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ENHANCED FINANCIAL LITERACY THROUGH FINANCIAL EDUCATION AND ITS IMPACT ON FINANCIAL BEHAVIOUR

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Executive Summary

This dissertation aims to contribute to the ongoing discourse on the effect an enhanced financial literacy, through financial education, has on financial behaviour. The literature on this topic is divided into two main streams. The first stream favors the idea that financial literacy is enhanced through financial education, indirectly affecting financial behaviour. Another group of scholars argues that financial education may affect financial literacy, but that does not significantly impact financial behaviour change. We posit that financial literacy is enhanced through financial education courses, but it also significantly impacts the financial behaviour of individuals. Moreover, we argue that improved financial literacy plays a significant role in mitigating behavioural biases and an asset price bubble.

Chapter 1 analyzes the impact of a financial education course in enhancing financial literacy in a high-school context. Students at specific schools in Tirana, Albania, are delivered a financial education course, which lasts one academic year. To understand the impact of this financial education course in enhancing financial literacy, PISA (2012) questionnaire on financial literacy is delivered to the students before and after the course is delivered. We perform a difference in difference analysis.

Chapter 2 analysis the impact of financial literacy in mitigating behavioural biases. We focus on the impact that enhanced financial literacy through the financial education course and financial education plays in reducing the propensity to mental accounting bias. After the financial education course, students are asked to fill a questionnaire to understand their financial behaviour based on the work of Prelec and Lowenstein (1998).

Chapter 3 investigates how financial literacy affects the propensity to an asset price bubble occurrence. We posit that enhanced financial literacy through financial education reduces the probability of an asset price bubble occurrence. Again, after the financial education course, students are asked to play an asset price game on a virtual trading platform, where they were required to play against each other.

Chapter I

Financial Education and its Impact on Financial Literacy

Abstract

This study focuses on the effectiveness of a financial education course as a tool for enhancing financial literacy. We analyse how baseline financial literacy scores affect the effectiveness of financial education courses in terms of improving financial literacy.

Given the low levels worldwide and the importance of financial literacy, there is a need for immediate action. Financial educators and policymakers suggest financial education as a tool to overcome such problems, however, the literature posits two different points of view, one in favour of financial education effectiveness and another against.

Our study used a sample of 519 students from four high schools in Tirana in Albania, two of which offered a financial education course, and two which did not. The results of difference in difference analysis suggest that financial education was effective in terms of financial literacy scores. Students who took the financial education course scored on average more than those who had not taken the course. Interestingly this research showed that being financially literate before taking a financial education course also affected post course financial literacy scores. The results showed that students with a lower baseline financial literacy score benefited the most from the course.

Keywords: *Financial Literacy; Financial Education; Difference-in-Difference.*

JEL Code: *G53; I22; C3.*

1. Introduction

This paper analyses the effectiveness of a financial education course in enhancing financial literacy in high school students. We first employ a difference in difference analysis to understand whether the course was effective or not. We then focus on understanding the effect of baseline financial literacy on this effectiveness.

It is essential to educate people about the importance of financial literacy, and it is also vital to provide them with the necessary tools or means to become financially literate. Financial literacy is a crucial factor in the financial behaviour and financial planning of individuals of all ages, regions, and genders, however, the literature on financial literacy and statistics suggests that financial literacy levels are deficient across different countries and areas, in both developed and developing countries, women and men, and the young and old population. The last financial crisis of 2008 once more showed the importance of financial knowledge, and the consequences that a wrong financial decision, or simply a financial "mistake" might have.

Given the importance of being financially literate, the global low financial literacy signals an immediate need for intervention. Great emphasis has been put on the importance of financial literacy, especially in the last two decades. The government of the US designated April as the month of financial literacy. In comparison, the OECD works to continually improve financial literacy, in cooperation with the International Network on Financial Education, and promotes financial education through different projects. Many other organisations, and researchers also stress that financial education can solve financial illiteracy issues.

There have been many experimental studies to examine the effect of financial education on financial literacy and economic behaviour. The reviews from this stream of literature reveal mixed results, and the answer to this question is not clear. Despite this, financial education is still seen as one of the main contributors to improving financial literacy.

This research contributes to the financial education literature as an essential tool in enhancing financial literacy. As many scholars recommend, we address the issue of adding financial education courses to the curricula of high schools so that the students will at least be equipped with the main financial concepts and information about personal finance issues before they start college life. We posit that baseline financial literacy, that is, financial literacy scores before the course, will affect post-course financial literacy. This financial education course is that traditionally offered to all students, regardless of their baseline financial literacy scores. Given the context of the course, we argue that its effect in enhancing financial literacy will be greater for those students with lower baseline financial literacy scores. In other words, the percentage change in financial literacy scores before and after the course will be greater for the students who scored lower before the course.

This project was conducted with high school students in Tirana, Albania. A total of four public schools in Tirana were included in this study. Two of the schools, the treated schools, delivered a course on financial education to their students. The other two, the non-treated schools, did not provide the financial education course. The course lasted for one whole academic year and covered topics of personal finance. A financial education course is effective when it meets its goals of enhancing financial literacy. We employed a difference in difference methodology to perform the empirical analysis. Pre- and post-course questionnaires on financial literacy were collected from the students at all the schools. The results show that the financial education course significantly improved financial literacy scores. This effect was significantly lower for those who scored better in the pre-course questionnaire. The empirical analysis suggests that the lower the baseline financial literacy score, the more effective the course will be in improving financial literacy scores. These results imply that a financial education course is more effective in increasing financial literacy among students with lower baseline financial

literacy scores; policymakers and educators should consider organising specific courses according to prior-intervention financial literacy levels.

2. Literature Review

The importance of financial literacy is best expressed by Annamaria Lusardi (Lusardi, 2011), who explained that: "Just as it was not possible to live in an industrialized society without print literacy-the ability to read and write- so it is not possible to live in today's world without being financially literate. To fully participate in society today, financial literacy is critical." The alarmingly low levels of financial literacy prompted the US government to designate April as National Financial Literacy Month. The JumpStart Coalition for Personal Financial Literacy 1997 defined financial literacy as "the ability to use knowledge and skills to manage one's financial resources effectively for lifetime financial security." As the literature suggests, however, financial literacy can have various meanings, including as mathematical and numerical skills in making financial decisions, knowledge of financial concepts such as inflation, interest rate, diversification, bonds and stocks, and engagement in financial planning. The main financial ideas individuals should be aware of to be considered financial literate include money and transactions, planning and managing finances, risk and reward, and the economic landscape (Lusardi, 2015). In this study, we use the definition by OECD: "Financial literacy is knowledge and understanding of financial concepts and risks, and the skills, motivation, and confidence to apply such knowledge and understanding to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life" (OECD, 2005).

2.1. An Overview of Financial Literacy Around World

A large body of research argues that financial literacy is deficient in countries across the world; both developed and developing, in both males and females, and in both younger and older

generations (Hastings, Madrian, & Skimmyhorn, 2013; Lusardi & Mitchell, 2014; Lusardi & Olivia, 2008; Lusardi & Mitchell, 2018; OECD, 2013). Levels of financial literacy are even deficient in countries with very developed financial markets, such as the Netherlands or Germany (Lusardi & Mitchell, 2011). The Financial Industry Regulatory Authority (FINRA) Investor Education Foundation in the USA conducted a survey in 2009 known as the National Financial Capability Survey. A notable result from that study is that less than 50% of young adults could answer questions about interest and inflation rates correctly (Lusardi & Mitchell, 2011). A survey in Japan to understand financial literacy in the overall population had generally the same results as found in the USA. Surprisingly, only 40% of the respondents could answer a question on risk diversification correctly, and the concept was mostly unknown to Japanese people. Overall, the results showed that financial literacy is not high, even in a disciplined country such as Japan (Sekita, 2015). In a study in Russia, only 36% of the respondents in a survey to measure the effect of financial literacy on retirement planning responded correctly to the interest rate question.

A less recent study in Mexico, involving an experiment with participants from a private social security system, and aiming to understand how financial literacy affects financial behaviour, found that the level of financial literacy is relatively low on average (Hastings & Tejeda-Ashton, 2008). Similar studies have been undertaken in Europe, in countries such as Germany, Netherlands, Italy, and Sweden. In the Netherlands, individuals seem to be financially knowledgeable concerning compounding interest and inflation rates. More than 80% of participants in the study responded correctly to these terms. They found less knowledge on more complex issues such as risk diversification, where only 50% of participants answered questions related to the risk field correctly (Rooij & Lusardi, 2011). Most participants in a study in Germany seemed to be financially knowledgeable regarding concepts such as inflation and interest rates, but less financially literate regarding risk diversification. Financial literacy

seemed to be lower in women, less educated individuals, and the population of East Germany (Bucher-Koenen & Lusardi, 2015).

A similar study undertaken in Italy indicated deficient financial literacy levels among individuals. Only 40% of respondents to the Bank of Italy's Survey on Household Income and Wealth adequately understood the concept of interest rates or 60% inflation, and only 52% did well on the question about risk diversification. Men, those with more education, and those living in the centre-north of Italy demonstrated higher financial literacy levels (Fornero & Monticone, 2011). Evidence from the OECD is in line with these results (2013).

In collaboration with the Russian Trust Fund for Financial Literacy and Education, the OECD International Network on Financial Education (INFE), conducted two surveys from 2010 to understand women's financial literacy levels worldwide, and whether it was necessary to provide financial education specifically for women. The results indicated that women in all the countries included in the sample had lower financial literacy, and were less knowledgeable about finance than men (OECD, 2013). The results suggested not only that women were less knowledgeable regarding finance basic concepts, but also less confident about their financial abilities. These results were supported by a more recent OECD/INFE report on adult financial literacy in the G20 countries, including Norway and the Netherlands as guest countries. Less than 50% of adults in the sample correctly responded to questions about financial knowledge. Women still perform more poorly in this situation than men (OECD/INFE, 2017). A less recent study by Lusardi et al. (2008) showed that reluctant to plan for retirement. They argued that this reluctance could be strongly correlated to women's financial literacy. They found that financial literacy was highly correlated with financial planning. As women were highly financially illiterate, they also failed to successfully plan for retirement (Lusardi & Mitchel, 2008).

Financial literacy also changes among different age groups. Lusardi et al. (2014) argue that the older generation in the USA lack adequate knowledge about the key concepts related to risk, portfolio diversification and bond pricing. Almost 60% of the survey respondents responded that they were not familiar with the simple relationship between bond pricing and interest rates (Lusardi, Mitchell, & Curto, 2014). The older population in Russia were found to be less financially literate than the younger generations. Survey results in 2009 indicated an inverse relationship between age and financial literacy, and the younger population seemed to be more financially literate (Klapper & Panos, 2011). Similar results were reported in Sweden, where older generations seem to be less financially literate (Almenberg & Säve-söderbergh, 2015). Financial literacy also appears to be a problem in the younger groups, however. A study by Lusardi et al. (2010) on youth financial literacy showed that overall financial literacy among young Americans is low. According to the results of the 11th Wave of the 1997 National Longitudinal Survey of Youth in the US, involving questions of risk diversification, interest, and inflation rates, only 27% of the participants could answer questions about these things correctly. The authors reported that 37% of participants said that they did not know about risk diversification (Lusardi, Mitchell, & Curto, 2010). This problem is also observed in other countries. The last wave of an international survey carried out in 2012 by the Program for International Student Assessment (PISA), an OECD initiative, indicated low financial literacy levels among the young. Low financial literacy scores were even reported for students from countries with developed financial markets, such as France or Italy (Lusardi, 2015). The sample of countries in this study comprised thirteen OECD countries and five other economies, Croatia, Latvia, Russia, Colombia, and Shanghai-China, making this a representative survey of financial literacy worldwide and raising awareness of the need to intervene and solve this issue. Less educated individuals are reported to be more financially illiterate (Bucher-Koenen & Lusardi, 2015; Almenberg & Säve-Söderbergh, 2015; Lusardi & Mitchell, 2011).

2.2. Importance of Financial Literacy

The literature to date suggests a strong relationship between financial literacy and financial behaviour. Hilgert et al. (2003) revealed a statistically significant relationship between financial knowledge and financial practices. Being financially knowledgeable about credit, savings, investment theory, and cash flow management was associated with bills paid on time, diversified investments, tracking expenses, and money put aside. In a similar vein, Gathergood (2012) showed that financially literate individuals face fewer problems in repaying their credit card debts. A growing and sizeable literature documents that financial literacy is directly correlated with savings, wealth accumulation, and retirement planning(Ameriks, Caplin and Leahy, 2003; Bucher-Koenen & Lusardi, 2015; Lusardi & Mitchell, 2017; Lusardi & Alessie, 2011). It also shows that financially literate people tend to perform better in financial decisions such as portfolio diversification (Abreu & Mendes, 2010; Guiso & Viviano, 2015; Hibbert, Lawrence, & Prakash, 2012; A. Lusardi, Mitchell, & Mitchell, 2005; A. Lusardi & Tufano, 2009; Stango & Zinman, 2009). Individuals who are less financially knowledgeable pay higher debt and credit card fees. Lusardi et al. (2009) found that individuals with low financial literacy pay very high debt fees due to a lack of financial knowledge. Financially literate individuals are more likely to invest in stocks (Christiansen, Joensen, & Rangvid, 2008; van Rooij, Lusardi & Alessie, 2011).

2.3. Financial Education and Financial Literacy

Financial education seems as if it should be the answer to financial illiteracy, and have a positive effect on financial decisions and economic outcomes, however, the literature on this topic offers mixed results. The JumpStart National Coalition researched the effect of financial education on financial literacy between 2005 and 2007. The sample consisted of states implementing a financial literacy mandate and others without such a mandate during this

period. The results showed a very low correlation between being financially educated and financial literacy performance (Jump$tart, 2007).

A study examining whether financial education had an effect on the management of the Defined Contribution Retirement Savings Plan portfolio showed that finance professors, in contrast to English professors, not only allocate more retirement savings to equities but are also more active in managing their retirement portfolio (Hibbert, Lawrence & Prakash, 2012). Evidence from a randomised field study with very low income families in a subsidised housing program participating in a financial education program, however, shows that the program did not significantly affect either savings or credit, even though self-reported behaviours seemed to improve (Collins, 2012). Noted as one of the most extensive randomised field studies on financial education, the survey on high schools by Bruhn et al. (2013) in Brazil revealed that financial education had a positive effect on savings, employment, and budgeting. The authors argue that it also led to increased money borrowing. A study examining the effect of financial education in German high schools shows that it increases financial knowledge but found no significant positive effect on the saving behaviours of teenagers (Lührmann, Serra-Garcia, & Winter, 2015). Carpena et al. (2015) showed that financial education positively affects measures of financial awareness and attitudes, but not actual financial behaviour. A randomised field experiment in Rwanda showed that a financial literacy intervention for farmers increased their financial literacy (Sayinzoga, Bulte, & Lensink, 2016). This intervention, however, did not have a positive effect on income level. Another randomised control study in Peru high schools revealed that financial education significantly improved the financial knowledge of students and teachers (Frisancho, 2019). Interestingly, the course improved the overall academic performance of the students. Financial education significantly reduces the number of adults requesting loans, known as alternative financial services (Harvey, 2019). very high interest rates make it very difficult for citizens to repay loans. A more recent study in the US

suggests that financial education results in youngsters having lower default rates and better credit scores, however, the authors argue that such courses would be much more effective if adequate training was provided to the teachers beforehand (Urban, Schmeiser, Collins, & Brown, 2020).

These results have shifted the focus of the literature from studying whether financial education affects financial literacy to the most effective way to deliver a financial education program or course. For example, Fischer et al. (2014) conducted a study in the Dominican Republic where they provided a financial education program using two different micro-entrepreneur approaches. The first approach was based on traditional accounting training, and the other on the rule of thumb methodology. The results showed that the financial behaviour of those taught through the second approach improved significantly compared to the other group (Fischer, Schoar &Alejandro, 2014). Carpena et al. (2015) conducted a study on the effect of a financial education intervention in India. In addition to financial education, the respondents were asked to set a target date for achieving a financial goal. Each of the subjects was provided with individualised counselling. The pairing of financial education with counselling and goal setting was a more effective method than simply offering baseline education. The intervention positively affected budget planning, savings, and the purchase of life insurance. Berg and Zia (2017) argued that mass media is an essential medium through which to deliver financial education messages, significantly affecting individual behaviours: important financial education messages were shown during a prime-time soap opera in this study, and the results showed that the participants who watched these soap operas scored more highly in financial knowledge.

Incorporating psychological theories in finance has also proved to be an effective way of achieving the desired results in a financial education intervention. The Transtheoretical Model of Change (TTM) by Prochaska et al. (1992) is one of these theories. It explains that to

stimulate a change, it is first essential to understand the phase that an individual is in, whether they are aware that such change is needed, and whether they have already started to do something to change. A program addressing the phase should be organised for each specific group (Prochaska, Diclemente, & Norcross, 1992). TTM was a very effective framework through which to study how ready credit card debt holders are to get out of this problem (Xiao, Newman & Prochaska, 2004). The MONEY 2000 financial education program is an example of the success of applying the TTM to evaluate the effectiveness of financial education programs).

Money 2000 TM is a financial education program designed to help consumers increase savings and reduce debts. The authors argue that it is straightforward to operationalise. They also stress the fact that a focused program could help consumers more effectively. Along the same lines, Shockey and Seiling (2004) applied the framework of TTM to a financial education program called the Independent Development Account (IDA). The sample comprised low-income consumers experiencing problems with credit card debt payments. The authors argued that TTM can be applied for the evaluation of financial education.

2.4. Research Question and Hypotheses

As stated above, the literature on financial education and literacy offers different results. One stream of the literature posits that financial education does not improve financial literacy and foster financial behaviour. Another stream of the literature argues that it does. We argue that trainings through the Central Bank of Albania, taken by students to continually raise their awareness, and delivered by professionals, effectively increase financial literacy. We thus aim to first answer the following research question.

- What effect does a traditional financial education course delivered to high school students has in enhancing financial literacy?

There are a few meta-analysis studies to date on the effect of financial education on financial literacy. According to one such study by Fernandes et al. (2014), of the different types of financial interventions, including counselling, exposure to information about financial education, financial education in high school, participation in seminars or workshops, or participation in a program of financial education, it is interventions in the form of seminars, workshops or financial education in high school that are the most effective. 0.15% of the variation in the financial behaviour studied was explained by financial education in high school, and 0.18% of the variance in the financial behaviour studied was explained by participation in seminars and workshops. It is important to state that financial education effect account for just 0.1% of the variance of the financial behaviors studied. They further argue that this effect is even weaker in lower income population. On the other side, Miller et al. (2015) showed that financial education is only effective for specific financial behaviours, and not others. Their study included 188 papers and articles that studied the impact of financial education interventions on financial literacy and individuals' financial behavior. They showed that financial education would affect financial behaviour such as savings and records keeping, which are crucial indicators of personal financial management. A more recent meta-analysis shows that financial education not only affects financial behaviour,but also financial literacy to a greater extent (Kaiser & Menkhoff, 2017). In a meta-analysis of 126 papers studying the impact of financial education interventions, the authors argue that these interventions are less effective for the low incomes. They further suggest that compulsory financial education tends to be less effective and that a course's intensity should increase, and should be provided at a "teachable" moment.

A more recent study by Kaiser et al. (2020) found evidence that financial education had a positive effect on financial knowledge and downstream financial behaviour. They argue that the economic size effect of such interventions is, on average, at least three times the results of

previous similar studies (Kaiser, Lusardi, Urban, & Menkhoff, 2020). As the literature suggests, such courses improve financial literacy and foster financial behaviour. But to what extent and why?

Individuals display different levels of financial literacy even before an intervention, that is, a financial education course, takes place. The effect of financial education on improving financial literacy would thus be different among different subjects. Given this, we aim to answer the following research question.

- How does baseline financial literacy affect the effectiveness of a financial education course in increasing financial literacy?

2.5. Hypotheses

Even though the literature on the effectiveness of financial education on financial literacy suggests different viewpoints, recent meta-analyses have shown that these kinds of interventions affect financial literacy improvement. The literature suggests such courses improve financial literacy and foster better financial behaviour (Kaiser & Menkhoff, 2017; Kaiser, Lusardi, Menkhoff & Urban, 2020). Given that, we expect,

i. The financial education course will significantly affect the financial literacy of students taking the course.

Levels of financial literacy are not the same for all students before a financial education course. As they all receive the same course and are taught the same subjects, more financially literate students benefit less from this intervention. On the other hand, the intensity of financial literacy improvement will be higher among less financially literate students. Even if a student starts the course with very low financial literacy and is aware of the importance of being financially acknowledgeable, the course will improve their financial literacy, results also supported by the meta-analysis of Kaiser and Menkhoff (2017).

Thus, we expect that,

ii. The higher the baseline financial literacy, the less effective financial education is regarding financial literacy improvements.

This would suggest that policymakers and educators should first consider the current (baseline) financial literacy to effectively deliver such courses and then design courses that would satisfy the needs of each specific category.

3. Research Context and Design

3.1. Financial Education Course

A study group from the Central Bank of Albania developed and organised a course to be offered to students in all high schools of Albania. With the permission of the Ministry of Education, Youth and Sports of Albania, they accomplished their goal of including a course called "Financial Education" in the high school curricula. The Central Bank offers free textbooks for use during the session to all the high schools that decide to provide the course. The book is entitled "Personal Finance in Your Hands." They also offer another textbook for teachers with exercises and case studies to support their teaching. The book has two main chapters. The first is "General Economic and Financial Knowledge," and the second is "Personal Finance." The course lasts for one academic year.

According to Central Bank officials, this course has low participation rates because of society's lack of awareness. The social sciences literature suggests that awareness is crucial to human behaviour, and is one of the main components of consciousness-raising. It leads individuals to be actively involved and increases interest in the focal issue (Bickford & Reynolds, 2002; Greene & Kamimura, 2003). Social awareness has been positively linked to an individual's attitudes and cognitive development (Tsui, 2000). We thus used awareness about the importance of financial education as a tool that would improve the financial knowledge and financial literacy of the student. In collaboration with the Central Bank, we made a short presentation to all the school students on the importance of financial education. The Bank of Albania continually promotes financial literacy and financial education by offering to organise short school visits to the bank's premises. They first show the students around the bank structures, and then briefly present the importance of being financially knowledgeable.

3.2. Research Questionnaire

We used the OECD definition of financial literacy for its measurement (OECD, 2005). With the permission of the Ministry of Education, Youth and Sports of Albania, students were asked to fill a questionnaire which measured financial literacy both before and after the course. As part of the PISA1 assessment survey, the OECD included a section about financial literacy in high school students for the first time in 2012. The survey questions were designed so that three main dimensions of financial literacy, content, process, and contexts, could be tackled. The content dimension has four main areas, intended to assess knowledge and understanding. These areas include money and transactions, planning and managing finances, risk and reward, and the financial landscape. The process dimension comprises questions about identifying financial information, analysing information in a financial context, evaluating financial issues, and applying financial knowledge and understanding. Lastly, the context dimension comprises questions involving different situations in which financial knowledge, skills, and understanding are applied. It is written for four main contextual conditions: education and

work, home and family, individual, and societal. In 2018, the OECD released the most recent financial literacy assessment guidelines for high school students (OECD, 2018).

The OECD's financial literacy questionnaire (Appendix A) collected information about the students' financial literacy before and after the financial education course. We must note that the time between the first phase and the second phase of data collection is one academic year. Moreover, the questionnaire includes questions which require some reasoning and calculation skills, and not multiple choice questions only. Given these, we can argue that students will find it hard to remember the questions, and thus bias the results of the second phase.

3.3. Research Sample

The sample used in this research project was composed of four schools in Tirana, Albania. Two of these schools provide a financial education course to their students, and we refer to them as the treated schools, and the other two, which we refer to as the untreated schools, do not. The students included in the study were in the 11th grade of high school studies during the baseline questionnaire distribution, and at the beginning of the 12th grade, during the end-line questionnaire.

Financial Education	2019	2020	Total
0	232	232	232
1	287	287	287
Total	519	519	1038

Table 1:Number of observations before and after the financial education course

Table 1 above reports the exact number of observations included in our sample before (in 2019) and after (in 2020) the financial education course for the treated and control schools. There are 519 observations for all the schools before, and 519 observations after the financial education course was delivered. At the beginning of the 2019-2020 academic year, in September 2019, a questionnaire about financial literacy was delivered to students from both the treated and control schools. Before they started to complete the questionnaire, we informed the students about the study's purpose, and read the instructions carefully to them. Students at the treated schools took the financial education course during this academic year. At the end of the academic year, in October 2020, the same

questionnaire was delivered to the students from the treated and control groups again. The purpose and instructions for the study were repeated to the students again. The questionnaire was delivered in a printed version in the schools, and we supervised its completion.

4. Empirical Analysis

4.1. Description and Interpretation of the Data

This section describes the main variables included in our study and their interpretation. It also explains the characteristics of the individual and school-level covariates included in the study.

The course has been delivered every year since its introduction in the 2015-2016 academic year. It is structured and designed to last for an entire academic year, from September to mid-June of the following year. As it is already a well-established course, randomisation was not possible at either school or individual level. It was also not possible to randomise the timing of the start of the course as the course lasts for an academic year and not one semester. We thus controlled for two potential self-selection sources, the individual and school levels, using covariates. According to the literature, economic status, age, gender, parental occupation, and mathematical literacy play a significant role in the financial literacy of individuals (Batty, Collins, & Odders-White, 2015; Lührmann, Serra-Garcia, & Winter, 2014; Walstad, Rebeck, & MacDonald, 2010). At the school and class level, school performance, class size and performance, and school location, as well as teacher education and experience might interfere with the treatment and outcome in this subject (Batty, Collins & Odders-White, 2015; Bruhn et al., 2013; Lührmann, Serra-Garcia, & Winter, 2015). Table 2 lists all the variables in the sample on which we collected information before and after the intervention, from both treated and control schools. There are 16 variables in total, of which 15 variables are our individual and school level.

		Financial Education	N	Mean	SD	Min	Max
	Main Variable						
	Financial Literacy						
	BFL: Before Financial Literacy	(1)	287	23.31	9.79	0	47
		(0)	232	24.82	9.35	0	48
	AFL: After Financial Literacy	(1)	287	19.13	8.9	0	48
		(0)	232	25.94	10.00	0	42
	Students Characteristics						
1	Gender	(1)	262	-	-	0	1
		(0)	216	-	-	0	1
2	***Parental Education***						
	2.1 Father's Education	(1)	271	-	-	0	1
		(0)	218	-	-	0	1
	2.2 Mother's Education	(1)	268	-	-	0	1
		(0)	220	-	-	0	1
3	***Parental Occupation***						
	3.1 Father's Job	(1)	284	-	-	0	1
		(0)	228	-	-	0	1
	3.2 Mother's Job	(1)	284	-	-	0	1
		(0)	229	-	-	0	1
4	Economic Status	(1)	287	0.64	0.48	0	1
		(0)	232	0.65	0.47	0	1
5	Mathematical Literacy	(1)	227	7.74	1.8	0	10
		(0)	174	7.92	1.6	0	10
6	Academic Performance	(1)	229	8.34	1.61	0	10.3
		(0)	174	8.46	1.5	0	10
7	Prior Economics Course	(1)	267	-	-	0	1
		(0)	209	-	-	0	1
8	Previous Employment History	(1)	272	-	-	0	1
		(0)	214	-	-	0	1
9	Cognitive Ability	(1)	213	-	-	0	1
		(0)	174	-	-	0	1
	School and Teacher Characteristics						
10	Teacher Background	(1)	287	-	-	0	1
		(0)		-	-		
11	Teacher Experience	(1)	287			0	4
		(0)					
12	Principal Education Data	(1)	287	-	-	0	0
		(0)	232	-	-	0	0
13	School Size	(1)	287			2	4
		(0)	232			0	4
14	Ranking in the State Matura[1]	(1)	287	-	-	1	9
		(0)	232	-	-	1	9
15	School Location	(1)	287	-	-	0	1
		(0)	232	-	-	0	1

Table 2: Descriptive statistics

The table reports the descriptive statistics of the variables included in our sample. *Financial Literacy Score* is calculated based on the answers of each student from the Financial Literacy Questionnaire delivered; *Gender* is a dummy taking the value 1 if the student is male, and 0 otherwise; *Parental Education* indicates whether father or mother hold a university degree or not and takes the value 1 if they hold a university degree, and 0 otherwise; *Parental Occupation* indicates the job of each parent; and is 1 if it is a finance or related background job and 0 otherwise; *Economic Status* indicates the average monthly income in the family and takes the values 1- if "Income

[1] State Matura is the comprehensive examination at the end of high school. Schools are ranked based on student results. It is a measure of school performance, as school continuation.

>=210.66 2Euro (26000 All)", 0- if "Income<210.66"; *Mathematical Literacy* is the average maths grade in the last academic year; *Academic Performance* is the cumulative GPA; *Prior Economic Course* is a dummy taking a value 1 if a student has taken any economic course prior to the financial education course; *Previous Employment History* is a dummy taking the value 1 if the students has ever worked before; *Cognitive Ability* is a dummy taking the value 1 if the student answered 0, 1 or 2 out of 4 Raven's progressive matrices correctly and 0 otherwise; *Teacher Background* indicates the educational degree background of the teacher who teaches financial education courses, taking the value 1, if it is from a finance or any other finance-related background, and 0 otherwise; *Teacher Experience* indicates the number of years they have been teaching the financial education course; *Principal Education Data* indicates the educational degree background of the school director, and takes the value 1 if from finance or any other finance-related background; *School Size* is number of classes per each school; *Ranking* indicates school's previous academic year ranking in the State Matura exam; *School Location* is a dummy taking the value 1 if the school is located in the city centre, and 0 otherwise.

We matched the samples from the first phase questionnaire with those from the second phase, using the student IDs found in the questionnaire. It is worth noting that the second phase questionnaire was delivered during the coronavirus crisis in October 2020. At the time, to obey the protocols and maintain social distance, classes in Albanian high schools were taught in shifts. Briefly, half the class had their lessons early in the morning and half in the afternoon or late afternoon. This resulted in fewer questionnaires delivered in the second phase. Given this limitation, we matched the samples only for students present before and after the financial education course. As a result, there were 232 samples from the non-treated schools and 287 from the treated schools.

	BFL	**AFL**
Financial Education (1)	23.3101	29.1324
No Financial Education (0)	24.823228	25.94397
Difference	1.51*	3.18***
Total	23.98651	27.70713

Table 3:Average baseline and end-line financial literacy scores conditional on financial education

**** p<0.01; ** p<0.05; * p<0.1*

After the intervention, the average financial literacy score (AFL), was increased in both treated and control schools (Table 3). On average financial literacy increased from 23.98 points in 2019, before the start of the course, to 27.7 in 2020, after the course has been delivered. As shown in Table 3, the average financial literacy score before the course (BFL) was higher in the non-treated schools by a difference of 1.51, which is statistically significant at 10%.

This result is explained by the fact that part of this group is continually ranked among the first in terms of its students' performance, measured by the Matura State Exam in Albania. After the financial

[2] The average salary in Albania according to World Bank (2019); ALL-Albanian Lek (National Currency)

education course was delivered, however, financial literacy was significantly higher in the treated schools, by a difference of 3.18 points.

4.1.1. Descriptive analysis of both individual and school-level covariates

This section explains the descriptive analysis of the control variables. Table 4 reports the average financial literacy score for both treated and control schools before and after the course, conditional on each control variable.

Variable		**AFL**			**BFL**		
		FinEd=1	**FinEd=0**	***Difference***	**FinEd=1**	**FinEd=0**	***Difference***
Gender	0	27.3	25.26	2.07*	22.42	24.83	-2.4*
	1	30.6	26.32	4.31***	24.12	25.07	-0.94
Mother's Education	0	28.84	25.73	3.11**	23	24.39	-1.39
	1	29.08	25.72	3.36**	23.89	26.12	-2.23
Father's Education	0	28.99	26.01	2.99**	22.57	24.52	-1.95*
	1	28.81	25.5	3.31**	24.42	25.52	-1.11
Mother's Job	0	29.39	26.05	3.34***	23.48	25.12	-1.64*
	1	26.6	25.51	1.08	22.03	23.30	-1.27
Father's Job	0	29.35	26.01	3.34***	23.33	24.79	-1.45
	1	28.16	25.76	2.4	23.31	25.02	-1.71
Cognitive Ability Score	0	27.14	24.18	2.95*	22.04	24.93	-2.89*
	1	30.64	27.08	3.55**	23.72	25.14	-1.41
Average Monthly Income	0	28.06	25.29	-2.77**	21.63	25.58	3.95**
	1	29.73	26.29	-3.44**	24.25	24.42	0.17
Worked Before	0	28.56	25.38	3.17**	22.57	25.33	-2.76***
	1	30.15	27.04	3.1*	25.87	24.19	1.67
Prior Economics Courses	0	28.77	25.76	3***	22.95	25.37	-2.42**
	1	30	23.13	6.88	24.92	16.375	8.55*
Directorate Education	0	29.13	25.94	3.18***	23.31	24.82	-1.51**
	1						
School Location	0	30.03	27.77	2.25	20.73	21.94	-1.21
	1	28.62	25.40	3.21***	24.80	25.68	-0.87
School Size	2	30.12	28.22	1.89	25.19	26.78	-1.59
	3	30.19	27.77	2.41	20.92	21.94	-1.02
	4	24.96	22.45	2.54	23.87	24.51	-0.64
Ranking	1	28.61	25.40	3.21**	24.80	25.67	-0.87
	9	30.19	27.77	2.42	20.92	21.94	-1.02

Table 4: Average of baseline and end-line financial literacy score conditional on financial education and control variables.
**** p<0.01; ** p<0.05; * p<0.1*

Male students, on average, scored more highly in financial literacy both before and after the intervention, regardless of having received the course or not. Parental education seems to be

positively correlated to financial literacy scores. Students whose fathers hold a university degree, both treated and non-treated, surprisingly, scored slightly lower after the course.

On the other side, parental jobs were negatively correlated with financial literacy scores. Students who scored better in terms of a cognitive ability test (CogA) have also scored higher in financial literacy scores, both before and after the intervention. The higher the income level (AMI), the higher the financial literacy score for treated and non-treated students before and after the financial education course. Those who had previous work experience scored higher on the financial literacy questionnaire. The before and after financial literacy scores are lower for students with prior economic courses.

The larger the school, the lower the financial literacy scores. On the other hand, school location does not seem to contribute to higher financial literacy scores after the course is delivered. None of the directors of the schools in our sample had a finance or related background.

Variable	FinEd=0	FinEd=1
Maths Average Grade	7.74	7.94
GPA	8.34	8.46

Table 5:Maths and overall GPA of students conditional on financial education
**** p<0.01; ** p<0.05; * p<0.1*

Table 5 reports the overall GPA and maths average grades for students in both treated and non-treated ones. We realise that GPA and MAG are slightly higher in the treated schools, but the difference is not statistically significant.

In the following paragraphs, we describe the schools and the characteristics of the teachers delivering the course. In one school, two teachers are delivering the course, neither of whom has a finance or finance-related background, and the teachers have either no experience or two years of experience in delivering the course. In the second-treated school, the teacher holds an economics degree and has four years of experience in delivering the course (Table 6). As shown in Table 6, having a finance or related educational background significantly increases a student's financial literacy. Experience in teaching the financial education course also resulted in higher financial literacy scores for the

students. The increase in the years of experience is not statistically significant, however, as increasing experience from two to four years does not statistically increase financial literacy scores.

Variable		BFL	AFL
Teacher Background	0	23.5	24.42
	1	26.7***	28.06***
Teacher Experience	0	24.5	22.42***
	2	21.94***	27.7***
	4	26.78***	28.21

Table 6: Teacher Characteristics
**** p<0.01; ** p<0.05; * p<0.1*

In Table 7, we report the characteristics of the schools included in our sample. One treated school is located inside the city centre and one outside, and the same is true for the non-treated schools. Again, one of the treated schools ranked the first in the Matura State exam and the other ranked ninth, and the same was true for the non-treated ones. The same characteristics hold for school size, and none of the directors of the schools had a finance or related background.

School	School Location	School Size	Ranking	Director Education	No. of Teachers	Teacher Experience	Teacher Background
1st treated	1	4	1	0	2	2;0	0;0
2nd treated	0	3	9	0	1	4	1
1st control	1	2	1	0			
2nd control	0	4	9	0			

Table 7:School and teacher Characteristics

Before further proceeding with the analysis, we report the covariate balance test for the variables included in our study. The results show that all individual-level variables, gender, parental education and job, prior economic courses, prior work, academic performance, and average monthly income are balanced. There is not enough evidence to reject the null hypothesis of similar means. This is not the same for school-level covariates, however, such as school location, size, and ranking (see Table 8). The test results in Table 8 support the hypothesis of different means for the school-level characteristics.

Variables	Mean control	Mean treated	Difference
Gender	0.500	0.531	0.031
Father's Education	0.413	0.391	-0.022
Mother's Education	0.295	0.343	0.048
Father's Job	0.202	0.215	0.013
Mother's Job	0.144	0.106	-0.038

Maths Average Grade	7.942	7.736	-0.206
GPA	8.466	8.339	-0.126
Cognitive Ability Score	0.586	0.657	0.071
Average Monthly Income	2.215	2.160	-0.054
Worked Before	0.220	0.195	-0.025
Prior Economic Courses	0.038	0.049	0.010
Ranking	2.828	3.909	1.082***
School Location	0.772	0.634	-0.137***
School Size	2.978	2.734	-0.244***
Directorate Education	0.000	0.000	0.000

Table 8:Covariates Balance Test
*** p<0.01; ** p<0.05; * p<0.1

5. Data Analysis and Results

5.1. Methodology

This study examined the effectiveness of the financial education course provided to high school students in Tirana, Albania. As previously mentioned, the course is offered to the students for a whole academic year, which was 2019-2020 in our study. Data on financial literacy was collected before and after the course was delivered. We have treated schools, schools that have delivered the financial education course, and control schools that have not delivered the course in the sample. We employed difference in difference analysis to study the effect of the course.

Difference in difference (DiD) is a design used in quasi-experimental settings to estimate the causal effect of an intervention using data from control and treatment groups. A DiD can be employed with longitudinal data pre-and post-intervention. The main assumption of DiD is that without any intervention, the change in the treated and the non-treated groups would be the same. This assumption is known as the parallel trend. In other words, treatment and control would have the same trends across time. DiD models are subject to some selection biases, however. Although the assumption is built upon a time-fixed effect concept, the treatment and control groups might differ in ways that would affect their time trends, or their composition may change over time.

The following model was estimated to study the effect of financial education in enhancing financial literacy.

$$FL_i = \alpha + \gamma FinEd_i + \lambda year_{i2020} + \beta year_{i2020} FinEd_i + \delta' Z_{it} + \varepsilon_{it}$$

Equation 1:The effect of FinEd in enhancing financial literacy

The FL_i indicates the financial literacy score. $FinEd_i$ is a dummy of having taken a financial education course or not; $year_{i2020}$ is a time variable, which equals one if the observation is from the year 2020, after the course, and 0 if it is from 2019. The interaction term $year_{i2020}FinEd_i$ equals one if the observations are from the treated schools in the year 2020. Z_is a vector of all covariates, both school and individual levels covariates, and ε_{it} is the error term.

5.1.1. Propensity score matching (PSM)

We empirically assessed the model using a propensity-score matching model to control the treatment's endogeneity issue. A propensity score is used to draw a causal inference in cases where the treatment, the financial education course in our case, is not randomly assigned. It controls for the selection bias problem. These scores are estimated by the fitted values from a logistic regression of treatment on the subjects' pre-treatment characteristics (covariates). The propensity score balances the study groups to make a comparison between them more manageable. According to Rosenbaum and Robin (1983), treated and untreated subjects with the same propensity scores have identical distributions for all pre-treatment characteristics. When comparing the groups' means, controlling for propensity score means, we effectively turned the study into a randomised block experiment. These blocks are composed of groups of subjects with the same propensity scores. In propensity score matching, you can match subsets of untreated individuals whose propensity scores are similar to those of the treated individuals (Rosenbaum, 2002). The fundamental assumption of PSM is the counterfactual framework, or un-confoundedness (Rosenbaum & Rubin, 1983; Rubin, 1978). This assumption is that the subjects of the treatment and control groups have potential outcomes in both the observed and not observed states. In other words, in addition to the observed mean outcome under treatment for a treated subject E (Y_1| W=1), the theory suggests an unobserved means under control E (Y_0| W=1). Under the same logic, control group subjects observed E (Y_0| W=0) and unobserved mean E (Y_1| W=0). Traditionally, researchers use E (Y_0| W=0) as a counterfactual of E (Y_0| W=1),

however, Rosenbaum and Robin (1978) argue that there is a bias in the evaluation of the effect $\tau = E(Y_1| W=1) - (Y_0| W=0)$. To control for this bias, they suggest that the assignment of cases to treatment or control is independent of the outcome of those not treated and the outcome of the treated is conditional on some covariates. Propensity score matching involves three main steps.

- The first step is the calculation of propensity scores through a logit regression. A logit regression including all the baseline covariates is run, and propensity scores are created. These propensity scores are then saved to be used for matching. Before going on with the analysis, the matching success is calculated. If the difference between the means of the control and treated groups after the matching has decreased, we can tell that the matching was effective.
- The second step is the matching of treated and control subjects based on those calculated propensity scores.
- The final step is the analysis of the treatment effect based on this new sample. In our case, we ran DiD using the matched sample. In this way, both selection bias and time-trend biases will be controlled for quasi-experimental or observational data. Briefly, propensity score matching reduces time-variant factors of heterogeneity by dealing with observable characteristics—and so the parallel trend assumption of the DiD estimator is meliorated. At the same time, the application of PSM eliminates the time-invariant unobserved heterogeneity. The estimation of DiD for the matched sample further increases the credibility of the analysis, as we have more significant control of heterogeneity and selection bias.

5.2. The Effectiveness of the Financial Education Course in Improving Financial Literacy

This section reports the empirical results. The difference in difference methodology, without matching, is first presented. The results show that financial education plays a significant role in improving the financial literacy scores of students.

Table 9 reports the difference in difference estimation results for both models, without covariates (MI) and with covariates (MII). The DiD estimator is statistically significant and different from 0 for

both models. This implies that the provision of financial education does affect the financial literacy scores of the students.

Variables	Model	
	M(I)	M(II)
DiD	4.702***	6.29***
	(1.19)	(1.7)
Year	1.12	0.39
	(0.90)	(1.28)
Financial Education	-1.51*	-2.71**
	(0.84)	(1.31)
Gender		0.58
		(1.004)
Father's Education		2.50**
		(1.06)
Mother's Education		-0.97
		(1.075)
Father's Job		1.3
		(1.18)
Mother's Job		-4.14***
		(1.29)
Maths Average Grade		-0.079
		(0.56)
GPA		0.34
		(0.69)
Average Monthly Income		2.28***
		(0.72)
Worked Before		1.48
		(1.02)
Prior Economics Courses		-4.4**
		(1.81)
Cognitive Ability		-0.41
		(1.07)
School Ranking		0.22*
		(1.3)
School Size		-4.03***
		(0.57)
School Location		Omitted
Directorate Education		Omitted
Constant	24.8***	28.28***
	(-0.61)	(3.88)

Table 9:Difference in Difference Estimation before Propensity Score Matching.
*Inference: *** p<0.01; ** p<0.05; * p<0.1; Robust Standard errors in brackets*

The average treatment effect of the course in improving financial literacy is 4.702 points, statistically significantly at 1%. Financial literacy thus increases by 4.702 points more than it would without providing the financial education course. The effect is increased to 6.29 points when the control variables are included in the second model.

We included individual-level control variables in the model, such as gender, parental education, and job, maths and the overall GPA of the students, cognitive ability score, average monthly income, previous work and previous economic courses, and the school-level covariates.

As previously mentioned, a randomisation process is not possible in this study, and propensity score matching was run using logit regression. These scores are estimated based on the individual pre-treatment characteristics of the individuals in the sample, both individual and school level characteristics. An important step after the evaluation of the propensity score is to evaluate the success of the matching. Table 10 reports the success of the propensity score matching. The means of each variable for both treated and control groups are reported before and after the matching. The % bias reduction statistics are shown, and the corresponding t-test values and significance are reported. The % bias reduction shows the percentage difference in of covariates' means before and after the matching between control and treated groups. The results show that the mean difference between the treated and control groups is significantly reduced after the matching, implying success in the matching strategy.

Variable	Unmatched (U) Matched (M)	Mean Treated	Mean Control	% Reduct bias	t-test t
Gender	*U*	0.71	0.57		2.31**
	M	0.67	0.57	28.7	1.55
Father's Education	U	0.412	0.48		-1.12
	M	0.411	0.48	-2.0	-1.10
Mother's Education	U	0.38	0.39		-0.18
	M	0.34	0.39	-303.8	-0.71
Father's Job	U	0.21	0.19		0.52
	M	0.17	0.19	65.9	-0.18
Mother's Job	U	0.13	0.18		-1.08
	M	0.15	0.18	44.6	-0.55
Maths Average Grade	U	7.8	8.12		-1.45
	M	7.9	8.12	33.7	-0.91
GPA	U	8.4	8.6		-0.95
	M	8.5	8.6	18.9	-0.72
Cognitive Ability	U	0.77	0.72		1.02
	M	0.74	0.72	51.8	0.46
Average Monthly Income	U	2.52	2.62		-1.19
	M	2.53	2.62	15.3	-0.98
Worked Before	U	0.20	0.25		-0.83
	M	0.23	0.25	59.4	-0.32
Prior Economic Courses	U	0.039	0.05		-0.26
	M	0.037	0.05	-32.6	-0.35
School Ranking	U	3.6	2.79		1.72*
	M	2.46	2.79	16.8	1.39
School Location	U	0.67	0.77		-1.72*

	M	0.69	0.77	16.8	-1.39
Directorate Education	U	0	0	.	.
	M	0	0	.	.
School Size	U	2.83	3.23		-3.67***
	M	2.9	3.23	18.3	-2.84

Table 10:Propensity Score Matching Success Test
**** p<0.01; ** p<0.05; * p<0.1*

5.2.1. The effectiveness of the financial education course in improving financial literacy after propensity score matching

After assessing the success of the propensity score matching, the difference in difference analysis is again applied without the covariates. After the matching, the new sample is as follows. As shown in Table 11, the total number of observations after matching in the DiD analysis is 428 students, 214 from the control schools and 214 from the treated ones.

	Number of Observations in the DiD after matching: 428		
	Before	**After**	**Total**
Control	107	107	214
Treated	107	107	214
Total	214	214	428

Table 11:Post-PSM Diff-in-Diff observation

The DiD estimation shows that the financial education course has effectively improved the students' financial literacy. The average treatment effect of the course in improving financial literacy is 5.598 units, which is statistically significantly at 5%. Financial literacy thus increases by 5.598 points more than it would without taking the financial education course (See Table 12).

Variables	**Model**
DiD	5.598**
	(1.9)
Year	0.5
	1.38)
Financial Education	-1.56
	(0.84)
Constant	25***
	(-0.61)

Table 12:Difference in Difference Estimation after PSM
*Inference: *** p<0.01; ** p<0.05; * p<0.1; Robust Standard errors in brackets*

5.3. The Effect of Baseline Financial Literacy in the Effectiveness of the Financial Education Course

As the literature has suggested, financial education does play an important role in improving financial literacy, however, we are interested in understanding how the baseline financial literacy level affects

the effectiveness of the financial education course. To study this effect, we regress the absolute percentage change in the baseline and end-line financial literacy (DFL) on baseline financial literacy score (BFL). To understand the effect of baseline financial literacy in post-course financial literacy, we constructed a new variable. DFL (change in financial literacy score) represents the absolute percentage increase or decrease in financial literacy before and after the financial education course, as follows:

$$DFL = \left|\frac{(AFL-BFL)}{BFL}\right| * 100;$$

Equation 2: Absolute % change in financial literacy before and after financial education course.

AFL is the financial literacy measured after the course has been delivered, and BFL is the financial literacy score before the financial education course was delivered. The following table shows that the average DFL for the treated schools is considerably higher than those of control schools (60.94>39.7).

DFL (Absolute Percentage Change in Financial Literacy)				
	Nr. of observations		**Average Score**	
No Financial Education (0)		230		39.7
Financial Education (1)		283		60.94
	Total	513	**Difference**	-2.24*

Table 13: Descriptive DFLs
*Inference: *** p<0.01; ** p<0.05; * p<0.1*

We aim to understand whether the course has been more effective for students with a lower baseline financial literacy score. For this reason, as stated above, we regress DFL on baseline financial literacy, financial education, and all individual and school-level covariates.

	Model
Variables	**M (I)**
Baseline Financial Literacy	-3.92***
	(-0.83)
Financial Education	25.92***
	(9.8)
Gender	3.79
	(9.56)
Father's Education	-20.47*
	(9.10)
Mother's Education	4.11
	(11.04)
Father's Job	-17.25
	(10.86)
Mother's Job	-2.12
	(10.56)
Maths Average Grade	12.46
	(8.39)
GPA	-26.46*
	(13.04)

Cognitive Ability	23.69* (11.28)
Average Monthly Income	-4.24 (10.31)
Worked Before	-9.7 (8.39)
Prior Economics Courses	11.5 (21.12)
Constant	262.7* (104.29)

Table 14:Effect of baseline financial literacy
F (16, 214) = 10.12; Prob > F = 0.000.
***Inference: *** p<0.01; ** p<0.05; * p<0.1*

The regression results in Table 14 show that with a one unit increase in the baseline financial literacy score, the percentage changes from the baseline to end-line financial literacy score decreases by 3.92%. This implies that the percentage change of the financial literacy score from 2019 to 2020 increases by 3.92% when the baseline financial literacy decreases by one unit. This effect is visually represented in Figure 2 below. The DFL values are plotted in the vertical axis, and baseline financial literacy scores are plotted in the horizontal axis. The FinEd1 line (in blue) shows the relationship of BFL with DFL for the treated schools, and the FinEd0 (in orange) shows the same effect but for the control schools. The downward sloping FinEd1 line implies that the financial education course seems to improve the scale of the weaker students, those with lower baseline financial literacy scores, more than that of the stronger students.

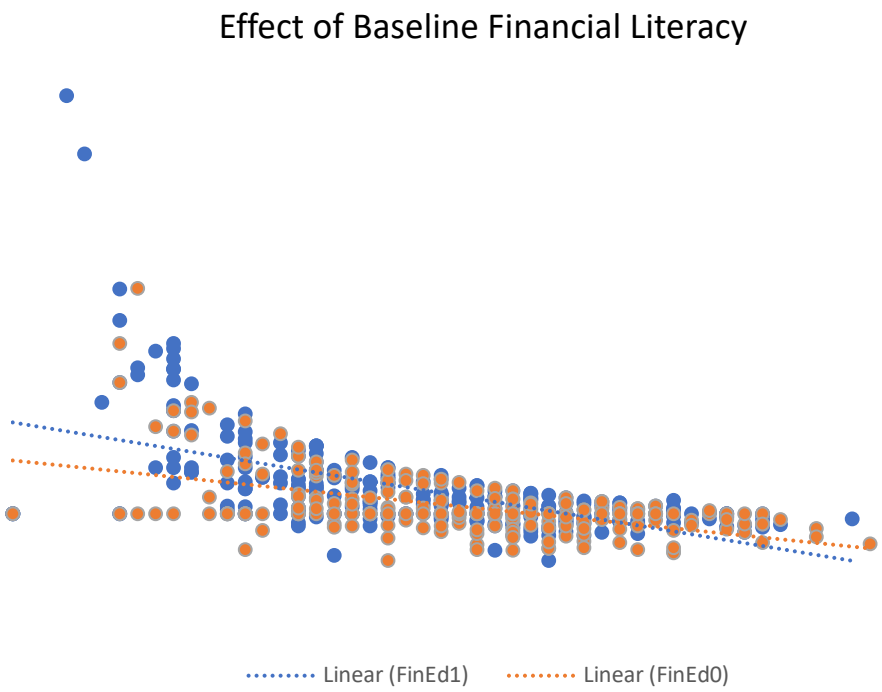

Figure 1: Effect of baseline financial literacy

These results suggest that the financial education course has been more effective for those students whose financial literacy was lower before the start of the course in 2019.

To control for any endogeneity issues, which may arise due to the nature of our data, where randomisation is not possible, we re-ran the analysis in the matched sample. The regression analysis run on the matched sample using the propensity score matching revealed the same results regarding the direction of the effect of baseline financial literacy (See Appendix B). In the following paragraphs, we limit our sample only to those students who have taken the financial education course. We regress DFL on BFL, controlling for school and individual level covariates, and we estimate the effect of BFL on DFL. In line with previous results and our hypothesis, the estimation showed that students whose financial literacy was lower before the start of the course had benefited the most from the financial education course.

	Model
Variables	**M (II)**
Baseline Financial Literacy	-6.51***
	(1.53)
Gender	16.05
	(17.98)
Father's Education	-15.65
	(14.93)

Mother's Education	-5.00 (17.06)
Father's Job	-16.35 (17.8)
Mother's Job	11.01 (16.17)
Maths Average Grade	17.03 (12.32)
GPA	-33.07 (18.2)
Cognitive Ability	24.84 (19.45)
Average Monthly Income	9.12 (14.48)
Worked Before	-10.86 (14.88)
Prior Economics Courses	26.6 (25.68)
Constant	326.75* (151.9)

Table 15: Effect of BFL on DFL; Treated Sample
***Inference: *** p<0.01; ** p<0.05; * p<0.1*

One unit decrease in baseline financial literacy caused an increase in DFL by 6.51% for the treated students. The results thus showed that the course was more effective for those students who, before the course, were less financially literate. In order to check robustness, the regression analysis was run on the matched sample, using propensity score matching (See Appendix B). These results are in line with our regression analysis when controlling for covariates.

To further support our results, we estimate the effect of baseline financial literacy on financial literacy, by regressing the financial literacy score on the baseline financial literacy scores and its interaction with the financial education course.The following model is used to estimate this effect.

$$FL_i = \alpha + \gamma FinEd_i + \lambda BFL_i + \beta BFL_i FinEd_i + \delta' Z_{it} + \varepsilon_{it}$$

Equation 3: Effect of baseline financial literacy on financial education effectiveness

The FL_i indicates the financial literacy score. $FinEd_i$ is a dummy of having taken a financial education course or not; BFL_i is the baseline financial literacy score. $BFL_i FinEd_i$ is the interaction term of baseline financial literacy scores and financial education dummy. Z_is a vector of all individual level covariates, and ε_{it} is the error term.

The estimated coefficient of baseline financial literacy suggests that a one unit increase in the baseline financial literacy scores increases the financial literacy scores after the course by 0.52 points for the non-treated students. The negative coefficient of the interaction term between baseline financial

literacy and financial education, however, shows that a unit increase in baseline financial literacy score is less beneficial in the treated subjects compared to the non-treated students. This result suggests that a higher baseline financial literacy score is not beneficial for our treated subjects, thus, implying that the students with higher baseline financial literacy scores have benefited less from the financial education course. The financial education itself positively and significantly affects after course financial literacy scores. Being a treated student increases after course financial literacy scores by 9.6 points on average. Again, the analysis was run on the matched sample, and the results were the same (See Appendix B).

	Model
Variables	**M (III)**
Baseline Financial Literacy	0.52***
	(0.094)
Financial Education	9.6***
	(3.22)
Baseline Financial Literacy _Financial Education	-0.21*
	(0.12)
Gender	2.87
	(1.28)
Father's Education	-2.67*
	(1.2)
Mother's Education	0.42*
	(1.30)
Father's Job	0.52
	(1.16)
Mother's Job	-2.04
	(1.41)
Maths Average Grade	-0.40
	(0.72)
GPA	-0.79
	(0.86)
Cognitive Ability	2.81*
	(1.09)
Average Monthly Income	2.32*
	(0.93)
Worked Before	2.76*
	(1.17)
Prior Economics Courses	0.32
	(2.44)
Constant	12.60***
	(3.94)

Table 16: Baseline financial literacy effect on after course financial literacy
***Inference: *** p<0.01; ** p<0.05; * p<0.1*

This implies that if the aim of providing such a course to students is that they all benefit from it, financial educators should design courses that address each student's specific needs. These kinds of interventions would thus be effective in increasing financial literacy and helping improve society's

overall well-being. A financially literate society means higher living standards and a wealthy community.

6. Conclusion

This paper studied the effect of a financial education course offered to high school students in Tirana, Albania. Four public schools in Tirana were included in this study. Two of the schools, the treated schools, delivered a course on financial education to its students, while the others, the non-treated schools, did not provide the financial education course. The course lasted one whole academic year and covered topics of personal finance. In addition to studying the effect of a financial education course in improving financial literacy, this study analysed the way in which the baseline financial literacy, financial literacy before the education course, affects the effectiveness of the financial education course. The difference in difference analysis showed that the financial education course had a significant effect in improving the students' financial literacy. Financial literacy scores increased by 6.29 points more than they would without the financial education courses, controlling for school and individual-level covariates. On the other hand, the study showed that students with lower baseline financial literacy gained more from this course. The course was more effective for those students whose baseline financial literacy was lower. A one unit decrease in baseline financial literacy scores resulted in a 5.32% improvement in financial literacy, which implies a more effective financial education for those students who had scored less in the baseline financial literacy questionnaire. In order to control endogeneity, we applied propensity score matching and then ran the analysis on the new sample resulting from the matching. The analysis of the matched sample showed the same results.

This study has implications for policymakers and financial educators. These findings imply that financial educators and policymakers should focus more on organising and providing different training and courses to society in general. In order to increase the effectiveness of such training, however, specific courses addressing the diverse needs and levels should be organised for different

target groups. It is important to assess the financial literacy and overall financial knowledge of any target group before any intervention, to be able to provide each category with a course or training to address their specific needs.

This study contributes to the literature on financial education and financial literacy. The findings imply that even traditional courses in financial education have a significant effect in improving financial literacy.

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Appendices

Appendix A: Financial Literacy Questionnaire

Financial Literacy Questionnaire

Jonada Tafa

Ph.D. in Finance

Bologna University

Italy

2019-2020

I am conducting a scientific study into high school students' financial knowledge and financial literacy and would like to ask a few questions on these topics.

Your responses to this survey will not have any consequences for you. The responsibility for compliance with data protection regulations lies with Jonada Tafa at Bologna University.

I will never ask you for your name or your address. I pursue no financial interest in this survey. It is conducted only for scientific purposes. I will question you again at the end of this academic year. For this reason, I ask five questions in the beginning, which help us link your answers from both questionnaires using a code number, which you generate yourself.

Researchers of Bologna University will gather your data. Then, it will be saved electronically, analyzed, and safely stored. Your data will be kept only for as long as is necessary for the scientific analysis and subsequent publication process. It will not be shared with third parties and will be deleted after publishing the findings. The results, which will be published, do not allow the tracing of information of any individual.

For data protection reasons, we do not want to ask you for your name. Thus, we use the following three questions to link your answers – like a bank accounts' pin code –, since we will ask you to participate in a survey again in a few months.

F1. What is the first letter of your mother's first name?
F2. What is the first letter of your father's first name?
F3. What is the first letter of the city you were born in?
F4. What is the first letter of your surname?
F5. What is the last number of your mobile phone?

F1	F2	F3	F4	F5

COSTS OF RUNNING A CAR

Mr. Davies takes out a loan to buy a car for his family. The interest rate on loan is fixed.
One cost Mr. Davies will have is the monthly loan repayments. There are also other costs of running a car such as petrol costs and repair and maintenance costs.

Question

Some costs will increase if the family uses the car more, but other costs will stay the same.
For each cost in the table, put a circle around "Increases" or "Stays the same" to show what is likely to happen if the family uses the car more.

Cost	What is likely to happen to the cost if the family uses the car more?
Monthly loan repayments	Increases/Stays the same
Petrol Costs	Increases/Stays the same
Repair and maintenance costs	Increases/Stays the same

MUSIC SYSTEM

Kelly asks her bank to lend her 2000 zeds to buy a music system.
Kelly has the choice to repay the loan over two years or over three years. The annual interest rate on a loan is the same in each case.
The table shows the repayment conditions for borrowing 2000 zeds over two years.

Repayment period	Monthly repayment (Zeds)	Total repayment (Zeds)	Total interest paid (zeds)
2 years	91.67	2200.08	200.08

Question

How will the repayment conditions for borrowing 2000 zeds over three years differ from the repayment conditions over two years?
Circle "True" or "False" for each statement.

Statement	Is the statement true or false?
The monthly repayments will be larger for a loan over three years.	True / False
The total interest paid will be larger for a loan over three years.	True / False

BANK STATEMENT

Each week, Mrs. Citizen transfers 130 zeds into her son's bank account.
In Zedland, banks charge a fee for each transfer.
Mrs. Citizen received this statement from her bank in November 2011.

ZEDBANK

Statement for: Mrs. Citizen		**Account type: Current**		
Month: November,2011		**Account Number:** *Z0005689*		
Data	**Transaction details**	**Credit**	**Debit**	**Balance**
1-Nov	Opening Balance			1780.25
5-Nov	Wage	575.00		2355.25
5-Nov	Transfer		130.00	2225.25
5-Nov	Transfer fee		1.50	2223.75
12-Nov	Wage	575.00		2798.75
12-Nov	Transfer		130.00	2668.75
12-Nov	Transfer fee		1.50	2667.25
13-Nov	Withdraw		165.00	2502.25
19-Nov	Wage	575.00		3077.25
19-Nov	Transfer		130.00	2947.25
19-Nov	Transfer fee		1.50	2945.75
26-Nov	Wage	575.00		3520.75
26-Nov	Transfer		130.00	3390.75
26-Nov	Transfer fee		1.50	3389.25
27-Nov	Withdrawal		180.00	3209.25
27-Nov	Withdrawal (Rent)		1200.00	2009.25
30-Nov	Interest	6.10		2015.35

Question 1

What were the total fees charged by the bank in November? _____

Question 2

The following transactions occurred on 3 December:

• Wages of 575 zeds were deposited into Mrs. Citizen's account.

• Mrs. Citizen transferred 130 zeds into her son's account.

Mrs. Citizen made no other transactions on 3 December.

What was her new bank balance at the close of business on 3 December? _____

PHONE PLANS

Ben lives in Zedland and has a mobile phone. In Zedland, there are two different kinds of phone plans available.

Plan 1

•You pay the phone bill at the end of the month.

•The bill is the cost of the calls you make **plus** a monthly fee.

Plan 2

•You buy credit for the phone in advance.

•The credit lasts for a maximum of one month or until all credit has been used.

Question 1

What is one possible financial advantage of using phone plans like Plan 2?

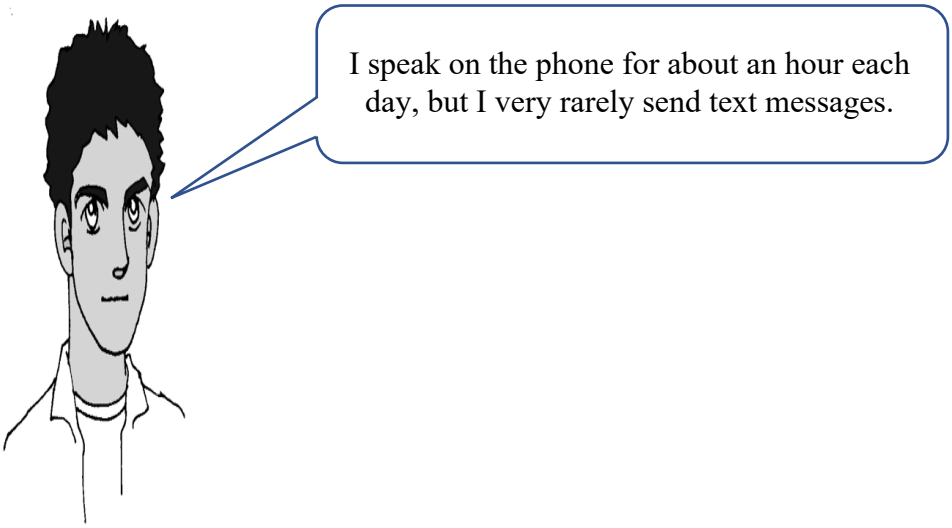
Ben decides to use Plan 1. He must now choose which phone company to use.
The table below shows the details of the four different phone companies that offer Plan 1.
All costs are shown in zeds.

Company 1		Company 2	Company 3	Company 4
Monthly fee (zeds)	20	20	30	30
Cost of call per minute (zeds)	0.27	0.25	0.30	0.25
Number of free minutes per month	90	90	60	60
Cost of text message (zeds)	0.02	0.02	free	0.01
Number of free text messages per month	200	100	unlimited	200

Question 2

Which phone company offers the best financial deal for Ben?

A. Company 1
B. Company 2
C. Company 3
D. Company 4



Ringtones

Colin sees this advertisement in a magazine for teenagers.

Get Cheeky Monkey™ ringtones for your phone.

Your phone will make a monkey noise when your friends call you.

Get one NOW for only 3 zeds*

Text the word MONK to 13 45 67

* Each ring-tone costs 3 zeds. By texting MONK to 13 45 67 customer agrees to receive a different Cheeky Monkey™ ring-tone every day. Customer can cancel contract at any time by texting STOP to 13 45 67. Cancellation fee is 5 zeds.

Question

Colin has 30 zeds credit on his phone.

He texts the word MONK to 13 45 67.

Colin does not use his phone again to make calls or send texts. He does not add any more credit.

How much credit will Colin have on his phone exactly one week later?

Credit in zeds: _____

ONLINE SHOPPING

Question

Kevin is using a computer at an Internet café. He visits an online shopping website that sells sports equipment. He enters his bank card details to pay for a football.

The security of financial information is important when buying goods online.

What is one thing Kevin could have done to increase security when he paid for the football online?

MOBILE PHONE CONTRACT

Alan wants a mobile phone, but he is not old enough to sign the contract.

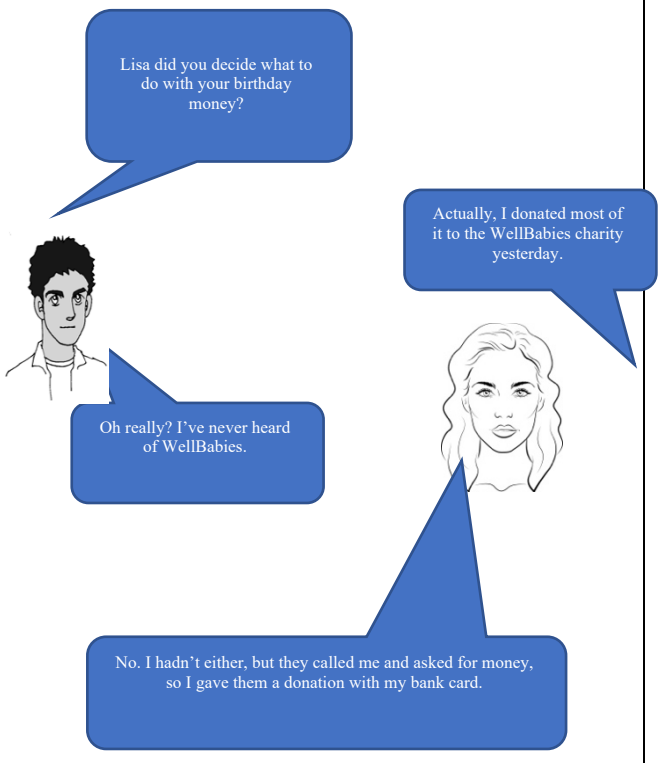
His mother buys the phone for Alan and signs a one-year contract.
Alan agrees to pay the monthly bill for the phone.
After six weeks, Alan's mother discovers that the bill has not been paid.

Question

Is each statement about the mobile phone bill true or false?
Circle "True" or "False" for each statement

Statement	Is the statement about the mobile phone bill true or false?
Alan's mother is legally responsible for paying the bill.	True/False
The mobile phone shop must pay the bill if Alan and his mother do not.	True/False
The bill does not have to be paid if Alan returns the mobile phone to the shop.	True/False

Charitable Giving

Charitable Giving	Charitable Giving
Explain why Lisa has taken a financial risk by making the donation _____	

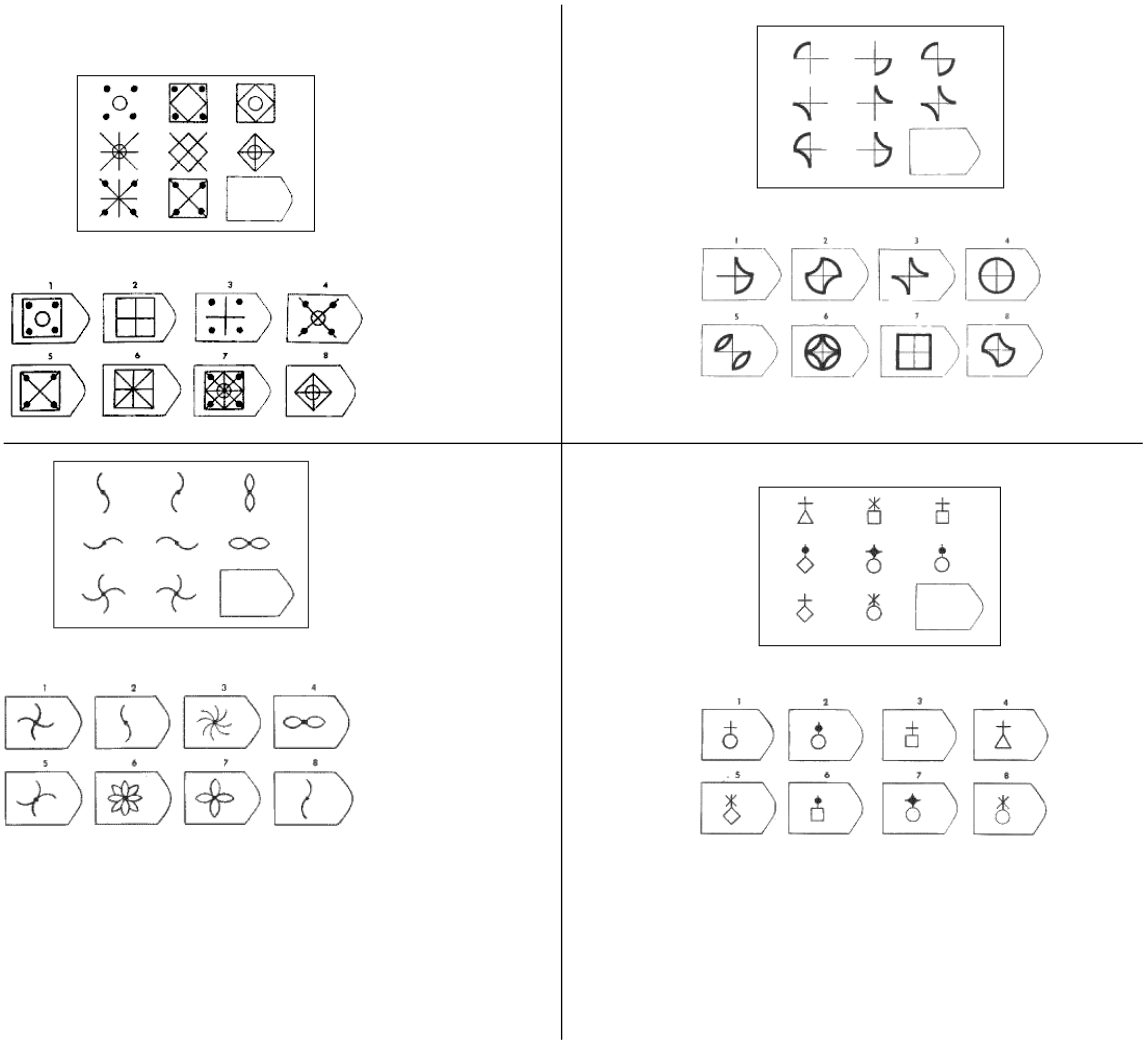
Personal Details

This section contains questions about you and your family.

1. When were you born? Month/Year
2. What is your gender? _____
3. Does your father hold a university degree? Yes No
4. Does your mother hold a university degree? Yes No
5. What's your fathers' job? Select no job if he is not working _____ No Job
6. What's your mothers' job? Select no job if he is not working? _____ No Job
7. What is your family's average monthly income?
   Income <210.66 Euro 210.66<Income<421.32 421.32 < Income
8. In which year of studies are you? 11th 12th
9. What was your Math's average grade last year? _____
10. What is your cumulative GPA? _____
11. Have you ever worked before? Yes No
12. Have you taken any economics courses before? Yes No

Combinations

Which of the pieces in the lower area completes the pattern in the upper area?



School and Class Information

Instructor Data (per class)

1. What is your graduation field? _____
2. For how many years have you been teaching this course? _____
3. What is the number of students in the class? _____
4. What is the class average grade? _____

Principal and School Data (per school)

1. What is your graduation field? _____
2. What was the last year ranking in the State Matura of this school? _____
3. What is the percentage of students moving to the next year? _____
4. What is the percentage of the students receiving social and economic support to continue their studies? _____
5. What is the number of classes in this school? _____

Appendix B: Effect of BFL on DFL using propensity score matching

Variables	M(I)	M(II)	M(III)
BFL	-4.57***	-7.16***	0.49***
Fin_Ed	30.15***	--------	10.09***
BFL_FinEd	--------	--------	-0.19
Constant	145.38***	238***	

Table 17: Effect of BFL on DFL; Propensity Score Matching

***Inference: *** p<0.01; ** p<0.05; * p<0.1*

M(I) is the model when both treated and control schools' observations are used to estimate the effect. M(II) is the model in which the analysis is run on the treated sample only.

Chapter II

The Impact of Enhanced Financial Literacy on Behavioural Biases

Abstract

Interest in financial literacy and its effect on financial behaviour has gained a great deal of momentum in the last decade, especially after the 2008-9 financial crisis. This research studies the effect of financial literacy, improved through financial education, in mitigating the propensity to behavioural biases, such as mental accounting.

Based on the seminal work by Prelec and Loewenstein (1998), a questionnaire was delivered to students of four high schools in Tirana, Albania, two of which had provided a financial education course to their students, while the other two had not. The questionnaire aimed to understand the students' financial behaviour as affected by a financial education course and increased financial literacy.

The results showed that financial literacy and financial education positively affect financial behaviour by inducing the selection of more rational choices. The financial behaviour of students who scored higher in financial literacy more closely resembles the traditional discounting model, where later payments are preferred. Those students who took a financial education course also made decisions that more closely approximate traditional discounting theory.

Keywords: *Behavioural Finance; Financial Education; Financial Literacy.*

JEL Code: *G41; I22; G53.*

1. Introduction

This research paper analyses the effect of improved financial literacy through financial education in mitigating behavioural biases. We focus on mental accounting bias and analyse the effect of financial literacy that has been improved through financial education in reducing the tendency to fall prey to such financial biases.

The sample used in this study is composed of high school students in Tirana, Albania. The dataset comprises four schools, two of which offer a financial education course to their students, and the other two do not. We aim to understand whether financial literacy that has improved through financial education mitigates the propensity to make irrational financial decisions. According to the standard economic discounting models, people prefer to delay expenditures and anticipate rewards. This implies that individuals prefer paying after having had a service or purchasing a product. However, the literature in behavioural finance suggests that individuals exhibit irrational behaviour in many situations, contrary to the traditional theory of finance (Arkes et al., 1994; Gneezy & Potters, 1997; Milkman & Beshears, 2009; Prelec & Loewenstein, 1998; Thaler, 1985). Several biases are identified: overconfidence, ambiguity inversion, optimism, anchoring, availability biases, and mental accounting. This paper focuses on the double-entry mental accounting bias developed by Prelec and Lowenstein (1998). These biases cause individuals to make less rational decisions, leading to non-sound financial situations.

We delivered a survey to all students once their financial education course had finished at the end of the 2019-2020 academic year. The survey replicates Prelec and Loewenstein's (1998) work, which developed the so-called double-entry mental accounting theory. A total of 344 students took part in the project, of whom 158 had taken a course in financial education, and 186 had not. We hypothesise that students with a higher financial literacy score are less biased by mental accounting

bias and more closely approximate the discounting model. In contrast, students with lower financial literacy scores exhibit a more behavioural approach and find prepayment a good strategy in order to fully enjoy consumption. We hypothesise that financial education itself plays a role in improving financial literacy and directly affecting the propensity to behavioural biases. We presume that students who have undertaken a financial education course will show a greater preference for rational choices than those who have not.

2. Literature Review

2.1. Financial Literacy and its Effect on Financial Behaviour

A large body of research on this topic argues that financial literacy is deficient in countries across the world; both developed and developing, in both males and females, and in both young generations and older ones (Hastings, Madrian, & Skimmyhorn, 2013; Lusardi & Mitchell, 2010; Lusardi, Mitchell, & Curto, 2014; OECD, 2013). Even in countries with a very developed financial market, such as the Netherlands or Germany, the level of financial literacy is deficient (Lusardi & Mitchell, 2011).

The literature to date suggests a strong relationship between financial literacy and financial behaviour. Hilgert et al. (2003) revealed a statistically significant relationship between financial knowledge and financial practices. Being financially knowledgeable about credit, savings, investment theory, and cash flow management was associated with paying bills on time, diversified investments, tracking expenses, and putting money aside. In a similar vein, more recent work by Gathergood (2012) shows that financially literate individuals face fewer problems in repaying their credit card debts. A growing and sizeable literature demonstrates that financial literacy directly correlates with savings, wealth accumulation, and retirement planning (Bucher-Koenen & Lusardi,

2011; Lusardi & Mitchell, 2017; van Rooij, Lusardi, & Alessie, 2011a). It also shows that financially literate people tend to perform better in financial decisions such as portfolio diversification (Abreu & Mendes, 2010; Guiso & Viviano, 2015; Hibbert, Lawrence, & Prakash, 2012a; Lusardi & Mitchell, 2005; Lusardi & Tufano, 2009a; Stango & Zinman, 2009). Those who are less financially knowledgeable pay higher debt and credit card fees. Lusardi et al. (2009) found that individuals with low financial literacy pay very high debt fees due to their lack of financial knowledge. Financially literate individuals are also more likely to invest in stocks (Christiansen, Joensen, & Rangvid, 2008; van Rooij et al., 2011).

2.2. Financial Behavior Biases

The literature on financial literacy and financial education has focused on studying the effect of financial education on actual financial behaviour, targeting traditional finance and assuming a rational investor. According to the behavioural finance approach, some financial phenomena are better explained by models in which individuals are not entirely rational. The rational expectations theory posits that individuals use all the available information when forming expectations. The literature on behavioural finance suggests that individuals instead are affected by psychological biases, and tend to exhibit less rational behaviours (Barberis & Thaler, 2002; Shefrin, 2002; Shiller, 2003).

Some streams of the literature suggest that financial crises are often caused by cognitive biases. Individual investors continually invest in risky assets, even though the markets signal high-risk (Akerlof & Shiller, 2009). Barberis and Thaler (2002) argue that when individuals make a decision they are subject to behavioural biases, such as overconfidence, optimism, and wishful thinking, representativeness, conservatism, belief perseverance, anchoring, availability biases, or ambiguity

aversion. Individuals are subject to these behavioural biases and fail to make rational financial decisions.

A situation where individuals overestimate their capabilities is known in the literature as the overconfidence bias. According to Shefrin (2000) investors are overconfident, first because they are not aware that they are at an informational disadvantage and second, because they trade at a higher frequency, which leads to excessive trading. Overconfidence manifests itself in three forms, such as;1) Better-than-average in which individuals believe they have better skills than the average individuals; 2) Volatility estimates;3) Miscalibration (Glaser & Weber, 2007) .

It has been argued that investors often have the tendency to sell winners sooner than losers. This condition is known as the disposition effect. When an investor is about to decide to sell a stock from his portfolio, he is more willing to sell one whose price has increased since the purchase, rather than selling one which price decreased (Bailey, Kumar, & Ng, 2011; Henderson, 2012). This is because the investor hopes for an increase of the price and aims to win.

Another important bias is narrow framing. As Bailey et al. (2009), states, narrow framing is a situation in which an investor judges an investment opportunity in isolation, without taking into consideration its impact on the overall portfolio.

Investors tends to take decisions and make judgements very quickly based on some mental shortcuts which is known as heuristics. In complex situations investors make use of heuristic bias, they tend to use rules of thumb to take a financial decision.

Of other financial biases, we also mention anchoring. In specific situations, when investors are about to make an investment and there is a lot of data to be collected and information to be

processed, they often anchor on the most recent information, thereby ignoring relevant elements (Sewel, 2007).

In our study we focus on mental accounting bias. As our target group are high school students, using the double-entry mental accounting theory and the survey developed by Prelec & Lowenstein (1998). The nature of the questionnaire, in Appendix, makes it easier to measure the effect we are aiming and is more understandable for the students.

2.3. Mental Accounting Theory

We focus our attention on the mental accounting bias first developed by Thaler (1985). The author best illustrates the concept of mental accounting through the following anecdote.

1. Mr. and Ms. L and Mr. and Ms. H went on a fishing trip in the northwest and caught some salmon. They packed the fish and sent it home on an airline, but the fish were lost in transit. They received $300 from the airline. The couples take the money, go out to dinner, and spend $225. They had never spent that much at a restaurant before.

The above anecdote by Thaler (1985) illustrates how individuals driven by mental accounting violate economic principles such as fungibility. According to the fungibility principle, no matter the source of money, no labels should be attached to it, and it should be valued in absolute rather than in relative terms. Given the above anecdote, however, we can understand that this principle does not always hold. In this example the couples see the company's $300 as a windfall gain and use it for dinner costing $225, something they would have never done using their regular income. The set of cognitive operations that individuals use to organise, evaluate, and keep track of financial activities is defined as mental accounting (Thaler, 1999). In order to understand mental accounting, three central components must be understood. First, understanding how economic outcomes are perceived, experienced, and evaluated is essential. Second, it should be kept in mind

that individuals assign different activities to specific mental accounts. The third component has to do with the concept of "choice bracketing," which involves the frequency with which accounts are evaluated.

According to this theory, individuals value things in relative rather than absolute terms. Thaler further argues that individuals perceive outcomes through the value function in Kahneman and Tversky's (1973) prospect theory. The value function is defined over gains and losses relative to some reference point, and agents display diminishing sensitivity to both gains and losses (Thaler, 1999).

The leading accounting decisions involving these three components, which mental accounting deals with are:

1. The category to which a specific economic activity should be assigned.
2. Whether the outcomes of each choice should be combined with the other outcomes within that category.
3. Deciding on the frequency of balancing and evaluating the accounts (Thaler, 1985; Thaler, 1999).

According to mental accounting theory, the money in one mental account is not a substitute for money in another mental account. People use money depending on its origin or its intended use. According to Heath and Soll (1996), consumers allocate different budgets for different expense accounts, such as entertainment, clothing, or food. They assign each expense in the appropriate account and recompute the balance of the money left from the budget allocated to that category. When a particular budget reaches its limits, they do not make further expenditures from that account.

According to Thaler et al. (1999), one of the components of mental accounting is myopic loss aversion, which explains the behaviour of investors in evaluating projects with different frequencies. Low-frequency subjects make more risky choices than high-frequency ones (Gneezy & Potters, 1997; Thaler, Tversky, Kahneman, & Schwartz, 1997).

The theory of mental accounting implies that individuals have a greater propensity to consume an unexpected windfall (income) and purchase items they would not purchase otherwise. The idea is that windfall gains and other sources of income are put into different mental accounts, and the decision about how to use them is then guided by these mental accounts. People spend more unexpected income than anticipated income (Arkes et al., 1994; Milkman & Beshears, 2009).

According to the literature, a portfolio's construction has financial implications for mental accounting. Shefrin and Thaler (1988) proposed the behavioural life-cycle theory, which describes a hierarchy of money locations arranged by how tempting it is for a household to spend the money in each. The most tempting category is current assets, then current wealth, and future accounts. This mental accounting model predicts that funds are more likely to be saved if they can be transferred to less inviting mental accounts.

As Thaler (1999) argues, mental accounting is helpful to understand the psychology of behavioural choice, and as it is associated with violations of economic principles, such as the principle of fungibility, "mental accounting matters."

In their seminal paper, Prelec and Loewenstein (1998) developed a new theory called "double-entry" mental accounting theory, which describes the interaction of the utility a consumer gains from consumption and their pain from the payment associated with this consumption. According to the traditional theory of discounted present value, consumers should prefer to make payments later. The choice of financing (debt vs. savings) should not depend on the type of product, but only

on minimising the purchase cost. Consumers often demonstrate irrational behaviour, however, contrary to that predicted by the economic theory. They prefer to prepay because when they then consume, they feel as if it is for "free," and on the other hand if they pay after consumption, they feel that they are paying for nothing. Consumption and payments associated with-it call-in mind mental accounts make the consumer experience pleasure or pain, depending on whether the accounts are in the red, and payment has not yet been made (not debt-free), or in the black, and payment has been made (debt-free). They build their theory on the basis of three mental accounting rules: prospective accounting, prorating, and coupling. Prospective accounting addresses how the imputed benefits and costs are affected by the timing of payments and consumption. According to this assumption, the effect of past events is zero, and the effect of future events is the same, regardless of the timing. A prepaid vacation is perceived as “free,” and post-paid vacations are fully recognised irrespective of their date. As there is more than one episode of payment and consumption during a particular purchase, consumers prorate residual payments to residual consumption and vice versa. In other words, individuals use prorating as a means of amortisation by dividing a single payment into several consumption sequences, or vice versa. Prelec and Loewenstein (1998) argue that benefits imputed by consumption are not fully attenuated by the imputed cost associated with the payments. They introduce two coupling coefficients to capture the pain associated with payments and the gain associated with consumption. According to the three accounting assumptions, the imputed benefits and costs are thus given in Equations 4 and 5.

Equation 4: Imputed Cost

$$\hat{p}_b = \alpha \left(\frac{u_b}{\sum_{t \geq b} u_t} \right) \sum_{t \geq b} p_t$$

Equation 5: Imputed Benefits

$$\hat{u}_c = \beta \left(\frac{p_c}{\sum_{t \geq c} p_t} \right) \sum_{t \geq c} u_t$$

$\hat{p}_b$ is the imputed cost of consumption at time b, $\sum_{t\geq b} p_t$ shows the sum of payments still due at time b, prorated overconsumption due at time b ($\frac{u_b}{\sum_{t\geq b} u_t}$), and α the attenuation coefficient of payments. While $\hat{u}_c$ is the imputed benefits of consumption at time c, $\sum_{t\geq c} u_t$ shows the sum of consumption still due at time c, prorated overpayment due at time c ($\frac{p_b}{\sum_{t\geq c} p_t}$), and β the buffering coefficient of consumption, which shows the pleasure gained by consumption.

3. Research Question and Hypotheses

As previously mentioned, the literature on financial literacy suggests that financial literacy plays a vital role in defining an individual's financial behaviour. Nevertheless, it also indicates that individuals are subject to some behavioural biases, which affect their financial behaviour and decisions (Barberis & Thaler, 2002; Shefrin, 2002; Shiller, 2003). Biases such as mental accounting cause individuals to behave differently from the discounted present value model. It is now widely observed and addressed, financial literacy worldwide is very low, and action needs to be taken to overcome this issue. Financial educators and policymakers argue that adequate financial education, preferably starting from an early age, is required in order to ameliorate the situation of financial literacy all over the world, and across genders and age groups (Hastings et al., 2013a; Lusardi & Mitchell, 2011; Lusardi et al., 2014; OECD, 2013a). As financial literacy improved through financial education is said to affect the financial behaviour of individuals positively, leading them to make more sound financial decisions, it could be assumed that in this case, financial literacy, improved through a financial education course, plays a significant role in mitigating behavioural biases, such as mental accounting. Our aim in this research is thus to answer the following research question.

- Does financial literacy, improved through financial education, reduce the propensity to mental accounting biases?

3.1. Research Hypotheses

We believe that the propensity to behavioural biases will be reduced after having been exposed to a financial education course, which improves a student's financial literacy. A survey, as in Prelec and Loewenstein (1998), was delivered to students who had taken the financial education course and those who had not taken it in order to assess this. Based on the literature review, we develop the following research hypotheses.

i. Financial literacy that has been improved through financial education reduces the propensity to mental accounting bias.
    1. The proportion of students displaying rational behaviour is highest in the treated classes.

ii. Financial literacy at the individual level reduces the likelihood of being defined as "behavioural"

Rational behaviour is defined as behaviour in line with discounted present value theory, which predicts that payment should be made later and not in advance of consumption, as the third group in the work of Prelec and Loewenstein (1988). "Behavioural" involves a situation in which subjects prefer to prepay for consumption. The pain of paying after consumption is higher because subjects feel they are paying for nothing.

4. Research Design

4.1. Research Sample and Financial Education Course

The research sample used in this study was composed of 344 students from four schools in Tirana, Albania. Two schools provide a financial education course to their students, and two do not offer this course. The former group is the treated group, and the latter is the control group. The financial education course lasts for a whole academic year. Having gained permission from the Ministry of Education and the directorates of each school, students in the 12th grade from both groups were asked to complete a survey. The survey aimed to understand the students' financial behaviour and responses to behavioural biases such as mental accounting. We aim to understand how financial literacy scores and the financial education course shaped their financial behaviour and their propensity to behavioural biases. The survey was delivered to them at the end of the 2019-2020 academic year after the financial education course was complete.

A study group from the Central Bank of Albania developed and organised a course to be offered to students in all high schools in Albania. With the permission of the Ministry of Education, Youth and Sports of Albania, they accomplished their goal of including a course called "Financial Education" in high school curricula. This is an extracurricular elective course, and it is the Directorate of each high school that decides whether it will be available to their students in each academic year. The Central Bank offers a free textbook to all the high schools that decide to include it, to be used during the sessions. The book is entitled "Personal Finance in Your Hands." They also provide a different textbook for teachers, with exercises and case studies to support their teaching. The book has two main chapters: "General Economic and Financial Knowledge," and "Personal Finance."

4.2. Research Questionnaire

We replicate the design by Prelec and Loewenstein (1998) to measure mental accounting in this project. Once the financial education course had been delivered, both the students who took the course and those who did not were given the survey, about double-entry mental accounting, as in Prelec and Loewenstein (1998). These measures were taken after the course has been provided, and without a baseline survey.

Prelec and Loewenstein (1998) provide a theoretical model which captures and explains the double-entry mental accounting model. According to this theory, individuals form t-accounts in their minds, as in the t-accounts in traditional accounting, and on one side they record the net utility of consumption after subtracting the disutility from payments. On the other side, they record the net disutility of payment after removing the utility from consumption. This theory builds upon three assumptions: prospective accounting, prorating, and coupling. Prospective accounting describes how imputed costs and benefits depend on the timing of consumption and payments. According to this mental accounting rule, future payments are fully recognised, while past payments are mostly "written off." The prospective mental account for a single purchase often includes more than one consumption or payment sequence. An individual would need an accounting rule such as prorating to assign payments to consumption and consumption to payments. Specifically, they would prorate residual payments to residual consumption and vice versa. The authors include two coupling coefficients that affect the imputed costs and benefits: α (for "attenuation") and β (for "buffering"), which represent, respectively, the degree to which payments attenuate the pleasure of consumption and the degree to which consumption buffers the pain of payments (Prelec & Loewenstein, 1998).

The authors cluster their subjects into three groups. In two groups, the authors find evidence that consumers prefer to pay before consumption. In this way, when the time for their vacation arrives, they enjoy it more as feels as if it was "free," whereas payment after consumption makes people feel like they are paying for nothing. These findings provide evidence in favour of prospective accounting, prorating, and coupling. In the third group, however, Prelec and Loewenstein (1998) observe a different result in which the subjects prefer to pay in the consumption year, thus supporting the traditional theory of discounted present value.

The questionnaire we used was based on the work of Prelec and Lowenstein (1988). It aims to measure and understand consumer preferences about payments and consumption, given different time schedules. The students were asked to rank 16 different vacation and payment times from their most preferable to the least preferable. A typical scenario is described below.

Imagine that you have invested ALL 300,000 into acquiring three weeks in a time-share for a luxury apartment suite at a very nice seaside hotel. The hotel has a private beach and pool and is about half an hour's drive away from a lively harbour town. You are now negotiating how to schedule your three weeks and when to pay the ALL300,000[3].

Consider the following schedule.

Schedule	***2020***	***2021***	***2022***	***2023***
	ALL W	----	ALL ALL	WW

Table 18:Choice Set Sample

The above schedule is interpreted as follows.

In the summer of 2020, you first pay ALL[4] 100,000 and take one week of vacation. In the summer of 2021, you neither pay nor take any vacation. In the summer of 2022, you pay the

[3] The minimum wage in Albania, according to Eurostat (2019). ALL: Albanian Lek (Currency)
[4] Note that W stands for a 1 week vacation, WW 2 weeks' vacation, ALL payment of ALL 100,000 , ALL ALL payment of ALL 200,000.

remaining ALL 200,000. You take the remaining two weeks of your vacation in the summer of 2023. The subjects could then see a 4x4 matrix of 16 diagrams, displaying different schedules per time and payment. They were required to list these diagrams on a scale from 1, for the best schedule, and 16, for the worst. The 16 diagrams paired eight different vacation schedules and eight different payment schedules to create variance in the timing of payments and vacations, and the ordering of payments and vacations within a given summer.

Table 19 lists all 16 schedules presented to the students.

Schedule	*2020*	*2021*	*2022*	*2023*
MA1	ALL ALL	ALL	W	WW
MA2	ALL	ALL ALL	WW	W
MA3	ALL ALL	WW	W	ALL
MA4	ALL	W	ALL ALL	W
MA5			ALL ALL W	ALLWW
MA6	W	ALL	ALL ALL	W W
MA7			ALL ALL W W	ALL W
MA8	W ALL ALL	WW ALL		
MA9	ALL W	ALL ALL W W		
MA10			W ALL	W W ALL ALL
MA11	ALL W W	ALL ALL W		
MA12	W	W W	ALL	ALL ALL
MA13	W W	W	ALL ALL	ALL
MA14			WW ALL	W ALL ALL
MA15	WW	ALL ALL	W	ALL
MA16	W W	W	ALL	ALL ALL

Table 19:Choice Set Listed Alternatives

5. Predictions under the standard discounting versus double-entry accounting model

According to the economic theory of the standard discounting model, an individual tends to consume now and spend later. Their aim is to minimise the present value of the payment, and then later payments have lower present values. In comparison, double-entry mental accounting posits that consumers are debt-averse and prefer prepayment for consumption.

Under the standard discounting model, our study subjects would show a greater preference for alternatives MA12, MA13, and MA16, and alternatives MA1 and MA2 would be the least preferred. We call this "rational behaviour". Alternatives MA12, MA13, and MA16 allow for full post-payment of the vacation. The present value of the future payments is thus minimised. MA1 and MA2 allow for the full prepayment of vacations. On the other side, under double entry mental accounting, the subjects in our study would show a higher preference for alternatives MA1 and MA2 and a lower preference for alternatives MA12, MA13, and MA16. We call this irrational behaviour, in which individuals are debt-averse, and they prefer prepayment, so as to perceive the act of consumption as being "free."

6. Empirical Analysis

6.1. Descriptive Analysis and Interpretation

The sample study, over which we had complete control, is comprised of 344 observations, which we get after applying propensity score matching. From these observations 158 are from the treated schools and 186 from control schools. The main variables of interest are FL (financial literacy) measured after the financial education course was delivered and FinEd (Financial Education) a dummy variable, 1 for students who took the financial education course and 0 otherwise.

Variables	N	Mean	SD	Min	Max
Financial Literacy	344	26.99	8.71	6	45
Financial Education	344	0.46	-	0	1

Table 20: Descriptive Statistics of Main Variables

This sample also includes data about individual-level characteristics such as gender, GPA, average maths grade, parental education, and jobs, average monthly income, previous employment history, any previous economic course, and cognitive ability measures. It also includes school and teacher

level covariates, such as teacher years of experience in delivering the course, teacher educational background, school ranking, size, location, and the directorate's educational background.

As the financial education course effectively improved financial literacy, it is reasonable to expect a higher average financial literacy score of the students who took the financial education course. The results in Table 21 show that the average financial literacy of treated students is higher than that of the non-treated students, with a difference of 1.92 points.

	Financial Literacy Score
FinEd	
0	26.11(0.64)
1	28.92 (0.69)
Difference	-1.92**

Table 21: Average Financial Literacy across Treated and Control Subjects

*** p<0.01; ** p<0.05; * p<0.1

6.2. Cluster Analysis

This section explains the results of cluster analysis used to identify the different financial behaviours of students and possible effects of financial education. A Ward's cluster analysis identified three main clusters from the given data, as in Prelec and Lowenstein (1998). Clustering is one of the most commonly used multivariate data analysis methods, aiming to identify groups with similar patterns and group them for further analysis. Subjects in a particular group have a high degree of association but a low association with other subjects belonging to other groups. There are several types of clustering, including hierarchical clusters, K-means clusters, and two-step clusters.

We employ a hierarchical cluster in our study, as introduced by Joe H. Ward, in his seminal work in 1963 on the "Hierarchical Grouping to Optimise an Objective Function".

The cluster analysis identified three groups. The first cluster had 175 observations, the second 122, and the last had only 47 observations. Table 22 reports the distribution of the treated and non-treated observations among clusters.

		Group		
FinEd	**1**	**2**	**3**	**Total**
0	116(66.29%)	49(40.16%)	21(44.68%)	***186***
1	59(33.71%)	73(59.84%)	26(55.32%)	***158***
Total	***175***	***122***	***47***	**344**

Table 22:Financial Education Distribution among the Clusters

As we will explain below, the first group is the most irrational one, and the last the most rational. The output shows that the proportion of non-treated students in the first group is higher compared to treated students, while in the other two groups, the proportion of treated students is higher than that of the non-treated students. We thus find some preliminary evidence that financial education has a positive significant effect on inducing rational behaviour.

As our cluster analysis, identified three main clusters of the individual choices of the given schedules, in Table 23 we report the schedules' means across all subjects and the means of the three groups which emerged from the cluster analysis (Ward's method). Thus, in Group 1 in the first column, we report the average rank each of the 16 schedules for the 1st identified cluster. Then in Group 2 schedule mean column, we show the average rank of each of 16 schedules for the 2nd identified cluster, and so on for the 3rd cluster as well. The last column presents the average rank of each of the 16th alternatives of the whole sample, without any cluster identification. The results show that, as in Prelec and Lowenstein (1998), the students included in our sample show different preferences for payment and consumption. We thus find evidence of both irrational and rational financial behaviour.

Schedules	***Gr.1***	***Gr.2***	***Gr.3***	***All subjects***
MA1	**1.92**	**3.68**	**12.08**	3.94
MA2	**2.46**	**5.64**	9.29	4.68
MA3	3.38	6.34	8.85	5.31

MA4	4.48	6.68	8.42	5.81
MA5	5.34	7.15	7.79	6.32
MA6	5.39	6.71	8.76	6.49
MA7	7.05	7.42	7.87	7.29
MA8	7.97	9.00	8.55	8.23
MA9	9.13	9.20	**10.29**	9.10
MA10	*9.95*	10.70	**6.32**	9.69
MA11	10.94	**10.85**	**6.00**	10.19
MA12	11.99	10.52	7.27	10.85
MA13	12.68	10.50	7.81	11.18
MA14	13.76	10.36	9.19	11.95
MA15	**14.40**	10.55	8.85	12.28
MA16	**15.14**	***10.97***	9.08	12.83

Table 23:Means Across All Subjects and Each Cluster

According to the traditional theory of future discounts, a rational individual prefers choices near the bottom of the choices represented in Table 19, in the previous section. As mentioned above, a present value-maximising decision-maker would prefer choices 12, 13, and 16, which allows for full post-payment, and would not prefer choices MA1 and MA2, as they allow for the full prepayment of vacation.

MA11 and MA10 are the most desirable choices of the third group, with average scores of 6.00 and 6.32, respectively. These two choices suggest a higher preference for taking most of the vacation first and then paying for it. The least attractive choices are MA1 and MA9. The first alternative is also the most irrational choice, and MA9 allows for some interleaving between payment and consumption, and a preference for paying for most of the vacation before taking it. This group resembles the standard discounting model more closely, tending to prefer later payments to present ones.

Subjects from the first group have shown a higher preference for MA1 and MA2, the most irrational choices. These two alternatives allow for the full prepayment of vacation. This group approximates the mental accounting model group developed by Prelec and Loewenstein (1998), which explains this prepaid vacation pattern as a behaviour in which the individuals feel like they

are taking a vacation for free. The payments associated with the vacation are put in the "black account." These subjects would thus be free from the pain of payment for this vacation when actually on vacation.

Conversely, the least preferred alternatives are MA15 and MA16, representing a more rational choice. Alternative 15 allows for some interleaving between payment and vacation, still showing a preference for taking part of the vacation and postponing the payment to the following year. In contrast, the 16th alternative suggests the full post-payment of the vacation.

The second group also resembles the mental discounting model of Prelec and Lowenstein (1998) in terms of their least preferred alternatives (MA16 and MA11). The former allows for full post-payment and MA11, again a preference for taking most of the vacation and then paying for it. Again, their most preferred choices are MA1 and MA2, with an average of 3.68 and 5.64, respectively. Both these choices allow for the full prepayment of the vacation.

In summary, the cluster analyses identified three main groups, of which the first two, being the largest, favour the mental accounting model. We call them the irrational groups. On the other side, we call the third group the rational group, as it more closely resembles the standard discounting model, and the subjects exhibit a present value-maximising behaviour.

6.3. Effect of Financial Education and Financial Literacy on Financial Behaviour

This section focuses on analysing the effect that financial education and financial literacy have in reducing the propensity for mental accounting bias, and a linear probability model (LPM) is estimated. To do so, we estimate the following model.

$$FinBeh = \alpha_0 + \beta FinEd + \delta FinLit + \sigma FinEdFinLit + \rho Z + \epsilon$$

Equation 6: Effect of Financial Literacy in Financial Behaviour

Where FinBeh is the financial behaviour variable, as explained below; FinEd is the financial education dummy, 1 for treated and 0 for non-treated; FinLit is the financial literacy at the

individual level; FinEdFinLit is the interaction of the financial education dummy and financial literacy, and Z is the vector of the control variables. δ shows the effect of financial literacy on the non-treated, and σ the incremental effect of financial literacy when taking a financial education course.

The Financial Behaviour variable takes the value 1 if the most rational alternatives in our choice set, MA12, MA13, and MA16, are placed among the first eight places and 0 otherwise. As explained earlier, the alternatives listed first are the most irrational, and the rationality increases toward the end of the choices. We argue that if a student chooses one of the most rational alternatives as one of their first eight choices, that student shows a lower preference for irrational choices. We call such behaviour rational behaviour.

	Financial Education		
Financial Behaviour	**0**	**1**	**Total**
0	135	76	***211***
1	51	82	***133***
Total	***186***	***158***	**344**

Table 24: Financial Behaviour Dummy Variable Distribution across Treatment

211 students exhibited irrational behaviour, of which only 76 belonged to the treated schools, and 133 exhibited rational behaviour, of which 82 belonged to the treated schools (Table 24).

The results of the LPM showed that both financial literacy and financial education have a significant effect in defining a student's rationality. A one unit increase in financial literacy increases the probability of demonstrating more rational behaviour by 0.7%. This implies that greater financial literacy induces a higher preference for more rational choices. Providing a financial education course also increases the probability of being defined as rational by 55%. However, as shown by the interaction term of financial literacy and financial education, the marginal effect of financial education decreases for those students who already have higher levels of financial literacy. These results are in line with those of Chapter 1, where we showed that a

higher baseline financial literacy decreased the effectiveness of the financial education course. Thus, marginal effect of financial education in increasing financial literacy decreased for those students whose baseline financial literacy was higher, and the course was more effective for those who had lower baseline financial literacy scores.

Variables	Model
Financial Literacy	0.007*
	(0.004)
Financial Education	0.55***
	(0.17)
Financial Literacy Financial Education	-0.012**
	(0.006)
Gender	-0.0007
	(0.06)
Father's Education	-0.072
	(0.06)
Mother's Education	0.031
	(0.07)
Father's Job	-0.02
	(0.069)
Mothers' Job	0.017
	(0.086)
Maths Average Grade	0.023
	(0.024)
GPA	-0.018
	(0.024)
Cognitive Ability	-0.033
	(0.07)
Average Monthly Income	-0.014
	(0.04)
Worked Before	0.045
	(0.07)
Prior Economics Courses	-0.19
	(0.13)
School Ranking	-0.005
	(0.02)
School size	0.05
	(0.037)
School Location	0.013
	(0.16)
Constant	-0.002
	(0.14)

Table 25: Effect of Financial Literacy and Financial Education on Financial Behaviour; Linear Probability Model
*** p<0.01; ** p<0.05; * p<0.1

We argue that these kinds of interventions, seem to be more effective for those students with lower financial literacy score, both in terms of enhancing financial literacy and financial behavior changes.

A binary logistic regression was run as a robustness check for LPM. The results of this estimation, reported in Appendix C, are in line with our LPM estimation.

We further extended our analysis by creating a new variable to define the behaviour of the students. We created a categorical variable, which takes the values 0,1, and 2. Suppose the student has chosen the two most irrational alternatives as one of their first eight choices. In that case, we assume the student is exhibiting irrational behaviour, and the financial behaviour variable takes the value 0. We argue that if a student chooses one of the most rational alternatives as one of their first eight choices, the student is exhibiting a rational behaviour, and the financial behaviour variable takes the value 2. All the other alternatives take the value 1, and we assume this category shows a more neutral behaviour.

As shown in the table below, some 61% of our observations showed more irrational behaviour, 35% showed rational behaviour, and only about 4% showed neutral behaviour.

Financial Behaviour	N.	Percentage
0	209	60.76%
1	13	3.78%
2	122	35.47%

Table 26:Categorical Financial Behaviour Variable Distribution

Table 27 reports the results of an ordinal logistic regression. The results showed that the provision of a financial education course increases the log-odds of being assigned to a higher financial behaviour category by 2.53 points. An increase in financial literacy increases the log-odds of a student being assigned to a higher financial behaviour category by 0.04 points. These results support our LPM regression results, showing that financial literacy and financial education positively affect rational behaviour, as implied by the higher financial behaviour category. Again, a negative value for the interaction term coefficient implies a marginally decreasing effect of financial education for those who already have a high level of financial literacy.

Variables	Coefficients
Financial Education	2.53*** (0.8)
Financial Literacy	0.04** (0.02)
Financial Literacy & Financial Education	-0.053* (0.03)
Gender	0.095 (0.28)
Father's Education	-0.31 (0.3)
Mother's Education	0.14 (0.3)
Father's Job	-0.13 (0.33)
Mothers' Job	-0.14 (0.42)
Maths Average Grade	0.062 (0.12)
GPA	-0.077 (0.12)
Cognitive Ability	0.063 (0.34)
Average Monthly Income	0.002 (0.19)
Worked Before	0.39 (0.31)
Prior Economics Courses	-0.64 (0.65)
School Ranking	1.22 (0.15)
School Size	10.06 (1.6)
School Location	0.19 (0.16)

Table 27:Effect of Financial Literacy and Financial Education on Financial Behaviour; Ordinal Logistic Regression Model
*** p<0.01; ** p<0.05; * p<0.1

As shown by the marginal effects, the probability of being assigned to the most irrational financial behaviour category (0) increased by 81% if the student belonged to the control group. The probability of being assigned to the most rational financial behaviour category (2) increased by 65% for a treated student. An increase in financial literacy decreases the probability of demonstrating more irrational behaviour by 0.87%, and increases the probability of demonstrating more rational behaviour by 0.8%. In line with our estimation results, the marginal effect of the interaction between financial literacy and financial education shows that an increase in financial literacy decreases the probability of belonging to a higher financial behaviour category by 1.1% more for the treated than for the control students.

		Financial Behaviour		
		0	1	2
Financial Education	0	0.81***	0.024***	0.16***
	1	0.32***	0.035***	0.65***
Financial Literacy		-0.0087**	0.0003*	0.008**
Financial Literacy & Financial Education		0.011***	-0.0004*	-0.011*

Table 28:Marginal Effect of Financial Literacy, Financial Education, and the Interaction term on Financial Behaviour
*** p<0.01; ** p<0.05; * p<0.1

The results showed that both financial literacy and financial education have a significant effect in inducing rationality. Nevertheless, the effect of greater financial literacy on demonstrating rational behaviour was significantly higher in the control students than in the treated students.

7. Conclusion

This research focused on studying the effect of financial literacy, improved through financial education, and the financial education itself in shaping financial behaviour, and particularly in mitigating the propensity for behavioural biases. We built our study on the double-entry mental accounting theory developed by Prelec and Loewenstein (1998). Students who took a financial education course and those who did not were given a questionnaire so as to understand their financial behaviour when deciding on different sequences of payment and consumption. Being introduced to a situation when they would be able to choose the timing of their vacation and its relevant payment allows us to understand whether they demonstrate a rational or irrational behaviour. By rational behaviour, we meant a situation in which the students approximate a traditional discounting model, in which later payments are preferred to full prepayment before the act of consumption. On the other hand, a student's behaviour is defined as irrational if that student

makes less rational choices, such as preferring prepayment before consumption, so that when the act of "consumption" takes place, it feels like it is for "free."

A cluster analysis revealed three main groups, of which the first and second groups resembled irrational behaviour, and the third group more closely approximated the standard discounting model.

To understand the effect of financial literacy and financial education in mitigating the propensity to mental accounting, we ran a linear probability regression where financial behaviour is regressed on financial literacy and financial education. The Financial Behaviour variable takes the value 1 if the most rational alternatives in our choice set, MA12, MA13, and MA16, are placed among the first eight places, which we called rational behaviour, and 0 otherwise. As the dependent variable is dichotomous, we run a logistic regression after LPM as a robustness check. The results suggested that financial literacy positively affects financial behaviour by inducing rational behaviour, in which students showed a higher preference for more rational choices. Financial education also positively affected financial behaviour by leading students who took the financial education course to demonstrate more rational behaviour than those who did not. The students who had taken the financial education course showed a greater preference for more rational choices. We further extended our analysis by running an ordinal regression analysis, where the dependent variable financial behaviour takes the values 0 (an irrational behaviour),1 (neutral), and 2 (rational behaviour). Again, the results showed that both financial literacy and financial education positively affect inducing a more rational behaviour.

These results imply that enhancing financial literacy means the propensity of individuals for financial biases would decrease. In this way, they would behave more rationally, which would increase the overall wellbeing of the individuals and society in general. The results also suggest

that financial education is an essential tool with which to improve financial literacy and help mitigate the propensity to behavioural biases.

This study contributes to the literature on financial literacy and financial behaviour by further supporting the idea of the importance of financial literacy in shaping the financial behaviour of individuals. We further argue that financial literacy plays a significant role in mitigating the financial behavioural biases to which individuals are often prone. These results have implications for policymakers and educators when considering financial education, which is an essential tool in terms of improving financial literacy and a means of mitigating the propensity for financial behavioural biases, such as mental accounting bias.

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Appendices

Appendix A: Mental Accounting Survey

MENTAL ACCOUNTING SURVEY

Imagine that you have invested ALL 300,000 into acquiring three weeks of time-share for a luxury apartment suite at a very nice seaside hotel. The hotel has its own private beach and pool and is about half an hour's drive away from a lively harbor town. You are now negotiating how to schedule your three weeks and when to pay the ALL300,000.

Consider the following schedule.

Schedule	2020	2021	2022	2023
	ALL W	-----	ALL ALL	WW

The above schedule is interpreted as follows.

In the summer of 2020, you first pay the ALL 100,000 and take one week of vacation. In the summer of 2021, you neither pay nor take any vacation. In the summer of 2022, you pay the remaining ALL[1] 200,000. The remaining two weeks from your vacation you take them in the summer of 2023.

Each schedule below follows the same logic of interpretation.

◊ ***Rate each schedule on a scale from 0, for the worst schedule, to 10, for the best schedule.***

Schedule	2020	2021	2022	2023	Rate
MA1	ALL ALL	ALL	W	WW	
MA2	ALL	ALL ALL	WW	W	
MA3	ALL ALL	WW	W	ALL	
MA4	WALLALL	WWALL			
MA5			ALL ALL W	ALLWW	
MA6	W	ALL	ALL ALL	W W	
MA7			ALL ALL W W	ALL W	
MA8	W W ALL ALL	W ALL			
MA9	ALL W	ALL ALL W W			
MA10			W ALL	W W ALL ALL	
MA11	ALL W W	ALL ALL W			
MA12	W	W W	ALL	ALL ALL	
MA13	W W	W	ALL ALL	ALL	
MA14	W ALL ALL	W W ALL			
MA15	ALL WW	ALL ALL W			

MA16	W W	W	ALL	ALL ALL

◊ *Note that W stands for 1 week vacation, WW 2 weeks' vacation, ALL payment of ALL 100,000 , ALL ALL payment of ALL 200,000.*

Appendix B: Control Variables Used in Propensity Score Matching

Variable	N	Mean	SD	Min	Max
Gender	387	0.52	0.5	0	1
Father's Education	395	0.4	0.5	0	1
Mother's Education	394	0.3	0.46	0	1
Father's Job	412	0.22	0.41	0	1
Mother's Job	413	0.12	0.32	0	1
Math Average Grade	381	6.69	3.19	0	10
GPA	382	7.19	3.29	0	10
Cognitive Ability Score	309	0.62	0.49	0	1
Average Monthly Income	339	2.23	1.22	0	9
Worked Before	391	0.21	0.41	0	1
Prior Economic Courses	382	0.04	0.21	0	1
School Ranking	417	3.26	3.61	0	9
School Location	417	0.71	0.45	0	1
Directorate Education	417	0	0	0	0
School Size	417	2.85	0.84	0	4

Table 29: Descriptive of the control variables used in PSM

Gender is a dummy taking the value 1 if the student is a male, and 0 otherwise; *Parental Education* indicate whether father and mother hold a university degree or not and takes the value 1 if holds a university, and 0 otherwise; *Parental Occupation* indicate the job of each parent; 1 if finance or related background job and 0 otherwise; *Economic Status* indicates the average monthly income in the family and takes the values 1- if "Income <210.66 [5]Euro (26000 All)", 2- if "210.66<Income<421.32", 3-if "421.32 < Income"; *Mathematical literacy* is the average math grade in the last academic year; *Academic performance* is the cumulative GPA; *Prior economic course* is a dummy taking a value 1 if student has taken any economic course prior to financial education one; *Previous Employment history* is a dummy taking the value 1 if the students has ever worked before; *Cognitive Ability* is a dummy taking the value 1 if the student answered 0, 1 or 2 out of 4 Raven's progressive matrices correctly and 0 otherwise; *Teacher background* indicates the educational degree background of the teacher which teaches financial education courses, taking the value 1, if from finance| any other finance-related background, and 0 otherwise; *Teachers Experience* indicates the number of years has been teaching the financial education course; *Principal Education Data* indicates the educational degree background of the school director, and takes the value 1, if from finance| any other finance-related background; *School size* is number of classes per each school; *Ranking* indicates school's previous academic year ranking in the State Matura exam; *School location* is dummy taking the value 1 if the school is located inside the city centre.

[5] Average salary in Albania according to World Bank (2019); ALL-Albanian Lek (National Currency)

Appendix C: The relationship between probability and log odds in LPM

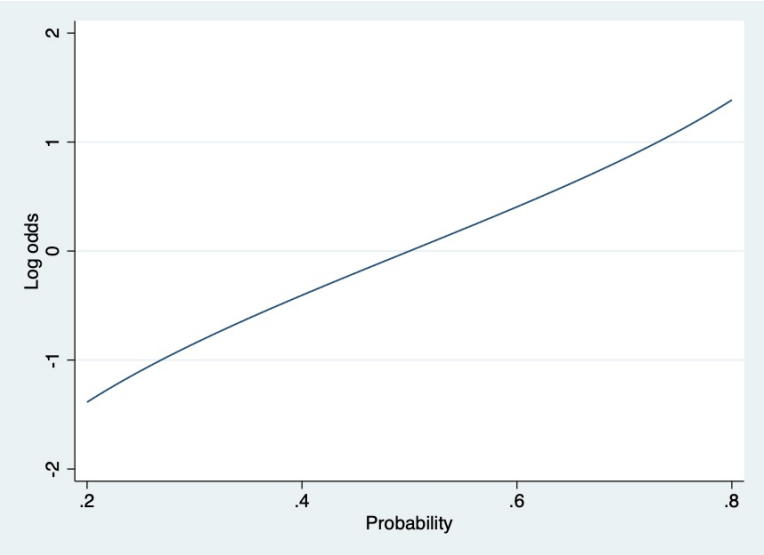

Figure 2

Appendix D: LPM and Logistic Regression Results using PSM

	LPM[ab]
Financial Literacy	0.0011 (0.003)
Financial Education	0.12 (0.05) ***
Constant	0.096 (0.09)

Table 30:LPM Estimation
*Inference: *** p<0.01; ** p<0.05; * p<0.1; Robust Standard Errors in Brackets*
a: Model significant at 10%. Pr (F=1.85) =0.16
b: No multicollinearity issue in the model VIF=1

	Logistic Regression Odds Ratios[ab]
Financial Literacy	1.02
Financial Education	2.37 ***
Constant	0.07***

Table 31:Logistic Regression Odds Ratios
*Inference: *** p<0.01; ** p<0.05; * p<0.1*
a: Model significant at 10%. Pr (chi2=3.93) =0.14
b: No multicollinearity issue in the model VIF=1

	Margins
Financial Literacy	0.0029
Financial Education	
FinEd=0	0.12 ***
FinEd=1	0.24***

Table 32:Marginal Effects Logistic Regression
*Inference: *** p<0.01; ** p<0.05; * p<0.1*

Chapter III

Enhanced Financial Literacy and Asset Price Bubbles

Abstract

This research paper focuses on how financial literacy can affect the occurrence of an asset price bubble: a condition where market prices are at considerable variance from the fundamental values and a high volume of trade is undertaken at these prices.

In the research to study asset price bubbles, we conduct a laboratory experiment in which we ask students from high schools in Tirana, Albania, to trade against each other. We use the virtual trading platform for experimental asset pricing by Holt (2006), which implements the principles developed earlier by Vernon Smith (1988). Students were split into two groups, one from schools that delivered a financial education course to their students (treated group) and one from schools that did not deliver such a course (nontreated group).

The results showed that the size of the bubble was higher in the nontreated groups compared to the treated ones. We argue that financial literacy enhanced through financial education has a positive significant impact on mitigating asset price bubbles.

Keywords: Price Bubbles; Financial Literacy; Financial Education.

JEL Codes: G12; G53; I22.

1. Introduction

This research study focuses on the impact of financial literacy enhanced through financial education and financial education itself on mitigating asset price bubbles. Asset price bubbles are known for their long-lasting and huge impact on the global economy. History has recorded many bubbles, like the Mississippi Bubble in Paris in 1917–1920 or even the more recent bubble-crash phenomenon in 2008, where the real estate market in the US crashed and its impact spread all over the world. The crisis of 2008 left banks with unpaid mortgage loans worth billions of dollars. Many individuals lost not only their homes but also their jobs or savings.

Studying bubbles and their determinants in the real market is more complicated. To effectively study bubbles, an ideal situation would be to control the dividend distribution and any knowledge that subjects have about that distribution. As this is not feasible in the real market, policy makers and researchers have instead switched to experimental settings to study this phenomenon. One of the reasons why bubbles develop is the irrational expectations formed by traders (Hommes, Sonnemans, Tuinstra, & van de Velden, 2008; Shiller, 2003). However, Smith et al. (1988), in a lab experiment where "traders" trade in the virtual, fictional asset market, concluded that common information about the dividend distribution is not enough to induce rationality. They further argue that it is uncertainty about the behaviour of their counterparts which induces unrealistic expectations and would result in the formation of an asset bubble. Other scholars posit that when the fundamental value is well understood, the propensity for an asset price bubble to occur is reduced (Huber & Kirchler, 2012). Other factors which would help reduce the likelihood bubbles include experience (Dufwenberg, Lindqvist, & Moore, 2005; Smith, Suchanek, & Williams, 1988) and market confidence (Michailova, 2011).

To the extent of our knowledge, this is the first study looking at the effect that financial literacy might have on the occurrence of asset price bubbles. As financial literacy affects the financial behaviour of individuals, such as stock market participation and behaviour, we posit that financial literacy has an impact in the occurrence of asset price bubbles.

In our study, we analyse the impact of financial literacy on the occurrence of asset price bubbles. To do so, we conduct online experiments with high-school students in Tirana, Albania. A total of four schools are included in this experiment, of which two offer a financial education course to the students while the other two do not. We hypothesize that financial literacy, enhanced through financial education, does play a role in mitigating asset price bubbles. We expect the size and the magnitude of the bubble to be lower for those students who have taken a financial education course, as the average financial literacy is higher among the treatment group. In Section 2, we briefly discuss the literature on the effect of financial literacy on the stock market and experimental asset pricing. Then, in Section 3, we discuss the research context of the study, in which we explain our data and the asset pricing mechanism. Section 4 illustrates the results of the experiment and Section 5 concludes.

The experimental results showed that an asset bubble was observed in all the sessions. Bubbles of lower size and magnitude were observed in the treated sessions, where students who had taken a financial education course traded against each other. The highest prices amplitude and magnitude was registered on the non-treated group, in which students not taking the financial education course traded against each-other. Yet, we observed the lowest price amplitude and magnitude in the mixed group, where both treated and non-treated students traded against each-other. It is important to say that the average financial literacy of the latter group, was the highest among the three groups. This would imply a positive correlation of financial literacy with the occurrence of an asset price bubble.

The results were further supported with the regression analysis, where we showed that both financial literacy and financial education have a positive impact in mitigating asset price bubbles. This study contributes to the literature on experimental asset pricing by arguing that financial literacy is important in defining the trading behavior of individuals. An enhanced average financial literacy would decrease the occurrence of an asset price bubble. It has implications for policy makers to consider financial education not only an essential tool to enhance financial literacy, but also an important indirect channel which would affect the occurrence of an asset price bubble. Thus, policymakers and educators should design financial education courses addressing investment and trading behavior.

2. Literature Review

2.1. Financial Literacy and the Stock Market

The literature on financial literacy documents a strong relationship with financial behaviour in general and with individuals' stock market participation and behaviour. Studies show that a financially literate person performs better in terms of risk diversification and holds a more diversified portfolio.

A study by Hilgert et al. (2003) reveals a statistically significant relationship between financial knowledge and financial practices. Being financially knowledgeable about credit, savings, investment theory, and cash flow management was associated with paying bills on time, having diversified investments, tracking expenses, and putting money aside.

Furthermore, financially literate individuals are more likely to invest in stocks (Christiansen, Joensen, & Rangvid, 2008). A study by Van Rooij et al. (2011) on households in the Netherlands shows that many subjects do not know about risk diversification concepts or the difference

between bonds and stocks and the relationship between bond prices and interest rates. Moreover, they show that households with lower financial literacy are less likely to invest in stocks.

In the same direction, Lusardi and Mitchell (2011) argue that regardless of higher wealth or better education, financial illiteracy negatively impacts stock market participation. They further suggest that knowledge about finance and its components would increase stock market participation, thus having an impact on wealth accumulation.

The same situation is observed in other countries, such as Japan. Kadoya et al. (2017) show that financial illiteracy is a reason for low stock market participation and that an increase in financial literacy significantly increases stock market participation.

These studies suggest that better financial literacy results in higher stock market participation, thus directly affecting wealth accumulation in the long run.

2.2. Experimental Asset Pricing

The detrimental impact that an asset price bubble might have on the economy has led many scholars to investigate the formation of asset prices bubbles and ways to mitigate it. A sharp rise of an asset, generating expectations of further increases and attracting new buyers, is known as a bubble (Kindleberger, 1991). In such cases, the market prices of an asset are at considerable variance from the fundamental value. When this rise reverses, associated with a sharp decline in price, it might lead to a financial crisis.

History has recorded several bubble phenomena, often known as "mania." Among them, Kindleberger (1991) mentioned the Tulip mania in the Netherlands in 1636–1637, the Mississippi bubble in Paris in 1719–1920, and the Railway mania in England in 1946–1947 as the most noteworthy bubbles in history. As one may recall, these bubbles had a significant impact on the economy of each country.

A wide stream of literature documents several lab experiments to study bubble formation and possible ways to reduce the probability of such occurrences. One of the reasons why bubbles develop is the irrational expectations about the dividend distribution formed by traders. According to the theory of rational expectations, where the market is efficient, then the change in the price of an asset will reflect and adjust according to the new information present. It is believed that common information can induce common rational expectations, thus diminishing the likelihood of bubbles forming presence of a bubble (Tirole, 1982).

However, as Smith et al. (1988) concluded, common information about dividend distribution is not enough to induce rationality. A common dividend and common knowledge of this are not sufficient to induce common initial expectations. These irrational expectations are created because individuals are not aware of the rationality of their counter-traders, thus giving room for speculation. In this setting where each share has a defined expected dividend value, whether a trader is experienced or inexperienced makes a difference. T

he experimental results show that given that there is common information available to all traders, these bubbles diminish with experience (Smith, Suchanek, & Williams, 1988). A bubble observed in an experimental asset market in the lab is a quite normal phenomenon due to the abovementioned factors such as irrationality.

However, scholars argue that when traders are to trade an asset with lottery characteristics, the pricing deviations from the fundamental value are much larger than when trading an asset without any lottery characteristic, such as claiming a large payoff (Lucy & Bryan, 2002).

Moreover, studies suggest that when even a small fraction, such as one third, of the traders in an experimental asset price model are experienced, the occurrence of asset price bubbles is decreased (Dufwenberg et al., 2005).

According to Hommes et al. (2008), who conducted an experiment on expectations and bubbles in asset pricing, one of the reasons for the presence of a bubble is the positive feedback expectations of the participants. The experimental results reveal that whenever participants observe a small increase in price, they predict a further increase, and this price increase becomes self-fulfilling.

On the other hand, other studies suggest that the mispricing can also be a result of confusion about the process of decline of the fundamental value. Others suggest that overconfidence is one of the reasons for asset price bubbles. Michailova (2011) argues that overconfidence significantly impacts asset pricing in experimental settings. The results show a high correlation between bubble and confidence measures, which is further associated with an increase in average prices and volume of trade.

In another study about overconfidence and asset price bubble, Michailova and Schmidt (2016) suggest that in markets with traders who are less overconfident, prices tend to follow the fundamental price and are less volatile compared to markets with traders with higher confidence.

Other scholars argue that the cognitive sophistication of subjects plays an important role in the occurrence of asset price bubbles and subsequent crashes in experimental asset pricing setting.

Rosa et al. (2018) show that in markets with subjects with high cognitive sophistication, no bubble or crashes are observed, while in markets where subjects have lower cognitive sophistication, bubble-crash patterns are quite normal.

Speculation is believed to be one of the causes of price bubbles. Therefore, a few studies in which speculation was not possible were conducted to understand whether bubbles occur in the absence of speculation. The first study of this type was conducted by Lei et al. (2001). In their study, where speculation is not possible because rebuying and reselling are not allowed, they observe bubbles

and crashes. They note the presence of a set of systematic errors in the decision-making process accompanying bubble formation.

In a more recent paper, Lei and Vesely (2009) further argue that a clearer understanding of the dividend structure can be enough to eliminate bubbles. In an experiment composed of the pre-market phase where participants observe the dividend distribution and create a clearer picture of the dividend structure, Lei and Vesely (2009) find no evidence of a bubble in the market phase. Other scholars argue that bubbles might be avoided when the fundamental value process is well understood by the participants.

Huber et al. (2012) find evidence of this. In their study, they report that whenever the fundamental level process is clearly explained and presented to the participants in the experiment, they observe significantly lower mispricing. A more recent study on this topic shows that bubbles can be ameliorated by training subjects to understand the fundamental value of the asset.

Furthermore, Cheung et al. (2014) argue that when the fact that the subjects have undergone such training is made public, so everyone knows that others received such training, there is higher chance of eliminating mispricing (Cheung, Hedegaard, & Palan, 2014).

3. Research Question

This paper investigates how does financial literacy enhanced through financial education affects the occurrence of an asset price bubble.

So far, the literature on experimental asset pricing models focuses on the effects that the trading characteristics of subjects, such overconfidence, (ir)rationality, cognitive abilities, or experience, and asset market mechanism characteristics, such as information on dividend distribution, fundamental value process, or the ability to speculate, have on the observed bubble-crash pattern. As already discussed, the literature suggests that asset price markets are highly affected by

financial literacy levels: a more financially literate person tends to hold a more diversified portfolio (Hilgert et al., 2003), and better financial literacy levels increase stock market participation (Christiansen et al., 2008; van Rooij et al., 2011). Given that financial literacy increases stock market participation and that financially literate individuals perform better in terms of risk diversification, we posit that financial literacy induces rational decision making. Thus, we argue that as financial literacy increases and individuals become more rational, the probability of observing an asset price bubble decreases.

As suggested by the literature (Cheung et al., 2014; Huber & Kirchler, 2012; Lei & Vesely, 2009), if the fundamental value process is well understood, bubbles are ameliorated, and so we posit that a financial education course which covers the fundamental value process will have an impact on asset pricing. As a result, we propose the following research question for this study.

- Does improved financial literacy mitigate the formation of asset price bubbles?

3.1. Hypotheses

Based on the literature review, we propose the following research hypothesis.

i. *Improved financial literacy decreases the probability of observing an asset price bubble.*

   1. The amplitude of the asset price bubble decreases as financial literacy increases.

      As the average financial literacy at the group level, enhanced through financial education, is higher in the treated group, we expect the amplitude of the asset price bubble to be lower in the treated group.

   2. The magnitude of the bubble decreases as financial literacy increases.

      Given that financial literacy is higher in the treated group, we expect the magnitude of the bubble to be lower in this group compared to the nontreated one.

4. Methodology and Asset Market Mechanism

The experiment to test for an asset price bubble is based on the work by Smith et al. (1988) and Lei et al. (2001) on "experimental asset pricing".

To conduct the experiment, we split the sample into two main groups:

i. A first group composed of students who have taken a course (treated students).
ii. A second group composed of students who have not taken a course (nontreated students).

Besides these two main groups, we have a third ancillary group comprising a combination of students who have and have not taken a course, that is, both treated and nontreated students. There are in total 74 subjects participating in this experiment, of which 34 are treated and 40 non-treated. The first group has in total 20 treated students, the second one has 25 non-treated students, while the combined group has 14 treated and 15 nontreated students.

To run the experiment, we use the Vecon Lab Leveraged Asset and Limit Order Market Experiments (VeconLab). Charles Holt developed a website “A Virtual Laboratory for Research and Teaching on Social and Economic Interactions”, in which there are around 60 online experiments to run different market experiments or games (2005).

In this experiment, the cash holdings do not earn interest and at the end of the twelfth period, each asset is redeemed at $14. The fundamental value in our experiment is declining. The dividend is randomly distributed and can take values of $1.20 and $1.60.

In our case, each student is endowed with $500 and 10 assets which they can trade in 12 trading periods. No real money and assets are used. The cash holdings change according to the gains or losses via trading and the dividends earnings at the end of each trading period. The cash holding is not the same as the initial cash endowment.

The trading periods lasts on average 90 seconds. Students are not allowed to go at their own pace but have to wait for the others to submit their decisions to continue with the next period. The instructions (in the Appendix A) are read in both English and Albanian before the experimental trial session and the real experiment. Students are informed whether their counterparts have taken a financial education course or not.

Before the trading period they are given information about the dividend distribution and that everyone will be paid the same dividend. However, they learn about the actual dividend distribution only at the end of the period, after all participants have submitted their decisions. Traders can place buying and selling orders at the same time. The ask price must always be higher than the bid price. Participants are free to enter a price quote to buy (sell) and the number of shares they are willing to buy (sell) at this price and then press the "submit decision" button.

On the next page, they are asked once more whether this is their final decision or whether they want to change it. In the next period, they can see the dividends earned in the previous session.

The screen of each student appears as shown below.

They can see how much cash and the number of assets they own at the beginning of each period. The market price of the prior trading period is shown, together with the earnings in cash from both interest earned and dividends.

Submit Limit Order for Round XX, ID XY

Random Determination of Dividends per Share
Random State: *1 2 3 4 5 6 7 8 9 10*
Share Dividend: *$1.20 $1.20 $1.20 $1.20 $1.20 $1.60 $1.60 $1.60 $1.60 $1.60*
Initial Cash: *$XYZ Shares Owned: X*

Shares owned at the end of period 12 will be redeemed for $14 per share after the final-period dividends are paid.
Note: *Current money balance is $XYZ*
*Cash balances **no**t used to purchase shares will earn interest of $0.0 per dollar. Shares owned or purchased will pay a randomly determined dividend.*

Buy Order
Number of shares:
For at most:
(bid price per share)

Sell Order
Number of shares:
For at least:
(ask price per share)

Submit decision

Market Period	Buy Order	Sell Order	Market Price	Shares Bought / Sold	Net Sales Income	Cash (before dividends) / Interest Earned	Share Dividends Earned	Net Earnings	Final Assets

1	$X X shares	$X X shares	$Y	X Y	$(-/+) X	$X $Y	X shares $X	$X	$X Y shares

Table 33: Participant's Screen Display

The program arranges the market clearing price. At this price, the number of shares offered and asked is the same. The number of shares with limit sell prices (asks) at or below this clearing price is equal to the number of shares with limit buy prices (bids) at or above this clearing price. All the deals are made at this market price.

Except for the total shares owned, students can also see on their screens the number of assets they could sell and buy in the previous trading periods (see Table 33).

Before starting the real experiment, a different session is created, and students are asked to join it. After we have read the instructions, they are asked if they have questions. After the questions, they start the first round. We explain to them how the platform works, where they should submit their decisions, and what all the buttons appearing on their screens do. After this trial section, new sessions are generated, and the real experiment begins.

There are two sessions for the treated schools, which we denote Treated1 and Treated2, two from the nontreated schools Nontreated1 and Nontreated2, and two for the combined group of both treated and non-treated subjects Combined1 and Combined2 (See Table 34).

Session	Initial Working Capital	Initial Asset Endowment	Nr. of Subjects	Nr. of Periods
Treated1	$500	10	9	12
Treated2	$500	10	11	12
Nontreated1	$500	10	11	12
Nontreated2	$500	10	14	12
Combined1	$500	10	14	12
Combined2	$500	10	15	12

Table 34: Experimental Setup

A topic to which the literature on experimental settings pays attention is the impact of monetary incentives. Several studies show that monetary incentive schemes affect the risk-taking behaviour of subjects. The literature on experimental asset price bubbles and monetary incentives has been

focused on the impact of different incentive schemes on bubbles. James and Issac (2003) show that "beating-the-market" incentives, in which the winner is determined at the end of the last trading period, increase mispricing.

Cheung and Coleman (2011) find that league-table incentives that are paid based on the portfolio growth value also increase mispricing: the assets are priced with a larger deviation from the fundamental value. Robin et al. (2012) show that the presentation of bonus contracts affects the severity of bubbles.

In our study, monetary incentives are not used. Given the age group with which we are dealing in this research study, the official bodies of the schools did not give permission to provide any monetary incentives to the subjects. They argue that such an approach could be misunderstood by the students or their parents.

A paper by Vinogradoc and Shadrina (2013) argues that the motivation of subjects to participate in an experiment plays the role of an intrinsic incentive. They show that in their study the subsample with highly motivated subjects obtains the same results as in other lab experiments using monetary incentives. They define motivation as the willingness to participate in the experiment and the number of questions answered. Referring to these results, we argue that if subjects participating in our experiments are motivated, then motivation itself serves as an incentive. We argue that their willingness to participate in the experiments shows their intrinsic motivation.

The number of subjects participating in the sessions of our experiments is lower than the number we had randomly selected before. This suggests that those students participating are driven by motivation and curiosity about such experiments to be part of this study. We further support this argument by adding that in all our sessions, no students leave the experiment before the last period.

To measure bubbles, we refer to the definition by Lei et al. (2001), which defines bubbles as "trade at high volumes at prices considerably at variance with fundamental values". This implies that the size of the bubble depends on the volume of trade at prices above the fundamental value.

4.1. Why Vecon Lab Leveraged Asset and Limit Order Market Experiments (VeconLab)?

The Leveraged Asset and Limit Order Market Experiment program sets up a market in which the traders are given “cash” endowments and “assets”. Traders may submit buying or selling orders. To understand bubbles, trading prices are compared to the fundamental value. The fundamental value is automatically generated by the virtual trading platform.

Being a friendly using and free-access platform, VeconLab has been widely used by scholars to study the asset price bubbles in experimental settings.

Bostian et al. (2005) conducting a study with undergraduate students of the University of Virginia using the VeconLab platform. Students were endowed with same cash and stock, and the fundamental value of the asset is held constant. They show that bubbles of higher sizes are observed in sessions where the dividend and interest earned is the highest. VeconLab platform allows for different modifications. Again, Bostian et al. (2005) modify some of the sessions by not paying any interest on cash earned and distributing no dividends. They argue that bubbles occur even in cases where neither interest nor dividend is earned, which implies that ability to accumulate cash is not the only reason for an asset bubble.

In another study by Lahav (2011), the author conducts an experiment with unexperienced undergraduate students at the Emory University, Atlanta, Georgia. In this experiment, using the VeconLab platform students are asked to trade against each other, but in this case with a longer horizon of 200 periods. Still, author finds evidence of asset price bubble.

Again, university students were used to conduct an experiment to study bubbles in the laboratory markets. Holt et al. (2017) through VeconLab platform study the effect of gender in asset price bubbles. They could modify the settings by providing sessions with a declining and flat fundamental value of the asset. They find evidence of high magnitude of bubbles on both genders. Differently from the previous experimental studies presented above, our experiment is run with high school students. They are all inexperienced in trading and a group of them took a financial education course before the experiment takes place. We run the experiment using the VeconLab platform, but we also have prior data on financial literacy for each student. We use these data and the data generated by the platform, to study the effect of financial literacy enhanced through financial education, on asset price bubbles. We don't modify the fundamental value for different sessions, as some studies do, but we keep a declining fundamental value for all the sessions. Again, different from other studies, we don't pay interest on cash accumulated in any of our sessions. Yet, like the previous studies, our subjects are inexperienced in asset trading and asset price bubbles of different magnitudes and size are registered in our sessions.

5. Empirical Results

As the literature on experimental asset pricing suggests, in a market where the asset has a finite lifetime (number of periods) and the dividend is common knowledge for all the traders, market prices do not follow fundamental prices. Instead, these markets are characterized by a "boom" phase, where price are significantly higher than the fundamental value, followed by a sudden decrease in the prices far below the fundamental value. Typical price trends are observed in our experiment as well, regardless of having taken a financial education course before or not. As it can be observed from the Figures below, in all our trading sessions market prices do not follow the fundamental price trends and are considerably above the fundamental value. The only exceptions

are observed in the first period of the second session of traders who have not taken a financial education course.

Both the first and the second session of the treated group composed of students who have taken the financial education course, follow a similar trend (Figure 3). The first period market prices

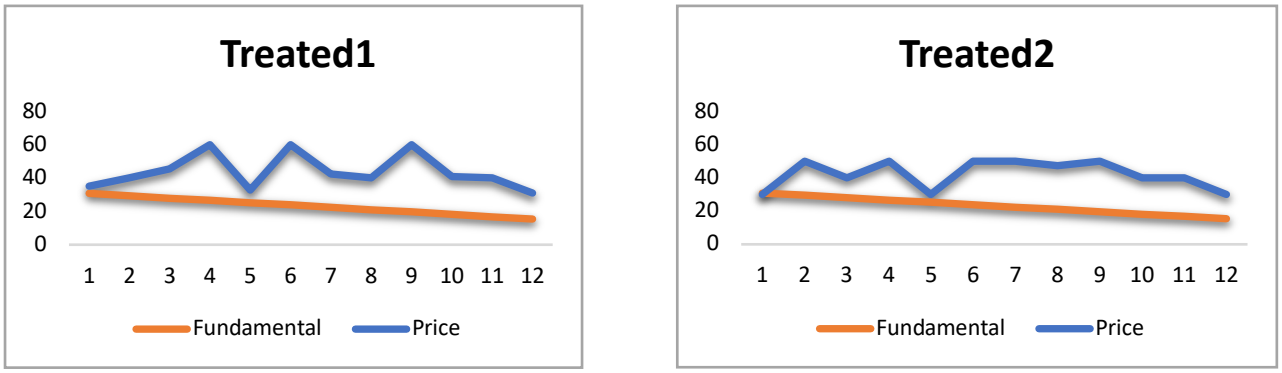

Figure 3: Treated Groups

tend to be close to the fundamental price and in the last two periods market price tend to decrease toward the fundamental value. On both sessions we observe a sharp decrease on the fifth period, after prices have been relatively high in the previous periods. Then we observe a boom on the sixth period. After that the prices fluctuate less with a downward sloping.

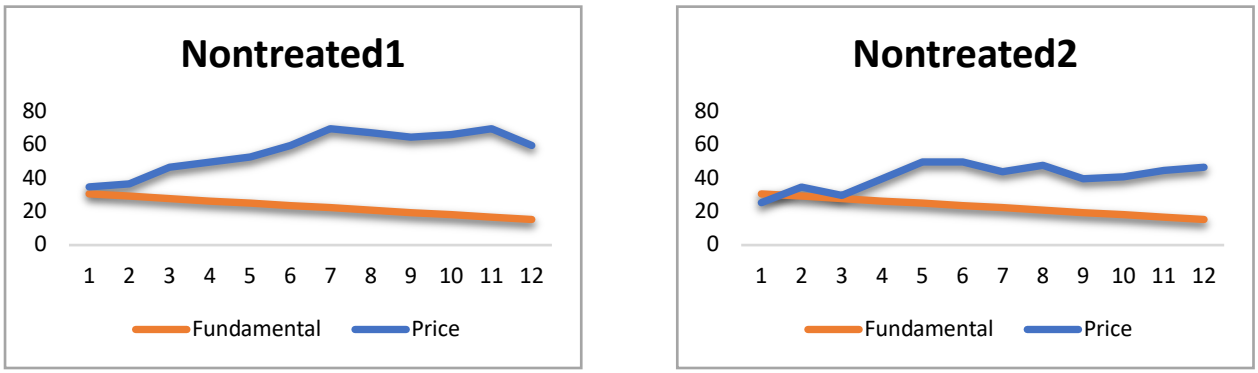

Figure 4: Non-treated Groups

In the sessions where students who have not taken a financial education course, as in Figure 4, trade against each other, we can easily see that market prices across periods are considerably at variance from the fundamental price. The market price trend is upward sloping, suggesting persistent overpricing, which increases from period to period, followed by small fluctuation. When

we compare the price fluctuations across the treated and nontreated, we see that the deviation between the fundamental value and the market price is higher in the nontreated group. As we can see from the Table 35 below, average financial literacy of the treated group is significantly higher than that of the nontreated one. Average financial literacy of the nontreated group is 5.74 points lower than that of the treated one, significant at 5%. This would suggest that as financial literacy increases, individuals tend to price the assets closer to its fundamental value.

	Nontreated		**Treated**	
Financial Literacy [a]	26.31***		32.05***	
	Nontreated1	**Nontreated2**	**Treated1**	**Treated2**
Financial Literacy	26.62	26.01	31.55	32.54

Table35: Average financial literacy across treated and nontreated
***p<0.01; **p<0.05; *p<0.1; [a] First line financial literacy is the average score of both sessions of each group: treated, nontreated and combined. Second line financial literacy is the average of each session of each group.

Regarding the third group, in which both students from treated and nontreated schools, trade against each other, we still observe market prices above the fundamental value, but the variance seems to be even lower compared with the treated one.

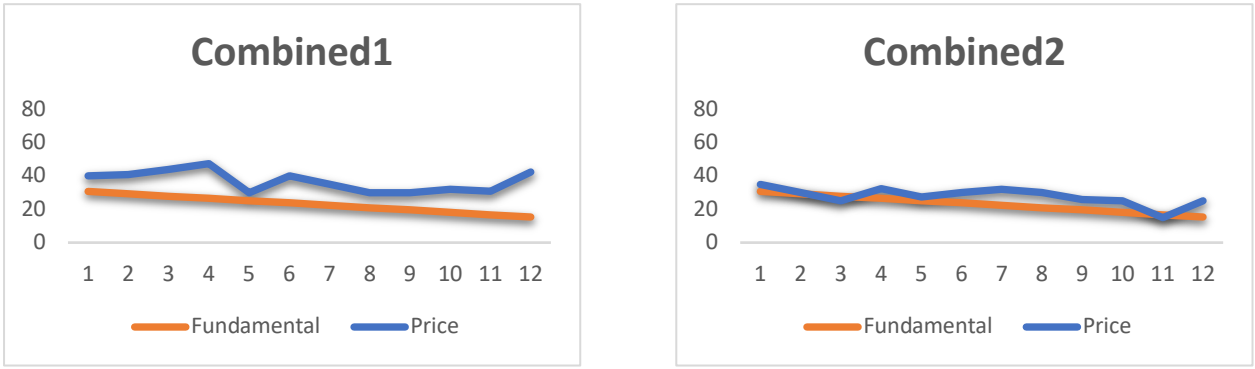

Figure 6:Combined Groups

As it is shown in Table 42 (in Appendix B), the average financial literacy (33.48) of this group of students is higher compared to that of the treated group (32.05). This would explain the lower variance between the fundamental and market prices, however, the average financial literacy does not differ significantly between the groups.

Whereas the prices of the first group of this session are always above the fundamental price, we cannot say the same for the second group. In the second group of this session, market prices fall below the fundamental one on the third and the eleventh period, which are then followed by a sudden increase in the price. An interesting pattern of both these groups, is that on the last period (12^{th}) market prices increase, after they have been decreased in the previous one (11^{th}). Based on the above figures, there is clear evidence that market prices deviate from the fundamental prices in all our sessions. In the first two groups, both sessions, the market price is closest to the fundamental value at period 1, while in the last group the market prices are closest to the fundamental one on the fifth and the eleventh period respectively for session 1 and 2.

The largest price deviation from the fundamental value is observed in the first session of the non-treated group in the 11^{th} period, where the market price is around 316% higher than the fundamental value. Whereas in the treated groups, the highest price deviation is 206% on 9^{th} period of this group's first session. In the third group, the maximum price deviation is below 200%, and a price deviation of approximately 176% is present in period 12 of the first session. We can conclude that maximum and minimum price deviations in all the sessions of the three groups, are outside the maximum and minimum interval of fundamental value.

	Nontreated1	**Nontreated2**	**Treated1**	**Treated2**	**Combined1**	**Combined2**
Round	**Volume**	**Volume**	**Volume**	**Volume**	**Volume**	**Volume**
1	6	19	8	10	11	10
2	8	15	6	14	10	10
3	12	17	6	17	13	13
4	7	3	5	10	12	8
5	7	7	5	10	15	5
6	10	15	5	4	23	7
7	8	6	1	14	10	2
8	6	8	7	3	9	8
9	7	3	6	6	13	6
10	6	10	2	3	10	7
11	12	5	2	8	5	14
12	3	8	1	12	12	6

Total Volume[6]	92	116	54	111	143	96
Turnover (%)[7]	83.6	83	60	100	102	64

Table 36: Turnover

We report in Table 36 the number of assets traded in each session of each group. The total volumes of trade for each session of each group are given. We see that total volume of trade for the 1st and 2nd sessions of the non-treated group is 92 and 116 assets respectively, which represent 83,6% and 83% of the maximum possible trade for each session, as represented by the turnover ratio. The volume of trade for the treated group is 54 and 111 for each session, which represent 60% and 10% of the maximum possible trades. The same high values are observed on the combined group as well. The turnover ratio is 102% and 64% for each session in this group. These high numbers imply that trade at high volumes has been made at prices at variance from the fundamental values. If we compare the price deviations of treated and non-treated sessions across rounds, we observe that these deviations tend to increase at a greater interval in the non-treated ones compared to the treated ones. Market prices deviate from the fundamental value by $44.6 and $31.6 in the first and the second sessions last period for the non-treated group. While in the treated group the deviations in the last period take the values of $15.60 and $14.60 for each session. These results are partially in line with our hypothesis stating that as the traders get experienced in later periods, the size of the bubble among traders who have received a financial education course experiences a larger decrease compared to the size of the bubble among traders who have not received such a course. However, contrary to our expectations, as can also be seen from the tables above, the priced deviations do not decrease from one round to another but tend to increase. Thus, we can only argue that the size of the price deviations is smaller in the treated groups compared to the non-treated ones. It looks like experience from one round to the other does not decrease the size of the bubble.

[6] Total Volume of Assets Trade per Session
[7] Total Volume of Assets Trade per Session over Total Number of Shares Outstanding

In addition to price characteristics, in Table 37 we report two most typical measures which are used to determine the size of a bubble, price amplitude and magnitude for each session separately.

	Treated1	Treated2	Nontreated1	Nontreated2
Price Amplitude	1.18	1.01	1.59	1.19
Magnitude	20.9	19.19	33.65	18.19
Observations	*9*	*11*	*11*	*14*

Table 37:Bubble Measures across the treated and nontreated

Porter and Smith (1995) first introduced price amplitude as a measure of a price bubble. They defined price amplitude as the difference between the maximum and minimum price deviations from the fundamental price normalized by the fundamental value in period 1.

$$PA = \frac{\max(\bar{P}_p - FV_p)}{FV_1} - \frac{\min(\bar{P}_p - FV_p)}{FV_1};$$

Equation 7: Price Amplitude

where $\bar{P}_p$ is the average price of one period; FV_p the fundamental value of the period; FV_1 the fundamental value of the first period. The higher PA, the further market prices from the fundamental price, implying a higher bubble size.

Magnitude is defined as the sum of all of price deviations from the fundamental value across all the rounds.

$$Magnitude = \frac{1}{n}\sum_{r=1}^{n}(\bar{P}_r - FV_r);$$

Equation 8: Magnitude

where $\bar{P}_r$ is the average price of one period; FV_p the fundamental value of the period; r is the round number.

Results in Table 37 show that price amplitude is higher in the non-treated group's sessions compared to the treated group. The highest value is registered in the first session of the nontreated group. The same pattern is somehow observed when we compare the magnitude value, with the

exception that the magnitude of the second session of the treated group is higher than that of the second session of the non-treated one.

In Table 38, we report the average price amplitude and magnitude of each group. When comparing between the treated and non-treated groups, we find that both price amplitude and magnitude are higher in the non-treated group, with a difference 0.5 and 5.87 units, respectively, statistically significant at 5%. As we have already shown in Table 35 above, the average financial literacy of the treated group is higher than that of the nontreated one. This implies a negative correlation of financial literacy with both price amplitude and magnitude. As average financial literacy in the treated group increases, both price amplitude and magnitude decrease significantly. Furthermore, as we report in Table 44 in Appendix B, price amplitude and magnitude are lower in combined group than in the treated groups. These results further suggest a negative correlation of financial literacy and bubble measures, as the average financial literacy of the combined group is higher than that of the treated one. We argue that as average financial literacy increases, it induces the subjects to behave more rationally.

Groups		**Price Amplitude**	**Magnitude**
Treated vs Nontreated	Treated	1.09	20.04
	Nontreated	1.39	25.9
	Difference	0.5***	5.87***

Table 38: Average Bubble Measures Across Treated and Nontreated
Inference: *** p<0.01; ** p<0.05; * p<0.1

In the following section we report the results of a regression analysis in which we aim to analyze the impact of financial literacy on asset price bubble measures, price amplitude and magnitude.

Before we proceed with the analysis, we show that the sample of the students who participated in this study, treated and non-treated ones, is balanced in terms of individual characteristics, such as gender, parental education and occupation, math average grade and GPA, prior economics courses and any prior work experience, cognitive ability score. They are also balanced in terms of school

characteristics such as school's ranking, location, and size. We report in Table 39 the results of the balance test.

Variables	Mean nontreated	Mean treated	Difference
Gender	0.68	0.43	0.19
Father Education	0.29	0.47	-0.18
Mother Education	0.343	0.344	-0.001
Father Job	0.27	0.12	0.15
Mother Job	0.125	0.06	0.066
Math Average Grade	6.44	6.73	-0.29
GPA	6.56	6.78	-0.22
Cognitive Ability Score	0.7	0.67	0.023
Average Monthly Income	1.9	2.18	-0.28
Worked Before	0.28	0.34	-0.06
Prior Economic Courses	0.08	0.064	0.024
Ranking	3	3.58	-0.58
School Location	0.75	0.67	0.073
School Size	2.75	2.79	-0.04
Directorate Education	0.000	0.000	0.000

Table 39: Individual and School Level Characteristics Balance Test
Inference: *** p<0.01; ** p<0.05; * p<0.1.

We have shown that the average financial literacy of the treated students who participated in this experiment is significantly higher than that of the nontreated ones. This is explained by the fact that the financial education course previously provided to the treated students has been effective in terms of increasing financial literacy.

As treated and nontreated students are different in terms of financial literacy, we employ weighted linear regressions, where we aim to estimate the effect of financial literacy, per se, on both price amplitude and magnitude. The following model is estimated.

$$Bubble\ Measure_i = \alpha + \gamma FL_i + \lambda Div_i + \varepsilon_i$$

Equation 9: Financial Literacy Impact on Price Amplitude and Magnitude

Bubble Measure stands for either price amplitude or magnitude per session, i stands for session average value. FL is average financial literacy per session and Div is average dividend distributed per session.

The results of the regression analysis showed that average financial literacy does have a significant impact in both measures.

	Price Amplitude (I)	Magnitude (II)
Financial Literacy	-0.72***	-0.41***
Dividend	0.59***	0.59***
Observations	*72*	72

Table 40: Average Financial Literacy Impact on Asset Bubbles
Inference: *** p<0.01; ** p<0.05; * p<0.1; Standardized coefficients are used.

The estimation showed that an increase in average financial literacy decreases the price amplitude and magnitude by 0.72 and 0.41 points respectively. These results imply that financial literacy has a positive impact in mitigating asset price bubbles, as shown by the inverse relationship between both price amplitude and magnitude with financial literacy. These results are in line with the literature review, which suggests that financial literacy has a significant positive impact in financial behaviour of the individuals. Furthermore, we see that dividend distribution has a direct positive relationship with bubble measures. As the average dividends increase, both price amplitude and magnitude also increase.

In the following paragraphs we further extend our analysis and discuss how financial literacy gained from financial education affects asset price bubbles. Instead of relying only on price amplitude and magnitude as bubble measures, we use bidding price and asking price of each subject as a proxy of an asset price bubble. Thus, we shift from session average data to individual data to study asset bubbles. We expect students with lower financial literacy, to both ask higher prices and show a higher willingness to pay more for assets, thus the market prices will exceed the fundamental prices, resulting in asset price bubbles.

For this reason, we employ a linear regression analysis, aiming to estimate the following equation.

$$Bubble\ Measure_i = \alpha + \gamma FL_i + \beta FinEd_i + \partial FinEdFL_i + \lambda Div_i + \varepsilon_i$$

Equation 10:Average Financial Literacy Impact on Price Bubbles, controlling for Financial Education

Bubble Measure stands for either asking price or bidding price per student, i stands for each individual's value. FL is average financial literacy per student , FinEd is the dummy variable which takes the value 1 if the student belongs to the treated schools, and 0 otherwise. FinEdFL is the interaction term between Financial Literacy and Financial Education course and Div is the dividend distributed. γ indicates the effect of financial literacy when financial education course equals 0, whereas the effect of financial literacy when financial education equals 1 is the sum of γ and ∂. Table 41 reports the results of the regression analysis.

	Asking Price (I)	**Bidding Price (II)**
Financial Literacy	-0.19	-0.12
Financial Education	61.92**	4.64
Financial Education x Financial Literacy	-1.31**	-0.14
Dividend	-1.09	7.66**
Observations	*888*	*888*

Table 41: Average Financial Literacy Impact on Price Bubbles, controlling for Financial Education
Inference: *** p<0.01; ** p<0.05; * p<0.1; Standardized coefficients are used.

The estimation results show that as financial literacy increases, asking pricing for the nontreated students decreases. The same holds for bidding prices, but in this case the results are not statistically significant. Whereas, as shown by the interaction term, when students are provided a financial education course, an increase in financial literacy decreases both asking and bidding prices. Yet, the results for bidding price are not statistically significant. These results show that financial literacy does have an impact in reducing price bubbles, but only on the supply side, as suggested by the statistical significance for the asking price. On the other side, financial literacy does not seem to impact bubbles via demand, as the results on bidding price are not statistically significant. Overall, these results imply that financial education not only improves financial literacy as we have discussed, but it also induces a more rational behaviour. Thus, we argue that

an enhanced financial literacy through financial education has a significant impact in reducing the propensity to price bubbles, at least via supply side.

5. Conclusion

This paper studied asset price bubbles in an experimental setting. Students from high schools in Tirana, Albania, were asked to trade against each other in a virtual asset price platform, by Holt (2005), called Vecon Lab. Students were split into two main groups, one from schools who delivered a financial education course to their students and one from schools who didn't deliver such course. A third group a combination of both treated and non-treated schools is used as an ancillary group. In this study we focused in understanding how financial literacy impacts the occurrence of an asset price bubble.

The results of our experiment showed that market prices didn't track fundamental prices in any of the sixth sessions. Furthermore, with a very few exceptions, these prices were always higher than the fundamental one. This price deviation was more prevalent in the non-treated sessions. Price amplitude and magnitude values showed that those students who have taken a financial education course, through which financial literacy is also enhanced, have generated a bubble of smaller size and magnitude compared to the non-treated ones. We argue that as the average financial literacy increases it induces a more rational behaviour, which decreases the probability of observing price bubbles. Moreover, as financial literacy increases through financial education, bubble measures, price amplitude and magnitude decrease significantly. This result implies that financial education as well, manages to induce a more rational behaviour. Thus, it plays a significant role in mitigating asset price bubbles.

We posit that if individuals are financially educated by which financial literacy is enhanced, the propensity to asset price bubbles will decrease. This research paper has implications for policy

makers by suggesting that financial literacy enhanced through financial education plays a significant role in mitigating asset price bubbles. The study further contributes to the literature of financial literacy, arguing that financial literacy is an important determinant in asset pricing, and it significantly impacts the occurrence of an asset price bubble.

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Appendices

Appendix A

Instructions

- **Market Setup:** There will be XX participants in this market. Each person is endowed with **$500.00** in cash and **10** shares of a durable asset that can be bought or sold.
- **Dividends:** All asset shares owned at the end of each period will pay a dividend (explained below). The dividends may not be known in advance.
- **Periods:** The market consists of exactly **12 trading periods** or "rounds". All asset shares that you own (from endowment or purchases) at the end of the final trading period (after dividends are paid) will be redeemed for **$14.00** each.
- **Earnings:** In addition to cash receipts from dividends, your cash balance will be altered as you buy and/or sell shares. Transactions will be executed for you based on "limit orders" to buy or sell that you may submit at the beginning of a trading period, as explained below.
- **Earnings on Investments:** Dividends will be paid on all shares owned after trading in a round is complete.
- **Dividends:** Each share held at the end of a trading period will pay a dividend that depends on the outcome of a random process. The computer will select a random number from 1 to 10, with each integer in this interval being equally likely. This random "state" determines which column of the Dividend Table (below) is relevant. Thus, each of the dividend amounts listed in the bottom row of the table are equally likely to be earned on each share that you own.

Random Determination of Dividends per Share

Random State:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Share Dividend:	**$1.20**	**$1.20**	**$1.20**	**$1.20**	**$1.20**	**$1.60**	**$1.60**	**$1.60**	**$1.60**	**$1.60**

- **Limit Orders to Buy or Sell:** At the beginning of a trading period, those with cash who wish to purchase shares will indicate the number of shares desired and the maximum or "limit" price that they are willing to pay. Similarly, those who wish to sell shares will indicate the number of shares offered and the minimum "limit" price that they are willing to accept.
- **Buy and Sell Orders:** The same person may offer to buy and sell shares, but the **buy price** or "bid" must be below the **sell price** or "ask," so you cannot sell to yourself.

- **Arranging Trades:** Trades are possible if some of the sell order prices (asks) are below some of the buy order prices (bids). The market maker is a computer program that will organize the buy and sell orders and use these to determine a market-clearing price. Ask prices that are too high (above the clearing price) and bid prices that are too low (below the clearing price) will be rejected.

- **Market Clearing:** All transactions will be at the **same** "market-clearing" price. This will be a price such that the number of shares that traders wish to buy is equal to the number of shares that traders wish to sell. In other words, the number of shares with limit sell prices (asks) at or below this clearing price is equal to the number of shares with limit buy prices (bids) at or above this clearing price. Thus, those who are willing to pay the most will buy from those who are willing to sell for the least, but all trades will be at the same price.

Random Determination of Dividends per Share

Random State:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Share Dividend:	**$1.20**	**$1.20**	**$1.20**	**$1.20**	**$1.20**	**$1.60**	**$1.60**	**$1.60**	**$1.60**	**$1.60**

- **Example 1:** Suppose that a person begins a round with **$20** in cash and **3 shares**. If this person makes no purchases or sales , then the person's cash position would remain unchanged.
    - If the randomly determined dividend turned out to be **$1.20**, then the total dividend income would be 3 x $1.20 = **$3.60**.
    - Similarly, if the randomly determined dividend turned out to be **$1.60**, then the total dividend income would be 3 x 1.60 = **$4.80**
    - **Example 1 (continued):** If the person who started with 3 shares and $20 were to purchase a share for $P in the trading period, then this person would earn a dividend on 4 shares, and these 4 shares would make up the person's portfolio at the start of the next period. The amount of cash carried over to the next period would be the initial cash $20, minus the cost of the purchase plus the dividends on the 4 shares.

Random Determination of Dividends per Share

Random State:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Share Dividend:	**$1.20**	**$1.20**	**$1.20**	**$1.20**	**$1.20**	**$1.60**	**$1.60**	**$1.60**	**$1.60**	**$1.60**

- You will begin with an initial cash account of **$*.**** and with ** **shares** of a stock with dividends determined by a randomly generated number as shown above, with each of the 10 columns in the dividend table being equally likely.

- Shares can be bought or sold by placing limit orders, which are executed at a single market-clearing price selected to equalize the number of shares demanded (with bids above the price) and the number of shared offered (with asks below the price).

- Each share owned at the end of a period (after trades have been executed) will pay a randomly determined dividend.

- Your cash balance will decrease if you purchase shares, and it will increase as you receive dividends, and as you sell shares or redeem them in the final period. The computer will keep track of your cash and share accounts. and your final earnings will equal your cash balance in the final period after any shares you have are redeemed. and after final dividend and interest payments have been made.

- This experiment consists of exactly **12 trading periods**, and all shares owned at the end of the final trading period (from your endowment or obtained by purchase) will be redeemed for **$14.00** each.

- **Cash Conversion:** Each **$100.00** in earnings for the experiment will be converted into **$1.00** in cash payments to you at the end.

Appendix B

	Treated		**Combined**	
Financial Literacy [a]	32.05		33.48	
	FinEd=1(1)	**FinEd=1(2)**	**FinEd=1&0(1)**	**FinEd=1&0(2)**
Financial Literacy	31.55	32.54	34.78	32.18

Table 42: Average Financial Literacy Across Treated and Combined

***p<0.01; **p<0.05; *p<0.1; [a] First line financial literacy is the average score of both sessions of each group: treated, nontreated and combined. Second line financial literacy is the average of each session of each group.

	Combined1	**Combined2**
Price Amplitude	0.72	0.41
Magnitude	13.8	4.65

Table 43: Bubbles Measures across treated and combined group sessions

Groups		**Price Amplitude**	**Magnitude**
Treated vs Combined	Treated	1.09	20.04
	Combined	0.56	9.22
	Difference	0.53***	10.82***

Table 44: Bubbles Measures across treated and combined group