BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

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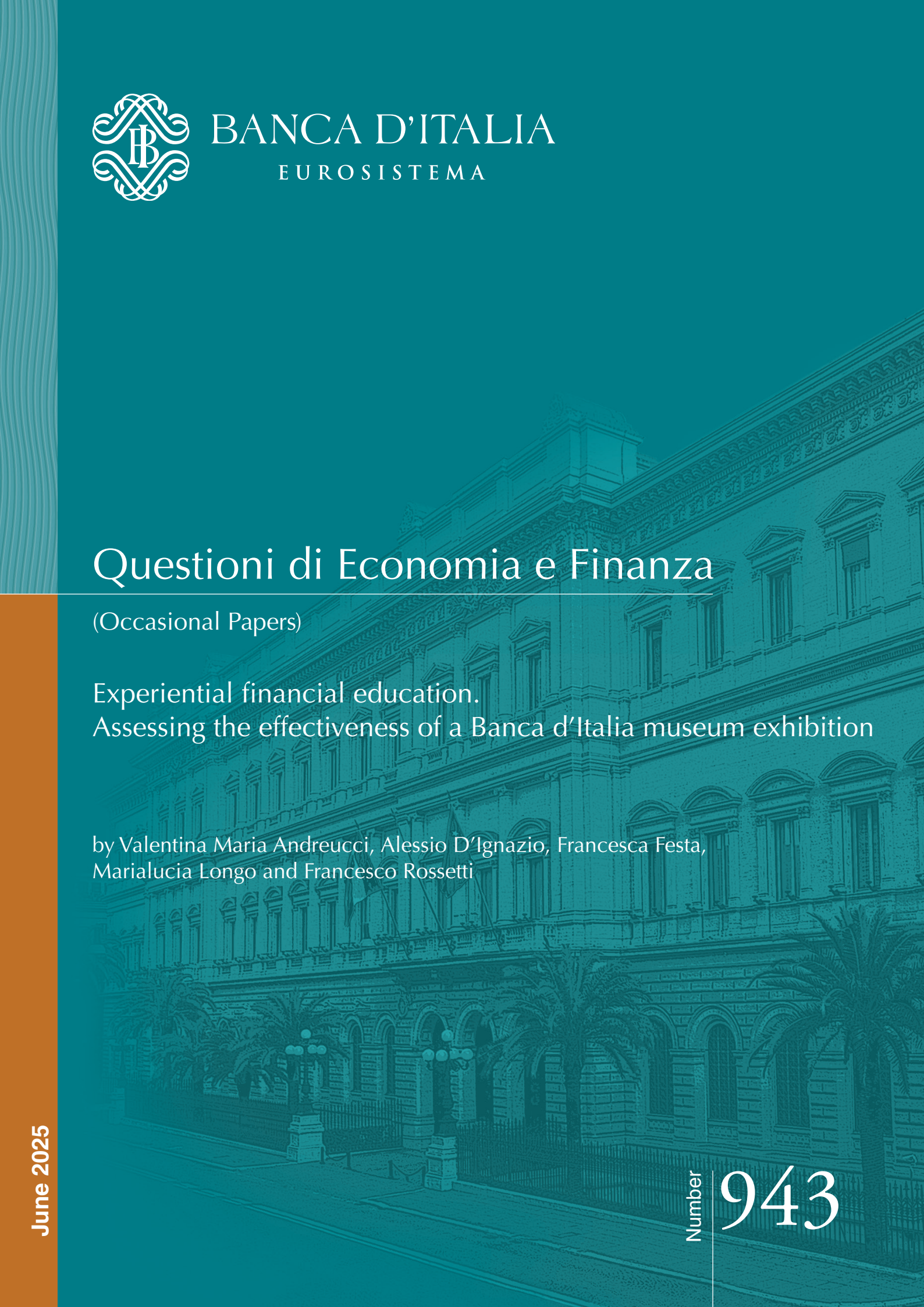
Experiential financial education. Assessing the effectiveness of a Banca d'Italia museum exhibition

by Valentina Maria Andreucci, Alessio D'Ignazio, Francesca Festa, Marialucia Longo and Francesco Rossetti



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EXPERIENTIAL FINANCIAL EDUCATION. ASSESSING THE EFFECTIVENESS OF A BANCA D'ITALIA MUSEUM EXHIBITION

by Valentina Maria Andreucci*, Alessio D'Ignazio*, Francesca Festa*, Marialucia Longo** and Francesco Rossetti*

Abstract

We investigate the impact of a museum exhibition on the financial literacy of young people. The exhibition, titled 'The Adventure of Money', took place in Rome between October 2023 and June 2024. It offered a preview of Banca d'Italia's upcoming Money Museum, which aims to stimulate interest in the main events in the history of money and finance. In order to evaluate the effectiveness of the exhibition, we conducted a randomized control trial with about 600 students from 19 Italian upper secondary schools. The results show an improvement in the students' financial knowledge, as evidenced by an increase of around one third in their initial test scores. The results also show that the exhibition had a greater impact on female students. Finally, no learning decay was observed within the first month following the exhibition.

JEL Classification: G53, I20, C93.

Keywords: financial education, museum/informal learning, randomized control trials.

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1 Introduction[1]

Despite its growing importance for societal well-being, many countries face low financial literacy among citizens. Complex markets, reduced welfare systems, and global economic challenges have pushed governments to prioritize financial education, especially for young people. Italy ranks among the countries falling behind in financial literacy, particularly among young people, women, and individuals without higher education. To tackle this gap, the Bank of Italy has been at the forefront of efforts to improve financial literacy, launching programs aimed at both youths and adults. As part of efforts to strengthen the economic and financial literacy of the population, the Bank of Italy is engaged in establishing the new Bank of Italy Money Museum (MUDEM), which will be located at Villa Hüffer, not far from its headquarters on Via Nazionale in Rome. The main mission of MUDEM is to stimulate the curiosity and interest of the public in key topics related to economic and financial culture.

On October 31, 2023, the temporary exhibition *The Adventure of Money*, which provides a preview of the upcoming MUDEM, was inaugurated at Palazzo Esposizioni Roma to promote awareness of the museum project among the public and gather initial feedback to improve its effectiveness. The exhibition remained open to the public until June 30, 2024. It consisted of nine rooms (one of MUDEM's three visitor itineraries[2], addressing topics such as the birth of finance and money, inflation and deflation, the risks and returns of major financial instruments, financial crises, monetary policy, and the key roles of the Bank of Italy and the European Central Bank.

This paper assesses the educational effectiveness of the exhibition through a rigorous randomized experiment involving a representative sample of secondary school students in the Rome area. This study, to the best of our knowledge, represents one

[1]The authors would like to thank Paola Ansuini, Magda Bianco, Giovanni Carrada, Riccardo De Bonis, Giovanni Iuzzolino, Paco Lanciano, Daniela Marconi, Massimo Omiccioli and Angela Romagnoli for useful comments and suggestions. The authors are also very grateful to all schools and students who partecipated in the experiment. The usual disclaimer applies. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy.

[2]The second MUDEM itinerary, *The adventure of Italian people*, is focused on the Italian history and its economic events over almost the last two century, starting from the Unification of Italy to the advent of the euro. The last itinerary, called *The gold adventure*, is dedicated to the story of this precious metal and to the discovery of how gold acquired its symbolic value.

of the first experimental evaluations, even on an international scale, of the impact of financial education initiatives conducted in a museum setting.

The impact evaluation study of the exhibition is based on a sample of 599 students from 19 secondary schools (high schools and vocational schools). The results indicate that participation in the exhibition led to an improvement in students' financial knowledge: the score measuring this knowledge increased by about one-third compared to the initial level. Additionally, visiting the exhibition resulted in greater awareness of the role of banks, the tasks of the ECB and the Bank of Italy, and a higher propensity to delve into economic and financial topics.

The rest of the paper is organized as follows. Section 2 discusses the research streams we contribute to, while Section 3 outlines the MUDEM project and introduces the exhibition *The Adventure of Money*. Sections 4 and 5 present the empirical strategy and describe the dataset used, respectively. Results are discussed in Section 6. Section 6.2 describes the findings and provides additional evidence about the external validity of the experiment. Finally, Section 7 concludes.

2 Related literature

Our paper contributes to two streams of research. First, we add to studies on the effectiveness of informal learning settings, such as museums, science centers, and after-school programs. Second, we contribute to the research stream focusing on the delivery of financial education contents to pupils.

2.1 Effectiveness of informal learning settings

There is a growing interest on research in informal learning settings, such as museums, science centers, and after-school programs. These environments provide to both youths and adults valuable opportunities, which complement formal education, often leading to the development of lifelong learning habits and fostering critical thinking, creativity, and problem-solving skills (see, for a survey, Johnson and Majewska, 2022; Andre et al., 2017). Museums, in particular, could play a crucial role within informal learning settings, offering visitors immersive, hands-on experiences that make learning engaging and personal. In this way, museums foster curiosity and a deeper understanding of several topics. At this regard, technology significantly enhanced the educational

potential of museums, since today's digital tools, such as interactive displays, augmented reality and mobile apps, provide additional layers of information beyond the physical exhibits (Zhou et al., 2022).

Although informal learning settings — especially museums — are becoming increasingly relevant, robust empirical evidence about their effectiveness remains limited, even with numerous evaluation studies in the field (King et al., 2024). This unwanted gap in the literature is largely related to the difficulties of exploiting credible empirical strategies, such as randomized controlled trials (RCT). However, properly conducted RCT are challenging since they require ensuring randomization and adherence to protocols, demands considerable logistical planning and resources. Second, ethical concerns can arise, particularly when withholding potentially beneficial interventions from control groups. Third, recruitment and retention of participants can be difficult, as individuals may not want to be randomly assigned to treatment or control groups, leading to selection bias or dropouts. Finally, RCTs can be time-consuming and expensive, making them harder to implement.

Among RCT-based studies, Tan et al. (2021) examine the educational impact of children's museums on cognitive development. They devised two experiments, focusing on a sample of 228 and 207 children of age 4 or 5 in China, respectively, showing a statistically significant effect. Free play and interactions with adults or peer are claimed to drive part of the effect. Similar results were obtained earlier by Gong et al. (2020). Novak et al. (2024) conducted an experimental study on the issue of animal farming at a large German museum on science and technology. Their results, based on a sample of 194 individuals aged between 18 and 79, show that exhibition visits leads to an increased interest in the topic as well as to a higher level of knowledge. Among studies not grounded on RCTs, Cheng et al. (2011) evaluated the effect of a interactive science exhibition at the North Carolina Museum of Life and Science about the effect on brain of drug abuse. Their sample was made up of 175 people with an age between 6 and 82. This study pointed out a significant improvement of the knowledge about the neurological impact of drugs after the visit of the exhibition.

We contribute to the stream of research on the effectiveness of museums as tools to improve knowledge by presenting an accurate RCT, conducted on a significantly larger number of subjects (600) compared to the average sample size used in the relevant literature. Second, we assess whether the effectiveness of museum educational initiatives

varies across some individuals observable characteristics. Third, we focus, for the first time to the best of our knowledge, on a financial education initiative provided in a museum context.

2.2 Effectiveness of financial education initiatives for students

A substantial body of research has examined the effectiveness of financial education programs for school students, typically delivered in a traditional fashion, by means of classroom lectures. Among the studies conducted following an experimental methodology, and hence providing very credible results, De Beckker et al. (2021) found that a four-hour financial literacy course improved the financial literacy of 688 Flemish 8th and 9th graders by 0.46 standard deviations, though it did not affect their consumer choices. Bover et al. (2018) studied a 10-hour "Finance for All" course in Spain, involving over 3,000 9th graders, and found that while the program did not improve budgeting skills, it significantly enhanced financial knowledge and attitudes. Batty et al. (2015) conducted a randomized controlled trial (RCT) with 700 U.S. 4th and 5th graders, showing that a five-lesson FE program led to a 1.4-point (11%) increase in financial literacy scores. Overall, these studies highlight that FE programs can positively impact financial literacy, although the effectiveness may vary depending on the program's format and duration. Finally, Agasisti et al. (2024) assessed a large financial education program offered by the Bank of Italy from primary to secondary schools nationwide, showing that it leads to an increase of students financial competences.

A second stream of research focuses instead on experiential or gamified learning approaches, which require no lesson plans. For example, Kalwij et al. (2019) evaluate a 45-minute gamified financial education session for primary school students and find that the program improved both students' financial literacy and their willingness to save. Similarly, Amagir et al. (2022) assess the effectiveness of 'SaveWise', a learning program based on student participation rather than theory. Their findings show that the program enhances students' financial knowledge and promotes a stronger intention to save. Finally, Batty et al. (2020) show that U.S. students who applied for classroom jobs and practiced budgeting and saving showed an increase in financial knowledge.

We extend this research by exploring the potential role of exhibitions as a tool to enhance students' financial literacy, potentially complementing in-school activities. Additionally, we examine whether such a learning setup reveals heterogeneous effects of

education programs and whether information decay — often overlooked by researchers — takes place.

3 The exhibition

The exhibition *The Adventure of Money* aimed to stimulate curiosity and interest in the themes of money and finance, to help visitors appreciate their fundamental role in the functioning of society and to emphasize the importance of possessing basic financial knowledge and skills. The visit experience, lasting approximately 1 hour and 15 minutes, was based on immersive visualization techniques to enhance historical objects and documents by means of lighting effects, sound, projection mapping and animations. The visitors were organized into small groups of 15 people and guided by a narrating voice through the rooms on the itinerary. The time spent in each room was fixed. The language used was chosen to be simple yet effective, making the exhibition also suitable for visitors not very familiar with the covered topics.

The exhibition consists of nine rooms, through which the narrating voice directs the audience attention to certain objects or documents of historical or numismatic interest, linking their particular stories to the broader educational messages intended to be conveyed. In particular, the exhibit begins with the main features of modern economic systems and the associated importance for monetary and financial exchanges (Room 1 - The invisible system). In the following room (Room 2 - The birth of finance) the visitor moves into ancient Mesopotamia, where some artifacts of the first form of writing, used to record financial transactions, were described. Then, the narrative continues by moving from ancient Greece to the 20th century, starting with the birth of coined money to the industrial Revolution and the rise of modern financial markets (Rooms 3-5). The sixth room focuses on the concepts of inflation and deflation, using as an example the impact of hyperinflation on the lifestyle of a German family in the 1920s. In the final three rooms the visitor is led back to the present day. In particular, financial instruments are depicted as a system that allows for the transfer of resources over time, through the buying and selling of specific promises of future payments (Room 7 - Finance as a time machine). Finally, the importance of a stable global financial system (Room 8 - Global finance and central banks) and of the role of the Bank of Italy and the Eurosystem in combating the risks of financial fragility (Room 9 - The functions of the Bank of Italy and of the Eurosystem) is highlighted.

One of the main targets of the exhibition was the school audience. In order to encourage pupils' participation, additional educational activities related to the topic of the exhibition were offered in addition to free admission. During the 211 days of opening, *The Adventure of Money* exhibition was visited by 19934 guests. All in all, the school audience accounted for 40 percent of all visitors during the opening period of the exhibition, achieving a promising result if compared to that of museums with a similar offering of educational activities.[3] The percent of paying visitors was 24 percent, while the remaining 36 percent consisted of young people under the age of 26, teachers, employees and guests of the Bank of Italy, who were offered free admission as well.

4 Objectives and empirical strategy

The aim of this work is twofold. Firstly, the paper assesses whether the exhibition *The Adventure of Money* was able to improve the financial competences of students. Secondly, it investigates whether the effects were heterogeneous across some observable characteristics of students (such as gender and initial financial competences) and types of schools.

To measure the impact of the exhibition *The Adventure of Money* on the financial knowledge of young people, we devised a randomized experiment on a large sample of students. In order to reduce logistical and organizational costs, the randomized experiment was conducted with upper secondary school students in the Roman area. Within upper secondary school, we focus on second-year (grade 10) students, since at this age students are beginning to prepare their future careers (with a final decision coming at grade 13) and recent research showed that financial literacy contributes to steering young people's career aspirations (Lamboglia et al., 2024).

The construction of the sample is based on a two phases process. The first phase was devoted to the selection of the schools participating to the experiment. At this stage, the headmasters of 97 high schools located in Rome were invited to take part in the study. In particular, the recruitment of the schools took place in October 2023 via both email and phone calls, where Bank of Italy researchers provided detailed information about the experiment. In the second phase, two classes were selected from each

[3]The school audience of the Museum of Science "MUSE" and of the National Museum of Science and Technology "Leonardo da Vinci" is around 20 and 6 per cent, respectively.

participating school; these were then randomly assigned to either the treatment group or the control group. All the treatment groups' students visited the exhibition *The Adventure of Money*, while control groups' students did not do any financial literacy-related activity during the experiment. To maximize participation from the schools and to avoid discrimination among students, the classes assigned to the control group were offered the opportunity to visit the exhibition at the end of the experiment. A schematic view of the experimental design is shown in figure 2.

The impact of the exhibition on students' financial competences was evaluated by means of an anonymous questionnaire[4] which was administered in both treated and control groups before and after the treatment. The questionnaire consists of 35 questions and three sections and the participants took approximately 20 minutes to complete it. The first section concerns demographic variables such as gender, age, nationality, and familiarity or interest in economic topics. The second section investigates the inclination to use a small amount of money in a risky activity and the perception of the usefulness of banks. The third section focuses on topics covered by the exhibition. Among the latter, particular emphasis was placed on the birth of money and the first financial instruments, inflation and financial crises, investments, and the main functions of the Bank of Italy and of the ECB. The questionnaire is available upon request from the authors.

5 Data

Among the 97 schools invited, 19 agreed to participate: 10 high schools (*Liceo)* and 9 vocational and technical institutes (*Istituto tecnico o professionale*).[5] Most schools that did not participate attributed their non-participation to logistical issues or other pre-scheduled extracurricular activities. While both potential confounders can arguably be considered to be orthogonal to our treatment, in Section 6.2 we present some tests

[4]The questionnaire was administered digitally at school under the supervision of Bank of Italy employees by means of an online survey tool based on *LimeSurvey*. Each student was asked to start filling in the survey by scanning a QR-code.

[5]The *Liceo* is a type of Italian secondary school where students study Latin, Philosophy in addition to Italian, English, Mathematics and Science. The *Istituto tecnico o professionale* is a type of Italian secondary school which offers a more technical training, expecially in the technological or economic sector.

comparing students' level performances across both participating and non-participating schools to assess potential selection bias.

All in all, the final sample is made up of 599 students, evenly divided between the treatment and control groups.[6] Of the students participating in the experiment, 63 percent belong to high schools and 37 percent to vocational and technical institutes. The sample is composed of 45 percent girls, 53 percent boys, and 2 percent who indicated "other" in the gender section; about one-third said they frequently discuss economic and financial topics at school or with family. Approximately 76 percent of the survey participants declare in the initial questionnaire that banks are useful to themselves and others, while 21 percent are unable to define their opinion on the matter.

The measurement of the students' financial competencies, evaluated before and after the visit of the exhibition *The Adventure of Money*, was based on the answers to the 22 questions of the third section of the questionnaire. A financial competence score was built from the sum of the correct answers of the each student, normalized between 0 and 1.

The financial competence score observed before the treatment is, on average, higher for high school students compared to those from vocational and technical institutes (Table 1). It is also higher among students who show greater interest in exploring economic topics. Finally, a score gap of about 3 percentage points against females emerges, consistently with findings on the gender gap in financial competencies emerging from OECD-PISA data (Invalsi and Bank of Italy, 2024). On average, about 15 days pass between the visit to the exhibition and the completion of the final questionnaire. In the pre-test, we observe a higher share of *don't know* responses among women compared to men and among students enrolled in vocational and technical institutes compared to those in lyceums (Table 2). The gender gap in *don't know* responses — approximately 5 percentage points — is highly statistically significant and it suggests lower confidence among women in finance and economics topics, consistently with previous research (see, for instance, Bucher-Koenen et al., 2021 and Hospido et al., 2023).

Table 3 describes the main characteristics of the students participating in the

[6]Students were provided with the basic information that academic best practices would typically require to be conveyed to participants in a randomized experiment. In particular, they were informed about the experiment's purpose, given a description of the activities, and told about the random assignment to two groups. They were also informed that the questionnaires were completely anonymous.

experiment by treatment and control group before the visit of the exhibition. Balancing tests pointed out that the two groups are homogeneous with respect to all characteristics observed before the treatment, supporting the validity of the randomization conducted.

6 Results

We estimate the average treatment effect (ATE) by comparing average outcomes of treated and control individuals through OLS estimates. Formally, we estimate the following regression model:

$$Post_{ij} = \beta_0 + \beta_1 \cdot Pre_{ij} + \beta_2 \cdot Treat_{ij} + \delta X_{ij} + School_{ij} + \epsilon_{ij} \tag{1}$$

where $Post_{ij}$ is the total financial competencies score of student i in school j in the post-visit questionnaire, Pre_i is the total financial competencies score of student i in school j in the pre-visit questionnaire, $Treat_{ij}$ is a dummy variable equal to one whether a student i in school j belongs to the treatment group and zero otherwise; X_{ij} is a vector of individual characteristic (e.g. gender, age, nationality and personal interest in financial topics) of the student i in school j and $School_{ij}$ is a dummy variable which accounts for the non observable heterogeneity across schools. The standard errors ϵ_i were clustered at the level of the randomization, specifically at the class level.

The results of the model estimates (1) are described in Table 4. Overall, participation in the exhibition results in an increase in the financial competence score of about 15 percentage points, which is approximately one-third of the initial score. The estimated effect of the treatment remains stable across different sets of controls considered (columns 1-4), supporting the validity of the randomization between groups. Concerning the other control variables, as expected the pre-treatment score is highly correlated with the post-treatment score. On the other hand, students' gender and nationality do not affect the post-treatment score, ceteris paribus. Moreover, students who declared at the beginning of the experiment to be interested in finance performed better in the post-questionnaire, controlling for other characteristics.

In addition to the impact of the treatment on the overall financial competence score, the impact of the course on specific variables of interest was analyzed separately. In particular, these variables include the perception of banks, knowledge of the main goal of the ECB, the functions of the Bank of Italy, and interest in financial topics.

The perception of banks by students is measured using a dummy variable equal to

one if banks are considered useful to themselves and others, and zero otherwise (useful only to others, only to oneself, or to no one). The knowledge of the main goal of the ECB is described by a dummy equal to one if the student correctly answers the question about price stability and zero otherwise. The knowledge of the activities of the Bank of Italy is represented by a normalized score between 0 and 1, calculated from five questions. Interest in financial topics is measured by a dummy equal to one if students reported being somewhat or very interested in exploring economic and financial topics in the future, and zero otherwise. Finally, the evaluation exercise was supplemented by a falsification test, conducted through three questions on taxation, a topic not covered in the exhibition; a normalized score was also constructed in this case.

The results about this additional set of outcomes are described in Table 5. The findings indicate that the visit resulted in greater awareness of the role of banks (column 1), of the primary task of the ECB (column 2) and of the activities of the Bank of Italy (column 3). Additionally, it led to a greater interest in economic topics among the students (column 4). The validity of the exercise is also supported by the outcome of the falsification test outlined above (column 5), which shows that there was indeed no effect of the exhibition on topics not covered by it.

6.1 Heterogeneous effects

The analysis of potential heterogeneous effects of the exhibition based on certain observable characteristics of the students focused on gender, type of school, the time interval between the museum visit and the administration of the final questionnaire, and initial financial competence scores. With respect to the latter, the sample of students was split in two groups, according to whether they were administered the final questionnaire within two weeks from the visit, or later than that (but still within one month from the visit). The results, described in Table 6, show that the initiative was more effective for girls. This finding provides contrasting evidence regarding the appeal of museum experiences to girls, as several studies have documented that certain exhibits in STEM subjects — which in some respects can be considered similar to Economics — tend to attract girls less and engage them for shorter periods compared to boys (see, for instance, Dancstep and Sindorf, 2018). No heterogeneous effects were found regarding instead the other aspects analyzed. All in all, these results suggest that the initiative is equally effective across different types of schools and students with varying

levels of financial competence. Additionally, estimates indicate that the information conveyed during the visit was retained and maintained over time during the first four weeks following the visit.

6.1.1 Investigating heterogeneous effects of the exhibition by gender

In this section, we investigate the channels through which the exhibition generates a larger increase in financial literacy for women compared to men. Theoretically, the exhibition could influence measured financial literacy by boosting women's confidence — leading to a reduction in the number of *don't know* answers, which are more frequent than men (see Table 2) — and/or by enhancing the accuracy of their responses other than 'I don't know'. We estimate model 1 using, first, as the dependent variable the share of *don't know* answers in the final questionnaire, controlling for the initial share. Second, we employ as dependent variable the accuracy of responses in the final questionnaire — controlling for the initial accuracy —, considering only questions that received an answer other than *don't know* in the initial questionnaire. Results presented in Table 7 indicate that the exhibition led to a reduction in *don't know* responses for both men and women, with the decrease being significantly larger—twice as large—for women. On the other hand, the exhibition improved answer accuracy, defined as the share of correct responses to questions that were answered, to the same extent for both men and women.

Overall, these findings suggest that the main channel through which the exhibition reduces the gender gap in financial literacy operates by increasing women's confidence. Hence, these findings are consistent with the stream of research highlighting the relevance of *don't know* responses in measuring the financial literacy gender gap; for instance, Hospido et al. (2023) argue that the largest portion of the gender gap in financial literacy (about two-thirds) is explained by differences in the propensity to choose 'I do not know'.

More broadly, our findings contribute to the research on the impact of teaching methodologies in reducing the gender gap in mathematics-related subjects, such as finance and economics. A key theoretical claim is that low-pressure, non-competitive learning environments — such as museum-based education — may be particularly beneficial for girls. In this context, Hughes et al. (2020) argue that girls engage more effectively in STEM activities when they are framed as social experiences and incor-

porate hands-on learning. Building on this, Di Tommaso et al. (2024) tested these theories through a RCT involving approximately 1,200 Italian primary school students, who were randomly assigned to either laboratory-based teaching classes or standard curriculum classes. Their findings indicate that the intervention reduced the gender gap in mathematics by 40 to 48 percent.[7]

6.2 Sample representativeness and external validity

The voluntary participation of schools in the experiment could raise questions about the representativeness of the student sample, and thus the external validity of the results obtained. To analyze the sample's representativeness, data from high school and vocational and technical institute students who participated in the experiment were compared with those from other high schools and technical institutes headquartered within 20 km from Rome's city centre. The data used, sourced from Eduscopio, pertain to the university careers of students and are drawn from the information in the National Student Registry Database (ANSU) of the Ministry of Education, University, and Research. The results of the comparison, highlighted in Table 8, show no differences in university grades, university credits, and a composite indicator that considers both grades and credits, suggesting that the exercise conducted also has external validity.

A similar analysis was conducted concerning vocational and technical institutes. In this case, the employment index was used, measuring for each vocational institute the percentage of employed individuals among those who did not enroll in university. Again, no statistically significant differences were found between participating and non-participating schools in the experiment.

7 Concluding remarks

The study describes the results of a randomized experiment aimed at evaluating the effectiveness of the Bank of Italy's exhibition *The Adventure of Money* on secondary school students' financial competencies. The results show that the exhibition contributed to a significant improvement in students' financial competencies, with scores increasing by approximately one-third from their initial levels. Additionally, the visit

[7] On a related note, Galasso and Profeta (2024) show that reducing the pressure stemming from time constraints in math tests leads to a decrease in the gender gap by about 40 percent.

resulted in greater awareness of the role of banks, the functions of central banks, and increased interest in economic and financial topics. The exhibition's impact was more significant for girls, suggesting that museum contexts could be useful policy instruments to tackle the gender gap in financial literacy. At this regard, our findings reveal that the exhibition boosted women's confidence, aligning with both research on the role of don't know responses in explaining the financial literacy gap and studies on the effectiveness of low-pressure learning environments to tackle gender gap on STEM subjects. On the other hand, there were no heterogeneous effects based on the type of school, the time interval between the exhibition and the final questionnaire, or initial financial competencies. The results are supported by a series of balancing tests and a falsification test. Despite the voluntary nature of the schools' participation in the experiment, the collected data show that the sample is representative of the school population in Rome, where the exhibition took place.

Finally, although the analysis in this study focuses exclusively on the cognitive effects of the museum, it is important to note that this dimension does not fully capture the "value" produced by a museum institution in the form of individual and collective benefits promoted among its visitors. This value also includes experiential and relational components activated in the audience, making the evaluation of museum contexts more complex than that of educational settings.

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Figures

Figure 1: Picture of the exhibition. (high) Room 3 - The birth of the minted money. (low) Room 5 - The industrial revolution and financial markets.

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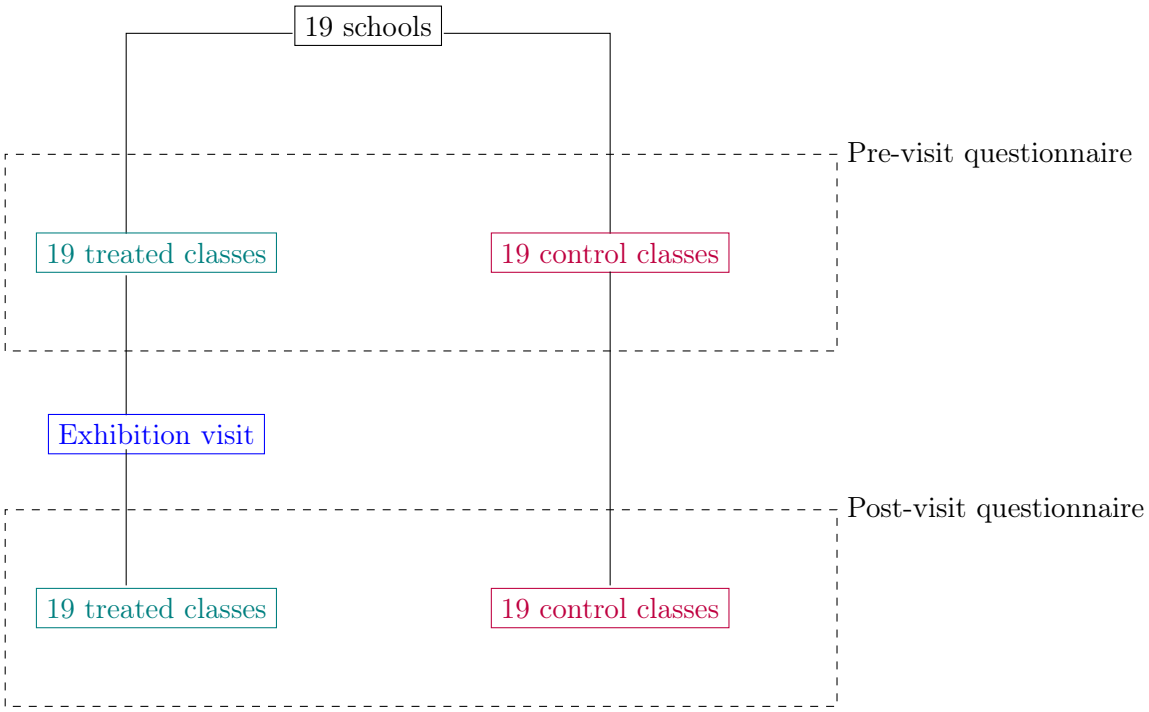

Figure 2: Schematic view of the randomized experimental design. For each partecipating school both treated and control class were randomly selected. The former took part to the exhibition *The Adventure of Money* in between the administration of the two questionnaires. The latter did not receive any additional information about the content of the exhibition within the period of the experiment.

Tables

Table 1: Financial competencies measured before the treatment and individual characteristics

	(1)	(2)	(3)	(4)
tech./voc. institute	-0.0624***	-0.0631***	-0.0659***	
	(0.0170)	(0.0167)	(0.0160)	
foreign		-0.0185	-0.0207	-0.00960
		(0.0181)	(0.0181)	(0.0204)
female		-0.0342***	-0.0297***	-0.0295***
		(0.00939)	(0.0101)	(0.0106)
interest in finance (pre)			0.0322**	0.0227
			(0.0153)	(0.0143)
talk about finance often (pre)			0.000898	0.00668
			(0.00933)	(0.00954)
school FE	no	no	no	yes
constant	0.473***	0.489***	0.463***	0.414***
	(0.0110)	(0.0114)	(0.0179)	(0.0168)
observations	599	599	599	599
R-squared	0.052	0.070	0.080	0.153

Notes. The dependent variable is the financial competence score, calculated as the sum of all correct answers to the questions in the initial questionnaire, normalized between 0 and 1. The independent variables are described in Table A1. OLS estimates. Std. err. clustered at the class-level. *** p<0.01, ** p<0.05, * p<0.1

Table 2: Share of *don't know* answers observed in the pre-test

	(1)	(2)	(3)	(4)
tech./voc. institute	0.0431**	0.0425**	0.0471**	
	(0.0197)	(0.0203)	(0.0195)	
foreign		0.0454	0.0441	0.0269
		(0.0307)	(0.0306)	(0.0327)
female		0.0457***	0.0414***	0.0510***
		(0.0142)	(0.0146)	(0.0138)
interest in finance (pre)			-0.0192	-0.0106
			(0.0176)	(0.0179)
talk about finance often (pre)			-0.0259**	-0.0277**
			(0.0122)	(0.0122)
school FE	no	no	no	yes
constant	0.182***	0.160***	0.185***	0.184***
	(0.0129)	(0.0139)	(0.0224)	(0.0178)
observations	599	599	599	599
R-squared	0.017	0.041	0.050	0.127

Notes. The dependent variable is the share of *don't know* answers, observed in the initial questionnaire, varying between 0 and 1. The independent variables are described in Table A1. OLS estimates. Std. err. clustered at the class-level. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Balancing tests

	treated		**control**		**diff**	
	mean	sd	mean	sd	b	p-value
female	0.442	0.497	0.413	0.493	-0.029	(0.472)
foreign	0.053	0.225	0.057	0.232	0.004	(0.835)
attended exhibition before	0.007	0.081	0.007	0.082	0.000	(0.992)
talk often about finance	0.319	0.467	0.359	0.481	0.040	(0.300)
talk sometimes about finance	0.621	0.486	0.581	0.494	-0.041	(0.310)
score pre (norm)	0.447	0.142	0.453	0.122	0.006	(0.596)
banks useful pre	0.751	0.433	0.768	0.423	0.018	(0.614)
know ecb aim	0.355	0.479	0.329	0.471	-0.027	(0.493)
score knowbankit (norm)	0.373	0.245	0.365	0.218	-0.008	(0.661)
interested in finance	0.774	0.419	0.819	0.386	0.045	(0.175)
fals score pre (norm)	0.750	0.280	0.721	0.294	-0.028	(0.229)
pre-don't know	0.206	0.173	0.190	0.149	-0.016	(0.216)
pre-accuracy	0.560	0.125	0.559	0.109	-0.001	(0.891)
observations	301		298		599	

Notes. All variables are observed before the treatment. The variables are described in Table A1.

Table 4: Treatment effects estimates: financial competences

	(1)	(2)	(3)	(4)
pre-treatment score (norm)	0.680***	0.669***	0.621***	0.564***
	(0.0526)	(0.0523)	(0.0501)	(0.0451)
treatment (dummy)	**0.152*** **	**0.152*** **	**0.151*** **	**0.147*** **
	(0.0175)	**(0.0166)**	**(0.0149)**	**(0.0101)**
female (dummy)		0.00955	0.00563	-0.00436
		(0.0149)	(0.0148)	(0.0134)
foreign (dummy)		-0.0482*	-0.0318	-0.0146
		(0.0255)	(0.0252)	(0.0257)
interested in finance (pre-treatment)		0.0318	0.0395*	0.0342*
		(0.0197)	(0.0195)	(0.0186)
tech./voc. institute (dummy)			-0.0548***	
			(0.0147)	
school FE	no	no	no	yes
constant	0.135***	0.113***	0.150***	0.102***
	(0.0256)	(0.0320)	(0.0323)	(0.0257)
observations	599	599	599	599
R-squared	0.410	0.418	0.437	0.480

Notes. The dependent variable is the financial competence score, calculated as the sum of all correct answers to the questions in the final questionnaire, normalized between 0 and 1. The independent variables are described in Table A1. OLS estimates. Std. err. clustered at the class-level. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Treatment effects estimates: additional outcomes

	banks useful (dummy)	know ecb's aim (dummy)	know bankit (score)	interested finance (dummy)	falstest (score)
	(1)	(2)	(3)	(4)	(5)
treatment	**0.0457*** **	**0.199*** **	**0.110*** **	**0.0628*** **	**0.0105**
	(0.0163)	**(0.0263)**	**(0.0108)**	**(0.0227)**	**(0.0186)**
pre-treatment Yvar	0.156***	0.250***	0.283***	0.427***	0.428***
	(0.0427)	(0.0325)	(0.0483)	(0.0480)	(0.0487)
female	-0.0128	-0.102**	-0.0144	-0.0573*	-0.0409**
	(0.0300)	(0.0450)	(0.0175)	(0.0332)	(0.0186)
foreign	0.00437	-0.0203	-0.000785	0.0886	0.0425
	(0.0696)	(0.0938)	(0.0391)	(0.0537)	(0.0419)
school FE	yes	yes	yes	yes	yes
constant	0.729***	0.148	0.151***	0.317***	0.384***
	(0.0848)	(0.135)	(0.0324)	(0.0637)	(0.0533)
observations	599	599	599	599	599
R-squared	0.086	0.169	0.204	0.251	0.289

Notes. The dependent variable is indicated in the columns' headers. In each regression we control for the pre-treatment level of the dependent variable. The variables are described in Table A1. OLS estimates. Std. err. clustered at the class-level. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Heterogeneous treatment effects estimates: financial competences

	gender	school type	test timing	initial score
pre-treat. score (norm)	0.571***	0.627***	0.630***	
	(0.0442)	(0.0510)	(0.0525)	
pre-treat. score low (dummy)				-0.111***
				(0.0163)
treat	0.128***	0.160***	0.168***	0.143***
	(0.0146)	(0.0199)	(0.0234)	(0.0155)
female	-0.0300**	0.00139	-0.00143	-0.0169
	(0.0137)	(0.0136)	(0.0142)	(0.0127)
tech./voc. institute		-0.0370**	-0.0524**	
		(0.0166)	(0.0194)	
short term			0.0183	
			(0.0178)	
treat*female	0.0413*			
	(0.0238)			
tech inst* treat		-0.0286		
		(0.0313)		
short term * treat			-0.0312	
			(0.0305)	
low-score pre*treat				-0.00267
				(0.0205)
school FE	yes	no	no	yes
observations	599	599	599	599

Notes. The dependent variable is the financial competence score, calculated as the sum of all correct answers to the questions in the final questionnaire, normalized between 0 and 1. The independent variables are described in Table A1. OLS estimates. Std. err. clustered at the class-level. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Channels behind gender heterogeneous effects

	share of don't know answers (1)		accuracy rate (2)	
	full (a)	het: gender (b)	full (c)	het: gender (d)
pre-don't know	0.565***	0.566***		
	(0.0633)	(0.0619)		
pre-accuracy			0.512***	0.511***
			(0.0492)	(0.0493)
treat	-0.101***	-0.0701***	0.128***	0.119***
	(0.0101)	(0.0153)	(0.0105)	(0.0147)
female	0.00387	0.0409**	-0.0203	-0.0313*
	(0.0130)	(0.0167)	(0.0143)	(0.0159)
treat*female		-0.0720***		0.0212
		(0.0239)		(0.0276)
foreign	-0.00213	-0.00349	-0.0342	-0.0337
	(0.0293)	(0.0291)	(0.0344)	(0.0346)
school FE	yes	yes	yes	yes
Constant	0.111***	0.0996***	0.142***	0.146***
	(0.0182)	(0.0146)	(0.0278)	(0.0276)
Observations	599	599	598	598
R-squared	0.356	0.365	0.404	0.405

Notes. In columns (a) and (b), the dependent variable is the share of 'don't know' answers observed in the post-test, varying between 0 and 1. In columns (c) and (d), the dependent variable is the share of correctly answered questions, between 0 and 1, calculated in the final questionnaire on the questions answered in the pre-test. The independent variables are described in Table A1. OLS estimates. Std. err. clustered at the class-level. *** p<0.01, ** p<0.05, * p<0.1

Table 8: External validity checks

	avg university grades (1)	university credits (2)	FGA index (3)
participating school (dummy)	0.382	3.574	3.369
	(0.311)	-3.253	-2.776
high schools	1.406***	18.77***	15.23***
	(0.175)	-1.682	-1.442
constant	23.77***	35.47***	41.79***
	(0.127)	-1.145	(0.949)
observations	204	204	204
R-squared	0.151	0.24	0.212

Notes. OLS estimates. Robust standard errors in parentheses. Sample of high schools and vocational schools headquartered within a 20 km distance from Rome's city centre, drawn from Eduscopio dataset. (1) Average university grades obtained by students from individual schools. – (2) University credits, as a percentage of the total required, obtained by students from the individual school. – (3) Index defined by the average of (1) and (2), with equal weights, normalized on a scale of 0-100. *** p<0.01, ** p<0.05, * p<0.1

Appendix A

Table A1: List of variables

Variable name	Description
foreign	dummy equal to one if the student is foreign born and zero otherwise
female	dummy equal to one if the student is female and zero otherwise
interested in finance	dummy equal to one if students reported being somewhat or very interested in exploring economic and financial topics in the future, and zero otherwise
talk often about finance	dummy equal to one if students reported they discuss often with parents, teachers or friends about money, savings or economic news, and zero otherwise
talk sometimes about finance	dummy equal to one if students reported they discuss sometimes with parents, teachers or friends about money, savings or economic news, and zero otherwise
pre-treat. score (norm)	financial competences score was based on the answers to 22 questions, normalized between 0 and 1, measured before the treatment
banks useful	dummy equal to one if students consider banks to be useful to themselves and others, and zero otherwise
know bankit	normalized score based on the correct answers to the 5 questions on the main functions of the Bank of Italy
know ECB's aim	dummy equal to one if students know ECB's main aim
falstest score	normalized score obtained from the answers to three questions on taxation, a topic not covered in the exhibition
treatment	dummy equal to one for treated students and zero for control group students
short term	dummy equal to one if the students were administered the final questions within two weeks following the exhibition, and zero otherwise
pre-treat. score low	dummy equal to one if the students initial financial competences score before the treatment is below the median, and zero otherwise
participating school	dummy equal to one for schools that participated to the experiment, and zero otherwise
tech./voc. institute	dummy equal to one if the students belongs to a technical or vocational institute, and zero otherwise
high school	dummy equal to one if the students belongs to a high school institute, and zero otherwise
pre-don't know	share of don't know answers, measured before the treatment
pre-accuracy	share of correct answers over given answers in both tests, excluding don't know answers, measured before the treatment