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Investor Education and Portfolio Diversification on the Stock Market

Kristjan Liivamägi
Tallinn School of Economics and Business Administration, Tallinn University of Technology
Akadeemia tee 3, 12618 Tallinn, Estonia
Phone: +372 5810 4092, e-mail: kristjan.liivamagi@gmail.com

Abstract

This study analyses how educational characteristics affect investor portfolio diversification on the stock market. I use a unique dataset from the Tallinn stock exchange, covering stock market transactions of a full business cycle from 2004 to 2012, with an official educational dataset. Having controlled for gender, age, wealth and investor trading behaviour, I provide empirical evidence that investors with higher academic education and top results in national high school exams in mathematics, mother tongue and geography hold more diversified portfolios. In addition, investors with a degree in the natural sciences, mathematics or statistics hold more diversified portfolios compared to investors with no such educational characteristics. Furthermore, investors with poor results in their mathematics and mother tongue exams and investors with no academic university degree hold less diversified portfolios. Analysing investor risk-adjusted performance reveals that higher portfolio diversification is a significant factor contributing to higher returns on the stock market.

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1. Introduction

Portfolio diversification between different assets is a portfolio management strategy to reduce the unsystematic risk of an investment portfolio. Trading decisions by investors in financial markets are assumed to be rational; nevertheless, under-diversification with unnecessary risk taking and lower stock market performance among some investors has been documented by Goetzmann and Kumar (2008) and Barber and Odean (2011). On the other hand, there are groups of investors who hold more diversified portfolios and with that avoid unnecessary risk-taking. What makes some investors diversify more between stocks than others? Is it age, experience, wealth, higher education, specific type of education or something else? The puzzle over how detailed educational characteristics influence investor portfolio diversification with stock market performance during a full business cycle has haunted many researchers, and has remained as yet unanswered due to the limitations of available data. I use a unique full business cycle dataset from the Nasdaq OMX Tallinn stock market, which covers transactions for the period from 2004 to 2012 with educational data from the Estonian Ministry of Education and Research, to answer this question.

My aim is to study how educational characteristics such as level and type of education and high school final exam results contribute to diversification among investors. An ordered logit regression with marginal analysis is used to identify the educational characteristics influencing investor diversification during the business cycle as defined by Aguiar and Gopinath (2007). Control variables, such as gender, age, wealth, experience and trading characteristics are derived based on documentation from Anderson (2007) and Goetzmann and Kumar (2008).

It has been documented that investors should hold a diversified portfolio of assets to minimize the impact of idiosyncratic risk on their monetary investments. Investors who overinvest in their employer company stock are exposed to idiosyncratic risk and there are many studies claiming that far too many investors fail to diversify this risk. Mitchell and Utkus (2003) estimate that more than 11 million survey respondents held over 20 per cent of their 401(k) account in their employer's stock and of that group five million participants had 60 per cent or more in company stock. Goetzmann and Kumar (2008) add to this by showing that individual US investors hold under-diversified portfolios, where the level of under-diversification is greater among younger, low-income, less-educated and less-sophisticated investors. The level of under-diversification is also correlated with investment choices that are consistent with over-confidence, trend-following behaviour and local bias.

Under-diversification by individual investors increases the portfolio volatility relative to the market portfolio, and therefore, decreases investor performance on the stock market as documented by Goetzmann and Kumar (2008). They claim that investors with higher levels of education hold more diversified portfolios, which contributes to better performance on the stock market. Several authors such as Nguyen and Schuessler (2012) and Kumar (2009) add to this by confirming that a higher level of education increases investor stock market performance. Hence, I set a hypothesis that investors with higher national high school exam results and higher educational levels, hold more diversified portfolios, and therefore, achieve better risk-adjusted performance on the stock market compared to investors with no such educational characteristics. Furthermore, I set a hypothesis that investors with no academic university degree and poor results in national high school exams hold less diversified portfolios and experience lower performance on the stock market compared to investors with no such educational characteristics.

Prior studies of investor portfolio diversification have used subsample analysis due to the limitation of available data. I use a complete business cycle dataset to avoid any biases arising from choosing only subsamples, which might lead to incomplete results. Hoffmann, Post, and Pennings (2013) note that individual investor perceptions have changed and have driven trading and risk taking behaviour during the 2008–2009 financial crisis. Investor perceptions have fluctuated during the crisis, with risk tolerance and risk perceptions being less volatile than return expectations. Kim and Nofsinger (2007) add to this by studying individual Japanese investors by contrasting their behaviour during a long bull market (1984–1989) to a long bear market (1990–1999). They identify differences in investing behaviour between the bull and the bear market, which are associated with poor investment performance. Based on the aforementioned studies I conclude that a full business cycle analysis is necessary when analysing investor stock market portfolio diversification.

The main contribution of the paper is the first empirical documentation of comprehensive educational characteristics, which influence investor diversification on the stock market including on bull and bear markets. In this paper I extend the documentation of previous studies and offer detailed empirical evidence that investors with higher academic education and top results in national exams in mathematics, mother tongue and geography hold more diversified portfolios. The same is true for investors who have the average score of more than 70 per cent in different high school exams. In addition, I conclude that investors holding a university degree in the natural sciences, mathematics or statistics hold more diversified portfolios. The opposite is true for investors with no academic degree and low performance in mathematics and mother tongue exams as they hold less diversified portfolios. The results for investors' risk-adjusted performance indicate that the economic costs of under-diversification is significant for most of the investors. Investors with under-diversified portfolios experience lower risk-adjusted performance on the stock market.

Many of my findings regarding control variables confirm results from the previous studies, indicating that investors on the Tallinn Stock Exchange have similar trading characteristics to investors in the rest of Europe, Asia or the USA. I provide empirical evidence that investors with higher numbers of transactions, as a proxy for experience, tend to hold more stocks in their portfolio. In addition, I show that greater portfolio size increases the average number of stock held in the portfolio. This finding is in line with Anderson (2007) and Goetzmann and Kumar (2008).

The second section provides an overview of previous studies. The third section offers insight into the unique dataset and provides the details of the methodology for measuring diversification and performance. The fourth section offers empirical evidence, results and robustness tests. The fifth section concludes.

2. Previous Studies

Investors are continually learning, gaining new knowledge and improving their knowhow about financial markets, but does it pay off to educate yourself? Many authors have found that education has a significant impact on investors' financial behaviour on the stock market and that learning eventually pays off. Nguyen and Schuessler (2012) argue that a higher level of education reduces behavioural biases such as the self-attribution bias, anchoring bias and representativeness, which contribute to better and more rational investment decisions.

Other authors claim that economic education increases financial awareness. Guiso and Jappelli (2005) provide empirical evidence that financial awareness is positively correlated with education, household resources, long-term bank relations and proxies for social interaction.

There is evidence that not only academic education, but also education obtained in the workplace and from other courses, improves investors' financial decisions. Bernheim and Garrett (2003) conclude that financial education in the workplace significantly increases the probability of savings in general, and the households which were exposed to financial courses during high school have higher savings rates than others. The educational environment where investors spend their time is an important factor influencing investment decisions and the choice to participate on the stock market. Vaarmets, Liivamägi, and Talpsepp (2014) show that higher education increases the probability of participation on the stock market.

Kumar (2009) sheds light on the reasons for the bad performance on the stock market of lower educated investors. The author finds that investors with a lower income and lower education level are more likely to choose lottery-type stocks or gamble on the stock market. Stock market gamblers are also rather younger and unemployed. Their portfolio performance is usually worse than average. This is consistent with evidence that financial decisions are influenced by age––older investors outperform younger investors. Additionally, female investors tend to experience better performance than male investors as they hold stocks longer and trade less as noted by Barber and Odean (2001) and Talpsepp (2010).

It is not only education itself, but also the quality and type of education, which contributes to better performance on the stock market as shown by Liivamägi, Vaarmets, and Talpsepp (2014). Gottesman and Morey (2006) add to this by demonstrating that fund managers who hold MBAs from schools ranked in the top 30 of the Business Week rankings of MBA programmes exhibit performance superior to the performance of both managers without MBA degrees and managers holding MBAs from unranked programmes. Additionally, they conclude that other education variables, such as whether the manager attained a CFA designation or holds either a non-MBA masters-level graduate degree or PhD, are generally unrelated to mutual fund performance.

Several authors conclude that education has a significant impact on investors performance, but does it also influence portfolio diversification? Rational investors should hold a diversified portfolio to minimize the impact of unnecessary volatility and risk on their investments. There are different opinions about how many stocks an investor should hold to have a well-diversified portfolio. Statman (1987) claims that individual investors should hold at least 30 stocks in their portfolio to have a well diversified portfolio. Evans and Archer (1968) conclude that a portfolio of at least ten stocks is enough to have the full benefits of diversification. In practice most investors worldwide hold under-diversified stock portfolios. Barber and Odean (2011) document that, on average, individual US investors in the LDB dataset hold only four stocks in their portfolio. The investors in the Estonian stock market hold in average 1.97 stocks in their portfolio, which is well below the considered optimal allocation of a well-diversified stock portfolio. One of the reasons is relatively small number of 23 different stocks available for investors in the Estonian stock market. Nevertheless investors holding fewer stocks than the average investor in their portfolio increases portfolio risk and reduces performance.

Investor behaviour on the stock market is not always rational and some of them over invest in the stock of their employer company, and therefore, are exposed to idiosyncratic

risk. Mitchell and Utkus (2003) demonstrate that far too many investors hold their 401(k) account investments in their employer's stock, and therefore, fail to diversify idiosyncratic risk. Poterba (2015) analyses the 20 largest defined contribution plans managed by corporations, and states that nearly half of the plan assets are invested in company stock. Benartzi (2001) documents that some of the allocation to company stock is voluntary on the part of employees.

Studies show that many investors tend to hold under-diversified portfolios, which adds additional economic cost to their wealth. Goetzmann and Kumar (2008) analyse the 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 individual US investors hold under-diversified portfolios, where the level of under-diversification is greater among younger, low-income, less-educated and less-sophisticated investors. The level of under-diversification is also correlated with investment choices that are consistent with over-confidence, trend-following behaviour and local bias. In addition, French and Poterba (1991) find that investors prefer local and familiar stocks and avoid investment in foreign stocks, which provide more stronger diversification benefits.

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, trade more and have worse trading performance. They conclude that investors fail to take advantage of the benefits of diversification. This view is also shared by Goetzmann and Kumar (2008).

Many studies conclude that younger, low-income, less-educated and less-sophisticated investors tend to hold under-diversified portfolios and overinvest in their employee company stock, local stocks and domestic companies, which exposes them to greater risks which they are not compensated for. So far there have been studies analysing the overall educational impact on investors portfolio diversification, but none of them touched upon how comprehensive educational characteristics such as type or level of education and high school grades or final exams affect investor portfolio diversification. I am dealing with this issue by using a unique dataset from the Nasdaq OMX Tallinn and Estonian Ministry of Education and Research.

3. Data and Methodology

The unique dataset presented in this section helps to solve the complex puzzle of the relationship between detailed educational characteristics and portfolio diversification among investors on the stock market. For this study I use a comprehensive dataset from the only stock exchange in Estonia, Tallinn stock exchange, provided by Nasdaq OMX Tallinn. The data covers a period of nine years starting from 1 January 2004 to 31 December 2012 and includes all transactions made with listed Estonian companies. The period covers transactions for a total of 23 listed companies, which have been traded on the Estonian stock exchange during that period. The Nasdaq OMX Tallinn has a market capitalization of about 1.7 billion euros as of 31 December 2014.

Besides the data from the Nasdaq OMX Tallinn, I also use a unique dataset from the Estonian Ministry of Education and Research, which includes all high school grades and results of high school final exams from their implementation in 1997 till 2012. Descriptive

statistics about the average number of stocks in investors' portfolios by educational characteristics is presented in Table 1. Combining those unique datasets makes it possible to analyse different individual investor types based on gender, age, portfolio size, stocks holding period, number of transactions, level of education (high school, bachelor, master, doctor), distribution by type of education (physics, psychology, mathematics, economics, finance, medicine, law, information technology, public administration, chemistry), high school grades and high school ranks. The total number of observations of individual investors by gender, age, wealth, trading characteristics, for which the diversification by the number of stock holdings is measurable, is over 21,800. Table 1 presents the number of investor stock holdings in portfolios based on different educational characteristics.

During the observed period, investors hold on average 1.86 stocks in their portfolio, which is a relatively small number compared to the 23 different stocks available to investors. The total number of different investors who have made at least one purchase trade during the sample period is 33,843, of which 25,426 are individual investors. Of those investors, official educational characteristics for 8,450 investors are obtained and that forms the main sample for the analysis. Although the stock market data for the whole population is obtained, it is possible to tie educational data for only those investors whose data are in the educational register, which reduces the sample to about one third of all investors. As the national state exams and educational register did not exist before 1997, the sample consists of quite young investors, with an average age of about 33 years in 2012. Besides the 12-year age difference and portfolio size difference there are no material differences in investors trading characteristics such as number of transactions, portfolio diversification and portfolio turnover rate between the investor in the education sample and the average Estonian investor.

Different exam results are analysed separately and in a combined model, because each high school graduate has to take 3–5 state exams. The high school graduate has to take mandatory exams such as mathematics, mother tongue and English or German, while the other exams are optional. When more than one exam is included in the regression model multicollinearity starts to affect the results. It can be easily assumed that students who are good at a certain subject are also successful at other subjects; therefore, the resulting multicollinearity. To solve this problem, I construct a new variable called "egghead" and use it to represent a student who has national high school exam results over 70% of the maximum exam score on average. This new variable helps to eliminate any effects that could arise from obligatory and selective exam selection as this variable represents students with higher mental abilities. For all investors, the daily transaction date, the transaction price and the specific stock have been obtained. As the investors stock purchase prices before January 2004 have not been obtained, so the positions opened before that for any of the calculations are not used. Prices are adjusted for stock splits and dividends.

Table 1. Average Number of Stocks in Investors' Portfolios

		Average number of stocks in investors' portfolios						
				Percentiles				
Independent variables	Number of observations	Mean	Std. Dev.	10%	25%	50%	75%	90%
Mathematics exam bottom quartile	952	1.75	1.05	1	1	1.33	2.07	3
Mathematics exam top quartile	970	1.95	1.18	1	1	1.5	2.5	3.5
English exam bottom quartile	1,072	1.88	1.26	1	1	1.5	2.33	3.4
English exam top quartile	1,102	1.84	1.15	1	1	1.5	2.25	3.4
History exam bottom quartile	519	1.77	1.18	1	1	1.33	2	3.14
History exam top quartile	526	1.95	1.27	1	1	1.5	2.5	3.5
Mother tongue exam bottom quartile	1,319	1.76	1.12	1	1	1.29	2.03	3.08
Mother tongue exam top quartile	1,347	1.89	1.21	1	1	1.5	2.33	3.5
Physics exam bottom quartile	172	1.98	1.4	1	1	1.5	2.5	3.5
Physics exam top quartile	177	2.08	1.35	1	1	1.6	2.55	4
Geography exam bottom quartile	254	1.65	1.03	1	1	1	2	3
Geography exam top quartile	228	2.03	1.31	1	1	1.5	2.69	4
Egghead (exam high performers)	2,006	1.90	1.20	1	1	1.5	2.33	3.5
No egghead	3,548	1.80	1.15	1	1	1.33	2.11	3.21
Higher education	6,647	1.91	1.25	1	1	1.5	2.33	3.56
High school graduate, without a degree	1,803	1.7	1.06	1	1	1.25	2	3
Master's or doctoral degree	448	1.99	1.35	1	1	1.5	2.39	4
No master's or doctoral degree	8,002	1.86	1.21	1	1	1.43	2.25	3.43
Bachelor or equivalent degree	4,957	1.92	1.25	1	1	1.5	2.33	3.62
No bachelor or equivalent degree	3,493	1.78	1.16	1	1	1.33	2	3.11
Degree in natural sciences	997	2.02	1.29	1	1	1.6	2.5	3.86
No degree in natural sciences	7,453	1.84	1.2	1	1	1.4	2.2	3.4
Degree in humanities	389	1.94	1.3	1	1	1.5	2.28	3.69
No degree in humanities	8,061	1.86	1.21	1	1	1.45	2.25	3.43
Degree in social sciences	4,141	1.9	1.26	1	1	1.5	2.33	3.56
No degree in social sciences	4,309	1.82	1.17	1	1	1.4	2.17	3.33
Degree in mathematics or statistics	29	2.3	1.42	1	1	2	2.67	4.5
No degree in mathematics or statistics	8,421	1.86	1.21	1	1	1.46	2.25	3.44
Degree in economics	2,047	1.91	1.29	1	1	1.5	2.33	3.58
No degree in economics	6,403	1.85	1.19	1	1	1.46	2.2	3.4
Degree in medicine	124	1.75	1.01	1	1	1.42	2.07	3.06
No degree in medicine	8,326	1.87	1.22	1	1	1.47	2.25	3.46
Degree in public administration	162	1.92	1.27	1	1	1.41	2.25	3.8
No degree in public administration	8,288	1.86	1.21	1	1	1.47	2.25	3.44
Degree in finance	181	1.98	1.56	1	1	1.31	2.22	4
No degree in finance	8,269	1.86	1.21	1	1	1.5	2.25	3.44
Degree in information technology	586	1.95	1.29	1	1	1.5	2.33	4
No degree in information technology	7,864	1.86	1.21	1	1	1.44	2.25	3.43
Degree in physics, or chemistry, or biology	102	1.95	1.14	1	1	1.56	2.43	3.98
No degree in physics, or chemistry, or biology	8,348	1.86	1.22	1	1	1.45	2.25	3.44
Degree in law	398	1.9	1.24	1	1	1.5	2.33	3.38
No degree in law	8,052	1.86	1.21	1	1	1.44	2.25	3.46
Degree in psychology	58	1.7	0.86	1	1	1.44	2.22	3.08
No degree in psychology	8,392	1.86	1.22	1	1	1.47	2.25	3.45
Male	5,532	1.89	1.21	1	1	1.50	2.33	3.5
Female	2,918	1.72	1.13	1	1	1.14	2	3

Note: Table 1 reports average number of stocks in investors' portfolios divided between the following educational categories: national high school exam results, level and type of education. The Table reports the number of observations, mean number of stocks, standard deviation and percentile allocation of stocks based on investors' characteristics.

Source: Author's calculations

Investor diversification is measured on the basis of the average number of stocks held by an investor in their portfolio, as suggested by Anderson (2007). The dependent variable is a categorical variable based on the average number of stocks in the investor portfolio. The dependent variable is divided into equally distributed thirds, as a quartile or higher distribution is statistically or economically not reasonable due to the relatively small average number of stocks held in investors' portfolios. The range of average stocks held in investors' portfolios varies for the lowest diversification category from 1.00 to 1.39 stocks, for the medium diversification category from 1.40 to 2.32 and for the high diversification category from 2.33 to 17. On average, investors hold 1.97 stocks in their portfolio. As a robustness check, I use a diversification ratio, which is defined as market portfolio return standard deviation divided by investor portfolio return standard deviation motivated by the discussion by Goetzmann and Kumar (2008). The diversification ratio means that the lower the number of stocks in an individual investor portfolio the higher the volatility and risk in the portfolio, which results in a lower calculated diversification ratio. Control variables, such as gender, age, wealth, experience and trading characteristics are derived based on documentation from Anderson (2007) and Goetzmann and Kumar (2008). Most of the independent variables are binary.

The study uses probability models to analyse the effect of educational characteristics on portfolio diversification and performance. Investors are divided in equally distributed thirds according to the average number of stocks held in their portfolios. For this kind of data analysis the ordered logit regression model has been used as suggested by Coval and Shumway (2005), Greene (1997), Gelman and Hill (2007) and van Dijk and Pellenbarg (2000). As a robustness test, the study uses the OLS regression models to analyse the effect of educational and other characteristics on different diversification groups separately and to confirm the results of the ordered logit regression model.

Aggregate data is used to provide an indicator for the average return during the observed period for investors. As investors can also trade foreign stocks and increase or decrease the amount invested, which has an effect on performance, portfolio return is calculated as an annual money-weighted return. Each transaction has been adjusted for transaction costs of five euros + 0.1% * (transaction amount). As discussed by Markowitz (1991) and Modigliani and Modigliani (1997), to have true picture of investor 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.

For the risk-adjusted performance measurement, a risk-adjusted return is used as defined by Modigliani and Modigliani (1997). They chose standard deviation as a measure of risk, and return as a measure of reward, deriving equations accordingly. From the discussion by Goetzmann and Kumar (2008) and Sharpe (1966), investor Sharpe ratios are calculated and compared for robustness check purposes.

4. Empirical Results

This section presents the empirical results indicating that investors with higher academic education and top results in national exams in mathematics, mother tongue and geography hold more diversified portfolios. The same is true for investors with national high school exam results averaging above 70% of maximum exam score. In addition, I conclude that

investors with a university degree in natural sciences, mathematics or statistics hold more diversified stock portfolios compared to investors with no such educational characteristics. The opposite is true for investors with no academic degree and low performance in mathematics and mother tongue exams as they hold less diversified portfolios. Analysing investors' risk-adjusted performance reveals that higher portfolio diversification is a significant factor contributing to higher returns on the stock market.

4.1. Do Top Performing Investors in High School National Exams Hold More Diversified Portfolios?

This section offers empirical evidence supporting the hypothesis that investors with higher high school exam results hold more diversified portfolios. In general, the conclusion is that investors with high national exam results in mathematics, mother tongue and geography hold more diversified stock portfolios. The opposite is true for investors demonstrating poor results in national exams in mathematics and mother tongue.

To test the hypothesis that investors with higher high school exam results hold more diversified portfolios, the study uses an ordered logit regression model. I start with single ordered logit regressions to study the single effects of educational variables on portfolio diversification and then introduce a number of control variables (demographic, wealth, experience, trading behaviour). Due to multicollinearity between educational characteristics, regression models with control variables are analysed individually and are not combined in one model. At first the top performers in high school mathematics together with control variables are studied and no other high school exam results are included in the model. After that an ordered logit regression is repeated for all educational characteristics. The statistical significance for control variable coefficients in regressions results does not differ for different educational characteristics. The results for all control variable regressions are available upon request. The results are reported for the most relevant national exams and specialist university fields determined based on the exam participation rate.

Table 2. Ordered Logit Regression Model for Investor Portfolio Diversification and Educational Characteristics

Independent variables	Individual variables		High school exam results and control variables		Level of education and control variables		Type of education and control variables	
	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value
Mathematics exam top quartile	1.31***	3.93	1.34***	3.83				
Mathematics exam bottom quartile	0.82***	-2.80	0.83**	-2.39				
Physics exam top quartile	1.14	0.82	1.48**	2.21				
Physics exam bottom quartile	0.86	-0.91	0.84	-0.95				
Mother tongue exam top quartile	1.15**	2.38	1.12*	1.77				
Mother tongue exam bottom quartile	0.81***	-3.47	0.81***	-3.22				
English exam top quartile	1.06	0.85	1.09	1.20				
English exam bottom quartile	1.10	1.50	0.99	-0.07				
History exam top quartile	1.14	1.38	1.03	0.27				
History exam bottom quartile	0.80**	-2.39	0.89	-1.13				
Geography exam top quartile	1.63***	3.38	1.40**	2.17				
Geography exam bottom quartile	0.70**	-2.53	0.85	-1.06				
Eggheads (exam high performers)	1.18***	3.20	1.17***	2.88				
Higher education	1.33***	5.67			1.23***	3.70		
Master's or doctoral degree	1.20**	2.01			1.02	0.14		
Bachelor or equivalent degree	1.25***	5.26			1.11**	2.36		
High school graduate	0.75***	-5.67			0.82***	-3.70		
Natural sciences degree	1.36***	4.99			1.22***	2.89		
Humanities degree	1.04	0.44			1.09	0.86		
Social science degree	1.09**	2.11			0.99	-0.15		
Degree in economics	1.04	0.85					0.98	-0.43
Degree in public administration	0.99	-0.10					1.00	-0.01
Degree in finance	0.89	-0.83					0.95	-0.31
Degree in information technology	1.09	1.06					1.03	0.30
Degree in math or statistics	2.19**	2.27					2.34**	2.32
Degree in physics, or chemistry, or biology	1.27	1.29					1.36	1.64
Degree in law	1.12	1.21					1.02	0.19
Degree in medicine	0.93	-0.43					0.99	-0.08
Degree in psychology	0.93	-0.30					0.93	-0.27
Male			1.17*	1.68	1.19***	3.12	1.18***	3.03
Birth year			0.99	-1.02	1.00	0.48	1.00	0.11
Total number of transactions			1.06***	19.36	1.06***	29.7	1.06***	29.72
Average portfolio size			1.00***	8.56	1.00***	10.36	1.00***	10.44
Average holding period			1.00***	7.33	1.00***	10.1	1.00***	10.11
Log likelihood			-3353		-7340		-7342	
Pseudo R^2			0.14		0.14		0.14	

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 1 to 3, depending on number of stocks held in the investors' portfolio. The first column presents independent dummy variables. The other columns present multiple regression results. Because of multicollinearity, the second, third and fourth column regressions are run individually together with control variables. In this table control variable coefficients for the second column are presented for top mathematics exam results, for the third column higher education and for the fourth column investors holding a degree in economics. The statistical significance of other regression control variable coefficients does not differ and are available upon request. Odds ratios are presented to simplify the interpretation. If the odds ratio > 1, it means increased probability of belonging to the particular group because of the factor. Coefficients denoted with *, ** and *** are significant at the 10%, 5% and 1% level respectively.

Source: Author's calculations

The Table 2 results show that investors in the top quartile of national high school exam results have an odds ratio above one indicating that top national exam performers hold more diversified portfolios. Table 1 shows that the average stocks held in portfolios is higher for investors performing better in national high school exams with the only exception being English exam results. The average number of stocks held in investors' portfolios for top performers in national high school exams are as follows: mathematics – 1.95, mother tongue – 1.89, history – 1.95, physics – 2.08 and geography – 2.03. The average number of stocks held in investors' portfolios for low performers in national high school exams are as follows: mathematics – 1.75, mother tongue – 1.76, history – 1.77, physics – 1.98 and geography – 1.65. The only exception is the English exam, with investors' average stocks in portfolios of 1.84 for exam high performers and 1.88 for low performers. The statistically significant educational variables for single and combined regression are mathematics and mother tongue top and bottom quartiles, and geography top quartile results, which are used for further analysis.

Including different control variables in the regressions does not change the interpretation of the educational factors (the odds-ratio does not change from above one to be below one or vice versa), but some educational characteristics being statistically significant in the single ordered regression model are not significant in the model with the control variables. For further interpretation, the study uses only those results, which are statistically significant for both regressions. The choice of control variables was made based on the findings of Anderson (2007) and Goetzmann and Kumar (2008). Such studies show that demographic variables, wealth, experience and trading characteristics influence portfolio diversification and portfolio performance and should be considered in analyses. The analysis of the control variables is discussed in more detail in section 4.3.

The results in Table 2 for single and combined ordered logit regression show that only top and bottom quartiles for the mathematics and mother tongue exam and the top quartile for the geography exam are statistically significant. The top quartile results for the mathematics exam and bottom quartile for the mother tongue exam are statistically significant at the 1% level. The bottom quartile results for the mathematics exam and top quartile for the geography exam are statistically significant at the 5% level and the top quartile results for the mother tongue exam are statistically significant at the 10% level for the combined regression. The odds ratio in Table 2 column 1 and 2 for top performers in the mathematics and mother tongue high school exams are both ordered logit regressions over one (for the mathematics exam the single regression odds-ratio is 1.31 and the odds-ratio with control variables is 1.34 and for the mother tongue exam the single regression odds-ratio is 1.15 and the odds-ratio with control variables is 1.12), indicating that investors belonging to those groups hold more diversified portfolios. The marginal effect analysis for investors presented in Table 3 indicates that the probability of holding more diversified portfolios increases by 5.12% for top performers in the national high school mathematics exam and by 2.61% for top performers in the mother tongue exam. For investors belonging to the top performers in the geography exam, an odds-ratio above one indicates that investors belonging to this group hold more diversified portfolios. In particular, they have 8.74% higher probability of belonging to the group of high diversifying investors.

Table 3. Marginal Effect Analysis for Investor Portfolio Diversification Categories

	Low		Medium		High	
Independent variables	I category		II category		III category	
	Coefficients	z-values	Coefficients	z-values	Coefficients	z-values
Marginal effect for high school exam results						
Mathematics exam top quartile	-6.73%***	-3.96	1.61%***	4.31	5.12%***	3.80
Mathematics exam bottom quartile	4.94%***	2.80	-1.42%***	-2.59	-3.52%***	-2.87
Mother tongue exam top quartile	-3.51%**	-2.39	0.90%**	2.50	2.61%**	2.34
Mother tongue exam bottom quartile	5.24%***	3.48	-1.52%***	-3.22	-3.72%***	-3.57
Geography exam top quartile	-12.09%***	-3.42	3.35%***	3.79	8.74%***	3.17
Eggheads (exam high performers)	-4.19%***	-3.21	1.14%***	3.28	3.04%***	3.16
Marginal effect for education level						
Higher education (dummy)	-7.14%***	-5.70	2.14%***	5.11	5.00%***	5.93
Bachelor or equivalent degree	-5.47%***	-5.27	1.51%***	5.04	3.96%***	5.31
High school graduate	7.14%***	5.70	-2.14%***	-5.11	-5.00%***	-5.93
Natural sciences degree	-7.71%***	-5.06	1.69%***	6.35	6.02%***	4.74
Marginal effect for education type and control variables						
Degree in mathematics or statistics	-18.47%**	-2.53	1.61%	1.55	16.86%**	2.02

Note: Table 3 reports coefficient probabilities and z-values from an ordered logit regression marginal analysis for the discrete change in the dummy variable from 0 to 1. The 1st category represents the lowest and the 3rd category the highest level for investor portfolio allocation. Coefficients denoted with *, ** and *** are significant at the 10%, 5% and 1% level, respectively.

Source: Author's calculations

Table 2 and Table 3 indicate that the opposite is true for investors demonstrating low results in national exams in mathematics and mother tongue. The odds ratio for low performers in the mathematics and mother tongue exam is below one for both regressions (for the mathematics exam the single regression odds-ratio is 0.82 and odds-ratio with control variables is 0.83, and for the mother tongue exam the single regression with control variables odds-ratio is 0.81), indicating that investors belonging to those groups hold less stocks in their portfolios. The marginal effect analysis for those investors indicates that the probability of holding less diversified portfolios increases by 4.94% for low performers in the mathematics exam and by 5.24% for low performers in the mother tongue exam.

For investors belonging to the egghead category, the story confirms prior findings. That is, the egghead category is statistically significant at the 1% level and has an odds-ratio in the single ordered logit regression of 1.18 and an odds-ratio with control variables of 1.17. Those results indicate that investors belonging to the egghead group have a higher probability of holding diversified portfolios compared to investors with no such educational characteristics. The marginal effect analysis for investors belonging to the egghead category indicates that the probability of holding diversified stock portfolio increases by 4.19% if the investor belongs to this category. The eggheads have on average 1.90 stocks in their portfolios compared to the average of 1.80 stocks for investors not belonging to this category. The relationship between portfolio diversification and stock market performance is discussed in detail in section 4.4.

4.2. Do Investors with an Academic Degree Hold More Diversified Portfolios?

This section offers empirical evidence supporting the hypothesis that investors with a higher academic education hold more diversified portfolios and high school graduates without an

academic degree tend to diversify their stock portfolios less. Regarding the type of education, investors with a degree in mathematics or statistics tend to have more diversified portfolios than investors with no such degree.

The study uses the same control variables (demographic, experience, wealth, trading style) in the ordered logit regressions for university degree and level of education as for the previous analysis. I collected all the available data on university degree types held by investors and generalized and grouped them into different categories according to the names of the university programmes. The results show that investors with a degree in mathematics or statistics hold more diversified portfolios. The odds ratio for mathematics or statistics degree holders is over one for both ordered logit regressions (the single regression odds-ratio is 2.19 and the odds-ratio with control variables is 2.34), indicating that investors with this degree tend to hold more stocks in their portfolios. The marginal effect analysis indicates that the probability of belonging to the highest diversifying investor group increases by 16.86% if the investor has a mathematics or statistics degree. Investors with a mathematics or statistics degree have on average 2.30 stocks in their portfolios compared to the average of 1.86 stocks in the portfolios for investors not belonging to this category. Degrees in law, public administration, economics, physics, medicine, information technology, finance, psychology nor any of the natural science fields seem to be statistically significant.

The results for the level of education shows that investors with a higher education have an odds ratio above one indicating that investors with an academic university degree hold more diversified portfolios. The odds ratio for investors with a higher education is over one for both ordered logit regressions (the single regression odds-ratio is 1.33 and the odds-ratio with control variables is 1.23), indicating that investors with a higher education have more diversified portfolios. Analysing high school graduates, bachelor and master's or doctoral degree holders separately, and the results show that investors with only a high school graduate diploma have an odds ratio below one, indicating that investors with such educational characteristics have less diversified portfolios. The odds ratio for investors holding only a high school graduate diploma for a single regression is 0.75 and for the regression with control variables is 0.82. The marginal analysis results show that the probability of the investor belonging to the lowest diversifying investors group increases by 7.14% if the investor has no academic degree. Investors with only a high school diploma have on average 1.70 stocks in their portfolios compared to the average of 1.91 stocks in portfolios for investors with a higher academic education.

Table 2 reports that investors with a bachelor degree have an odds ratio above one indicating that investors with such a university degree have more diversified portfolios than investors with no such educational characteristics. The odds ratio for investors with a bachelor degree for a single regression is 1.25 and the odds-ratio for the regression with control variables is 1.11. The marginal analysis indicates that the probability of the investor belonging to the highest diversifying investors group increases by 3.96% if the investor has a bachelor or equivalent degree. Investors with a bachelor or equivalent degree have on average 1.92 stocks in their portfolios compared to the average of 1.78 stocks in portfolios for investors with no such educational characteristics. Holding a master's or doctoral degree is not statistically significant in the model combined with control variables, and therefore, no conclusion can be drawn for this level of education. Still, investors with a master's or doctoral degree on average have 1.99 stocks in their portfolios compared to the average of 1.78 stocks in portfolios for investors without this degree.

Analysing the results for education level by the type of science, the results indicate that investors with a degree in natural sciences are statistically significant and have an odds ratio above one showing that investors with such a university degree have more diversified portfolios. The odds ratio for investors with a degree in natural sciences for the single regression is 1.36 and for the regression with control variables is 1.22. The marginal analysis confirms that the probability of the investor belonging to the highest diversifying investors group increases by 6.02% if the investor has a natural sciences degree. Investors with a degree in the natural sciences on average have 2.02 stocks in their portfolios compared to the average of 1.84 stocks in portfolios for investors without such educational characteristics. Social and humanities sciences degrees are not statistically significant for investor portfolio diversification.

There could be several reasons why investors with higher academic degrees show better portfolio diversification on the stock market. By analysing university curricula one reason for better portfolio diversification among mathematics or statistics degree holders as well as for investors with a degree in the natural sciences is that these degrees provide stronger analytical skills. These skills can help them to better understand and analyse financial information and make more accurate analyses by having a deeper understanding of the numbers. One possible reason why investors with a university degree have more diversified portfolios can be connected with their higher intellectual abilities, which are further enhanced during their university student years, regardless of what they study. Higher intellectual abilities come with the potential for analysing financial markets and related risks together with portfolio diversification. The view that a higher level of education helps investors make more rational investment decisions is supported by Grinblatt, Keloharju, and Linnainmaa (2012). The relationship between portfolio diversification and stock market performance is discussed in detail in section 4.4.

4.3. Other Factors Influencing Investor Portfolio Diversification

Besides educational variables, the study uses a number of control variables to test the effect of other possible factors on investor portfolio diversification. When including continuous control variables (such as birth year, total number of transactions, average portfolio size or average holding period), educational factors and control variables remain significant, but the odds-ratios for control variables remain qualitatively very near to one. The story behind the control variables is slightly complicated.

Feng and Seasholes (2005) suggest using the total number of transactions as a measure of investor experience. An odds-ratio above one for the control variable indicates that more experience tends to increase investor portfolio diversification. On the other hand, Barber and Odean (2000) use the same variable as a proxy for trading too much. By analysing the number of transactions and dividing the continuous control variable into seven groups, I see that the average number of stocks held in portfolios increases as the number of transactions increases. But for investors who have made more than 100 transactions, the average number of stocks in the portfolio decreases, suggesting that investors trading actively hold less diversified portfolios. Such a finding seems to be consistent with both of the mentioned references. This control variable remains significant in all of the model setups.

The level of wealth seems to be clearly an important factor for portfolio diversification. The average portfolio size was used as a proxy for wealth. The study shows that greater portfolio size increases the average number of stock held in the portfolio. Also, the fact that

the control variable coefficient is above 1 and statistically significant indicates that investors with greater portfolio size hold more stocks in their portfolios. This finding is in line with the findings of Anderson (2007) and Goetzmann and Kumar (2008). In addition, the average holding period has a positive effect on investor portfolio diversification as the control variable coefficient reported in Table 2 is above one. The demographic control variables together with educational variables show that birth year is statistically not significant. This result is expected as the average age of investors is quite young due to the availability of the education data. On the other hand, the gender variable is statistically significant, and has an odds-ratio above one indicating that male investors tend to hold more diversified portfolios over female investors. Male investors have on average 1.89 stocks in their portfolios compared to females with 1.72 stocks in theirs.

4.4. Economic Impact and Cost of Under-Diversification

To test what effect the under-diversification has on investors' portfolios, I compare their risk-adjusted performance. To evaluate the economic cost of under-diversification, I examine the relationship between portfolio diversification and portfolio risk-adjusted performance. I calculate and compare two different performance measures: annual risk-adjusted performance and Sharpe ratio. Table 4 presents the performance measures for different portfolio diversification groups of investors. The results for the full period from 2004 to 2012 indicate that investors with more diversified portfolios experience higher risk-adjusted performance and higher Sharpe ratios. Investors belonging to the group of lowest portfolio diversification have an annual risk-adjusted return in the 50th percentile – 1 per cent compared to investors risk-adjusted return of 0 per cent and 1 per cent in the medium and high diversification group. This means that investors with low diversification lose 2 percentage points of risk-adjusted performance annually compared to investors with higher portfolio diversification.

The strongest difference in risk-adjusted performance can be observed in the first bull market from 1 January 2004 to 05 February 2007, where investors belonging to the lowest portfolio diversification group have an annual risk-adjusted return in the 50th percentile – 12 per cent compared to investors risk-adjusted returns of 28 per cent and 39 per cent in the medium and high diversification groups. In the subsequent bear market from 6 February 2007 to 9 March 2009 and bull market from 10 March 2009 to 31 December 2012, the economic effect exists between the group of investors with the lowest and highest diversification, but is not so strong, being in range of 1–2 percentage points. The Sharpe ratio analysis presented in Table 4 confirms the previous statements.

The study conducted a regression analysis to assess the statistical significance of the risk-adjusted performance results in Table 4. The regression coefficients for the risk-adjusted performances for the lowest diversification groups were statistically significant at the 5% level and negative, indicating that investors belonging to the lowest diversification groups during the four periods observed received lower risk-adjusted returns on the stock market. By contrast, the regression coefficients for the risk-adjusted performances for the highest diversification groups were statistically significant at the 5% level and positive, indicating that investors belonging to the highest diversification groups during the four periods observed received higher risk-adjusted returns on the stock market. The regression results indicate that higher portfolio diversification has a positive and statistically significant influence on the investors' risk-adjusted performances, which has also been previously noted by Goetzmann and Kumar (2008).

More detailed empirical analysis regarding investor education and risk-adjusted performance has been done by Liivamägi, Vaarmets, and Talpsepp (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 investor portfolio diversification and its overall relationship to risk-adjusted performance.

Table 4. Investors Risk-Adjusted Performance and Sharpe Ratio on the Stock Market

	Lowest diversification				Medium diversification				Highest diversification			
	Number of obs.	25th %ile	50th %ile	75th %ile	Number of obs.	25th %ile	50th %ile	75th %ile	Number of obs.	25th %ile	50th %ile	75th %ile
Panel A Risk-adjusted performance												
Period 2004 - 2012	14,435	-8%	-1%	11%	10 705	-6%	0%	13%	11 329	-5%	1%	12%
Period 2004 - 2007	7,941	11%	12%	44%	5 308	12%	28%	76%	5 657	16%	39%	80%
Period 2007 - 2009	4,626	-51%	-42%	-30%	4 748	-52%	-43%	-32%	5 983	-52%	-43%	-34%
Period 2009 - 2012	4,460	-3%	8%	22%	4 858	-1%	9%	21%	6 446	1%	10%	21%
Panel B Sharpe ratio												
Period 2004 - 2012	14,479	-0.78	-0.31	0.19	10 733	-0.52	-0.19	0.26	11 337	-0.49	-0.19	0.23
Period 2004 - 2007	7,965	-0.91	-0.82	0.60	5 334	-0.82	-0.16	1.64	5 664	-0.82	0.21	2.01
Period 2007 - 2009	4,657	-0.77	-0.6	-0.18	4 771	-0.76	-0.52	-0.08	6 011	-0.77	-0.52	-0.10
Period 2009 - 2012	4,514	-0.79	-0.14	0.53	4 895	-0.75	-0.15	0.48	6 516	-0.73	-0.21	0.45

Note: Table 4 reports investors annual risk-adjusted performance (Panel A) and Sharpe ratio (Panel B) according to portfolio diversification. Investors are divided into groups by portfolio diversification level: low, medium and high diversification groups. The table reports investors' risk-adjusted performance and Sharpe ratios based on the business cycle. In the first row the performance is reported for the full period; in the second row for the bull market period from 01.01.2004 to 05.02.2007; in the third row for the bear market period from 06.02.2007 to 09.03.2009; in the fourth row for the bull market period from 10.03.2009 to 31.12.2012. The table reports percentile allocations of investors risk-adjusted performance and Sharpe ratio based on investor portfolio diversification.

Source: Author's calculations

Overall, the results for risk-adjusted performance indicate that the economic cost of under-diversification is significant for most investors. Investors with under-diversified portfolios experience higher volatility and lower risk-adjusted performance on the stock market for which they are not compensated. The findings are consistent with those of Brennan and Torous (1999). Another conclusion derived from Table 4 is that only the top 25 per cent of investors during the full business cycle show positive Sharpe ratios, meaning that the rest of the investors would be better off just investing in risk-free assets and not selecting individual stocks at all. Those remaining 75 per cent of investors earn lower returns than the risk-free rate, while taking considerable risks during the observed period.

4.5. Robustness Checks

To verify the robustness of the results, the study conducted a number of additional analyses. The ordered logit regression models for the diversification ratio was estimated. Those results are available upon request. Lower numbers of stocks in individual investor portfolios result in higher volatility in the portfolio, which results in a lower calculated diversification ratio. For the diversification ratio, the same model setup was used as for the average stock in

portfolio, except the ordered logit regression model was divided to quartiles. The results from the diversification ratio confirm the findings presented in Table 2. In addition, the study used OLS regressions (see Table 5) instead of ordered logit, although the latter should be preferred for the task. The results of the OLS regressions using control variables confirm the results presented in Table 2. For the empirical model, the study derived control variables, such as gender, age, wealth, experience and trading characteristics, based on documentation from Anderson (2007) and Goetzmann and Kumar (2008).

The robustness test results reported in Table 5 confirm the findings from Table 2 that investors with top results in national exams in mathematics, mother tongue and geography have more diversified portfolios. In addition, investors who belong to the egghead category tend to have more diversified stock portfolios. Investors with a higher academic education, bachelor degree and university degree in the natural sciences, mathematics or statistics diversify their stock portfolios more. The opposite is true for investors with no academic degree and low performance in mathematics and mother tongue exams as they hold less diversified portfolios.

Table 5. Regression Results for Investor Diversification and Educational Characteristics

Independent variables	Lowest diversification		Medium diversification		Highest diversification	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Panel A. Regression results without control variables						
Mathematics exam top quartile	-0.07***	-3.79	0.02	1.38	0.05***	2.97
Mathematics exam bottom quartile	0.05***	2.68	-0.02	-0.93	-0.03**	-2.15
Mother tongue exam top quartile	-0.04***	-2.60	0.02*	1.66	0.02	1.31
Mother tongue exam bottom quartile	0.05***	3.42	-0.02	-1.43	-0.03**	-2.51
Geography exam top quartile	-0.11***	-2.78	0.00	-0.13	0.11***	3.53
Eggheads (exam high performers)	-0.04***	-2.89	0.01	0.60	0.03***	2.78
Higher education	-0.06***	-4.84	0.00	0.17	0.06***	5.49
Bachelor or equivalent degree	-0.05***	-4.79	0.01	1.04	0.04***	4.51
High school graduate	0.06***	4.84	0.00	-0.17	-0.06***	-5.49
Natural sciences degree	-0.08***	-5.01	0.03**	2.22	0.05***	3.54
Degree in mathematics or statistics	-0.18*	-1.92	0.01	0.06	0.17**	2.18
Panel B. Regression results with control variables						
Mathematics exam top quartile	-0.06***	-3.60	0.02	1.17	0.04***	2.98
Mathematics exam bottom quartile	0.05***	2.57	-0.01	-0.82	-0.03**	-2.14
Mother tongue exam top quartile	-0.04***	-2.85	0.03**	2.15	0.01	1.02
Mother tongue exam bottom quartile	0.05***	3.44	-0.02*	-1.66	-0.03**	-2.27
Geography exam top quartile	-0.07*	-1.86	-0.01	-0.25	0.07***	2.58
Eggheads (exam high performers)	0.01	1.57	-0.02*	-1.89	0.00	0.14
Higher education	-0.05***	-3.50	0.00	0.06	0.05***	4.14
Bachelor or equivalent degree	-0.04***	-3.57	0.01	0.96	0.03***	3.22
High school graduate	0.05***	3.50	0.00	-0.06	-0.05***	-4.14
Natural sciences degree	-0.07***	-4.01	0.03*	1.90	0.04***	2.69
Degree in mathematics or statistics	-0.18**	-2.08	0.01	0.09	0.18**	2.40
Male	-0.07***	-3.44	0.03*	1.69	0.04**	2.19
Birth year	0.00	1.65	0.00	-0.84	0.00	-1.02
Total number of transactions	0.00***	-16.57	0.00	1.53	0.00***	18.11
Average portfolio size	0.00***	-7.74	0.00*	-1.81	0.00***	11.34
Average holding period	0.00**	-2.43	0.00***	-3.30	0.00***	6.68

Note: Table 5 reports regression results for investors diversification and educational characteristics for statistically significant independent variables derived from Table 2. Table 5 reports coefficients and t-values from an OLS regression for different educational characteristics without control variables (Panel A) and with control variables (Panel B). The columns are presented based on investors diversification. Coefficients denoted with *, ** and *** are respectively significant at the 10%, 5% and 1% level.

Source: Author's calculations

5. Conclusion

Many authors have concluded that investors hold under-diversified portfolios, which contribute to unnecessary risk taking and lower stock market performance on the stock market. Still some investors successfully avoid under-diversification and demonstrate higher risk-adjusted returns on the stock market. With the help of a unique dataset, I provide empirical evidence to the complex puzzle of how comprehensive educational characteristics influence investor portfolio diversification with stock market performance during the full business cycle.

The main aim of this paper is to provide empirical results showing how educational characteristics affect investor portfolio diversification on the stock market during the full business cycle from 2004 to 2012. I present empirical evidence confirming that investors with a higher academic education and top national high school exam results in mathematics, mother tongue and geography have more diversified portfolios. The same is true for investors who have the average score in different high school exams above 70 per cent of the maximum exam score. By contrast, investors demonstrating low results in mathematics and mother tongue high school exams hold less stocks in their portfolio. In addition, I show that investors with a bachelor degree or a degree in the natural sciences, mathematics or statistics diversify their stock portfolios more than investors with no such educational characteristics. The opposite is true for investors with no academic degree as they have less diversified portfolios.

The results for investors risk-adjusted performance indicate that the economic costs of under-diversification is significant for most of the investors. Investors with under-diversified portfolios experience lower risk-adjusted performance on the stock market for which they are not compensated. Another conclusion is that only the top 25 per cent of investors show positive Sharpe ratios, meaning that the rest of the investors would be better off just investing in risk-free assets and not selecting individual stocks at all. These remaining 75 per cent of investors earn lower annual returns during the full business cycle than the risk-free rate, while taking considerable risks during the observed period.

Many of my findings regarding control variables confirm results from previous studies, including that investors with a greater number of transactions, as a proxy for experience, tend to increase investor portfolio diversification. In addition, my empirical results suggest that greater portfolio size increases the average number of stocks held in the portfolio. Having provided empirical evidence that the level and type of education influences investor portfolio diversification on the stock market, it would be interesting to study whether the level and type of education have an effect on investor trading behaviour.

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