



## Original Research

# Gambling and online trading: emerging risks of real-time stock and cryptocurrency trading platforms



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## ABSTRACT

**Objectives:** Online platforms enable real-time trading activities that are similar to those of gambling. This study aimed to investigate the associations of traditional investing, real-time stock trading, and cryptocurrency trading with excessive behavior and mental health problems.

**Study design:** This was a cross-sectional population-based survey.

**Methods:** The participants were Finnish people aged 18–75 years (N = 1530, 50.33% male). Survey asked about monthly regular investing, real-time stock-trading platform use, and cryptocurrency trading. The study had measures for excessive behavior: gambling (Problem Gambling Severity Index), gaming (Internet Gaming Disorder Test), internet use (Compulsive Internet Use Scale), and alcohol use (Alcohol Use Disorders Identification Test). Psychological distress (Mental Health Inventory), perceived stress (Perceived Stress Scale), COVID-19 anxiety, and perceived loneliness were also measured. Background factors included sociodemographic variables, instant loan taking, and involvement in social media identity bubbles (Identity Bubble Reinforcement Scale). Multivariate analyses were conducted with regression analysis.

**Results:** Within the sample, 22.29% were categorized into monthly regular investors only, 3.01% were investors using real-time stock-trading platforms, and 3.59% were cryptomarket traders. Real-time stock-trading platform use and cryptocurrency trading were associated with younger age and male gender. Cryptomarket traders were more likely to have an immigrant background and have taken instant loans. Both real-time stock-trading platform use and cryptomarket trading were associated with higher excessive behavior. Cryptomarket traders especially reported higher excessive gambling, gaming, and internet use than others. Cryptomarket traders reported also higher psychological distress, perceived stress, and loneliness.

**Conclusions:** Regular investing is not a risk factor for excessive behavior. However, rapid online trading platforms and applications were significantly more commonly used by participants reporting excessive behavior and mental health problems. The strong association between cryptomarket trading and excessive behavior in particular underlines the need to acknowledge the potential risks related to real-time trading platforms.

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## Introduction

Real-time trading applications and platforms, such as Robinhood, have recently caused concerns over the gamification in investing. Investor Warren Buffett said the apps were bringing casino-like behavior to the stock market.<sup>1</sup> Although the

similarities between investing and gambling have been discussed for a long time,<sup>2,3</sup> new forms of online apps and platforms have created a new need for empirical research in this area. These apps and platforms offer fast and easy entry into diverse investing opportunities and risks, and they are also potentially attractive to people manifesting excessive behaviors. Recently, discussions have focused on potential gambling risk in day trading and cryptocurrency trading.<sup>4,5</sup>

Online apps and platforms such as Robinhood, eToro, and Plus500 have opened the doors of day trading for many. Robinhood states that their mission is to “democratize finance for all.”<sup>6</sup> Users

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are allowed to trade stocks in real time and often without commission. Such apps and platforms also offer high-risk investing options such as leverage (using borrowed capital) which multiplies both wins and losses and carries a risk of losing all of one's own capital in forced liquidations. Cryptocurrency trading apps and platforms (e.g., Binance and Phemex) enable 24/7 real-time trading of cryptocurrencies such as Bitcoin and Ethereum with leverages up to more than one hundred. Cryptocurrency trading is estimated to be the fastest growing market in the world.<sup>4</sup> Economists have considered cryptocurrency trading to be a highly speculative, lottery-like activity.<sup>7</sup>

Researchers have suggested people might have discovered new trading apps and platforms while at home due to the COVID-19 pandemic and the temporary collapse of markets in March 2020.<sup>8,9</sup> Some people may also have looked for new types of gambling opportunities and activities owing to the lack of sporting events, especially in the beginning of the COVID-19 crisis in Spring 2020.<sup>5</sup> At that point, many of the regular gambling activities were closed, including much of sports betting. An economic analysis in 37 equity markets showed that during COVID-19, investing increased more in countries that have more gambling opportunities.<sup>10</sup> This calls for attention to analyze different forms of investing and trading. Also, the COVID-19 pandemic has been a major psychological, social, and economic stressor for people. Hence, it is important to investigate the correlates of mental health to these new forms of investing and trading.

In the financial sector, there is a continuum from investing to speculation. Speculation refers to forms of financial actions that are shorter term and higher in risk. These include day-trading, inexpensive but volatile penny stocks, and the use of financial instruments such as shorting, leverage, and derivatives.<sup>2,11,12</sup> Even though a relationship between gambling and financial speculation has long been noted, according to a systematic review by Arthur, Williams, and Delfabbro, there is relatively little empirical research on the topic.<sup>2</sup> Economic studies suggest gamblers and gambling-like investors have similar sociodemographic and psychological profiles, with the less wealthy individual making riskier decisions to rise out of poverty.<sup>3</sup> However, one Canadian study found that high-risk stock-traders were more likely to be male, self-employed, or employed full-time and to have higher income than gamblers.<sup>2</sup> Studies suggest that personal risk factors, such as risk-taking, sensation-seeking, and overconfidence, are similar for both gambling and stock trading.<sup>2,13</sup> Trading is also found to be more common among males.<sup>14,15</sup>

There are very few studies on users of real-time trading apps and platforms. A recent study based on a sample drawn from Amazon's Mechanical Turk found that cryptocurrency trading strongly correlates with problem gambling severity.<sup>16</sup> Another recent study based on a sample of gamblers from the panel of Prolific found that cryptocurrency trading was associated with a wider range of gambling activities.<sup>4</sup> A Korean study found out that bitcoin investors reported higher rates of excessive gambling than share investors.<sup>17</sup> There is also a general lack of studies investigating the relationship between day trading and gambling. A South Australian study found that day-traders were involved in skill-based gambling and had a higher rate of problem gambling than non-traders.<sup>11</sup> A Dutch study on investors showed that investors who had gambling problems were more speculative, traded more frequently, and invested more often in derivatives and leveraged products.<sup>18</sup>

This study aimed to investigate the associations of traditional investing, real-time stock trading, and cryptocurrency trading with excessive behaviors and mental health problems. Our research questions were the following: 1) What background factors are

associated with regular investing and real-time trading using online platforms and 2) how different types of investing are related to excessive behaviors and mental health problems.

## Methods

### Participants and procedure

*Gambling in the Digital Age* Survey was targeted to Finnish speakers in mainland Finland in April 2021. The survey focused on gambling and addictive behavior. Participants (N = 1530) were 18–75 years old (M = 46.67; SD = 16.42), and 50.33% of them were male (n = 770), 49.41% were female (n = 756), and 0.26% reported other gender (n = 4). The participants were from all major areas of Finland: 35.29% were from Helsinki-Uusimaa region, 21.50% from Southern Finland, 24.84% from Western Finland, and 18.37% from Northern and Eastern Finland.

Data collection was administrated by Norstat, and all respondents answered the survey online. Participants were drawn from Norstat's Web-based panel. The response rate for the survey was 34.60%, and the median response time for the full survey was 18 min. Comparison of the sample to the Finnish population aged 18 to 75 years was conducted using population census figures provided by Statistics Finland in StatFin service ([https://www.stat.fi/tup/statfin/index\\_en.html](https://www.stat.fi/tup/statfin/index_en.html)). Gender distribution of the sample was almost identical to the population aged 18 to 75 years according to statistics provided by statistics Finland (50.33% vs 50.20% male). Also, in terms of age, the sample matched the Finnish population aged 18 to 75 years (mean age = 46.67 vs 46.89). There were slightly more participants from the Helsinki-Uusimaa region in the sample than in the population (35.29% vs 30.94%) and less participants from Northern and Eastern Finland (18.37% vs 23.16%). The sample also included a higher percentage of people having at least a BA degree from a university than in the population (38.50% vs 27.28%).

The data quality protocol for the project was stored on the Open Science Framework website prior to the data collection. Data quality checks involved attention checks, patterned responses checks, rapid responses checks, and nonsensical responses checks.<sup>19,20</sup> Open-ended comments were also checked to further evaluate possible biased motives in response patterns.

The study was approved by the academic ethics committee of Tampere region in Finland in March 2021. All participants agreed to voluntarily participate in the surveys and were informed about the aims and purpose of the study.

### Measures

Types of monthly investing and trading were categorized based on three questions: "How often have you practiced investing (e.g., investing in stocks or funds)?" "How often do you use services suitable for real-time investing (e.g., eToro, Plus500)?" and "How often have you traded in cryptomarkets (e.g., Binance, BitPanda)?" We created a categorical variable on the basis of participants' monthly investing and trading activity: non-investors (0), regular investors who do not use online platforms for stock or cryptocurrency trading (1), investors using real-time stock-trading platforms but not trading in cryptomarkets (2); and cryptomarket traders (3).

We used the Problem Gambling Severity Index (PGSI) to measure excessive gambling.<sup>21,22</sup> The PGSI has been widely used to assess problem gambling in the general population rather than in clinical settings.<sup>23,24</sup> For the purpose of the study, respondents were asked about their gambling during the previous 6 months

(e.g., “Have you felt that you might have a problem with gambling?”). The response choices were 0 (*never*), 1 (*sometimes*), 2 (*most of the time*), and 3 (*almost always*). A higher score on the scale indicates more excessive gambling. The scale had excellent internal consistency measured with McDonald’s omega ( $\omega = 0.95$ , see details in Table 1).

We used the Internet Gaming Disorder Test (IGDT) to measure excessive gaming. The IGDT is a short 10-item screen that has been used to assess internet gaming disorders.<sup>25</sup> The measure includes statements about excessive behaviors in gaming during previous 6 months for the purposes of this study (e.g., “Have you risked or lost a significant relationship because of gaming?”). Answer choices were 0 (*never*), 1 (*sometimes*), and 2 (*often*). Higher scores of the scale indicate higher levels of excessive gaming. The scale had good internal consistency ( $\omega = 0.89$ ).

We measured excessive internet use with the 14-item Compulsive Internet Use Scale (CIUS).<sup>26</sup> The CIUS has been widely used and validated in previous studies on excessive internet use.<sup>27,28</sup> The CIUS is designed as an addiction screener and includes measures that are similar to other addictions scales, such as those on withdrawal (e.g., “Do you think about the internet, even when not online?”). Responses are rated on a five-point scale from 0 (*never*) to 4 (*very often*). Higher scores on the scale indicate higher levels of excessive internet use. The scale had excellent internal consistency ( $\omega = 0.95$ ).

We measured excessive alcohol use with the Alcohol Use Disorders Identification Test (AUDIT-C). The AUDIT-C is a widely used screener for excessive drinking.<sup>29,30</sup> Three items of AUDIT-C measure frequency of drinking, heavy drinking, and units per drinking occasion. Responses to each item are assigned risk points from 0 to 4. Higher scores on the scale indicate higher risk for excessive drinking. The scale showed good internal consistency ( $\omega = 0.81$ ).

**Table 1**  
Characteristics of study variables.

Categorical variables	n	%			
Monthly investing					
No	1088	71.11			
Regular investors	341	22.29			
Real-time platform users	46	3.01			
Cryptomarket traders	55	3.59			
Male	770	50.33			
Age < 40 years	579	37.84			
Higher education	589	38.50			
Working	806	52.68			
Income > 3000€/month	528	34.51			
Children	896	58.56			
Immigrant background	52	3.40			
Instant loans	292	19.08			
Continuous measures	M	SD	Range	n of items	$\omega$
Social media identity bubbles (IBRS-9)	30.38	10.74	9–63	9	0.90
Excessive gambling (PGSI)	1.31	3.33	0–25	9	0.95
Excessive gaming (IGDT)	1.34	2.64	0–20	10	0.89
Excessive internet use (CIUS)	8.79	9.65	0–52	14	0.95
Excessive alcohol use (AUDIT-C)	3.58	2.69	0–12	3	0.81
Psychological distress (MHI-5)	12.40	4.73	5–30	5	0.89
Perceived stress (PSS)	13.61	7.04	0–40	10	0.89
COVID-19 anxiety (C-19-ANX)	18.89	7.34	6–42	6	0.88
Perceived loneliness (R-UCLA-3)	1.76	1.77	0–6	3	0.86

SD, standard deviation; IBRS-9, 9-item Identity Bubble Reinforcement Scale; PGSI, Problem Gambling Severity Index; IGDT, Internet Gaming Disorder Test; CIUS, Compulsive Internet Use Scale; AUDIT-C, Alcohol Use Disorders Identification Test; MHI-5, 5-item Mental Health Inventory; PSS, Perceived Stress Scale; C-19-ANX, COVID-19 anxiety scale; R-UCLA-3, Revised UCLA Loneliness Scale.

We measured psychological distress using the 5-item Mental Health Inventory (MHI-5). The MHI-5 is a short version of the original 38-item inventory including items on anxiety, depression, positive affect, and emotional control (e.g., “How much of the time, during the last month, have you felt downhearted and blue?”).<sup>31</sup> It has been widely validated as an accurate screener for mood disorders in general population.<sup>32–34</sup> Responses were given on a scale from 1 (*none of the time*) to 6 (*all of the time*). Two items on positive affect were reverse coded. The measure had good internal consistency ( $\omega = 0.89$ ).

Perceived stress was measured with the 10-item Perceived Stress Scale that was developed as a screener for psychological stress.<sup>35,36</sup> Items of the scale ask about uncontrollable and stressful events during the last month (e.g., “How often have you been upset because of something that happened unexpectedly?”). Answer options ranged from 0 (*never*) to 4 (*very often*). A higher score on the scale indicates higher perceived stress. The measure had good internal consistency ( $\omega = 0.89$ ).

COVID-19 anxiety was assessed using a scale based on the 6-item Spielberger State–Trait Anxiety Inventory (STAI-6).<sup>37</sup> The COVID-19 anxiety scale screens anxiety state during the COVID-19 pandemic.<sup>38</sup> Respondents were asked to evaluate their feelings about the COVID-19 crisis during the past seven days with six statements (e.g., “I feel tense”). The response scale for each statement ranged from 1 (*does not describe my state at all*) to 7 (*describes my state completely*). The scale had good internal consistency ( $\omega = 0.88$ ).

Loneliness was measured with a 3-item loneliness scale adapted from the standard Revised UCLA Loneliness Scale.<sup>38–40</sup> The scale includes three statements about perceived loneliness (e.g., “How often do you feel isolated from others?”). Answer options were 0 (*almost never*), 1 (*sometimes*), or 2 (*often*). Higher scores indicate higher levels of perceived loneliness. The measure had good internal consistency ( $\omega = 0.88$ ).

Background and control variables included sociodemographic variables. Options for gender included categories for male ( $n = 770$ ), female ( $n = 756$ ), and other ( $n = 4$ ). Dummy variables were created to indicate participants who were male and those younger than 40 years. We also used dummy variables for income (more than 3000€/month) and having children. Immigrant background was assessed with the question: “Was your mother or father born abroad?” We also asked respondents whether they have taken any instant loans (i.e., pay-day loans). Instant loans were included in the data because they are considered major economic stressors that can lead to long-term financial difficulties.<sup>41,42</sup>

Social media identity bubbles were measured with the 9-item Identity Bubble Reinforcement Scale.<sup>43</sup> This measure involves statements on social identification, homophily with others online, and reliance on information coming from others on social media. This type of bubble behavior is an important form of herd behavior, and bubble behavior has been recognized in cryptomarket trading as well.<sup>9,44,45</sup> Possible responses ranged from 1 (*does not describe me at all*) to 7 (*describes me completely*). Higher scores on the scale indicate higher involvement in social media bubbles. The measure had excellent internal consistency ( $\omega = 0.90$ ).

Our survey also included questions on activities during the COVID-19 pandemic. Measured items were gambling in general, gaming, cryptocurrency trading, and social media profile updates. Response options were the following: *I have not engaged in this activity, no change, decreased, and increased*. We report descriptive findings on these measures in the results section to provide additional information about activities of investors during the COVID-19 era.

Statistical analyses

Statistical analyses were carried out using Stata, version 16, software. We report descriptive findings on different types of investing and other behaviors during the COVID-19 pandemic. Statistical modelling focused first on the analysis of background factors associated with different types of investing. This was conducted with multinomial logistic regression using non-investors as a reference group. Table 2 reports relative risk ratios (RRRs), standard errors (SE), and the statistical significance of results (p). RRRs are interpreted as odds ratios (ORs) in binary logistic regression (RRRs >1 indicate higher risk, and RRRs <1 indicate lower risk).

Associations of different types of investing and excessive behavior and mental health problems are analyzed using negative binomial regression owing to the overdispersion of scales measuring excessive behavior. Hence, negative binomial regression provides a better alternative for the analysis of skewed outcome variables. A similar method of analysis was selected for all eight outcome variables reported in Tables 3 and 4 for the sake of comparability. Robustness checks were conducted by running the analyses with ordinary least squares regression, but the main results concerning types of investing remained the same. For these reasons, we report only the results based on the main analyses.

Tables 3 and 4 report the incidence-rate ratios (IRRs). IRRs are interpreted as ORs (an IRR >1 indicates higher risk, and an IRR <1 indicates lower risk). We first report unadjusted models (model 0) without control variables, indicating only the associations of types of investing with excessive behavior and mental well-being. Full models adjusted for number of confounding factors.

Results

Within the sample, 22.29% of participants were categorized into monthly regular investors only, 3.01% were investors using real-time stock trading platforms, 3.59% were cryptomarket traders, and the rest were non-investors.

Multinomial logistic regression models were used to analyze background factors associated with these three categories of investing in comparison to non-investors (Table 2). Male gender was associated with all forms of investing, especially real-time stock market platform use (RRR = 6.24, P < 0.001) and cryptocurrency trading (RRR = 5.06, P < 0.001). Younger age and higher income were associated with all types of investing. Regular investing was more common among those with higher education (RRR = 1.48, P = 0.005) and employment (RRR = 1.42; P = 0.015). Cryptomarket traders were less likely to have children (RRR = 0.49, P = 0.045) and more likely to have an immigrant background (RRR = 3.47, P = 0.008). Instant loans were less common among regular investors

(RRR = 0.47, P < 0.001) and more likely among cryptomarket traders (RRR = 2.53; P = 0.005) than among non-investors.

Respondents were asked about their activities during the COVID-19 pandemic (from March 2020 to April 2021) in comparison to their previous activities. Of all respondents, 4.58% reported increased gambling during the COVID-19 pandemic; 13.07% reported increased gaming, 2.55% reported increased cryptocurrency trading, and 6.93% reported increased their social media updates. These figures were higher especially among real-time stock trading platform users, and of them, 13.04% reported increased gambling, 23.91% reported increased gaming, and 15.22% reported increased frequency of social media updates. Of cryptomarket traders, 47.27% reported increased purchases of cryptocurrencies.

Table 3 reports the findings on associations of excessive behaviors and different types of investing. As indicated by results for model 0, regular investing was not associated with any of the excessive behaviors. However, regular investors did report higher excessive internet use than non-investors (IRR = 1.18; P = 0.037). Real-time trading app users reported higher excessive gaming (IRR = 2.12; P = 0.016), higher excessive internet use (IRR 1.57; P = 0.018), and higher excessive alcohol use (IRR = 1.39, P = 0.003) than did non-investors. Similarly, cryptomarket traders reported higher excessive gambling (IRR = 5.98; P < 0.001), higher excessive gaming (IRR = 4.21; P < 0.001), higher excessive internet use (IRR 2.43; P < 0.001), and higher excessive alcohol use (IRR = 1.35, P = 0.004) than did non-investors. Full models adjusted a number of background factors, but the main results did not change. Both real-time stock-trading platform users and cryptomarket traders reported higher excessive behavior than non-investors and regular investors. Cryptomarket trading had very high IRRs. All types of investing were associated with excessive internet use. In comparison to non-investors, only real-time stock trading platform users reported higher excessive alcohol use than non-investors.

Table 4 reports the findings of associations between mental well-being and different types of investing. The results for model 0 demonstrate that cryptomarket traders reported higher distress (IRR = 1.18, P = 0.001), higher stress (IRR = 1.24, P = 0.004), higher COVID-19 anxiety (IRR = 1.16, P = 0.007), and higher perceived loneliness (IRR = 1.37, P = 0.025) than did non-investors. Regular investors and real-time platform users did not differ from non-investors. Full models showed that cryptomarket traders reported higher psychological distress (IRR = 1.11; P = 0.035), higher perceived stress (IRR = 1.16; P = 0.043), and higher perceived loneliness (IRR = 1.32, P = 0.044) than did non-investors.

Discussion

This study investigated users of real-time trading apps and platforms. Analyses based on a sample of adult population in

Table 2 Multinomial logistic regression model on correlates of different types of monthly investing.

	Regular investors				Real-time platform users				Cryptomarket traders			
	RRR	95% CI	95% CI	P	RRR	95% CI	95% CI	P	RRR	95% CI	95% CI	P
Male	1.36	1.05	1.77	0.022	6.24	2.73	14.26	<0.001	5.06	2.44	10.47	<0.001
Age<40 years	2.32	1.70	3.18	<0.001	3.82	1.83	7.95	<0.001	7.66	3.47	16.87	<0.001
Higher education	1.48	1.13	1.95	0.005	1.40	0.73	2.70	0.310	0.90	0.47	1.70	0.738
Working	1.42	1.07	1.89	0.015	0.63	0.31	1.26	0.192	1.79	0.88	3.63	0.107
Income>3000€/month	2.50	1.84	3.40	<0.001	3.19	1.48	6.86	0.003	3.48	1.75	6.93	<0.001
Children	1.22	0.90	1.65	0.195	0.69	0.34	1.41	0.314	0.49	0.25	0.98	0.045
Immigrant background	0.80	0.37	1.72	0.573	0.37	0.05	2.90	0.340	3.47	1.38	8.73	0.008
Instant loans	0.47	0.32	0.71	<0.001	1.05	0.48	2.29	0.903	2.53	1.33	4.80	0.005
Social media identity bubbles	0.99	0.98	1.00	0.154	1.03	1.00	1.06	0.059	1.00	0.97	1.03	0.926

\*Reference category, no monthly investing. RRR, relative risk ratio; CI, confidence interval.

**Table 3**  
Negative binomial regression models on associations of different types of monthly investing and excessive behavior.

	Gambling				Gaming				Internet				Alcohol			
	IRR	95% CI	P		IRR	95% CI	P		IRR	95% CI	P		IRR	95% CI	P	
<b>Model 0</b>																
Investing (ref. no)																
Regular investors	0.77	0.55	1.08	0.130	0.90	0.69	1.17	0.441	1.18	1.01	1.38	0.037	1.02	0.92	1.12	0.731
Real-time platform users	1.96	0.90	4.26	0.089	2.12	1.15	3.89	0.016	1.57	1.08	2.28	0.018	1.39	1.12	1.73	0.003
Cryptomarket traders	5.98	2.98	12.01	<0.001	4.21	2.44	7.28	<0.001	2.43	1.73	3.42	<0.001	1.35	1.10	1.65	0.004
<b>Full model</b>																
Investing (ref. not)																
Regular investors	0.76	0.54	1.07	0.111	0.87	0.67	1.13	0.298	1.17	1.00	1.36	0.045	0.96	0.87	1.06	0.436
Real-time platform users	2.08	0.96	4.52	0.064	1.87	1.05	3.31	0.033	1.63	1.15	2.30	0.006	1.20	0.97	1.49	0.087
Cryptomarket traders	4.61	2.25	9.42	<0.001	2.62	1.55	4.43	<0.001	1.91	1.38	2.65	<0.001	1.14	0.93	1.39	0.219
Male	1.43	1.08	1.89	0.012	1.48	1.20	1.83	<0.001	0.83	0.74	0.94	0.003	1.38	1.27	1.49	<0.001
Age<40 years	1.55	1.15	2.09	0.004	2.37	1.87	3.00	<0.001	2.16	1.88	2.48	<0.001	0.99	0.91	1.09	0.902
Higher education	0.70	0.53	0.94	0.017	0.95	0.76	1.18	0.630	1.02	0.90	1.16	0.767	0.85	0.78	0.92	<0.001
Working	1.24	0.93	1.67	0.143	1.13	0.91	1.41	0.284	1.07	0.94	1.22	0.297	1.12	1.03	1.22	0.006
Income>3000€/month	0.77	0.56	1.06	0.104	0.73	0.56	0.94	0.014	0.84	0.73	0.98	0.026	1.11	1.01	1.22	0.034
Children	0.82	0.62	1.10	0.186	0.71	0.56	0.89	0.003	0.85	0.74	0.97	0.017	0.82	0.75	0.90	<0.001
Immigrant background	1.09	0.52	2.26	0.825	1.21	0.70	2.07	0.495	1.47	1.06	2.03	0.022	0.88	0.71	1.10	0.253

IRR, incidence-rate ratio; CI, confidence interval.

**Table 4**  
Negative binomial regression models on associations of different types of monthly investing and mental well-being.

	Distress				Stress				COVID-19 anxiety				Loneliness			
	IRR	95% CI	P		IRR	95% CI	P		IRR	95% CI	P		IRR	95% CI	P	
<b>Model 0</b>																
Investing (ref. no)																
Regular investors	0.97	0.93	1.02	0.250	0.94	0.88	1.00	0.056	0.97	0.93	1.02	0.265	0.88	0.77	1.01	0.075
Real-time platform users	1.01	0.90	1.12	0.898	0.95	0.81	1.12	0.578	1.04	0.92	1.17	0.524	1.10	0.80	1.51	0.550
Cryptomarket traders	1.18	1.07	1.30	0.001	1.24	1.07	1.43	0.004	1.16	1.04	1.29	0.007	1.37	1.04	1.81	0.025
<b>Full model</b>																
Investing (ref. not)																
Regular investors	0.99	0.95	1.04	0.694	0.97	0.91	1.03	0.331	0.97	0.92	1.02	0.242	0.97	0.84	1.11	0.617
Real-time platform users	0.99	0.90	1.11	0.922	0.96	0.83	1.13	0.654	1.03	0.92	1.15	0.656	1.14	0.84	1.55	0.397
Cryptomarket traders	1.11	1.01	1.22	0.035	1.16	1.00	1.34	0.043	1.08	0.97	1.20	0.158	1.32	1.01	1.74	0.044
Male	0.96	0.92	0.99	0.020	0.91	0.86	0.96	<0.001	0.94	0.90	0.98	0.002	0.87	0.78	0.97	0.013
Age<40 years	1.15	1.10	1.20	<0.001	1.22	1.15	1.30	<0.001	1.16	1.11	1.21	<0.001	1.26	1.11	1.42	<0.001
Higher education	1.04	1.00	1.09	0.030	1.01	0.95	1.06	0.864	1.07	1.03	1.12	0.002	1.11	0.99	1.24	0.080
Working	0.99	0.95	1.03	0.543	1.00	0.94	1.06	0.968	1.02	0.98	1.07	0.249	0.89	0.80	1.00	0.050
Income>3000€/month	0.89	0.85	0.93	<0.001	0.86	0.81	0.92	<0.001	0.92	0.87	0.96	<0.001	0.71	0.62	0.82	<0.001
Children	0.92	0.88	0.95	<0.001	0.89	0.84	0.95	<0.001	0.96	0.91	1.00	0.044	0.78	0.69	0.88	<0.001
Immigrant background	1.10	1.00	1.20	0.056	1.16	1.00	1.33	0.045	1.14	1.03	1.26	0.014	1.16	0.88	1.52	0.282

IRR, incidence-rate ratio; CI, confidence interval.

Finland compared non-investors and regular investors to real-time trading platform users and cryptocurrency traders. According to our results, males, younger individuals, and those with a higher education were more likely to engage in all forms of investing. Cryptomarket traders were more likely to have taken instant loans and less likely to have children. Results showed that both real-time trading platform use and cryptomarket trading were associated with higher scores of addictive behavior measures. Especially cryptomarket traders reported significantly higher scores in excessive gambling, gaming, internet use, and alcohol use. Cryptomarket traders also reported higher scores in different measures on mental health problems.

Considering previous economic studies, it is not surprising that males engage in risky economic activities.<sup>14,15</sup> Specifically, cryptomarket traders were more commonly younger males. This could be, at least partly, explained by personality and preference factors, such as high excitatory value and orientation toward a specific economic goal.<sup>46</sup> The results are aligned with those of previous studies on the

association between cryptomarket trading and excessive gambling.<sup>4,16,17</sup> We also found strong associations between cryptomarket trading and excessive gaming and internet use that has not been reported in previous studies.

Cryptomarket traders reported higher scores in psychological distress, stress, and perceived loneliness. These difficulties may have been exacerbated during the COVID-19 pandemic owing to concerns over economics, health, and social isolation.<sup>47</sup> Prior studies have shown that mental health problems are related to higher risk-taking online.<sup>48</sup> Hence, it is conceivable to at least hypothesize that people with existing mental health problems would be more susceptible to taking economic risks on online platforms.

Under unusual and unexpected circumstances brought by COVID-19, people have rushed into stock markets and looked for alternative activities. Cryptocurrencies have been in the spotlight and gained attention in the media and social media. As noted in economic literature, there is a continuum from investing to speculation, and most speculative forms of investing are often related to

day-trading.<sup>2,11</sup> During the COVID-19 pandemic, the markets have certainly been more unpredictable, but at the same time, people have had the opportunity provided by the platforms to practice day-trading. Our results call for more studies on how investing turns into gambling given the use of these platforms.

Our study is limited to Finland, and findings are based on self-reported measures and a cross-sectional design. No implications of causality can thus be drawn from the results. Also, our data are limited by relatively few participants using platforms for real-time trading and cryptomarket trading. Despite these limitations, we were able to demonstrate that real-time trading apps are used by people manifesting excessive behaviors. More research attention should therefore be directed toward these speculative forms of investing as a specific form of gambling. Future studies should also investigate in detail different forms of cryptocurrency investing and trading that were beyond the scope of our study.

Trading platforms enable making a large volume of transactions quickly and relatively effortlessly, making impulsive and high-risk short-term actions possible. The results of this study indicate that users of these platforms reported higher scores in excessive behaviors. Although our study did not focus on potential long-term impacts of these platforms, it would be important to recognize that these platforms are potentially attractive to those individuals who are struggling with behavioral addictions. User awareness training may be needed for individuals using such trading platforms to increase awareness of the risks involved.

## Author statements

### Ethical approval

None sought.

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### Competing interests

None of the authors have a conflict of interest to declare.

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