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**Article**

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# Investor education and trading activity on the stock market

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## ABSTRACT

This study analyses how investors' educational characteristics affect their trading activity on the stock market. It uses a unique dataset from the Tallinn Stock Exchange, covering all transactions of a full business cycle from 2004 to 2012, along with a dataset containing the official educational background for all individual investors. Applying an ordered logit regression model and controlling for gender, age, wealth, portfolio diversification and average stock holding period, this study provides empirical evidence that the investors with top results in national exams or the investors holding an academic degree trade stocks more actively. The opposite is true for the investors with no academic degree as they trade stocks less actively. Analysing investors' risk-adjusted performance reveals that trading experience in the form of trading activity is the contributing factor for higher returns on the stock market.

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G02; G11

## 1. Introduction

One might think that investing on the stock market is a difficult task and therefore the individual would assess one's abilities rationally. The empirical evidence suggests the opposite as the investors tend to oversimplify the situations that lead to mistakes in the investment decision process (Shefrin, 2002). Still, making mistakes is not so costly for the investors' wealth. Nicolosi, Peng, and Zhu (2009) posit that investors do learn from mistakes and their trading experience improves performance on the stock market. In order to understand investors' behaviour and financial decisions on the stock market, it is important to determine whether investors' education affects trading activity.

Education is a significant component, which among other factors influences investors' performance, risk-taking and stock market participation. Campbell (2006) notes that educated investors participate more actively on the stock market and they tend to make more rational investment decisions than investors with lower educational level. Besides stock market participation choices, education is considered a key element explaining investors' risk-taking behaviour. Grable (1998) provides empirical evidence that education appears to encourage risk taking and offers a possible explanation that higher level of academic education allows individuals to assess risk and benefits more adequately compared to investors with a lower educational level. Goetzmann and Kumar (2008) find that investors

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who are younger, have lower income, are less-educated, and less-sophisticated, tend to hold portfolios that are highly volatile and consist of stocks that are more highly correlated compared to stocks, which were chosen randomly. Anderson (2007) adds to this viewpoint by stating that less-educated investors invest a greater proportion of their wealth in individual stocks, hold more highly concentrated portfolios and have worse trading performance.

Several authors state that besides academic education, real-life trading experience helps to achieve better performance on the stock market. Dhar and Zhu (2006) provide empirical evidence that trading experience helps investors to reduce certain behavioural biases and that investors' trading improves over time. Feng and Seasholes (2005) use the number of trades as a proxy for investor experience and find that investors do learn from their trading experience. Education is considered an important characteristic explaining investors' stock market participation choices, performance and risk-taking decisions on the stock market. Assessing the impact of education on investor trading experience in the form of trading activity, would be important in understanding investors' financial decision-making process.

The aim of the paper is to study how educational characteristics influence investors' trading activity and whether investors benefit from their trading experience. This study uses the number of trades as a proxy for investors' trading activity and trading experience. Nguyen and Schuessler (2012) state that a higher level of education reduces behavioural biases such as self-attribution bias, anchoring bias and representativeness and helps to make more rational investment decisions. Hence, this study formulates the hypothesis that investors with good results in national state administrated high school exams and investors with higher level of education trade more on the stock market. The rationale for those investors executing more trades to a certain extent is to gain practical experience and use this experience to achieve higher risk-adjusted returns on the stock market.

Liivamägi, Vaarmets, and Talpsepp (2014) find that the level and type of education affect investment decisions and performance on the stock market. Christiansen, Joensen, and Rangvid (2008) propose that financial decisions are influenced by the type of education and show that individuals who obtained university degree in economics, have higher tendency to hold stocks. Hence, the paper studies the effects of the education level and type (specialty) on investors' trading activity.

Prior researchers show that education is a key factor explaining investors' stock market behaviour, but due to the limitation of data availability they have used only education level as an explanatory variable. This study uses a unique dataset of detailed educational characteristics such as national exam results, university degree, specialty and education type to address the research gap in the literature. The main contribution of the paper is the first empirical documentation of comprehensive educational characteristics which influence investors' trading activity on the stock market.

This paper attempts to extend the documentation of previous studies and offers detailed empirical evidence that investors with an academic degree and top results in national exams are more likely to trade actively on the stock market. In addition, the paper concludes that investors with a university degree, a synonym for an academic degree, in natural sciences trade more actively compared to the investors with no such degree. The opposite is true for the investors with no academic degree and for the investors with poor performance in geography exam results as they execute a lower number of

trades. As regards the type of education, the empirical finding is that the investors holding a degree in medicine are more likely to trade less compared to investors with no such degree. The analysis of investors' risk-adjusted returns shows that their trading experience contributes to better performance on the stock market compared to the investors with lower trading experience. The message of this study is that investors having different educational characteristics trade differently on the stock market and real-life trading experience significantly contributes to investors' performance.

At first sight the findings of this study contradict conclusions presented by Barber and Odean (2000, 2001) who found that too much trading has a negative effect on investors' wealth. More detailed analysis of investors transactions provides an explanation for this apparent conflict. The analysis of investors' transactions reveals that to a certain point, a larger number of trades increases the probability of the performance success. As the number of trades increases over 100 during the observed period, the probability of being successful decreases. Such a finding is consistent with Barber and Odean (2000) who claim that trading too much is unfavourable to investors' wealth, but is also consistent with the findings of Nicolosi et al. (2009) who suggest that trading experience to some extent improves stock market performance as the investors learn from their trading experience.

Controlling for other characteristics such as age, average number of stocks in the portfolio, average portfolio size and average holding period, educational factors, and control variables remain significant. Many of the findings regarding the control variables confirm the results of previous studies indicating that investors on the Tallinn Stock Exchange have similar trading characteristics to the investors in the rest of Europe, Asia or the U.S.A. The analysis of the findings regarding control variables indicate that male investors trade more actively compared to females. This conclusion is in line with the documentation of Barber and Odean (2001), Graham, Harvey, and Huang (2009), Grinblatt and Keloharju (2009) and Hoffmann, Shefrin, and Pennings (2010), who conclude that men trade more than females on the stock market. In addition, control variables indicate that the investors who made more transactions on the stock market held more diversified and larger portfolios. On the other hand, the investors trading more actively on the stock market have a lower average stock holding period. These findings are in line with the conclusions of Graham et al. (2009) and Grinblatt and Keloharju (2009).

The second section provides an overview of previous studies. The third section presents a unique dataset and provides details of the methodology of trading activity and investors' performance measurement. The fourth section offers empirical evidence and the fifth section concludes.

## 2. Previous studies

This section summarizes how education influences investors' trading decisions and performance on the stock market. Prior research in the field of household finance suggests that education has a significant impact on investors' financial decisions including stock market participation choices, risk-taking behaviour and performance. Guiso, Haliassos, and Jappelli (2003) state that investors' choices to participate on the stock market are strongly influenced by the level of education and wealth. These findings are also supported by Campbell (2006), who concludes that less-educated and less-wealthy

households tend to avoid investing in stocks. He proposes that this kind of behaviour may be reasonable, because less-educated individuals tend to make more investment mistakes. Therefore, it should not be a surprise that financial knowledge and participation on the stock market increases together with the overall education level and household resources as stated by Guiso and Jappelli (2005).

Besides stock market participation decisions, education is an important characteristic explaining investor risk-taking behaviour on the stock market. Haliassos and Bertaut (1995) found that individuals with less than a college degree are less likely to hold risky assets, compared to individuals with at least a college degree. The findings confirmed conclusions by Grable (1998), who provides empirical evidence that the higher an individual's education, the greater the likelihood of the individual having higher risk tolerance. Grable (1998) concludes that education appears to encourage risk taking, because increased level of attained academic training allows individuals to assess risk and benefits more carefully than in the case of someone with less education.

In addition, education is considered a significant factor determining investors' portfolio diversification choices, which is directly linked to the investor risk-taking behaviour on the stock market. Goetzmann and Kumar (2008) analyse under-diversification of investors and find that investors tend to hold portfolios that are highly volatile and consist of stocks that are more highly correlated than one would expect when stocks were chosen randomly. They show that US individual investors hold under-diversified portfolios, whereas the level of under-diversification is greater among younger, low-income, less-educated, and less-sophisticated investors. Anderson (2007) ties individual investor portfolio diversification together by documenting that lower income, poorer, younger and less well-educated investors invest a greater proportion of their wealth in individual stocks, hold more highly concentrated portfolios and have worse trading performance. Based on prior empirical research, education plays a significant role in investors' financial decisions. Hence, it could be presumed that education has a significant impact on investors' trading activity.

As education is considered one key factor explaining investors participation and risk-taking choices, it is important to study whether education also has an influence on investor trading activity on the stock market. One might think that as investing on the stock market is a complex task and during the process investor puts its own money on the table, the investor would analyse its investment decisions in more detail, but in reality the opposite is the case. Griffin and Tversky (1992) demonstrate that when predictability is very low, as can be observed on the stock market, even experts may oversimplify their investment decisions, which lead to poor investment choices. Barber and Odean (2008) find that many investors make various mistakes in their investment decisions when investing on the stock market. Shefrin (2002) reveals the reasons behind irrational and faulty investment decisions by stating that investors tend to oversimplify the situations. Shefrin (2002) claims that heuristic-driven biases and framing effects have an impact on market prices by driving them away from fundamental values.

Regardless investors' irrationality Daniel, Hirshleifer, and Subrahmanyam (1998) and Gervais and Odean (2001) claim that investors do learn from previous mistakes through their private signals and that those mistakes are not systematic. In spite several empirical researches, the results regarding individual learning are mixed. Knetsch and Sinden (1984) and Camerer and Hogarth (1999) argue that learning can take a long period of time and may not be effective in eliminating behavioural biases. Nicolosi et al. (2009) argue that not

only does the laboratory setup fail to accurately capture investor behaviour when significant wealth is at stake, but the subjects also deal with relatively simple signals and tasks, leading to more restricted learning. They state that learning in a trading environment can be more challenging. Still, studies show that real-life trading experience has a significant role in eliminating judgment errors, such as the endowment effect (List, 2003) and the disposition effect (Dhar & Zhu, 2006). In addition, Roth and Erev (1998) and Feng and Seasholes (2005) provide empirical evidence that investor sophistication and trading experience help to reduce certain behavioural biases in financial markets and that individuals' behaviour improves over time. Determining whether education affects investor trading experience in the form of trading activity, would be one important step forward in understanding the investors' financial decision-making process on the stock market.

Discussion whether active trading is beneficial for investors' performance has been initiated by several authors. Feng and Seasholes (2005) and Nicolosi et al. (2009) use the number of transactions as a proxy for investor experience and sophistication and conclude that trading experience contributes to better performance. On the other hand, Grinblatt and Keloharju (2009) and Barber and Odean (2001) use the number of transactions as a proxy for investor overconfidence and find that too much trading has a negative effect on investors' wealth. This empirical documentation contradicts at first sight the findings of this study, but detailed analysis in Section 4.4 suggest, that trading experience to some extent increases stock market performance as investors do benefit from real-life trading experience.

Prior researchers show that education contributes to more rational investment decisions on the stock market. This study addresses how comprehensive educational characteristics influence investors' trading activity and whether investors learn from their trading experience and demonstrate better performance on the stock market. In order to test the learning effect, the study compares investors risk-adjusted returns on the stock market as done by Nicolosi et al. (2009). This study uses a unique dataset from the Estonian Stock Exchange and combines it with the national education dataset.

### 3. Data and methodology

This study uses a dataset from the Tallinn Stock Exchange, provided by Nasdaq OMX Tallinn. The data cover the period of 9 years starting from 01.01.2004 to 31.12.2012 and includes all transactions made with listed Estonian companies. The period covers transactions for a total of 23 listed companies, which were traded on the Estonian Stock Exchange during that period. Nasdaq OMX Tallinn has a market capitalization of about 1.7 billion euros as of 31.12.2014.

Besides the data from Nasdaq OMX Tallinn, a unique dataset from the Estonian Ministry of Education and Research is used,<sup>1</sup> which includes all high school grades and results of high school final exams. Descriptive statistics about investors educational characteristics together with the number of transactions is presented in Table 1. Combining those unique datasets allows to analyse different individual investor types based on gender, age, portfolio size, the average number of stocks in a portfolio, the average stocks holding period, the level of education, education type and high school exams. This has not been possible for previous studies due to limited data availability.

**Table 1.** Investor education and trading activity on the stock market.

Independent variables	Number of observations	Number of trades						
		Mean	Std. dev.	Percentiles				
				10th	25th	50th	75th	90th
Mathematics exam bottom quartile	1135	17.52	41.90	2	3	6	15	39
Mathematics exam top quartile	1184	18.39	64.42	2	3	6	16	39
English exam bottom quartile	1297	19.24	44.78	2	2	6	18	42
English exam top quartile	1374	16.38	41.80	2	2	5	14	35
History exam bottom quartile	637	18.16	85.04	2	2	5	14	30
History exam top quartile	666	27.35	200.11	2	2	6	16	39
Mother tongue exam bottom quartile	1602	18.89	66.36	2	2	6	15	35
Mother tongue exam top quartile	1667	18.56	55.31	2	2	6	15	39
Physics exam bottom quartile	209	17.49	32.21	2	2	7	18	42
Physics exam top quartile	220	15.12	23.00	2	3	7	16	38.5
Geography exam bottom quartile	303	9.38	15.55	2	2	4	10	21
Geography exam top quartile	311	13.66	24.54	2	2	5	14	37
Egghead	2510	20.48	117.41	2	2	5	16	39
No egghead	4332	17.60	52.28	2	2	4	14	36
Higher education	8311	20.24	81.09	2	2	6	16	41
High school graduate	2244	14.82	58.07	2	2	5	12	30
Natural sciences degree	1244	21.76	68.89	2	3	7	19	46
No natural sciences degree	9311	18.74	77.79	2	2	5	14	37
Degree in medicine	169	13.51	42.25	1	2	4	10	32
No degree in medicine	10386	19.18	77.23	2	2	5	15	38
All investors with educational data	10555	19.10	76.80	2	2	5	15	38
Male	19189	22.77	103.78	2	2	5	16	43
Female	8627	10.80	82.88	1	2	3	8	19
Lowest trading group	3393	1.00	0.00	1	1	1	1	1
Second trading group	12346	2.69	0.79	2	2	2	3	4
Third trading group	9511	8.23	2.76	5	6	8	10	13
Highest trading group	8589	141.21	2254.22	17	21	33	66	152

Source: Author's calculations.

Note: The table reports independent variables descriptive statistics by the following educational categories: national high school exam result groups, level and type of education. In addition, the table reports demographic and group allocations based on investor trading activity. The table reports the number of observations, mean, standard deviation and percentile allocation of average trades based on investors' educational characteristics.

The total number of different investors who made at least one purchase during the sample period is 33,839, of which 27,816 are individual investors. Out of those investors, official educational data have been obtained for 10,555 investors and that forms the main sample for the analysis. Although the stock market data for the whole population have been obtained, it is possible to use educational data of only those investors whose data are in the educational register, which reduces the sample of the investors.

For all investors the transaction date, price and the specific stock has been obtained. As investors' stock purchasing prices before January 2004 have not been obtained, the positions opened before that are not used for any of the calculations. Prices are adjusted for stock splits and dividends. Investors' trading activity is measured as the number of transactions executed by the investor as suggested by Feng and Seasholes (2005) and Nicolosi et al. (2009). Nicolosi et al. (2009) state that an alternative measure for trading activity is trade turnover, but the number of trades is a straightforward measure for trading intensity. Hence, this study uses the number of transactions as a measure for investors' trading activity.

The dependent variable is a categorical variable based on the number of transactions made by an investor during the period of 2004 until 2012. The dependent variable is



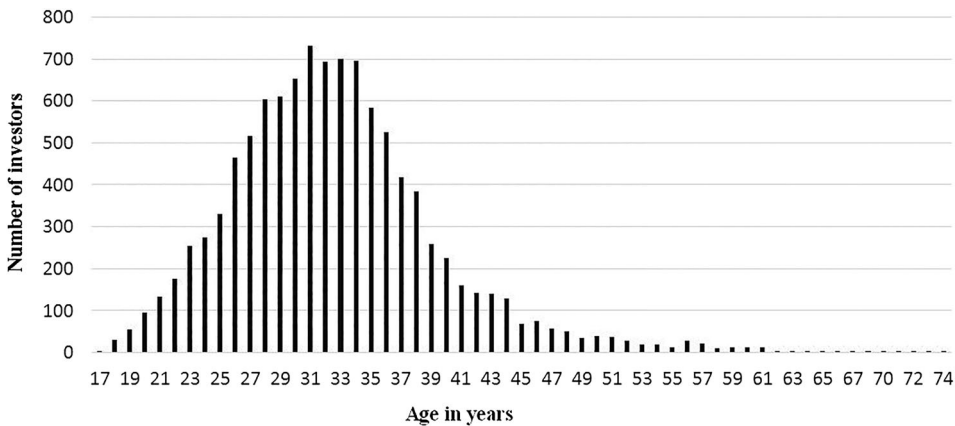
divided into quartiles. Investors allocated to the lowest trading activity group made only one transaction during the observed period. For the second group, the number of trades varies between two to four trades. In the third group, investors made between 5 and 14 trades and the investors belonging to the highest trading group made 15 or more trades. The allocation to quartiles has been made, so that the number of investors in each group would be similar. The first group has a smaller number of investors compared to other quartiles due to the reason that the number of investors who made only one trade is smaller.

For empirical model control variables, this study uses gender, age, portfolio size, portfolio diversification and the average stock holding period based on the documentation of Feng and Seasholes (2005) and Grinblatt and Keloharju (2009). Most of the independent variables are binary. This study uses probability models to analyse the effect of educational characteristics on investor trading activity. Table 1 indicates that the mean and standard deviations for the number of trades are rather large. Therefore, the dependent variable is categorized to quartiles to eliminate the effect of outliers. For this kind of data analysis, the ordered logit regression model has been used by Coval and Shumway (2005), Greene (1997), Gelman and Hill (2007) and van Dijk and Pellenbarg (2000). For robustness analysis, the study uses logit regression models to study the effect of educational and other characteristics on different trading groups separately.

The study analyses different exam results in a single and in a multivariable model, because each high school graduate has to take three to five state exams. The exam results are divided into quartiles to analyse the effect of the top and bottom exam results on trading activity. A high school graduate has to take mandatory exams such as mathematics, mother tongue and English or German, while other exams are optional. When more than one exam is included in the regression model, multicollinearity starts to affect the results. It can be assumed that students who are good at certain subject are also successful at other subjects, thus the multicollinearity. To solve the problem, a new variable called 'egghead'<sup>2</sup> has been constructed.

The traders in the sample are relatively young and most of the investors belong to the Y generation, because the national exams are taken around the age of 18 and the dataset obtained from the Estonian Ministry of Education and Research starts from 1997. The average age of the investors in the sample is 32.6 years. Still, the sample is in line with the overall Estonian stock market as an average Estonian investor is also relatively young due to the short history of its capital markets (Talpsepp, 2011). The age distribution of the sample is presented in Figure 1.

The study uses aggregate data for the average return for investors during the observed period. As investors can also trade foreign stocks and change the amount invested, which has an effect on performance, the portfolio return is calculated as an annual money-weighted return. Each transaction has been adjusted for transaction costs in the amount of five euros plus 0.1% of the transaction amount. Markowitz (1991) and Modigliani and Modigliani (1997) state that to have a true picture of the investors' performance, the risk, which is associated with a particular investment, should be taken into account. Therefore, each individual's risk-adjusted returns are calculated, because some investors might intentionally take higher risks in order to achieve higher returns. Modigliani and Modigliani (1997) choose standard deviation as a measure of risk.



**Figure 1.** Investors age distribution. Source: Nasdaq OMX Tallinn dataset, author's calculations.

## 4. Empirical results

This section presents the results of how detailed educational characteristics affect investors' trading activity on the stock market. This study offers evidence how high school national exam results, a university degree and the type of education affect investors' trading decisions. In addition, the study analyses other factors such as age, the average number of stocks in the portfolio, the average portfolio size and the average holding period. The section ends with the analysis how trading experience in the form of the number of trades influences investors' risk-adjusted performance on the stock market.

### 4.1. Do top performers in high school national exams trade more?

This part of the study uses an ordered logit regression model to test the hypothesis whether investors with better high school exam results trade more actively on the stock market. The study runs a single-ordered logit regression model to study the isolated effects of educational variables on investors' trading activity and then includes a number of control variables such as age, gender, portfolio size as a proxy for wealth, portfolio diversification and the average holding period in the regression. The study analyses regression models with control variables individually and does not combine them in one model due to multicollinearity between educational characteristics.

The paper analyses high school exam results in a simple ordered logit regression and then together with the control variables. The statistical significance of the control variable coefficients in the regression results does not change for different regression model setups. The results of all regressions are available upon request. The paper reports the most relevant national exams and university specialties determined on the basis of the exam participation rate. Table 2 shows that statistically significant high school exam results for simple and multivariable regression are only geography exam bottom quartile results and egghead group results. Neither mathematics, physics, mother tongue, English or history exam results are statistically significant for both regressions.

For further interpretation, the paper uses only those results which are statistically significant for both regressions. Table 2 presents the results in odds ratio to simplify

**Table 2.** An ordered logit regression model for the investors' trading activity and educational characteristics.

	Individual variables for number of trades		High school exam results and control variables		Educational level and control variables		Education type and control variables	
	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value
Mathematics exam top quartile	1.06	0.95	0.97	−0.34				
Mathematics exam bottom quartile	0.97	−0.53	1.03	0.42				
Physics exam top quartile	0.98	−0.17	0.97	−0.17				
Physics exam bottom quartile	0.86	−1.01	1.04	0.21				
Mother tongue exam top quartile	1.04	0.76	1.02	0.26				
Mother tongue exam bottom quartile	0.97	−0.63	0.99	−0.02				
English exam top quartile	0.97	−0.55	0.93	−0.94				
English exam bottom quartile	1.19***	2.99	1.11	1.44				
History exam top quartile	1.08	0.90	1.15	1.35				
History exam bottom quartile	0.80***	−2.75	0.87	−1.31				
Geography exam top quartile	1.18	1.35	1.19	1.11				
Geography exam bottom quartile	0.76**	−2.29	0.65***	−2.75				
Eggheads (exam high performers)	1.08**	2.07	1.08**	2.10				
Higher education	1.31***	6.26			1.18***	2.83		
Master's or doctoral degree	1.01	0.18			1.15	1.01		
Bachelor or equivalent degree	1.22***	5.54			1.07	1.53		
High school graduate	0.76***	−6.26			0.85***	−2.83		
Natural sciences degree	1.32***	5.04			1.16**	2.11		
Humanities degree	0.83**	−2.27			1.06	0.49		
Social science degree	1.11***	2.95			1.00	−0.01		
Degree in economics	1.05	1.27					0.90**	−2.00
Degree in public administration	1.05	0.38					1.07	0.41
Degree in finance	0.91	−0.79					1.15	0.86
Degree in information technology	1.23***	2.91					1.06	0.69
Degree in mathematics or statistics	1.35	0.97					1.32	0.73
Degree in physics or chemistry or biology	1.18	1.03					1.23	1.02
Degree in law	1.09	1.06					1.06	0.55
Degree in medicine	0.67***	−2.85					0.68**	−2.05
Degree in psychology	0.68*	−1.86					1.08	0.30
Male			2.11***	7.98	1.89***	11.57	1.86***	11.26
Birth year			1.01	0.66	1.00	0.94	1.00	−0.40
Average stocks in portfolio			4.19***	28.40	3.97***	41.94	3.98***	41.97
Average portfolio size			1.01***	14.09	1.01***	21.65	1.01***	21.77
Average holding period			0.99***	−15.15	0.99***	−22.58	0.99***	−22.5
Log likelihood			−3185		−7075		−7077	
Pseudo R <sup>2</sup>			0.25		0.26		0.26	

Source: Author's calculations.

Note: Table 2 reports coefficients and z-values from an ordered logit regression with robust standard errors in which the categorical dependent variable takes the value 0–3, depending on the investors' number of transactions. The first column presents independent dummy variables. Other columns present multiple regression results. The second, third and fourth column regressions are run individually together with control variables, because of multicollinearity. Table 2 presents control variables coefficients for mathematics exam results in the second column, in the third column for higher education and in the fourth column for investors holding a degree in economics. The statistical significance of other regression control variables coefficients does not differ and are available upon request. The table presents odds ratios to simplify interpretation. If odds ratio > 1, it means there is an increased probability of belonging to a particular group because of the factor.

\*Coefficients statistically significant at the 10% level.

\*\*Coefficients statistically significant at the 5% level.

\*\*\*Coefficients statistically significant at the 1% level.

interpretation. The odds ratio above one indicates increased probability of belonging to a particular group, because of the factor and vice versa. The results in Table 2 for single and multivariable ordered logit regression show that geography exam bottom quartile results are statistically significant at the 1% level and the egghead category is statistically significant at the 5% level. The odds ratio presented in Table 2 for the geography exam bottom quartile is for both ordered logit regressions below one (single-ordered logit regression odds ratio is 0.76 and for the control variables 0.65), indicating that investors belonging to the geography exam bottom group trade less compared to the investors with no such an educational characteristic.

The odds ratio presented in Table 2 for the egghead category is for both ordered logit regressions 1.08, indicating that investors belonging to the egghead category trade more actively compared to the investors with no such an educational characteristic. The reason might be in a larger population, which makes this group relevant for trading activity. Neither mathematics, English, physics, mother tongue nor history exam top and bottom performers are alone statistically significant. The study obtained similar results when logit regression models were used for the purpose of robustness check.

The marginal effect analysis presented in Table 3 indicates that the probability of belonging among the low trading activity investors' group increases by 2.51% for poor performers in geography high school exam. The investors belonging to the low performing group in geography exams made on average 9.38 trades compared to investors' population average of 19.1 trades. The results of Table 3 show that the probability of belonging to the most active traders group increases by 1.48% for the egghead category. The investors belonging to the egghead group made on average 20.48 trades compared to 17.4 trades made by the investors not belonging to this category. Consequently, the study finds confirmation to the hypothesis that the investors having top results in national exams trade more actively on the stock market. The investors risk-adjusted performance is analysed in section 4.4.

**Table 3.** Marginal effect analysis for the investor trading activity quartiles.

	Quartile I		Quartile II		Quartile III		Quartile IV	
	Coef.	z-values	Coef.	z-values	Coef.	z-values	Coef.	z-values
<b>Marginal effect for high school exam results</b>								
Geography exam bottom quartile	2.51%**	2.15	4.37%**	2.36	-2.58%**	-2.13	-4.29%**	-2.38
Eggheads (exam high performers)	-0.68%***	-2.13	-1.23%**	-2.05	0.43%	0.03	1.48%**	2.04
<b>Marginal effect for education level</b>								
Higher education	-2.04%***	-5.80	-4.69%***	-6.39	1.78%***	5.45	4.95%***	6.52
High school graduate	2.04%***	5.80	4.69%***	6.39	-1.78%***	-5.45	-4.95%***	-6.52
Natural sciences degree	-1.79%***	-5.46	-4.95%***	-5.00	1.21%***	6.78	5.53%***	4.82
<b>Marginal effect for education type and control variables</b>								
Degree in medicine	3.30%**	2.45	6.58%***	3.12	-3.06%**	-2.33	-6.82%***	-3.19

Source: Author's calculations.

Note: Table 3 reports the marginal effect and z-values from an ordered logit regression marginal analysis for the discrete change in a dummy variable from 0 to 1. Category I quartile represents the lowest and category IV quartile the highest trading activity investors group.

\*Coefficients significant at the 10% level.

\*\*Coefficients significant at the 5% level.

\*\*\*Coefficients significant at the 1% level.

Table 2 reports that on an individual level national high school exam results (except geography exam) are statistically not significant. This raises the question why mathematics high school exam results, which one would consider as one type of cognitive ability, are not significant and result in geography exams are significant for trading activity. The reason might hide in the specific type of cognitive abilities. One possible interpretation could be that individuals performing well in geography exams may have an increased and open curiosity for learning about the world around us. Just the opposite, investors demonstrating poor results in geography exam may have decreased interest in learning how the world works. Those findings relate to documentation of Borghans, Duckworth, Heckman, and Weel (2008) who state that both cognitive abilities and personality traits predict a variety of social and economic outcomes. Dohmen et al. (2011) provide further empirical evidence that cognitive abilities are closely related to risk aversion and impatience, which are significant factors influencing investors' trading decisions.

The results in Table 2 reveal that investors performing poorly in geography high school exams are the only statistically significant investors group in high school exam results which affects trading decisions. Further and deeper analysis of university specialty choices for geography exam low performers reveals that this group of investors chooses with high probability not to continue their studies at university (Vaarmets, 2015). This finding is in line with the conclusion that investors with no academic degree are more likely to trade less actively on the stock market. As for this study, it is not possible to acquire more detailed information regarding the geography exam structure and student answers, there is also a chance that the result is just a random outcome.

#### **4.2. Do higher educated investors trade more?**

This part of the study tests the hypothesis that investors holding a university degree trade more actively on the stock market compared to investors without a university degree. In addition, the study provides empirical evidence how the education type affects trading activity on the stock market.

The study uses the same control variables in ordered logit regressions for the university degree and the level of education as in previous analysis of the national exams. All available data of university degree types held by investors have been collected and grouped into different categories according to the names of university programs. The results for the level of education show that the investors with higher education have the odds ratio above one indicating that the investors with a university degree trade more actively on the stock market compared to the investors with no academic university degree. The coefficient is statistically significant and the odds ratio for the investors with higher education for a single-ordered logit regression is 1.31 and for an ordered logit regression with control variables 1.18. The analysis of the high school graduates, bachelor's and master's or doctoral degree holders separately reveals that the investors having only high school graduate diploma have the odds ratio below one indicating that investors with such educational characteristics trade less stocks. The coefficient is statistically significant and the odds ratio for the investors holding only a high school graduate diploma for a single regression is 0.76 and for a regression with control variables 0.85. The ordered logit regression coefficients for bachelor's and master's or doctoral degree holders are above one, indicating that the investors holding those degrees trade more actively on the

stock market. Still, as those coefficients are statistically not significant for all regressions, the study cannot draw a conclusion regarding bachelor's and master's or doctoral degrees separately.

The results of marginal analysis presented in [Table 3](#) show that the probability of an investor belonging to the lowest trading group increases by 2.04% if the investor holds no academic degree. In case the investor has higher education, the probability to belong to the highest trading group increases by 4.95%. Investors with an academic degree made on average 20.24 trades compared to 14.82 trades by investors with no academic degree. Consequently, the study confirms the hypothesis that investors holding a university degree trade more actively on the stock market compared to investors with no university degree.

The study analyses the results for the education level by the type of science and finds that the investors holding degree in natural sciences have the odds ratio above one. It shows that the investors with such a university degree trade more on the stock market compared to the investors with no such an educational characteristic. The coefficient is statistically significant and the odds ratio for investors holding a degree in natural sciences for a single regression is 1.32 and for a regression with control variables 1.16. The marginal analysis results reveal that the probability of an investor belonging to the highest trading investors group increases by 5.53% if the investor holds a natural science degree. The investors with a degree in natural science made on average 21.76 trades compared to 18.74 trades by the investors with no such a degree. Interestingly natural science specialties alone are statistically not significant and therefore the study cannot draw conclusions regarding those specialties on an individual level. Still, the ordered logit regression coefficients for biology, chemistry, physics and mathematics specialty are above one, indicating that investors holding this specialty degree are more likely to trade actively on the stock market. Neither social sciences nor humanities degrees are statistically significant for investors' trading activity. The study used a logit regression for robustness check purposes and obtained similar results.

In addition, the study analyses university specialties. The odds ratio presented in [Table 2](#) for medicine degree holders for both ordered logit regressions is below one (the single odds ratio of 0.67 and the odds ratio with control variables of 0.68), indicating that the investors holding this degree tend to make less transactions on the stock market. The marginal effect analysis in [Table 3](#) indicates that the probability of belonging to the group of lowest trading investors increases by 3.30% if the investor holds a degree in medicine. The investors with a medicine degree made on average 13.51 trades compared to 19.18 trades in the case of investors not belonging to this category. As it was not possible to inquire more detailed information regarding medicine students and the medicine students' population is rather small in the total sample, there is also a chance that the result is just a random outcome. Neither economics, law, public administration, physics, medicine, information technology, finance or psychology seem to be statistically significant.

One possible reason for more active trading among the investors with higher education and a degree in natural sciences might be connected with their higher intellectual abilities which are enhanced while they are their university students. Higher intellectual abilities come with the potential of analysing their trades and learning from this experience. The statement that a higher level of education helps investors to make more rational investment decisions is supported by Grinblatt, Keloharju, and Linnainmaa (2012). Detailed analysis regarding the investors ability to learn from their trading experience and to improve their risk-adjusted performance is presented in Section 4.4.

The results in [Table 2](#) show that holders of degrees in natural are likely to execute more trades on the stock market compared to investors with no such a degree. The analysis of high school exam results does not show that investors with good results in natural science exams such as mathematics, physics, biology or chemistry has a statistically significant effect on trading activity. The study analyses investors university specialty choices and finds that investors with good results in natural science exams like as well as mathematics, physics or biology do choose to continue their university studies with higher probability in natural sciences, but the strongest effect on the decision to obtain a university degree in natural sciences, is noted in case of geography exam top performers. The results are statistically significant and the coefficient is much higher than for the mathematics, physics or biology high school top performers. Detailed analysis of investors' educational choices in the same dataset is presented by Vaarmets ([2015](#)).

#### **4.3. Other factors influencing investor trading activity**

In addition to educational characteristics, this study analyses a number of other factors, which influence investors' trading activity. When including continuous control variables such as the birth year, the average number of stocks in the portfolio, the average portfolio size and the average holding period, educational factors and control variables remain significant.

This study analyses demographic variables such as the birth year and gender and finds that only the latter is statistically significant. The odds ratio for male investors presented in [Table 2](#) indicates that male investors are more active in trading stocks compared to female investors. This conclusion is in line with the finding of Barber and Odean ([2001](#)) who find that men trade 45% more than women.

In addition, the level of wealth seems to be an important factor for trading activity. The average portfolio size was used as a proxy for wealth. Results presented in [Table 2](#) show that a higher portfolio size increases the average number of stocks traded on the stock market as the control variable coefficient is above one and statistically significant. This finding is in line with the findings of Graham et al. ([2009](#)) who conclude that wealthier investors are more likely to perceive themselves as competent and therefore trade also more actively on the stock market. In addition, this paper finds that investors who trade more actively hold more diversified portfolios, but hold their stocks in the portfolio for a shorter period of time. Those findings are in line with the conclusions of Grinblatt and Keloharju ([2009](#)).

The findings that investors who trade more actively hold more diversified portfolios and have a higher portfolio size is expected. In order to draw a final conclusion how portfolio diversification and portfolio size influence trading activity a ratio analysis should be performed. As the findings regarding control variables are not the main focus of the paper the ratio analysis would be the focus of another study.

#### **4.4. Trading activity and investor risk-adjusted returns**

Prior studies suggest that besides other factors education and trading experience help investors to achieve better performance on the stock market. Grinblatt et al. ([2012](#)) provide empirical evidence that investors with higher IQ achieve better performance. More detailed empirical analysis has been done by Liivamägi et al. ([2014](#)) who used the same dataset and provided empirical evidence that the level and type of education



affect performance on the stock market. The focus of this study is to analyse investors' real-life trading experience and the relationship to risk-adjusted performance. For this kind of analysis, Feng and Seasholes (2005) and Nicolosi et al. (2009) suggest using the total number of transactions as a measure of investor trading experience in the form of trading activity. To test whether investors who trade more stocks learn from their trading experience, the study analyses their risk-adjusted performance.

Table 4 reports coefficients and *t*-values from a regression where the independent variable is the number of trades and the dependent variable is investors' risk-adjusted return. The results reported in Table 4 are statistically significant at the 5% level. The coefficients reported in Table 4 indicate that the third and fourth trading activity groups, which are the groups with the highest number of trades, have a positive and statistically significant influence on the investors' risk-adjusted performance. The opposite is true for the second trading group with low trading activity as the negative coefficient indicates an

**Table 4.** Investor risk-adjusted performance and trading activity on the stock market.

		Risk-adjusted returns for trading activity groups				
		Percentiles				
	Number of observations	25th	50th	75th	Coefficient	t-value
I group (low trading activity)						
Full period 2004–2012	1325	−6%	1%	16%	0.10**	2.08
Period 2004–2007	334	16%	40%	92%		
Period 2007–2009	401	−52%	−44%	−29%		
Period 2009–2012	516	−3%	8%	21%		
II group						
Full period 2004–2012	8896	−10%	−3%	5%	−0.76***	−32.25
Period 2004–2007	5553	11%	12%	28%		
Period 2007–2009	2516	−51%	−42%	−34%		
Period 2009–2012	1830	−5%	7%	20%		
III group						
Full period 2004–2012	8257	−6%	2%	15%	0.13***	5.49
Period 2004–2007	4796	12%	32%	78%		
Period 2007–2009	3705	−51%	−42%	−30%		
Period 2009–2012	3140	−3%	8%	21%		
IV group (high trading activity)						
Full period 2004–2012	8251	−4%	6%	20%	0.64***	26.71
Period 2004–2007	4673	25%	50%	102%		
Period 2007–2009	5239	−50%	−40%	−24%		
Period 2009–2012	5238	2%	12%	26%		
All investors						
Full period 2004–2012	26729	−7%	1%	14%	0.30***	2.99
Period 2004–2007	15408	12%	27%	72%		
Period 2007–2009	11943	−51%	−42%	−28%		
Period 2009–2012	10885	0%	10%	24%		

Source: Author's calculations.

Note: Table 4 reports investors' portfolio risk-adjusted performance based on investors' trading activity on the stock market.

The I group consists of investors with the lowest trading activity and the IV group consists of investors, who made the most trades. The table reports investors' risk-adjusted performance during business cycles. In the first column performance is reported for the full period; in the second column for the bull market period from 1 January 2004 to 5 February 2007; in the third column for the bear market period from 6 February 2007 to 9 March 2009; in the fourth column for the bull market period from 10 March 2009 to 31 December 2012. The table reports the number of observations, percentile risk-adjusted returns for investor groups, regression coefficients and *t*-values. The table reports coefficients and *t*-values from a regression where the independent variable is the number of trades and the dependent variable is investors' risk-adjusted return.

\*Coefficients significant at the 10% level.

\*\*Coefficients significant at the 5% level.

\*\*\*Coefficients significant at the 1% level.



unfavourable influence on the risk-adjusted performance. The first group with the lowest trading activity has a positive coefficient indicating a favourable effect on the risk-adjusted performance, but the relationship to risk-adjusted performance is weaker than for the two groups with the highest trading activity. The regression coefficient presented for the whole investor population in Table 4 is positive and statistically significant at the 1% level. The results of regression analysis confirm the hypothesis that more executed trades, which is a proxy for investors' experience, have a positive effect on investors' risk-adjusted performance.

Table 4 presents performance measures for different trading groups of investors throughout the business cycles. The results for the full period from 2004 to 2012 indicate that investors with more trading experience achieve higher risk-adjusted returns. The risk-adjusted return for the investors in the 50th percentile and those who belong to the group of lowest trading activity is 1%. The risk-adjusted return for the investors in the 50th percentile and those who belong to the medium activity groups and high trading activity group are, respectively, -3%, 2% and 6%. In Table 4 the results for average risk-adjusted performance indicate that risk-adjusted performance increases group by group if the number of trades increases.

It is important to point out the finding by Barber and Odean (2000) and Barber and Odean (2001) who found that too much trading has a negative effect on investors' wealth. At first this finding contradicts conclusions of this study, but more detailed analysis provides an explanation of this conflict. By dividing investors into 10 categories according to the number of transactions reveals that to a certain point, a larger number of trades increases the performance success probability, but executing more than 100 transactions during the period reduces the probability of being successful. Such a finding is consistent with Barber and Odean (2000) who claim that trading too much is unfavourable for investors' wealth, but is also consistent with the findings of Nicolosi et al. (2009) who suggest that trading experience to some extent increases stock market performance as investors do learn from their experience.

## 5. Conclusion

Previous studies provide empirical evidence that trading experience helps eliminate judgement errors, such as the endowment effect and the disposition effect. This paper provides the first empirical documentation of comprehensive educational characteristics that influence investor trading experience in the form of trading activity on the stock market. This study extends documentation of previous studies and offers detailed empirical evidence to confirm the hypothesis that investors with academic education or those who demonstrate top results in national exams trade more actively on the stock market. In addition, the study finds that investors holding a degree in natural sciences trade more actively on the stock market compared to investors with no such a degree. The opposite is true for investors with no academic degree and for investors with low results in geography national exams as they execute a lower number of trades. In addition, the study finds that investors holding a degree in medicine trade less actively on the stock market. Other university degrees do not seem to influence investor trading activity. The regression analysis regarding investors' risk-adjusted returns reveals that trading experience helps

investors to achieve better performance on the stock market compared to investors with lower trading experience.

In addition, many of the findings confirm the results of previous studies including that male investors trade more actively compared to female. In addition, the study concludes that investors who made more transactions on the stock market hold more diversified and larger portfolios. Additionally, the study finds that investors trading more actively hold stocks in their portfolio for a shorter period of time.

Having provided evidence that investors with an academic degree and better results in national exams trade more on the stock market, further studies could address the research question how their trading activity has evolved and changed during business cycles.

## Notes

1. The stock market and educational data sets were combined by using national identity codes. Data used for analysis are anonymized.
2. The dummy variable egghead has been generated to represent a student who has the average national high school exam result over 70% of the maximum exam score. As every student has to take at least three national high school exams the egghead dummy represents a student with the average of those exam results of over 70%.

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## Disclosure statement

No potential conflict of interest was reported by the author.

## Notes on contributor

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