


Is Popularity of Technical Analysis a Product of Low Financial Literacy and Overconfidence Among Stock Market Investors?

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Teknik Analizin Popülaritesi, Hisse Senedi Piyasası Yatırımcıları Arasında Düşük Finansal Okuryazarlığın ve Aşırı Güvenin Bir Ürünü Mü?	Is Popularity of Technical Analysis a Product of Low Financial Literacy and Overconfidence Among Stock Market Investors?
Öz Komisyon giderleri, içeriden öğrenenlerin ticareti, spreadler ve kurumsal yatırımcıların yüksek frekanslı algoritmaları gibi faktörler nedeniyle işlem sıklığının artmasıyla bireysel yatırımcıların hisse senedi piyasalarındaki toplam getirisi azalmaktadır. Bu çalışmada, teknik analiz yöntemine inanma ile yatırımcıların finansal okuryazarlık düzeyi, aşırı güven ve yüksek getiri beklentileri arasındaki ilişki 3.844 kişiye ait anket verileri kullanılarak analiz edilmiştir. Yüksek frekanslı işlemlerde teknik analizin etkinliği ve başarısı, yatırımcının analitik becerilerine bağlı olsa da; teknik analiz ve ticaretin, finansal okuryazarlığı düşük ve irrasyonel yüksek getiri beklentileri olan kişiler arasında oldukça popüler olduğu tespit edilmiştir.	Abstract Individual investors' overall return in stock markets decreases with the increase in trading frequency due to factors such as commission expenses, insider trading, spreads, and institutional investors' high-frequency algorithms. In this study, the relationship between believing the technical analysis method and the financial literacy level, overconfidence, and high return expectations of investors have been analyzed with the use of survey data of 3,844 people. Although the efficiency of technical analysis and success in high-frequency trading depends on investor's analytical skills, it is found that technical analysis and trading are very popular among people who have low financial literacy and irrational high return expectations.
Anahtar Kelimeler: Teknik Analiz, Aşırı Güven, Finansal Okuryazarlık, Kumar	Keywords: Technical Analysis, Overconfidence, Financial Literacy, Gambling
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Bu çalışma, 10.02.2021 tarih ve 2021/01 sayılı Ufuk Üniversitesi Sosyal ve Beşerî Bilimler Araştırma ve Yayın Etiği Kurulu Karar Belgesi ile bilimsel araştırma ve yayın etiği kurallarına uygun olarak hazırlanmıştır.

Yazarların Makaleye Olan Katkıları

Yazar 1'in makaleye katkısı %100'dür.

Çıkar Beyanı

Yazar açısından ya da üçüncü taraflar açısından çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

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1. Introduction

Fundamental analysis and technical analysis are two very popular methods that are used by investors in the stock markets (Bettman, Sault, and Schultz, 2009; Brown, Jennings, 1989; Greig, 1992). Regarding fundamental analysis, starting with Dodd and Graham (1934) there is extensive literature, and its validity has been confirmed many times (Wafi, Hassan and Mabrouk, 2015). On the other hand, the acceptability of technical analysis especially in practice is a question mark on which academics could not build consensus. Although studies in technical analysis have been started long ago, recent technological developments and quant funds have a huge impact on the profitability of technical analysis tools. In their study, Park and Irwin (2007) have reviewed the modern studies on the profitability of technical analysis starting with the 1990s. According to their results, 56 of the 95 modern studies have found positive abnormal results by the use of technical analysis tools, they also highlighted the drawbacks of these studies including data snooping, transaction costs, spreads, and some other concerns during the implementation of trades. There are also various studies examining the returns obtained by investors who trade frequently or use technical analysis. Lewellen, Lease, and Schlarbaum (1980) studied the investment styles and performances of individual investors. They have used the trade data of 972 individuals in the years between 1964 and 1970. According to the findings of their study, 27% of the investors are in the high-turnover group who are described as frequent margin users, taking short positions often and more receptive to the suggestions of their advisors. The study showed that the high-turnover group has a 4.1% lower performance than the other investors. Odean and Barber (2000) analyzed the trading frequency and return of 66,465 individual investors between 1991 and 1996. According to their results, the return of the individuals, who has a high turnover rate, is 11.4% which is 6.5% lower than the market return of 17.9%. The difference in annual return between individuals with high and low turnover is 6.8%. In a recent study, Hoffmann and Shefrin (2014) analyzed the performance of individual investors using the technical analysis method. In the study carried out in the Netherlands, where brokerage firm data and survey study were used, the information of 5500 people was included. According to the findings obtained, investors using technical analysis focus on short-term results, have high turnover rates with concentrated portfolios and obtain lower returns compared to other investors. Gerritsen (2016) tested 5017 buys and sell signals based on technical trading rules which are recommended by banks and online signal services. It has been found that these recommendations did not offer additional returns to investors. Other similar studies also reported that investors using technical analysis have overconfidence but poor results (Hoffmann and Post, 2016; Kubińska et al., 2018). Advanced knowledge in statistics and mathematics is required to be successful in technical analysis (Dourra and Siy, 2002). High financial literacy changes traders' trading behavior and enables them to trade at a lower frequency. In this way, they can reduce transaction costs and increase their returns (Jiang et al., 2020). Many investors have proven to be successful by making long-term investments with the use of fundamental analysis instead of technical analysis (Vanhaverbeke, 2014). So, it is important to determine the motivation of those who are interested in technical analysis. Three reasons may cause investors to believe in the technical analysis even though they have a high risk of losing their capital. These are (1) low financial literacy, (2) overconfidence, and (3) irrational high return expectations.

Several studies in the literature examined the relationship between financial literacy, self-confidence, return expectation and trading frequency. While technical analysis is common

when trading high frequency, not all traders use technical analysis. In addition, studies in the literature show that investors using technical analysis do not get successful results. Today, the use of technical analysis maintains its popularity and technical analysis training emerges as an important trade area. For example, a search on Udemy, a popular education sales site, with the keywords "Technical analysis stock market" yields 10,000 results. It is observed that over 50,000 students enrolled in some of these trainings by paying a fee. In addition, when it is searched for "technical analysis" on Youtube, it is seen that hundreds of thousands of people watch videos teaching this method. It is quite common in paid training that promises high returns in technical analysis. Although technical analysis is an inefficient method, the reasons why it maintains its popularity is an interesting topic that has not been covered in the literature. In this study, in order to contribute to the literature by filling this gap, the main factors that led investors to believe in technical analysis, even if the results are negative, are examined. The findings of this study reveal that investors who believe in technical analysis should question their own financial knowledge and expectances. In addition, the results of this research supply academic evidence to regulatory authorities which motivate them to audit technical analysis trainings to protect consumers and to take necessary measures to increase the financial literacy level of investors.

Another contribution of the study to the literature is that Borsa İstanbul was chosen as the field of study. Borsa İstanbul is the exchange with the fastest trading frequency in the world in terms of transaction volume / market value excluding Nasdaq and Shenzhen Stock Exchanges. Borsa İstanbul's volume / market value ratio is 4 times the Hong Kong stock market; 3 times the New York stock market and 36% higher than the Shanghai Stock Exchange (TSPB, 2020). As of 2020, the average holding period of individual investors in Borsa İstanbul is 18 days, while the average holding period of foreign investors with a much higher portfolio size is 74 days (MKK, 2021). Although different factors that cause investors to have a high trading frequency, one of the main ones is the use of technical analysis (Hoffmann and Shefrin, 2014: 498). It is thought that examining a developing market with this characteristic will contribute to the literature.

The remained parts of the paper are as follows: Section 2 summarizes studies in the literature that examine the impact of financial literacy, self-confidence, and high return expectation on stock markets. Section 3 defines the data set and the variables used in the research. Section 4 presents the results obtained by cross-table analysis and ordered logit regression analysis. Section 5 concludes the paper.

2. Literature Review

People cannot make the right investment decisions without basic financial knowledge. With technological developments, financial markets are developing, many different financial products are offered to ordinary people, as a result, people's need for financial literacy becomes more important than in the past (Lusardi and Mitchell, 2014). A recent international study showed that only one out of three adults is financially literate (Klapper and Lusardi, 2020). Several studies in the literature examine financial literacy and people's investment preferences. These studies show that there is a positive relationship between financial literacy and participation in the stock market (Balloch, Nicolae, and Philip, 2015; Munir et al., 2020; Sivaramakrishnan, Srivastava and Rastogi, 2017; Van Rooij, Lusardi and Alessie, 2011). Financial literacy is positively correlated with stock market diversification (Anwar, Khan, and Rehman, 2017; Mouna and Jarboui, 2015). Most of the stock market investors do not have sufficient knowledge about financial markets (Arora and Marwaha, 2013; Van Rooij, Lusardi, and Alessie,

2011). On the other hand, it is seen that stock investments contribute to people's financial literacy level (Harter and Harter, 2010). In this study, the answer to the following research question was sought and a contribution was made to the financial literacy literature.

RQ1: Is there a relationship between investors' financial literacy and knowledge of stock markets, and their belief in the validity of the technical analysis method?

Obtaining a higher-than-market return in the stock market is a difficult task. The probability of making accurate predictions is not high and it is often difficult to measure actual performance. On the other hand, the risk of losing capital causes only confident investors to step into the stock market. So, there is a positive correlation between overconfidence in financial literacy and participation in stock investment (Balloch, Nicolae, and Philip, 2015; Xia, Wang, and Li, 2014). De Bondt and Thaler (1985) showed in the overreaction theory that markets can overreact to positive or negative developments in some companies, while the momentum process that occurs in the short run is balanced with the adverse price movement in the long run. High returns in the market increased the confidence of investors and as a result, the amount of trade in the market increased in the following periods (Chuang and Lee; 2006; Hsu and Shiu, 2010; Statmen, Thorley and Vorkink, 2006). Investors who are overconfident about their investment skills and past performance trade more (Barber and Odean, 2001; Glaser and Weber, 2007; Graham et al., 2009; Odean, 1998). Overconfident investors underestimate risk and trade more in riskier securities (Chuang and Lee, 2006). Although they do quite well in the first few trades, the returns for frequent traders are gradually reduced in subsequent trades (Hsu and Shiu, 2010). In this paper, studies that examine the relationship between investors' self-confidence and stock market investments are taken one step further and the following research question has been investigated.

RQ2: Is there a relationship between investors' overconfidence and their belief in the validity of the technical analysis method?

While stock markets offer an important alternative for rational investors to make use of their savings, they also create a suitable environment for gamblers (Statman, 2002). If a lottery draw is considered, the amount of prize that the participants will win comes from other participants' losses. Considering the organizer's profit and other expenses, the price paid by the participants is higher than the prize the winner will receive. A similar situation is valid in the stock market with high-frequency trading. Valuations of companies are much more stable compared to momentarily changing share prices, and often share price changes do not reflect actual valuation changes. Besides, many traders can pay more commission expenses than the added value created by companies. Even though trading is a negative-sum game in the short term because of the commission expenses, the hope of winning drives some lottery lovers into the stock market. Kumar (2009) has shown that there is a positive correlation between lottery demand and lottery-type stocks in economic downturns. People who like to gamble or invest in stocks are twice as likely to trade as others (Dorn and Sengmueller, 2009). To reach more information about investors who approach stock market investment in a gambling manner, the following research question is examined in this study.

RQ3: Is there a relationship between investors' irrational high return expectations and their belief in the validity of the technical analysis method?

3. Methodology

3.1 Data

This study has been prepared in accordance with the scientific research and publication ethics rules with the Decision Document of the Social and Human Sciences Research and Publication Ethics Committee of Ufuk University, dated 10.02.2021 and numbered 2021/01. An online questionnaire was created to collect the data needed within the scope of this study. During the preparation of the questionnaire, opinions of two expert researchers were taken. Later, a pre-test group of 30 people was used to test the understandability and effectiveness of the questions. The necessary revisions were made in the questionnaire by benefiting from the feedback received from this test group. Participants were invited to fill out the questionnaire through popular accounts on Twitter, mostly followed by Turkish stock market investors. The relevant invitation message was viewed by 527,621 people, 3,844 of these people answered the questionnaire. A total of 42 questions were asked in the questionnaire, and participants were not required to answer all questions. Despite this, it was determined that the ratio of the questions that the respondents answered on average to the total questions was 99%. The questionnaire consists of 6 parts. In the first part, demographic information of the participants was asked. In the second part, separate questions were asked whether the survey participants believed in the validity of the technical analysis and fundamental analysis. In the third part, the question about the self-confidence of the survey participants was asked. In the fourth part, it is tried to understand whether the survey participants have irrational expectations or not. In the fifth part, questions about financial literacy were asked. In the sixth part, questions regarding the information about the stock market investment knowledge were asked.

3.2 Variables of the Research

The aim of this study is to analyze the factors that affect the choice of method used by stock investors for investment decisions. Therefore, belief in the effectiveness of technical analysis and fundamental analysis methods were used as dependent variables. Using a 5-point Likert scale ((1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly agree), the participants were asked to what extent they agree with the statement of "I think the technical (fundamental) analysis is a good way to invest". The answers to this question have been used as dependent variable.

Independent variables of the study include (1) financial literacy, (2) stock market investment knowledge, (3) overconfidence, and (4) high return expectations. For the determination of financial literacy Vieira, Potrich, and Bressan's (2020) proposal for financial knowledge scale has been used. The questions have been reorganized for the Turkish people. The aim of the questions is to measure participants' general financial knowledge that they can use in everyday life, independent of stock markets. Two questions were used to determine each of the beginning, intermediate and advanced levels of financial literacy. The questions and their answers are shown in Table 1. Correct answer ratios for these six questions differ from 78% to 95%.

Table 1: Financial Literacy Questions and Answers

Focus	Question	Answer	Correct answer
Discount/ consumption	1. Suppose you saw the same TV in two different stores for the starting price of 5000 TL. Store A offers a 750 TL discount, while store B offers a 10% discount. What is the best choice?	Buy in store A	95.4%
Math	2. Imagine that five friends receive a donation of 10000 TL and they need to share the money equally between them. How much will each get?	2000 TL	92.2%
Time value of money / investment	3. Suppose you put 10000 TL into a savings account that yields 10% per year. What would be the balance at the end of the first year if you do not make any deposits or withdrawals in the period?	11000 TL	95.2%
Financial products / investment types	4. Usually, which asset typically has the largest oscillations over time?	Stocks	90.2%
Time value of money / compound interest / debt management	5. Ali gets a 10000 TL loan that has an interest rate of 20% per year compounded annually. If he does not make repayments on the loan and at this interest rate, how many years would it take for the amount due to double?	Less than 5 years	78.0%
Diversification / risk management	6. You can reduce the risk of investing in the stock market by buying a wide range of stocks. This statement is:	TRUE	88.6%

Notes: This table shows six financial literacy questions used to evaluate the financial literacy variable. The questions have been obtained from Vieira, Potrich, and Bressan's (2020). Participants were instructed to choose one of the multiple choices, including the "I don't know" alternative. In the last column of the table, the percentages of the participants who gave the correct answer are indicated. 1 TL equals approximately \$ 0.13.

Investing in stocks requires knowledge of financial markets, so ordinary financial literacy skills are not enough to invest in the stock market. Like Li, Li, and Wei (2020) and Volpe, Kotel, and Chen (2002) special set of questions have been used to measure the stock market experience and knowledge of participants. The purpose of these questions is to understand whether investors have the necessary knowledge on fundamental issues such as the ability to understand the financial statements of companies, the return that can be achieved in the stock market, and risk management. The questions, answers, and correct answer percentages of this phase have been shown in Table 2. 94% of the participants of the survey are active stock market investors however results related to their stock market knowledge are poor with correct answer rates ranging between 27% and 73%.

Table 2: Stock Market Knowledge Questions and Answers

Focus	Question	Answer	Correct answer
Stocks price movements / math / statistics	1. The return of the BIST100 index in 2019 was 25.4%. How many of the 249 trading days in the same year could the stock exchange perform positively?	135	36.0%
Compound return	2. If an investor starts investing with 10.000 TL, earns 2% every week, how much the worth of his investment will reach after 10 years?	>100 million TL	24.5%
Financial tables	3. Which of the following shows the assets, liabilities and equity of a company at the end of a certain period?	Balance sheet	73.1%
Balance Sheet	4.If firm A has 7000 TL debt and 10 000 TL equity, what are the assets of firm A?	17 000 TL	32.0%
Income statement	5. Company A's sales are 50 000 TL, its sales cost is 40 000 TL, and its general expenses are 10 000 TL. What is the gross profit of firm A?	10 000 TL	31.6%
Capital increase	6. How does the company's equity change if there is a capital increase through bonus issues?	not change	65.3%
Capital increase and tax	7. The decision to distribute a cash dividend of a company that made a paid capital increase in the same year the tax burden of the company partners according to the cash amount obtained that year.	Increases	34.3%
Risk management / finance mathematics	8. Consider the companies below and their beta values. Which stock will outperform others when the stock market rises by 10%?	Purple company with the beta of -1.10	27.2%

Notes: This table shows eight stock market knowledge questions used to evaluate the stock market knowledge variable. The questions have been asked in the Turkish language and they are related to the Turkish stock market. Questions 4 and 5 have been obtained from Kılıç, Ata, and Seyrek (2015), question 8 from Volpe, Kotel, and Chen (2002). Other questions prepared by the author. Participants were instructed to choose one of the multiple choices. In the last column of the table, the percentages of the participants who gave the correct answer are indicated.

Overconfident and underconfident variables has been determined similar to Chu et al.'s (2017) and Xia, Wang, and Li's (2014) methodologies. The confidence question "I think I will be more successful in the stock market than an average investor" was asked first. The answer to this question and the responses of the participant to the questions of financial literacy and stock market knowledge were compared. If the participant answered "strongly agree" or "agree" to the question of confidence and at the same time scored below the average in a 14-question test measuring knowledge about financial literacy and stock markets, these participants were considered overconfident. If the participant answered "strongly disagree" or "disagree" to the question of confidence and at the same time scored above average in a 14-question test measuring knowledge about financial literacy and stock markets, these participants were considered underconfident.

In order to understand the participants' irrational return expectations level, they were asked whether they plan to double their money every year, on the 5-point Likert scale (strongly agree: 5, strongly disagree:1). Respondents who strongly agree or agree with this statement are classified as having irrational return expectations.

In the study, descriptive statistics were created first. Afterward, the existence of the relationship between technical analysis and independent variables was examined by cross-table analysis. Finally, ordered logit regression analysis was performed using different combinations of independent variables.

4. Results

4.1. Descriptive Statistics

Summary statistics of the research are presented in Table 3. 3844 people answered the questionnaire. Although the survey is open to everyone, the male population is dominant due to the greater interest of males in the stock market (Almenberg and Dreber, 2015). While the average correct answer rate for financial literacy questions is 5.47 out of 6 questions, the average rate of correct answers given to questions about stock market knowledge is 3.14 out of 8 questions. It is observed that as the level of income, financial wealth, education level, and experience in the stock market increase, the financial literacy level of individuals increases, but their belief in technical analysis decreases.

Table 3: Summary Statistics

Variable	Category	N	Financial Literacy	Stock market knowledge	Technical Analysis	Fundamental Analysis	Expectance to Win the Market
Gender	Female	160	5.28	2.58	4.00	4.09	3.06
	Male	3,666	5.48	3.17	3.63	4.32	3.46
Age	<18	15	4.67	2.13	3.37	4.00	3.86
	18-25	464	5.31	3.02	3.79	4.43	3.72
	26-35	1,444	5.47	3.33	3.36	4.38	3.47
	36-45	1,355	5.52	3.09	3.27	4.27	3.39
	46-55	447	5.51	2.98	3.43	4.16	3.30
	56-65	107	5.55	2.94	3.51	4.16	3.25
	>65	9	4.89	2.56	3.60	4.00	3.13
Marital Status	Married	2,450	5.50	3.15	3.63	4.30	3.37
	Single	1,375	5.41	3.14	3.39	4.34	3.58
Monthly Income	<2500 TL	433	5.31	2.99	3.36	4.36	3.63
	2501-5000 TL	667	5.29	2.61	3.53	4.23	3.36
	5001- 10000 TL	1,578	5.48	3.14	3.50	4.32	3.39
	10001- 20000 TL	786	5.62	3.49	3.38	4.31	3.48
	>20000 TL	368	5.66	3.66	3.32	4.35	3.53
Financial Savings	<10000 TL	403	5.21	2.59	3.10	4.26	3.47
	10000-50000 TL	784	5.36	2.85	3.67	4.27	3.35
	50001-250000 TL	1,359	5.46	3.16	3.50	4.32	3.44
	250001-1000000 TL	896	5.59	3.35	3.39	4.33	3.46
	>1000000 TL	389	5.73	3.84	3.27	4.38	3.62
Financial Profession	Yes	1,025	5.49	3.64	3.05	4.28	3.56
Education Level	None	2	2.50	1.50	3.42	4.50	4.50
	Primary School	54	5.19	1.91	4.50	3.96	3.25
	High School	320	5.23	2.21	3.43	4.31	3.39
	Bachelor's degree	2,531	5.46	3.14	3.59	4.32	3.46
	Master's degree	765	5.60	3.57	3.38	4.30	3.47
	Doctorate	166	5.61	3.58	3.26	4.36	3.29

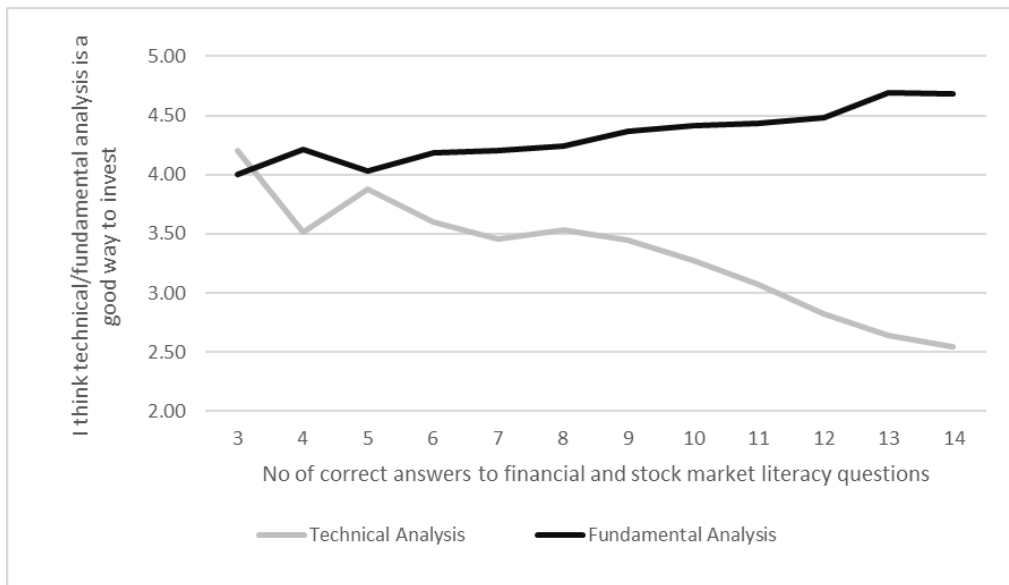
Tablo 3 Cont.

Variable	Category	N	Financial Literacy	Stock market knowledge	Technical Analysis	Fundamental Analysis	Expectance to Win the Market
Stock Market Experience	None	229	5.06	2.32	3.41	3.77	2.88
	< 1 year	913	5.36	2.75	3.57	4.34	3.43
	1- 2 years	956	5.49	3.24	3.45	4.33	3.44
	3 - 5 years	949	5.54	3.34	3.34	4.40	3.47
	6 - 10 years	377	5.55	3.43	3.31	4.28	3.49
	> 10 years	420	5.63	3.54	3.33	4.35	3.71
Average Holding Period of Stocks	I did not invest in stocks	235	5.24	2.45	3.42	3.77	2.87
	0 - 1 day	16	5.13	3.25	3.53	4.19	3.44
	2 days - 7 days	186	5.42	2.96	4.00	4.00	3.63
	8 days - 90 days	1,354	5.44	2.95	4.07	4.25	3.41
	91 days - 12 months	1,147	5.52	3.36	3.76	4.43	3.51
	13 months - 5 year	735	5.54	3.46	3.15	4.49	3.53
	> 5 years	160	5.56	3.18	2.89	4.34	3.54
Return Expectation	None	206	5.15	2.29	2.88	3.92	2.97
	0%-4%	70	5.37	3.09	3.49	4.20	3.11
	5%-10%	467	5.43	3.30	3.51	4.30	3.29
	11%-15%	610	5.55	3.35	3.12	4.31	3.45
	16% - 20%	695	5.56	3.26	3.11	4.35	3.44
	21% - 30%	663	5.51	3.19	3.38	4.37	3.48
	>30%	1,116	5.44	3.06	3.40	4.34	3.60
Irrational High Return Expectation		1,019	5.63	3.64	3.86	4.49	4.11
Overconfident		843	5.09	1.89	3.65	4.36	4.19
Underconfident		141	5.86	4.62	3.12	4.20	1.80

Notes: This table shows the summary statistics of the 3844-person sample used in the study. The financial literacy variable in the fourth column shows the arithmetic mean of correct answers to 6 related questions. The stock market knowledge variable in the fifth column shows the arithmetic mean of correct answers to 8 related questions. For the technical analysis, fundamental analysis, and expectance to win the market variables, a 5-point Likert scale has been used. On the Likert scale, the answers are scored with 5 points strongly agree and 1 point strongly disagree. 1 TL equals approximately \$ 0.13.

Fig. 1 shows financial and stock market knowledge scores of the participants out of 14 questions and their beliefs whether the technical or fundamental analysis is a good method for investment on a 5-point Likert scale, with 5 being strongly agreeing and 1 strongly disagreeing. As the level of financial literacy increases, it is seen that the belief about the usefulness of the technical analysis method decreases, while the belief about fundamental analysis increases.

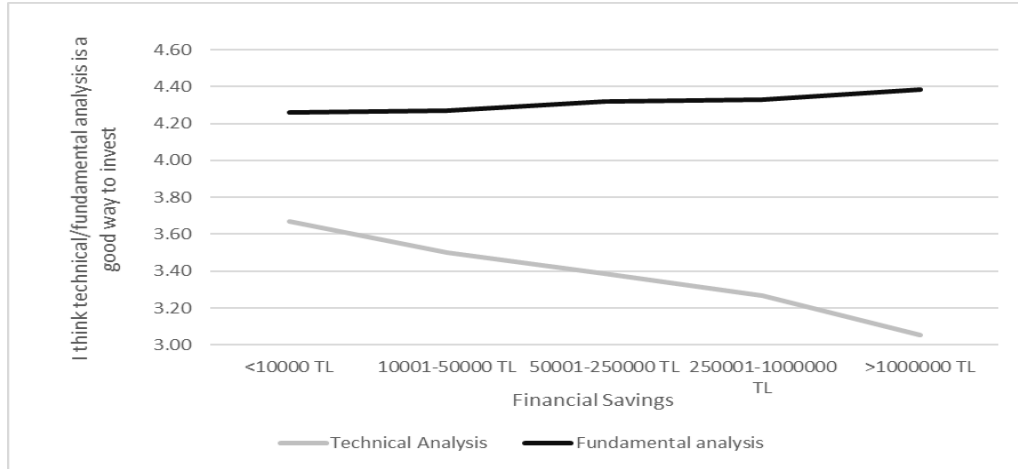
Figure 1: The Relationship between Belief in Validity of Technical or Fundamental Analysis and Financial and Stock Market Knowledge



Note: Participants were asked 6 questions about financial literacy and 8 questions to measure their knowledge of the stock market. The X-axis shows the number of correct answers given by the participants over a total of 14 questions. The Y-axis shows to what extent participants believe the validity of the technical (fundamental) analysis. To calculate this value, the survey participants were asked to what extent they agreed with the statement "I think technical (fundamental) analysis is a good way to invest". Answers were taken on a 5-point Likert scale (1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly agree). Fewer than 20 people have 0, 1, and 2 correct answers on and financial and stock market knowledge test. Since the statistical significance of these groups is low, they are not shown in the graph.

Fig. 2 shows the financial savings of the participants and their beliefs whether the technical or fundamental analysis is a good method for investment on a 5-point Likert scale, with 5 being strongly agreeing and 1 strongly disagreeing. As the financial savings of the participants increase, their beliefs about the validity of technical analysis decrease significantly.

Figure 2: The Relationship between Belief in Validity of Technical or Fundamental Analysis and Financial Savings



4.2. Cross Table Analyses

Table 4 shows the relationship between the participants' beliefs in technical analysis and fundamental analysis and their correct answers to the questions that measure their financial knowledge level consisting of 14 questions (Financial literacy questions consisting of 6 questions and stock market knowledge questions consisting of 8 questions). It is seen that the group with the highest level of financial literacy believes in the benefit of fundamental analysis but does not believe in technical analysis.

Table 4: The Relation between Belief in Technical and Fundamental Analysis and Overall Financial Literacy Scores of Participants

		I think technical analysis is a good way to invest					Overall
		1 (Strongly Disagree)	2	3	4	5 (Strongly Agree)	
I think fundamental analysis is a good way to invest	1 (Strongly Disagree)	7.89 (27)	8.38 (32)	9.5 (16)	9.21 (14)	7.9 (10)	8.49 (99)
	2	8 (7)	8.18 (44)	7.67 (12)	8 (14)	8.56 (18)	8.15 (95)
	3	10.5 (2)	8.44 (16)	7.46 (165)	7.74 (39)	7.77 (35)	7.63 (257)
	4	9.55 (33)	9.16 (182)	8.32 (256)	8.29 (849)	8.07 (115)	8.42 (1435)
	5 (Strongly Agree)	9.75 (259)	9.46 (360)	8.94 (324)	8.86 (527)	8.22 (467)	8.95 (1940)
	Overall	9.55 (328)	9.21 (634)	8.41 (777)	8.49 (1445)	8.17 (646)	8.61 (3844)

Notes: The values in the table show the average financial literacy and stock market knowledge scores of the participants out of 14. All participants were asked 6 questions about general financial literacy and 8 questions about stock market knowledge. Columns show belief in technical analysis and rows show belief in fundamental analysis. Numbers in the parenthesis shows the number of participants who selected the related answers.

Table 5 shows the irrational return expectations of the participants and their choice of the analysis method. It is seen that as the belief in fundamental analysis increases, return expectations decrease, on the other hand, there is a positive relationship between technical analysis and high return expectations.

Table 5: The Relation between Belief in Technical and Fundamental Analysis and Irrational High Return Expectations of Participants

		I think technical analysis is a good way to invest					Overall
		1 (Strongly Disagree)	2	3	4	5 (Strongly Agree)	
I think fundamental analysis is a good way to invest	1 (Strongly Disagree)	2.26 (27)	2.03 (32)	2.13 (16)	1.86 (14)	3.2 (10)	2.2 (99)
	2	2.71 (7)	2.23 (44)	2.17 (12)	2.64 (14)	2.78 (18)	2.42 (95)
	3	2 (2)	2.44 (16)	2.33 (165)	2.72 (39)	2.31 (35)	2.39 (257)
	4	1.85 (33)	1.98 (182)	2.22 (256)	2.46 (849)	2.66 (115)	2.36 (1435)
	5 (Strongly Agree)	1.71 (259)	1.89 (360)	2.01 (324)	2.31 (527)	2.62 (467)	2.18 (1940)
	Overall	1.79 (328)	1.96 (634)	2.16 (777)	2.4 (1445)	2.63 (646)	2.27 (3844)

Notes: The values in the table measure the irrational return expectations of the participants on a 5-point Likert scale. To determine the irrational return expectations, participants were asked if they think they can double their money every year during the time they invested in the stock market. The answer categories are scored as strongly agree 5, agree 4, undecided 3, disagree 2, and strongly disagree with 1 point. Columns show belief in technical analysis and rows show belief in fundamental analysis. Numbers in the parenthesis shows the number of participants who selected the related answers.

To examine the relationship between the trading frequency of investors and their financial literacy and belief in technical analysis, t-tests performed, and results are shown in Table 6. It is seen that investors with short holding periods (or in other words, high trading frequency) have low financial literacy and believe in the validity of the technical analysis method more than other investors.

Table 6: Holding Period, Financial Literacy Scores and Belief in Technical Analysis

Holding Period	N	Overall Financial Literacy Score		Financial Literacy Score		Technical Analysis	
		Mean	t stat	Mean	t stat	Mean	t stat
I did not invest in stocks	235	7.69***	6.79	5.24***	4.18	3.53*	1.86
0- 7 days	202	8.38	1.57	5.40	1.14	4.06***	8.30
8 days - 90 days	1354	8.38***	3.56	5.44	1.15	3.76***	11.02
91 days - 12 months	1147	8.88***	3.86	5.52**	2.12	3.15***	5.75
13 months - 5 year	735	9.00***	4.70	5.54**	2.19	2.89***	10.58
> 5 years	160	8.74	0.74	5.56	1.38	2.88***	5.29
Overall	3833	8.61	0.00	5.47	0.00	3.38	0.00

Notes: Overall financial literacy score has been calculated out of 14 questions (6 basic financial literacy questions and 8 stock market knowledge questions.) Financial literacy score has been calculated out of 6 basic financial literacy questions. The technical analysis column shows the participants' beliefs in the validity of the technical analysis method according to the 5-point Likert scale (5 strongly agree, 1 strongly disagree). T test was applied to determine the difference of values from the mean. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

According to cross table analysis results, investors who believe in the fundamental analysis but do not believe in the technical analysis have the highest level of financial literacy and the lowest level of irrational high return expectations. On the other hand, there is a negative relationship between trading frequency and financial literacy, and a positive relationship between trading frequency and technical analysis.

4.3. Ordered Logit Regression Analysis

Using the following linear equations, the effects of financial literacy, confidence, and irrational high return expectations of stock market investors on their belief in the validity of the technical analysis method have been estimated. The results of the regression analysis have been presented in Table 7. The definitions of independent variables are shown in the notes part of the table.

The main hypothesis of this research is that investors with low financial literacy will be more interested in the technical analysis method. One of the important biases of this study is that those interested in technical analysis do not have information about the fundamental analysis of stocks. This will cause them to give wrong answers to some questions about stock markets. To overcome this problem, similar to the studies of Jiang et al. (2020) and Van Rooij et al. (2011), the level of financial literacy is divided into two. Financial literacy involves general questions, while stock market investment knowledge directly measures participants' knowledge of stock markets. In this way, the effect of the divergence of participants in the process of investing in stocks can be neglected because basic financial literacy questions are related to everyday life. Confidence to beat the stock market return, overconfident, underconfident, and irrational expectations are other independent variables. In addition to the confidence variable, the underconfident (overconfident) variable was added to the analysis as a dummy variable that more clearly defines the expectation of high (low) return despite having low (high) financial literacy. Demographics of participants have been used as control variables. Similar to Chu et al. (2017) independent variables were first tested without control variables in the first equation (column 1). In the second equation shown in column (2) financial literacy

variable has been tested alone. In the third, fourth, and fifth equations shown in columns (3), (4), and (5), financial literacy and confidence variables were tested with different combinations. The results of the variables overconfident, underconfident, and irrational return expectations are shown in columns (6), (7), and (8).

It is seen that as investors' s financial literacy and stock market knowledge increase, their beliefs in technical analysis decrease statistically at the 1% significance level. The negative impact of stock market knowledge on choosing technical analysis is higher than the negative impact of financial literacy. Columns (1), (4), and (5) show that as investors' beliefs to beat the market return increase, their interest in the technical analysis also increases. When the results obtained in equations (5) are compared with equation (1), it is seen that the control variables increase the explanatory power of the equation, and the effect of the independent variables is confirmed. Overconfident investors believe in the validity of technical analysis with a coefficient as high as 0.5 and statistically with a significance level of 1%. On the other hand, underconfident investors believe in the validity of technical analysis much less, despite their high financial knowledge. As can be seen in column (8), investors with irrational high return expectations believe more in the validity of the technical analysis method at the 1% confidence level. Even though the equations have limited explanatory power, this result is similar to the studies in the literature examining the investors' behaviors (Hoffmann and Post, 2016; Jiang et al., 2020; Kansal and Singh, 2018).

Results in Table 7 show that demographic factors such as age, education and marital status do not have a significant effect on belief in the validity of the technical analysis. The inclusion of stock investors predominantly in the sample of the research creates a more homogeneous participant profile in this respect and affects the result. If a study involving ordinary people were organized, the impact of demographic factors could likely be observed much more clearly. However, as stated earlier in this study, stock market investors were targeted as a research sample. Another important point is that although the statistical significance of the results is high, their explanatory power is limited. This suggests that individuals with both low and high financial literacy can believe in the validity of the technical analysis, but belief in the validity of the technical analysis is more frequent among investors with a low financial literacy level. This can be explained by the fact that simple operations such as using computer tools that calculate moving averages or drawing trend lines, one of the important components of technical analysis, can be easily performed by everyone with basic computer knowledge. However, it is much more difficult to discover unique profitable methods and to statistically test those that consciously work. It is understandable that investors with a high level of financial literacy, who are aware of this situation, approach technical analysis more conservatively and start to believe it only if they see themselves competent in this regard. An important result obtained from the ordered logit regression analysis is that people with low financial literacy, high return expectation, and overconfidence believe more in the validity of the technical analysis method. Considering the competencies required to be successful in technical analysis method, it is seen that this method is preferred by investors with the wrong profile.

Table 7: Underlying Determinants of Belief in Technical Analysis

Ordered logit regression estimates		(1)		(2)		(3)		(4)	
		Coeff	z-stat	Coeff	z-stat	Coeff	z-stat	Coeff	z-stat
Dependent Variable: "I think technical analysis is a good way to invest"									
1 = Strongly disagree, 2= Disagree, 3=Undecided, 4=Agree, 5= Strongly agree									
Financial Literacy		-0.10**	-2.5	-0.13***	-3.2	-0.07*	-1.8		
Stock Investing Knowledge		-0.19***	-10.3			-0.14***	-7.0		
Confidence		0.14***	3.9					0.17***	4.7
Overconfident									
Underconfident									
Irrational Expectations									
Male				-0.29**	-2.1	-0.242*	-1.8	-0.33**	-2.4
Married				0.07	0.9	0.06	0.8	0.10	1.3
Age	<18			-0.76	-0.9	-0.54	-0.6	-1.03	-1.2
	18-25			-1.02***	-2.7	-0.84**	-2.1	-1.00***	-3.2
	26-35			-0.89**	-2.4	-0.71*	-1.8	-1.08***	-2.8
	36-45			-0.56	-1.5	-0.44	-1.1	-0.72*	-1.9
	46-55			-0.44	-1.2	-0.34	-0.9	-0.57	-1.5
	56-65			-0.39	-1.0	-0.30	-0.7	-0.50	-1.2
Monthly	<2500 TL			0.47	0.6	0.51	0.6	0.33	0.4
Income	2501-5000 TL			0.21	0.3	0.19	0.2	0.07	0.1
	5001- 10000 TL			0.15	0.2	0.16	0.2	-0.01	0.0
	10001 TL - 20000 TL			0.15	0.2	0.18	0.2	-0.04	-0.1
	>20000 TL			0.02	0.0	0.06	0.1	-0.17	-0.2
Financial	<10000 TL			0.40	0.4	0.43	0.5	0.31	0.3

Table 7 Cont.

		(1)		(2)		(3)		(4)	
		Coeff	z-stat	Coeff	z-stat	Coeff	z-stat	Coeff	z-stat
Wealth	10001-50000 TL			0.13	0.1	0.19	0.2	0.04	0.0
	50001-250000 TL			0.05	0.1	0.13	0.1	-0.05	-0.1
	250001-1000000 TL			-0.08	-0.1	0.00	0.0	-0.19	-0.2
	>1000000 TL			-0.39	-0.4	-0.26	-0.3	-0.51	-0.6
Financial Professional			0.02	0.3	0.10	1.5	0.01	0.2	
Education	Primary School			-0.80	-0.7	-0.83	-0.7	-0.87	-0.7
	High School			-0.45	-0.4	-0.46	-0.4	-0.45	-0.4
	Graduate			-0.57	-0.5	-0.49	-0.4	-0.66	-0.5
	Postgraduate			-0.59	-0.6	-0.48	-0.4	-0.71	-0.6
	Doctorate			-0.24	-0.2	-0.11	-0.1	-0.37	-0.3
	None			-0.35	-1.5	-0.33	-1.4	-0.42*	-1.8
Stock Market	< 1 year			-0.29	-1.2	-0.24	-1.0	-0.38	-1.6
Experience	1- 2 years			-0.21	-0.9	-0.15	-0.6	-0.31	-1.3
	3 - 5 years			-0.21	-0.8	-0.14	-0.5	-0.29	-1.2
	6 - 10 years			-0.08	-0.3	0.01	0.0	-0.20	-0.8
	> 10 years			-0.86	-1.1	-1.00	-1.3	-1.06	-1.3
Average	0 - 1 day			0.31	0.3	0.26	0.2	0.21	0.2
Holding	2 days - 7 days			0.31	0.4	0.18	0.2	0.16	0.2
Period	8 days - 90 days			-0.18	-0.2	-0.32	-0.4	-0.351	-0.4
	91 days - 12 months			-1.12	-1.6	-1.23*	-1.7	-1.32*	-1.7
	13 months - 5 year			-1.48**	-2.1	-1.60**	-2.2	-1.74**	-2.2
	> 5 years			-1.51**	-2.1	-1.64**	-2.2	-1.80**	-2.2
Observations		3813		3828		3828		3811	
Pseudo R ²		0.013		0.052		0.057		0.050	

Table 7 Cont.

Ordered logit regression estimates		(5)		(6)		(7)		(8)	
		Coeff	z-stat	Coeff	z-stat	Coeff	z-stat	Coeff	z-stat
Dependent Variable: "I think technical analysis is a good way to invest"									
1 = Strongly disagree, 2= Disagree, 3=Undecided, 4=Agree, 5= Strongly agree									
Financial Literacy		-0.08*	-1.9						
Stock Investing Knowledge		-0.15***	-7.6						
Confidence		0.20***	5.4						
Overconfident				0.52***	7.0	0.50***	6.8		
Underconfident						-0.36**	-2.2		
Irrational Expectations								0.31***	10.0
Male		-0.26*	-1.9	-0.29**	-2.1	-0.29**	-2.1	-0.24*	-1.8
Married		0.09	1.2	0.09	1.2	0.09	1.3	0.07	1.0
Age	<18	-0.79	-0.9	-1.03	-1.2	-1.02	-1.2	-0.79	-0.9
	18-25	-1.04**	-2.5	-1.2***	-2.9	-1.2***	-2.8	-1.04**	-2.6
	26-35	-0.83**	-2.1	-1.02**	-2.6	-1.00**	-2.5	-0.92**	-2.4
	36-45	-0.52	-1.3	-0.69*	-1.7	-0.67*	-1.7	-0.63	-1.6
	46-55	-0.39	-1.0	-0.56	-1.4	-0.54	-1.3	-0.52	-1.3
	56-65	-0.34	-0.8	-0.48	-1.1	-0.47	-1.1	-0.36	-0.8
Monthly	<2500 TL	0.43	0.6	0.42	0.6	0.41	0.6	0.33	0.4
Income	2501-5000 TL	0.12	0.2	0.13	0.2	0.11	0.2	0.07	0.1
	5001- 10000 TL	0.09	0.1	0.09	0.1	0.07	0.1	0.04	0.1
	10001 TL - 20000 TL	0.07	0.1	0.08	0.1	0.05	0.1	0.05	0.1
	>20000 TL	-0.05	-0.1	-0.04	-0.1	-0.08	-0.1	-0.08	-0.1
Financial	<10000 TL	0.36	0.4	0.29	0.3	0.32	0.4	0.35	0.4
Wealth	10001-50000 TL	0.13	0.1	0.06	0.1	0.08	0.1	0.13	0.2
	50001-250000 TL	0.06	0.1	-0.01	0.0	0.01	0.0	0.07	0.1
	250001-1000000 TL	-0.06	-0.1	-0.16	-0.2	-0.14	-0.2	-0.04	0.0
	>1000000 TL	-0.33	-0.4	-0.45	-0.5	-0.42	-0.5	-0.34	-0.4
Financial Professional		0.10	1.4	0.04	0.6	0.04	0.6	0.00	0.0

Table 7 Cont.

		(5)		(6)		(7)		(8)	
		Coeff	z-stat	Coeff	z-stat	Coeff	z-stat	Coeff	z-stat
Education	Primary School	-0.82	-0.6	-0.76	-0.6	-0.73	-0.5	-1.37	-1.2
	High School	-0.36	-0.3	-0.34	-0.3	-0.33	-0.2	-1.02	-0.9
	Graduate	-0.45	-0.3	-0.48	-0.4	-0.47	-0.4	-1.09	-1.0
	Postgraduate	-0.46	-0.3	-0.51	-0.4	-0.49	-0.4	-1.13	-1.0
	Doctorate	-0.10	-0.1	-0.20	-0.1	-0.16	-0.1	-0.79	-0.7
	None	-0.36	-1.5	-0.41*	-1.8	-0.42*	-1.7	-0.39*	-1.7
Stock Market Experience	< 1 year	-0.28	-1.1	-0.36	-1.5	-0.35	-1.4	-0.32	-1.4
Experience	1- 2 years	-0.20	-0.8	-0.28	-1.2	-0.28	-1.1	-0.20	-0.8
	3 - 5 years	-0.18	-0.7	-0.25	-1.0	-0.24	-1.0	-0.18	-0.7
	6 - 10 years	-0.05	-0.2	-0.11	-0.4	-0.11	-0.4	-0.09	-0.3
	> 10 years	-1.17	-1.4	-1.06	-1.4	-1.09	-1.3	-0.62	-0.8
Average Holding Period	0 - 1 day	0.19	0.2	0.28	0.3	0.28	0.3	0.70	0.7
Holding Period	2 days - 7 days	0.06	0.1	0.21	0.3	0.16	0.2	0.49	0.7
	8 days - 90 days	-0.46	-0.6	-0.33	-0.4	-0.36	-0.5	0.05	0.1
	91 days - 12 months	-1.40*	-1.7	-1.28*	-1.7	-1.32*	-1.7	-0.86	-1.2
	13 months - 5 year	-1.83**	-2.3	-1.70**	-2.3	-1.74**	-2.2	-1.22*	-1.8
	> 5 years	-1.91**	-2.3	-1.77**	-2.4	-1.81**	-2.3	-1.31*	-1.9
Observations		3811		3828		3828		3828	
Pseudo R ²		0.056		0.052		0.052		0.058	

Notes: In the analysis presented in this table, the survey data of Turkish stock investors were used. The table reports beta coefficients. Participants' belief in the technical analysis was used as the dependent variable. Different combinations of independent variables were shown in columns (1) to (8). The financial literacy variable was calculated using the number of correct answers given by the participants to 6 basic financial literacy questions. The stock market knowledge variable shows the number of correct answers given to 8 more specific questions related to the stock market. The confidence variable shows how confident participants are in beating market returns on a 5-point Likert scale (Strongly agree: 5, Strongly disagree: 1). The overconfident variable is the dummy variable, with a value of 1, used to identify participants who have a high level of confidence in beating the market return, but below-average financial literacy score. The underconfident variable, on the other hand, is the dummy variable, with a value of 1, used to identify participants who have a low confidence level in beating the market but with an above-average financial literacy score. The irrational expectation variable is the dummy variable, with a value of 1, assigned to those who responded "strongly agree" or "agree" to the statement that they will double their money each year as long as they invest in the stock market. * p<0.1, ** p<0.05, *** p<0.01.

The analysis presented in Table 8 was conducted to test the validity of the results presented in Table 4 and Table 7 in different educational groups and among participants with and without financial expertise. According to the results presented in the table, the previous findings are confirmed regardless of the educational background of the participants or their financial expertise. There is an inverse relationship between the participants' beliefs in the validity of the technical analysis and their financial literacy level.

Table 8: The Relationship between the Belief in the Validity of the Technical Analysis Method and the Level of Financial Literacy

	N	High Financial Literacy Top 30% Scores	Average Financial Literacy Medium 40% Scores	Low Financial Literacy Bottom 30% Scores	Overall
<i>Overall</i>	3830	3.08***	3.49***	3.56***	3.38
<i>Financial Profession</i>					
Yes	1020	3.01***	3.54*	3.59**	3.42
No	2808	3.02***	3.45**	3.57***	3.36
<i>Education</i>					
None, Primary or High School	378	3.32*	3.64	3.67	3.57
Bachelor's degree	2525	3.13***	3.45	3.58***	3.38
Graduate Degree	933	2.87***	3.33	3.52***	3.28

Note: The analysis presented in this table was used to test the validity of the relationship between technical analysis and financial literacy in different groups of the sample. First, the survey participants were divided into three groups according to their financial literacy levels. While determining the participants' financial literacy level, the number of correct answers they gave to 14 questions are used. Participants were ranked according to the number of correct answers they gave. As the financial literacy level, the values belonging to the highest 30th percentile are shared in the high financial literacy column, the middle 40th percentile in the average financial literacy column, and the bottom 30th in the low financial literacy column. The values in the table show average values showing to what extent the participants believed the validity of the technical analysis. While finding these values, the survey participants were asked to what extent they agreed with the statement "I think technical analysis is a good way to invest". Answers were taken on a 5-point Likert scale (1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly agree). T test was applied to determine the difference of values from the mean. * p < 0.1, ** p < 0.05, *** p < 0.01.

5. Conclusion

This study investigates whether financial literacy, overconfidence, and irrational high return expectations cause investors to prefer the technical analysis method. Besides, the relationship between the belief in the validity of the technical analysis method and the investors' stock holding periods was also examined. In the research, unique survey data has been used. The analyses show that low financial literacy, over-confidence, and irrational high return expectations lead investors to believe in the technical analysis.

As stated in Dourra and Siy's (2002) article, advanced knowledge in statistics and mathematics is required to be successful in technical analysis. However, this research shows that technical analysis is mostly preferred by investors with low financial literacy. As a result, negative results arise, as stated in the studies in the literature (Hoffmann and Shefrin, 2014; Hoffmann and Post, 2016; Kubińska et al., 2018).

Although theoretically, some studies support the technical analysis method, the findings of this research show that in practice technical analysis is preferred by unsuitable investors and leads these investors to trade more. Amateur traders who use technical analysis and make more transactions will pay more commission expenses and suffer losses due to the existence of professional traders who are better than them. In today's financial markets where there are high-frequency algorithms, it will not be easy for investors with low financial literacy to reach the desired result by using ordinary technical analysis methods and high-frequency trading. These findings support the thesis in the literature that technical analysis is not a suitable method for individual investors (Hoffmann and Shefrin, 2014; Kubińska et al., 2018; Neely, 1997).

The findings of the research support studies that found that most of the stock market investors do not have sufficient financial literacy (Arora and Marwaha, 2013; Van Rooij, Lusardi, and Alessie, 2011), and show that a similar relationship exists between low financial literacy and the use of technical analysis method. In addition, studies that have determined the positive relationship between overconfidence and trade frequency (Barber and Odean, 2001; Glaser and Weber, 2007; Graham et al., 2000; Odean, 1998) are supported and it has been determined that overconfident investors prefer technical analysis methods that are more suitable for trading. According to the results of the study, there is a positive relationship between irrational high return expectations and more frequent trades. This supports studies that reported the existence of individuals approaching the stock market as gambling (Dorn and Sengmueller, 2009; Kumar, 2009; Statman, 2002).

The results obtained from this study emphasize the importance of investors' financial literacy, knowledge of the stock market, and having appropriate return expectations. Informing individual investors on these issues will contribute to the healthy development of capital markets. The findings of the research provide evidence for policymakers to take further action in educating individual investors. In the future studies, the technical competencies of the investors using technical analysis and the results they obtained in practice can be analyzed.

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