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Financial Frauds on Payment Cards: The Role of Financial Literacy and Financial Education

Gianni Nicolini[†] · Lucia Leonelli^{*}

ABSTRACT

The growing number of payment cards issued around the world, and the growing number of transactions generated by those cards (even thanks to the e-commerce trend) have seen an increase in the relevance of financial frauds based on the use of payment cards. Negative consequences from payment card frauds do not affect only the card users, but involve sellers, financial intermediaries, and other players in the payments system. The aims of this study are (1) to assess how financial literacy can help individuals to identify and avoid financial frauds related to the use of payment cards, and (2) to assess the effectiveness of a one-shot financial education seminar to increase the ability to identify and avoid a financial scam (“fraud literacy”). Data from a sample of college students was collected in 2019 and used to address both research questions. Results support the hypothesis that financial literacy can help financial consumers to avoid being a victim of a financial fraud, even if further analysis are required. Additional results show how financial literacy is related to financial confidence, with a risk of a potential “over-confidence” effect. Results from a diff-in-diff estimation suggest that a single seminar does not improve the ability to detect financial frauds.

Keywords: Payment cards, Credit cards, Debit Cards, Financial Literacy, Financial Education, Financial Frauds, Financial Scams, Over-confidence

1. Introduction

In the payment cards industry a financial fraud refers to the unauthorized use of a card by a third party (not the account holder or cardholder) with the intent to deceive for personal gain (FED 2018). Financial frauds related to the (mis)use of payment cards tend to be an historical and persistent phenomenon. Advances in technology, such as the switch from magnetic stripe cards to chip cards,

the use of PIN cards, and more recent innovations in the identification systems of payment cards, try to contrast the unauthorized use of issued cards and other card related frauds but (1) the growing number of cards in the payment system, (2) the increase in the use of those cards, and (3) the relevance of international trades (e.g. e-commerce), represent strong incentives for fraudsters to foster their activities.

The number of payment cards in the payment systems is growing. According to the American Banking Association (ABA 2020), at the end of 2019-Q3 there were (around) 375 million open credit card accounts in the US;¹ an increase of seven million credit cards issued in the last

[†] Associate Professor of Finance, Department of Management and Law (DML); University of Rome “Tor Vergata” (Rome, Italy); Via Columbia 2, 00133 Rome (Italy); gianni.nicolini@uniroma2.it

^{*} Associate Professor of Finance, Department of Management and Law (DML); University of Rome “Tor Vergata” (Rome, Italy); Via Columbia 2, 00133 Rome (Italy); leonelli@uniroma2.it

¹ Super-Prime holders were 196 Mln, Prime were 103 Mln, Sub Prime were 76 Mln.

year (2018-Q3 368 million), and a growth of 71 million cards in five years (2014-Q3 304 million), which represents a 23.3% increase. Including other card types (e.g. debit cards, pre-paid cards, etc.) the Bank of International Settlement (BIS 2019) estimates that 2.3 billion cards were used in the US in 2017, compared with 2.1 billion in 2014 (9.5%). Data from the European Central Bank (ECB 2019) confirms a growing trend in the EU, with approximately a total of 812 million cards (credit cards, debit cards, pre-paid cards) in the 28 countries of the EU at the end of 2017, with an increase of around 8 million cards (1%) from 2016 (804 million), and plus 74 million cards (10.0%) from 2012 (738 million). The Bank of International Settlement (BIS 2020) estimates 7.5 billion cards (credit cards, debit cards, and prepaid cards) in China in 2018, which compared with the 6.6 billion cards in 2017 involves a year-to-year growth of 900 million cards (+13.6%). A comparison of 2018 data with data from 2014 (4.9 billion cards) shows that the Chinese market has grown by 53% in five years. The positive trend for the payment cards' market is confirmed even in Japan, where the BIS data (BIS 2019) estimates 1.45 billion cards (credit and debit cards) in 2018, 1.42 billion cards in 2017 (2.11%), and 1.28 billion cards in 2014 (21.87%).

The number of transactions and the total values of transactions by payment cards is also growing. According to the 2019 Federal Reserve Payment Study (Fed 2019) the total number of transactions by payments cards (credit, debit, pre-paid) in the US in 2018 was 131.2 billion: 29.3% more than in 2015 (101.5 billion), and 57.3% more than in 2012 (83.4 billion). At the same time, the dollar value of those transactions has grown. In 2012 the total value of payment card transactions was 4.65 US\$ trillion, becoming 5.52 US\$ trillion in 2015, and 7.08 US\$ trillion in 2018. Data from the European Central Bank (ECB 2019²) estimates 69.2 billion transactions by payment cards (credit, debit, pre-paid) in 2017: 30.5% more than in 2015 (53.0 billion), and 73.9% more than in 2012 (39.8 billion)³. The total value of those transactions was equal to 39.8€ billion in 2012, 53.0€ billion in 2015, and 69.2 billion in 2017. According to the People's Bank of China (PBOC 2019)⁴, there were 210.3 trillion trans-

actions by bank cards in 2018 in China, with a total value of 113.61 US\$ trillion. The number of transactions in 2017 was 149.4 trillion, with a total value of US\$ 100.37 trillion. This means a year-to-year growth rate of 40.77% on the number of transactions, and 13.19% in their total value.

Thanks to e-commerce, international trade related to business-to-consumer (B2C) transactions is growing. As reported by the United Nations (UNCTAD 2019⁵), global e-commerce sales grew 13% in 2017 (total value estimated US\$ 29 trillion) and a similar surge was seen in the number of online shoppers, which jumped by 12% and stood at 1.3 billion people. The share of those buying from abroad rose from 15% in 2015 to 21% in 2017. The growth was driven mainly by an increase in the United States. As a result, cross-border B2C sales reached an estimated US\$ 412 billion, accounting for almost 11% of total B2C e-commerce (a 4% hike on the previous year's numbers).

With a growing market for payment cards, a growing number of frauds on payment cards is an easy guess. The Federal Reserve (FED 2018⁶) reports that the number of fraudulent credit card payments rose from 14.0 million in 2012 to 30.4 million in 2015, while the number of fraudulent debit card payments rose from 13.7 million to 28.7 million. In the meantime, the share of card frauds of total payments frauds - including cheques and other payment tools - increased from 64.6% (2012) to 77.5% (2015). Within the card frauds, frauds on credit cards are the most prevalent in term of dollar values, representing 60.2% of the card payment frauds in 2015 (57.4% in 2012), while debit card frauds were 34.3% in 2015 (36.1% in 2012), and ATM withdrawals frauds were 5.5% in 2015 (6.5% in 2012%). The number of frauds confirms credit cards as the most defrauded, with 50.3% of the total frauds in 2015 (48.3% in 2012), with debit card frauds representing 47.5% of cases (48.3% in 2012), and ATM withdrawals 2.2% (4.4% in 2012). The total value of credit card frauds in the US in 2015 was \$3.89 billion (\$2.26 billion in 2012). The same value for debit cards was \$2.22 billion in 2015 (\$1.43 billion in 2012). In relative terms the dollar value of credit card frauds accounted for 0.173% of the total value of credit cards

² European Central Bank - Payment Statistics

³ Data from European Central Bank - Statistical Data Warehouse.

⁴ <http://www.chinabankingnews.com/2019/03/19/per-capita-credit-card-ownership-in-china-hit-5-46-in-2018-average-card-spending-at-12200-yuan/>

⁵ United Nation Conference on Trade and Development (<https://unctad.org/en/pages/PressRelease.aspx?OriginalVersionID=505>)

⁶ Changes in U.S. Payments Fraud from 2012 to 2016: Evidence from the Federal Reserve Payments Study October 2018 (<https://www.federalreserve.gov/publications/files/changes-in-us-payments-fraud-from-2012-to-2016-20181016.pdf>)

transactions in the US in 2016, while the similar frauds-to-total-value-transaction ratio is 0.0915% for debit cards.

Data from the European Central Bank (ECB 2019) reports the total value of fraudulent transactions conducted using cards issued within the Single European Payment Area (SEPA⁷) amounted to €1.8 billion in 2016. The total value of card transactions using cards issued in SEPA amounted to €4.38 trillion in 2016. In relative terms the value of credit card frauds represented 0.11% of the total value of transactions by credit cards in 2016. In the same year debit card frauds accounted for 0.02% of the total value of transactions by debit card. With respect to the composition of card frauds in 2016, 73% of the value of card frauds resulted from card-not-present (CNP) payments, i.e. payments via the internet, post or telephone, 19% from transactions at point-of-sale (POS) terminals and 8% from transactions at automated teller machines (ATMs). With €1.32 billion in fraud losses in 2016, CNP fraud was not only the largest category of fraud in absolute value but, unlike ATM and POS fraud, it was also the only one to record an increase (of 2.1%) compared with the previous year. For debit cards and credit cards, CNP fraud was the most common type of fraud in 2016, accounting for 76% of the total value, followed by fraud occurring at POS terminals (20%) and ATMs (4%). From a geographical perspective, domestic transactions accounted for 90% of all transactions, but only 35% of fraudulent transactions. Cross-border transactions within SEPA made up for 8% of all transactions, but 43% of fraudulent transactions.⁸

The payment cards' market size, its trends, and the statistics on payment card frauds can be impressive, but could not be enough to stimulate a research interest. What increases the interest on payment card frauds and the possible strategies to prevent them is the evidence that

a market populated by fraudsters negatively affects not only the card users, but the entire industry and beyond.

As noted by Reurink (2016) in a study on identity scams, financial frauds involve three separate groups of victims who suffer from both direct and indirect costs as a result of the fraud. Consumers are the first group of victims. Beyond the money theft, the costs suffered by consumers include having to spend time and money in sorting out the fraud and re-establishing the victim's identity and credit standing, a loss of access to credit due to credit score deteriorations, and psychological and emotional consequences. The second group consists of the merchants and credit providers who have been tricked by the operators of financial scams into delivering money or goods based on fraudulent payments. These companies generally suffer from direct and quantifiable fraud losses; costs resulting from investments in fraud detection technologies; and the forgoing of additional potential revenue due to the refusal to accept valid transactions because they look suspicious and due to growing consumer reluctance to engage in e-commerce. The third group of victims consists of banks, credit card companies, and e-retailers whose brand names are hijacked, for instance, by phishing schemes. These companies may suffer from costs associated with (1) deactivating scam sites, resetting passwords, and other such protective steps; (2) costs associated with increased surveillance and prevention; (3) and the negative effects on stock prices and trading volume. Hence, in preventing frauds there are benefits that go beyond the monetary value of the fraud.

Zunzunegui et al. (2017) analyzed investment frauds in Spain, finding that victims of financial fraud had poorer health, more mental health and sleeping problems, and poorer quality of life than comparable populations of a similar age. About the relationship between the monetary loss and the health status, the authors find that those who had recovered at least a part of the fraud losses had better health and quality of life than those who had not. Another study on the psychological consequence of being victimized is the one of Brenner et al. (2020). The authors use a panel of US household victims of financial frauds that involved misrepresentation of information as well as misuse of money by third parties and assessed the effect of those frauds on the perceived financial well-being. Results support the hypothesis that multiple channels through which victimization might reduce perceived financial well-being exist: psychological consequences (loss of confidence in financial matters) and economic consequences (decrease in

⁷ The Single Euro Payments Area (SEPA) is a payment-integration initiative of the European Union for simplification of bank transfers denominated in Euro. As of 2020, there were 36 members in SEPA, consisting of the 27 member states of the European Union, the four member states of the European Free Trade Association (Iceland, Liechtenstein, Norway and Switzerland), and the United Kingdom. Some countries participate in the technical schemes: Andorra, Monaco, San Marino, and Vatican City.

⁸ A lack of official statistics from China does not allow to complete the big picture, but there are no reasons to assume big differences with other developed countries. Unofficial sources - http://www.xinhuanet.com/english/2017-10/05/c_136660592.htm - cite statistics from the Chinese Ministry of Public Security, reporting that in 2016 credit card crime has surged in China, with more than 63,000 cases, accounting for one-third of the country's total financial crime.

net wealth). The authors show that fraud is more negatively associated with a loss in individuals' confidence in financial matters than with declines in their net worth. People tend to doubt their abilities to handle financial matters after having fallen prey to fraud, which in turn carries major implications for subsequent financial decision making.

The relationship between fraud victimization, psychology, and health is confirmed by FINRA (2015), which studied the non-traditional cost of financial frauds using data from a nationally distributed online survey of 600 self-reported fraud victims. The study highlights how victims report being stressed (50% of the cases), anxious (44%), having difficulty sleeping (38%), loss of personal confidence (38%), depression (35%), physical health problem (24%), and negative relationship consequences as divorce or separation (21%). Additional behavioral biases from financial frauds are reported by Gurun et al. (2018), who studied investment frauds and found that individuals living in areas with higher concentration of victims from a large Ponzi scheme withdraw assets from independent financial advisors and increase savings at banks in safe assets. These change in asset allocation by individuals that were not directly victimized by a fraud suggests a spill-over effect that should be added to the indirect cost of financial frauds.

Hence, the motivations of this study are based on (1) the relevance of payment card frauds for the payment card market, (2) the relevance for the victimized users (including the direct- and indirect-monetary cost, the additional personal consequences related to psychological issues, health issues, and other social consequences), (3) and the evidence that the negative consequences of payment card frauds goes far beyond the card users and involves even third parties (e.g. payment card issuers and the all companies of the industry).

The study has three different aims. The first is to identify how much people are able to identify (and avoid) a fraud. If the prevention of fraud can be done by improving the quality and the effectiveness of security systems, and other technology based solution, the ability to identify a scam or a fraud represents a pivotal defence line against fraudsters. The second aim is to assess the effect of financial literacy (basic financial principles and the functioning of payment cards) on preventing victimization of financial frauds on payment cards. The assumption is that an individual who knows more about finance and the functioning of payment cards is more able to identify and avoid a financial fraud. The third aim is to test how much a single one-shot financial education event can improve the ability to identify financial frauds.

This study shares the same conceptual framework of several previous studies in consumer finance. Financial literacy - referred as the mix of knowledge, skills, and attitudes to take effective financial decisions (OECD 2012 pp. 13) - is supposed to positively affect consumers' financial decisions and behaviors. People who know more about finance, the functioning of financial products, and the functioning of the whole financial system, are supposed to be more likely to take effective financial decisions and to plan for the future (van Rooij, Lusardi, and Alessie 2007; Robb 2011; Fornero and Monticone 2011). At the same time the concept of financial education - as any process (e.g. seminars, curricula, counselling, etc.) by which financial consumers improve their financial literacy or improve one of its components (knowledge, skills, attitude) (OECD 2005) - is linked to financial literacy, under the assumption that good financial education increases financial literacy that then facilitates good financial decisions and responsible financial behaviors, helping people to achieve a financial well-being⁹. This study uses this conceptual framework to test several hypotheses in the case of frauds on payments cards.

II. Literature review

A fraud can be defined as *“the deliberate deception or intention of deception of an individual with the promise of goods, services or other financial benefits that are actually nonexistent, were never intended to be provided, or were grossly misrepresented”* (Titus and Gover 2013 pp.134). However, an analysis of the literature on payment card financial frauds requires a clear definition of what is a financial fraud and what are the differences with a payment card fraud. The *“financial frauds (or scams, cons, or swindles) are deceptive and fully fraudulent schemes in which fraudsters, often assuming a false identity or exhibiting a misplaced aura of trustworthiness, convince,*

⁹ Financial well-being is defined by the Consumer Protection Financial Bureau (CFPB 215) as *“a condition wherein a person can fully meet current and ongoing financial obligations, can feel secure in their financial future, and is able to make choices that allow them to enjoy life”* (pp.18). The analysis of the concept of financial well-being goes beyond the aim of this study, but it represents the final and pivotal concept of the conceptual framework of the study.

mislead, or induce people to voluntarily interact with the fraudster and, ultimately, to willingly hand over money or sensitive information related to their personal finances” (Reurink 2018 pp. 1292). So what a financial fraud shares with other frauds is the deception related to the abuse of trust, and differs from other frauds for being related to money or sensitive information about money. A payment fraud is *“a cleared and settled transaction that a third party initiated without the authorization, agreement, or voluntary assistance of the authorized user (the accountholder or cardholder) with the intent to deceive for personal gain”* (FED 2018 pp.6). Hence, payment fraud is a financial fraud - as investment fraud or insurance fraud - that involves a monetary loss, but differs from other financial fraud for being related to payment tools such as cheques and payment cards.

Beyond the technicalities of the frauds related with the presence of a card, payment card frauds differ from other frauds for the amount of the single transaction (i.e. usually lower than an investment business), the frequency of the card use, and the instrumental use of the card to complete another transaction (i.e. the purchase of the good or service, the withdraw of cash, etc.). So, while in investment frauds the attention of the victim is on the investment, in card frauds the main attention is not on the card but on the good or service related with the purchase. It is important to stress those differences because most of the literature on financial frauds concerns investment frauds, making payment card frauds a less explored research field. The existing literature on card frauds is mainly focused on card technology and security systems to prevent fraud, taking the card issuer point of view, and not representing financial studies.

If differences between card frauds and investment frauds exist, those types of fraud share some similarities (e.g. key role of trust in the transaction, the monetary loss, etc.). It follows that even a study on payment card frauds can take benefits from studies on investment frauds. Shadel and Pak (2007) administrated a 72 questions survey to 80 victims of investment frauds and used a control group of non-victims. Their result is that investment fraud victims demonstrated a better understanding of basic financial literacy than non-victims. Lokanan (2014) analyzed the Investment Dealers Association's tribunal cases in Canada between 1984 to 2008 to examine the demographic characteristics of investors who have been victims of investment frauds. The findings indicate that the victims

were not particularly rich and a significant proportion borrowed money and opened margin accounts to invest. Those most vulnerable were investors who were retired and had limited investment knowledge. Many also dipped into their savings to fund their future retirement needs.

Kiefer and Mottola (2017) examined the demographic and psychological patterns associated with investment fraud victimization using data from the US, and estimate that one in ten investors will be victimized by investment fraud over the course of their lives. Older people are targeted for investment fraud more frequently than younger people, but after controlling for the effects of targeting, older people are not more likely than younger to be victimized by investment fraud. The study highlights that psychological variables associated with fraud victimization are risk tolerance, perception of debt, impulsiveness, and financial literacy. Higher levels of risk tolerance and engagement in risky behaviors are associated with a higher probability of fraud victimization, as are higher level of debt. The authors cite even evidence that victims and non-victims differ in term of impulsiveness. Victims reported higher impulsiveness and demonstrated less cognitive flexibility. A counter-intuitive evidence is that higher levels of financial literacy is associated with an increased probability of investment fraud victimization. The authors argue this effect can be related to over-confidence.

Panayiotis and Philip (2018) address the role of financial literacy on fraud victimization as well. The authors use data from 881 Cypriot students in five universities to assess the risk of university students to be victims of personal debt and fraudulent investments. In this case, results support the hypothesis that higher levels of financial literacy influence the students' ability to deter themselves from fraudulent investments. Williams, Strauch, and Duncan (2018) studied the connection between financial literacy and investment frauds in the case of Ponzi schemes, looking at their warning signs and how best to avoid them. Using data from a survey of college students in the US, they find that financial literacy helps people to identify Ponzi schemes and avoid financial frauds. Those results are consistent with Chariri (2018), who analyzes the effect of age, education and financial literacy on the ability to detect investment scams. Using a questionnaire survey in Indonesia, the author applies both a factor analysis and a regression model finding that the level of individual financial literacy positively affects the ability to detect investment scams, while there are no effects of age and education.

Engels, Kumar, and Philip (2019) use data from the National Financial Well-Being Survey (NFWBS), fielded in 2016 by the Consumer Financial Protection Bureau (CFPB), to test if more financially knowledgeable individuals have a higher propensity to detect fraud. The conclusion of the study is that financial literacy is relevant in predicting the ability of individuals to detect financial frauds. DeLiema et al. (2020) analyzed a sample of 214 investment fraud victims in the US, looking for similarities in order to define a victim profile. Results suggest that, in addition to being older and male, victims were more materialistic than general investors, were more frequent stock traders, and purchased more investments sold through unsolicited calls, emails, television advertisements, or “free lunch” seminars, but were less likely to invest based on a social network member’s recommendation.

Evidence from China confirms the hypothesis that financial literacy can help to prevent investment frauds. Gui, Huang and Zhao (2018) study how investors are exploited by fraudulent financial products. Using data from experiments and a survey in China (Shenzen), the authors tested the effect of an “eye-opening financial education program”, finding for the participants a significant reduction in the tendency to invest in fraudulent products, especially among the most risk-averse individuals.

The emphasis in the financial fraud literature on investment frauds is clear even when studies pay attention to financial frauds that target specific groups, like the elderly. DeLiema (2017) tries to identify older adults’ specific attitudes and characteristics that may increase the risk of victimization. Using data from a telephone survey in the US, 700 victims of financial frauds (verified by the FBI) were studied and compared with a random sample from the general investor population. Compared to non-victims, investment fraud victims would have more positive attitudes toward risky investment opportunities, would be more open to investment solicitations, and be more likely to have experienced negative life events prior to making the investment. DeLiema, Deevy, Lusardi, and Mitchell (2018) used data from the Health and Retirement Study (HRS) to evaluate the incidence and risk factors for investment frauds among older Americans. In their conclusions the authors state that a fraud is a complex phenomenon and no single factor uniquely predicts victimization.

If we put aside financial frauds and we pay attention to the relationship between credit cards and financial literacy, we find some papers that tried to connect the

use of payment cards with financial knowledge and financial literacy. Allgood and Walstad (2016) used data from the US (FINRA National Financial Capability Study), but in their conclusions they say they are unable to identify a causal relationship between financial literacy and credit card behaviors. However, the results from the probit analysis show that both actual and perceived financial literacy appear to influence financial behaviors and that perceived financial literacy may be as important as actual financial literacy.

Robb (2011) examined the relationship between financial knowledge and credit card behavior of college students. Using a sample of 1,354 students from a major south-eastern university in the US, the author suggests that financial knowledge is a significant factor in the credit card decisions of college students. Students with higher scores on a measure of personal financial knowledge are more likely to engage in more responsible credit card use. Robb and Sharpe (2009) analyzed data from 6,520 college students from a large Midwestern University. Results confirm the significance of financial knowledge in explaining the credit card decisions of college students. What is surprising - and somehow counter-intuitive - is that those with higher levels of financial knowledge had higher credit card balances. The authors conclude that this is evidence of the complex nature of the relationship between personal financial knowledge and credit card behavior, but another possible reading of this result is that financial literacy could be linked to higher credit card balances by the overconfidence generated by the financial knowledge.¹⁰

This paper started from the evidence that the literature on financial frauds is mostly related to investment frauds and still limited on payment card frauds, and the literature on payment cards and financial literacy mainly referred to card users’ behavior (e.g. balance on credit cards, late fees, etc.), but did not account for the risk of victimization in financial fraud. Hence, the intention of the study is to fill this gap in the literature and investigate the role of financial literacy in preventing financial frauds that involve the use of payment cards. The assessment of people’s ability to identify (and avoid) a fraud will be useful to estimate the risk of victimization. The assessment of the effect of financial literacy (basic financial principles and the functioning of payment cards) on preventing victimization of financial frauds on payment cards will

¹⁰ See Williams et al. (2018) and Xiao et al. (2010) for additional studies using college students.

shed light on the chance to support financial consumers by financial education. Finally a quasi-experiment will help to figure out the effectiveness of a single-event financial education initiative to improve the ability to identify financial frauds.

III. Data and Methodology

A. Study Design

The study is based on an experimental approach. A sample of 387 senior students from a faculty of economics of one of the main universities in central Italy was used to analyze the relationship between financial literacy and financial frauds and to test the effectiveness of a financial education curriculum, based on a single two-hours-long seminar. As reported in the previous section of this study, the use of college students to address financial frauds and the use of financial product is not new. Several previous studies referred to college students samples and motivated their decision. For the present study the use of college students, and the restriction to a faculty of economics have specific motivations too. Senior college students should have enough experiences with the use of payment cards to be aware of their functioning. The young age compared with the rest of the population should guarantee more confidence with technology and the use of payment cards on line (e.g. e-commerce). The fact that all the students belong to a faculty of economics and addressed financial topics in different courses guarantees (1) previous exposure to (at least) general financial management education, and (2) bigger interest about finance than students from other faculties or other young adults not attending any college. In that manner the average financial literacy of the sample should be higher than the average population. It gives the chance to test something more than the “average” risk of victimization of a population. Such “elite group” allows to test if financial fraud sophistication and the scam techniques are so developed to put at risk even individuals that should be more prepared than the average in dealing with financial topics and in identifying financial scams. This analysis can make a step forward from the identification of groups of individuals that are more at risk of victimization, testing if there are groups that can

be considered completely safe or at least more prepared in dealing with scams.

A first questionnaire was administered to all the participants and served as a baseline. That questionnaire had the aim to assess the initial level of financial literacy - assessing (1) basic principles and (2) financial knowledge on payment cards - and to assess the ability to recognize and avoid financial frauds. Some additional socio-demographic variables were added to analyze if the most fragile individuals (those who failed the most to identify financial frauds) show some similarities. After the first questionnaire students were randomly assigned to two different groups. The first group attended the financial education seminar. The second group did not and was used as control group. A few days after the seminar a second questionnaire tested one more time the knowledge and the skills of the participants on payment cards and financial frauds.

Data were collected in October 2019. All of the questionnaires in the pre-test and post-test phases were collected on line for both the treatment group and the control group. The participation for students was voluntary and all the participants who completed the experiment were rewarded with extra-curriculum credits. The dedicated website used to administer the questionnaire guaranteed the anonymity of the participants.

B. Sample Characteristics

1. Socio-demographics

The study included socio-demographic data - as control variables - assuming that that some of these factors may affect financial literacy and the likelihood of financial fraud victimization. The descriptive statistics of socio-demographic characteristics of the sample are listed in Table 1. Being a sample of college students, the age of the participants is in around the 90% of the cases between 21 and 24 years old. What is relevant is that the group that attended the financial education seminar (treatment group) and the other participants (the control group) do not significantly differ in term of age. Males are around 55% of the sample (214 on 388), and most of the students are full time students (68% as 264 on 388).

The majority of the sample (87.1%, 338 on 388) still live with parents. This may be an important variable that can help to explain the students' ability to deal with frauds

because those who do not live with parents should make more financial experiences, specially about payments and payment cards. At the same time students from foreign countries should be more financially literate about budgeting because they have to take care of their own personal budget.¹¹

The inclusion of a variable about the parents' education of participants allows for the possibility that an intergenerational learning effect can help to explain the students' ability to deal with financial frauds, if education is a proxy for parents' financial literacy. It is interesting how the sample is almost

Table 1. Socio-demographic characteristics of the sample

Variables	Values	All	Treatment group	Control group
Age (in years)	21	27	12	15
	22	208	110	98
	23	88	42	46
	24	28	14	14
	25+	37	17	20
	Total	388	195	193
Gender-Male	1=Male	214	106	108
	0=Female	174	89	85
	Total	388	195	193
Job status 1	1=Full time student	264	128	136
	2=Part-time student	8	3	5
	3=Study and Work (part-time)	79	46	33
	4=Study and Work (full-time)	5	2	3
	5=Study and Work (freelance)	16	8	8
	6=Other	0	0	0
	99=Not Available	16	8	8
	Total	388	195	193
Job status 2	1=Full time student	264	128	136
	0=Other (part-time student, study and work, etc.)	124	67	57
	Total	388	195	193
Highest education of parents (it compares the education level of the parents and considers the highest)	1=Primary school	1	0	1
	2=Middle school	37	21	16
	3=High school	159	78	81
	4=Some college (without degree)	35	15	20
	5=University (degree)	100	52	48
	6=Post-graduate (Master or PhD)	40	19	21
	N.A.	16	10	6
	Total	388	195	193
Housing	1=With parents	338	168	170
	0=Other	50	27	23
	Total	388	195	193
Foreigner (Student with a different citizenship than the local one)	1=Yes	22	10	12
	0=No	366	185	181
	Total	388	195	193

¹¹ However the small percentage of foreign students (22 on 388) and the chance that even Italian students had to move far from home to attend college can jeopardize the test of this hypothesis.

Variables		Values	All	Treatment group	Control group
GPA (Grades in the Italian system are based on a range from 18 to 30. 18 is the minimum to pass the exam)	Mean		24.755	24.734	24.777
	Std.Dev.		2.04	2.06	2.02
	Min		19	19	19.5
	Max		30	30	29.3
	18-21		9	5	4
	>21-24		112	57	55
	>24-27		201	100	101
	>27-30		66	33	33
Total			388	195	193
Fraud victim (To have been victim of a financial fraud)	1=Yes		51	28	23
	0=No		331	163	168
	N.A.		6	4	2
	Total		388	195	193

equally split in two, with half of the sample of first generation of college attendants (197 on 388) and another half (175 on 388) coming from families where at least one of the parents graduated or attended some college.

Students' GPA is used as an additional control variable.

The variable "fraud victim" control for the chance that individuals developed their knowledge about financial frauds even from previous direct experiences (being victim of a fraud in the past). The variable is equal to one if the respondent says to have ever been victim of a financial frauds. No information about the type of frauds or the timing of the victimization are available. Around 13% of the respondents declare to have been victim of a financial fraud. In this case the inclusion of the variable represents an explorative variable.

2. Financial Literacy and Use of Payment Tools

A second group of control variables measure the availability of payment tools (see Table 2). Those who have access to payment cards and other payment tools could develop more knowledge about the functioning of those systems, being more ready to deal with the risk of scams. The majority of the respondents is unbanked (56.7%, 220 of 388), and prepaid cards are the most frequently owned payment card (74.5%, 289 of 388). Debit cards are available for 47.1% of the participants (183 of 388), while only 15.7% own a credit card. The low rate among college students in the use of credit cards is related with at least two phenomena. The first one is student loans. The practice to borrow in order to pay college tuitions

Table 2. Availability of payment tools

Variables	Values	All	Treatment group	Control group
Payment-Bank Account (If the student has or not)	Yes	220	111	109
	No	168	84	84
	Total	388	195	193
Payment-Credit card (If the student has or not)	Yes	61	31	30
	No	327	164	163
	Total	388	195	193
Payment-Debit card (If the student has or not)	Yes	183	91	92
	No	205	104	101
	Total	388	195	193
Payment-Prepaid card (If the student has or not)	Yes	289	147	142
	No	99	48	51
	Total	388	195	193
Payment-PayPal (If the student has or not)	Yes	119	60	59
	No	269	135	134
	Total	388	195	193
Payment-SatisPay (If the student has or not)	Yes	4	3	1
	No	384	192	192
	Total	388	195	193
Payment-ApplePay (If the student has or not)	Yes	24	15	9
	No	364	180	184
	Total	388	195	193
Payment-GooglePay (If the student has or not)	Yes	13	5	8
	No	375	190	185
	Total	388	195	193

and other college related expenses is quite common in some countries (e.g. the US) but is almost completely absent in Italy. The low cost of education in Italy compared with other countries and the lack of student loan products from the industry inhibit the development of a student loan market, and by consequence the use of credit cards as a borrowing facility.

The second reason is that in Italy credit cards are linked to bank accounts, so the evidence that half of the sample is unbanked reduces the chance for participants to submit a credit card application. Another characteristic of the Italian credit card market is the practice to use credit cards as deferred payment tools more than a real credit line. The typical credit card user pays in full the balance of the card at the end of each month, never paying by installments. Hence, if college students do not have to borrow and do not refer to credit cards as borrowing tools, they tend to use other type of payment cards, specially when they are unbanked. Payment solutions that are not card-based are less popular and mainly referred to PayPal (30.7% of the sample), while other payment options like ApplePay (6.2%), GooglePay (3.3%), and SatisPay¹² (1.0%) are mentioned only in a few cases. Of course, the data of single payment tools does not provide the big picture about the payment behaviors of the respondents. They could own a single card but be quite active in its use, completing a lot of transactions every day, or a single individual could own more types of cards and to have access to different payment solutions at the same time, while others could rely simply to cash. However, a detailed analysis of the students' payment behaviors is beyond the aim of this study.

To address the role of financial literacy in preventing victimization in financial frauds, three different measures of financial literacy have been included in the study to test the main hypothesis that the more a person knows about finance (so, the higher is financial literacy), the lower is the chance to be victim of a financial fraud. The first measure of financial literacy is the sum of correct answers to five questions widely used in the literature on financial literacy and referred as the “big five” questions or “Lusardi-Mitchell questions”. The original set of three questions was developed by Lusardi and Mitchell in 2004¹³

and then replicated in several other studies. These questions address general financial principles like inflation, compound interest, and stocks. This set of questions was extended with additional two questions on mortgages, and bond pricing, completing the set of five¹⁴. These questions were included in the present study to use a financial literacy measure based on general principles and to guarantee the comparability of the results with previous studies. The assumption is that even referring to very basic financial concepts, this knowledge is enough to discriminate between individuals that are more or less at risk of victimization.

Descriptive statistics on this Lusardi-Mitchell score of financial literacy are reported in Table 3. Details about each of the five questions and their descriptive statistics are available in the appendix. The average number of correct answers to the five questions is 3.57, with a small difference between the treatment group (3.68) and the control group (3.46). Compared with previous studies the scores tend to be pretty good, confirming the hypothesis that the sample of the study represents a subgroup of the population that should be more knowledgeable than the average, thanks to their attitude about finance (they have chosen to be enrolled in curricula in finance), their exposure to financial education (students already attended courses in economics, finance, and statistics) and their personal characteristics (young, attending college, etc.).

The second measure of financial literacy addresses knowledge on payment cards. It is based on a score that sums the number of correct answers to five questions on the main characteristics of credit cards, pre-paid cards, and debit cards¹⁵. This second measure replicates the structure of the Lusardi-Mitchell score, and it is based on the same number of items. In that manner the values of the two indices are immediately comparables because they share the same range of values and the same metrics. The use of a measure of financial literacy directly related to knowledge about payment cards allows to directly

¹² Satisfy is a free mobile app for paying in stores, exchanging money with friends, and buying services. It does not need to be linked to a bank account.

¹³ Questions were introduced in the 2004 wave of the Health and Retirement Study (HRS). The HRS is a longitudinal project sponsored by the National Institute on Aging and the Social Security Administration (USA). The study is managed by the Survey Research Center at the University of Michigan (Ann Arbor, MI USA).

¹⁴ The addition of the two questions on mortgages and bond pricing to the three question on inflation, compound interest, and stocks was proposed by FINRA in the National Financial Capability Survey (NFCS) in 2012, and then adopted by several other surveys.

¹⁵ For details about the five questions and their descriptive statistics, please see the appendix.

test the hypothesis that those who know more about the functioning of payment cards tend to be more ready to identify a scam. For instance, being aware that data from a card allows to spend money even without the physical

presence of a card should inhibit individuals from sharing this information by email or giving it to strangers. The average number of correct answers to these five questions on payment cards for the whole sample is 1.41¹⁶. The

Table 3. Financial Literacy

Variables	Values	All	Treatment group	Control group
Lusardi-Mitchell score (Sum of the correct answers to the five questions on (1) Inflation, (2) Compound interest, (3) Stock (4) Bond pricing, (5) Mortgage)	(0 1 2 3 4 5)			
	0	3	1	2
	1	17	7	10
	2	54	27	27
	3	92	38	54
	4	124	67	57
	5	98	55	43
	Total	388	195	193
	Mean	3.57	3.68	3.46
	St.Dev.	1.17	1.15	1.19
Card score (Sum of correct answers to five questions on payment cards)	(0 1 2 3 4 5)			
	0	4	1	3
	1	31	15	16
	2	110	59	51
	3	138	69	69
	4	95	46	49
	5	10	5	5
	Total	388	195	193
	Mean	1.41	1.41	1.41
	St.Dev.	1.58	1.57	1.59
Financial Literacy self-assessed (Self-assessment of financial literacy on a 1-Low to 7-High Likert scale)	(0 1 2 3 4 5 6 7)			
	1	2	1	1
	2	21	14	7
	3	90	44	46
	4	124	58	66
	5	99	53	46
	6	30	14	16
	7	3	1	2
	N.A.	19	10	9
	Total	388	195	193
	Mean	4.34	4.42	4.27
	St.Dev.	1.10	1.12	1.08

¹⁶ Values for the treatment group and the control group are the same.

comparison between the Lusardi-Mitchell score on general financial principles (mean 3.57) and the payment card score (mean 1.41) highlights that when addressing specific topics the difficulty of the questions tend to increase. At the same time, the low correlation between the two indices (.08) recommends to test the effect of financial literacy in preventing financial frauds using both of them.

The third measure of financial literacy is a self-assessed measure where participants were invited to judge their financial literacy using a Likert scale from one (low literacy) to seven (high literacy). The inclusion of this measure in the study is supported by previous studies that show how sometimes there is a gap between what people think they know about finance and what they really do (Muller and Weber 2010, Sekita 2011, Klapper et al. 2013). The average value of the self-assessed financial literacy score is 4.34, with most of the respondents (313 of 388) positioning themselves in between 3 and 5. The correlation between this subjective financial literacy measure and the other objective measures is pretty low (.21 with Lusardi Mitchell score; .07 with card score).

3. Financial Fraud Literacy

A last set of items was used to assess the ability to identify financial frauds (so called "fraud literacy"). Respondents were asked to assess 20 different scenarios and, for each of them, to say if a risk to be a victim of a financial fraud exists or does not. Some of the 20 scenarios were typical financial scam schemes systematically proposed by fraudsters in the last years (e.g. email with an inheritance that requires a payment to be unlocked, emails from a fake e-commerce website that requests to confirm the credit card number, etc.) and widely experienced by people around the world, other scenarios were designed in order to appear to be a safe scenario or to sound just a bit suspicious, not being related with any scam¹⁷. The full list of scenarios and some descriptive statistics about the response rate of the participants are reported in the Appendix. The set of available options to answer each question was quite standard (e.g. "Yes, it is a fraud", "No, it is a safe scenario"). In that manner it should be avoided any implicit suggestion or bias in the answers. A third option "In this case I do not know

what to do" was always included and gave respondents the chance to express their doubts if the case was a fraud or not. The presence of this neutral option should reduce the risk that who is not sure about the answer will simply guess, with the risk to interpret a correct answer as result of knowledge, when it is simply luck.

Starting from those 20 items, three measures of fraud literacy were developed. The first one (score1) is based on the number of right answers to each of the 20 questions/scenarios. Correct answers are considered the ones where the respondent identifies a fraud in a fraudulent scenario, and the ones where the respondent considers as a safe scenario one that is not related with frauds. In that manner it is not only the ability to avoid a fraud that matters, but even the ability to act when a scenario is safe. Doing so the score accounts the attitude of the individual to not be inhibited in the use of his/her payment card. In fact, one possible negative consequence of the risk of fraud is the chance that individuals quit to use their payment cards for the risk to be victimized. This effect should be measured by the "do not know" option, that will not be accounted as a positive answer and will not contribute to this score. From the distribution of the number of correct answers a dummy variable representing the score of fraud literacy identifies those who are above the median of the distribution. In that manner a value equal to one is related to who was more able to identify frauds and to recognize safe scenarios. The decision to dichotomize the score in a dummy variable is related to the will to do not stress the relevance of the single question/scenario and to refer to the ability to deal with financial frauds looking at the big picture of the study. The same dichotomization process has been used for all the other measures developed from the financial frauds questions.

The second fraud literacy measure (score2) starts from the 20 items on financial frauds and sums the number of points related to each option selected in the answers. A correct answer adds points to the respondent's score, a wrong answer subtracts points. Respect to the previous score, in this case the negative effect of a wrong answer is not only related with the opportunity cost of a missing right answer (that will not contribute to the score), but the respondent is penalized with an additional negative effect due to the points subtracted from the score. This additional effect is not a simple parallel shift of the score because different options in a question could be related with different points¹⁸.

¹⁷ All the twenty items were tested on a small group of students before the experiment to test their difficulty.

The third measure (score3) counts the number of questions where the respondent said to do not know if there is a risk of fraud or not in the proposed scenario. The number of “Do Not Know” answers represents a measure of the confidence an individual has in dealing with potential frauds. The descriptive statistics of these three indices are listed in Table 4, while details of the 20 items are described in the appendix.

C. Empirical Methods

The analysis of the data required the application of two different methodologies to address the two different

aims of the study. To assess the role of financial literacy in preventing financial frauds that involves the use of payment cards, different multivariate regression models were applied. Each of the scores was used as a measure of the ability to identify and avoid financial frauds (score1 and score2) or as a measure of financial confidence (score3). Being all the variables are 0-1 indicators or “dummy variables”, a logistic regression model was used. The explanatory variables of the model include the three measures of financial literacy (Lusardi Mitchell, card score, self-assessed financial literacy) that should shed light on the role of financial literacy in preventing financial fraud. Other independent variables are the socio-demographic variables (gender-male, job status2, highest education of parents,

Table 4. Financial Fraud detection skills

Variables	Values	Pre-test			Post-test		
		All	Treatment group	Control group	All	Treatment group	Control group
Score1 (0 1) Number of right answers* to the 20 financial fraud questions	0	158	83	75	198	102	96
<i>*A right answer is when the respondent identifies a fraud when the question involved a fraud, and when the respondent identifies as safe a safe scenario that does NOT involved a fraud</i>	1	230	112	118	190	93	97
Total		388	195	193	388	195	193
The variable is equal to 1 if the score is below the median (=13), and zero otherwise: hence a value of 1 is for a high risk of victimization	Mean	0.59	0.57	0.61	0.49	0.47	0.50
	Std.Dev.	0.49	0.50	0.49	0.50	0.50	0.50
Score2 (0 1) Sum of points (gained or lost*) from the answers of the 20 financial fraud questions.	0	158	83	75	198	102	96
<i>*A correct answer (e.g. the respondent identifies a fraud when the scenario of the question was a fraud, and identifies a safe scenario when it was safe) add points to the score, while a wrong answer (e.g. the respondent fails to identify a fraud or think there is a fraud in a safe scenario) subtract points to the score.</i>	1	230	112	118	190	93	97
Total		388	195	193	388	195	193
The variable is equal to 1 if the score is below the median (=7), and zero otherwise: hence a value of 1 is for a high risk of victimization	Mean	0.59	0.57	0.61	0.49	0.47	0.50
	Std.Dev.	0.49	0.50	0.49	0.50	0.50	0.50
Score3 (0 1) Number of “Do not know what to do” in the 20 financial fraud questions (Confidence index)	0	180	87	93	188	104	84
	1	208	108	100	200	91	109
Total		388	195	193	388	195	193
The variable is equal to 1 if the score is above the median, and zero otherwise: hence a value of 1 is for the less confident respondents (that used the Do Not Know option more than others)	Mean	0.54	0.55	0.52	0.51	0.46	0.56
	Std.Dev.	0.50	0.50	0.50	0.50	0.50	0.50

¹⁸ A wrong answer can be wrong because the respondent did not choose option A (right option) but option B, or option C. If both options B and C are wrong, option C can be considered “more wrong” than option B and such difference is accounted with a “-1” point for option B and a “-2” points for option C.

housing, foreigner, GPA), an indicator of previous victimization, and the available payment options (credit cards, debit cards, pre-paid cards). Those variables were included to check the above mentioned hypothesis and to check if they can help to explain the ability to avoid frauds, according with previous studies and the above mentioned assumptions about the logic connections with financial fraud knowledge. The expected result, as reported in the previous declaration of the hypothesis, is a positive correlation between financial literacy and the ability to identify financial frauds. At the same time the ownership of payment cards is expected to be positively related with the ability to avoid scams.

The second methodology is a difference-in-difference approach and addresses the effectiveness of the financial education seminar offered between the two waves of the survey (pre-test and post-test). Using this methodology the difference between the average financial fraud literacy before and after the seminar was assessed in the treatment group (those who attended the seminar) using each of the available measures of fraud literacy (score1, score2, and score3). In the meantime the same differences were

measured in the control group (those who did not participate to the seminar), and the differences between those means were tested by a T-test. The expected result is a positive effect of financial education on financial fraud literacy with an increase in the fraud literacy that should be bigger for the participants that attended the seminar (financial education) compared to the others.

IV. Results

A. Risk of Victimization

Table 5 shows the output of the logistic regression analysis used to explain the risk of victimization in financial frauds, measured by the number of correct answers at the 20 items on financial frauds (score1). The coding of the dummy variable is 1 for a high risk of victimization (score below the median) and 0 for low risk (score above the median). Estimates are reported as odds ratios.

Table 5. Results of logistic regression on risk of victimization - Score 1 (# correct answers to fraud literacy questions)

Score1 (# correct answers)	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value
studyonly	1.23	0.345	1.34	0.215	1.38	0.177	1.32	0.272	1.33	0.265
withparents	0.71	0.290	0.71	0.298	0.73	0.359	0.61	0.177	0.61	0.169
foreigner	0.89	0.803	0.58	0.277	0.63	0.360	0.49	0.172	0.49	0.176
male	0.74	0.164	0.81	0.340	0.86	0.512	1.09	0.743	1.09	0.734
gpa			0.95	0.310	0.95	0.310	1.01	0.818	1.02	0.780
parenteduMAX			0.98	0.787	0.97	0.709	0.97	0.789	0.98	0.863
Payment-Credit card					1.50	0.198	2.10	0.034 **	2.10	0.034 **
Payment-Debit card					1.05	0.827	1.02	0.947	1.01	0.960
Payment-Prepaid card					0.90	0.685	0.88	0.655	0.91	0.753
Payment-PayPal					0.77	0.296	0.74	0.249	0.77	0.332
Payment-SatisPay					0.96	0.967	1.37	0.773	1.34	0.791
Payment-ApplePay					0.89	0.788	0.89	0.809	0.76	0.590
Payment-GooglePay					1.07	0.919	1.27	0.707	1.22	0.757
LMscore							0.72	0.003 **	0.71	0.002 **
cardscore							0.77	0.028 **	0.77	0.034 **
selfassess							0.98	0.881	0.99	0.949
fraudvictim									1.00	0.751
	Obs	388		372		372		353		351
	Pseudo R-squared	0.0095		0.0121		0.0189		0.0556		0.0544

*p-value<.10; **p-value<.05; ***p-value<.01.

The hypothesis that those with higher financial literacy tend to be less victimized in financial frauds is confirmed. In the final step of the analysis, both of the objective measures of financial literacy are statistically significant. The odds of the LMscore (.71) and the cardscore (.77) suggest that each correct answer to one of the five questions of those scores reduces the risk of victimization by almost 30%. The third measure - based on the self-assessment of the respondent about his/her financial literacy - is not related with the risk of victimization. The hypothesis that those who have more access to payment cards and other payment tools are more ready to deal with the risk of scams is not confirmed by the empirical results. Six out of seven of the variables related to the ownership of payment types are not statistically significant, while the seventh variable suggests that those who have a credit card are twice as likely to be at high risk of victimization. If that result seems to be counterintuitive, it can be interpreted as a measure of overconfidence. The use of the credit card can make people feel more confident about their financial behaviors, paying less attention in scenarios that involve a risk of financial fraud. To have been victi-

mized in the past does not help to identify financial frauds. The lack of significance can be the evidence that people struggle to learn from previous mistakes, but it can be related with the fact that an individual could have been the victim of only one of the frauds proposed in the 20 items used to assess the fraud literacy, or the fraud he/she was victim of could be out of that list. The socio-demographic variables (e.g. to be male, to be a full time student, to live with parents, parents' education, etc.) show no evidence of a clear correlation with the risk of victimization and do not support the related hypothesis.

The same analysis was repeated using the second measure of fraud literacy (score2) based on the “points” gained or lost answering the 20 questions on financial frauds. Like the other indices of financial fraud victimization, the value 1 is for the individuals with the high risk of victimization (measured by being below the median of the distribution based on the total points from the answers). Results are summarized in Table 6, with estimates reported as odds ratios.

In this case financial literacy is unrelated to the risk of victimization. All the three measures (LMscore, card-

Table 6. Results of logistic regression on risk of victimization - Score 2 (# points related to answer to fraud literacy questions)

Score 2 (# points)	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value
studyonly	0.64	0.051 *	0.73	0.184	0.69	0.135	0.73	0.217	0.73	0.214
withparents	0.58	0.099 *	0.57	0.095 *	0.55	0.082 *	0.51	0.065 *	0.52	0.076 *
foreigner	0.80	0.623	0.51	0.173	0.47	0.148	0.42	0.094 *	0.43	0.102
male	1.00	0.983	1.08	0.729	1.08	0.745	1.16	0.559	1.16	0.555
gpa			0.94	0.229	0.94	0.247	0.97	0.596	0.98	0.671
parenteduMAX			0.97	0.718	0.97	0.705	0.92	0.402	0.93	0.465
Payment-Credit card					0.90	0.741	0.95	0.877	0.94	0.845
Payment-Debit card					1.13	0.591	0.98	0.944	0.99	0.977
Payment-Prepaid card					0.65	0.109	0.58	0.052 *	0.60	0.079 *
Payment-PayPal					1.25	0.376	1.28	0.350	1.33	0.290
Payment-SatisPay					2.18	0.537	2.05	0.567	2.01	0.576
Payment-ApplePay					0.53	0.157	0.44	0.090 *	0.37	0.054 *
Payment-GooglePay					1.01	0.985	1.01	0.984	0.98	0.977
LMscore							0.86	0.173	0.86	0.171
cardscore							0.98	0.865	0.99	0.933
selfassess							1.13	0.267	1.13	0.272
fraudvictim									1.00	0.761
	Obs	388		372		372		391		351
	Pseudo R-squared	0.0119		0.017		0.0317		0.0396		0.04

*p-value<.10; **p-value<.05; ***p-value<.01.

score, selfassess) are not statistically significant. On the other hand, there is some evidence that the ownership of payment tools is correlated with the risk of victimization. Pre-paid cards (odd .60) and Apple Pay (odd .37) strongly decrease the chance to be at high risk of victimization. Results for the other cards/services (credit cards, debit cards, PayPal, etc.) do not confirm the same hypothesis. The socio-demographic variables are not significant even in this case, with the only exception of the variable that identifies those who live with parents (withparents, odd .52). In this case the results suggest that to live at home with parents decreases the chance to be victim of a financial fraud. However the significance at only 10% does not allow additional comments.

Thus we can conclude that those who are more financially literate are more able to judge if there is or not a risk of fraud but, at the same time, when their performance is not strictly related to the number of times they succeed (score1) but account even for the number of times they fail (score2) this positive relationship tend to fade. That difference suggests that those with more financial literacy tend to be more active (to take more decisions and to

answer more questions) even if they do not always do the right thing. The chance that this hyper-activity could be the consequence of an over-confidence generated by financial literacy can be directly addressed by replacing the dependent variable of the regression models with the third score (score3) based on the number of Do Not Know answers. While score1 and score2 address the likelihood to fail the answers related to the 20 items on financial fraud, the score3 addresses the likelihood to do not really answer, choosing the option “Do Not Know”. Hence, this index assesses the lack of confidence in the judgement of a certain scenario and provides a different perspective. As the other indices, it is a dummy variable where the value 1 means that the respondent belongs to the group of those used the Do Not Answer the most (above the median), showing a low confidence in dealing with financial frauds. The results are listed in Table 7. Estimates are reported as odds ratios.

The odds of the three variables on financial literacy - LMscore (odd .98), cardscore (odd .59), selfassess (.63) - support the hypothesis that the higher is the financial literacy, the higher is financial confidence (so lower is the

Table 7. Results of logistic regression on risk of victimization - Score 3 (# Do Not Know to fraud literacy questions)

Score 3 (# Do Not Know)	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value		
studyonly	1.49	0.074	1.44	0.118	1.48	0.106	1.25	0.401	1.25	0.396		
withparents	0.84	0.584	0.80	0.497	0.81	0.534	0.74	0.399	0.75	0.431		
foreigner	0.61	0.278	0.47	0.133	0.53	0.220	0.42	0.122	0.43	0.137		
male	0.63	0.027	**	0.71	0.117	0.76	0.216	0.76	0.290	0.75	0.267	
gpa			1.06	0.284	1.06	0.306	1.11	0.077	*	1.12	0.050	**
parenteduMAX			0.95	0.587	0.96	0.618	1.02	0.873	1.03	0.785		
Payment-Credit card					1.40	0.266	2.08	0.031	**	2.10	0.029	**
Payment-Debit card					0.82	0.373	0.95	0.839	0.95	0.846		
Payment-Prepaid card					0.94	0.823	0.95	0.872	1.00	0.988		
Payment-PayPal					0.87	0.578	0.80	0.404	0.81	0.433		
Payment-SatisPay					-	-	-	-	-	-		
Payment-ApplePay					0.86	0.741	1.22	0.697	1.07	0.901		
Payment-GooglePay					0.60	0.455	0.88	0.852	0.89	0.869		
LMscore							0.98	0.849	0.98	0.851		
cardscore							0.59	0.000	***	0.59	0.000	***
selfassess							0.64	0.000	***	0.63	0.000	***
fraudvictim									1.01	0.221		
Obs		388		372		368		349		347		
Pseudo R-squared		0.0197		0.0209		0.0272		0.1031		0.1057		

*p-value<.10; **p-value<.05; ***p-value<.01.

chance of belonging to the low confidence group). Within the objective measures of financial literacy, the index based on the knowledge on payment cards (cardscore) is the one statistically significant, while the index based on the Lusardi-Mitchell questions is not. The self-assessed variable - that measures the financial literacy by a self-assessment of the respondent - is statistically significant and its odd below one shows that the more the respondent feels knowledgeable in finance, the lower is the chance they use the Do Not Know option. Thus, if results from the previous analysis of this study do not always confirm a relationship between financial literacy and the ability to prevent financial frauds, it seems clear how financial

literacy is able to make the respondent feel more confident in taking financial decisions.

The awareness that different kind of scams exist and individuals could be ready to deal with some of them, but not with others, suggested to replicate the analysis replacing the fraud literacy scores - one by one - with each of the 20 variables accounting for the 20 items separately. To preserve the readability of the paper the outputs of the 20 logistic regressions models are not discussed here but are available in the appendix.

Table 8. Results of diff-in-diff analysis of the effectiveness of financial education seminar

Panel A:		Before	After		
	Control	193	193	386	
	Treated	195	194	389	
		388	387		
Outcome var.	# of correct answers (0 20)	Std. Err.	t	P> t	
Before					
	Control	12.788			
	Treated	12.887			
	Diff (Treated - Control)	0.100	0.239	0.42	0.676
After					
	Control	13.171			
	Treated	13.459			
	Diff (Treated - Control)	0.288	0.239	1.2	0.229
	Diff-in-Diff (N=775)	0.188	0.388	0.56	0.577
	R-squared:	0.01			
Panel B:		Before	After		
	Control	193	193	386	
	Treated	195	194	389	
		388	387		
Outcome var.	# of points (-27 20)	Std. Err.	t	P> t	
Before					
	Control	6.347			
	Treated	6.559			
	Diff (Treated - Control)	0.212	0.416	0.51	0.611
After					
	Control	5.627			
	Treated	5.603			
	Diff (Treated - Control)	-0.024	0.417	0.06	0.954
	Diff-in-Diff (N=775)	-0.236	0.589	0.40	0.689
	R-squared:	0.01			

Panel C:	Before	After			
Control		193	193	386	
Treated		195	194	389	
		388	387		
Outcome var.	# of Do Not Know (0 20)	Std. Err.	t	P> t	
Before					
Control	2.135				
Treated	2.195				
Diff (Treated - Control)	0.060	0.206	0.29	0.77	
After					
Control	1.352				
Treated	1.000				
Diff (Treated - Control)	-0.352	0.206	1.71	0.088*	
Diff-in-Diff (N=775)	-0.412	0.291	1.42	0.157	
R-squared:	0.06				

B. Effects of a Financial Education Seminar

The second part of the study tried to assess the effectiveness of a financial education program based on a single-event in improving the ability to identify financial frauds. The analysis was based on a difference-in-difference approach. Results of the analysis are in Table 8.

Results do not confirm the hypothesis that a single financial education seminar can improve the ability of individuals to identify a financial fraud related with payment cards. The first attempt used the number of correct answers to the 20 items on financial frauds (score1). The comparison between the pre-test (questionnaire filled before the seminar) and the post-test (data collected after the seminar) shows an increase in the average number of correct answers for both the participants to the seminar (treatment group) and the others (control group). The statistical analysis rejects the hypothesis that the participants to the seminar (thanks to their attendance) improved their financial frauds knowledge more than the others.

A second attempt replaced the measure of financial fraud literacy, switching from the number of correct answers to the number of points gained or lost with the answers to the financial fraud questions (score2). In this case the comparison between the pre-test and the post-test shows a score in the post-test that decreases from the pre-test. This result is for both the treatment and the control group. A possible interpretation is that participants used the Do Not Know options in the pre-test more frequently than the post-test, but the additional answers were related to negative points (wrong answers) with a final result of a diminishing average score in the post-test. Regardless the trend of the score between the pre-test and the post-test, what is relevant is that even in this case there is not a statistically significant difference between who was exposed to the financial education seminar and who did not.

In the third case the diff-in-diff approach analyzed the number of Do Not Know answers (score3). In this case there is a statistical significant result and it is about the post-test. Results suggest that who participated to the seminar used the Do Not Know option less than the control group. This result can be interpreted as the evidence that a single seminar on financial fraud - if it is not able to increase the real knowledge on financial fraud - at least can raise the confidence of the participants that become more active when they have to deal with a potential financial fraud. However the final result of the diff-in-diff analysis does not allow to fully support this hypothesis.

V. Conclusions

This study analyzed the role of financial literacy in preventing financial frauds related to the use of payment

cards. The lack of literature on this topic represented the main motivation of the study, together with the relevance and the possible negative consequences of financial scams for different subjects (e.g. consumers, financial intermediaries, producers and sellers). The analysis used recent data from a survey on college students from a faculty of economics to assess the ability to identify and avoid financial frauds, and to assess the financial literacy of the respondents. Different measure of “fraud literacy” and different measures of financial literacy have been used in statistical analysis based on logistic regression models, where the fraud literacy was the dependent variable and financial literacy was one of the explanatory variables, together with variables addressing the ownership of payment cards, previous victimization experiences, and socio-demographic characteristics (e.g. gender, housing, job status, etc.).

Results confirm a positive effect of financial literacy on the ability to identify a financial fraud in one of the two cases. When the “fraud literacy” is assessed as the number of time the respondent was able to identify a fraudulent scenario as a fraud and when recognized as safe a scenario not related with a scam (score1), both the objective measures of financial literacy - one replicating the Lusardi-Mitchell questions, the other focused on the knowledge about the functioning of payment cards - were able to decrease the risk of victimization. Those variables were not statistically significant anymore when the “fraud literacy” was measured accounting positive or negative points in case of right or wrong answers (score2). Regardless the methodology applied to measure the ability to identify a financial fraud, the self-assessed measure of financial literacy was not relevant on a statistic point of view. This result is coherent with results from previous studies that shown how the perception of people about their financial literacy often differs from the real knowledge and skills they have in finance.

What is interesting is that when financial literacy was a statistically significant variable, it was the only variable - together with the ownership of credit cards - correlated with the fraud literacy. The fact that other variables did not contribute to explain the volatility of the fraud literacy can be interpreted as the difficulty to identify the drivers of the decision making process of individuals that deal with financial frauds, and - at the same time - the key role of financial literacy in that process.

The fact that the median of the number of correct

answers to the 20 questions on financial frauds (used in the score1) was 13 shows how even in a sample of individuals that should be more prepared than the general population in dealing with financial frauds (thanks to their studies in economics and finance, their attitude to deal with emails and internet where several frauds happens, etc.) half of the respondents risks to be victimized in around 50% of the cases. This result should be a warning about the risk of victimization for more weak groups of the population.

A third analysis paid attention to the confidence that individuals have in dealing with a possible financial fraud. Counting the number of “Do Not Know” answers (score3), where individuals admit to do not know if the scenario of the question was a fraud or not, this measure was used as dependent variable in a last regression model. Results shows how in this case two of the three measures of financial literacy are statistically significant. The knowledge on the functioning of payment cards (cardscore) has a odd .59. So higher is the knowledge on payment cards lower is the chance to use a lot the option “Do Not Know”. In the meantime, more a respondent self-assesses his/her financial literacy as high, lower is the use of the “Do Not Know” option. These results can be interpreted as a positive effect of financial literacy on financial confidence. People with more financial knowledge, or people that simply think to be more knowledgeable, tend to be more active and to be more prone to take decisions when they use their payment cards, even when those decisions involve a risk to be victim of a fraud. If to be confident in finance is important, because increase the likelihood to participate to the financial system and take benefit from that, the evidence that financial literacy is not always correlated with the ability to identify and avoid a financial fraud requires to be wary about the positive correlation between financial literacy and financial confidence, because there is the chance that financial literacy could generate more confidence than abilities, with a final “overconfidence” effect that could increase the risk of victimization in financial frauds.

The second part of the study assessed the effect of financial education on fraud literacy. The main interest was to test if a “one shot” event, represented by a two hours seminar on financial frauds related with payment cards, was able to improve the ability of individuals to deal with financial frauds. Using a diff-in-diff approach the same questionnaire was administered to two groups

of individuals. Then the first group attended the seminar, while the other did not. A second wave of the questionnaire was administered few days after the seminar to both groups. Results suggest that the one-shot approach does not work. Using two different measures of fraud literacy, no difference in the pre- and post-tests results' differences are statistically significant. It follows that any difference in the ability to identify a fraud between the two points in time (before and after the seminar) can not be proved to be due by the seminar. If the lack of evidence about the effectiveness of the seminar can be related to some seminar's issues, as the structure of the seminar, the contents of the seminars, the attention paid by the participants, and many other possible explanations, the doubts about the chance to empower financial consumers with single events of financial education still remains. The only effect that the seminar seems to produce is an increase in financial confidence. The application of the diff-in-diff approach on the variable that counts the number of "Do Not Know"s shows how in the second wave of the survey (the post-test) there is a statistically significant difference between the treatment group (seminar attendants) and the control group, with the former less prone to use the "Do Not Know" option than the latter. However, the overall result of the diff-in-diff does not confirm the general validity of this hypothesis.

We can conclude that, even if further studies on the effectiveness of financial literacy to reduce the risk of victimization in financial frauds that involve the use of payment cards are necessary, results of this study suggest a positive relationship between financial literacy and the ability to avoid that kind of scams. Those results are coherent with results of previous studies where financial literacy was proven to be relevant in promoting positive financial behaviors and to avoid investment scams.

About the chance to adopt financial education strategies based on single and short events to increase financial literacy, this study does not support the effectiveness of this approach. However the chance that a lack of empirical evidence on the effectiveness of financial education could be explained by the different issues does not allow to conclude that financial education is worthless or that short seminars are never useful, while additional studies that compare the effectiveness of financial education programs that differ in terms of contents, teaching methodology, and target of recipients can help to shed light on the big question about the effectiveness of financial

education and the opportunity to invest on it to improve the consumer financial literacy.

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Appendix

Table A1. Details of the financial literacy items used for the financial literacy indices

Variables	Values	All	Treatment group	Control group
Lusardi-Mitchell Compound interest	Suppose you had 100€ in a savings account (without cost) and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?			
	1=More than 102€ (RIGHT ANSWER)	341	176	165
	2=Exactly 102€	6	2	4
	3=Less than 102€	37	16	21
	98=Do not know	1	0	1
	99= Prefer not to say	1	1	2
	N.A.	2	0	0
	Total	388	195	193
Correct Answer %	87.9%	90.3%	85.5%	
Lusardi-Mitchell Inflation	Suppose that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?			
	1=More than today	14	7	7
	2=Exactly the same amount of today	25	12	13
	3=Less than today	319	164	155
	98=Do not know	26	10	16
	99= Prefer not to say	1	1	0
	N.A.	3	1	2
	Total	388	195	193
Correct Answer %	82.2%	84.1%	80.3%	
Lusardi-Mitchell Mortgage	A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.			
	1 = True (RIGHT ANSWER)	249	127	122
	2 = False	112	60	52
	98=Do not know	25	8	17
	99= Prefer not to say	1	0	1
	N.A.	1	0	1
	Total	388	195	193
	Correct Answer %	64.2%	65.1%	63.2%
Lusardi-Mitchell Stock	Buying a single company's stock usually provides a safer return than a stock mutual fund.			
	1=True	29	12	17
	2=False (RIGHT ANSWER)	265	133	132
	98=Do not know	90	49	41
	99= Prefer not to say	3	1	2
	N.A.	1	0	1
Total	388	195	193	
Correct Answer %	68.3%	68.2%	68.4%	

Variables	Values	All	Treatment group	Control group
Lusardi-Mitchell Bond pricing	If interest rates rise, what will typically happen to bond prices?			
	1=They will grow	95	46	49
	2=They will fall (RIGHT ANSWER)	213	118	95
	3=They will stay the same	10	3	7
	4=There is no relationship between bond prices and the interest rate	23	10	13
	98=Do not know	40	15	25
	99= Prefer not to say	5	2	3
	N.A.	2	1	1
Total	388	195	193	
Correct Answer %	54.9%	60.5%	49.2%	
Card 1	What type of payment card does allows to buy now a good and pay for it in the future?			
	1=Debit card	46	19	27
	2=Credit card (RIGHT ANSWER)	339	174	165
	3=Pre-paid card	1	1	0
	98=Do not know	2	1	1
	99= Prefer not to say	0	0	0
	N.A.	0	0	0
	Total	388	195	193
Correct Answer %	87.4%	89.2%	85.5%	
Card 2	If you do not have money in your bank account (and you can not overdraft), which of the following is an available option to buy a good in a shop?			
	1=Cheque	74	41	33
	2=Debit card	43	19	24
	3=Pre-paid card (RIGHT ANSWER)	246	122	124
	98=Do not know	24	13	11
	99= Prefer not to say	1	0	1
	N.A.	0	0	0
	Total	388	195	193
Correct Answer %	63.4%	62.6%	64.2%	
Card 3	Which is the payment option in the following list that - if used - affects the balance of your bank account?			
	1=Cash	12	6	6
	2=Pre-paid card	27	13	14
	3=Debit card (RIGHT ANSWER)	346	176	170
	98=Do not know	2	0	2
	99= Prefer not to say	1	0	1
	N.A.	0	0	0
	Total	388	195	193
Correct Answer %	89.2%	90.3%	88.1%	

Variables	Values	All	Treatment group	Control group
Card 4	If you receive the balance of your credit card and you immediately pay in full for it, do you pay any interest? *Interest do not refer to withdraw fees or other commission			
	1=Yes	119	61	58
	2=No (RIGHT ANSWER)	188	90	98
	3=Only if you used your credit card abroad	21	13	8
	98=Do not know	55	28	27
	99= Prefer not to say	4	2	2
	N.A.	1	1	0
	Total	388	195	193
	Correct Answer %	48.5%	46.2%	50.8%
Card 5	Can you withdraw money in a ATM using your credit card?			
	1=No, ATM works only with debit cards, not even with credit cards	56	27	29
	2=Yes, but you will be charged with commissions/fees (RIGHT ANSWER)	269	142	127
	3=Yes, and it is free of charge	37	17	20
	98=Do not know	24	8	16
	99= Prefer not to say	1	0	1
	N.A.	1	1	0
	Total	388	195	193
	Correct Answer %	69.3%	72.8%	65.8%

Table A2. Details of the fraud literacy items used for the fraud literacy indices

Variables	Points	Questions and options	Pre-Test			Post-Test		
			All	Treatment group	Control group	All	Treatment group	Control group
FraudLit01		Your credit card is a magnetic band card and it is in your wallet in your pants' pocket. Riding the metro you see a man approaching passengers with a device in his hand similar to a wireless point-on-sale machine...	All	Treatment group	Control group	All	Treatment group	Control group
	-1	A) You have to take distance because approaching you he could connect the wireless device to your credit card and withdraw money from your account	192	100	92	227	91	136
	-2	B) You just need to put a hand in your pocket and cover your wallet to avoid that the wireless reader will stole your data from the card and use it to withdraw money from your account.	41	23	18	24	10	14
	1	C) You do not have to worry because he can not withdraw money from your account even if he has a wireless POS machine	98	43	55	128	92	36
	0	D) (In this case I do not know what to do)	51	27	24	5	0	5
		99 Prefer not to say	4	1	3	3	1	2
		N.A.	2	1	1	0	0	0
	Correct Answers %		50.0%	45.3%	54.5%	80.0%	89.3%	63.2%
FraudLit02		You are at the hotel desk to check in and the concierge asks you two ID documents, your ID card and your SSN, telling you that you do not need to wait and you can enjoy your room. You can come back later to take them back...	All	Treatment group	Control group	All	Treatment group	Control group
	-1	A) There is no problem: it is usual to present your ID card when you check in in hotels	100	50	50	170	80	90
	1	B) There is the risk of an identity theft	72	37	35	153	87	66
	-2	C) You ask the concierge will complete the procedure in front of you so you avoid to leave your documents	197	96	101	49	20	29
	0	D) (In this case I do not know what to do)	16	10	6	13	7	6
		99 Prefer not to say	1	1	0	1	0	1
		N.A.	2	1	1	1	0	1
	Correct Answers %		18.6%	19.0%	18.1%	39.5%	44.8%	34.2%
FraudLit03		You are at the hotel desk to check in and the concierge asks you an ID card (e.g. your ID card, a passport, a driving license...), telling you that you do not need to wait and you can enjoy your room. You can come back later to take it back...	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) There is no problem: it is usual to present your ID card when you check in in hotels	140	75	65	197	94	103
	-1	B) There is the risk of an identity theft	58	23	35	85	45	40
	-2	C) You ask the concierge will complete the procedure in front of you so you avoid to leave your document	182	92	90	94	50	44
	0	D) (In this case I do not know what to do)	7	4	3	9	5	4
		99 Prefer not to say	1	1	0	2	0	2
		N.A.	0	0	0	0	0	0
	Correct Answers %		36.1%	38.5%	33.7%	50.9%	48.5%	53.4%

Variables	Points	Questions and options	Pre-Test			Post-Test		
			All	Treatment group	Control group	All	Treatment group	Control group
FraudLit04		You are at the hotel desk to check in and the concierge asks you to leave your ID card and your credit card - that will be used to authorize a 300€ lock (as a collateral in case of damages) ...						
	-2	A) It is ok, there is no risk of fraud	45	26	19	17	6	11
	1	B) There is a risk of fraud	307	150	157	349	177	172
	0	C) (In this case I do not know what to do)	32	16	16	18	9	9
	99	Prefer not to say	3	2	1	1	1	0
		N.A.	1	1	0	2	1	1
		Correct Answers %	79.1%	76.9%	81.3%	90.2%	91.2%	89.1%
FraudLit05		You are at the restaurant with your family, at the end of the dinner you asked to pay by credit card and the waitress gives you the bill in a booklet case, with the invitation to leave your credit card						
	1	A) In some countries it can happen, because it is a standard procedure. If you are in one of those countries there is no need to worry, even if you are aware there is the risk that the data of your card can be stolen	292	143	149	302	152	150
	-1	B) It is 100% a fraud, hence you deny to leave your card	62	32	30	69	36	33
	0	C) (In this case I do not know what to do)	29	18	11	11	3	8
	99	Prefer not to say	5	2	3	4	2	2
		N.A.	0	0	0	1	1	0
		Correct Answers %	75.3%	73.3%	77.2%	78.0%	78.4%	77.7%
FraudLit06		You receive a package with an item you bought on line. When you did your purchase you filled the data of your credit card on the e-commerce platform, but the delivery man ask you to take a picture of your credit card - front and rear sides - using a device similar to a smartphone. He tells you it is necessary to check your data and complete the transaction.						
	1	A) There is a risk of fraud	345	172	173	372	188	184
	-1	B) It is ok there is no risk of fraud	13	7	6	7	3	4
	0	C) (In this case I do not know what to do)	23	11	12	5	1	4
	99	Prefer not to say	6	4	2	4	2	2
		N.A.	1	1	0	0	0	0
		Correct Answers %	88.9%	88.2%	89.6%	95.9%	96.9%	94.8%
FraudLit07		You receive a call from a utility company (e.g. electricity) asking you to confirm your residence address, that matches with your current residence address. You are asked to confirm your first name and last name (that are right). After this identification process the employee of the company tells you that the call is to check the payment information used to charge their services, and he invites you to give the number of your credit card, the expiration date and the three digits on the rear of the card..						
	1	A) There is a risk of fraud	366	186	180	359	187	172
	-1	B) It is ok there is no risk of fraud	6	0	6	14	5	9
	0	C) (In this case I do not know what to do)	12	7	5	12	2	10
	99	Prefer not to say	2	1	1	2	0	2
		N.A.	2	1	1	0	0	0
		Correct Answers %	94.3%	95.4%	93.3%	92.8%	96.4%	89.1%

Variables	Points	Questions and options	Pre-Test			Post-Test		
			All	Treatment group	Control group	All	Treatment group	Control group
FraudLit08		You posted a sell announcement on line to sell your bike. You receive a call from the phone number you provided in your announcement and the buyer ask you to pay by ATM. He gives you a code and invite you to go to the ATM of his bank where you can insert your credit or debit card, insert the code and receive the payment with a recharge of your card.						
	1	A) There is a risk of fraud	188	97	91	258	134	124
	-1	B) It is ok there is no risk of fraud	77	38	39	74	35	39
	0	C) (In this case I do not know what to do)	116	56	60	48	21	27
	99	Prefer not to say	5	4	1	7	4	3
		N.A.	2	0	2	0	0	0
		Correct Answers %	48.5%	49.7%	47.2%	66.7%	69.1%	64.2%
FraudLit09		You are visiting a foreign country and you are at a bank to withdraw money in local currency (that it is not your home country currency) using your credit card. The employee at the bank desk recommends to do not use the credit card to avoid an exchange rate that is not be cheap, and he recommends to exchange cash.						
	-1	A) There is a risk of fraud. There is no reason to give such advice by the employee	37	18	19	149	78	71
	1	B) It is ok, there is no risk of fraud (exchange rates used by credit card issuers are never cheap)	279	140	139	192	94	98
	0	C) (In this case I do not know what to do)	64	33	31	31	0	31
	99	Prefer not to say	6	3	3	14	15	-1
		N.A.	2	1	1	1	7	-6
		Correct Answers %	71.9%	71.8%	72.0%	49.6%	48.5%	50.8%
FraudLit10		You are visiting a foreign country and you are in line to use and ATM, waiting that who is currently using the ATM will have done. From the main entrance of the bank a man exits and approaches you introducing himself as a bank employee. He recommend to not use the ATM to withdraw money and he offers to gives you cash in local currency at the official exchange rate - listed on the bank screen - without doing the transaction with the bank in order to avoid the bank commissions.						
	1	A) There is a risk of fraud	311	159	152	119	55	64
	-1	B) It is ok there is no risk of fraud	30	12	18	237	125	112
	0	C) (In this case I do not know what to do)	39	20	19	26	12	14
	99	Prefer not to say	5	2	3	3	2	1
		N.A.	3	2	1	2	0	2
		Correct Answers %	80.2%	81.5%	78.8%	30.7%	28.4%	33.2%
FraudLit11		You receive an email from a lawyer - Mr John Smith - (from an email address smithlawfirm@lawandjustice.com) with a legal notice related to a tax evasion issue described in the attachment.						
	1	A) There is a risk of fraud	164	77	87	226	132	94
	-1	B) It is ok there is no risk of fraud	127	70	57	111	52	59
	0	C) (In this case I do not know what to do)	86	44	42	33	8	25
	99	Prefer not to say	11	4	7	6	1	5
		N.A.	0	0	0	1	1	0
		Correct Answers %	42.3%	39.5%	45.1%	59.9%	68.0%	51.4%

Variables	Points	Questions and options	Pre-Test			Post-Test		
FraudLit12		You receive an email from a lawyer of a foreign country. The email notices you that one of your relatives passed away and you are the only heir. In order to start the legal procedure required to transfer the inheritance the lawyer asks you to do a wire transfer (and includes in the email he bank information numbers to do it).	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) There is a risk of fraud	359	180	179	356	182	174
	-1	B) It is ok there is no risk of fraud	11	9	2	12	5	7
	0	C) (In this case I do not know what to do)	14	6	8	14	6	8
	99	Prefer not to say	4	0	4	4	1	3
		N.A.	0	0	0	1	0	1
		Correct Answers %	92.5%	92.3%	92.7%	92.0%	93.8%	90.2%
FraudLit13		You receive an email from noreply@amazon.com with a promo code that you can use going to the Amazon website, which link is reported for convenience in the email (www.amazon.com)	All	Treatment group	Control group	All	Treatment group	Control group
	-1	A) There is a risk of fraud	65	39	26	72	39	33
	1	B) It is ok there is no risk of fraud	302	157	145	301	149	152
	0	C) (In this case I do not know what to do)	19	9	10	9	4	5
	99	Prefer not to say	2	0	2	5	2	3
		N.A.	0	0	0	0	0	0
		Correct Answers %	77.8%	76.6%	79.2%	77.8%	76.8%	78.8%
FraudLit14		You receive an email from noreply@amazon.bfriday.com with a promo code that you can use going to the Amazon website, which link is reported for convenience in the email (www.amazon.bfriday.com)	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) There is a risk of fraud	230	109	121	242	127	115
	-1	B) It is ok there is no risk of fraud	131	74	57	130	61	69
	0	C) (In this case I do not know what to do)	22	10	12	9	5	4
	99	Prefer not to say	4	2	2	4	1	3
		N.A.	1	0	1	2	0	2
		Correct Answers %	59.3%	55.9%	62.7%	62.5%	65.5%	59.6%
FraudLit15		You receive an email about an unauthorized attempt to use your credit card, that has been locked to prevent further issues. In the same email you find a link to a webpage where you can unlock your card by filling the following information: first name, last name, credit card number, expiration date, security code.	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) There is a risk of fraud	349	180	169	231	115	116
	-2	B) It is ok there is no risk of fraud	23	7	16	131	70	61
	0	C) (In this case I do not know what to do)	13	6	7	18	8	10
	99	Prefer not to say	2	2	0	3	1	3
		N.A.	1	0	1	4	1	3
		Correct Answers %	89.9%	92.3%	87.6%	59.7%	59.0%	60.1%

Variables	Points	Questions and options	Pre-Test			Post-Test		
			All	Treatment group	Control group	All	Treatment group	Control group
FraudLit16		You receive an email from the email address of a friend of yours with the following message “Hi, I am abroad and my credit card does not work because has been cloned. I need to pay for my hotel and then run to the airport to do not miss my flight. Can you send me the info of your credit card? When I will be back I will tell you what happened in details”	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) It is a fraud: I do not reply	293	149	144	330	171	159
	-2	B) It is my friend email account, I know him, hence I immediately reply sending my credit card infos	35	13	22	23	10	13
	0	C) (In this case I do not know what to do)	41	21	20	27	11	16
	99	Prefer not to say	19	12	7	6	2	4
		N.A.	0	0	0	1	0	1
		Correct Answers %	75.5%	76.4%	74.6%	85.3%	88.1%	82.4%
FraudLit17		While you insert your debit card in an ATM you notice that the keyboard is above the rest of the machine.	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) There is a risk of fraud	219	108	111	98	61	37
	-1	B) It is ok there is no risk of fraud	65	37	28	219	101	118
	0	C) (In this case I do not know what to do)	98	47	51	58	27	31
	99	Prefer not to say	4	3	1	9	4	5
		N.A.	2	0	2	3	1	2
		Correct Answer %	56.4%	55.4%	57.5%	25.3%	31.4%	19.2%
FraudLit18		It is 7.00pm. You inserted your debit card in an ATM and inserted your PIN but the monitor of the machine showing the logo of the bank turn black and the following message appear “Error 404...system error. ATM is locked. If your card is in the machine it will be retained for security issues. Please go to the bank offices to have it back.”	All	Treatment group	Control group	All	Treatment group	Control group
	1	A) There is a risk of fraud	76	38	38	76	44	32
	-2	B) It is ok there is no risk of fraud	224	109	115	271	133	138
	0	C) (In this case I do not know what to do)	83	47	36	32	14	18
	99	Prefer not to say	4	1	3	7	3	4
		N.A.	1	0	1	1	0	1
		Correct Answers %	19.6%	19.5%	19.7%	19.6%	22.7%	16.6%
FraudLit19		You are trying to insert your PIN at the ATM, but the digit “9” of the keyboard does not work (and that digit is part of your PIN). After the third failed attempt the following message appears on the screen “Your available attempts are over. Your card will be retained for security issues. Please go to the bank offices to have it back.”	All	Treatment group	Control group	All	Treatment group	Control group
	-1	A) There is a risk of fraud	66	24	42	109	59	50
	1	B) It is ok there is no risk of fraud	265	143	122	237	115	122
	0	C) (In this case I do not know what to do)	53	26	27	39	19	20
	99	Prefer not to say	4	2	2	2	1	1
		N.A.	0	0	0	0	0	0
		Correct Answers %	68.3%	73.3%	63.2%	61.2%	59.3%	63.2%

Variables	Points	Questions and options	Pre-Test			Post-Test		
			All	Treatment group	Control group	All	Treatment group	Control group
FraudLit20		You have just inserted your debit card in an ATM to withdraw cash, but even before to chose an option from the ones listed on the menu, the following message appears on the screen "your bank could charge a fee for this transaction".						
	-1	A) There is a risk of fraud	36	14	22	80	42	38
	1	B) It is ok there is no risk of fraud	326	170	156	256	129	127
	0	C) (In this case I do not know what to do)	22	10	12	38	17	21
	99	Prefer not to say	4	1	3	13	6	7
	N.A.		84.0%	87.2%	80.8%	66.1%	66.5%	65.8%
Correct Answers %								

Table A3. Results of the logistic regression on each of the 20 financial fraud questions. The dependent variable is equal to 1 if the respondent answered correctly, and zero otherwise.

Fraud Literacy - Question #...	1		2		3		4		5	
	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value
studyonly	0.62	0.099 *	1.36	0.367	1.79	0.031 **	1.93	0.029 **	0.72	0.286
withparents	0.60	0.164	0.96	0.933	1.52	0.255	0.90	0.795	1.91	0.073 *
foreigner	1.49	0.470	2.75	0.070 *	0.78	0.665	1.32	0.681	1.51	0.503
male	0.87	0.631	1.10	0.773	0.83	0.461	1.15	0.656	0.97	0.907
gpa	1.07	0.306	1.07	0.379	0.96	0.444	1.08	0.277	1.08	0.262
parenteduMAX	0.93	0.502	0.96	0.724	1.06	0.546	1.03	0.824	1.17	0.177
Payment-Credit card	1.46	0.299	0.51	0.163	1.30	0.426	1.61	0.256	1.17	0.687
Payment-Debit card	1.30	0.342	1.50	0.199	0.89	0.633	0.49	0.017 **	0.69	0.192
Payment-Prepaid card	1.80	0.078 *	1.11	0.771	1.04	0.879	1.11	0.755	0.99	0.964
Payment-PayPal	0.97	0.930	0.98	0.952	1.00	0.987	0.90	0.740	1.65	0.115
Payment-SatisPay	2.54	0.474	1.13	0.927	-	-	-	-	0.61	0.702
Payment-ApplePay	0.73	0.586	2.34	0.137	1.58	0.371	1.52	0.507	0.94	0.916
Payment-GooglePay	0.14	0.086 *	0.64	0.618	1.04	0.958	0.94	0.939	0.90	0.895
LMscore	0.98	0.836	1.17	0.261	1.21	0.091 *	0.97	0.831	1.08	0.510
cardscore	0.89	0.387	1.35	0.058 *	0.88	0.294	1.23	0.144	1.03	0.805
selfassess	1.08	0.561	0.93	0.608	0.92	0.470	1.02	0.914	0.91	0.455
fraudvictim	0.87	0.008 **	0.99	0.630	0.97	0.239	0.97	0.036 **	1.04	0.242
Obs	347		347		347		347		347	
Pseudo R-squared	0.06		0.05		0.03		0.07		0.05	

*p-value<.10; **p-value<.05; ***p-value<.01.

6			7		8		9		10	
Fraud Literacy - Question #...	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value
studyonly	1.074	0.860	0.78	0.663	0.83	0.462	0.83	0.503	0.57	0.095 *
withparents	1.31	0.616	2.29	0.260	0.90	0.744	2.45	0.013 **	1.23	0.607
foreigner	0.69	0.603	-	-	1.45	0.483	2.56	0.161	0.75	0.636
male	0.40	0.027 **	0.54	0.284	2.23	0.001 **	0.55	0.038 **	1.02	0.960
gpa	1.06	0.546	1.02	0.879	0.93	0.237	0.95	0.395	1.02	0.826
parenteduMAX	1.04	0.812	0.72	0.112	0.95	0.586	1.13	0.270	0.94	0.591
Payment-Credit card	0.81	0.685	1.35	0.714	0.56	0.083 *	1.40	0.392	0.56	0.130
Payment-Debit card	0.56	0.131	0.93	0.901	1.02	0.948	1.34	0.284	1.07	0.829
Payment-Prepaid card	1.09	0.840	1.25	0.722	0.97	0.922	1.10	0.760	2.26	0.012 **
Payment-PayPal	0.94	0.889	2.00	0.294	0.86	0.553	1.20	0.544	0.73	0.317
Payment-SatisPay	0.34	0.414	0.06	0.060 *	1.43	0.779	-	-	-	-
Payment-ApplePay	2.34	0.435	0.25	0.150	0.58	0.293	0.81	0.709	2.24	0.315
Payment-GooglePay	0.70	0.711	0.51	0.636	3.28	0.102	1.10	0.914	1.79	0.599
LMscore	1.21	0.246	1.32	0.226	1.02	0.880	1.11	0.364	1.30	0.039 **
cardscore	1.18	0.347	1.35	0.226	1.31	0.021 **	1.24	0.094 *	1.41	0.017 **
selfassess	1.58	0.015 **	1.37	0.204	0.97	0.766	1.13	0.316	0.97	0.834
fraudvictim	1.04	0.419	1.03	0.574	1.00	0.781	1.01	0.659	1.00	0.776
Obs	353		333		351		347		347	
Pseudo R-squared	0.08		0.11		0.05		0.05		0.08	

*p-value<.10; **p-value<.05; ***p-value<.01.

11			12		13		14		15	
Fraud Literacy - Question #...	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value
studyonly	0.60	0.043 **	1.04	0.939	1.04	0.896	1.25	0.369	1.70	0.198
withparents	0.84	0.605	5.33	0.001 **	2.23	0.031 **	1.44	0.286	2.41	0.106
foreigner	1.98	0.185	2.99	0.333	0.55	0.272	0.98	0.972	1.57	0.674
male	1.04	0.879	1.25	0.641	0.74	0.313	0.80	0.377	0.62	0.253
gpa	1.08	0.192	1.13	0.276	0.91	0.165	1.00	1.000	0.90	0.293
parenteduMAX	0.96	0.673	0.96	0.840	0.98	0.852	1.04	0.702	0.84	0.270
Payment-Credit card	1.07	0.840	0.90	0.870	1.05	0.900	1.32	0.400	0.33	0.020 **
Payment-Debit card	1.33	0.240	1.07	0.880	0.83	0.517	1.31	0.264	1.77	0.171
Payment-Prepaid card	1.30	0.346	1.52	0.401	0.67	0.227	1.99	0.013 **	1.68	0.247
Payment-PayPal	0.78	0.354	-	-	0.88	0.692	0.93	0.778	0.76	0.529
Payment-SatisPay	5.92	0.156	0.36	0.030 **	0.56	0.655	0.62	0.662	-	-
Payment-ApplePay	0.55	0.248	0.45	0.335	1.46	0.579	1.95	0.215	1.85	0.577
Payment-GooglePay	0.48	0.269	-	-	3.52	0.266	1.52	0.542	0.15	0.022 **
LMscore	1.13	0.264	1.36	0.105	0.99	0.923	1.15	0.201	1.31	0.115
cardscore	1.12	0.346	1.07	0.766	0.83	0.177	1.17	0.184	1.35	0.116
selfassess	1.14	0.249	1.48	0.062 *	1.45	0.007 **	0.89	0.290	1.21	0.298
fraudvictim	1.02	0.146	1.02	0.590	0.99	0.572	1.02	0.228	1.03	0.511
Obs	351		336		351		351		347	
Pseudo R-squared	0.04		0.16		0.06		0.03		0.10	

*p-value<.10; **p-value<.05; ***p-value<.01.

16			17		18		19		20	
Fraud Literacy - Question #...	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value	Odds	P-value
studyonly	0.58	0.082 *	1.07	0.795	1.37	0.322	0.75	0.300	0.76	0.424
withparents	2.74	0.006 **	2.53	0.008 **	0.75	0.500	0.78	0.522	1.11	0.817
foreigner	3.29	0.139	1.85	0.271	0.36	0.205	1.25	0.698	1.98	0.382
male	0.71	0.241	0.98	0.945	1.35	0.346	0.75	0.287	1.43	0.266
gpa	1.09	0.228	0.95	0.404	0.92	0.273	0.99	0.920	1.06	0.426
parenteduMAX	1.00	0.975	1.02	0.841	0.94	0.581	0.98	0.839	1.15	0.272
Payment-Credit card	0.93	0.840	0.61	0.133	0.64	0.332	2.19	0.052 *	0.82	0.649
Payment-Debit card	0.99	0.958	0.84	0.476	0.77	0.385	0.71	0.189	1.83	0.062 *
Payment-Prepaid card	1.39	0.308	1.29	0.363	1.02	0.955	0.73	0.303	0.76	0.485
Payment-PayPal	1.05	0.864	-	-	1.18	0.612	1.00	0.989	1.06	0.862
Payment-SatisPay	1.66	0.712	1.33	0.292	3.37	0.286	-	-	-	-
Payment-ApplePay	1.89	0.355	0.79	0.644	1.71	0.340	0.64	0.397	0.60	0.422
Payment-GooglePay	0.26	0.040 **	-	-	2.41	0.200	0.41	0.189	-	-
LMscore	1.06	0.661	1.00	0.972	1.05	0.724	1.06	0.587	0.93	0.621
cardscore	0.99	0.915	1.32	0.020 **	0.88	0.392	1.17	0.202	1.12	0.433
selfassess	0.90	0.433	1.21	0.098 *	1.04	0.790	1.12	0.344	1.17	0.270
fraudvictim	1.02	0.250	1.01	0.590	0.97	0.303	1.00	0.869	1.02	0.461
Obs	351		336		351		347		336	
Pseudo R-squared	0.06		0.05		0.05		0.04		0.04	

*p-value<.10; **p-value<.05; ***p-value<.01.