Cryptocurrency investment: A safe venture or a new type of gambling?

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Abstract

Investment behaviour and gambling overlap from time to time. It is stated that there is a spectrum between gambling and investment behaviour, and there are "speculative" investment tools in the middle of the spectrum. Considering that it presents a higher risk because of its high volatility compared to traditional investment instruments, trading cryptocurrencies can become pathological and gambling-like. This study aims to investigate the pathological trading behaviour and frequency among cryptocurrency investors, to investigate additional gambling disorders, and to investigate the relationship between cryptocurrency investment behaviour and impulsivity. An online questionnaire was created to investigate these issues. In the questionnaire, the Pathological Trading Scale, the South Oaks Gambling Screen Test and the Barratt Impulsivity Scale were all used. A total of three hundred persons were evaluated. We found that total pathological traders were 48.7% of all traders, impulsivity in 18–25 age group was higher, high-frequency traders were more pathological, and their impulsivity was higher; also margin traders and day traders show more pathological behaviour. It seems that an important part of cryptocurrency traders may be pathological, and certain of them may have cryptocurrency addiction, which can be evaluated as a subtype of gambling disorder.

Keywords: addictive behaviour, cryptocurrency, trading, investment, gambling

Résumé

Le comportement de l'investisseur et celui du joueur se chevauchent de temps à autre. On dit qu'il existe un spectre entre ces deux comportements, au milieu duquel se trouvent des outils d'investissement « spéculatif ». Compte tenu de leur risque plus élevé dû à leur plus grande volatilité par rapport aux instruments d'investissement traditionnels, les échanges de cryptomonnaies peuvent devenir pathologiques et

s'apparenter aux jeux de hasard. Cette étude vise à analyser le comportement des investisseurs de cryptomonnaies et la fréquence de leurs opérations afin d'examiner d'autres troubles liés à la pratique des jeux de hasard et la relation entre le comportement des investisseurs de cryptomonnaies et l'impulsivité. Un question-naire en ligne a été créé à cette fin et la Pathological Trading Scale, le South Oaks Gambling Screen Test et la Barratt Impulsivity Scale y étaient utilisés. En tout, 300 personnes ont été évaluées. Nous avons constaté que les joueurs pathologiques représentaient 48,7% de tous les spéculateurs, que l'impulsivité dans le groupe des personnes de 18 à 25 ans était plus élevée, et que les spéculateurs qui effectuaient des transactions plus souvent étaient plus pathologiques et faisaient preuve d'une plus grande impulsivité; de plus, les spéculateurs sur marge et les spéculateurs sur séance affichaient un comportement plus pathologique. Il semble qu'une proportion importante des spéculateurs de cryptomonnaies peuvent être pathologiques, et que certains d'entre eux peuvent être dépendants à l'égard des cryptomonnaies, ce qui peut être évalué comme un sous-type de jeu compulsif.

Introduction

Cryptocurrency is a digital medium of exchange wherein individual ownership or transfer information is kept in a digital ledger or a database and in which transactions are protected using cryptography. The first cryptocurrency, bitcoin, was launched in 2009, and in 2011, the first altcoin (alternative coin) was created as an alternative to bitcoin. More than six thousand altcoins have been released to date. In the early years of its genesis, bitcoin was used mostly for illegal purposes such as drug trading or online gambling through "Dark Net" (Foley et al., 2019), but has attracted investors' attention as a means of a store of value over the years, and reached a total market value of $238 billion in 2019. The value of bitcoin, which was traded at one dollar in February 2011, reached about twenty thousand dollars at the end of 2017. Although it lost more than 70% of its highest value, today bitcoin is nevertheless traded by many investors all over the world. Turkish investors have also shown a deep interest in bitcoin. A survey in 2019 showed that 20% of Turks own cryptocurrency, and it is stated to be the "highest per capita rate of cryptocurrency ownership of all nations surveyed" (Partz, 2019).

Although its value is much more volatile than classical investment tools, bitcoin is becoming a widely accepted investment tool. It has been stated that investment behaviour involving high-risk investment instruments may become pathological, and those high-risk investors may have behavioral similarities to gamblers over time (Deck et al., 2014). Founders of 'value investing' Graham and Dodd indicated that an investment is an economical strategy that promises a safe and satisfactory return with an appropriate analysis (Graham & Dodd, 2009). Graham and Dodd also list the factors that are associated with gambling but not with the

investment behaviour. According to Graham and Dodd, regarding gambling, all depends on luck than analysis, the stake can entirely be lost, and a lucky bet can result in an excessive (far more than a satisfactory) return (Graham & Dodd, 2009). Although these differences between investment behaviour and gambling were stated in the literature many years ago, it seems that investment and gambling may overlap to a certain degree over time, and this overlap may be more common in high-risk investment instruments (Arthur et al., 2016). On the other hand, personality factors such as risk-taking, stimulus seeking, and impulsivity were also found to be determinants of investment and gambling behaviour (Jadlow & Mowen, 2010). It has been observed that more impulsive individuals tend to gamble more, while less risk-taking and less impulsive investors tend in turn to make for safer bets (Arthur et al., 2016).

Arthur and colleagues have stated that there is a spectrum between gambling and investment behaviour and that there are speculative investment tools in the middle of the spectrum. These are more volatile, higher-risk instruments, mainly focused on financial earnings (Arthur et al., 2016). It is observed that those who frequently invest in speculative investment tools have similar behaviours to gamblers. The trading behaviours that could have adverse effects on the person's functionality and psychology are called "pathological trading" (Guglielmo et al., 2016). To date, most of the studies related to pathological trading behaviours have used the dependency criteria in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), and the concept and criteria of pathological trading have been proposed by Guglielmo and colleagues (Guglielmo et al., 2016). Pathological trading causes various problems both for the person and their environment, which can negatively affect mental health. These mental problems include depression, anxiety disorders, suicide attempts, and it remains clear that this is a significant mental health problem.

Until today, studies on high-risk investment instruments and their relation to gambling have been conducted through traditional stock market investors. To the best of our knowledge, cryptocurrencies, which are becoming an increasingly accepted investment instrument worldwide, have much higher volatility and are riskier than traditional stocks, have not been investigated in this regard. This study aims to investigate the pathological trading behaviour, and its frequency among cryptocurrency investors, to investigate additional gambling disorders among cryptocurrency investors, as well as to investigate the relationship between cryptocurrency investment behaviour and impulsivity. Considering that it presents a higher risk because of its higher volatility compared to traditional investment instruments, it is hypothesized that cryptocurrency investors show higher pathological trading behaviours than traditional stock market investors as reported in the literature, riskier trading behaviours such as day trading or margin trading cause more pathological behaviour, and the impulsivity rates are higher in riskier instruments.

Method

Procedure

An online questionnaire had been created to investigate pathological trading, additional gambling disorders, and impulsivity in cryptocurrency investors. Through this questionnaire, with the socio-demographic data form, the participants' socio-demographic data and investment habits were obtained, subsequently the Pathological Trading Scale, recommended by Guglielmo and colleagues, was used, followed by the South Oaks Gambling Screening Test and the Barratt Impulsivity Scale-SF. After obtaining the approval of the university's ethics committee, we invited participants to the questionnaire through the popular social media sites in Turkey in April 2020. At the beginning of the questionnaire, detailed information was given about the study.

Inclusion criteria included being a cryptocurrency investor for more than six months, being over the age of 18, and willing to participate in the study. Exclusion criteria were producing a diagnosis of psychotic disorder or bipolar disorder. All of the participants' data were evaluated, and the data which did not meet the inclusion criteria were excluded.

Evaluation tools

Socio-demographic Data Form

With the socio-demographic data form, information about gender, age, education, income level, and marital status were obtained, and participants were each asked for how long had they been trading in cryptocurrency exchanges, how often had they followed the value of cryptocurrencies, in which cryptocurrency had they traded, how were they defining their investment behaviour and whether or not they traded on margins. Margin trading is a prepayment in the futures market made today to secure future contracts, a practise which often involves leveraged options, therefore entailing riskier financial instruments. The researchers then created their socio-demographic data form (Appendix A).

Pathological Trading Scale

The pathological trading scale recommended by Guglielmo and colleagues was used (Guglielmo et al., 2016). The scale was translated into Turkish, and a total of 5 points or more was interpreted as "pathological trading," as suggested by the authors. The scale consisted of 13 questions, and the first 9 questions were taken from the diagnostic criteria of gambling disorder in DSM-5, adapted to trading. The remaining 4 questions were concerning trading behaviour. The "yes" answers in the questions were scored as 1 point, the "no" answers were 0 points, and the eleventh question was scored in reverse (see Appendix B). The third question in the test concerned itself with "tolerance," the first question "preoccupation," and the ninth question "chasing losses." The test had no sub-scales and 5 or more points are

considered as possible pathological trading (Guglielmo et al., 2016). The validity and reliability study of the Pathological Trading Scale in Turkish had not yet been conducted, and to the best of our knowledge, this is the first study that uses the scale in the Turkish language.

South Oaks Gambling Screen Test

The test was developed by Lesieur and Blume (1987) and adapted to Turkish in 2001 (Duvarcı & Varan, 2001). It includes questions about the gambling type in which the person is involved and screens for possible gambling disorder. It has been recommended that those scoring equal or more than 8 over 19 points could be identified as potentially pathological gamblers. The internal consistency coefficient of the scale was determined to be 0.87.

Barratt Impulsiveness Scale-SF

Developed by Barratt in 1959, translated into to Turkish in 2008 by Güleç and colleagues, and it is short-form, which was created to be more widely used, adapted to Turkish in 2013 by Tamam and colleagues (Tamam et al., 2013). The test consists of 15 questions and includes three sub-scales: "motor impulsivity," "planning impulsivity," and "attention impulsivity." The internal consistency coefficient of the scale was determined as 0.82.

Statistical Analysis

The continuous data were given as mean $\pm$ standard deviation. Categorical data were given as a percentage (%). Shapiro Wilk test was used to investigate the suitability of the data for normal distribution. To compare the non-normally distributed groups, we used the Mann-Whitney U test for data with two groups and the Kruskal-Wallis H test for data with three or more groups. We used the Pearson Chi-Square analysis for the analysis of the cross tables. IBM SPSS Statistics 21.0 was used for the analyses. A p-value of <0.05 was considered statistically significant.

Results

Three hundred and ten persons participated in the study. Eight people were excluded for not giving consent for the study; two persons were excluded for stating that they had psychotic or bipolar disorders; thus, a total of three hundred persons were included. The socio-demographic data and information on the investment behaviour of the participants are presented in Table 1. Pathological Trading Scale, South Oaks Gambling Screen Scale, and Barratt Impulsivity Scale scores of the participants are presented in Table 2.

When we investigated the presence of pathological trading by gender, we found no statistically significant difference ($p = 0.974$, $\chi^2 = 0.001$). When the pathological trading and impulsivity of the cryptocurrency investors by age were examined,

Table 1

Socio-demographic data and information about participants' investment choices

Category	n	%
Gender		
Male	290	96.7
Female	10	3.3
Age		
Between 18–25	46	15.3
Between 25–45	235	78.3
Over 45	18	6.0
Education level		
Secondary School	37	13.3
University	204	68.0
Postgraduate	56	18.7
Monthly income		
Less than 2000Ł	44	14.7
Between 2000–7000Ł	148	49.3
Over 7000Ł	108	36.0
Marital status		
Married	144	48.0
Single	156	52.0
Total trading duration in cryptocurrency exchanges		
Shorter than 1 year	31	10.3
Between 1–2 years	43	14.3
Between 2–3 years	129	43.0
Over 3 years	95	31.7
How often do you track the value of cryptocurrencies?		
Every hour or less	115	38.3
A couple of times a day	156	52.0
Once in a day	16	5.3
A couple of times a week	12	4
Cryptocurrency traded		
Bitcoin	33	11.0
Altcoin(s)	42	14.0
Bitcoin and altcoin(s)	225	75.0
Investment behaviour		
Day trader	76	25.3
Short term trader (days-weeks)	121	40.3
Midterm trader (months)	49	16.3
Long term trader (years)	52	17.3
Margin trade		
Yes	135	45.0
No	165	55.0

no significant difference could be located in the pathological trading scores by age ($p = 0.178$); however, the motor impulsivity of those between the ages of 18–25 was significantly higher ($p = 0.001$). No significant difference was determined between planning, attention impulsivity, and age groups ($p = 0.077$, $p = 0.255$).

Table 2

Distribution of participants according to psychometric characteristics

Scales	n	%	Mean	SD	95% CI Lower	Upper
Pathological Trading Scale						
Possible pathological traders	146	48.7	7.03	1.96	6.71	7.35
Possible non-pathological traders	154	51.3	2.38	1.33	2.16	2.60
South Oaks Gambling Screen Test						
Participants with possible gambling disorder	6	2.0	9.0	1.54	7.37	10.62
Participants without possible gambling disorder	294	98.0	2.08	1.22	1.57	2.58
Barratt Impulsiveness Scale						
Motor Impulsivity	300	100	8.27	2.01	8.03	8.48
Planning Impulsivity	300	100	9.41	2.48	9.15	9.71
Attention Impulsivity	300	100	8.00	2.07	7.76	8.23

SD = Standard Deviation. CI = Confidence Interval.

To investigate the relationship between the frequency of trading behaviour and pathological trading, we investigated the participant responses by dividing them into two separate groups. One group consisted of individuals responding to the question "How often do you track the value of cryptocurrencies?" We then divided them into "those who track cryptocurrency values every hour or less" and "others." The other group consisted of individuals responding to the question "How do you define your investment behaviour?" We then divided those respondents into "day traders" and "others" (see Table 1, Appendix A). Participants who tracked cryptocurrency values every hour or less scored significantly more on the pathological trading scale ($p < 0.001$, $\chi^2 = 38.767$). Their motor impulsivity was significantly higher ($p = 0.002$, $\chi^2 = 21.596$). No statistically significant difference could be found in terms of total gambling scores ($p = 0.868$, $\chi^2 = 8.213$), planning ($p = 0.830$, $\chi^2 = 13.210$), and attention impulsivity ($p = 0.816$, $\chi^2 = 14.275$). Also, day traders had significantly higher pathological trading scores than others ($p < 0.001$, $\chi^2 = 28.595$), their motor impulsivity was significantly higher ($p = 0.027$, $\chi^2 = 14.244$), there was no significant difference in terms of gambling scores ($p = 0.458$, $\chi^2 = 6.275$), planning ($p = 0.607$, $\chi^2 = 12.005$), and attention impulsivity ($p = 0.128$, $\chi^2 = 11.390$).

Regarding the cryptocurrency traded, the pathological trading scores ($p = 0.438$), gambling scores ($p = 0.798$), motor impulsivity scores ($p = 0.223$), planning ($p = 0.492$), and attention impulsivity scores ($p = 0.058$) were not significantly different between the groups. When this relationship was evaluated in terms of margin trading, it was found that the pathological trading scores were significantly higher in margin traders ($p = 0.012$, $\chi^2 = 17.819$), and no significant difference was found in terms of gambling ($p = 0.175$, $\chi^2 = 6.581$), motor impulsivity ($p = 0.332$, $\chi^2 = 13.146$), planning ($p = 0.929$, $\chi^2 = 6.512$), and attention impulsivity ($p = 0.645$, $\chi^2 = 3.250$).

Table 3

Relationship between value tracking frequency and pathological trading, gambling and impulsivity*

Total scale scores	Every hour or less (n= 74)		Others (n= 226)			
	Mean	SD	Mean	SD	p	χ^2
Pathological trading scale total score	5.90	± 2.69	4.00	± 2.74	<**0.001**	38.767
South Oaks gambling screen test total score	0.33	± 1.29	0.38	± 1.55	0.868	8.213
Motor impulsivity scale total score	8.75	± 2.22	7.97	± 1.82	**0.002**	21.596
Planning impulsivity scale total score	9.43	± 2.68	9.37	± 2.30	0.830	13.210

*Chi-square test. *SD* = Standard deviation.

Table 4

Relationship between investment behaviour and pathological trading, gambling and impulsivity*

Total scale scores	Day traders (n= 76)		Others (n= 224)			
	Mean	SD	Mean	SD	p	χ^2
Pathological trading scale total score	6.13	± 2.69	4.28	± 2.79	<**0.001**	28.595
South Oaks gambling screen test total score	0.29	± 1.41	0.38	± 1.46	0.458	6.275
Motor impulsivity scale total score	8.66	± 1.99	8.14	± 2.02	**0.027**	14.244
Planning impulsivity scale total score	9.79	± 2.89	9.26	± 2.28	0.607	12.005
Attention impulsivity scale total score	8.26	± 2.00	7.87	± 2.08	0.128	11.390

*Chi-square test. *SD* = Standard deviation.

Data on the relationship between the participants' investment behaviours and pathological trading, gambling, and impulsivity are presented in Tables 3 and 4.

Bivariate analysis

Bivariate analysis showed that pathological trading was positively correlated with gambling (p = 0.001, r = 0.195), motor impulsivity ($p < 0.001$, r = 0.359), planning impulsivity ($p < 0.001$, r = 0.297) and attention impulsivity ($p < 0.001$, r = 0.284). Also, gambling scores were positively correlated with pathological trading (p = 0.001, r = 0.195) and all areas of impulsivity sub-scales ($p < 0.05$). Data regarding bivariate correlations are presented in Table 5.

Discussion

To date, studies on trading and its pathological aspects are few, and no studies have been conducted in terms of these features of cryptocurrencies. Several case reports

Table 5

Bivariate analysis results between pathological trading scores, total gambling screen test scores and Barratt Impulsiveness Sub-Scales

Total scale scores		(1)	(2)	(3)	(4)
(1) Pathological trading scale total score	r	-			
	p	-			
(2) South Oaks gambling screen test total score	r	0.195			
	p	**0.001**			
(3) Motor impulsivity scale total score	r	0.359	0.167		
	p	**0.000**	**0.004**		
(4) Planning impulsivity scale total score	r	0.297	0.042	0.306	
	p	**0.000**	0.476	**0.000**	
(5) Attention impulsivity scale total score	r	0.284	0.099	0.405	0.503
	p	**0.000**	0.090	**0.000**	**0.000**

and research on investor behaviours show that trading behaviour can sometimes become pathological. It has been stated that several common aspects of pathological trading exist: investors often experience small early wins; they chase losses and invest more money over time; their control over the staked money deteriorates gradually; and they have several cognitive biases such as selective memory, gambler's fallacy, and rationalization (Grall-Bronnec et al., 2017; Guglielmo et al., 2016; Team & Turner, 2011). In time, the compulsive trading activity takes most of the person's time, forces the gambler to follow the markets frequently, and causes him or her to stake more money. All these developments can in turn lead to adverse economic and mental health-related consequences as losses increase (Guglielmo et al., 2016; Mills & Nower, 2019).

In the literature, it is observed that shorter time-spanned, riskier, and more volatile financial instruments are associated more with pathological behaviours (Arthur et al., 2016; Grall-Bronnec et al., 2017). It is indicated that certain investment behaviours such as day trading or margin trading cause a "rush" just as in gambling, and the motivation of the investment behaviour is to seek pleasure rather than a financial earning (Arthur et al., 2016; Mills & Nower, 2019). It has been put forward that cryptocurrencies, which have high volatility, are conceptually similar to high-risk stocks (Mills & Nower, 2019). Consequently, in this study, we aimed to investigate the relationship between cryptocurrency investment and pathological trading, gambling disorder, and impulsivity.

When the relationship between investment behaviours and socio-demographic data is viewed, we note the following compelling finding. Previous studies show that female stock market investors take less risk, show less pathological trading behaviour, and are less impulsive than men, whereas those who take more financial risk are mostly young, educated men (Arthur et al., 2015; Deck et al., 2014; Jadlow & Mowen, 2010). In our study, however, no statistically significant difference

emerged between women and men in terms of pathological trading, gambling and impulsivity. Nevertheless, we did find that 96.7% of the participants were male and 86.62% of those had university and postgraduate education. In this respect, our study's socio-demographic data showed similarity to the studies conducted on high-risk investments. The fact that females make up to 3.3% of the total sample may indicate that because females take less risk in investing, and that they may show less interest in cryptocurrencies and prefer investment options other than cryptocurrencies. This data should be evaluated with caution because the highly limited size of female participants may not represent all cryptocurrency investors gender profiles. Although no significant difference was found in pathological trading scores by age, the fact that motor impulsivity was significantly higher in the 18–25 age group may indicate that cryptocurrencies may be more attractive to young and more impulsive individuals. Even though this age group showed no difference in terms of pathological trading compared to other age groups, pathological behaviours could nonetheless be observed in these individuals during the follow-up period.

In studies that were carried out with traditional stock market investors, the presence of problematic trading behaviours has been reported to be about 11% to 30% of total investors (Konstantaras & Piperopoulou, 2011; Piperopoulou, 2004). One of our study's more prominent findings is that this rate is 48.7% among cryptocurrency investors. One of the reasons why this rate is higher in cryptocurrencies may be that cryptocurrencies, in which value may change in day and night continuously and which can have high returns or losses, force their investors to track their value frequently. Investors often chase their losses, and sometimes having five, ten or even one hundred times the return on investment can lead to more (and potentially erroneous) trades. Barber and Odean state that one of the most important factors underlying problematic trading behaviours is "excessive self-confidence," caused by the "illusion of control," which causes to trade more and more even with fewer earnings (Barber & Odean, 2002). In this way, Griffiths proposed the concept of "cryptocurrency addiction" as a subtype of "stock market addiction," and stated that cryptocurrency addiction is a form of gambling addiction (Griffiths, 2018).

With the key criteria being "chasing losses," gambling disorder shares certain common aspects with substance addictions such as tolerance and preoccupation. The three questions with the highest rate of "yes" in the sub-items of the pathological trading scale in our study were tolerance (item 3, 72%), preoccupation (item 1, 68%) and chasing losses (item 9, 55%). Despite the low rates of "possible gamblers" in the gambling screening test, the high rates of pathological trading and additional sub-items require an exposition. The gambling screening test used in our study is more sensitive to traditional gambling tools, such as casino and card games (Lesieur & Blume, 1987), and may be insufficient in detecting potential cryptocurrency trading addicts. Although the pathological trading scale includes questions to detect problematic trading behaviour, it is not a scale that was developed to make an "addictive disorder" diagnosis. While the trading behaviours of nearly half of the participating cryptocurrency investors could in fact be pathological, a need nevertheless arises for studies to be carried out with structured interviews about whether these people are addicted or not.

Although the percentage of pathological traders in our study is nearly half of the total participants, it cannot be said that every cryptocurrency investor maintains pathological behaviours. When the behaviours that may lead to pathological trading are examined, we found that, among those persons who track cryptocurrency values every hour or less, day traders and margin traders maintain significantly higher total pathological trading scores ($p < 0.001$, $p < 0.001$, $p < 0.001$). Also, we discovered that frequent cryptocurrency trackers and day traders maintain significantly higher motor impulsivity scores ($p = 0.002$, $p = 0.027$). Markiewicz and colleagues stated that the motivation of day trading behaviour is mostly seeking stimulus and pleasure, rather than an investment (Markiewicz & Weber, 2013). Those persons who follow the market often remain under a bombardment of stimuli, and they may trade with less control with a compulsion of having to trade more in a shorter time. These trades occasionally lead to losses, and frequent trades then take place to compensate for this loss. In the studies on investment neurobiology, it is seen that during the expectation of reward, an activation takes place in the ventral striatum, which is innervated by the dopaminergic nerves, and that the same area can also be stimulated by certain stimulants, such as amphetamine and cocaine (Knutson & Bossaerts, 2007). Excessive and frequent stimulation of this area seems to be exceptionally important in the development of addiction. Neurobiologically, the risk of developing addictions with frequent stimuli increases, and those who follow the market more frequently and trade on more volatile instruments may have a higher risk of developing an addiction. In the study conducted by Jadlow and Mowen, they found that several personality factors, such as risk-taking, stimulus seeking, and impulsivity, are essential factors that differentiate investment and gambling behaviour (Jadlow & Mowen, 2010). The finding that motor impulsivity is significantly higher in day traders and frequent value trackers may mean that pathological trading and impulsivity may be interconnected. Whether or not higher impulsivity causes pathological trading in problematic traders requires more research.

In our study, the number of people with possible gambling disorders was found to be 2% of the total participants ($n = 6$). When these individuals were examined in terms of trading behaviour, it was seen that all of them were pathological traders, and this finding was found to be statistically significant ($p = 0.014$). A recent study among regular gamblers found that the frequency of cryptocurrency trades correlates with both the frequency of gambling behaviour and the severity of gambling addiction. Thus, the authors stated that cryptocurrencies might be attractive to gamblers seeking risk and excitement (Mills & Nower, 2019). Given that the adults affected by gambling disorders, which is found to be 0.2–5.3% worldwide (Hodgins et al., 2011) and cryptocurrency traders are similar, our findings support the results of Mills & Nower's and cryptocurrencies might be attractive to gamblers.

Conclusions

We found that a significant portion of the participants show pathological trading behaviour, and those who are frequent value trackers and day traders are more

impulsive than others, as it was hypothesized. Although our study is not a comparative study, it has been found that the pathological trading rates of the participants are higher compared to the studies conducted with traditional stock market investors in the literature. Further studies are needed to determine whether these persons do in fact suffer an addictive disorder.

Limitations and Suggestions for Future Research

In our study, the participants were evaluated through an online questionnaire, and the scales used are not diagnostic. The validity and reliability study of the Pathological Trading Scale in Turkish has not yet been conducted and this might influence the efficacy of the scale. The survey was open to all participants, and it was not possible to determine the imposters. This is a limitation of our study. The limited sample size, the high proportion of male participants, and the high level of education may not reflect all cryptocurrency investors' sample. Accordingly, the results should be replicated in larger populations. In this study, we only evaluated the crypto-currency investors, and we had no control group. In future studies, it may be fruitful to include people associated with different investment tools, e.g., stock market investors, to reveal the problematic trading behaviours specific to cryptocurrency involvement.

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Appendix A

Socio-demographic data form

1. Gender
   (a) Male
   (b) Female

2. Age
   (a) 18–25
   (b) 25–45
   (c) Over 45

3. Educational status
   (a) Elementary school
   (b) High school
   (c) University
   (d) Postgraduate

4. Monthly income
   (a) Less than 2000Ł
   (b) Between 2000–7000Ł
   (c) Over 7000Ł

5. Marital status
   (a) Married
   (b) Single
   (c) Divorced

6. Have you ever been diagnosed with a psychiatric or neurological disease? If not, you may leave it blank

7. How long have you been trading on cryptocurrency exchanges?
   (a) Less than six months
   (b) Between 6 months–1 year
   (c) Between 1 year–2 years
   (d) Between 2 years–3 years
   (e) More than 3 years

8. How often do you keep track of the value of cryptocurrencies?

   (a) Every hour or less
   (b) Several times a day
   (c) Once a day
   (d) A few times a week
   (e) Less often

9. What cryptocurrency do you trade in?

   (a) Bitcoin
   (b) Altcoin(s)
   (c) Bitcoin and altcoin(s)

10. Which of the following better describes your investment behaviour?

   (a) I trade daily (day trader)
   (b) I am a short term investor (days to weeks)
   (c) I am a medium-term investor (months)
   (d) I am a long term investor (years)

11. Do you trade margins? Note: You can tick "No" if you are not familiar with margin trading.

   (a) Yes
   (b) No

Appendix B

Pathological trading scale

1. Are you involved in compulsive daily trading activity (having persistent thoughts of reliving past trading experiences, analyzing or planning the next venture; persistently involved in reading financial literature or online forums; trading becomes the main activity of daily life) Note: In the case of professional traders, it refers outside of working hours

   (a) Yes
   (b) No

2. Do you need to trade with increasing amounts of money to achieve the desired excitement?

   (a) Yes
   (b) No

3. Do you need to spend increasing amounts of time engaged in trading and/or need to look for new financial instruments to invest in?

   (a) Yes
   (b) No

4. Are you restless or irritable when attempting to cut down or stop trading?

   (a) Yes
   (b) No

5. Do you have altered sleep-wake rhythm (e.g., waking up at night to be connected at the opening of foreign financial markets)? Note: In the case of professional traders, it refers outside of working hours

   (a) Yes
   (b) No

6. Did you make repeated unsuccessful efforts to control, cut back, or stop trading? Note: In the case of professional traders, it refers outside of working hours

   (a) Yes
   (b) No

7. Did you lose interest in previous hobbies and activities as a result, and with the exception of trading?

   (a) Yes
   (b) No

8. Do you often trade when feeling stressed? (e.g., helpless, guilty, anxious, depressed)
    (a) Yes
    (b) No

9. After losing money trading, do you often return to trade immediately and/or another day to get even?
    (a) Yes
    (b) No

10. Did you lie to conceal the extent of involvement with trading? (e.g., showing selective memory only for right investments; lying about the financial losses; magnification of being a great investor)
    (a) Yes
    (b) No

11. Did you jeopardize or lost a significant relationship, job, or educational or career opportunity because of trading?
    (a) Yes
    (b) No

12. Do you rely on others to provide money to relieve desperate financial situations caused by trading?
    (a) Yes
    (b) No

13. Did you have suicidal ideation without a specific plan, or a suicide attempt, or a specific plan for committing suicide?
    (a) Yes
    (b) No