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Financial Literacy, Behavioral Biases and Participation in Crypto Asset Markets

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Finansal Okuryazarlık, Davranışsal Önyargılar ve Kripto Varlık Piyasalarına Katılım

Öz

Bu çalışmada finansal okuryazarlık ve kripto varlık piyasalarına katılım arasındaki ilişkinin belirlenebilmesi amacıyla anket uygulanmıştır. Finansal okuryazarlıkla beraber bireylerin kendine güven ve risk sevme eğilimleri gibi davranışsal önyargıları çalışma kapsamına alınmıştır. Lojistik regresyon sonuçları finansal okuryazarlık ve kripto piyasalarına katılım arasındaki çarpıcı ilişkileri göstermiştir. Analizler finansal okuryazarlığın kripto varlık piyasalarına katılım üzerinde pozitif ve anlamlı etkisi olduğunu ortaya koymuştur. Özellikle, ileri düzeyde okuryazar katılımcıların kripto varlık piyasalarına katılma olasılıklarının, temel düzeyde okuryazar katılımcılardan daha yüksek olduğu bulunmuştur. Finansal kararlarda kendine güven ve risk sevme eğiliminin de kripto varlık piyasalarına katılımı pozitif etkiledikleri ancak bu etkilerin anlamsız oldukları belirlenmiştir. Bunların haricinde, piyasaya katılım davranışı ve diğer kontrol değişkenleri (yaş, cinsiyet, geleneksel yatırımlar) arasında çeşitli ilişkiler saptanmıştır. Son olarak, Türk kripto yatırımcılarının finansal okuryazarlık ve davranışsal önyargılarının demografik özelliklere göre anlamlı farklılıklar gösterdiği bulunmuştur.

Anahtar Kelimeler: Finansal Okuryazarlık, Piyasa Katılımı, Davranışsal Finans, Kripto Varlıklar

JEL Kodları: G11, G41, G53

Financial Literacy, Behavioral Biases and Participation in Crypto Asset Markets

Abstract

We have conducted a survey to determine the relationship between financial literacy and crypto market participation. Furthermore, we have included overconfidence and risk lover tendency, which are considered behavioral biases, in our models along with financial literacy. Logistic regression results revealed striking findings on financial literacy and crypto market participation. Our analysis shows that financial literacy has a positive significant impact on crypto market participation. Specifically, advanced financial literates are more likely to engage in crypto markets than basic financial literates. Confidence in financial decisions and risk – lover tendency also positively affect crypto investments, however these effects are insignificant. Apart from this, we determined a relationship between participation behavior and other control variables such as age, gender and investing in traditional assets. Lastly, we focus on Turkish crypto investors and find significant differences in respect of demographic factors in financial literacy and behavioral biases.

Keywords: Financial Literacy, Market Participation, Behavioral Finance, Crypto Assets

JEL Codes: G11, G41, G53

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Yazarların Makaleye Olan Katkıları	Tüm yazarların makaleye olan katkıları eşit düzeydedir.
Çıkar Beyanı	Yazarlar açısından ya da üçüncü taraflar açısından çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

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1. Introduction

Factors affecting market participation are often discussed phenomenon in finance and related fields. In today's world, saving management has become a critical issue for market participants due to riskier global financial markets and products. In particular, the increasing complexity of newly developed financial products and services affects retail investors, and thus managing savings effectively has been harder for individuals who do not have adequate financial knowledge. At this point, the concept of the financial literacy gains importance (Lusardi and Mitchell, 2011). Especially in recent years, it seems to be a very important agenda item for financial sector, states and other relevant actors.

Financial literacy, in short, is the ability to understand financial concepts. According to Noctor et al. (1992), financial literacy is the competence of using and managing money in different economic conditions and making informed decisions. According to Jacob et al. (2000), Huston (2010) and Remund (2010), financial literacy refers to a financial awareness, financial knowledge of individuals' and capability of using financial instruments**.** Based on these descriptions, financial literacy includes wealth management, debt management, investment behavior and saving awareness**.**

Hassan Al-Tamimi and Kalli (2009) stated that some of the reasons financial literacy has come into prominence from both scientific and sectoral perspective today are the increasing complexity of financial markets and also emerging of new financial instruments. Besides, with the advances in internet and financial technologies, the factors in the financial decision-making process are quite different than it was even a generation ago (Boshara et al., 2010). Rational factors such as financial knowledge have a notable effect on those decisions as well as irrational factors like emotion, psychology, and investor's personality. Therefore, participation in financial markets and the influence of rational – irrational variables related to financial characteristics on market participation are some of the important research questions.

The internet and FinTech has brought about unprecedented innovations in financial sector and in this regard, crypto assets that use blockchain technology are among the most important of these. Since its emergence in 2008, crypto assets have grown exponentially (Xi et al., 2020). Spread of Covid-19 pandemic accelerated digitalization in the economy and popularity of crypto assets has increased rapidly in 2021. Crypto assets other than cryptocurrencies such as ICO, NFT, Security and Utility Tokens, ETFs and digital wallet have become investable assets for many investors due to sharp rise in their prices and high returns, despite their high volatility (Ji et al., 2019).

Although decentralized nature of crypto assets, they are traded on many centralized exchanges today. For this reason, it can be claimed that crypto assets exhibit same trading dynamics with traditional financial products. From this point of view, we argue that there might be a relationship between the level of financial literacy and crypto asset market participation and main motivation of our study arises from this idea. The aim of this paper is exploring whether levels of individuals' financial literacy are related to crypto market participation. For that purpose, the data obtained from 1137 respondents by conducting a questionnaire were analyzed using logistic regression model. Our findings showed that there exists positive relationship between financial literacy and crypto market participation. Additionally, advanced financial literacy has strong positive impact on participation in crypto asset markets. Behavioral biases also have a positive effect on market participation, but none of them are statistically

significant. Aside from these findings, we observed significant differences among Turkish crypto investors with respect to independent variables.

This paper makes three contributions to the common literature. First, this research is, to the best of our knowledge, one of the pioneering studies examining the relatedness between financial literacy and crypto market participation. Second, we reveal the profile of Turkish crypto asset investors by working with large data set. Finally, we also shed light on different relations between financial literacy, behavioral biases (confidence in financial decisions, risk lover tendency) and other control variables (age, gender, education level, marital status, occupation, monthly income, having taken a finance course and working in finance field).

The rest of the study proceeds as follows. Section two reviews the literature on the relationship between financial literacy and other financial – nonfinancial characteristics. Section three presents the dataset, descriptive statistics and dependent and independent variables adopted in the study. The main findings of the statistical analyses are discussed in section four. Fifth part of the paper outlines the results of the study and policy recommendations. We think that the results derived from the analysis will be guiding especially for investors and policymakers in terms of crypto markets.

2. Literature Review

There are many studies on financial literacy in the relevant literature. Most of these studies have focused on the effects of financial literacy on financial decision-making, financial planning, investments and savings. For instance, Allgood and Walstad (2016) examined the impact of financial literacy on financial behaviors using the data of 28146 individuals in United States and stated that both perceived and actual financial literacy affect financial behaviors. Authors also claimed that perceived financial literacy may be as important as actual financial literacy. Scheresberg (2013) and Grohmann (2018) revealed that a high level of financial literacy helps to make accurate financial decisions. Ali et al. (2015) analyze the data obtained from 1957 respondents who attend investment seminars in Malaysia and empirical results show the importance of financial literacy on making healthier cash management and financial planning. Parallel findings also noted by Agarwal et al. (2015). Another research conducted with a large sample size by Asaad (2015) assessed the survey data collected from 25509 participants in the U.S. Not surprisingly, results showed that individuals with higher confidence and financial knowledge make better financial decisions. Calcagno and Monticone (2015) suggested that investors who have low financial literacy do not invest in risky assets and are less likely to consult a financial advisor. Al-Tamimi and Kalli (2009) focused on the relationship between financial literacy and investment decisions. They applied logistic regression and ANOVA and found statistically significant relationship. In another similar study, Naiwen et al. (2021) concluded that there is a positive relationship between financial literacy and risk tolerance. They also emphasized the impact of financial literacy and risk tolerance on investment decisions. On the other hand, Chen and Volpe (1998) investigated the effects of financial literacy on the financial decisions of university students and argued that students with low level of financial literacy tend to make faulty decisions about financial events. According to Chu et al. (2017), individuals with high literacy invest in mutual funds as well as stocks and are more likely to generate positive returns from their investments.

In the common literature, there are also researches examining the relation between financial literacy and debt management. For instance, Disney and Gathergood (2013) stated that individuals with low financial literacy have loan portfolios with higher costs. Fong et al.

(2021) found that the increase in financial literacy in Singapore is positively related to the behavior of paying off credit card debts on time and to the participation in stock markets. Kurowski (2021) investigated the relationship between financial literacy and financial decision – making behaviors during the Covid-19 pandemic. A questionnaire was applied to 1300 participants in Poland and it was claimed that individuals with higher financial literacy are able to manage their credit and debt position better. Supporting these results, Sevim et al. (2012) emphasized that individuals with higher financial literacy are less likely to exhibit excessive borrowing behavior.

Some of the studies in the relevant literature discuss portfolio management decisions within the framework of financial literacy. Abreu and Mendes (2010) explored the effect of financial literacy on portfolio diversification in Portugal and they found that education and financial knowledge have positive impacts on portfolio diversification decisions. Similarly, Gaudecker (2015) concluded that individuals with high levels of financial literacy generate higher returns. Şahin and Barış (2017), Gilenko and Chernova (2021) and Yılmaz and Kaymakçı (2021) indicate that financial literacy has a positive effect on the saving tendency.

Another group of studies focuses on the relationship between financial literacy and demographic & individual characteristics. One of the pioneering research projects on this subject was carried out by Lusardi et al. (2010). Authors analyzed the survey data of 7417 respondents in U.S. and concluded that financial literacy directly related to sociodemographic characteristics and family structure. Kılıç et al. (2015) report that male students have higher levels of financial literacy than female students while Yılmaz and Elmas (2016) confirmed that financial literacy does not differ according to gender and credit card usage. Kutukız and Özden (2018) suggested that financial literacy levels of women entrepreneurs are generally low. In addition, they found a statistically significant relationship between financial attitude and demographic variables such as education and income. Kıran et al. (2018) claimed that the level of financial literacy differs significantly according to gender, credit card interest rate and internet banking usage. Cumurovic and Hyll (2019) analyzed the survey data of 2222 participants in Germany in an attempt to determine whether the level of financial literacy has a statistically significant and positive effect on self – employment. Results showed that there is a positive relationship between these variables. Bağcı and Arabacı (2019) show the effect of factors like family income, father's occupation, credit card usage and credit card limit on financial literacy. Çetiner and Çilingirtürk (2019) reports that individual's income positively affects financial literacy but gender and education have no significant impact on the level of literacy. Priyadarshani and Kumari (2021) determined a positive relationship between the education level of family members' and financial literacy level of the individuals. One of the interesting research projects on financial literacy conducted by Finke et al. (2017). Based on survey data in the U.S., authors state that financial literacy scores decreased significantly after the age of 60. Referring to studies of Kıran and Bozkurt (2020) and Hermansson and Jonsson (2021), one can claim that there is a positive and significant relationship between financial literacy and risk tolerance.

A large number of studies focus on whether financial literacy affects financial market participation. Rooij et al. (2011) argue, for example, that individuals with low financial literacy are less likely to engage in stock markets. Almenberg and Dreber (2015) concluded that low level of financial literacy is more common for female respondents, leading to less participation in the stock market. In another study, Rooij et al. (2012) examined the survey data of 2028

respondents in Netherlands and reported that the level of financial literacy increases the likelihood of participation in stock markets. Moreover, financial literacy was positively associated with the retirement plans of respondents. Similar results with stock markets were also achieved for derivatives market. Using survey data of 2523 Taiwanese respondents, Hsiao and Tsai (2018) suggested that individuals with higher financial literacy have a higher tendency to engage in derivative markets. Ünal (2018), using data from Turkey, examined the relationship among financial literacy and knowledge of FX market and revealed a positive but weak relationship between. Another study on market participation conducted by Zhao and Zhang (2021). They provide evidence from U.S. to emphasize that both financial literacy and past investment experience positively affect participation in crypto markets.

Numerous studies investigated the relationship between financial literacy and daily habits. Watanapongvanich et al. (2021) found that there is a negative relationship between financial literacy and gambling behavior. On the other hand, Ono et al. (2021), states that individuals with high financial literacy tend to exercise more regularly. Similarly, Khan et al. (2021) noted that individuals with high financial literacy had a lower tendency to smoke.

Finally, several studies examine financial fragility, demand for financial services and degree of financial inclusion. Chhatwani and Mishra (2021) determined that financial literacy reduced financial vulnerability during the Covid-19 pandemic. Hasan et al. (2021) present empirical evidence that financial literacy has a positive impact on financial inclusion and access to financial services. Further, Morgan and Long (2020) found that financial literacy positively affects financial inclusion. A recent study conducted by Fujiki (2022) focused on the relationship among financial literacy and demand for financial services during the Covid-19 era. Regression results show that individuals with higher financial literacy prefer non-face-to-face financial services.

Based on our literature review, a limited number of studies investigate financial literacy and participation in financial markets. Among these research, Rooij et al. (2011), Rooij et al. (2012) and Almenberg and Dreber (2015) focused on stock markets. Hsiao and Tsai (2018) examined this subject in derivatives market and Ünal (2018) applied to FX markets. As far as we know, only a few studies examined the relationship between financial literacy and crypto markets (Fujiki, 2020; Zhao and Zhang, 2021; Santoso and Modjo, 2022; Modjo and Santoso, 2022).

3. Data and Variables

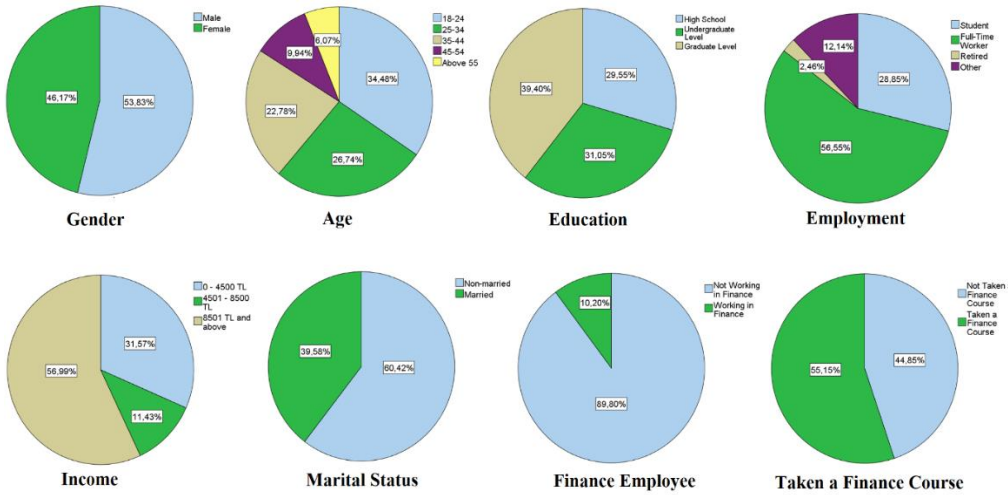
3.1. Data and Descriptive Statistics

Our dataset contains data from 1137 survey respondents, 18 years of age and older, in Turkey. Both face-to-face and online questionnaires were conducted in order to evaluate the relationship among financial literacy and crypto market participation. Online surveys were applied via email and social media platforms. The response rate is higher in the face-to-face surveys than in the online surveys. As far as we can observe, our questionnaire reached approximately 110.000 individual between May and November 2022. Thus, the response rate of our survey was around 1% (1137 out of 109.758).

Numerous graphs regarding descriptive statistics of this study's sample can be found in Figure 1. The sample consists of 1137 respondents, which of 612 are male and 525 are female. Our sample size is mainly dominated by younger people: 392 respondents are in between 18 and 24 years old, and 304 respondents are in between 25 and 34 years old. Nonetheless, our survey managed to reach elder people as well, 69 respondents are over 55 years old. The

respondents are more fairly distributed in terms of attained education level: 336 of the respondents are high school graduates, 353 of them have a degree in bachelor level, and 448 of them have a graduate degree. In correlation with respondents' age, the most frequent occupations in the survey are being a full-time worker (643) and being a student (328). In terms of respondents' income, income level that is higher than 8501 ₺ dominates our sample. Due to high inflation in Turkey in recent months, there has also been a large increase in salaries, and it may be the main cause of concentration in this level. Considering the possible effects of marital status on financial decisions, this determinant is also investigated: The majority (687 individuals) of the dataset in not married. Lastly, we assume that being familiar with financial topics influence financial investment decisions, thus we also take a look at respondents' working fields and the courses they took: The majority of respondents (627) took a finance course. However, only 116 individuals of the whole sample work in a finance related area.

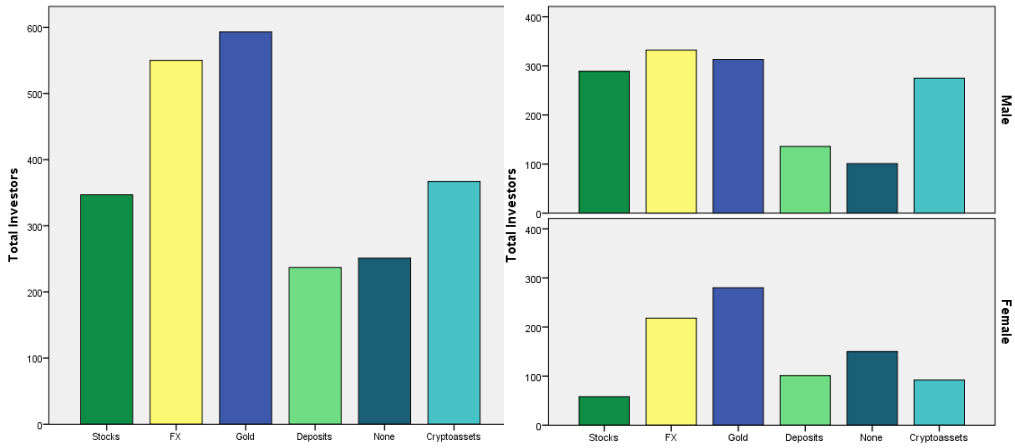
Figure 1: Descriptive Graphs of the Sample



Next, we turn our attention into the relationship between investor demographics and financial instruments they invest in (Figure 2). The first diagram shows the number of investors invested in each financial asset. The most preferred asset is gold, with 593 respondents investing in the precious metal. While foreign exchange has been the second most invested option (587 respondents), crypto assets have somewhat surprisingly surpassed stocks, 367 individuals investing in crypto assets and 347 investing in stocks. An interesting fact is that deposit is the least preferred investment option for the survey respondents.

Asset choices of men and women show us a salient difference in stocks and crypto assets. Whereas a high number of men invest in stocks and crypto assets, women avoid these two assets, generally. This can be explained by men being more into risk taking choices, than women. Meanwhile, the most two frequent assets opted for both men and women are the same: foreign exchange and gold, although the ranking differs in between them. One can also realize that women invest in financial assets less than men, in general.

Figure 2: Investment Choices of the Respondents (Total, Gender)



The following bar charts demonstrate respondents' investment choices by their age, occupation and education level (Figure 3). Once again, gold and foreign exchange are the most preferred instruments within various groups, except retired individuals opting stocks more. It is not surprising that high school graduates in our sample have the lowest levels of investment – because most of them are still students in undergraduate level. Deposits are the least preferred investment option, bar respondents that are over 55 years old. Crypto assets investment levels are similar in different groups, except respondents who are retired and over 55 years old.

Figure 3: Investment Choices of the Respondents (Total, Gender)

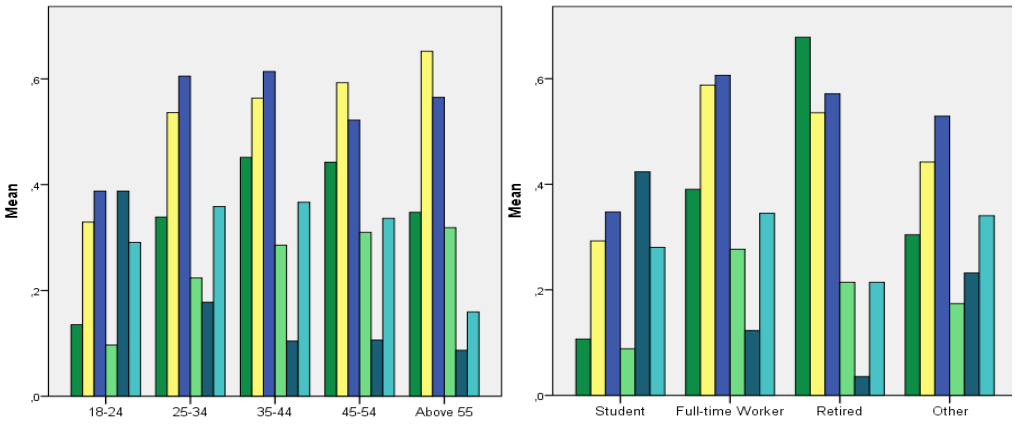
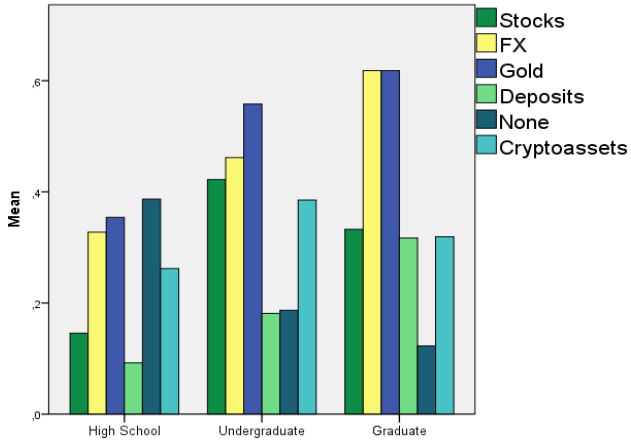
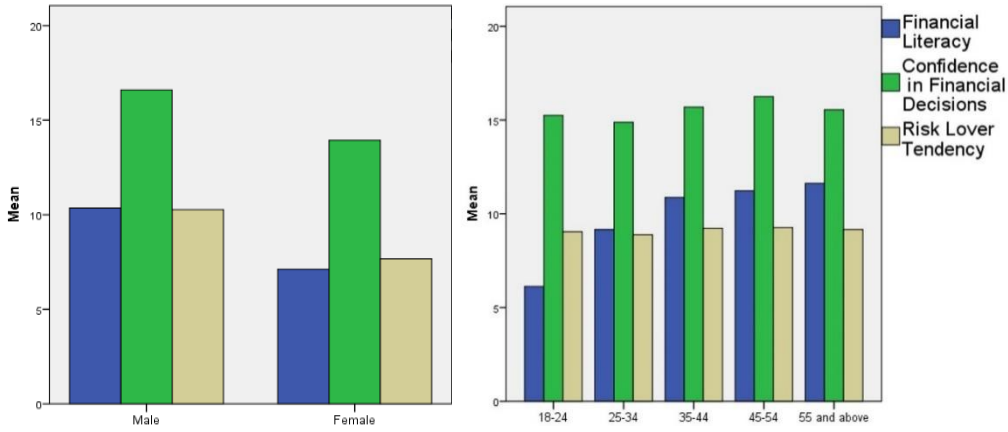


Figure 3 (Continued): Investment Choices of the Respondents (Total, Gender)



Our final bar charts focus on level of financial literacy, confidence in financial decisions and being more inclined to taking financial risks, by gender and age (Figure 4). The graph indicates that men did fairly better than women on average, in terms of correctly answering financial literacy measuring questions. Moreover, financial literacy level significantly increases by age. According to the survey, men have higher confidence in financial decisions and are more inclined to take risks, compared to women, which is in line with existing literature.

Figure 4: Financial Characteristics of Respondents'



3.2. Variable Definition and Hypothesis Development

The main independent variables adopted in this study are financial literacy (basic and advanced), confidence in financial decisions and risk lover tendency. Other independent variables consist of age, education, gender, marital status, occupation, monthly income, other investments, having taken a finance course and whether working in finance field. Crypto market participation is the only dependent variable in our analysis. Table 1 presents the variables and definitions.

Table 1: Main Variable Definitions

Variable		Definition
Dependent Variable	***Crypto Market Participation***	This variable shows whether the respondents participate in crypto asset markets. A dummy variable is used to identify crypto market participation. (1) implies that the respondent has crypto asset investments, (0) is otherwise.
Independent Variables	***Financial Literacy (Basic and Advanced)*** (Lusardi and Mitchell, 2011; Rooij et al., 2011; Finke et al., 2017)	This variable measures the level of financial literacy of respondent and composed of two parts: basic and advanced financial literacy. The basic literacy questions include an understanding of basic economic and financial concepts such as interest, inflation and time value of money. Advanced literacy represents the respondent's sophisticated financial knowledge such as functions of capital market instruments, risk – return and price – interest rates relationship. Correct answers were coded as (1) and (0) is otherwise.
	Confidence in financial decisions (Adil et al., 2022)	This variable measures whether the participants have an overconfidence in their financial decisions using five questions and a 5 – point Likert – scale. (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree
	Risk Lover Tendency (Adil et al., 2022)	Risk lover tendency variable shows the risk profile of investors (a risk averse or a risk lover) in their financial transactions using five questions and a 5 – point Likert scale. (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree
	Age	This variable indicates the respondents' age group: (1) 18-24; (2) 25-34; (3) 35-44; (4) 45-54; (5) Above 55
	Education	Education represents the participant's level of education: (1) High school and below; (2) Associate and bachelor; (3) Master and above.
	Gender	Gender is a binary variable that indicates the gender of the participants where (0) is male and (1) is female.
	Marital Status	This variable represents the marital status of respondents where (0) is single and (1) is married.
	Occupation	Occupation shows whether the respondents are currently employed or not.
	Monthly Income	Monthly income represents the monthly income of respondents.
	Other Investments	This variable represents the investments preferences of participants except crypto assets: (1) Stocks; (2) FX; (3) Gold; (4) Deposit; (5) None
	Taken a finance course	This variable measures whether the respondents have taken a finance course throughout their education life where (1) is yes and (0) is otherwise.
	Working in finance field	This variable indicates whether the employed respondents work in finance field where (1) is yes and (0) is otherwise.

We applied factor analysis on the questions and observed that two of the questions regarding risk lover tendency have an insignificant effect, so we took them out from the analysis (see Appendix, behavioral bias questions Q6 and Q7).

In order to contribute to the common literature, we have used financial literacy and behavioral bias questions. A limited number of research have examined the relationship among these variables and participation in crypto market. Table 2 summarizes the results of these studies.

Table 2: Studies on the Relationship Between Crypto Market Participation and Other Characteristics

Dependent Variable	Financial literacy	Confidence in Financial Decisions	Risk Lover Tendency	Author(s)
Crypto Market Participation	***+***	***+***	***+***	Fujiki (2020)
	insignificant	*null*	***+***	Zhao and Zhang (2021)
	insignificant	***+***	***+***	Santoso and Modjo (2022); Modjo and Santoso (2022)

Source: Fujiki (2020); Zhao and Zhang (2021); Santoso and Modjo (2022); Modjo and Santoso (2022).

As seen from the Table 2, Fujiki (2020) found a relationship between crypto asset ownership and other characteristics (financial literacy, confidence in financial decisions and risk lover tendency). The average crypto asset owner tends to be overconfident and impatient compared with non-owners. In addition, they are less likely to show self – control and are less risk averse. Finally, the average crypto owner is financially literate compared with non-owners.

In a recent study, Santoso and Modjo (2022) determined that higher risk tolerance increases the probability of Indonesian inventors to invest in cryptocurrency. In contrary to these results, no evidence was found that higher financial literacy increases participation in crypto market. Another research conducted by Modjo and Santoso (2022) and they implied that the average crypto asset owner has high confidence in financial decisions. On the other hand, Zhao and Zhang (2021) stated that risk tolerance was positively associated with cryptocurrency investment behavior but there was no statistically significant relationship between objective financial knowledge and investing in cryptocurrency. Thus, we developed three hypotheses based upon the findings of these studies.

H1: There is a significant positive relationship between financial literacy and crypto market participation.

H1a: There is a significant positive relationship between basic financial literacy and crypto market participation.

H1b: There is a significant positive relationship between advanced financial literacy and crypto market participation.

H2: There is a significant positive relationship between confidence in financial decisions and crypto market participation.

H3: There is a significant positive relationship between risk lover tendency and crypto market participation.

4. Findings

4.1. Financial Literacy and Market Participation

Correlation matrix (Figure 5) provides information about the correlations between some of the crucial variables of our survey. First of all, correlations between financial investment choices give us two interesting insights: The highest two correlations are between foreign exchange and gold (0.33), and crypto assets and stocks (0.27). It looks like there are two different investment strategies among respondents – one approach invests on a portfolio consisting of foreign exhange and gold, the other on crypto assets and stocks. The reason behind may be risk perception, because the highest correlations between tendency to be risk lover and chosen financial instruments are seen in stocks (0.59) and crypto assets (0.22). Also, the same assets have the highest correlation with confidence in financial decisions: Stocks have a correlation level of 0.3, and crypto assets have a correlation level of 0.16. However, things are a bit different with financial literacy. Although stocks have the highest correlation (0.49) again, foreign exhange has the second highest correlation (0.3) this time. There are some other interesting observations regarding crypto assets: It has the lowest correlation with age, education level, income and being married determinants, among all assets. Lastly, another striking implication is that being female determinant has negative correlation with all financial assets, except gold.

Figure 5: Correlation of Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1) Crypto assets	1.000														
(2) Stocks	0.278	1.000													
(3) FX	0.201	0.169	1.000												
(4) Gold	0.055	0.149	0.332	1.000											
(5) Deposit	0.053	0.149	0.201	0.088	1.000										
(6) None	-0.172	-0.334	**-0.494**	**-0.534**	-0.252	1.000									
(7) Financial Literacy	0.244	**0.494**	0.306	0.212	0.222	-0.360	1.000								
(8) Confidence	0.168	0.304	0.108	0.091	0.084	-0.171	0.339	1.000							
(9) Risk Lover	0.225	**0.592**	0.038	0.021	-0.017	-0.131	0.357	**0.491**	1.000						
(10) Gender	-0.292	-0.392	-0.127	0.022	-0.037	0.145	-0.412	-0.284	-0.409	1.000					
(11) Age	-0.011	0.229	0.206	0.125	0.197	-0.263	**0.505**	0.057	0.053	-0.136	1.000				
(12) Education	0.043	0.152	0.241	0.213	0.230	-0.256	**0.443**	0.003	-0.080	-0.010	**0.628**	1.000			
(13) Income	0.087	0.286	0.263	0.226	0.231	-0.327	**0.484**	0.048	0.050	-0.135	**0.664**	**0.725**	1.000		
(14) Occupation	0.033	0.161	0.104	0.119	0.073	-0.163	0.249	0.065	0.068	-0.120	0.324	0.262	0.289	1.000	
(15) Marital Status	0.045	0.276	0.152	0.181	0.103	-0.240	0.411	0.126	0.146	-0.180	**0.567**	0.440	**0.521**	0.241	1.000

In order to measure the identified determinants' level of effects on crypto assets investment decision, we utilize the question regarding whether the respondent has an investment in crypto assets as the dependent variable of our model. Those who answered "yes" to the question were coded as "1" and those who answered "no" were coded as "0", making the dependent variable a dummy variable. Hence, it is reasonable to apply logistic regression in our analysis.

In line with our hypotheses, the first model consists of three independent variables: Level of financial literacy, level of confidence in financial decisions and tendency to being risk lover. Although our second model is very similar to the first one, there is a slight difference in terms

of level of financial literacy variable: It is divided into two different variables, the first measuring basic level of financial literacy, and the second measuring advanced level of financial literacy.

We have also taken a number of control variables into account, which are age, attained education level, gender, marital status, occupation, monthly income, other types of investments, whether the respondent took a finance course, and whether the respondent is working in finance field.

The results are shown on Table 3. In the first model, it is clear that there is a statistically significant relationship between financial literacy and participation in crypto asset markets ($p < 0.01$). A unitary increase in level of financial literacy increases the probability of participation in crypto asset markets by 7.7% (odds ratio: 1.077). Therefore, we can claim that the level of financial literacy has a significantly positive effect on the decision of crypto asset market participation. In other words, individuals with higher financial literacy are more likely to invest in crypto asset markets. The results show us that individuals with high financial literacy are able to understand the structure and nature of crypto assets and markets better, as well as the possible risks they may face, hence the probability of them to invest in crypto asset markets is relatively higher. Contrary to common belief, crypto asset investors have a higher financial literacy in general.

Table 3: Estimation Output Table

Variables	**N**	***MODEL I***			***MODEL II***		
		Coef.	**S.E.**	**Exp (β)**	**Coef.**	**S.E.**	**Exp (β)**
Constant		-3.274***	0.772	0.038	-3.262***	0.773	0.038
Financial Literacy		0.074***	0.028	1.077			
-Basic					0.058	0.053	1.059
-Advanced					0.087**	0.044	1.091
Confidence in Financial Decisions		0.013	0.019	1.013	0.013	0.019	1.013
Risk Lover Tendency		0.010	0.030	1.010	0.009	0.030	1.009
Age							
18-24	392	1.877***	0.520	6.532	1.888***	0.521	6.608
25-34	304	1.559***	0.420	4.754	1.572***	0.421	4.816
35-44	259	1.231***	0.412	3.423	1.236***	0.413	3.442
45-54	113	1.037**	0.432	2.820	1.040**	0.433	2.829
≥ 55	69		Ref.			Ref.	
Education							
High school and below	336	-0.428	0.297	0.652	-0.430	0.297	0.651
Associate and bachelor	353	0.069	0.195	1.071	0.067	0.196	1.069
Master and above	448		Ref.			Ref.	
Gender							
Male	612	0.890***	0.169	2.434	0.893***	0.169	2.443
Female	525		Ref.			Ref.	
Marital Status							
Single	687	0.154	0.187	1.167	0.158	0.187	1.171
Married	450		Ref.			Ref.	
Occupation							
Student	328	0.331	0.292	1.393	0.334	0.292	1.396
Full-time employed	643	-0.110	0.252	0.896	-0.107	0.253	0.899
Retirees	28	-0.226	0.591	0.798	-0.224	0.591	0.799
Other	138		Ref.			Ref.	

Monthly income							
0 – 4500 ₺	359	-0.335	0.294	0.715	-0.338	0.293	0.713
4501 – 8500 ₺	130	-0.231	0.253	0.794	-0.236	0.253	0.790
≥ 8501 ₺	648		Ref.			Ref.	
Other Investments							
Stock	347	-0.590***	0.203	0.554	-0.586***	0.203	0.557
Foreign exchange	550	-0.669***	0.165	0.512	-0.667***	0.165	0.513
Gold	593	0.227	0.164	1.255	0.226	0.164	1.254
Deposits	237	0.094	0.180	1.099	0.100	0.180	1.105
None	251	0.364	0.247	1.439	0.368	0.247	1.445
Taken a finance course							
Yes	627		Ref.			Ref.	
No	510	0.043	0.155	1.044	0.041	0.155	1.042
Working in finance field							
Yes	116		Ref.			Ref.	
No	1021	-0.134	0.234	0.875	-0.126	0.235	0.881
Nagelkerke R^2			%23.2			%23.2	

*** denotes significance at 1% level, ** denotes significance at 5% level

The estimation results provide more surprising results in terms of level of confidence in financial decisions and tendency to being risk lover: Although both variables have a positive effect on crypto asset market participation, these effects are insignificant. One could argue that investing in crypto assets is a more suitable choice especially for risk lovers, because it is a more novel and volatile market compared to other assets. However, the results of our estimation demonstrate that this is not the case. A similar outcome also applies to the level of confidence in financial decisions variable: Being a so-called overconfident investor does not affect the participation decision in crypto asset markets.

In terms of analyzing the effect of financial literacy on investing in crypto assets, we reran our model by distinguishing basic and advanced level of financial literacy. The results are shown on the column under Model II. Interestingly, no relationship was found between basic level of financial literacy and participation in crypto asset markets. This is to say, basic financial literacy levels of individuals do not have a significant effect on investment decision on crypto assets. However, advanced level of financial literacy has a significantly positive effect on the decision of crypto asset markets participation ($p < 0.05$). For instance, every one unit increase in advanced financial literacy increases the probability of participation in crypto asset markets by 9.1% (odds ratio: 1.091; $p < 0.05$), which is higher than the effect of level of financial literacy analyzed in Model I. This shows that individuals equipped with higher level of advanced financial literacy are also more likely to engage in crypto asset markets. The results indicate the importance of having advanced financial literacy knowledge, rather than basic financial literacy for being able to invest in crypto assets. In the cause of the sharp price movements, stemming from the extremely volatile and risky nature of crypto assets, individuals with only basic level of financial literacy might be more hesitant to get into these markets and miss out on possible opportunities.

There are a number of interesting outcomes from the effects of control variables, as well. Firstly, it is noteworthy that age and gender both have significant effects on the decision of participation in crypto asset markets. Individuals aged between 18 and 24 are 6.6 times more likely to participate in crypto asset markets than those aged 55 and over. In a similar manner, probability of participating in the crypto asset markets decreases with age, with the results of

all age groups being significant at the 1% level. Thus, one can conclude that young individuals are more likely to invest in crypto assets. There is also significant evidence regarding the probability of men's participation in crypto asset markets being 2.44 times higher than women (reference category: female; $p < 0.01$). Another striking result is the negative effect of investing in stock options and foreign exchange on investing in crypto assets. In this case, the likelihood of investing in crypto assets for individuals investing in stocks and foreign exchange decreases, and the results are significant at the 1% level. One can argue that the respondents portray crypto assets as an alternative investment to stocks and foreign exchange. Another explanation could be that individuals investing in stock markets choose to abstain from increasing their portfolio risks by investing in crypto assets, which are even riskier than stocks. Foreign exchange investors, on the other hand, are in a manner that stay away from investing in risky instruments, hence from crypto asset markets.

4.2. The Profile of Turkish Crypto Investors

We asked crypto asset investors additional questions regarding their investments and general trading strategies in the market (see Appendix, crypto asset market questions) to identify whether there are differences among the investor profiles.

The table below provide information about the descriptives of crypto owners in our study. We have 367 crypto market participants: 75% of the respondents are male and 210 respondents are single. In addition, our sample consists mostly of young adults. 114 of them are between the ages of 18 and 24 and 109 of them are between the ages of 25 and 34.

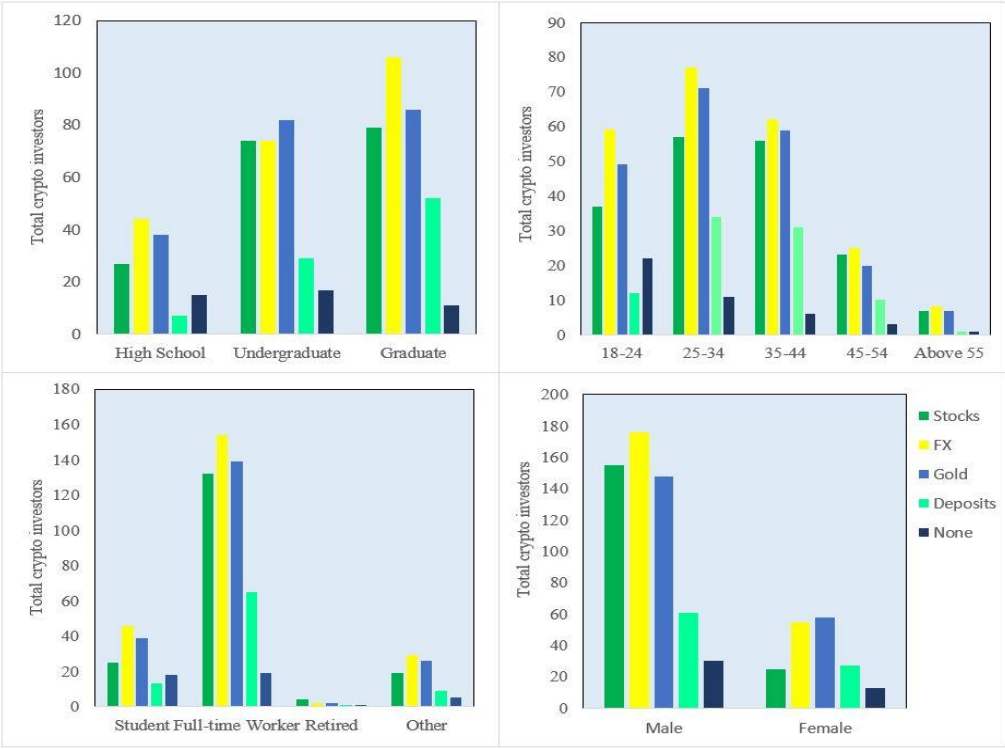
One can argue that being familiar with the field of finance has an impact on financial decisions, so we asked two questions about this topic. The majority of the respondents (252) have taken finance courses throughout their education. Monthly income is another demographic factor in the analysis: approximately 63 percent of respondents have incomes greater than 8500 ₺.

Table 4: Descriptives of Crypto Owners

	N	% of sample		N	% of sample
Gender			**Marital Status**		
Male	275	74.93%	Married	157	42.77%
Female	92	25.06%	Single	210	57.22%
Education			**Monthly income**		
High school and below	88	23.97%	0 – 4500 ₺	96	26.15%
Associate and bachelor	136	37.05%	4501 – 8500 ₺	40	10.89%
Master and above	143	38.96%	≥ 8501 ₺	231	62.94%
Age			**Occupation**		
18 – 24	114	31.06%	Student	92	25.06%
25 – 34	109	29.70%	Full – Time worker	222	60.49%
35 – 44	95	25.88%	Retirees	6	1.63%
45 – 54	38	10.35%	Other	47	12.80%
≥ 55	11	2.99%			
Taken a finance course			**Working in finance field**		
Yes	252	68.66%	Yes	52	14.16%
No	115	31.33%	No	315	85.83%

In Figure 6, bar charts represent the investment choices of crypto market investors in terms of age, gender, education and employment status. FX (44) and gold (38) are the most preferred financial products by respondents with only a high school diploma or less. Master's or doctoral degree holders, on the other hand, rely mostly on FX (106). While crypto owners between the ages of 25 and 34 also choose to invest in FX (77), retirees hold mostly stocks. In addition, we observe gender differences in investment choices of Turkish crypto owners: men prefer FX (176) whereas women lean towards gold (58).

Figure 6: Investment Choices of Crypto Asset Owners



Next, we tested whether financial characteristics (financial literacy, confidence in financial decisions and risk lover tendency) differ significantly among groups and, thus, performed normality tests. Shapiro – Wilk test (1965) results showed that our data of variables is not normally distributed, so we used non – parametric tests: Mann – Whitney U (1947) and Kruskal Wallis (1952) – H. Dunn's Post Hoc Test (1961) is then adopted to see which groups are statistically significantly different. Test results are shown in Table 5.

Table 5: Results of Non – Parametric Tests

	Invest Amount (Q1)	Invest Strategy (Q2)	Storing (Q3)	Token Ownership (Q4)	Coin Diversity (Q5)	Market React. (Q6)	F. Literacy	Risk Lover	Conf.
Gender	**0.003 *****	0.519	0.305	0.117	**0.022 ****	0.779	**0.000 *****	**0.000 *****	**0.005 *****
Age	**0.000 *****	**0.036 ****	0.762	0.546	0.901	0.355	**0.000 *****	0.335	0.494
18-24 v 25-34	**0.036 ****	**0.014 ****					**0.000 *****		
18-24 v 35-44	**0.000 *****	0.933					**0.000 *****		
18-24 v 45-54	**0.003 *****	0.757					**0.000 *****		
18-24 v ≥ 55	**0.003 *****	0.080					**0.000 *****		
25-34 v 35-44	0.053	**0.015 ****					0.055		
25-34 v 45-54	0.139	0.150					**0.037 ****		
25-34 v ≥ 55	**0.034 ****	0.479					0.224		
35-44 v 45-54	0.968	0.717					0.519		
35-44 v ≥ 55	0.212	0.076					0.717		
45-54 v ≥ 55	0.255	0.148					0.981		
Education	**0.019 ****	0.116	0.202	0.632	0.695	0.096	**0.000 *****	**0.018 ****	0.609
High s. and below v Ass. and bach.	**0.030 ****						**0.000 *****	**0.006 *****	
High s. and below v Mas. and above	**0.006 *****						**0.000 *****	0.262	
Ass. and bach. v Mas. and above	0.538						**0.003 *****	0.062	
Marital status	**0.001 *****	0.754	0.131	0.827	0.614	0.371	**0.000 *****	**0.003 *****	0.463
Occupation	**0.000 *****	0.212	**0.049 ****	0.281	0.566	0.105	**0.000 *****	**0.010 ****	0.775
Student v Full-time employed	**0.000 *****		0.704				**0.000 *****	**0.001 *****	
Student v Retirees	0.093		0.269				0.097	0.517	
Student v Other	**0.001 *****		**0.041 ****				**0.000 *****	0.135	

Full-tine employed v Retirees	0.581		0.215				0.379	0.728	
Full-time employed v Other	0.554		**0.010 ****				**0.008 *****	0.354	
Retirees v Other	0.758		0.820				0.897	0.991	
Monthly income	**0.000 *****	0.108	0.539	0.360	0.344	0.137	**0.000 *****	**0.034 ****	0.350
0-4500 ₺ v 4501-8500 ₺	0.177						0.200	0.088	
0-4500 ₺ v ≥8501 ₺	**0.000 *****						**0.000 *****	**0.012 ****	
4501-8500 ₺ v ≥8501 ₺	0.076						**0.000 *****	0.936	
Working in finance field	0.142	0.100	0.968	**0.002 *****	0.643	0.096	**0.002 *****	**0.010 ****	**0.000 *****
Taken a finance course	0.870	0.591	0.771	0.098	**0.035 ****	0.994	**0.000 *****	0.051	**0.043 ****

*** denotes significance at 1% level, ** denotes significance at 5% level

Findings indicate that there exist statistically significant differences among crypto asset owners in terms of crypto – specific and financial characteristics. Gender seems to be a decisive factor in many ways: males invest more money, (mean = 193.30 > 156.20; $p < 0.01$), hold more diverse cryptocurrencies (mean = 190.79 > 163.70; $p < 0.05$), have higher levels of financial literacy (mean = 203.43 > 125.91; $p < 0.05$), higher tendency for risk (mean = 202.20 > 129.60; $p < 0.01$) and higher level of confidence in financial decisions (mean = 192.94 > 157.29; $p < 0.01$).

We discovered significant differences among the age groups with respect to amount ($p < 0.01$), investment strategy ($p < 0.05$) and financial literacy ($p < 0.01$). 18 – 24 age group significantly differ from the other age groups. Education also plays a huge role. Amount of money invested in crypto assets ($p < 0.05$), financial literacy ($p < 0.01$) and risk lover tendency ($p < 0.05$) differ across educational levels. Specifically, respondents with only a high school diploma or less invest less money in crypto assets (mean = 157.92 < 195.90), are less financially literate (mean = 109.42 < 225.98) and have a lower tendency to engage in risky behavior (mean = 163.04 < 179.08) than those of master's or doctoral degree holders. Our results also reveal a statistically significant difference between the means of the two groups: married and single. Respondents who are not married invest less money ($p < 0.01$), have lower levels of financial literacy ($p = 0.000$) and are less risk lover ($p < 0.01$).

Employment status of respondents affect the storage choices ($p < 0.05$), financial literacy levels ($p = 0.000$), risk – taking behavior ($p < 0.01$) and amount of investment ($p = 0.000$). When we compare the means between groups, we find out that full – time workers invest more money (mean = 194.63 > 145.72), achieve higher levels of financial literacy (mean = 218.55 > 106.22) and are more risk lover (mean= 197.30 > 153.26) than students but we observe no difference between the means of retirees and students. Along with this, amount of investment, financial literacy and risk lover tendency differ related to monthly income of the crypto owners.

Respondents with the monthly income of 0 – 4500 ₺ significantly differ from respondents with income above 8500 ₺.

Lastly, we attempted to establish the role of working in finance field and having taken a finance course. Based on the results of non – parametric tests, finance employees show higher financial literacy levels (mean = 225.50 > 177.15; $p < 0.01$) and higher tendency to take risk (mean = 219.14 > 178.20; $p < 0.05$) than non – finance employees. They are also more confident in their financial decisions (mean = 254.57 > 172.35; $p = 0.000$) and invest more in a projects such as Launchpad. ICO and DAO (mean= 210.96 > 179.55; $p < 0.01$). Besides, respondents who have taken a finance course are more financially literate (mean= 192.82 > 157.51; $p = 0.000$), have higher confidence (mean=192.82 > 169.87; $p < 0.05$) and own more cryptocurrencies (mean=192.57 > 170.27; $p < 0.05$) than those who have not taken such a course. So one can conclude that working in finance field and having taken a finance course affect portfolio diversification decisions and general financial knowledge of Turkish crypto owners.

5. Concluding Remarks

Due to the increasing complexity of financial instruments, concept of financial literacy and understanding the dynamics of financial markets gain importance for financial market participants, policymakers and regulators. Although trading in traditional financial markets is generally considered to be in relation to financial literacy or financial knowledge, there is limited evidence that the same relationship occurs in crypto asset markets. Crypto assets exhibit higher return potential but also involve higher risk. So, more meticulous investment decisions must be made in these markets. Thence it should be taken into account that basic financial information may be inadequate when trading in crypto asset markets.

As noted by Rooij et al. (2011); Almenberg and Dreber (2015); Rooij et al. (2012), it can be stated that there is a relationship between participation in traditional financial markets and levels of financial literacy. Crypto asset markets also have the same dynamics in terms of trading mechanism and market structure but existence of this kind of relationship is still debated. According to Zhao and Zhang (2021) and Santoso and Modjo (2022), financial literacy and crypto asset market participation are not related to each other. However, Fujiki (2020) has found significant and positive relationship between. Especially considering that these results were obtained from different investor profiles in several countries, our study offers an important contribution to the relationship among financial literacy and crypto market participation in Turkey.

We carried out a survey between May and November 2022, which includes questions on financial literacy, behavioral biases, demographic factors and crypto market participation. Based on the data collected from 1137 Turkish participants, we found that there is a positive and statistically significant relationship between financial literacy and crypto market participation in line with those of an earlier study by Fujiki (2020). Regression analysis indicate that Turkish investors with higher financial literacy levels are more likely to engage in crypto asset markets. A unitary increase in financial literacy, increases the likelihood of participation by 7.7 percent.

Our models have achieved remarkable results in terms of basic and advanced financial literacy. While basic literacy has no statistically significant impact on crypto market participation, advanced literacy seems to have a significant positive effect on participation behavior. This finding reveals an important aspect of crypto asset investor profile in Turkey:

they make information – based crypto – asset transactions with rational expectations. In other words, while investors equipped with basic financial literacy (low level of financial literacy) may prefer not to participate in crypto – asset markets which they may perceive to be riskier than they actually are, investors with high levels of advanced financial literacy may be more eager to participate. Considering the irrational price movements and noise trading in crypto – asset markets, investors with low levels of literacy may have been washed out because of high losses experienced in the pre – survey and survey period. This result, which is compatible with Adaptive Markets Hypothesis by Lo (2004), also provides a sight about the investor profile in Turkey.

Our empirical analysis does not just discover the relationship among crypto market participation and financial literacy, but also tries to shed light on the behavioral biases and demographic factors. From this point of view, results show that both confidence in financial decisions and risk lover tendency have positive but statistically insignificant impact on levels of financial literacy. Hence, we cannot accept our second and third hypotheses for Turkish investors.

With regard to the demographic characteristics affecting participation behavior, age seems to have a significant impact on the crypto market participation but this effect decreases with an advancing age. This finding proves that the tendency to invest in risky assets is higher among young adults. Gender also affects market participation. Men are 2.44 times more likely to participate in crypto asset markets than women. All other control variables in the research have no significant effect on crypto asset investments.

We discussed the relationship between investing in traditional assets and participation in crypto asset markets and found out that engaging in stock markets and FX trading negatively affects crypto market participation. To put it differently, investors taking positions in stock and FX markets are not willing to participate in crypto asset markets. One reason that could be speculated for this result is the investors do not tend to increase total portfolio risk excessively, they rather prefer having balanced portfolio.

Finally, we tried to establish the profile of Turkish crypto asset investors. Our analysis indicated that there are statistically significant differences among crypto owners in terms of financial literacy, behavioral biases and crypto market investments and strategies. We discovered significant differences with respect to demographic variables in financial literacy, risk lover tendency and confidence in financial decisions. An amount of money invested in crypto assets, investment strategies and preferences also differ between groups.

The major limitation of the study is the sample itself. The survey respondents consist of people living in Turkey. Conducting studies in other countries may yield different results. Future research may wish to discover behavioral finance theories that affect participation in crypto – asset markets. In addition, the levels of financial literacy of crypto investors and traditional investors can be assessed in a comparative way. Increasing number of studies on crypto – asset markets may bring new research topics on crypto – asset literacy and its determinants.

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Appendix

To access full survey form:
https://docs.google.com/document/d/1nj07DKWwJpG_tP5YoF6jicFpbFr4bk_JtkUgmm1JdrE/edit?usp=sharing