is beneficial to investment performance, which is broadly consistent with the evidence of Gargano and Rossi (2018). These numbers suggest that an average investor in our sample would be able to increase their portfolio Sharpe ratio by 0.005 if they double the portfolio monitoring frequency.

It is noteworthy that the coefficient values for $Margin_{i,t}$ and $EmbedLev_{i,t}$ for explaining the Sharpe ratio are more negative in Model 2 than in Model 1, suggesting that adding investor attention as a control variable alters the result. More interestingly, the results of the analysis with investor attention suggest that the joint effects of leverage and investor attention are also significant factors in explaining investment performance. For both margin trading and embedded leverage users, the coefficients for the interaction variables with investor attention are highly statistically significant and positive for the Sharpe ratio and return (Models 2 and 4) and negative for standard deviation (Model 6). These results suggest that the negative effect of leverage usage on investment performance decreases with greater investor attention, which is in line with our Hypothesis 2, that *the performance of leverage users improves with greater investor attention*. This result is consistent with the literature, suggesting that investors make better investment decisions by paying more attention and acquiring more information (see, e.g., Gargano & Rossi, 2018; Peress, 2004), and supports the idea that more attentive investors have a comparative advantage (see, e.g., Dierick et al., 2019) which can offset the negative behavioral effects of leverage use (see, e.g., Bailey et al., 2019; Barber et al., 2020; Ben-David, 2019; Heimer & Imas, 2022).

Regarding the control variables, most of the investor demographics and trading characteristics appear to be significant determinants of investment performance throughout all the regression specifications and are in line with the previous literature. We document that male investors significantly underperform compared to female investors, while older and more experienced traders tend, on average, to perform better. Trade size seems to be negatively related to the Sharpe ratio and positively associated with standard deviation, while the number of trades is, in general, positively associated with performance. Interestingly, the interaction term of $Logins_{i,t}$ with the number of trades in Model 2 in Table 4 is negative and highly statistically significant, suggesting that an investor who frequently logs into their account and makes more transactions obtains, on average, a lower Sharpe ratio than one who often logs in but trades less.

The results reported so far may potentially be subject to endogeneity problems. For example, investors anticipating favorable economic conditions may lever up their positions, thus causing a reverse causality issue in the observed relationship between investment performance and leverage usage. Moreover, omitted variables issues may also bias our estimates. To address these issues, we first re-estimate our baseline models and substitute investor gender indicative variable with individual investor-fixed effects.[10] The inclusion of investor-fixed effects does not qualitatively alter our main results and hence is not tabulated for the sake of brevity.

Next, to diminish the reverse causality concerns, we consider the performance of those investors who switched from leverage users to nonusers (and vice versa) in a subsample of individual investors. By comparing the performance of the same investors over time who decide to take on or give up on leverage usage, we are aiming to capture whether the levered traders make suboptimal investment decisions. Presumably, if an investor consistently makes suboptimal trading decisions, the usage of leverage would have an amplifying effect. In contrast, if the poor performance is the

[10] We would like to thank an anonymous reviewer for these suggestions.

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result of leverage usage and not due to poor market timing or security selection, we should observe a structural shift in performance once the investor taps or eliminates leverage from their investment strategy. Table 5 reports the results of this analysis. In line with the expectations, the indicative variables of shifting from leverage users to nonusers show that giving up investment leverage significantly positively affects the Sharpe ratio and raw return while bringing portfolio standard deviation downwards. In additional tests (not tabulated), we also assess whether a reverse shift from a nonuser of leverage to a leverage user has any implications for portfolio performance and find that such a shift has a negative effect on investment performance, at least in the case of products with embedded leverage. Notably, our results on the role of investor attention and leverage usage in portfolio performance remain unchanged.

Finally, we address the potential endogeneity problem using the two-step Heckman selection model, wherein the first step a logit model is used to predict the usage of leverage while the second step estimates the investment performance equation with inverse Mills ratio obtained from the first step. While in these estimations, we notice that unobserved investor-specific characteristics that make the usage more likely are associated with poorer investment performance, our main results on the relationship between investor attention and investment performance remain unchanged.[11] The usage of margin or embedded leverage still negatively affects the Sharpe ratio while more frequent portfolio monitoring helps to alleviate this effect.

4.4 | Intensity of using leverage, investor attention, and portfolio performance

Our results so far suggest that using leverage has a significant negative effect on investment performance, which may be diminished by frequent portfolio monitoring. While we observe distinct differences in trading behavior between leverage users and nonusers, it is important to acknowledge that there are potential differences within the group of leverage users. Therefore, the next step of our analysis is to examine the role of the intensity of leverage usage among margin accounts and embedded leverage users. Specifically, we estimate the different specifications of Equation (2), where we replace the dummy variables for using investment leverage with two continuous variables: (i) the average loan-to-value ratio (LTV) for investor *i* during year *t* ($LTV_{i,t}$), and (ii) the ratio of turnover in securities with embedded leverage to the total turnover for investor *i* during year *t* ($Turnover\ in\ EmbedLev_{i,t}$). The estimates of these measures of intensity are reported in Table 6.

Panel A in Table 6 presents the mean and percentile statistics for the LTV ratio and turnover in embedded leverage securities among investors who trade on margin and/or who trade securities with embedded leverage. The LTV ratio of 48% for the 95th percentile suggests that there are very few investors with large leverage positions while the majority of margin users have moderate or low levels of leverage with a mean of 9%. Regarding the turnover in embedded leverage securities, which shows the percentage of turnover in securities with embedded leverage in the total trading turnover, the 100% turnover at the 95th percentile suggests that some investors trade exclusively in securities with embedded leverage. The median share of turnover in embedded leverage securities is 8%, suggesting that securities with embedded leverage do not dominate the trading of a median investor who trades with leverage.

Panel B in Table 6 reports the regression results of the analysis of the effects of the intensity of leverage usage on the Sharpe ratio, annual return, and annualized standard deviation of returns. The results are broadly consistent with our previous results. For margin trading, we observe a negative effect from LTV on investment performance for all three measures. The higher the loan-to-value ratio, the lower the Sharpe ratio and annual return, and the higher the standard deviation of returns. The statistically significant and positive coefficient for the joint effect of investor attention and margin usage intensity, $LTV_{i,t} \times Login_{i,t}$, is also similar to the joint effect of investor attention and margin trading, $Margin_{i,t} \times Login_{i,t}$, as shown in Table 4, which confirms our finding on the power of attention in alleviating the negative effect from leverage on performance.

[11] These results are not reported for the sake of brevity but are available from the authors upon request.

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TABLE 5 Leverage usage shifts, attention, and portfolio performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Sharpe ratio	Sharpe ratio	Return	Return	StDev	StDev
Shift from margin to no margin use	0.078***	0.072***	0.022***	0.022***	−0.041***	−0.040***
	(0.014)	(0.014)	(0.004)	(0.004)	(0.003)	(0.004)
Shift from EmbedLev to no EmbedLev use	0.162***	0.163***	0.041***	0.041***	−0.051***	−0.051***
	(0.011)	(0.011)	(0.003)	(0.003)	(0.004)	(0.005)
Margin use	−0.082***	−0.222***	−0.011***	−0.034***	0.067***	0.108***
	(0.009)	(0.028)	(0.002)	(0.008)	(0.002)	(0.009)
Ln (Logins) × Margin use		0.035***		0.005***		−0.011***
		(0.005)		(0.002)		(0.002)
EmbedLev use	−0.344***	−0.635***	−0.075***	−0.143***	0.122***	0.237***
	(0.007)	(0.026)	(0.002)	(0.008)	(0.003)	(0.018)
Ln (Logins) × EmbedLev use		0.064***		0.015***		−0.025***
		(0.005)		(0.002)		(0.004)
Ln (Logins)		0.002		0.004***		−0.007***
		(0.002)		(0.001)		(0.001)
Gender	−0.144***	−0.099***	−0.031***	−0.026***	0.069***	0.054***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Ln (Age)	0.126***	0.122***	0.021***	0.021***	−0.039***	−0.038***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Ln (Account tenure)	0.071***	0.067***	0.017***	0.017***	−0.033***	−0.032***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Trade size)	−0.007***	0.002***	−0.000	0.001***	0.006***	0.003***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Number of trades)	0.057***	0.158***	0.008***	0.024***	−0.020***	−0.060***
	(0.001)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)
Ln (Logins) × Ln(Number of trades)		−0.019***		−0.003***		0.008***
		(0.000)		(0.000)		(0.000)
Constant	−0.207***	−0.325***	−0.157***	−0.185***	0.521***	0.584***
	(0.013)	(0.015)	(0.003)	(0.004)	(0.004)	(0.005)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.202	0.209	0.050	0.052	0.057	0.070
N. of obs.	692,168	692,168	692,168	692,168	692,168	692,168
N. of traders	428,412	428,412	428,412	428,412	428,412	428,412

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TABLE 5 (Continued)

The table presents the estimates of the analysis of the effects of switching between leverage users and nonusers and investors' attention on the Sharpe ratio, annualized standard deviation of returns, and annual return. The analysis is based on different specifications of Equation (2), where the dependent variable is either the Sharpe ratio, annualized standard deviation of returns or annual return for an investor. *Shift from margin to no margin use* and *Shift from EmbedLev to no EmbedLev use* are dummy variables indicating an investor who shifts from leverage user to nonuser of leverage during the next period.
All the models include control variables for investor demographics and investment activity. $Login_{i,t}$ is the natural logarithm of the number of days an investor was logged into an investment account in a year. $MarginUse_{i,t}$ is a dummy variable for trading on margin account by investor *i* during a year, and $EmbedLevUse_{i,t}$. is a dummy variable for using products with embedded leverage by investor *i* during a year. All models include time-fixed effects. Heteroskedasticity robust, clustered at individual investor level standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

However, while we also observe a negative effect of turnover in securities with embedded leverage, the coefficient for the joint effect of investor attention and turnover in embedded leverage products, $Turnover\ in\ EmbedLev_{i,t}{}^{*}Login_{i,t}$, is statistically significant and negative in regressions with the Sharpe ratio and return, and positive with standard deviation. These estimates imply that a higher level of trading intensity in embedded leverage products together with a higher level of attention is associated with even poorer performance, which is the opposite of the joint effect with the dummy variable for use of embedded leverage securities observed in Table 4. This finding may indicate that investors who trade exclusively in securities with embedded leverage potentially exhibit different trading behavior or capability. One potential reason for the observed relationship could be the difference between the two types of leverage usage as it is up to investors in the case of margin trading to decide which securities they want to combine with leverage, unlike embedded leverage securities that typically follow broad market indexes. Thus, margin traders have more flexibility in paying attention to information related to firm-specific events such as earnings announcements and may potentially exert more benefit from such information.

While the above analysis considers the intensity of leverage use, it does not consider any potential nonlinearity in the relationship between the degree of leverage and performance. Hence, in the additional tests, we substitute the LTV ratio and turnover in the embedded leverage securities ratio with four dummy variables for low and high values of LTV and turnover share in the embedded leverage securities. We define these dummy variables as low (high) if the underlying ratio is below (above) the mean values reported in Panel A in Table 6. In addition, we introduce another pair of variables that capture the intensity of the embedded leverage usage given the degree of leverage in the underlying securities. Specifically, we calculate the share of turnover in instruments with high leverage (STHL), which are instruments with a multiplier of times three or higher, and the share of turnover in instruments with low leverage (STLL), which are instruments with a multiplier of less than times three. Table 7 presents the results of this analysis.

As can be seen in the table, the results are in line with the findings reported in Tables 4 and 6, suggesting that investors who trade on margin and who trade securities with embedded leverage underperform regardless of the degree of leverage usage. By comparing the degree of leverage usage in margin trading, we find that investors with a high degree of leverage (High LTV) underperform compared to those with a low degree of leverage (Low LTV). Similar to the findings in Table 6, more active monitoring of these portfolios still helps diminish the negative effect of leverage in both cases of high and low LTV ratios (Model 1). For leverage-unconstrained investors, we observe that trading securities with embedded leverage still has a significant negative effect on portfolio performance, regardless of the degree of leverage. However, investors who have a higher turnover in securities with embedded leverage (High turnover in EmbedLev) or a larger share of turnover in instruments with high embedded leverage (STHL) actually perform somewhat better than those who have a low turnover in securities with embedded leverage (Low turnover in EmbedLev) or a larger share of turnover in securities with low embedded leverage (STLL) (Models 2 and 3). Interestingly, we also observe that investor attention alleviates the negative effect of leverage use, but only in the case of low turnover in securities with embedded leverage (Logins×Low turnover in EmbedLev) and with a higher share of turnover in securities with low embedded leverage (Logins×STLL). This finding supports the notion that aggressive embedded leverage users, measured either by high turnover in securities with embedded leverage or by a higher share

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TABLE 6 Intensity of leverage usage, attention, and portfolio performance

Panel A. Intensity of leverage usage among margin debt and embedded leverage users

	N. of obs.	mean	min	p25	p50	p75	p95	p99	max	sd
LTV	27,271	0.09	0.00	0.00	0.00	0.10	0.48	0.71	0.98	0.16
Turnover in EmbedLev	43,007	0.24	0.00	0.02	0.08	0.35	1.00	1.00	1.00	0.32

Panel B. Intensity, attention and portfolio performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Sharpe ratio	Sharpe ratio	Return	Return	StDev	StDev
LTV	−0.750***	−1.158***	−0.189***	−0.268***	0.487***	0.981***
	(0.021)	(0.057)	(0.009)	(0.029)	(0.015)	(0.049)
Ln(Logins) × LTV		0.119***		0.022***		−0.126***
		(0.012)		(0.006)		(0.010)
Turnover in EmbedLev	−0.663***	−0.550***	−0.183***	−0.118***	0.338***	0.252***
	(0.012)	(0.037)	(0.005)	(0.014)	(0.009)	(0.036)
Ln (Logins) × Turnover in EmbedLev		−0.020**		−0.014***		0.017**
		(0.008)		(0.003)		(0.008)
Gender	−0.127***	−0.090***	−0.025***	−0.021***	0.058***	0.042***
	(0.002)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)
Ln (Age)	0.127***	0.127***	0.020***	0.020***	−0.040***	−0.040***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)

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TABLE 6 (Continued)

Ln (Account tenure)	0.066***	0.067***	0.015***	0.015***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Trade size)	−0.010***	−0.004***	−0.000***	0.000**	0.005***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Logins)		0.004***		0.002***		−0.000
		(0.001)		(0.000)		(0.000)
Ln (Number of trades)	0.045***	0.132***	0.006***	0.018***	−0.013***	−0.048***
	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)
Ln (Logins) × Ln (Number of trades)		−0.017***		−0.002***		0.007***
		(0.000)		(0.000)		(0.000)
Constant	−0.729***	−0.858***	−0.159***	−0.180***	0.310***	0.355***
	(0.010)	(0.011)	(0.003)	(0.003)	(0.003)	(0.004)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.186	0.192	0.045	0.046	0.045	0.059
N. of obs.	937,501	937,501	937,501	937,501	937,501	937,501
N. of traders	503,346	503,346	503,346	503,346	503,346	503,346

This table presents the statistics and analysis of the intensity of leverage usage, investor attention and portfolio performance. Panel A presents the descriptive statistics for two variables of the intensity of leverage use (Loan-to-Value (*LTV*)) ratio and turnover in embedded leverage securities to total turnover (*Turnover in EmbedLev*). Panel B presents the estimates of different specifications of the following ordinary least squares (OLS) model:

$F_{i,t} = \alpha_i + Demographic_{i,t} + Activity_{i,t} + Login_{i,t} + Intensity_{i,t} + Intensity_{i,t} \times Login_{i,t} + \varepsilon_{i,t}$,

where the dependent variable $F_{i,t}$ is either the Sharpe ratio, annualized standard deviation of returns or annual return for an investor *i*. $Demographic_{i,t}$ includes the natural logarithm of age in years for investor *i* ($Age_{i,t}$) and a dummy variable for the gender of investor *i* (male = 1) ($Gender_{i,t}$). $Intensity_{i,t}$ includes an $LTV_{i,t}$ ratio for investor *i* during a year and a variable for the ratio of turnover in securities with embedded leverage for investor *i* during a year ($Turnover\ in\ EmbedLev_{i,t}$). $Activity_{i,t}$ includes the natural logarithm of the account tenure of investor *i* in days ($AccountTenure_{i,t}$), the natural logarithm of an average transaction value made by investor *i* in a year ($TradeSize_{i,t}$), and the natural logarithm of the number of trades made by the investor during a year ($Number\ of\ Trades_{i,t}$). $Login_{i,t}$ is the natural logarithm of the number of days an investor was logged into an investment account in a year. All models include dummy variables for the years 2017 and 2018 to control for time effects. Heteroskedasticity robust, clustered at individual investor level standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

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TABLE 7 Degree of leverage, attention, and portfolio performance

	(1) Sharpe ratio	(2) Sharpe ratio	(3) Sharpe ratio	(4) Return	(5) Return	(6) Return	(7) StDev	(8) StDev	(9) StDev
High LTV	−0.520***			−0.112***			0.386***		
	(0.024)			(0.010)			(0.016)		
Low LTV	−0.285***			−0.056***			0.215***		
	(0.021)			(0.007)			(0.009)		
Ln (Logins) × High LTV	0.073***			0.015***			−0.057***		
	(0.005)			(0.002)			(0.003)		
Ln (Logins) × Low LTV	0.042***			0.007***			−0.032***		
	(0.005)			(0.002)			(0.002)		
High turnover in EmbedLev		−0.423***			−0.089***			0.174***	
		(0.027)			(0.009)			(0.021)	
Low turnover in EmbedLev		−0.587***			−0.115***			0.176***	
		(0.031)			(0.008)			(0.019)	
Ln (Logins) × High turnover in EmbedLev		0.003			−0.006***			0.007	
		(0.006)			(0.002)			(0.004)	
Ln(Logins) × Low turnover in EmbedLev		0.088***			0.018***			−0.026***	
		(0.006)			(0.002)			(0.004)	
Share of turnover in instr. With high leverage (STHL)			−0.385***			−0.091***			0.238***
			(0.035)			(0.013)			(0.034)

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TABLE 7 (Continued)

	(1) Sharpe ratio	(2) Sharpe ratio	(3) Sharpe ratio	(4) Return	(5) Return	(6) Return	(7) StDev	(8) StDev	(9) StDev
Share of turnover in instr. With low leverage (STLL)			−0.611***			−0.087***			0.005
			(0.079)			(0.018)			(0.021)
Ln (Logins) × STHL			−0.062***			−0.027***			0.040***
			(0.008)			(0.003)			(0.007)
Ln (Logins) × STLL			0.057***			0.009**			−0.014***
			(0.018)			(0.004)			(0.005)
Ln (Logins)	0.005***	0.005***	0.006***	0.003***	0.002***	0.002***	−0.000	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	−0.831***	−0.828***	−0.823***	−0.174***	−0.175***	−0.173***	0.339***	0.350***	0.346***
	(0.011)	(0.011)	(0.011)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Other investor-specific controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.189	0.190	0.190	0.042	0.046	0.047	0.048	0.046	0.051
N. of obs.	937,501	981,235	981,235	937,501	981,235	981,235	937,501	981,235	981,235
N. of traders	503,346	527,876	527,876	503,346	527,876	527,876	503,346	527,876	527,876

This table presents the estimates of the ordinary least squares (OLS) analysis of the effects of investors' leverage usage on the Sharpe ratio, annualized standard deviation of returns, and annual return. The analysis is based on different specifications of Equation (2), where the dependent variable is either the Sharpe ratio, annualized standard deviation of returns, or the annual return for an investor. High (Low) LTV is a dummy variable, which equals 1 for values above (below) the mean loan-to-value ratio on margin accounts. High (Low) turnover in EmbedLev is a dummy variable, which equals 1 for values above (below) the mean turnover share in embedded leverage securities in the total turnover. STHL (STLL) is the turnover share in instruments with a leverage multiplier equal to or above three (below three). All the models include control variables for investor demographics and investment activity. *Logins* is the natural logarithm of the number of days an investor was logged into an investment account in a year. All models include dummy variables for the years 2017 and 2018 to control for time effects. Heteroskedasticity robust, clustered at individual investor level standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

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of turnover in securities with high embedded leverage, may be subject to behavioral bias that causes leverage usage and investor attention to have a negligible joint effect on investor performance in their case.

Collectively, the results in Tables 6 and 7 provide evidence suggesting that trading with leverage has a negative effect on portfolio performance, which can be diminished if an investor pays attention and does not trade excessively on margin, and in instruments with embedded leverage in particular.

4.5 | Intensity of investor attention, leverage usage, and portfolio performance

As the final step of our analysis, we consider the role of the intensity of investor attention in the usage of leverage and portfolio performance. Specifically, we test whether the extreme levels of portfolio monitoring frequency have a different effect on portfolio performance given the leverage usage. To perform these tests, we estimate the different specifications of Equation (2) with several alternative measures of investor attention. First, we generate dummy variables for high and low investor attention for the top and bottom 33rd percentiles of Logins frequency. In the top 33rd percentile (High attention), the minimum number of days an investor is logged into their account in a year is 131, which is slightly over 50% of a typical number of trading days. In contrast, in our sample's bottom 33rd percentile (Low attention) of the Logins distribution, investors are logged in for no more than 28 days. Furthermore, to be more conservative, we specify another pair of dummy variables for extreme values of intensity of investor attention: Close attention and Neglected attention. We define investors who are logged into their accounts almost every trading day (at least 250) as those who pay close attention to their portfolios. Similarly, investors who log into their accounts very infrequently (not more than 12 days a year) are considered to be traders with neglected attention. We report the estimation results of this analysis in Table 8.

Models 1 through 3 in Table 8 present the results for the first set of attention proxies, that is, the dummy variables for the top and bottom 33rd percentiles. We note the same negative effect from the margin and embedded leverage usage on the Sharpe ratio as well as a positive effect from the higher portfolio monitoring frequency documented in the previous sections of this paper. However, the joint effect of investor attention and leverage usage on performance becomes more pronounced. The coefficient estimate for the interaction term of the high attention dummy and margin use is positive and statistically significant and has a greater magnitude than the coefficient for the margin use variable. In the case of low investor attention, the effect on the Sharpe ratio becomes even more negative than from margin use alone. These results imply that investors who pay more attention to their portfolios may benefit from using margin debt.

In Models 4 through 6, we report the estimation results for the more conservative measures of intensity of investor attention: Close attention and Neglected attention. In this part of the analysis, we observe an even more pronounced effect of attention on portfolio performance. Investors who pay close attention to their portfolios are able to significantly improve their investment performance by using margin debt while investors who trade on margin and do not pay attention significantly undermine their portfolio performance.

In the case of securities with embedded leverage, we observe similar results to those in Table 4. Investors who pay high levels or very close attention to their portfolios are able to diminish the negative effect of embedded leverage usage on investment performance while investors who pay less attention lose even more from using embedded leverage securities. This result confirms our previous finding on the damaging effect of the leverage-unconstrained feature of securities with embedded leverage, but closer investor attention may alleviate this negative effect.

5 | CONCLUSION

In this study, we examine whether leverage usage together with investor attention, measured as portfolio monitoring frequency, determines investor performance. We consider investor attention as an indicator of investor sophistication

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TABLE 8 Intensity of attention, leverage usage, and portfolio performance

	(1)	(2)	(3)	(4)	(5)	(6)
	Sharpe ratio	Return	StDev	Sharpe ratio	Return	StDev
Margin use	−0.076***	−0.014***	0.042***	−0.066***	−0.011***	0.047***
	(0.013)	(0.004)	(0.003)	(0.008)	(0.002)	(0.002)
High attention	0.069***	0.016***	−0.005**			
	(0.006)	(0.002)	(0.002)			
Low attention	−0.002	−0.005***	−0.018***			
	(0.005)	(0.001)	(0.002)			
High attention × Margin use	0.087***	0.022***	−0.006			
	(0.015)	(0.004)	(0.004)			
Low attention × Margin use	−0.041**	−0.003	0.058***			
	(0.021)	(0.006)	(0.008)			
Close attention				0.072***	0.023***	0.006**
				(0.008)	(0.002)	(0.003)
Neglected attention				−0.021***	−0.005***	−0.007***
				(0.004)	(0.001)	(0.002)
Close attention × Margin use				0.103***	0.025***	−0.018***
				(0.012)	(0.003)	(0.004)
Neglected attention × Margin use				−0.062***	−0.005	0.082***
				(0.022)	(0.006)	(0.010)
EmbedLev use	−0.276***	−0.068***	0.125***	−0.275***	−0.065***	0.118***
	(0.009)	(0.003)	(0.005)	(0.006)	(0.002)	(0.003)
High attention × EmbedLev use	0.095***	0.025***	−0.051***			
	(0.011)	(0.003)	(0.005)			
Low attention × EmbedLev use	−0.113***	−0.013**	0.022*			
	(0.016)	(0.005)	(0.011)			
Close attention × EmbedLev use				0.136***	0.035***	−0.069***
				(0.010)	(0.003)	(0.004)
Neglected attention × EmbedLev use				−0.136***	−0.021***	0.041***
				(0.020)	(0.006)	(0.016)

(Continues)

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TABLE 8 (Continued)

	(1) Sharpe ratio	(2) Return	(3) StDev	(4) Sharpe ratio	(5) Return	(6) StDev
Constant	−0.802***	−0.164***	0.379***	−0.762***	−0.160***	0.362***
	(0.011)	(0.003)	(0.003)	(0.010)	(0.003)	(0.003)
Other investor-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.189	0.044	0.043	0.188	0.044	0.040
N. of obs.	981,235	981,235	981,235	981,235	981,235	981,235
N. of traders	527,876	527,876	527,876	527,876	527,876	527,876

This table presents the estimates of the ordinary least squares (OLS) analysis of the intensity of investor attention, leverage usage and portfolio performance. The analysis is based on different specifications of Equation (2), where the dependent variable is either the Sharpe ratio, annualized standard deviation of returns or annual return for an investor. *MarginUse* is a dummy variable for trading on a margin account, *EmbedLevUse* is a dummy variable for using products with embedded leverage. High (Low) attention is a dummy variable for investors on the top (bottom) 33rd percentile of Logins frequency. Close (neglected) attention is a dummy variable for investors who monitor their portfolios for at least 250 days (not more than 12 days) a year. All the models include control variables for investor demographics and investment activity. All models include dummy variables for the years 2017 and 2018 to control for time effects. Heteroskedasticity robust, clustered at individual investor-level standard errors are in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%, respectively.

in line with Dierick et al. (2019) and expect investor attention to offset the negative effects of leverage usage on investor performance. Our analysis of the determinants of leverage use suggests that margin accounts and embedded leverage securities are used by different types of investors. Older and more tenured investors are more likely to use margin accounts than to trade securities with embedded leverage. In addition, margin traders monitor their portfolios more frequently but trade less actively, which may also indicate self-control and patience.

Our findings from the analysis of investor performance are in line with the results of Heimer and Imas (2022), and Barber et al. (2020), showing that investors who trade on margin underperform in terms of having lower Sharpe ratios than those who do not have margin accounts. In addition to this stream of the literature, we present evidence that investors who trade securities with embedded leverage also underperform and show even poorer performances than investors who use margin debt. This finding is consistent with the evidence related to embedded leverage in that leverage-constrained investors are trading securities with high embedded leverage that have low risk-adjusted returns (Frazzini & Pedersen, 2014; 2022). Alternatively, this finding may be explained by the additional patience (Cremers & Pareek, 2016) and self-control (Uhr et al., 2019) of investors who choose to trade on margin instead of trading securities with embedded leverage. Overall, our study lends support to the idea that investors are better off trading on margin than investing in securities with embedded leverage.

In relation to the literature on investor attention (e.g., Dierick et al., 2019), we show that investors who use leverage perform better if they are more frequently logged into their investment accounts, that is, they are more attentive investors. Thus, our study suggests that more attentive investors may have a comparative advantage in using leverage, offsetting the negative behavioral effects of leverage use (see, e.g., Bailey et al., 2019; Barber et al., 2020; Ben-David, 2019; Heimer & Imas, 2022). From a practical point of view, our study suggests that investor inattention and using leverage is an especially poor combination.

Furthermore, our dataset also allows us to measure the intensity of investments in securities with embedded leverage and to differentiate between investors' choices of the intensity of using margin debt. Our results imply that the poorer performance induced by trading embedded leverage securities is not alleviated by more frequent portfolio monitoring in cases of high trading intensity in these products. Therefore, our finding that more attentive investors are

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relatively better users of leverage does not seem to apply to the most aggressive traders of securities with embedded leverage. For investors with larger turnover shares in instruments with high embedded leverage, we find that paying more attention leads to even poorer performance. In turn, when we consider the intensity of investor attention, our results suggest that paying closer attention to investment portfolios is especially beneficial in terms of portfolio performance.

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