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# Financial education and spillover effects

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## Abstract

Using a newly introduced, semester-long university course on financial education in Cyprus, a country of low financial literacy, we find evidence of financial knowledge spillovers from university students to their parents. We measure the financial knowledge score of students and parents before and after the introduction of the course, using both a treatment and a control sample. The spillover effect is economically significant, and it is driven by the subsample of students who have frequent face-to-face interaction with their parents.

**Keywords** Financial education · Financial literacy · Spillover · University course

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## 1 Introduction

The effects of the 2008 global financial crisis led to a significant focus on financial literacy education in countries around the world as the means to improve financial resilience.[1] The significance of financial literacy was highlighted during the largest economic crisis of a century caused by the COVID-19 pandemic (World Bank 2022) and the ensuing inflation surge as a result of increased government spending globally. Increasing political risk from events such as Brexit, wars in Ukraine and the Middle East, and the recent elections in the US, and increasingly adverse effects of climate change put additional pressure on households, threatening their financial resilience, especially for those not sufficiently literate to understand the risk factors that can affect them.[2]

An important step towards increasing financial literacy in society is equipping the younger generations with the knowledge necessary for effective and responsible financial choices.[3]A large body of academic literature examines the level of financial literacy of young individuals (Lusardi et al. 2010; Jorgensen and Savla 2010; Mandell 2008). Other studies focus on the evaluation of various intervention programs typically of short duration,[4] aiming to increase the level of financial literacy in colleges and high schools around the world (Bover et al. 2018; Lührmann et al. 2015; Walstad et al. 2010). The evaluation of these programs concentrates on their effects on outcomes such as financial knowledge, attitudes, and behaviors of the participating individuals.

Financial education programs could have important spillover effects. Spillovers from a financial education intervention could occur from treated individuals actively passing new knowledge to their colleagues, friends or their family. Knowledge spillovers are beneficial since they help financial education programs reach a larger audience (Lusardi 2013) overcoming the challenges of reaching the adult population due to time constraints, opportunity costs, and limited workplace financial education. Despite its critical importance, knowledge sharing through financial education interventions has received limited attention in the literature (e.g. Brugiavini et al. 2020), especially interventions conducted in a university environment. To our knowledge, no study has examined the spillover effects in the setting of financial education interventions for university students. Furthermore, studies evaluating financial education interventions face critical limitations and challenges. These include difficulty proving causality, potential biases, and the lack of a control group (see Lusardi and Mitchell 2014; Lusardi 2013; Lyons and Neelakantan 2008 and Fox et al. 2005 for

[1] According to a joint study by OECD and the G-20 (OECD/G-20, 2013), since the financial crisis, a growing number of governments have developed dedicated national strategies to enhance financial education efficiency. See also OECD (2009).

[2] For the effects of the COVID-19 pandemic on resilience and the moderating factor of financial literacy see Schneider et al. (2020) and Bertola and Lo Prete (2024).

[3] The importance of financial education for the youth OECD (2014) has been emphasized by the G-20 Leader's in the June 2012 summit (OECD 2013).

[4] Examples of other studies linking financial education to long-term effects are Bernheim et al. (2001), Frisancho (2023a), Jamison et al. (2014), Stoddard and Urban (2020), and Urban et al. (2020).

discussions on the limitations of financial education program evaluation studies).[5] Establishing a potential for knowledge transfer from students to their parents could support mandatory financial education in schools and universities, thereby reducing the cost-effectiveness ratio in reaching a broader audience.

In this paper, we test for financial knowledge spillover effects from university students to their parents following the introduction of a new semester-long course at the University of Cyprus, the first and primary research university of the country, on financial education in an environment of documented, low prior financial literacy (Andreou and Philip 2018; Andreou and Anyfantaki 2021; Kyriacou et al., 2024).[6] The natural experiment of introducing a new university course along with our study design allows us to overcome some of the challenges faced by previous studies, such as potential contamination from existing financial education initiatives. Moreover, we use a quasi-experimental design with treatment and control groups, thus addressing shortcomings in the literature that did not include control groups.[7]

We start our study by assessing first the impact of the financial education university course on the students' financial knowledge score by measuring it before and after the introduction of the course on the treatment group (students who took the course) and a control group (students who did not take the course over the same semester). We use this as the stepping-stone for our main contribution in assessing the financial knowledge spillover effect from students to their parents.

Specifically, we first establish that financial knowledge increases for students, on the treatment group relative to the control group. We document this (expected) increase in financial knowledge score of the students who registered for the course relative to the control group. After controlling for the students' initial financial knowledge score, as well as demographic characteristics that may have an impact on the level of financial knowledge (e.g. age, gender, and income status), students in the treated group exhibit a statistically and economically significant increase in financial knowledge, relative to the control group. It is important to note that interaction between the control and treatment groups was minimal during the Fall semester of 2020 due to COVID-19 restrictions.[8]

We then test whether the documented increase in financial knowledge score of the students who registered for the course spills over to their parents by measuring the change in the parents' financial knowledge before and after the course. We find that parents of students in the treated group experience a statistically significant

[5] Such limitations draw the attention of researchers, with some recent studies (e.g. Sayinzoga, Bulte, and Lensink 2016) using designs that aim at bypassing the limitations.

[6] Cyprus ranks between the lowest countries in the European Union in the latest Standard and Poor's Global Financial Literacy Survey with 35% of adults being considered as financially literate (for more information: http://gflec.org/initiatives/sp-global-finlit-survey/). Furthermore Andreou and Philip (2018) find low levels of financial literacy among university students in Cyprus.

[7] See Reichardt (2009) for more on using quasi-experimental designs to estimate treatment effects.

[8] The first vaccines were introduced in Cyprus in December of 2020; hence the level of face-to-face interaction was significantly reduced due to health protocols introduced by the government of Cyprus. Especially the first-year students who were required to take the course in their first semester of study did not have opportunities to meet other students outside their cohort and thus potentially spill over any knowledge to the control group.

increase in their financial knowledge. Moreover, we find that the increase in financial knowledge of treated parents arises in the subsample of parents who interact frequently with their child.

We note that the financial education course is required for first-year undergraduate students in the Department of Accounting and Finance, and it is optional for students in other departments of the University of Cyprus. To minimize concerns related to self-selection bias into the elective course, we conduct a robustness test by re-running the analysis on the sample of students who are required to take the course, their parents, and the respective control group of students and parents who did not take the course. That is, we exclude the group of students who chose to enrol in the elective course (and their parents) from the treatment group.

Our study contributes to the existing literature in several ways. Our main contribution is to document knowledge spillovers from university students to their parents, which constitute an important aspect of the success of financial literacy interventions (Sayinzoga et al. 2016; Lusardi 2013), since spillovers can lead to an amplification of the effect of the treatment through knowledge propagation from treated individuals to their peers. Even though many studies focus on the effects of financial education programs on treated individuals, studies on the spillover effects of financial knowledge associated with these programs are scant. Duflo and Saez (2003) examine the effect of a retirement plan that benefits information fair and find positive spillover effects resulting in increased enrolment in a Tax Deferred Account. In a different setting, Haliassos et al. (2020) use a quasi-field experiment of exogenous allocation of refugees to estimate the effect of access to financially literate neighbors on saving for retirement and participation in stockholding. They find that the exposure to a higher share of neighbors with business or economics education and some college attendance has positive effects on the two aforementioned financial behaviors. On the contrary, no evidence of knowledge spillover is documented by Drexler et al. (2014) when examining the effects of accounting and rule-of-thumb financial training for entrepreneurs, and by Sayinzoga et al. (2016) when examining financial education intervention on smallholder farmers in Rwanda.

The closest papers to ours are Bruhn et al. (2016) and Frisancho (2023b), who document spillover effects from high school students to their parents. Bruhn et al. (2016) show that high school students' financial education has spillover effects on parents' financial knowledge, while Frisancho (2023b) show that the spillover effect carries over to parents' financial behavior up to three years later. Our paper differs from these two papers as it focuses on a semester-long, financial education intervention to university students instead of high school students and documents a spillover effect on the financial knowledge of treated students' parents. Our results suggest that in addition to spillover effects documented from younger individuals (high school students; Bruhn et al. 2016; Frisancho 2023b), spillover effects are also documented when a financial education intervention is conducted in young adults who might have a different interaction with their parents than teenagers.

The second way our study differs from the literature is that it uses a longer intervention than previous studies to test the impact on financial education. According to Lusardi and Mitchell (2014), offering a few seminars can be ineffective since a large portion of the population is not financially literate about basic financial concepts.

They also point out that it is unlikely that short exposure to financial literacy training would have a significant impact on the treated individual's decision-making process. Our study uses a semester-long university course, meeting twice a week (75 min each time) for 13 weeks. Moreover, students are assessed through a major project and two exams, thus giving them extensive exposure to the course material but also to information they research to deliver their project.

We also differ from the literature examining the impact of financial education on university students in one important aspect, namely the inclusion of a control group. With the exception of Brugiavini et al. (2020), previous studies on college interventions typically do not incorporate a control group. The lack of a control group may lead to important biases in the measurement of program effectiveness. Collins and O'Rourke (2010) label the use of treatment groups and a comparison group as the "golden rule" of program evaluation (see also Lusardi and Mitchell 2014 and Fox et al. 2005).

To the best of our knowledge, our study is the first to examine the spillover effects in the setting of financial education interventions for university students. Our findings have important policy implications. Treated individuals transfer knowledge through their face-to-face interactions, suggesting multiplier effects[9] from the introduction of financial education programs in curriculums. This result complements the results of earlier studies that show a spillover effect for financial education interventions in high school students.

The remainder of the paper is organized as follows: In the next section, we discuss the level of financial literacy in the country setting (Cyprus), the introduction of the new course and provide a review of the related literature. Section 3 presents the survey setup, while Sect. 4 presents the data construction and the sample description. In Sect. 5 we present a descriptive analysis of our experiment and the empirical testing for the spillover effect. Finally, Sect. 6 concludes and discusses the public policy implications.

## 2 Background, literature review and objectives

### 2.1 Financial literacy in Cyprus

In 2013, Cyprus suffered one of its worst economic and financial crises as it was concurrently facing a twin crisis in its banking sector and government finances. This crisis led to an unprecedented bail-in of its banking sector, amounting to 5.8 billion euros or about 24% of its GDP, that affected the uninsured depositors of the two

[9] The results of Maturana and Nickerson (2018), in a study that examines the effect of teacher's mortgage refinancing activities on the refinancing activity of their peers, suggest that there are multiplier effects associated with increasing the availability of information and financial education of an individual.

largest Cypriot banks, and resulted in a multi-year Memorandum of Understanding (MoU) with Troika extending up to 10 billion euros.[10]

The fallout from this crisis highlighted the lack of financial knowledge for a significant part of the Cypriot population, namely the lack of basic understanding on matters related to financial risk, borrowing, debt management and, crucially, depositor insurance. The lack of basic financial knowledge among the Cypriot population is documented in existing surveys and the scientific literature. According to the 2015 Standard and Poor's Global Financial Literacy Survey, Cyprus ranks among the lowest from the European Union countries with only 35% of adults being considered as financially literate.[11] Andreou and Anyfantaki (2021), using a sample of adult individuals between 25 and 65 years old, find that only 37.33% of the survey's participants can be viewed as financially literate, with the problem being more pronounced among women and young individuals. Furthermore, the Central Bank of Cyprus (2021) survey finds that Cyprus ranks relatively low in terms of financial literacy compared to other European Union countries. Equivalently, Demertzis, et al (2020) find that Cyprus ranks very high in terms of financial fragility in the European Union.[12] Cypriots rank among the lowest in terms of savings in bank accounts and among the highest in terms of household debt. Moreover, one out of two households in Cyprus are unable to meet an unexpected, required expense equal to the household's monthly income. At the same time, according to a 2019 AON Hewitt Cyprus survey on retirement readiness, the average Cypriot employee will have to work until the age of 72 in order to meet retirement adequacy and maintain their standard of living.[13] Andreou and Philip (2018) find low levels of financial literacy among university students in Cyprus.

### 2.2 Introduction of the new financial literacy course

The low levels of financial literacy in Cyprus have led various bodies in Cyprus to take initiatives to remedy the situation. One such initiative was made by the University of Cyprus in 2015 by proposing the replacement of an existing elective course in economics taught in upper secondary education to be replaced by a course in Personal Finance. While this proposal was at first well received by the Cyprus Ministry of Education, Sport and Youth, it did not develop further. Other initiatives followed by professional associations related to the financial services industry to offer single-day workshops (of duration 1–6 h) primarily to high school students.

In September 2020 the Department of Accounting and Finance of the University of Cyprus became the first public university in Cyprus to introduce a Financial

[10] Troika is a decision group formed by the European Commission, the European Central Bank, and the International Monetary Fund. The crisis led into strict austerity measures, the closure of the country's second-largest bank and prolonged capital controls (see Zenios 2013 and Michaelides 2014 for details on the 2013 Cypriot Crisis, and Zenios 2016, for the bailin).

[11] http://gflec.org/initiatives/sp-global-finlit-survey/.

[12] Lack of financial literacy is an important determinant of financial fragility (Lusardi et al. 2021).

[13] http://www.aonhewitt.com.cy/english/About/News?id=13.

Education course to its students.[14] The idea was that since there was no systematic exposure of Cypriot secondary education students (about 9000 students per year) to finance in general but also to personal finance, the situation could be remedied by the students accepted at the University of Cyprus (about 1200 students), by having an opportunity to take a course at the university. Since the University of Cyprus enjoys the highest degree of perceived credibility from the population of Cyprus,[15] it could set an example for others to follow.

The course is mandatory for all first year students of the Department of Accounting and Finance. It is offered as an elective for all University of Cyprus students and has been running with full enrolment since first offered. It is attracting students from all years of study from most academic departments at the university, including engineering, mathematics & statistics, law, psychology, physics, history & archaeology, languages (e.g., French, English), computer science, sociology, education, together with business administration and economics. In general, students in the control group lack sufficient financial knowledge to start with. Four sections were offered in the Fall Semester of 2020, one section in the Spring Semester and one section in the summer. In the academic year 2023–2024 an additional summer section was offered to satisfy excess demand. The second largest public university followed suit offering a course in personal finance for their students in the following years, which has also been offered since then.

As a result of this course offering, the University of Cyprus was invited to participate in the Ad-hoc Committee to draft the National Strategy of Financial Literacy and Education. The committee was formed in December 2020 under the auspices of the Central Bank. The University of Cyprus was also asked to draft a financial education course by a private school in secondary education in Cyprus, for its students. This pilot course in Financial Education was offered from September 2021 until April 2022. The success of this newly introduced course prompted the majority of private, secondary education schools in Cyprus (15 schools, servicing about 2/3 of the student population) to commit in including financial education in their programs from September 2022. In June 28, 2022 the Council of Ministers of the Republic of Cyprus adopted the National Strategy on Financial Literacy and Education in Cyprus, as proposed by the Ad-hoc Committee.[16]

The financial education course at the University of Cyprus has a duration of the full 13-week semester, with two 75-min lectures each week. It draws from contemporary topics in personal finance and assesses students on a major project and two exams. The topics of financial literacy covered by the course include interest rate compounding, inflation, risk and return, and consumer biases. The course also extends into real-life problems and applications such as money management,

[14] To develop this course, best practices from around the globe were reviewed and then adjusted to Cyprus-specific characteristics, such as the tendency to consume and borrow more and also to save less than the average European. Course material was developed in both Greek and English. This material has been adjusted using feedback from students, instructors, other academics and industry professionals from Cyprus.

[15] See the latest survey results of September 2024 at https://www.stockwatch.com.cy/el/article/ereynes-stockwatch/ston-pato-i-axiopistia-thesmon-veltiosi-gia-elegkti, accessed Nov. 2024.

[16] https://www.centralbank.cy/el//announcements/financial-literacy-28-06-2022.

budgeting, saving, consumer borrowing, setting financial goals, mortgage, insurance, investments, and pension and retirement. Throughout the course, students are also made familiar with concepts of digital financial literacy.

Our study measures the impact of the introduction of this course on the financial knowledge of registered students and, importantly, the spillover effects from these students to their parents. To address concerns about potential contamination of the treatment group from other initiatives that might be taking place in the country, we use a control group of university students and their parents, who are not registered for the course. Given that the course was offered during the Covid-19 pandemic period (September 2020–December 2020), over which strict health protocols were imposed since the first vaccines arrived in Cyprus after the end of the course, student interaction was also reduced. Moreover, first-year students in accounting and finance were required to take the course in their first semester when all their courses were predetermined, making it difficult to interact with students from other cohorts.

College students, in contrast to high school students, are typically adults that are likely to face soon, or are facing already, critical decisions that could affect their future financial wellbeing. Thus studies on college interventions, unlike studies examining high school interventions (see Walstad et al. 2010; Lührmann et al. 2015; Mandell and Klein 2009 among other), allow an examination of the treatment effects very close to important decisions and behavior adjustments.[17] However, none of these studies have investigated spillover effects for university students. In our paper, we study spillover effects from university students to their parents, where university students are less likely to live at home and have less frequent interaction with their family than high school students, while, on the other hand their interactions can be more influential. Hence, they are quite distinct from high school students as a potential medium for knowledge transfer.

Among the existing studies that focus on the effect of intervention programs aiming to increase the level of financial literacy of college students, Brugiavini et al., (2020) use a 20-min financial education intervention to examine its effect on financial knowledge in a test that took place at the completion of the intervention. They find an increase in both perceived and actual financial knowledge at the completion of the course. Similarly, Popovich et al. (2020) finds that a 38-min-long series of short digital learning objects positively affects college student's financial knowledge following the course. Borden et al. (2008) find that a one-and-a-half-hour financial education seminar has a positive effect on the post-test financial knowledge and attitudes. Similar results are reported by Bowen and Jones (2006) in a study that examines the effects of a 6-h classroom seminar. In their meta-analysis, Kaiser and Menkhoff (2017) find that the intensity of an intervention matters for its effectiveness. We corroborate these studies with results from a semester-long course, as expected.[18]

[17] Fernandes et al. (2014) in a metanalysis of the relationship between financial literacy and financial behaviors finds that intervention effects tend to decay over time and provides evidence in favour of scheduled interventions right before expected behaviors-time. More recent robust evidence to this effect is provided by Kaiser et al. (2022) and Kaiser and Lusardi (2024).

[18] This course offers more opportunities for instructors to highlight several teachable moments for students at university as they manage their own monthly budget to a certain extent. Such moments could be the loss of a part-time job without savings and impulse purchases online especially with credit cards.

Importantly, however, we complement these studies by documenting significant spillover effects.

## 3 Survey setup

We conduct the following survey with the use of both treatment and control groups and conduct pre-test and post-test evaluations. We use the 2018 OECD/INFE (International Network on Financial Education) Toolkit (OECD 2018) for measuring financial literacy and financial inclusion along with the Toolkit's proposed questionnaire in order to assess the surveyed individuals financial knowledge as well as the identification of their demographic characteristics.[19,20] The questionnaire was translated in the Greek language following the instructions provided by OECD.

Our survey was conducted in two waves, one at the beginning of the course (September 2020) and one at the end of the course (December 2020). The participants include University of Cyprus students and their parents. Our student samples consist of those students who registered for the financial education course (treatment group) and other students from the university who did not register for the course (control group). Moreover, the parents of students in the treatment group are used as the treatment group in our knowledge spillovers analysis while the parents of the students serving as the control group are the control group for the spillover effect.

The parent and student questionnaires are almost identical. The only difference is the inclusion of two additional questions in the students' questionnaire on the frequency of student-parent interactions. The first question asks students whether they live with their parents. The second question is only presented to students who answer that they do not live with their parents, and it asks about the weekly or monthly frequency of face-to-face interactions with their parents.[21]

## 4 Data

### 4.1 Data construction

In order to evaluate the effect of the financial education course on the students registered for the course, as well as their parents, we construct various variables from questionnaires answered by students and parents at the beginning and the end of the course. We follow the OECD (2018) methodology and compute financial knowledge scores as the number of correct responses to seven financial

[19] The toolkit offers methodological guidance for measuring financial literacy and financial inclusion. According to the authors, since 2010, the year that the questionnaire was first piloted, it has been successfully used to capture financial literacy of diverse populations. Moreover, the Toolkit was welcomed by G20 leaders in September 2013.

[20] The questionnaire can be found in Sect. 3 of the Toolkit (pages 11–33): http://www.oecd.org/financial/education/2018-INFE-FinLit-Measurement-Toolkit.pdf.

[21] The questions are presented in Appendix A1.

knowledge questions that cover the following topics: time value of money, interest paid on a loan, simple interest calculation, interest compounding, risk and return, inflation and diversification. Scores range from 0 to 7. The initial (final) financial knowledge score is based on the answers to the same questionnaires provided at the beginning (end) of the course; the questions are given in Appendix A2.

We calculate the change in financial knowledge score between the final and initial score. To distinguish between the student control and treatment group, we construct the indicator variable *S_Treat* that takes the value of 1 if the student registered for the course and 0 otherwise. Similarly, indicator variable *P_Treat* is used to distinguish between the parent control and treatment group.

Next, we quantify the frequency of interaction between students and parents by constructing the indicator variable *Home*. This variable takes the value of 1 (otherwise 0) if the student lives at home with the parent or if the parent meets face-to-face with the student (his/her child) at least five times per week. We conduct subsample analysis based on the *Home* variable to test if the frequency of interaction between parents and students plays a role on a potential spillover effect.

We also construct various variables for demographic characteristics to capture the main differences in financial knowledge recorded by the Central Bank of Cyprus (2021) study. Specifically, the study finds lower financial knowledge scores in younger people, women, people with lower education, and people with lower income; these results are consistent with similar studies in other countries (e.g. Bucher-Koenen and Lusardi 2011; Cupák et al. 2018; Hasler and Lusardi 2017; Klapper and Panos 2011; Lusardi et al. 2010, 2017; Mandell 2008; OECD 2020). Therefore, we use the following variables to capture these differences. *Female* is an indicator variable that takes the value of 1 if the individual is female and 0 if male. We use four categories of monthly household net income: *900€ or lower* (used as the benchmark category), *between 900€ and 1600€*, *1600€ or higher,* and people who responded "*Don't know*". *30_or_greater* is an indicator value that takes the value of 1 if the student's age is 30 or greater and 0 otherwise. Similarly, in the parents' analysis, *50_or_greater* indicates if the parent's age is 50 or greater and 0 otherwise. Also, we identify the parent's education using the *Above_Secondary* indicator with value 1 for those parents with higher than secondary level education, and 0 otherwise.

Data was collected via an online questionnaire, delivered to the students' university email address and to the email of their parents provided by the students. So, the responses are tied to the respective emails. Students were asked that at least one of their parents should complete the questionnaire and that they should not complete the questionnaire on behalf of their parents. Still, we cannot rule out that parents sought out information in completing the questionnaire.

### 4.2 Sample description

Table 1 shows the demographic characteristics of the student sample. The total number of students is 284, out of which 134 took the financial education course (treatment group) and 150 did not (control group). From the sample of 284 students, 71%

of respondents are female, and 29% are male. Around 97% of students are in the 18–29 age group, while less than 3% are above 30 years old. These numbers are consistent with the overall undergraduate population at the University of Cyprus (63% female, 3% are 30 years or older). Finally, around 11% of the students report that their net monthly household income is lower than € 960, 19.6% report net monthly household income between €960 and €1600 while around 40% report € 1,600 or higher.[22] A significant number of students (29.2%) reported "don't know" on the household income question.

Table 2 presents descriptive statistics of the parents' sample. The sample comprises 135 parents, 84 of which are in the treatment group and 51 are in the control group. 64% of the parents who responded are female, and 36% are male. In terms of their age, around 58% of parents are below 50 years of age, with the remaining over 50. Around 58% of the parents have higher than secondary level education, while the rest have high school or lower education. Around 7% of parents report net monthly income lower than € 960, 23% between €960 and €1600 and around 66% over € 1,600. Around 4% of the parents did not indicate their household income.

## 5 Empirical analysis

### 5.1 Descriptive analysis of financial knowledge scores

Table 3 presents the average financial knowledge scores for students that took part in our survey before ("Initial Score") and after ("Final Score") the course began. Starting from the first row showing the entire sample ("All"), we observe an initial average knowledge score of 4.2 out of 7 and an average post-treatment score of 4.8 out of 7. The improvement in the initial knowledge score is 0.6 units (about 14%), and it is statistically significant ($p$ value $< 0.01$). This increase documented on the entire sample is driven by the respective increase in the knowledge score of the treatment group. Specifically, when we focus on the Treatment and Control groups, we observe no statistically significant change in the knowledge score of the control group.[23] On the contrary, we observe a significant improvement in the knowledge score of the treatment group from an initial score of 4.5 out of 7 to a final score of 5.9 out of 7, thus generating an improvement of 1.4 units (31%).[24,25]

We take a deeper look into the treatment group by splitting this group into those with high and low initial knowledge scores. According to OECD (2016), individuals with a score of at least 5 out of 7 are considered financially knowledgeable. Hence,

[22] We follow the OECD/INFE toolkit's suggestions to specify the income thresholds in the questionnaire, which are the same income thresholds used by the Cyprus National Statistics Office.

[23] This result also suggests that being exposed to the questionnaire twice, did not produce a "learning" effect, either through familiarity with the questionnaire or through people educating themselves.

[24] These differences remain, when we replicate Table 3 on the subsample of students whose parents responded to the questionnaires.

[25] We provide further details on the distribution of correct/incorrect/don't know answers before and after the treatment across groups; see Appendix Tables A1–A2.

**Table 1** Students' sample distribution

| | | Treatment | | Control | | Total | |
|---|---|---|---|---|---|---|---|
| | | # | % | # | % | # | % |
| Treatment | | 134 | 47.18 | 150 | 52.82 | 284 | 100.00 |
| Gender | Female | 85 | 30.04 | 116 | 40.99 | 201 | 71.02 |
| | Male | 48 | 16.96 | 34 | 12.01 | 82 | 28.98 |
| Age group | Below 30 | 130 | 45.77 | 146 | 51.41 | 276 | 97.18 |
| | 30 and above | 4 | 1.41 | 4 | 1.41 | 8 | 2.82 |
| Net household income | Up to €960 | 9 | 3.20 | 23 | 8.19 | 32 | 11.39 |
| | Between €960 and €1,600 | 27 | 9.61 | 28 | 9.96 | 55 | 19.57 |
| | €1,600 or more | 60 | 21.35 | 52 | 18.51 | 112 | 39.86 |
| | Don't Know | 37 | 13.17 | 45 | 16.01 | 82 | 29.18 |

The table presents the descriptive statistics of the students' sample, in total, and also separately for the control and treatment samples. The treatment group comprises the students who registered for the newly introduced Financial Education course at the University of Cyprus in September 2020. The control group comprises students who did not register for this Financial Education course over the same period. The demographic characteristics are gender, age (below 30 years of age or 30 and above) and 4 net monthly household income categories: (a) up to €960; (b) between €960 and €1,600; (c) €1,600 or more; and (d) those that said "Don't Know"

**Table 2** Parents' sample distribution

| | | Treatment | | Control | | Total | |
|---|---|---|---|---|---|---|---|
| | | # | % | # | % | # | % |
| Treatment | | 84 | 62.22 | 51 | 37.78 | 135 | 100 |
| Gender | Female | 54 | 40.91 | 30 | 22.73 | 84 | 63.64 |
| | Male | 27 | 20.45 | 21 | 15.91 | 48 | 36.36 |
| Age group | Below 50 | 47 | 36.15 | 28 | 21.54 | 75 | 57.69 |
| | 50 and above | 33 | 25.38 | 22 | 16.92 | 55 | 42.31 |
| Education level | Above secondary level | 44 | 33.85 | 32 | 24.62 | 76 | 58.46 |
| | Secondary level or below | 36 | 27.69 | 18 | 13.85 | 54 | 41.54 |
| Net household income | Up to 960 € | 6 | 4.62 | 3 | 2.31 | 9 | 6.92 |
| | Between €960 and €1,600 | 19 | 14.62 | 11 | 8.46 | 30 | 23.08 |
| | €1,600 or more | 53 | 40.77 | 33 | 25.38 | 86 | 66.15 |
| | Don't Know | 2 | 1.54 | 3 | 2.31 | 5 | 3.85 |

The table presents the descriptive statistics of the parents' sample, in total, and also separately for the control and treatment samples. The treatment group comprises the parents of the students who registered for the newly introduced Financial Education course at the University of Cyprus in September 2020. The control group comprises parents of students who did not register for this Financial Education course over the same period. The demographic characteristics are: gender, age (below 50 years of age or 50 and above), education (those with education up to the secondary level and those with above secondary level education) and 4 net monthly household income categories: (a) up to €960; (b) between €960 and €1,600; (c) €1,600 or more; and (d) those that said "Don't Know"

we categorize students within the treatment group into the low initial knowledge score group if they have scored less than 5 out of 7 and in the high initial score group if they scored at least 5 out of 7. The statistics of the two groups suggest a larger improvement in the financial knowledge score for those students with a low initial financial knowledge score. Specifically, students with low initial score experience an increase in financial knowledge of 2.2 units (improvement of 69%), that is, from an initial score of 3.2 to a final score of 5.4. On the other hand, students with a high initial score also experience a statistically significant increase in the financial knowledge score of only 0.6 units (10% improvement), from 5.8 to 6.4 units.

To control for the fact that the elective course students are not all first-year, we included the year of study as a control variable in the updated tables. The results (available upon request) indicate that first-year students perform better overall compared to students from other years, with the difference being weakly statistically significant (at the 10% level) when comparing first-year students to third-year students, and statistically significant (at the 5% level) for fourth-year students. Hence, it appears that, even though in the elective course, students are older than those in the required course, we do not find evidence that they might be doing better than first year students with respect to financial knowledge. This is partly justified by the fact that students in the elective course are students outside the Accounting and Finance department and come from other departments of the university starting with lower levels of financial knowledge.[26]

We have also conducted additional robustness tests to control for age and year and age of study. From these tests we observe (results not shown, available from the authors) that the first year students increase their financial knowledge more than 4th year students (5% significance) and only weakly more than 3rd year students (19% significance). This result is echoed when age groups are added where students over 20 years old have smaller increase in financial knowledge than the rest. When both the year of study and age are added, only the result for the year of study survives.

Turning to the parents' sample, Table 4 presents the results of the average initial and final financial knowledge scores. The pre-treatment average score of all parents ($n = 135$) is around 4.7 out of 7, which is about half a unit more than the financial knowledge score of students reported in Table 3. A similar difference is recorded in the most recent study with a representative sample of the Cypriot population on financial literacy conducted by the Central Bank of Cyprus (2021). Specifically, the Central Bank of Cyprus (2021) study reports that the age group 18–29 has an average score of 4.4, while age groups 40–49 and 50–59 have average scores of 5.3 and 4.6, respectively. Turning to the final score, we observe that it is almost identical to the initial score, and the difference is not statistically significant. Similar results are

[26] The control group scores 3.9 out of 7 in the initial measurement. This result echoes a result from the recent study of the Central Bank of Cyprus (2021), where financial knowledge is shown to be lower if people have not been exposed to economic courses during secondary education (high schools). Since accounting and finance students (who register for the required course) are typically exposed to economic courses in high schools, then this result makes sense. Students from other departments, such as engineering, mathematics, physics, and history, are very unlikely to be exposed to economics courses in high school.

**Table 3** Students' financial knowledge scores in September 2020 and December 2020

| Group | N | Final score | Initial score | Difference | Standard error | *p* value |
|---|---|---|---|---|---|---|
| All | 284 | 4.774 | 4.190 | 0.585 | 0.112 | 0.000*** |
| Treatment group | 134 | 5.910 | 4.515 | 1.396 | 0.144 | 0.000*** |
| Control group | 150 | 3.760 | 3.900 | −0.140 | 0.145 | 0.336 |
| *Treatment group* | | | | | | |
| – Low initial score | 67 | 5.448 | 3.239 | 2.209 | 0.223 | 0.000*** |
| – High initial score | 67 | 6.373 | 5.791 | 0.582 | 0.115 | 0.000*** |

This table presents the average financial knowledge score for students recorded at the beginning of the course in September 2020 ("Initial Score") and at the end of course in December 2020 ("Final Score"). The table also shows the Difference between the Initial and Final scores, as well as the standard error and the p-value of this difference. The results are presented for all students in our sample ("All") and separately also for the treatment group and the control group. The treatment group comprises the students who registered for the newly introduced Financial Education course at the University of Cyprus in September 2020. The control group comprises students who did not register for this Financial Education course over the same period. Finally, we split the treatment group into those students with "Low Initial Score", i.e., those with initial financial knowledge score lower than 5 out of 7, and "High Initial Score", i.e., those with initial financial knowledge score of at least 5 out of 7. *** denote statistical significance at the 1% level

shown in the second and third row where we report the scores for the treatment and control groups.

Following the rationale in Table 3, we split the parents' sample into subsamples of high and low initial financial scores (fourth and fifth rows respectively). A weakly significant ($p$ value $< 0.10$) difference is obtained in the subsample of low initial financial score. On the other hand, the scores for the subsample of high initial score are not statistically different from each other.

We take the univariate analysis a step further in the subsample of low initial score to understand if the frequency of interaction between students and parents matters (sixth and seventh row).[27] Results from simple t-tests, show a statistically significant difference between the initial and final scores of the subsample of parents with low initial scores and high face-to-face interaction with their child. Specifically, the initial score is 2.5 and increases by 1.4 units ($p$ value $< 0.01$) to reach the final score of 3.9; this is an improvement exceeding 50%.

In summary, the descriptive statistics on the student sample show an (expected) improvement in the financial knowledge score of those students who registered for the course. This evidence is consistent with the literature showing that financial education interventions improve financial knowledge. Our results reinforce previous results since our study is based on an intervention of a longer duration than the one used in the literature. Furthermore, we use both treatment and control groups, which are not typical of the literature. Moreover, we observe that the improvement in financial knowledge is larger for registered students with a

[27] We note that there are four observations with a missing value for the Home variable, which accounts for the difference between the sum of the observations with Home = 0 and Home = 1 (80) not being equal to the sample size of the treatment group (84).

**Table 4** Parents' financial knowledge scores in September 2020 and December 2020

| Group | N | Final score | Initial score | Difference | Standard error | *p* value |
|---|---|---|---|---|---|---|
| *Panel A* | | | | | | |
| All | 135 | 4.660 | 4.674 | −0.020 | 0.157 | 0.924 |
| Treatment Group | 84 | 4.869 | 4.715 | 0.155 | 0.205 | 0.453 |
| Control Group | 51 | 4.314 | 4.608 | −0.290 | 0.237 | 0.220 |
| Treatment group | | | | | | |
| – Low Initial Score | 33 | 3.364 | 2.606 | 0.758 | 0.426 | 0.085* |
| – High Initial Score | 51 | 5.843 | 6.079 | −0.24 | 0.178 | 0.194 |
| – Home = 0 | 21 | 4.572 | 4.715 | −0.140 | 0.38 | 0.711 |
| – Home = 1 | 59 | 5.136 | 4.763 | 0.373 | 0.241 | 0.128 |
| *Panel B* | | | | | | |
| Treatment group & Home = 1 | | | | | | |
| – Low Initial Score | 21 | 3.905 | 2.524 | 1.381 | 0.480 | 0.009*** |
| – High Initial Score | 38 | 5.816 | 6.000 | −0.180 | 0.223 | 0.414 |

This table presents the average financial knowledge score for parents, recorded in September 2020 ("Initial Score") and in December 2020 ("Final Score"). The table also shows the Difference between the Initial and Final scores, as well as the standard error and the p-value of this difference. In Panel A, the results for all parents in our sample ("All") and separately also for the treatment group and the control group, are presented. The treatment group comprises the parents of the students who registered for the newly introduced Financial Education course at the University of Cyprus in September 2020. The control group comprises parents of students who did not register for this Financial Education course over the same period. Next, we split the treatment group into those parents with "Low Initial Score", i.e., those with initial financial knowledge score lower than 5 out of 7, and "High Initial Score", i.e., those with initial financial knowledge score of at least 5 out of 7. Finally, the treatment group is split into subgroups based on the "Home" indicator variable. "Home" takes the value of 1 if students either live at home with their parents or meet face-to-face with their parents at least five times a week. In panel B, we further split the Treatment group conditional on the "Home" indicator. ***, **, and * denote statistical significance at the 1%, 5% and 10% level, respectively

low initial financial knowledge score, than registered students with a high initial score. Importantly, we observe early evidence of a spillover effect of financial education from the classroom to home. Results show that parents with low initial knowledge scores, whose children have attended the financial education course, have a positive and statistically significant improvement in their financial knowledge score, if they have high frequency of face-to-face interactions. We test the robustness of this early evidence of the spillover effect using a multivariate analysis in the next section.

### 5.2 Impact of the course on students' knowledge

We now evaluate the effect of the course on the registered students using multivariate analysis. The dependent variable is the difference between the initial and final financial knowledge scores of all students (control and treatment group). The main explanatory variable is an indicator variable identifying the treatment group (*S_Treat*). The control variables we use are the initial knowledge score and

demographic characteristics of the individuals, such as indicator variables for the gender, age group, and net monthly household income.

We show the results in Table 5, in four different models that progressively add control variables to the regression model. The simplest model (column 1) uses *S_Treat* and initial knowledge score as explanatory variables. We then add gender (column 2), age group (column 3), and finally, the different income indicators (column 4). Results confirm the evidence in Table 3 and document an improvement of more than 1.8 units out of 7 in the financial knowledge scores of the treatment group ($p$ value $< 0.01$) compared to the control group. This improvement is robust to all specifications. Turning to the control variables, we note a negative and statistically significant coefficient ($p$ value $< 0.01$) on the initial knowledge score, which suggests that students with a lower initial knowledge score experience a higher increase in financial knowledge score. A similar explanation applies to households with higher incomes, while no statistical significance obtains for gender and age.[28]

### 5.3 Spillover effects

To test for spillover effects in financial knowledge from the students to parents, we use a similar multivariate setting. The dependent variable is now the difference between the parents' initial and final financial knowledge scores. We use two main explanatory variables in our model. The first (*P_Treat*) is an indicator variable to identify the parents of the students who registered for the course. The second variable indicates if parents have a high or low frequency of interaction with their children (*Home*). The main control variables are the parents' initial knowledge score and demographic characteristics such as indicators for gender, age group, education, and thresholds of the net monthly household income.

Table 6 presents the results testing for financial knowledge spillover effects. In column 1 we use the variables *P_Treat, Home*, and the initial financial knowledge score of parents, and progressively add the indicator for gender (column 2), education (column 3), age group (column 4) and household income (column 5). We note, however, a smaller number of observations compared to the models in Table 5 due to the lower response rate of parents in our questionnaire.

The coefficient of *P_Treat* is positive and statistically significant in the first two models, suggesting a spillover effect in financial knowledge from the student to the parents. This improvement in the financial knowledge score of parents is economically significant as it is about 0.6 units from an initial financial knowledge score of parents of 4.7 (an improvement of about 13%). The coefficient of *P_Treat* remains qualitatively the same in the third, fourth and fifth models when more control variables are added (columns 3–5), albeit with a lower statistical significance in columns 3 and 4, and the same statistical significance in column 5. With respect to the rest of the control variables, we note that the coefficient of the initial financial knowledge

[28] It is worth emphasizing that while several studies including the most comprehensive study by the Central Bank of Cyprus (2021) show that financial knowledge is lower among women in the entire population, we do not find evidence that female students in our student have different financial knowledge scores than male students.

**Table 5** Change in students' financial knowledge score

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| S_Treat | 1.847*** | 1.830*** | 1.832*** | 1.837*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Initial financial knowledge score | −0.507*** | −0.531*** | −0.536*** | −0.547*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Gender* | | | | |
| Female | | −0.215 | −0.217 | −0.146 |
| | | (0.288) | (0.284) | (0.473) |
| *Age group* | | | | |
| 30 and above | | | 0.487 | 0.436 |
| | | | (0.233) | (0.281) |
| *Monthly household net income* | | | | |
| 900€ or lower | | | | −0.147 |
| | | | | (0.626) |
| Between 900€ and 1600€ | | | | −0.532** |
| | | | | (0.038) |
| Don't know | | | | −0.385* |
| | | | | (0.096) |
| Intercept | 1.836*** | 2.098*** | 2.107*** | 2.337*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| N | 284 | 283 | 283 | 280 |
| Adjusted R2 | 0.348 | 0.348 | 0.347 | 0.354 |

The table presents the results of multivariate regressions of the difference between the final and initial Students' Financial Knowledge Scores on various explanatory variables. S_Treat is an indicator variable that takes the value of 1 if the student was in the treatment group and 0 otherwise. Initial Financial Knowledge Score is the student's financial knowledge score in September 2020. Female takes the value of 1 if the student is female and 0 if the student is male. "30 and above" takes the value of 1 if the student's age is 30 or greater and 0 otherwise. Four categories of monthly household net income are used, which are represented using indicator variables as follows: "900€ or lower", "Between 900€ and 1600€", "1600€ or higher" (used as the benchmark category) and people who responded "Don't know". We use robust standard errors. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively

score of parents is negative and statistically significant, suggesting that the higher the initial financial knowledge score, the lower the overall increase in the financial knowledge of parents at the end of the period. The results are consistent with those of Table 5. We also observe weak statistical significance on the control variables for gender and education, in line with the results of the Central Bank of Cyprus (2021). Education and household income variable coefficients are not statistically significant. Similarly, turning to the *Home* variable, we do not observe any statistical significance in this model specification.

We take our analysis a step further to test if the level of interaction between parents and students plays a role in the increase of the parent's financial knowledge score as a result of the spillover from their children. This further analysis is motivated by the univariate results of Table 4. To test if the spillover effect is conditional

**Table 6** Change in parents' financial knowledge score

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| P_Treat | 0.618** | 0.654** | 0.533* | 0.532* | 0.566** |
| | (0.041) | (0.030) | (0.054) | (0.055) | (0.044) |
| Home | 0.151 | 0.00107 | −0.0383 | −0.0369 | 0.0178 |
| | (0.659) | (0.997) | (0.908) | (0.911) | (0.959) |
| Initial financial knowledge score | −0.454*** | −0.526*** | −0.406*** | −0.406*** | −0.390*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Gender* | | | | | |
| Female | | −0.533* | −0.282 | −0.271 | −0.293 |
| | | (0.093) | (0.358) | (0.421) | (0.394) |
| *Education* | | | | | |
| Above Secondary | | | 0.532* | 0.529* | 0.579* |
| | | | (0.080) | (0.076) | (0.064) |
| *Age group* | | | | | |
| 50 and above | | | | 0.0316 | 0.0403 |
| | | | | (0.915) | (0.896) |
| *Monthly household net income* | | | | | |
| 900€ or lower | | | | | 0.163 |
| | | | | | (0.735) |
| Between 900€ and 1600€ | | | | | 0.186 |
| | | | | | (0.602) |
| Don't know | | | | | 0.520 |
| | | | | | (0.402) |
| Intercept | 1.666*** | 2.439*** | 1.396** | 1.378* | 1.136 |
| | (0.003) | (0.000) | (0.049) | (0.064) | (0.178) |
| N | 122 | 119 | 115 | 115 | 115 |
| Adjusted $R^2$ | 0.261 | 0.292 | 0.170 | 0.162 | 0.144 |

The table presents the results of multivariate regressions of the difference between the final and initial parents' Financial Knowledge Scores on various explanatory variables. P_Treat is an indicator variable that takes the value of 1 for the parent of a registered student and 0 otherwise. Initial Financial Knowledge Score is the parent's financial knowledge score in September 2020. Home is an indicator variable taking the value of 1 if the student lives at home with parents or if he/she has very frequent, face to face interaction with parents (at least five times a week). Female takes the value of 1 if the parent is female and 0 if the parent is male. Above Secondary is an indicator variable that takes the value of 1 for parents with higher than secondary level education and 0 otherwise. "50 and above" takes the value of 1 if the student's age is 50 or greater and 0 otherwise. Four categories of monthly household net income are used, which are represented using indicator variables as follows: "900€ or lower", "Between 900€ and 1600€", "1600€ or higher" (used as the benchmark category) and people who responded "Don't know". We use robust standard errors. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively

on the level of interaction between parents and students, we conducted sub-sample analysis by splitting the original sample into those parents with high interaction (*Home* = 1) and low interaction (*Home* = 0) with their children (Table 7).

**Table 7** Change in parents' financial knowledge score–subsample analysis

| | Home = 1 | | | | | Home = 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| P_Treat | 0.898** | 0.891** | 0.702** | 0.700** | 0.713** | −0.539 | −0.406 | −0.380 | −0.351 | −0.132 |
| | (0.010) | (0.011) | (0.024) | (0.026) | (0.027) | (0.146) | (0.336) | (0.436) | (0.464) | (0.800) |
| Initial financial knowledge score | −0.535*** | −0.567*** | −0.422*** | −0.423*** | −0.411*** | −0.292** | −0.448*** | −0.470** | −0.502** | −0.504* |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.017) | (0.009) | (0.031) | (0.040) | (0.058) |
| *Gender* | | | | | | | | | | |
| Female | | −0.412 | −0.185 | −0.160 | −0.168 | | −0.786 | −0.679 | −1.168 | −1.393 |
| | | (0.239) | (0.602) | (0.665) | (0.658) | | (0.161) | (0.260) | (0.358) | (0.375) |
| *Education* | | | | | | | | | | |
| Above secondary | | | 0.463 | 0.460 | 0.461 | | | 0.706 | 0.906 | 1.084 |
| | | | (0.182) | (0.182) | (0.241) | | | (0.311) | (0.151) | (0.176) |
| *Age group* | | | | | | | | | | |
| 50 and above | | | | 0.0943 | 0.0803 | | | | −0.699 | −0.715 |
| | | | | (0.764) | (0.822) | | | | (0.547) | (0.575) |
| *Monthly household net income:* | | | | | | | | | | |
| 900€ or lower | | | | | −0.0176 | | | | | 0.358 |
| | | | | | (0.976) | | | | | (0.772) |
| Between 900€ and 1600€ | | | | | 0.0669 | | | | | 0.562 |
| | | | | | (0.880) | | | | | (0.534) |
| Don't know | | | | | 0.403 | | | | | 0.836 |
| | | | | | (0.643) | | | | | (0.398) |
| Intercept | 2.022*** | 2.412*** | 1.313** | 1.267* | 1.185 | 1.771** | 3.023*** | 2.607* | 3.272 | 2.897 |
| | (0.000) | (0.001) | (0.050) | (0.075) | (0.147) | (0.010) | (0.007) | (0.097) | (0.169) | (0.251) |
| N | 95 | 93 | 90 | 90 | 90 | 27 | 26 | 25 | 25 | 25 |
| Adjusted $R^2$ | 0.327 | 0.335 | 0.184 | 0.175 | 0.147 | 0.122 | 0.151 | 0.092 | 0.078 | −0.053 |

The table presents the results of multivariate regressions of the difference between the final and initial parents' Financial Knowledge Scores on various explanatory variables. The results are presented separately for cases where a student lives at home with parents or if he/she has very frequent, face to face interaction with parents (Home = 1) and the rest of the sample (Home = 0). P_Treat is an indicator variable that takes the value of 1 for the parent of a registered student and 0 otherwise. Initial Financial Knowledge Score is the parent's financial knowledge score in September 2020. Female takes the value of 1 if the parent is female and 0 if the parent is male. Above Secondary is an indicator variable that takes the value of 1 for parents with higher than secondary level education and 0 otherwise. "50 and above" takes the value of 1 if the student's age is 50 or greater and 0 otherwise. Four categories of monthly household net income are used, which are represented using indicator variables as follows: "900€ or lower", "Between 900€ and 1600€", "1600€ or higher" (used as the benchmark category) and people who responded "Don't know". We use robust standard errors. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively

Results in Table 7 document a spillover effect in the subsample of parents who have high interaction with their children (*Home* = 1), as the coefficient of *P_Treat* is positive and statistically significant. The size of the coefficient is also sizable as it ranges from 0.65 to 0.90 units. Turning to the subsample of parents with low interaction with their children, we do not obtain any significant results on the *P_Treat* variable. While the spillover effect on financial knowledge is clearly documented in the high interaction subsample, we note that the sample size in the low interaction subsample is small.

One potential concern relates to sample selection bias in the financial education course. For example, some students might choose to take the course because they have extra incentives to learn and spread the knowledge over their network. Running our tests on the sample of students who were required to take the course (see Appendix Table A3) we find that our results are robust, alleviating this concern.[29]

## 6 Conclusion

In this paper we evaluate the impact of the introduction of a financial education university course in a country with documented low levels of financial literacy. To our knowledge, this is the first study to use a financial education intervention of a full-semester university course. We further use a quasi-experimental design with treatment and control groups, by measuring the financial knowledge score before and after the introduction of the course, to test for potential spillover effects from students registered for the course and their parents.

After controlling for the initial knowledge score as well as demographic characteristics that may have an impact on the level of financial knowledge, we first document an increase in financial knowledge for the treated group relative to the control group. While this increase in financial knowledge is expected given the exposure of students to the financial education material, if the new course was effective in achieving its goals, it is important to document it before we test for spillover effects of this increase in knowledge to the treated group's parents.

We then provide our main evidence of a financial knowledge spillover effect on the parents whose children are registered for this course. Moreover, when splitting the treated sample into parents who have high and low interaction with their children, we find that the result is driven by the subsample of high interaction between parents and children (students).

Our findings have important policy implications for the advancement of financial literacy. In the aftermath of the the 2008 financial crisis, governments around the globe are developing national strategies in order to enhance financial education efficiency with a particular focus on young individuals.

[29] This robustness test cannot be performed for the spillover tests to parents since not both subgroups of parents (i.e. Home = 1 and Home = 0) have enough observations for a meaningful analysis. The "Home = 1" subgroup has 62-65 observations while the subgroup of "Home = 0" only has 14-16 observations.

According to the 2017 OECD and G-20 report on financial literacy in G-20 countries, targeted financial education for young individuals is essential in order to develop the necessary knowledge and skills that will lead to positive behaviors and attitudes (OECD/G-20, 2017).

We show that financial education intervention programs of significant duration can have a multiplier effect through financial knowledge spillover effects from students to parents. Specifically, the positive effect a financial education course has on students' financial knowledge, as well as the multiplier effects associated with the introduction of a financial education program in the university curriculum, can motivate authorities around the globe to encourage academic institutions to pursue such knowledge interventions. Interestingly, the University of Cyprus intervention had significant spillover effects, not only on the parents of treated students but also to local high-schools and another public University, that introduced similar courses.

## Appendix

### Frequency of interaction questions–Student questionnaire

The following two questions were included in the Student questionnaire:

F1. Do you live with your parents?

- Yes
- No
- Don't know / Refused to answer

F2. How many times per week do you personally interact (face-to-face) with your parents?

- Everyday
- 5–6 times per week
- 3–4 times per week
- 1–2 times per week
- Less than 4 times a month

Note that question F2 showed up in the questionnaire only in the case that the students replied "No" in question F1.

### Financial Literacy questions

The correct responses are presented in bold.

#### Impact of inflation on spending power

Five brothers are going to be given a gift of €1,000 in total to share between them. Now imagine that the brothers have to wait for one year to get their share of the €1,000 and inflation stays at 2 percent. In one year's time will they be able to buy:

(a) More with their share of the money than they could today.
(b) The same amount.
(c) Less than they could buy today.
(d) It depends on the types of things that they want to buy.
(e) Different answer (respondents had the option to type an answer).
(f) Don't know.

#### Identification of interest

You lend €25 to a one evening and he gives you €25 back the next day. How much interest has he paid on this loan?

(a) Open response: _____ **(0 or 0%)**
(b) Don't know

#### Simple interest calculation

Imagine that someone puts €100 into a savings account with a guaranteed interest rate of 2% per year. They don't make any further payments into this account and they don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made?

(a) Open response: _____ **(€102)**
(b) Don't know

#### Understanding the implication of compounding

And how much would be in the account at the end of five years?

(a) More than $110.
(b) Exactly $110.
(c) Less than $110.
(d) Impossible to tell from the information given.
(e) Don't know.

#### Relationship between risk and reward

An investment with a high return is likely to be high risk.

(a) True
(b) False
(c) Don't know

#### Definition of inflation

High inflation means that the cost of living is increasing rapidly.

(a) True
(b) False
(c) Don't know

#### Risk diversification

It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stocks and shares.

(a) True
(b) False
(c) Don't know

See Tables 8, 9 and 10.

**Table 8** Descriptive statistics for all students, treatment, and control groups before and after the course

| Question indicator | Group | Before: correct (%) | Before: incorrect (%) | Before: don't know/ didn't answer (%) | After: correct (%) | After: incorrect (%) | After: don't know/ didn't answer (%) |
|---|---|---|---|---|---|---|---|
| Impact of inflation on spending power | All students | 113 (39.79) | 122 (42.96) | 49 (17.25) | 159 (55.99) | 86 (30.28) | 39 (13.73) |
| | Treatment | 60 (44.78) | 59 (44.03) | 15 (11.19) | 100 (74.63) | 30 (22.39) | 4 (2.99) |
| | Control | 53 (35.33) | 63 (42.00) | 34 (22.67) | 59 (39.33) | 56 (37.33) | 35 (23.33) |
| Identification of interest | All students | 256 (90.14) | 5 (1.76) | 23 (8.10) | 249 (87.68) | 6 (2.11) | 29 (10.21) |
| | Treatment | 127 (94.78) | 1 (0.75) | 6 (4.48) | 122 (91.04) | 4 (2.99) | 8 (5.97) |
| | Control | 129 (86.00) | 4 (2.67) | 17 (11.33) | 127 (84.67) | 2 (1.33) | 21 (14.00) |
| Simple interest calculation | All students | 209 (73.59) | 39 (13.73) | 36 (12.68) | 189 (66.55) | 52 (18.31) | 43 (15.14) |
| | Treatment | 108 (80.60) | 15 (11.19) | 11 (8.21) | 102 (76.12) | 22 (16.42) | 10 (7.46) |
| | Control | 101 (67.33) | 24 (16.00) | 25 (16.67) | 87 (58.00) | 30 (20.00) | 33 (22.00) |
| Understanding compounding | All students | 113 (39.79) | 139 (48.94) | 32 (11.27) | 158 (55.63) | 94 (33.10) | 32 (11.27) |
| | Treatment | 57 (42.54) | 70 (52.24) | 7 (5.22) | 101 (75.37) | 28 (20.90) | 5 (3.73) |
| | Control | 56 (37.33) | 69 (46.00) | 25 (16.67) | 57 (38.00) | 66 (44.00) | 27 (18.00) |
| Relationship between risk and reward | All students | 185 (65.14) | 54 (19.01) | 45 (15.85) | 207 (72.89) | 26 (9.15) | 51 (17.96) |
| | Treatment | 89 (66.42) | 30 (22.39) | 15 (11.19) | 125 (93.28) | 3 (2.24) | 6 (4.48) |
| | Control | 96 (64.00) | 24 (16.00) | 30 (20.00) | 82 (54.67) | 23 (15.33) | 45 (30.00) |
| Definition of inflation | All students | 214 (75.35) | 27 (9.51) | 43 (15.14) | 220 (77.46) | 22 (7.75) | 42 (14.79) |
| | Treatment | 108 (80.60) | 11 (8.21) | 15 (11.19) | 119 (88.81) | 11 (8.21) | 4 (2.99) |
| | Control | 106 (70.67) | 16 (10.67) | 28 (18.67) | 101 (67.33) | 11 (7.33) | 38 (25.33) |
| Risk diversification | All students | 119 (41.90) | 45 (15.85) | 120 (42.25) | 159 (55.99) | 32 (11.27) | 93 (32.75) |
| | Treatment | 65 (48.51) | 18 (13.43) | 51 (38.06) | 108 (80.60) | 8 (5.97) | 18 (13.43) |
| | Control | 54 (36.00) | 27 (18.00) | 69 (46.00) | 51 (34.00) | 24 (16.00) | 75 (50.00) |

This table presents the descriptive statistics of students' responses to financial literacy questions before and after participating in a financial education course. The table is divided by question indicator, which includes topics such as inflation impact on spending power, identification of interest, simple and compound interest calculations, risk-reward relationship, inflation definition, and risk diversification. For each question, responses are segmented into "All Students," "Treatment," and "Control" groups to assess the difference in correct, incorrect, and non-responses ("Don't Know/Didn't Answer") both before and after the course

**Table 9** Descriptive statistics for parents before and after the course

| Question indicator | Group | Before: correct (%) | Before: incorrect (%) | Before: don't know/ didn't answer (%) | After: correct (%) | After: incorrect (%) | After: don't know/ didn't answer (%) |
|---|---|---|---|---|---|---|---|
| Impact of inflation on spending power | All parents | 56 (41.48) | 46 (34.07) | 33 (24.44) | 89 (65.93) | 24 (17.78) | 22 (16.30) |
| | Treatment | 33 (39.29) | 33 (39.29) | 18 (21.43) | 66 (78.57) | 13 (15.48) | 5 (5.95) |
| | Control | 23 (45.10) | 13 (25.49) | 15 (29.41) | 23 (45.10) | 11 (21.57) | 17 (33.33) |
| Identification of interest | All parents | 121 (89.63) | 2 (1.48) | 12 (8.89) | 116 (85.93) | 1 (0.74) | 18 (13.33) |
| | Treatment | 76 (90.48) | 1 (1.19) | 7 (8.33) | 77 (91.67) | 1 (1.19) | 6 (7.14) |
| | Control | 45 (88.24) | 1 (1.96) | 5 (9.80) | 39 (76.47) | 0 (0.00) | 12 (23.53) |
| Simple interest calculation | All parents | 106 (78.52) | 9 (6.67) | 20 (14.81) | 87 (64.44) | 22 (16.30) | 26 (19.26) |
| | Treatment | 68 (80.95) | 4 (4.76) | 12 (14.29) | 64 (76.19) | 13 (15.48) | 7 (8.33) |
| | Control | 38 (74.51) | 5 (9.80) | 8 (15.69) | 23 (45.10) | 9 (17.65) | 19 (37.25) |
| Understanding compounding | All parents | 77 (57.04) | 44 (32.59) | 14 (10.37) | 77 (57.04) | 37 (27.41) | 21 (15.56) |
| | Treatment | 48 (57.14) | 27 (32.14) | 9 (10.71) | 63 (75.00) | 17 (20.24) | 4 (4.76) |
| | Control | 29 (56.86) | 17 (33.33) | 5 (9.80) | 14 (27.45) | 20 (39.22) | 17 (33.33) |
| Relationship between risk and reward | All parents | 103 (76.30) | 6 (4.44) | 26 (19.26) | 97 (71.85) | 8 (5.93) | 30 (22.22) |
| | Treatment | 63 (75.00) | 4 (4.76) | 17 (20.24) | 75 (89.29) | 1 (1.19) | 8 (9.52) |
| | Control | 40 (78.43) | 2 (3.92) | 9 (17.65) | 22 (43.14) | 7 (13.73) | 22 (43.14) |
| Definition of inflation | All parents | 103 (76.30) | 6 (4.44) | 26 (19.26) | 102 (75.56) | 7 (5.19) | 26 (19.26) |
| | Treatment | 67 (79.76) | 4 (4.76) | 13 (15.48) | 73 (86.90) | 6 (7.14) | 5 (5.95) |
| | Control | 36 (70.59) | 2 (3.92) | 13 (25.49) | 29 (56.86) | 1 (1.96) | 21 (41.18) |
| Risk diversification | All parents | 70 (51.85) | 10 (7.41) | 55 (40.74) | 77 (57.04) | 15 (11.11) | 43 (31.85) |
| | Treatment | 43 (51.19) | 6 (7.14) | 35 (41.67) | 65 (77.38) | 7 (8.33) | 12 (14.29) |
| | Control | 27 (52.94) | 4 (7.84) | 20 (39.22) | 12 (23.53) | 8 (15.69) | 31 (60.78) |

This table presents the descriptive statistics of parents' responses to financial literacy questions before and after participating in a financial education course. The table is divided by question indicator, which includes topics such as inflation impact on spending power, identification of interest, simple and compound interest calculations, risk-reward relationship, inflation definition, and risk diversification. For each question, responses are segmented into "All Parents," "Treatment," and "ontrol" groups to assess the difference in correct, incorrect, and non-responses ("Don't Know/Didn't Answer") both before and after the course

**Table 10** Change in students' financial knowledge score by excluding students who chose to take the elective course

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| S_Treat | 2.365*** | 2.358*** | 2.396*** | 2.435*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Initial financial knowledge score | −0.527*** | −0.542*** | −0.552*** | −0.561*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Gender* | | | | |
| Female | | −0.152 | −0.161 | −0.103 |
| | | (0.501) | (0.474) | (0.649) |
| *Age group* | | | | |
| 30 and above | | | 1.392*** | 1.312*** |
| | | | (0.000) | (0.000) |
| *Monthly household net income* | | | | |
| 900€ or lower | | | | −0.164 |
| | | | | (0.622) |
| Between 900€ and 1600€ | | | | −0.788*** |
| | | | | (0.006) |
| Don't know | | | | −0.496** |
| | | | | (0.034) |
| Intercept | 1.917*** | 2.091*** | 2.098*** | 2.420*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| N | 220 | 220 | 220 | 218 |
| Adjusted R2 | 0.457 | 0.456 | 0.462 | 0.479 |

The table presents the results of multivariate regressions of the difference between the final and initial Students' Financial Knowledge Scores on various explanatory variables. S_Treat is an indicator variable that takes the value of 1 if the student was in the treatment group and 0 if the student was in the control group. The analysis excludes students that registered for the elective course. Initial Financial Knowledge Score is the student's financial knowledge score in September 2020. Female takes the value of 1 if the student is female and 0 if the student is male. "30 and above" takes the value of 1 if the student's age is 30 or greater and 0 otherwise. Four categories of monthly household net income are used, which are represented using indicator variables as follows: "900€ or lower", "Between 900€ and 1600€", "1600€ or higher" (used as the benchmark category) and people who responded "Don't know". We use robust standard errors. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively

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## Declarations

**Disclaimer** The views expressed in the paper are those of the authors and do not necessarily reflect those of the Central Bank of Cyprus or the Eurosystem.

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