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Technical Analysis as a Rational Tool of Decision Making for Professional Traders

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ABSTRACT: The psychological background of technical analysis usage is investigated to further explain the popularity and common usage of technical analysis as an investment decision tool. Attitudes toward technical analysis of professional futures market traders and neophyte investors, represented by finance students, were examined. Technical analysis is one of the most popular methods supporting investment decisions and it is much more popular among future market traders than among neophyte investors. The concept of processing information was used to explain this phenomenon. Neophyte investors are more experiential and intuition-driven while using technical analysis models, while futures market traders are more rationally driven. Technical analysis methods help professional traders on futures markets, which are less transparent than regulated stock markets, to process information; those methods are perceived by them as rational, cognitive tools supporting their decision making.

KEY WORDS: Experiential and rational systems, information processing, technical analysis

JEL Classification: G02, G11, G14.

The main goal of this article is to analyze the concept of processing information in explaining the phenomena of great popularity of technical analysis among traders. Technical analysis methods help traders on foreign exchange and futures markets to process fundamental and non-fundamental information and they can be considered to be rational tools that reduce the level of perceived uncertainty caused by lower market transparency.

Recent empirical literature indicates that technical trading strategies are profitable in foreign exchange markets and futures markets, but not in stock markets (Gradojevica and Lentob 2015; Neely, Weller, and Dittmar 1997; Park and Irwin 2007). Foreign exchange markets and futures markets differ significantly from the stock market. They are not operating in the form of a centralized exchange like a regulated stock market. They are organized as over-the-counter (OTC) markets, where transactions are bilateral; there is no single market price like at exchange-based multilateral markets. The volume of foreign exchange and futures markets is exceptionally big. The foreign exchange market, with a daily trading volume about five trillion USD,[1] is the biggest financial market in the world. Information transparency is a crucial aspect of foreign exchange and futures markets. Participants of foreign exchange and futures markets have only partial knowledge about the trades of other investors; they are aware of liquidity, supply, and demand only for some segments of the market, not the entire market. Results about the profitability of technical analysis methods in the forex exchange market suggest that excess returns are not consistent across all currency pairs or time periods; this conforms to the Adaptive Markets Hypothesis (Neely, Weiler, and Ulrich 2009). The Adaptive Market Hypothesis introduced by Lo (2004) states that *investment strategies will wax and wane, performing well in certain environments and performing poorly in other environments* (p. 24), so technical analysis methods are profitable in foreign exchange and futures markets, but not in stock markets. Technical analysis methods are very popular, as well as considered to be effective, in the foreign exchange market. Menkhoff and Taylor (2007) provide an excellent summary of the popularity of technical analysis

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among foreign exchange traders. These authors even called this popularity "obstinate passion" to emphasize the strength of this phenomenon. They give four stylized facts that explain the popularity of technical analysis in currency markets. Two of them are connected with processing information, the third states that technical analysis models can be used to profit from the central bank's market interventions, and the fourth states that it is an indicator of the incompletely rational behavior of market participants.

Most of the relevant literature reports that technical analysis methods are effective and popular in foreign exchange markets (Gradojevica and Lentob 2015; Menkhoff and Taylor 2007; Park and Irwin 2007). In our study, we test the hypothesis about the popularity of technical analysis methods among future markets traders:

H1a: *Technical analysis is one of the most popular methods supporting investment decisions of futures market traders.*

According to the Adaptive Market Hypothesis, the profitability of technical analysis depends on the market segments that Lo calls *environments*. We will show the hypothesized popularity of technical analysis methods among future markets traders by comparing them to neophyte investors:

H1b: *Technical analysis as a method supporting investment decisions is much more popular among futures market traders then among neophyte investors.*

A classical explanation of the profitability of technical analysis methods given by Merton (1948) states that technical analysis can work as a self-fulfilling prophecy when a large enough group of investors (but not all of them) uses technical analysis and follows its signals. Other explanations presume that, with the tools of technical analysis, traders can anticipate the movements of noise traders and make profits on that basis (De Long et al. 1990). In more recent studies, the popularity of technical analysis methods was explained by the presence of cognitive biases and heuristics that stand behind the signals. Zielonka (2004) pointed out the importance of psychological inclinations in the popularity of technical analysis. He administered a questionnaire to 24 Polish financial analysts. Each item of the questionnaire described some technical analysis signal. One-third of the items were the real technical analysis signals derived from the financial press and each of them represented one of four cognitive biases: gambler's fallacy, misperception of regression to the mean, anchoring effect, and herd behavior. Two-thirds of the items were created by the researcher—half of them represented the four cognitive biases mentioned above, and half were named "empty signals"—they did not represent any psychological bias. A majority of the financial analysts rated highly the predictive value of technical analysis signals that were based on cognitive biases, while the group of "empty signals" received very low ratings. Czupryna, Kubińska, and Markiewicz (2015) affirmed that faith in the effectiveness of technical analysis models, and by this its popularity, is related to the overconfidence bias in the form of a better than average effect. On the other hand, the results of Yang and Zhu (2016) indicate that traders who think they are better than average trade more in ambiguous conditions and not in risky conditions. These two cited results can be used to support the greater popularity of technical analysis on foreign exchange and futures markets operating as OTC markets that are less transparent and more ambiguous. Other studies point out that technical analysis methods based on information from order flows that appeared to be profitable (Gradojevica and Lentob 2015). Menkhoff and Taylor (2007) suggest that the popularity of technical analysis in currency markets is related to processing information, namely technical analysis can be treated as a means of processing information from both fundamental and non-fundamental influences.

The present study attempts to elaborate more on the role of processing information in using technical analysis, since technical analysis is a tool for processing and assimilating market information and this contributes to its popularity among traders. There is a high level of subjectivity revealed in technical analysis reasoning. There is no single criterion indicating what combination of indices should definitely trigger a transaction. The analysis of the price formation is even more subjective. Like psychological patients describing the same Rorschach inkblots differently, traders observing the same price patterns can see different signals. Simply put, the reliability of such methods is low from a theoretical point of view. Thus, the question is what types of investors are attracted by technical analysis, since the method has such a high dose of

subjectivity in its reasoning? Are they artist-type investors who rely upon their own intuition and see technical analysis as a more qualitative method—or on the contrary, are they rationalist-oriented investors who see technical analysis as a quantitative method of supporting decisions, or is there a mix of them?

These simple questions relate to a long line of research related to dual-process theories in psychology. The plural form is intentional here, since several theories have been introduced so far, e.g., the dual processing theories by Epstein (1973) and Epstein et al. (1996) or Evans and Over (1996); the dual-process theory by Sloman (1996), the two-system theory by Stanovich and West (2000), or the theory by Frederick (2005). Osman (2004) provides an overview of these theories. Albeit they differ in many minor aspects, the main assumption remains the same for all: human reasoning comprises two underlying systems devoted to intuitive (System 1) and analytical (System 2) thinking (Kahneman 2011). The first system is effortless, associative, automatic, and designed for fast and frugal answers. The second requires cognitive effort and logical deliberative reasoning. Because of the strategy for the efficient allocation of resources, decision makers tend to use System 1 rather than System 2. Many theoreticians claim that System 1 is a default, non-removable, autotriggered feature of cognitive processing, and that System 2 is optional (Białek 2010; De Neys 2006; Evans 2008). While mathematical equations are needed for System 2 activation, it seems possible that analyzing charts, as pictures, can be done sufficiently with System 1.

Technical analysis can be viewed as a means of processing information on non-fundamental influences (e.g., sentiment, psychological influences on prices, and self-fulfilling decision processes) and on fundamental influences (e.g., the revelation of fundamentals on the market and the patterns of order flows). Using technical analysis as a way of processing both types of information expresses the investors' preferences for simplification of information processing. Instead of studying macro- and microeconomic data and the earnings prospects of a company or making attempts to predict the behavior of other investors, investors can focus on only the signals coming from the technical analysis charts. Technical analysis makes the information processing simpler and more heuristic in its nature. According to Tversky and Kahneman (1974), the intuitive type of reasoning in dual-processing information theories is based on heuristics and therefore is responsible for common heuristics usage like representativeness, availability, and anchoring. (See also the biases classification in Evans and Frankish (2009) or Kahneman and Frederick (2005).) Since the perception of the predictive power of technical analysis methods is related to the presence of cognitive biases and heuristics that stand behind signals (Czupryna, Kubińska, and Markiewicz 2015; Zielonka 2004) and on the other hand heuristics and biases are connected with the intuitive type of reasoning, there is support for the concept that making investment decisions based on technical analysis signals relies more on the experiential system (System 1).

The fact that technical analysis methods are much more popular in foreign exchange and futures markets rather than in stock markets suggests that there is no single approach to technical analysis among investors and further considerations are needed. The motives that stand behind the use of technical analysis could be responsible for this phenomenon. Although technical analysis relies on the experiential system, as previously stated, technical analysis can be perceived by investors by means of either System 1 or System 2. Traders can treat technical analysis as an analytical tool for making decisions or as a tool supporting investors' intuition. The common wisdom and behavioral finance experts claim that nonprofessionals with the tools of technical analysis try to anticipate the movements of the market, while professionals with the same tool try to anticipate the behavior of nonprofessionals, the so-called "noise traders" (De Long et al. 1990). Thus there are two groups using technical analysis tools with two possibly different motives. In our study we are comparing professional traders to neophyte investors, represented by a group of students. We suspect that, while nonprofessionals can use the criticized technical analysis tools to support their intuitive judgments, professionals can be in fact rational by using the non-effective (or barely effective) tools exploited by nonprofessional noise traders. This leads as to the second hypothesis about the relation between processing information and technical analysis usage:

H2: *Neophyte investors are more experiential and intuition-driven while making decisions with the use of technical analysis models, while futures market traders are more rationally driven.*

To verify the hypotheses we have introduced variables measuring dominating modes in processing information and attitudes toward technical analysis tools. They are presented in the method section, where characteristics of neophyte investors and futures market traders are presented too. Next, we present the results verifying our hypotheses and the final conclusions.

Method

In our research, we are comparing attitudes toward technical analysis between professional futures market traders and neophyte investors, represented here by a group of students. This research approach is common in this discipline; for example, Abbink and Rockenbach (2006) compared the behavior of students and professional traders in an option pricing experiment, while Haigh and List (2005) tested the myopic loss aversion of these groups, and Glaser, Langer, and Weber (2007) investigated forecasting strategies. This approach is usually employed to confirm that professionals succumb to the same effects—discussed in behavioral finance literature—as amateurs, e.g., the disposition effect (see Kubińska, Markiewicz, and Tyszka 2012) or excessive trading (Markiewicz and Weber 2013). Here however we are expecting differences, and not similarities, of both kinds of traders: amateurs and professionals. Locke and Mann (2000) suggest, however, that studying the behavior of professional traders is more important, since they have a much higher impact on market prices than nonprofessionals.

Participants

Our participants were both professional future market traders and students. The first study with professional future market traders was conducted in July 2013 and August 2014. There were 17 traders who took part in the study in July 2013 and 18 traders in August 2014. The first part was conducted in the Cracow branch of a trading company and later the sample was enlarged by including traders that were employed in the Warsaw branch. The traders dealt with financial instruments on behalf of the firm employing them (proprietary trading). The traders participated in the online study, completing the initial set of questionnaires as well as weekly follow-up short-answer questions. All traders were male, with an average age of 27 years (SD = 5,45), and were employed in the company for an average of 23 months (SD = 19,53 months). The dominance of men is typical for the professional category of traders; e.g., in the study by Fenton-O'Creevy et al. (2003), the sample was 98.3% men and 1.7% women. One could argue that the sample size of traders is relatively small. It should be noted however that we recruited almost the entire staff of two major offices in a large trading company, thus exhausting the population of this company's traders. At the same time, even if the group appears to be small, the members are responsible for a substantial trading volume generated in Poland.

The second study was conducted during the Technical Analysis course[2] in 2013 with third-year undergraduate students majoring in Capital Markets at the Faculty of Finance of the Cracow University of Economics. The group of students consisted of 43 students (32 males) with an average age of 21 years (M = 21,26; SD = 0,82). Only a limited number of students had real-life investment experience, so the judgments of this group were based mainly on their theoretical knowledge and second-hand experience. The student volunteers who participated in the study were debriefed during the last class.

Materials

All subjects were asked to complete the questionnaire related to their experiential system propensity and technical analysis usage. The exact formulation of questions in Polish can be found in the Appendix. The questionnaires were distributed to the students in electronic form at the beginning of the course (just after the start of the half-semester Technical Analysis course). For the traders of the proprietary trading company, the questionnaires were distributed in electronic form in June 2013 and August 2014. This was coordinated by the managers of the company with no direct contact by researchers with the traders.

The Dominant Mode in Processing Information

There are many tests available that measure decision-makers' propensity toward an intuitive versus a rational way of thinking (e.g., Frederick 2005; Sjöberg 2003). We decided to use Pacini and Epstein's (1999) 40-item "Rational-Experiential Inventory" questionnaire (REI-40) in our research for several reasons. First, this questionnaire has a solid background in the form of Cognitive-Experiential Self Theory (CEST) (Epstein 1973), which has been proposed as a global theory of personality with two parallel systems. Thus the preferred system dependence can be treated more as a personal, stable trait. While some people rely mostly on experiential reasoning, others rely on analytical and cognitive reasoning (Norris and Epstein 2011). Thus the REI can be used to measure individual differences in intuition and rational thinking propensity. Second, only the REI introduced additional subscales, defined as ability and engagement (separately for each of the rational and experiential thinking scales). While the ability subscale expresses the person's self-assessment of the ability to make effective, correct judgments in a reflective way (Rational Ability, RA) or an intuitive way (Experiential Ability scale, EA), the engagement subscale reflects the person's reliance on and enjoyment of thinking in an analytical, logical manner (Rational Engagement, RE) or reliance on and enjoyment of feelings and intuitions in making decisions (Experiential Engagement, EE). Pacini and Epstein (1999) claim that ability scales are better predictors of self-expressed competences, while engagement scales explain better the person's values and attitudes.

Respondents reported their opinions about the items on a 5-point scale, where 1 means "definitely not true of me" and 5 means "definitely true of me". The particular value subscales were calculated as the mean of all statements critical for particular subscales. We used the two-way method (forward and backward) to translate the original REI-40 questionnaire into Polish. The scales have acceptable internal consistency; for the RA scale, Cronbach's Alpha = 0,682; for the RE scale, Cronbach's Alpha = 0,804; for the EA scale, Cronbach's Alpha = 0,604; and for the EE scale, Cronbach's Alpha = 0,782. The exact wording of the REI questions in Polish can be found in the Appendix.

Technical Analysis Usage

The attitude toward technical analysis was assessed in three ways, to measure both cognitive and behavioral components of the attitude. The first two questionnaire measures are connected with the declared usage of technical analysis methods (behavioral factors), while the third one is expressing the faith in the effectiveness of technical analysis methods (cognitive factor).

First, both groups of participants were asked about the factors influencing their investment decisions: "What factors do you take into consideration while making investment decisions?" (**Question 1**). Using a scale from 1 (no impact at all) to 5 (big impact), the participants were asked to specify the impact of the following factors:

- Technical analysis,
- Fundamental analysis—economic information from the market,
- Recommendations of colleagues,
- Your own intuition and hunches.

Furthermore, the traders were also asked the question intended to measure their level of sophistication while using technical analysis: "To what extent do you use these particular technical analysis methods?" (**Question 2—Traders**). The traders answered using a five-point scale, where 1 means "totally not used" and 5 means "used very often" for the following items:

- Basic analysis of charts—e.g.,, resistance lines, trend lines, moving averages, etc.
- More advanced formations—e.g., head and shoulders, crab downward/upward, butterfly downward/upward, bat downward/upward, etc.
- Analysis of indicators—RSI, CCI, MACD, stochastic oscillator, etc.

Students were asked about different forms of technical analysis methods in the context of the trading systems that they were preparing during the course (**Question 2—Students)**. The question was formulated as follows: "Please specify which of the groups of technical analysis methods you are going to use in your auto-trading system" with the answers on a dichotomous scale, where 1 means "I'm not going to use" and 2 is "I'm going to use".

The third measure of technical analysis usage is cognitive, and it expresses faith in the effectiveness of technical analysis models (**Cognitive Factor**). It was derived from the four statements:

1. Technical analysis indices are able to generate above-average returns.
2. Charts analysis (e.g., trend lines, support and resistance line) allows one to achieve superior returns.
3. Methods and tools of technical analysis are derived from empirical observations of the market and therefore they are effective.
4. Technical analysis is a more effective method of investing in financial markets than is fundamental analysis.

Principal Components Analysis showed that the four statements load on a single factor (explaining 58% of the variance in the student subsample, and 68% in the traders subsample). The scale has relatively high internal consistency with Cronbach's Alpha = 0,821 (Cronbach's Alphas are 0,760 and 0,832 for subsets of students and traders, respectively).

English formulation of questions verifying attitudes toward technical analysis methods is the direct translation of questions in Polish. The exact wording in Polish of Question 1, Question 2—Traders, Question 2—Students, and four items for the Cognitive Factor can be found in the Appendix.

Results

Traders assigned much higher importance to technical analysis and their own intuition in making investment decisions than to the fundamental analysis and recommendations of colleagues. This can be observed based on the answers given to Question 1, which are presented in Table 1.

The differences between the role of technical analysis and traders' own intuition are not statistically significant (t (33) = 0,159, *p*-value = 0.8756), so we can state that technical analysis is one of the most popular methods supporting decisions of future markets traders. In order to find which methods of technical analysis are the most popular among traders, we have calculated correlation coefficients between the assessment of role of technical analysis in making investment decisions (Question 1) and the use of different types of methods classified according to levels of sophistication (Question 2—Traders). The results[3] are shown in Table 2. Traders generally are chartists—they treat technical analysis methods as the analysis of charts and more advanced graphic formations. The tendency to use technical analysis methods while making investment decisions is not significantly correlated with the use of indicators like RSI, CCI, MACD, stochastic oscillator, etc. Those results confirm the *H1a* hypothesis, which states that technical analysis is one of the most popular methods supporting investment decisions for futures market traders.

Contrary to futures market traders, students assigned much lower importance to the technical analysis, which can be seen based on the answers given to Question 1 (see Table 1). Fundamental analysis and intuition are the most reliable methods supporting students' investment decisions, and differences between those two are not statistically significant (t (42) = 0,121, *p*-value = 0.9045). The Cognitive factor, based on four items representing faith in the effectiveness of technical analysis methods, was calculated as the mean of all four statements (M = 2,46; SD = 0,71; the statistics are for all respondents). As presented in the bottom row of Table 1, the traders believe more strongly in the effectiveness of technical analysis methods (t (64,388) = 3,013; $p < 0,01$). The correlation coefficients between the faith in the effectiveness of technical analysis (Cognitive Factor) and the assessment of to what extent subjects are guided by the signals of technical analysis in making investment decisions (Question 1) are significant in both analyzed groups (students: r (43) = 0,40; $p < 0,01$ and traders: r (35) = 0,48; $p < 0,01$). These results confirm the *H1b* hypothesis stating that technical analysis as a method supporting investment decisions is much more popular among future markets traders then among neophyte investors.

We claimed that processing information can be used to explain the popularity of technical analysis methods. The results about relationships between processing information and technical analysis usage for professional traders are presented in Table 3. There are positive correlations between different measures of favoring technical analysis and the RA subscale. Correlation coefficients for Question 1, Question 2—Advanced formations are statistically significant, while correlation coefficients for "Question 2—Basic analysis of charts", "Faith—cognitive factor" approach statistical significance.[4] The more traders assess their ability to make effective, correct judgments in a reflective way, the more they use technical analysis methods in making investment decisions and the more they believe in their effectiveness. On the other hand, we observe negative correlation coefficients between Question 1 and Question 2—Advanced formations with the EE subscale. The more professional traders use technical analysis methods in making investment decisions, especially the more advanced methods, then the less they rely on their intuition.

Relationships between processing information and technical analysis usage in the group of students can be examined based on the results presented in Table 4. We observed two positive correlations between some measures of technical analysis usage and the Experiential subscales. The tendency to use technical analysis while making investment decisions (Question 1) is correlated with the EA subscale, while the faith in the effectiveness of technical analysis methods (Cognitive Factor) is correlated with the EE subscale. Students do not perceive technical analysis methods as a rational way of making decisions. The more they assess their ability to make effective, correct judgments in an intuitive way, the more they use technical analysis methods in making investment decisions. The reliance on and the enjoyment of making decisions in an intuitive way is positively related to the faith in the effectiveness of technical analysis methods. The more they believe in the profitability of technical analysis tools, the more they feel comfortable with making decisions based on their intuition.

For the sake of clear demonstration of group membership, we also used moderation analysis. We implemented Model 1 from PROCESS for SPSS with 1000 bootstrap resamples with the dichotomous moderator (i.e., group membership: neophyte investor vs. futures market traders). In the case of the relationship between EE and faith in the effectiveness of technical analysis methods (Cognitive factor), the model demonstrated that the grouping variable is a significant moderator (b = −0,8394; 95% CI [−1,4935, −0,1853]; t = −2,5570; p = 0,0126), indicating that the relationship between EE and Cognitive

Table 1. Comparison of factors influencing investment decisions in groups of traders and students

	Factor	Traders M	Students M	t-test	Df	P value
	Behavioral indicator: Question 1					
1	Technical analysis	4.171	2.884	5.787	74.162	<0.0001
2	Fundamental analysis	2.743	3.791	–4.389	64.358	<0.0001
3	Recommendations	2.457	2.442	0.073	75.676	0.942
4	Intuition	4.235	3.767	2.534	69.4	0.013
	Cognitive Factor					
	Faith in the efficiency of technical analysis	2.728	2.256	3.013	64.388	0.003

Table 2. Correlation coefficients between the use of technical analysis while making investment decisions (Question 1) and different levels of sophistication of technical analysis methods for traders (Question 2—Traders) (N = 35)

Levels of sophistication:	Correlation coefficient	p-value
Basic analysis of charts	0.58	0.0002
Advanced formations	0.57	0.0003
Indicators	0.02	0.8975

Table 3. Correlation coefficients between the tendency to use technical analysis while making investment decisions (Question 1), the tendency to use technical analysis methods with different levels of sophistication (Question 2—Traders), the faith in the effectiveness of technical analysis methods (Cognitive factor), and REI subscales for the group of traders (*N* = 35)

	Question 1		Question 2—Basic analysis of charts		Question 2—Advanced formations		Faith—Cognitive factor	
REI subscales:	**Corr.**	***p*-value**	**Corr.**	***p*-value**	**Corr.**	***p*-value**	**Corr.**	***p*-value**
Rational Ability (RA)	0.42	0.011	0.31	0.069	0.37	0.026	0.33	0.051
Rational Engagement (RE)	0.14	0.406	0.12	0.481	0.15	0.388	0.16	0.373
Experiential Ability (EA)	–0.12	0.506	–0.11	0.518	–0.27	0.123	0.08	0.659
Experiential Engagement (EE)	–0.49	0.002	–0.27	0.110	–0.51	0.002	–0.28	0.108

Table 4. Correlation coefficients between the tendency to use technical analysis while making investments decisions (Question 1), the faith in the effectiveness of technical analysis methods (Faith—cognitive factor) and REI subscales for the group of students (*N* = 43)

	Question 1		Faith—cognitive factor	
REI subscales correlation with:	**coefficient**	***p*-value**	**coefficient**	***p*-value**
Rational Ability (RA)	–0.014	0.927	–0.07	0.634
Rational Engagement (RE)	–0.031	0.843	–0.03	0.826
Experiential Ability (EA)	0.287	0.062	0.20	0.199
Experiential Engagement (EE)	0.160	0.305	0.36	0.018

factor is moderated by the group membership (Moderation significantly increased R^2 of the model by adding 0,1160 ($F(1,74) = 6,5381$; $p = 0,0126$) to the R^2 value of 0,2295). Faith in the effectiveness of technical analysis methods goes in hand with growing EE in the neophyte investor group (b = 0,3845; 95% CI [0,0959, 0,6731]; t = 2,6544; $p = 0,0097$), but not in the group of futures market traders (b = −0,4550; 95% CI [−1,0420, 0,1321]; t = −1,5443; $p = 0,1268$). On the other hand, group membership does not influence the EE and Intuition relationships. Having expertise increases the role of intuition in making investment decisions (b = 0,4810; 95% CI [0,1232, 0,8388]; t = 2,6791; $p = 0,0091$) as well as revealing higher EE (b = 0,5232; 95% CI [0,0937, 0,9526]; t = 2,4280; $p = 0,0176$). However, there is no significant interaction effect (b = 0,3287; 95% CI [−0,5887, 1,2462]; t = 0,7141; $p = 0,4774$), showing that group membership does not influence the EE and Intuition relationships. (It is not a moderator.)

Based on both moderation analyses, we can conclude that technical analysis has similar status to intuition in the neophyte group (being driven by EE), while futures market traders see technical analysis and intuition in the opposite manner—EE drives intuition usage but not technical analysis usage. Similarly, RA (as shown in Table 3) drives technical analysis usage in the traders group, which triangulates these data. For neophyte investors, technical analysis is similar to intuition; for future markets traders, technical analysis is different from intuition—it is a rational tool. The results confirm the hypothesized relationships within *H2*: that neophyte investors are more experiential and intuition driven while making decisions with the use of technical analysis models, while future markets traders are more rationally driven.

Conclusions

Our study integrates the findings of both psychological and financial perspectives. To our knowledge, no previous studies have been aimed at the influence of psychological variables on technical analysis usage propensity in a systematic way. To complete the analysis, we studied the declarations and behaviors of both

professional traders and neophyte investors, represented here by finance students. The measures of technical analysis usage that we introduced appear to be consistent with each other in both analyzed groups, which support the reliability of the new measures. The more the futures market traders and students believe in the effectiveness of technical analysis methods, the more they use them while making financial decisions.

The results indicate significant differences between the futures market traders and the students in the relationships between the tendency to use technical analysis and the way they perceive their own information processing, as measured by the REI-40 inventory. We confirmed the two hypotheses about the popularity of technical analysis methods among futures market traders. Technical analysis is one of the most popular methods supporting investment decisions by futures market traders; in fact, it is more popular than fundamental analysis. Traders generally treat technical analysis methods as the analysis of charts and more advanced formations. By comparing futures market traders with neophyte investors, we have corroborated the popularity of technical analysis models among futures market traders. In the next hypothesis, we postulated that technical analysis preference is related to the experiential system dependency in the group of neophyte investors (e.g., the pleasure related to making intuitive judgments, positive values, and attitudes toward intuitive thinking), while this preference is related to the rational system dependency in the group of professional traders. This hypothesis also received empirical support. While newcomers use technical analysis to find the signals confirming their intuitive judgment, professional traders instead use it to systematically explore the market. The more that newcomers rely on intuition (or System 1), the more likely they are to use technical analysis; however, there is a different relationship in the professional group—the more that professional traders rely on rationality (or System 2), the more likely they are to use technical analysis. Thus technical analysis preference is related to different types of information processing for these two groups: professional traders and neophyte investors. One of the limitations of our study is its correlational character; therefore we refrain from discussing causality. It should be noted however that the information processing styles (as described by REI) emerge much earlier in one's personal development than the time when an investor can learn the basics of technical analysis. Assuming that the earlier construct influences the later one, we would expect that information processing styles influence the attitudes toward technical analysis in the analyzed groups.

The *environment* (Lo 2004) can be the factor that has the strongest differential impact on the perception of technical analysis as a method of processing market information; thus the investigation of the differences in the *environments* of professional traders and novices is called for. By *environment*, we mean whatever influences the investor's decision making. In the case of professional traders, this includes the way they are trained and their day-to-day experiences. In the case of neophyte investors, this includes the knowledge and attitudes toward financial markets they obtained at the universities. Professional traders have positive feedback about the effectiveness of technical analysis from their trading *environment*, e.g., the other traders can report successful transactions triggered by technical analysis signals and/or their supervisors can encourage them to use those methods. When they are first employed, the professional traders are provided with technical analysis courses, handbooks, software, and the milieu that supports technical analysis as a successful method. These factors are likely to influence the way the traders perceive technical analysis methods as a systematic, logical, well-integrated approach toward decision making, which is a rational one. They perceive technical analysis as similar to fundamental analysis. In the case of neophyte investors, the influence of academic approach and the content of the courses they took make an impact on their attitudes toward the effectiveness of technical analysis methods. They were taught that technical analysis tools cannot give sustainable profits because the markets behave according to the paradigm of the Efficient Market Hypothesis (Fama 1970). Neophyte investors with a very strong theoretical background in finance are likely to disregard technical analysis as a rational tool for supporting their investment decisions, and treat it as supporting their intuition. Thus the influence of the environment can lead to different perceptions of technical analysis tools by investors. Using the same technical analysis methods, some investors treat them as a scientific tool, while others consider them to be beyond reason, like witchcraft.

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Notes

1. Triennial Central Bank Survey of foreign exchange and derivatives market activity in 2013, Bank for International Settlements 2013 available at http://www.bis.org/publ/rpfx13fx.pdf.

2. During the course, students were asked to prepare a computerized technical trading system, based on any chosen technical analysis model, e.g., moving averages, channels, or stochastic oscillators. Students were evaluated based on the system's design and coherence, but not on the rate of return (with the exception of extremely good or bad results) generated by the system for the data provided by the lecturer at the final exam. Therefore, the number of technical analysis models used, the parameterization that was introduced, and the logical rule for making the final signal were important for the students' evaluation; but less important was the effectiveness of the system.

3. Due to the ordinal scales for Question 1 and Question 2, here and later on we report Spearman's rank correlation coefficient values.

4. It is worth noting that technical and fundamental analyses are similarly perceived by traders in the context of information processing. Although they were not significantly correlated (r (35) = 0,11, $p > 0,10$), we observed comparable correlation coefficients of technical and fundamental analyses with REI subscales (fundamental analysis with RA: r (35) = 0,36, $p = 0,064$; RE: r (35) = −0,06 $p = 0,725$; EA: r (35) = −0,21, $p = 0,230$; EE: r (35) = −0,43, $p = 0,011$).

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Appendix

Questionnaires' questions used to measure dominating modes in processing information (REI-40) and attitudes toward technical analysis tools (Question 1, Question 2, Cognitive factor). First, they are presented in English, later in Polish. The original survey was conducted in Polish.

Rational-Experiential Inventory (Pacini and Epstein 1999)

For each statement, indicate how true it is for you. Please use a scale from 1 to 5, where 1 means completely false while 5 means completely true.

	1—completely false	2	3	4	5—completely true
1. I have a logical mind.	1	2	3	4	5
2. I prefer complex problems to simple problems.	1	2	3	4	5
3. I believe in trusting my hunches.	1	2	3	4	5
4. I am not a very analytical thinker.	1	2	3	4	5
5. I trust my initial feelings about people.	1	2	3	4	5
6. I try to avoid situations that require thinking in depth about something.	1	2	3	4	5
7. I like to rely on my intuitive impressions.	1	2	3	4	5
8. I don't reason well under pressure.	1	2	3	4	5
9. I don't like situations in which I have to rely on intuition.	1	2	3	4	5
10. Thinking hard and for a long time about something gives me little satisfaction.	1	2	3	4	5
11. Intuition can be a very useful way to solve problems.	1	2	3	4	5
12. I would not want to depend on anyone who described himself or herself as intuitive.	1	2	3	4	5
13. I am much better at figuring things out logically than most people.	1	2	3	4	5
14. I usually have clear, explainable reasons for my decisions.	1	2	3	4	5
15. I don't think it is a good idea to rely on one's intuition for important decisions.	1	2	3	4	5
16. Thinking is not my idea of an enjoyable activity.	1	2	3	4	5
17. I have no problem thinking things through carefully.	1	2	3	4	5
18. When it comes to trusting people, I can usually rely on my gut feelings.	1	2	3	4	5
19. I can usually feel when a person is right or wrong, even if I can't explain how I know.	1	2	3	4	5
20. Learning new ways to think would be very appealing to me.	1	2	3	4	5
21. I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.	1	2	3	4	5
22. I think it is foolish to make important decisions based on feelings.	1	2	3	4	5
23. I tend to use my heart as a guide for my actions.	1	2	3	4	5
24. I often go by my instincts when deciding on a course of action.	1	2	3	4	5
25. I'm not that good at figuring out complicated problems.	1	2	3	4	5
26. I enjoy intellectual challenges.	1	2	3	4	5
27. Reasoning things out carefully is not one of my strong points.	1	2	3	4	5
28. I enjoy thinking in abstract terms.	1	2	3	4	5
29. I generally don't depend on my feelings to help me make decisions.	1	2	3	4	5
30. Using logic usually works well for me in figuring out problems in my life.	1	2	3	4	5
31. I think there are times when one should rely on one's intuition.	1	2	3	4	5
32. I don't like to have to do a lot of thinking.	1	2	3	4	5
33. Knowing the answer without having to understand the reasoning behind it is good enough for me.	1	2	3	4	5
34. Using my gut feelings usually works well for me in figuring out problems in my life.	1	2	3	4	5
35. I don't have a very good sense of intuition.	1	2	3	4	5
36. If I were to rely on my gut feelings, I would often make mistakes.	1	2	3	4	5
37. I suspect my hunches are inaccurate as often as they are accurate.	1	2	3	4	5
38. My snap judgements are probably mot as good as most people's.	1	2	3	4	5
39. I am not very good at solving problems that require careful logical analysis.	1	2	3	4	5
40. I enjoy solving problems that require hard thinking.	1	2	3	4	5

Technical analysis usage

Question 1

What factors do you take into consideration while making investment decisions? Using a scale from 1 (no impact at all) to 5 (big impact), please specify the impact of the following factors:

	1- no impact at all, on my decisions	2 3 4	5- big impact on my decisions
Technical analysis,	1	2 3 4	5
Fundamental analysis—Economic information from the market,	1	2 3 4	5
Recommendations of colleagues,	1	2 3 4	5
Your own intuition and hunches.	1	2 3 4	5

Question 2—Traders

To what extent do you use these particular technical analysis methods? Please use a five-point scale, where 1 means "totally not used" and 5 means "used very often" for the following items:

	1—totally not used	2 3 4	5- used very often
Basic analysis of charts—for example, resistance lines, trend lines, moving averages, etc.	1	2 3 4	5
More advanced formations—for example, head and shoulders, crab downward/upward, butterfly downward/upward, bat downward/upward, etc.	1	2 3 4	5
Analysis of indicators—RSI, CCI, MACD, stochastic oscillator, etc.	1	2 3 4	5

Question 2—Students

Please specify which of the groups of technical analysis methods you are going to use in your auto-trading system. Give your answers on a dichotomous scale, where 1 means "I'm not going to use" and 2 is "I'm going to use".

	1 I'm not going to use	2 I'm going to use
Basic analysis of charts—for example, resistance lines, trend lines, moving averages, etc.	1	2
More advanced formations—for example, head and shoulders, crab downward/upward, butterfly downward/upward, bat downward/upward, etc.	1	2
Analysis of indicators—RSI, CCI, MACD, stochastic oscillator, etc.	1	2

Cognitive Factor

For each statement, indicate in what extent it describes you. Please use a scale from 1 to 4, where 1 means that you totally disagree with the statement, while 4 indicates that you absolutely agree with the statement.

	1- I totally disagree	2	3	4—I absolutely agree
Technical analysis indices are able to generate above-average returns.	1	2	3	4
Charts analysis (e.g., trend lines, support and resistance line) allow one to achieve superior returns.	1	2	3	4
Methods and tools of technical analysis are derived from empirical observations of the market and therefore they are effective.	1	2	3	4
Technical analysis is a more effective method of investing in financial markets than is fundamental analysis.	1	2	3	4

Polish Translation of Rational-Experiential Inventory

Proszę użyj skali od 1 do 5, gdzie 1 oznacza zdanie zdecydowanie fałszywe a 5 zdecydowanie prawdziwe, w ocenie na ile poniższe stwierdzenia opisują Ciebie. Swoje odpowiedzi w każdym stwierdzeniu zaznacz na skali obok pytania, zaznaczając krzyżykiem odpowiednie pole tabeli

	1—zdecydowanie fałszywe	2	3	4	5—zdecydowanie prawdziwe
1. Mam ścisły umysł.	1	2	3	4	5
2. Wolę złożone problemy niż proste.	1	2	3	4	5
3. Wierzę w słuszność ufania swoim przeczuciom.	1	2	3	4	5
4. Nie jestem bardzo analityczną osobą	1	2	3	4	5
5. Ufam mojemu pierwszemu wrażeniu wobec ludzi	1	2	3	4	5
6. Staram się unikać sytuacji wymagających dogłębnej analizy	1	2	3	4	5
7. Lubię polegać na intuicyjnym wrażeniu	1	2	3	4	5
8. Trudno mi wnioskować w sytuacjach stresowych	1	2	3	4	5
9. Nie lubię sytuacji, w których muszę polegać na intuicji.	1	2	3	4	5
10. Intensywne rozmyślanie przed dłuższy czas daje mi niewielką satysfakcję.	1	2	3	4	5
11. Intuicja może być bardzo przydatna w rozwiązywaniu problemów	1	2	3	4	5
12. Nie chciał(-a)bym być zależna/-y od osoby określającej się jako kierująca się intuicją	1	2	3	4	5
13. Lepiej rozwiązuję problemy wymagające logicznego myślenia niż większość ludzi	1	2	3	4	5
14. Zazwyczaj mam jasne, uzasadnione powody swoich decyzji	1	2	3	4	5
15. Nie uważam za dobre aby polegać na intuicji w ważnych decyzjach	1	2	3	4	5
16. Uważam, że rozmyślanie nie jest przyjemną aktywnością	1	2	3	4	5
17. Nie mam problemów ze staranną i dogłębną analizą	1	2	3	4	5
18. Jeśli chodzi o ufanie innym ludziom, zazwyczaj polegam na mojej intuicji	1	2	3	4	5
19. Zazwyczaj czuję czy dana osoba ma rację, czy nie, nawet jeśli nie jestem w stanie wyjaśnić w jaki sposób	1	2	3	4	5
20. Uczenie się nowych sposobów myślenia byłoby bardzo interesujące dla mnie	1	2	3	4	5
21. Bardzo rzadko mylę się, kiedy słucham moich wewnętrznych przeczuć aby znaleźć rozwiązani	1	2	3	4	5
22. Uważam, że to jest głupie, podejmować ważne decyzje kierując się uczuciami	1	2	3	4	5

(*Continued*)

(Continued)

	1—zdecydowanie fałszywe	2	3	4	5—zdecydowanie prawdziwe
23. Mam tendencję do kierowania się sercem w moich działaniach	1	2	3	4	5
24. Często kieruje się instynktem, gdy decyduję o przebiegu zdarzeń	1	2	3	4	5
25. Nie jestem zbyt dobry w „rozgryzaniu" skomplikowanych problemów	1	2	3	4	5
26. Cieszą mnie wyzwania intelektualne.	1	2	3	4	5
27. Systematyczne wnioskowanie nie jest jedną z moich stron	1	2	3	4	5
28. Cieszą mnie abstrakcyjne rozważania	1	2	3	4	5
29. Zasadniczo nie polegam na swoich uczuciach w podejmowaniu decyzji	1	2	3	4	5
30. Stosowanie logiki zazwyczaj sprawdza się w rozwiązywaniu problemów w moim życiu	1	2	3	4	5
31. Uważam, że są chwile w których należy zaufać swojej intuicji	1	2	3	4	5
32. Nie lubię, kiedy muszę dużo rozmyślać	1	2	3	4	5
33. Poznanie wyniku bez potrzeby poznania i zrozumienia rozumowania prowadzącego do tego wyniku jest wystarczające dla mnie	1	2	3	4	5
34. Używanie przeczuć, intuicji zazwyczaj sprawdza się w rozwiązywaniu problemów w moim życiu	1	2	3	4	5
35. Nie mam bardzo dobrej intuicji	1	2	3	4	5
36. Gdybym musiał polegać na moich przeczuciach, często popełniał bym błędy	1	2	3	4	5
37. Podejrzewam że moje przeczucia są tak samo często trafne jak i nietrafne.	1	2	3	4	5
38. Moje szybkie decyzje nie są prawdopodobnie tak dobre jak innych ludzi	1	2	3	4	5
39. Nie jestem bardzo dobry w rozwiązywaniu problemów wymagających dokładnej analizy logicznej.	1	2	3	4	5
40. Cieszy mnie rozwiązywanie problemów wymagających intensywnego myślenia	1	2	3	4	5

Technical analysis usage in Polish

Question 1

Jakie czynniki bierzesz pod uwagę podejmując decyzje inwestycyjne. Używając skali od 1 do 5, określ proszę jaki wpływ mają poniżej wymienione czynniki na Twoje decyzje.

	1-zupełnie bez wpływu na moje decyzje	2	3	4	5-bardzo duży wpływ na moje decyzje
analiza techniczna	1	2	3	4	5
analiza fundamentalna—Informacje ekonomiczne z rynku	1	2	3	4	5
rekomendacje kolegów w pracy	1	2	3	4	5
własna intuicja i przeczucia	1	2	3	4	5

Question 2—Traders

W jakim zakresie stosujesz wymienione poniżej podejścia analizy technicznej? Przy odpowiedzi posłuż się skalą od 1 do 5, gdzie 1—zupełnie nie stosuje 5-stosuje bardzo często.

	1—zupełnie nie stosuje	2	3	4	5-stosuje bardzo często
prostą analizę wykresów—np. linie oporu, linie trendu, średnie ruchome, itp.	1	2	3	4	5
bardziej zaawansowane formacje—np. głowa i ramiona, krab spadkowy/wzrostowy, motyl spadkowy/wzrostowy, nietoperz spadkowy/wzrostowy, itp.	1	2	3	4	5
analizę wskaźników—RSI, CCI, MACD, oscylator stochastyczny, itp.	1	2	3	4	5

Question 2—Students

Proszę, określ jaki wstępnie planujesz zbudować system autotransakcyjny na zaliczenie przedmiotu. Które z grup narzędzi zamierzasz użyć.

	1—nie zamierzam zastosować	2- zamierzam zastosować
prostą analizę wykresów—np. linie oporu, linie trendu, średnie ruchome, itp.	1	2
bardziej zaawansowane formacje—np. głowa i ramiona, krab spadkowy/wzrostowy, motyl spadkowy/wzrostowy, nietoperz spadkowy/wzrostowy, itp.	1	2
analizę wskaźników—RSI, CCI, MACD, oscylator stochastyczny, itp.	1	2

Cognitive Factor

Proszę użyj skali od 1 do 4, gdzie 1 oznacza zdecydowanie nie zgadzam się z danym stwierdzeniem a 4 zdecydowanie zgadzam się, w ocenie poniższych stwierdzeń:

	1- zdecydowanie nie zgadzam się	2	3	4—zdecydowanie zgadzam się
Wskaźniki występujące w analizie technicznej umożliwiają uzyskanie ponadprzeciętnej stopy zwrotu.	1	2	3	4
Analiza wykresów za pomocą metod analizy technicznej (np. linie trendu, wsparcia, oporu) umożliwia uzyskanie ponadprzeciętnej stopy zwrotu.	1	2	3	4
Metody, narzędzia analizy technicznej wynikają z empirycznych obserwacji i dlatego są skuteczne.	1	2	3	4
Analiza techniczna jest skuteczniejszą metodą inwestowania na rynkach finansowych niż analiza fundamentalna.	1	2	3	4