Essays in Household Finance and FinTech

Doctoral Thesis

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The gender gap in over-indebtedness

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Abstract – We document a significant *gender gap* in over-indebtedness, as we find women to be less likely to become over-indebted even after controlling for risk attitude, financial literacy and socio-demographic characteristics. However, once we account for loan purposes the gender gap diminishes. Our findings highlight the importance to account for loan purposes when analyzing individuals' debt behavior.

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1. Introduction

Over the last two decades, individuals' demand for uncollateralized debt, such as consumer loans, has increased considerably. For instance, in Germany, individuals carry €207 billion in uncollateralized debt (Deutsche Bundesbank, 2017) and the number of over-indebted individuals increased four years in a row to approximately 6.9 million households in 2017 (Creditreform, 2017). Excessively accumulating uncollateralized debt bears substantial consequences, such as the risk of bankruptcy, credit constraints, or even the exclusion from the credit market (e.g., Gathergood, 2012; Lusardi and de Bassa Scheresberg, 2013). Next to these economical aspects, high amounts of debt and perceived stress caused by holding debt have been shown to affect physical health (Drentea and Lavrakas, 2000), psychological distress (Brown, Taylor, and Wheatley Price, 2005), and depression (Bridges and Disney, 2010).

Using data from a large representative survey conducted by the German Central Bank (Deutsche Bundesbank), we acknowledge the manifold negative consequences of over-indebtedness and analyze the determinants that cause individuals to become over-indebted on uncollateralized debt. The novelty of our study is that we particularly investigate the relationships of gender, loan purposes, and over-indebtedness jointly.[1]

However, why should gender and loan purposes be associated with individuals' over-indebtedness? Research reveals that women are more risk averse when conducting financing decisions (Almenberg and Dreber, 2015; Jianakoplos and Bernasek, 1998; Powell and Ansic, 1997). For example, women have been found to feel less comfortable with debt (Almenberg et al., 2018) and to find debt less useful

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[1] We focus on uncollateralized debt (i.e., consumer loans, credit card loans, and overdraft facilities), because they are readily available and of high cost, compared to collateralized loans (e.g., mortgage loans).

compared to men (Haultain, Kemp, and Chernyshenko, 2010). Hence, we hypothe-size that women might be less likely to become over-indebted, because they might more carefully consider the decision to take on a loan and for what purpose.

Similarly, there is an extensive literature concerning individuals' indebtedness, with evidence suggesting that economic, demographic, and psychological attitudes shape individuals' subjective attitudes towards debt, which in turn affects individuals' decision to take on debt (e.g., Lea et al., 1993, 1995). In our study, we use loan purposes as an objective measure of individuals' attitudes towards debt, and assess their relationship to individuals' likelihood to become over-indebted.

Our contribution to the literature is twofold. First, despite women and men show similar likelihoods to take on debt and face virtually the same debt burdens, we find women to be less likely to become over-indebted. Interestingly, this gender gap in over-indebtedness persists even after controlling for a number of factors that have been previously identified to explain other gender gaps (e.g., stock market participation, retirement planning, or credit card usage), including risk attitude, financial literacy and individuals' socio-demographics (e.g., Almenberg and Dreber, 2015; Lusardi and Mitchell, 2008; Mottola, 2013). Second, once we control for individuals' loan purposes, which we find to be strongly related to over-indebtedness, the gender effect becomes insignificant. This finding reveals that loan purposes account for a significant part of the gender gap in over-indebtedness. We further elaborate on this finding and investigate whether women engage in debt for other purposes than men. Our results provide some evidence that women are less likely to engage in debt to cover cost of living or to finance larger consumption driven purchases. Those loans have been found to be related to self-control issues, which in turn might increase individuals' propensity to become over-indebted (Gathergood,

2012). In that, our results might provide support for the notion that women more carefully consider for which purpose they take on a loan.

In general, our results highlight the importance to control for loan purposes when analyzing individuals' debt behavior, especially in the context of gender differences, as we document that loan purposes explain a significant part of the gender gap in over-indebtedness.

2. Material and methods

To assess whether gender and loan purposes affect over-indebtedness on uncollateralized debt, we use representative survey data from the 2011 Panel on Household Finances (PHF), which has been conducted by the German Central Bank (Deutsche Bundesbank) and covers responses of 3,565 individuals. The PHF comprises in-depth information on individuals' financial assets, and individuals' debt, as well as socio-demographic and psychological characteristics. Moreover, respondents' were asked for what purpose they took out their loans. Respondents took out their loans for at least one of the following eight purposes: real estate (7.8%), vehicle (19.4%), company or occupation (1.8%), debt conversion (6.0%), student loans (1.2%), cover cost of living (24.7%), other purposes specified (5.8%) or no specific purpose specified (44.3%).[2] For each of the eight different loan purposes, we build an indicator variable, that equals one if a respondent reports that she took out the loan for the respective purpose, zero otherwise.

For our dependent variable, we follow Gathergood (2012) and measure individuals' over-indebtedness as self-reported credit repayment struggles. In this regard, we classify individuals as being over-indebted if they got into arrears on debt within

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[2] Because individuals can have more than one loan, individuals may report multiple loan purposes.

the past 12 months. Our measure of over-indebtedness provides two major advantages in contrast to other debt measures, such as debt-to-income ratios, as it combines the strengths of being an objective measure while simultaneously being unbiased by an individual's current life-cycle stage (Gathergood, 2012). To match over-indebtedness to uncollateralized loans, we restrict our sample to respondents that hold no other debt than uncollateralized debt, which comprises consumer loans, credit card debt and overdraft facilities (henceforth, indebted individuals). This restriction leads to a final sample of 649 indebted individuals of which approximately 7% report being over-indebted.

3. Results

3.1. Descriptive statistics

Table I-1 shows descriptive statistics for all indebted individuals, distinguishing between indebted women and men.[3]

Table I-1: Summary statistics of indebted individuals

This table reports summary statistics of individuals that took out an uncollateralized loan ($N = 649$, thereof 318 women and 331 men). The data are weighted and representative for the German population. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%-level, respectively.

	All	Female	Male	Diff.	N
Female	0.49				649
Financial literacy	2.34	2.38	2.29	0.09	634
General trust	5.44	5.59	5.30	0.29	648
Impatience	4.41	4.45	4.37	0.08	648
Risk attitude	4.03	3.86	4.19	-0.33	648
Age	44.28	43.16	45.37	-2.21	649
Education	0.35	0.37	0.33	0.03	649
Married	0.45	0.45	0.46	-0.01	649
Divorced	0.19	0.22	0.16	0.06	649
Self-employed	0.06	0.03	0.10	-0.07***	649
Retired	0.16	0.12	0.20	-0.08**	649
Unemployed	0.08	0.06	0.11	-0.05*	649
Net income	2,018	2,039	1,997	42	649
Net wealth	61,368	63,550	59,244	4,306	649
Amount of uncollateralized debt	9,287	10,544	8,063	2,480	649

[3] We provide detailed variable descriptions in Appendix I-1.

The sample is evenly divided between women (49%) and men (51%), indicating that women take on debt quite as often as men.[4] Moreover, women face the same debt burdens and possess comparable repayment capabilities like men. The only exceptions where women differ from men are related to respondent's employment status. In particular, indebted women are less likely to be self-employed, unemployed or retired. Interestingly, indebted women achieve similar financial literacy scores compared to indebted men. This is somewhat surprising, as on population-level, women have repeatedly been found to be less financially literate compared to men (Bannier and Neubert, 2016; Lusardi and Mitchell, 2008).[5]

3.2. Regression analysis

3.2.1. Determinants of over-indebtedness

In this section, we assess whether gender and loan purposes affect individuals' likelihood to become over-indebted on uncollateralized debt. Table I-2 reports average marginal effects from a series of Probit regressions featuring over-indebtedness as the dependent variable. In column (1), we regress individuals' over-indebtedness on gender (dummy for being female) without further control variables. The average marginal effect in column (1) reveals a significant gender gap in over-indebtedness as we find women to be approximately 7.3 percentage points less likely to become over-indebted. Next, in column (2), we add socio-demographics as well as measures for financial literacy and risk attitude as further controls to our regression model.

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[4] A formal F-test equals 0.02 with a corresponding *p*-value of 0.88, indicating that women take on uncollateralized debt quite as often as men.

[5] Please note that we also find women to be less financially literate on population-level. Descriptive statistics on population-level are available upon request.

Table I-2: Determinants of over-indebtedness

This table presents average marginal effects from a series of Probit regressions featuring over-indebtedness as the dependent variable. In column (1), we regress over-indebtedness on *Female*. Next, in column (2), we further include control variables, including measures for financial literacy, risk attitude as well as a large set of socio-demographic variables. Finally, in column (3), we further add individuals' reported loan purposes as control variables. For detailed variable descriptions, please refer to Appendix I-1. The data is weighted and representative for the German population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Dependent: *Over-indebtedness*		
	(1)	(2)	(3)
Female	-0.0725**	-0.0592**	-0.0264
	(0.0328)	(0.0261)	(0.0217)
Financial literacy		-0.0328**	-0.0303**
		(0.0141)	(0.0122)
Risk attitude		0.0086	0.0057
		(0.0055)	(0.0046)
Trust		-0.0127**	-0.0107*
		(0.0060)	(0.0057)
Impatience		0.0021	-0.0022
		(0.0043)	(0.0046)
Age		0.0083	0.0053
		(0.0071)	(0.0058)
Age^2		-0.0001	-0.0001
		(0.0001)	(0.0001)
Education		0.0000	0.0037
		(0.0203)	(0.0201)
Married		-0.0041	0.0093
		(0.0272)	(0.0218)
Divorced		0.0677**	0.0616**
		(0.0300)	(0.0263)
Self-employed		0.0027	-0.0291
		(0.0405)	(0.0441)
Retired		0.0792*	0.0557
		(0.0479)	(0.0409)
Unemployed		0.0014	0.0319
		(0.0350)	(0.0275)
Net income (log)		-0.0580**	-0.0660***
		(0.0241)	(0.0232)
Net wealth (log)		-0.0021*	-0.0009
		(0.0011)	(0.0010)
Amount of debt (log)		0.0309***	0.0184*
		(0.0107)	(0.0097)
Cost of living and larger purchases			0.1136***
			(0.0260)
Real estate			0.1155***
			(0.0405)
Company or occupation			0.1825***
			(0.0471)
Student loans			0.0626
			(0.0450)
Vehicle			-0.0200
			(0.0286)
Debt conversion			0.0689**
			(0.0333)
Other purposes			-0.0233
			(0.0333)
Observations	649	633	633
F-test	5.592	2.709	2.408
F-test *p*-value	0.018	0.000	0.000

We proceed in this way, because studies have shown that especially financially illiterate individuals are more likely to become over-indebted (e.g., Gathergood, 2012; Lusardi and Tufano, 2015). Since taking on debt can be associated with significant risks, we further add respondents' risk attitude as a control variable (Brown, Garino, and Taylor, 2013). Interestingly, results in column (2) show that, although the gender gap decreases in magnitude, it is still statistically significant, indicating that differences in socio-demographics as well as financial literacy and risk attitude fail to explain the gender gap in over-indebtedness.[6] This result is in contrast to findings on the well-documented gender gap in stock market participation as outlined in Almenberg and Dreber (2015), who document that socio-demographics and financial literacy fully explain the gender gap in stock market participation. Finally, in column (3), we further include individuals' loan purposes as explanatory variables. We document that the effect of gender on over-indebtedness sharply declines and becomes statistically insignificant once we control for the initial loan purposes. While our results suggest that student loans and loans for vehicles are not associated with over-indebtedness, loans for real estate, company or occupation, debt conversion, and to cover cost of living or to finance larger purchases turn out to be strongly positively related to over-indebtedness. With respect to student loans, this is reasonable, as, in contrast to the US, student loans are quite uncommon in Germany and only of low amounts since German public universities do not raise tuition fees (Usher, 2005). The non-existing relationship between loans for vehicles and over-indebtedness is also not surprising, as interest rates for loans on vehicles are rather low. Some providers even offer zero percent financing. With regard to the

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[6] Please note that this result remains robust when we exclude either self-employed, unemployed or retired individuals, indicating that the gender gap in over-indebtedness shown in column (2) of Table I-2 even persists after excluding potential confounding differences in socio-demographics as displayed in Table I-1.

positive relationship between loans for real estate and individuals' over-indebted-ness, we argue that using large amounts of uncollateralized debt for real estate purposes is of relatively high cost compared to using a collateralized mortgage loan (Disney and Gathergood, 2013). Loans for company or occupation, however, might also be related to over-indebtedness because they are often used to finance the formation of businesses, which clearly bear the risk of failure. A possible reason for the positive relationship between over-indebtedness and loans for debt conversion might be that individuals only engage in loans for debt conversion when they are already highly indebted. Lastly, the positive relationship between loans to cover the cost of living and larger purchases is in line with Gathergood (2012), who finds that taking on such loans is related to a lack of self-control and therefore to over-indebtedness.

3.2.1. Do women engage in debt for other purposes than men?

In this section, we investigate why women show lower likelihoods of becoming over-indebted, although they face virtually the same debt burdens compared to men.[7] Because studies provide some evidence that women show a more hesitant attitude towards debt, they might more carefully consider for which purpose they take on a loan and thus take on debt for other purposes than men. To test this assumption, in Table I-3, we regress the eight loan purposes presented in section 2 on respondent's gender and all control variables displayed Table I-1.

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[7] Please see Table I-1.

Table I-3: Do women engage in debt for other purposes than men?

This table presents average marginal effects from a series of Probit regressions featuring loan purposes as the dependent variables. In columns (1) to (8), we regress each different loan purpose on *Female* and all other control variables displayed in column (2) of Table I-2. For detailed variable descriptions, please refer to Appendix I-1. The data is weighted and representative for the German population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Real estate	Vehicle	Company or occupation	Debt conversion	Student loans	Cost of living and larger purchases	Other purposes	No purpose named
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female	0.0295	0.0236	-0.0063	0.0057	-0.0092	-0.1225***	0.0023	0.0497
	(0.0188)	(0.0371)	(0.0080)	(0.0244)	(0.0090)	(0.0465)	(0.0224)	(0.0460)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	633	633	588	633	535	633	588	633
F-test	4.142	3.802	4.033	2.633	2.770	2.848	0.846	6.595
F-test *p*-value	0.000	0.000	0.000	0.001	0.001	0.000	0.626	0.000

At a first glance, results for most columns of Table I-3 reveal that loan purposes do not vary between genders. However, results in column (6) of Table I-3 suggest that women are approximately 12.3 percentage points less likely to engage in loans to cover cost of living or to finance larger consumption driven purchases. Gathergood (2012) shows that individuals engage in those loans due to a lack of self-control, which in turn is related to over-indebtedness. The finding that women refrain from engaging in loans to cover cost of living or to finance larger consumption driven purchases thus supports the notion that women might more carefully consider for which purpose they take on a loan.

4. Conclusion

Research has acknowledged several gender gaps when it comes to financial decision-making. Gender specific differences are found in, for example, stock market participation (Almenberg and Dreber, 2015), retirement planning (Lusardi and Mitchell, 2008), overtrading (Barber and Odean, 2001), comfort in taking debt (Almenberg et al., 2018), or credit card usage (Mottola, 2013). A great number of those gender gaps can be ascribed to women being (or feeling) less financially literate and less risk tolerant.

Our results document an economically and statistically significant gender gap with regard to individuals' likelihood to become over-indebted. In particular, we show that women are less likely to become over-indebted, even after controlling for a large set of variables including socio-demographics as well as measures for financial literacy and risk attitude. This indicates that, unlike in other studies analyzing gender gaps in financial decision-making, the gender gap in over-indebtedness cannot be explained by gender differences in financial literacy or risk attitude. We show that loan purposes are strongly related to over-indebtedness and explain a significant part of the gender gap in over-indebtedness. Moreover, despite women and men face virtually the same debt burdens, we find women to refrain from engaging in loans to cover cost of living or to finance larger purchases. Such loans, for example, for buying a new television, might often be for pleasure and due to a lack of self-control (Gathergood, 2012), which is why they seem to be related to over-indebtedness. However, there might also be considerable reasons to take on such loans, for example when the products are of urgent needs, such as replacing a broken washing machine. Unfortunately, our data does not provide information on the specific products for which respondents took out the respective loans. While this might present a limitation of our study, future studies should further investigate whether women are less likely to engage in loans for products that are not of urgent needs.

Our results highlight the importance to control for loan purposes when analyzing individuals' debt behavior, especially in the context of gender differences, as we document that loan purposes explain a significant part of the gender gap in financing decisions.

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6. Appendix

<div align="center">Appendix I-1: Variable descriptions</div>

Panel A: Controls	
Age	Ordinal variable that contains head of respondent's age.
Amount of uncol-lateralized debt	Continuous variable measuring respondents' total outstanding uncollateralized debt, including credit card debt, overdraft facilities and consumer loans.
Divorced	Dummy variable that equals one if respondent is divorced, and zero otherwise.
Education	Ordinal variable that describes the respondent's highest degree of education/qualification: 1- Higher education entrance; 2- non-academic post-secondary education; 3- University degree or higher. Zero otherwise.
Financial literacy	Ordinal variable measuring the number of correct answers to financial literacy questions. Corresponding PHF items:
	Question 1: Compound interest effect: "Let us assume that you have a balance of 100 EUR on your savings account. This balance bears interest at a rate of 2% per year and you leave it for 5 years on this account. How high do you think your balance will be after 5 years?" 1-More than 102 EUR [correct]; 2-Exactly 102 EUR; 3-Less than 102 EUR.
	Question 2: Inflation: "Let us assume that your savings account bears interest at a rate of 1% per year and the rate of inflation is 2% per year. Do you think that in one year's time the balance on your savings account will be the same as, more than, or less than today?" 1-More than today; 2-The same as today; 3-Less than today [correct].
	Question 3: Diversification: "Do you agree with the following statement: 'Investing in shares of a company is less risky than investing in a fund containing shares of similar companies'?" 1-Agree; 2-Disagree [correct].
Impatience	Ordinal variable that measures respondents' impatience on a scale from [0] - Very patient [10] - Very impatient.
Male	Dummy variable that equals one if the respondent is male, and zero for female.
Married	Dummy variable that equals one if the respondent is married, and zero otherwise.
Net income	Continuous variable measuring respondents' monthly income (EUR).
Net wealth	Continuous variable measuring respondents' net wealth (EUR).
Over-indebtedness	Dummy variable that equals one if the respondent reports that she got into arrears on uncollateralized debt within the past 12 months, and zero otherwise.
Retired	Dummy variable that equals one if the respondent is retired, and zero otherwise.
Risk attitude	Ordinal variable that measures respondents' financial risk attitude on a scale from [0] - Highly risk-averse [10] - Very happy to take risks.
Self-employed	Dummy variable that equals one if the respondent is self-employed, and zero otherwise.
Trust	Ordinal variable capturing respondents' general trust levels on a scale from [0] - I do not trust other at all, to [10] I trust others completely.
Unemployed	Dummy variable that equals one if the respondent is unemployed, and zero otherwise.
Panel B: Loan purposes	
Company or occupation	Dummy variable that equals one if the respondent took on uncollateralized debt for company or occupation, and zero otherwise.
Cost of living and larger purchases	Dummy variable that equals one if respondent took on uncollateralized debt to cover cost of living or to finance larger purchases, and zero otherwise.
Debt conversion	Dummy variable that equals one if the respondent took on uncollateralized debt for debt conversion of other loans, and zero otherwise.
No purpose named	Dummy variable that equals one if the respondent took on uncollateralized debt and did not explicitly named the purpose for which she took on the debt, and zero otherwise.
Other purposes	Dummy variable that equals one if the respondent took on uncollateralized debt for other reasons, and zero otherwise.
Real estate	Dummy variable that equals one if the respondent took on uncollateralized debt for real estate, and zero otherwise.
Student loans	Dummy variable that equals one if the respondent took on uncollateralized debt to finance a period of study, e.g., a student loan, and zero otherwise.
Vehicle	Dummy variable that equals one if the respondent took on uncollateralized debt to purchase a vehicle or any other mode of transport, and zero otherwise.

II. Why do households leave money on the table? The case of subsidized pension products

Co-authors: Thomas Pauls, Andreas Walter
Own share: 70%

Previous versions of this paper ("The household savings paradox") were presented on the following refereed conferences:

- European Financial Management Association 2018 Annual Meetings (EFMA), Milan, Italy, 2018.
- 80th Annual Meeting of the German Academic Association for Business (VHB), Magdeburg, Germany, 2018.
- Eastern Finance Association 2018 Annual Meetings, Philadelphia, USA, 2018.
- 21st Annual Conference of the Swiss Society for Financial Market Research (SGF), Zurich, Switzerland, 2018.

Why do households leave money on the table?
The case of subsidized pension products

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Abstract – Many individuals only save money in their savings account for their old-age provision rather than investing in more profitable asset classes. That is despite the existence of subsidized pension products, for which smallest contributions can be made monthly, which guarantee the capital preservation, and which offer higher expected returns than saving money in bank deposits. We investigate the determinants that affect individuals' decision to leave money on the table by not investing in subsidized pension products. Our results show that financial literacy and financial advice are positively related to holding such pension products. In that, our results emphasize the role of financial literacy and financial advisors for sound financial decision-making in increasingly complex financial markets.

Keywords: Household finance, financial advice, financial literacy, risk attitude, savings and investment behavior

JEL-Codes: D8, D12, D14, G20

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1. Introduction

In our study, we exploit the availability of secured subsidized pension products in Germany that offer the downward protection feature of bank deposits while simultaneously providing higher upside potential than saving in bank deposits (Deutsche Bundesbank, 2017; Institut für Vorsorge und Finanzplanung, 2016). Those products offer state subsidies, tax advantages and higher interest rates compared to saving money in bank accounts.[1]

However, we show that, on population level, more than a quarter of German households neither holds subsidized pension products nor other pension products, risky financial assets and saving loan contracts. For their old age savings, these households rely solely on contributions to their bank deposits, an "investment strategy" that is associated with negative inflation-adjusted returns. The reluctance to invest in risky financial assets is a well-documented finding being explained by, for example, high levels of risk aversion or high participation costs associated with those products (e.g., Antoniou, Harris, and Zhang, 2015; Dimmock et al., 2016; Shum and Faig, 2006; Vissing-Jørgensen, 2003). However, literature has not yet elaborated why households do not hold subsidized pension products that offer a reasonable and secure investment alternative to bank deposits, while offering an easy entry through small monthly contributions.

Our study aims to close this gap by investigating the underlying determinants affecting households' decision to engage in subsidized pension products. Subsidized pension contracts are fairly more complex and require a sufficient understanding of financial concepts. We argue that this complexity might serve as a potential explanation why households do not engage in such pension products. In our study, we

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[1] We provide detailed information on the subsidized pension products under review, as well as their functioning in section 2.1.2.

investigate whether financial literacy and receiving financial advice is associated with a higher likelihood of holding those products. More precisely, we hypothesize that financially literate households are likely to face fewer problems when evaluating more complex financial products. Further, we hypothesize that financially literate households are more likely to be aware of the negative consequences of persistently low interest rates and thus, seek for comparable safe products with higher expected returns than bank deposits. With regard to receiving financial advice, we hypothesize that financial advisors might provide households with valuable information on financial products, raise awareness of the negative consequences of holding solely bank deposits, thereby guiding households to subsidized pension products as a reasonable investment alternative.

To test whether financial literacy and financial advice are related to households' propensity to engage in subsidized pension products, we use the Panel on Household Finances (PHF), a nationally representative German household survey provided by the German Central Bank (Deutsche Bundesbank).

We contribute to the literature and show that both financial literacy and financial advice are positively related to holding subsidized pension products. In that, our results point to the fact that financial literacy and receiving financial advice might help households to better understand the benefits of holding subsidized pension products. Our findings are robust to a variety of different alternative explanations, including liquidity constraints, traumatic experiences due to the financial crisis, savings purpose, as well as households' degree of indebtedness. Moreover, we perform a propensity score matching analysis to control for a potential selection bias of receiving financial advice.

Our study adds to two strands of economics and finance literature. First, our research is closely related to the literature investigating the effects of financial literacy on households' financial decision-making. Prior studies have shown that financially literate households are more likely to hold stocks (van Rooij, Lusardi, and Alessie, 2011), better diversified portfolios (Goetzmann and Kumar, 2008; Guiso and Jappelli, 2008), and to be more likely to plan for their retirement (Bucher-Koenen and Lusardi, 2011; van Rooij, Lusardi, and Alessie, 2012). Further, studies have suggested that financially literate households possess the relevant knowledge to understand even more complex financial products, such as private pension plans (Börsch-Supan, Coppola, and Reil-Held, 2012; Bucher-Koenen, 2009). Our results provide some evidence in favor of the latter as we document that financially literate households are more likely to hold more complex subsidized pension products, probably because they are more likely to correctly assess the benefits associated with those products.

Second, our study largely contributes to the mixed evidence on financial advisor's role for households' financial decision-making. Although basically any product can be bought, and any investment can be made online nowadays, the literature has particularly emphasized that a large proportion of households consult financial advisors before purchasing financial products (e.g., Chater, Huck, and Inderst, 2010; Hung and Yoong, 2013; Investment Company Institute, 2007). According to Collins (2012), a financial advisor's role is to provide customers with product-related information and to defuse biases associated with common investment mistakes. In doing so, financial advisors are a strong determinant of households' asset allocation decisions (Foerster et al., 2017). However, on the downside, recent studies provide some evidence that portfolios of advised households underperform those of unadvised households (e.g., Bergstresser, Chalmers, and Tufano, 2009). Further, studies reveal

that advisors can encourage households to chase past returns and to hold actively managed funds, which usually come up with higher management fees and front-up loads (Mullainathan, Noeth, and Shoar, 2012). On the upside, other studies show that financial advisors add value by increasing households' portfolio diversification (Bluethgen et al., 2008) and participation in the stock market (Shum and Faig, 2006). Moreover, in his seminal work, von Gaudecker (2015) shows that advised households achieve higher risk-adjusted returns. Our study provides some evidence that receiving financial advice seems to be beneficial for households' financial decision-making, because we find that advised households are more likely to engage in subsidized pension products. In that, financial advisors might provide households with product-related information, thereby helping households to overcome a potential fear of investing in more complex financial products, such as subsidized pension products.

2. Data and institutional framework

2.1. Savings and investment behavior in Germany

2.1.1. Risky and safe financial assets and non-subsidized pension products

In our study, we draw on the Panel on Household Finances (PHF), which is a nationally representative survey covering more than 3,500 households conducted by the German Central Bank (Deutsche Bundesbank) between September 2010 and July 2011 (von Kalckreuth et al., 2017).[2] When conducting savings and investment decisions, households in our sample can choose from a wide array of different asset classes, including risky financial assets, bank deposits, saving loan contracts and both state-subsidized and non-subsidized pension products. Risky financial assets include any assets held in a securities account, namely, mutual funds, stocks, bonds,

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[2] See von Kalckreuth et al. (2012) for further information on the data collection process of the PHF data. We apply survey weights in all of our main analyses to obtain representative results for the German population.

and other securities such as certificates. Likewise, households can rely on safe investment alternatives, such as bank deposits that include checking (incl. positive balances on credit cards) and savings accounts. While risky financial assets usually provide the chance to achieve positive inflation-adjusted returns, they also entail the risk of a total loss of invested capital, due to the investment being affected by market up- and downturns. In contrast, saving only in bank deposits can be considered as safe because, up to an amount of €100,000, they are protected by the German Deposit Guarantee Act. However, on the downside, interests on households' bank deposits have steadily declined during the last years. Figure II-1 shows the sharp decline in effective interest rates on households' bank deposits with an agreed maturity of under 3 months (Deutsche Bundesbank, 2019).[3]

Figure II-1: Effective interest rates on households' bank deposits from 2003 to 2018
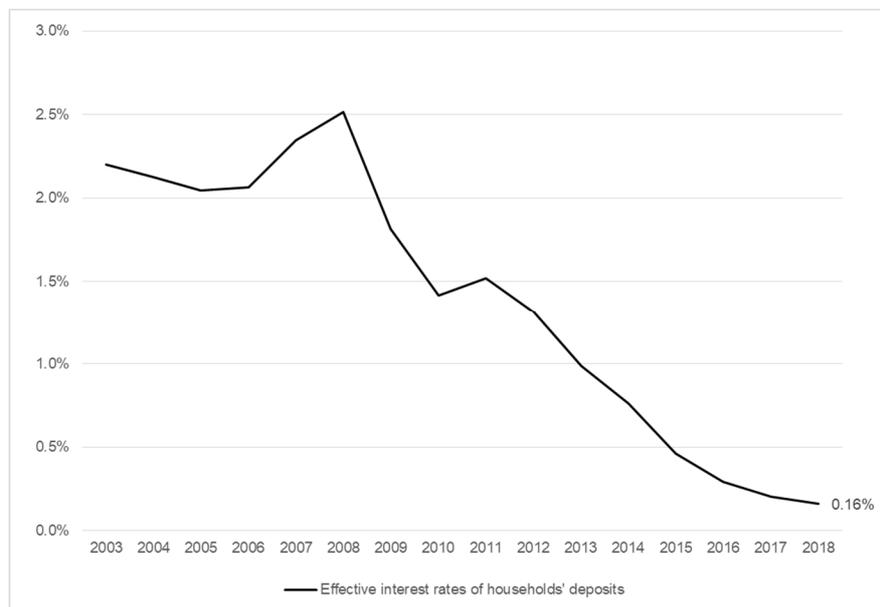
This figure shows the effective interest rates on households' bank deposits with an agreed maturity of under 3 months provided by the German Central Bank (Deutsche Bundesbank, 2019).

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[3] Please note that the depicted interest rates are not inflation adjusted. If so, they would have been negative from the years 2010 on.

German households can also rely on saving loan contracts as well as non-subsidized pension products, including occupational pensions (if offered by an employer), non-subsidized life insurance policies and other non-subsidized pension plans. Although those products guarantee the capital preservation of invested amounts, they also share the negative commonality with bank deposits in terms of unsatisfactory inflation-adjusted returns especially in the recent low-interest environment. Moreover, the products are often of rather high cost (e.g., distributional costs), thereby lowering the potentially higher interest rates compared to bank deposits.

2.1.2. The case of subsidized pension products

When conducting savings and investment decisions, households constantly face a tradeoff between risk and return. However, Germany as well as other European countries offer *subsidized pension products* that provide a reasonable and downward protected investment alternative to bank deposits simultaneously featuring profitable state subsidies. In particular, the German Retirement Saving Act of 2001 introduced the so called "Riester" pension in order to strengthen the privately funded pillar of old-age provision in Germany.[4] Those products are state-subsidized and intended to close the pension gap caused by the gradual decline in the relative performance of the statutory pension system (Börsch-Supan et al., 2016). Riester pension contracts of different types are closed with certified Riester providers such as banks or insurance companies. The most common type is the classic Riester pension insurance and amounts to 65.3% of all issued contracts (Bundesministerium für Arbeit und Soziales, 2019). Other, less popular types of Riester contracts are mutual fund Riester contracts (19.7%), as well as bank saving Riester contracts (4.1%). However, all types have in common that Riester savers regularly, usually

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[4] For self-employed individuals, there are complementary products called Rürup pension products.

monthly, contribute a certain amount of money and eventually receive a lifelong annuity upon the beginning of the pension phase. To remain flexibility, the monthly payments might be increased, reduced, and/or paused, which of course affects the amount of the premiums correspondingly (e.g., Börsch-Supan et al., 2016).

The subsidies associated with Riester pension products are particularly designed for households with a low income and households with children (Bucher-Koenen, 2009). They can be differentiated in three parts. First, the owner of the Riester contract receives a *personal subsidy*. This subsidy is determined by the amount of the savings sum and comprises the regular contributions by the Riester contractor plus the subsidies. To receive the maximum personal subsidy of €154[5], the savings sum has to equal 4% of the last years' gross income, but at least €60 and not more than €2,100. The same applies for marital partners that might be indirectly eligible for Riester subsidies.[6] The second part of Riester subsidies is represented by a *child subsidy*. In particular, Riester savers receive a subsidy of €300 per year for each child.[7] Third, Riester savers, particularly with higher incomes, are able to reduce their taxable income (*tax deduction*) by the savings sum, whereby the potentially saved taxes are reduced by the granted subsidies.[8]

In Figure II-2, we calculate subsidy quotas for various scenarios with respect to the Riester savers' income, marital status and number of children living in household. For example, the yearly contribution to receive the maximum direct personal

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[5] As of 2010, the time the survey took place. In the meantime, the maximum direct personal subsidy has been raised to €175 (2018).

[6] If a Riester saver's partner has no income, he or she can engage in an own contract and pay the minimum contribution of €60 per year to receive the full direct personal subsidy of €154.

[7] Please note that in case of both marital partners having one Riester contract, the child subsidy is only granted once per child.

[8] Next to the just described components of Riester subsidies, there is also a starter bonus of €200 which is granted to job starters under the age of 25 years.

subsidy of €154 for a married Riester saver with an income of €20,000, one child born after 2008 and whose partner has no income, equals €800 (i.e., 4% of €20,000).

Figure II-2: Subsidy quotas of subsidized Riester pension products (own calculations)
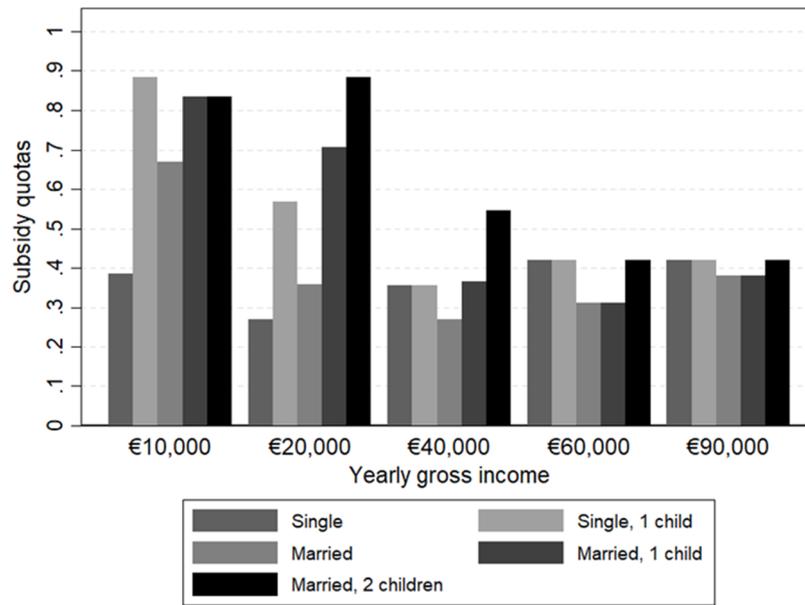
This figure shows subsidy quotas for various scenarios, distinguishing between Riester savers' income, marital status and number of children living in household. The subsidy quotas are calculated as the granted subsidies divided by the savings contribution, whereby the savings contribution is defined as the sum of subsidies and own contribution. We assume that the Riester contract is designed to receive the maximum subsidies, that children are born after 2008, and that in case of married couples, only one individual has an income.

The marital partner, who has no income has to pay additional €60 in a separate Riester contract to receive another €154. In addition, the couple receives €300 for their child. Altogether, the couple has to pay €252 in order to receive €608 in subsidies, resulting in a subsidy quota of 70.7%.[9]

Next to the subsidies, Riester savers profit from the investment of their savings. In case of the classic Riester pension insurance, the minimum nominal interest rate,

[9] The yearly contributions of the couple (€860) are deducted by the granted subsidies that are comprised of two times the direct personal subsidy of €154 (€308) as well as the child subsidy of €300, resulting in an effective contribution of €252 p.a. In this example, the couple cannot profit from the special tax deduction as the potential tax benefit of €148 is exceeded by the subsidies. We calculated the potential tax benefit using resources from the Federal Ministry of Finance (Bundesministerium der Finanzen, 2019).

which is paid on the savings sum (after costs) is guaranteed by law and equals 2.25% p.a.[10] For mutual fund Riester contracts, significant portions of the contributions are invested in financial products (e.g., governmental bonds) with very low risk to ensure the payment of the minimum pension. The remainder will be invested in riskier products. Some mutual fund Riester contracts will not guarantee a certain interest rate but only the capital preservation of the savings sum (after costs), offering the opportunity to allocate a higher proportion to riskier products.

In this regard, subsidized pension products in Germany substantially differ from those of other countries, such as 401(k) plans or IRAs in the US. Despite they also provide individuals with tax advantages, 401(k) plans and IRAs are far less secure as they do not guarantee the capital preservation. For instance, in cases of sharp decreases in investment value due to market downturns, individuals will not be refunded the amounts that they initially invested. In contrast, all types of Riester guarantee to refund the amount initially invested by individuals. Hence, while 401(k) plans or IRAs entail the risk of a total loss of invested capital, this risk does not apply to any type of Riester products under review. Altogether, with a few hundred euros savings a year, savings of ten thousands of euros can be accumulated, which underlines how saving in Riester pension products is preferable compared to saving in bank deposits.

To illustrate the Riester contracts' advantageousness compared to saving in bank deposits, we estimate internal rates of return for exemplary 30-year Riester contracts in Appendix II-3.[11] Since Riester contracts are very heterogeneous in their designs and underlying investments, we restrict our analysis to the potential returns

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[10] As of 2010, the time the PHF survey took place. In the meantime, the guaranteed interest rate for new contracts sunk to 1.75% (2012), 1.25% (2015) and 0.9% (2017).

[11] Note that we estimate the internal rates of return based on the amount of money in the Riester contract after 30 years. In reality, this money will be paid out as a pension and is not available as lump sum for the contractor. For further assumptions we had to make, please refer to Appendix II-3.

of the subsidies only and assume that the returns from the underlying investments do not exceed the costs of the contracts and are used to cover them. As a result, the returns from our exemplary (simulated) contracts do only stem from the subsidies and are likely to be higher in reality. Appendix II-3 supports the notion in Bucher-Koenen (2009) and reveals how low-income households and households with children strongly profit from the subsidies. The internal rate of return for a married couple with two children and an income of €20,000 equals 9.97%. The lowest internal rate of return in our sample is received by a single household with no children and an income of €20,000 and amounts to 1.95%. However, as Figure II-1 shows, the average interest rate for savings in bank deposits in 2010 equaled 1.41% and decreased sharply since then. While the sharp decrease might not have been predictable for investors, the already comparably high ex-ante expected returns from the subsidies only indicate the Riester pension plans' potential.

2.1.3. Households' actual savings behavior

But how do households actually save and invest their money?

Table II-1: Savings behavior in Germany (analysis sample)

| Name | Sample N = 2,261 % | Amount of assets in € | | | |
		Mean	Median	Std. dev	N
Risky Financial Assets	24.51%	34,304	10,000	116,316	715
Funds	19.22%	21,521	8,000	38,265	516
Stocks	11.54%	23,588	6,000	124,728	404
Bonds	4.44%	29,073	10,000	103,206	167
Other securities	2.31%	11,275	8,000	33,539	77
Bank deposits	89.66%	15,972	5,000	37,772	2,066
Checking accounts	79.92%	3,346	1,300	7,977	1,851
Savings accounts	68.60%	16,979	5,600	39,746	1,640
Saving loan contracts (excl. state-subsidized)	39.99%	7,772	3,800	13,236	931
Pension products	71.15%	34,048	14,592	62,440	1,721
State-subsidized pension products	36.84%	6,697	2,470	20,264	877
Non-subsidized pension products	60.55%	35,934	15,500	62,711	1,524
Total financial assets		52,462	20,800	112,568	2,181

This table shows savings and investment behavior of German households (N = 2,261). Amounts of assets with positive values are conditional on owning the respective asset class. The data we use is weighted and draws on a subsample of the representative PHF survey. For a detailed variable description, we refer to Appendix II-2.

In Table II-1, we present the savings and investment behavior of German house-
holds. Throughout our analysis, we excluded retired households and those younger
than 18 and older than 67 years, because already retired households are not eligible
to close any new pension contracts.[12] Table II-1 shows that German households
possess total financial assets of €52,462 and 24.5% hold any risky financial assets.
This result is in line with Bannier and Neubert (2016), who found approximately
23.0% of German households to possess risky assets. Disaggregating risky financial
assets, we find that 19.2 (11.5%) of German households hold mutual funds (stocks).
Further, 4.4% possess bonds, and 2.3% engage in other securities, including certifi-
cates. Among the other financial assets, we document that 89.7% hold bank deposits
and approximately 40.0% engage in saving loan contracts. Börsch-Supan, Coppola,
and Reil-Held (2012) state that both nonsubsidized and subsidized private pension
products play important roles in German households' old-age provision. Our results
support this notion, as we find that 71.2% of households under review possess at
least one pension product.

However, somewhat surprisingly, we document that only 36.8% engage in sub-
sidized pension products, whereas around 60.6% possess non-subsidized pension
products. But why does a large fraction of households not engage in subsidized
pension products? Do households that do not invest in subsidized pension products
hold other financial assets providing sufficient returns, so that they simply do not
have to use subsidized pension products? For a large fraction of households, the
answer is worrisome – it seems they do not. In Figure II-3, we show that a large
fraction of 15.4% of households only save in bank deposits, despite the availability
of subsidized pension products providing a reasonable and downward protected

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[12] For population-level summary statistics on the savings and investment behavior of German households,
please refer to Appendix II-4.

investment alternative to bank deposits.[13] We find that the fraction of households only saving in bank deposits is larger among households in the lower income brackets. For instance, the fraction of households only saving in bank deposits among those with yearly net income up to €10,000 equals around 43.5%. This finding is particularly worrisome, because subsidized pension products are particularly designed for low income groups, i.e., they receive the highest subsidy quotas and they only require very low amounts of regularly contributions.[14] In light of the ongoing demographic changes leading to increases in the pension gap of future retirees relying solely on statutory pension system, we aim to assess factors affecting households' decision to make use of subsidized pension products.

Figure II-3: Fraction of households who only save using bank deposits across income brackets
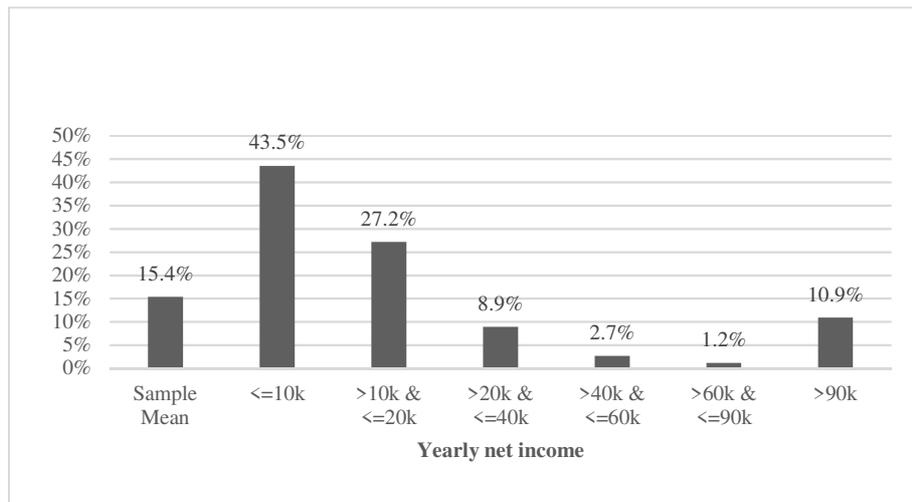
This figure shows the fraction of households who only save using bank deposits (i.e., not owning any financial assets other than bank deposits) across different income brackets. The data we use is weighted and draws on a subsample of the representative PHF survey. We provide detailed variable descriptions in Appendix II-1.

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[13] Note that on population level (i.e., including retired households and those older than 18 and older than 67 years), the fraction of households, who save only using bank deposits equals 25.8%, respectively.

[14] With regard to the highest income bracket (yearly net income above €90,000), we find an increase in the likelihood to save only in bank deposits. However, this effect might be driven by potential outliers because only 98 households in our sample belong to this group.

Table II-2: Summary statistics (analysis sample)

	N	Mean	SD	Min.	10th	25th	Median	75th	90th	Max.
Financial literacy	2,228	2.560	0.688	0	2	2	3	3	3	3
Financial advice	2,026	0.254	0.435	0	0	0	0	1	1	1
Risk aversion	2,261	6.048	2.343	0	3	5	6	8	9	10
Trust	2,258	5.445	2.105	0	3	4	5	7	8	10
Male	2,261	0.516	0.500	0	0	0	1	1	1	1
Married	2,261	0.512	0.500	0	0	0	1	1	1	1
No. of children living in household	2,261	0.658	0.971	0	0	0	0	1	2	6
Age	2,261	42.247	11.57	19	26	33	43	51	58	67
Education	2,261	0.620	0.859	0	0	0	0	1	2	3
Self-employed	2,261	0.097	0.295	0	0	0	0	0	0	1
Unemployed	2,261	0.077	0.267	0	0	0	0	0	0	1
Household monthly net income	2,261	2,550	2,664	100	896	1,319	2,100	3,100	4,500	100,000
Household net wealth	2,261	139,584	369,885	0	0	3,470	30,000	150,000	350,000	26,627,400
Value of household's main residence	2,261	88,062	158,374	0	0	0	0	150,000	270,000	3,600,000
Outstanding mortgage debt	2,261	30,821	79,519	0	0	0	0	13,000	110,000	1,800,000
Outstanding non-mortgage debt	2,261	4,276	15,541	0	0	0	0	3,000	10,000	362,000
Homeowner	2,261	0.391	0.488	0	0	0	0	1	1	1
Receiving of larger gifts or inheritances	2,261	0.278	0.448	0	0	0	0	1	1	1
Save regularly	2,261	0.585	0.493	0	0	0	1	1	1	1

This table reports summary statistics of German households used in our analysis. Retired households and respondents younger than 18 as well as older than 67 are excluded from our analysis. The data we use is weighted and draws on a subsample of the representative PHF survey. We provide detailed variable descriptions in Appendix II-1.

Table II-2 reports summary statistics for the main explanatory variables used in our analysis.[15] The average level of financial literacy in our sample equals 2.6, indicating that respondents on average correctly answered more than two out of three financial literacy questions first introduced in Lusardi and Mitchell (2008). This result corresponds well to Bucher-Koenen and Ziegelmeyer (2014), who used the same set of financial literacy questions regarding representative data from German households and found that the average number of correctly answered financial literacy questions was 2.4.[16] Of the households in our sample, 25.4% received investment advice by their house bank, while 74.6% reported that they did not consult their financial advisor over the last two years. Furthermore, households in our sample are rather risk averse, with average risk aversion levels of 6.0 (scale from 0 to 10 with higher values indicating higher risk aversion), and they exhibit trust levels of 5.4 as measured in Guiso, Sapienza, and Zingales (2008) on a scale from 0 to 10 with lower values indicating greater distrust of people. With respect to households' socio-demographics, 51.6% of the respondents are male and 51.2% are married. The average respondent in our sample is 42 years old. Following Dick and Jaroszek (2015) or Meyll and Pauls (2018), education is measured as a categorical variable that denotes the level of respondents' education from primary (0) to post-tertiary (3). In terms of labor market status, 9.7% are self-employed, 7.7% report being unemployed. The average household earns monthly net income of €2,550, and their average net wealth measured as total wealth minus outstanding liabilities, equals €139,584. In our sample, 39.1% report being homeowners. Of the total wealth, households' value of main residence accounts for approximately €88,062 euros with

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[15] For population-level summary statistics of German households (i.e., including retired and younger and older households), please refer to Appendix II-5.

[16] Bucher-Koenen and Ziegelmeyer (2014) use representative SAVE (Sparen und Altersvorsorge in Deutschland) data from 2009.

outstanding mortgage debt of €30,821. In terms of unsecured debt, households in our sample on average have outstanding non-mortgage debt of €4,276.[17] Finally, 27.8% of households report that they received larger gifts or inheritances and 58.5% of households report to regularly save a certain amount of their income each month.[18]

Table II-3: Comparing demographic profiles of subsidized pension product owners vs. non-owners

	SP owners	Non-owners	Diff.	*t*-Stat.	N
Financial literacy	2.669	2.498	0.171	4.18***	2,228
Financial advice	0.329	0.211	0.118	4.13***	2,026
Risk aversion	5.861	6.157	-0.297	2.07**	2,261
Trust	5.610	5.349	0.261	1.99**	2,258
Male	0.473	0.541	-0.068	2.21**	2,261
Married	0.604	0.459	0.145	4.71***	2,261
No. of children living in household	1.006	0.454	0.552	9.33***	2,261
Age	40.654	43.177	-2.523	3.79***	2,261
Education	0.698	0.575	0.123	2.32**	2,261
Self-employed	0.075	0.109	-0.033	2.09**	2,261
Unemployed	0.048	0.094	-0.046	3.18***	2,261
Household monthly net income	2,985	2,297	688	4.70***	2,261
Household net wealth	168,066	122,968	45,098	2.67***	2,261
Homeowner	0.443	0.361	0.081	2.73***	2,261
Receiving of larger gifts or inheritances	0.318	0.254	0.064	2.29**	2,261
Save regularly	0.687	0.525	0.162	5.47***	2,261

This table reports demographic profiles of respondents distinguishing between owners of subsidized pension products (SP owners) and non-owners, respectively. The data we use is weighted and draws on a subsample of the representative PHF survey. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Next, in Table II-3, we compare demographic profiles of households holding subsidized pension products (*SP owners*) and those who do not hold any subsidized pension products (*non-owners*). We also report the difference in means between the two groups and the corresponding significance levels as indicated by a *t*-test.[19]

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[17] The total amount of outstanding non-mortgage debt includes outstanding balances of credit lines or overdrafts, outstanding balances of credit cards, and outstanding balances on all other non-collateralized loans (i.e., student loans, car loans, consumer loans, instalment loans, and private loans from relatives, friends and employers).

[18] Households were provided with a list of items to indicate in which form they received the large gift or inheritance. Please see Appendix II-1 for more details.

[19] In Appendix II-6, we further compare the fractions of households holding subsidized pension products among different demographic variables (e.g., fraction of SP owners in the groups of advised vs. unadvised households).

As already mentioned, Riester pension plans are particularly designed to benefit low-income households and households with children (Bucher-Koenen, 2009). With regard to marital status and the number of children, we find that SP owners are more frequently married and on average have more children. However with regard to households' income, we find that SP owners actually have higher average incomes. Together with the findings from Figure II-3, it seems that just low-income households turn down subsidized pension plans, even though the products are particularly designed for them. Furthermore, we find that SP owners show higher levels of financial literacy, are more likely to consult financial advisors and to have lower levels of risk aversion. SP owners also have higher levels of general trust, are less likely to be male and more likely to be married, compared to non-owners. In terms of education and labor market status, we document that SP owners have higher level of education, and they are less likely to be self-employed or unemployed. On average, SP owners have higher a higher wealth, compared to non-owners and they are more likely to be homeowners. Finally, we find that SP owners are more likely to report that they received any larger gifts or inheritances, as well as they are more likely to report to regularly save a certain amount of their income each month.

3. Regression results

3.1. Model

To examine the relationships between financial literacy, financial advice and individuals' holding of state-subsidized pension products, we estimate a series of specifications using the following Probit regression model:

$$SP_i = \beta_0 + \beta_1 FL + \beta_2 * FA + \gamma' \boldsymbol{c}_i + \delta' \boldsymbol{a}_i + \varepsilon_i \tag{1}$$

where SP_i denotes an indicator variable that equals one for individuals holding state-subsidized pension products, FL is the financial literacy score measured on a

0-3 scale, and *FA* is an indicator variable that equals one for individuals that obtained investment advice by their house bank during the last two years (i.e. advised individuals). The vector of control variables c_i captures a large set of individual characteristics that have been previously identified in literature to affect savings and investment decisions, such as stock market participation. In particular, in vector c_i, we include a measure for individuals risk aversion (Dohmen et al., 2010), general trust (Guiso et al., 2008), as well a large set of socio-demographics including gender, marital status, number of children living in household, age groups, educational level, labor market status, household monthly income quartiles and net wealth quartiles.[20] Furthermore, we assess whether the household is a homeowner, whether the household received any larger gifts or inheritances, and whether the household is regularly saving a certain amount each month. Finally, in vector a_i, we capture other financial assets held by the household by including the indicator variables that equal one if households report to hold risky financial assets, saving loan contracts, or non-subsidized pension products, respectively. To ensure the interpretability of the results from our Probit regression model, we estimate average marginal effects.

3.2. Main Results

Table II-4 reports average marginal effects obtained from various specifications of the generic Probit regression model formalized in Equation (1). In specification (1) and (2), we report the unconditional effects of financial literacy and financial advice on holding subsidized pension products, and in specification (3), we jointly control for both main variables of interest. The average marginal effects reveal a statistically significant positive effect of both financial literacy and financial advice. More precisely, a one-unit increase in financial literacy is associated with a 8.8

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[20] Please see section 2.2. and Appendix II-1 for a detailed definition of household net wealth.

percentage point increase in the propensity to hold subsidized pension products (specification (1)). Furthermore, results in specification (2) show that households that received investment advice by their main house bank during the last two years are 13.9 percentage points more likely to hold subsidized pension products. Specification (3) reveals that both factors are still significant once we jointly control for them. In column (4) and (5) of Table II-4, we add the vector of control variables c_i and the vector of other financial assets held in portfolio a_i to our regression model. While the average marginal effects of financial literacy and financial advice decrease in magnitude, the results in specification (4) and (5) still provide evidence in support of statistically and economically significant effects of both variables.

Table II-4: Determinants of households to invest in subsidized pension products

| | Dependent: Subsidized pension product = YES | | | | |
	(1)	(2)	(3)	(4)	(5)
Financial literacy	0.0884***		0.0732***	0.0602***	0.0555**
	(0.0213)		(0.0225)	(0.0223)	(0.0225)
Financial advice		0.1389***	0.1326***	0.0870***	0.0709**
		(0.0325)	(0.0328)	(0.0316)	(0.0329)
Risk aversion				-0.0126**	-0.0114*
				(0.0062)	(0.0062)
Trust				0.0019	0.0017
				(0.0070)	(0.0069)
Male				-0.0716**	-0.0779***
				(0.0281)	(0.0279)
Married				0.0162	0.0180
				(0.0340)	(0.0337)
No. of children living in household				0.0934***	0.0950***
				(0.0154)	(0.0152)
Age under 30				0.3198***	0.3171***
				(0.0657)	(0.0652)
Age 30 to 40				0.2481***	0.2323***
				(0.0632)	(0.0623)
Age 40 to 50				0.2749***	0.2664***
				(0.0598)	(0.0591)
Age 50 to 60				0.1928***	0.1837***
				(0.0597)	(0.0587)
Education				0.0127	0.0132
				(0.0166)	(0.0168)
Self-employed				-0.1024**	-0.1013**
				(0.0436)	(0.0434)
Unemployed				0.0036	0.0210
				(0.0559)	(0.0555)

Table II-4: Determinants of households to invest in subsidized pension products – *continued*

	(1)	(2)	(3)	Dependent: Subsidized pension product = YES (4)	(5)
Income Q2				0.0497	0.0477
				(0.0475)	(0.0473)
Income Q3				0.1370***	0.1240**
				(0.0492)	(0.0496)
Income Q4				0.1621***	0.1427***
				(0.0531)	(0.0534)
Net wealth Q2				0.0232	0.0057
				(0.0439)	(0.0444)
Net wealth Q3				-0.0299	-0.0518
				(0.0484)	(0.0496)
Net wealth Q4				-0.0417	-0.0697
				(0.0573)	(0.0591)
Homeowner				0.0112	0.0060
				(0.0374)	(0.0379)
Receiving of larger gifts or inheritances				0.0149	0.0133
				(0.0327)	(0.0327)
Save regularly				0.0776**	0.0527
				(0.0323)	(0.0341)
Non-subsidized pension products					0.0685*
					(0.0349)
Saving loan contracts					0.0506*
					(0.0294)
Risky financial assets					0.0297
					(0.0355)
Observations	2,228	2,026	2,000	1,997	1,997
F-test	16.565	17.288	13.804	8.094	7.784
F-test *p*-value	0.000	0.000	0.000	0.000	0.000

This table reports average marginal effects obtained from a Probit regression model of the generic form featuring the holding of state-subsidized pension products as the dependent variable.

$$SP_i = \beta_0 + \beta_1 FL + \beta_2 * FA + \gamma' \boldsymbol{c}_i + \delta' \boldsymbol{a}_i + \varepsilon_i$$

Specification (1) and (2) show the unconditional effect of financial literacy and financial advice on individual i's holding of subsidized pension products. Specification (3) shows the joint effects of financial literacy and financial advice on holding subsidized pension products. Specification (4) shows the conditional effect of financial literacy and financial advice on holding of subsidized pension products including the vector of control variables $\boldsymbol{c}_i$. Finally, in specification (5) we present our baseline model, in which we further add a vector capturing other financial assets in the respondents' portfolios $\boldsymbol{a}_i$ to our regression model. We report detailed variable descriptions in Appendix II-1. The data we use is weighted and draws on a subsample of the representative PHF survey. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

More precisely, in our baseline model in specification (5), we document that a one-unit increase in financial literacy is associated with a 5.6 percentage point increase in the propensity to hold subsidized pension products. Among the households that received investment advice, we document that their propensity to hold subsidized pension products is 7.1 percentage points higher, compared to unadvised

households. As a robustness check, we also estimated Equation (1) using a linear probability regression model (OLS). The results remain quantitatively unchanged and are reported in Appendix II-7.

With respect to the remaining regressors, although providing the capital preservation guarantee like bank deposits, we find the propensity to hold subsidized pension products to decrease with higher risk aversion. We further show that subsidized pension products are more likely to be held by females. Moreover, we confirm prior findings in the literature that the number of children living in the household significantly affects households' propensity to hold subsidized pension products (e.g., Börsch-Supan et al., 2012; Bucher-Koenen, 2009). In particular, we document that having one more child increases households' propensity to invest in subsidized pension products by remarkable 9.5 percentage points. However, this finding is not surprising, because those products offer large subsidies per child (Bucher-Koenen, 2009). We also find that the propensity to hold subsidized pension products decreases with age. In particular, households younger than 30 are most likely to save in subsidized pension products. In addition to, for example, Hibbert, Lawrence, and Prakash (2012), whose results suggest that education plays a smaller role for retirement planning compared to financial literacy, we document that education, compared to financial literacy, has a less important role on households' product choice for retirement planning. In terms of labor market effects, we document that self-employed individuals are less likely to hold subsidized products. While the products in our study also provide subsidies for self-employed individuals, our results show that self-employed individuals might rely on other forms of investments, such as holding large stakes in their own businesses. We find that holding subsidized pension products is more pronounced among households with above-median income (income quartiles 3 and 4). This finding is surprising, because those products are

particularly designed for low-income households (i.e., low-income households receive the highest subsidy quotas).[21] In that, our results confirm prior findings in Bucher-Koenen (2009), further casting some doubt on the target effectiveness of the pension products. Finally, among the other financial assets held in portfolio, we show that households having experience with non-subsidized pension products as well as saving loan contracts are also more likely to engage in subsidized pension products.

4. Further analyses

4.1. Alternative explanations to avoid investments in subsidized pension products

In Table II-5, we assess whether the effects of financial literacy and financial advice remain robust when we control for alternative explanations that might explain why households do not use subsidized pension products. To control for alternative explanations, we estimate a series of specifications using the following Probit regression model:

$$SP_i = \beta_0 + \beta_1 FL + \beta_2 * FA + \omega' \boldsymbol{f}_i + \gamma' \boldsymbol{c}_i + \delta' \boldsymbol{a}_i + \varepsilon_i$$

where SP_i denotes an indicator variable that equals one for individuals holding state-subsidized pension products, FL is the financial literacy score measured on a 0-3 scale, and FA is an indicator variable that equals one for individuals that obtained investment advice by their house bank during the last two years (i.e. advised individuals). $\boldsymbol{c}_i$ and $\boldsymbol{a}_i$ present the vectors of control variables and other financial assets held in portfolio analogously to our baseline model in specification (5) of Table II-4. In addition, we include a vector $\boldsymbol{f}_i$ that captures four different alternative explanations. The alternative explanations that we add to our model are liquidity constraints, financial crisis effects, savings purpose, and effects of being

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[21] Please see Figure II-2 for the subsidy quotas related to the subsidized pension products under review.

indebted. As in our main regression, we estimate average marginal effects to ensure the interpretability of the Probit regression results.

Table II-5: Controlling for alternative explanations of not holding subsidized pension products

	Dependent: Subsidized pension product = YES				
	Main result	+ Liquidity constraints	+ Financial crisis effects	+ Retirement savers	+ Effects of debt
	(1)	(2)	(3)	(4)	(5)
Financial literacy	0.0555**	0.0547**	0.0546**	0.0551**	0.0552**
	(0.0225)	(0.0223)	(0.0225)	(0.0223)	(0.0223)
Financial advice	0.0709**	0.0739**	0.0741**	0.0727**	0.0726**
	(0.0329)	(0.0329)	(0.0329)	(0.0333)	(0.0332)
Excess liquidity (6-months income)		-0.0663*	-0.0661*	-0.0689*	-0.0690*
		(0.0356)	(0.0356)	(0.0359)	(0.0361)
Loss in financial assets due to financial crisis			0.0370	0.0380	0.0381
			(0.0543)	(0.0549)	(0.0550)
Saving for retirement				0.0157	0.0158
				(0.0328)	(0.0328)
Non-mortgage debt > financial assets					-0.0023
					(0.0471)
Controls (main model)	Yes	Yes	Yes	Yes	Yes
Observations	1,997	1,997	1,997	1,970	1,970
F-test	7.784	7.565	7.322	6.763	6.536
F-test p-value	0.000	0.000	0.000	0.000	0.000

This table reports average marginal effects obtained from a Probit regression model of the generic form featuring the holding of state-subsidized pension products as the dependent variable.

$$SP_i = \beta_0 + \beta_1 FL + \beta_2 * FA + \omega' \boldsymbol{f_i} + \gamma' \boldsymbol{c_i} + \delta' \boldsymbol{a_i} + \varepsilon_i$$

In column (1), we reestimate our main model from column (5) of Table II-4. Column (2) further controls for households' liquidity constraints by including a dummy variable that equals one for individuals holding more than 6-months income in bank deposits. In column (2), we control for potential effects caused by the financial crisis by including an indicator variable that equals one if households report that they experienced substantial losses in financial assets due to the financial crisis. Column (4) further controls for households' savings purpose by including an indicator variable that equals one if households' primary savings reason is saving for old-age provision. Finally, in column (5), we control for potential effects caused by indebted households by including an indicator variable that equals one for households carrying more non-mortgage debt than financial assets. The data we use is weighted and draws on a subsample of the representative PHF survey . Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively. We report detailed variable descriptions in Appendix II-1.

In specification (1) of Table II-5, we re-estimate our main model in specification (5) of Table II-4. Next, in specification (2), we consider that households might avoid committing themselves to make regular payments in subsidized pension products in fear of potential income disruptions, for example by getting unemployed. In this vein, households might only start saving in other assets when precautionary needs

are satisfied (Barasinska, Schäfer, and Stephan, 2012). We believe that this should not be the case as the monthly payments for subsidized pension plans can usually be reduced or paused in such situations. Nevertheless, we adopt empirical findings from the literature on households' emergency fund savings, first conceptualized by Johnson and Widdows (1985). The authors defined emergency funds as households' financial holdings in liquid assets, including cash, savings- and checking accounts, which cover the households' liquidity for at least three months. Moreover, these liquid savings should ensure that households do not have to alter their living standards due to income disruptions, such as unemployment or illness. Researchers and financial planners recommend that households hold at least two to six months of monthly income in liquid savings (i.e., cash, savings-, and checking accounts).[22] We assess households' excess liquidity using an indicator variable that equals one if households' liquid savings exceed households' six-month income. If households with that amount of excess liquidity do not hold subsidized pension products, it might not be driven by fear of potential income disruptions. Results in specification (2) suggest that our main results on financial literacy and financial advice remain robust when we consider potential liquidity constraints. Somewhat surprisingly, we find that households with high liquidity are less likely to engage in subsidized products. This rather counterintuitive finding might be (at least partially) explained by the construction of our measure for excess liquidity. In particular, individuals can only accumulate high levels of excess liquidity when they save large amounts of their monthly income in bank deposits. However, when individuals use subsidized pension products, their monthly savings sum is deducted from their income and thus does not increase households' bank deposits.

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[22] For instance, Gathergood and Weber (2014) uses as similar measure of liquid savings to assess households' financial resources available to pay down outstanding consumer credit balances. For an extensive overview of different emergency fund levels, please see especially Chang, Hanna, and Fan (1997).

In specification (3), we account for households not owning subsidized pension products because they suffer from potentially traumatic experiences in, for example, the stock market. One such event that affected a large proportion of households worldwide was the financial crisis from 2008 (Bucher-Koenen and Ziegelmeyer, 2014). We address this issue by including an indicator variable that equals one if households suffered considerable losses in financial assets during the last two years. Because our data at hand were collected between 2010 and 2011, we thereby capture households that experienced wealth losses during and immediately after the financial crisis. Even after accounting for realized losses due to the financial crisis, our main results regarding financial literacy and financial advice remain robust. Furthermore, the average marginal effect of losses in financial assets due to the financial crisis is insignificant, indicating that potentially traumatic experiences, such as the financial crisis, do not explain why households do not engage in subsidized pension products.

Next, in specification (4), we control for households' savings reasons by including an indicator variable that equals one for households reporting that their primary savings reason is to save for old-age. While our results for financial literacy and financial advice remain robust in this specification, the average marginal effect of the savings purpose is economically small and statistically insignificant.

Finally, in specification (5), we further account for the fact that households might not engage in subsidized pension products (and potentially any other financial assets beyond bank deposits), because they use their income to pay down their outstanding debt obligations. To account for this, we build an indicator variable that equals one if households' non-mortgage debt exceeds households' financial assets, and zero otherwise. Results in specification (5) reveal that the observed effects of financial literacy and financial advice remain robust. Furthermore, we document

that the effect of being indebted does not seem to affect households' decision to hold subsidized pension products.

4.2. Controlling for observed heterogeneity between advised and unadvised households

In this section, we address that advised households might greatly differ in observable covariates compared to unadvised households, indicating that they show unequal (selection) probabilities of receiving investment advice (i.e., selection bias). For instance, households that gain a higher average income or that possess more wealth probably exhibit a greater propensity to consult financial advisors. We address potential selection concerns in Table II-6 by matching advised (treated) households with unadvised (control) households in the sample based on their propensity score to receive financial advice. For each treated household, we use a 1:1 nearest-neighbor matching approach and match on all variables as in our baseline model in column (5) of Table II-4.[23]

Table II-6: Robustness of results for matched samples		
	Dependent: Subsidized pension product = Yes	
	Main results	Matched sample
Financial literacy	0.0555**	0.1094***
	(0.0225)	(0.0345)
Financial advice	0.0709**	0.1161***
	(0.0329)	(0.0370)
Controls (main model)	Yes	Yes
Observations	1,997	1,124
F-test	7.784	4.735
F-test p-value	0.000	0.000

In this table, we re-estimate our main results from column (5) of Table II-4 using the matched samples obtained from our propensity score matching analysis (PSM). Column (1) replicates the results from our main model and column (2) shows the results for the matched sample, respectively. The data we use is weighted and draws on a subsample of the representative PHF survey. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively. We report detailed variable descriptions in Appendix II-1.

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[23] Balance tests of covariates before and after matching as well as additional matching quality indicators are available upon request.

In Table II-6, we present the average marginal effects of our main Probit regression model in Equation (1), featuring the holding of subsidized pension products as the dependent variable. Specification (1) replicates our main results and in specification (2) we re-estimate our main model using the matched sample, respectively. As can be inferred from the results in Table II-6, the average marginal effects are still statistically significant and even higher than in our baseline regression, indicating that our results are robust to a potential selection bias based on distributional differences in observable covariates between advised and unadvised households.

5. Conclusion

In this study, we present evidence that, on population level, more than a quarter of German households leave considerable amounts of money on the table. Those households save using only bank deposits, despite the existence of downward protected subsidized pension products offering higher expected returns. In light of the decreasing relative performance of the statutory pension system, such a behavior is particularly harmful for future retirees. We find a positive relationship between financial literacy, financial advice and owning subsidized pension products. Although studies raise substantive issues regarding conflicted financial advice (e.g., Mullainathan et al., 2012), especially due to information asymmetries between advisors and advisees which might lead to opportunistic advisor behavior (Chater et al., 2010), our results suggest that financial advisors fulfil their initial role by explaining the functioning and highlighting the benefits of subsidized pension products. In doing so, financial advisors can add value to households' savings decisions, and guide households to allocate their available financial resources in subsidized pension products that are able to generate superior returns than saving in bank

deposits. Unlike financial literacy and financial advice, we find that potential liquidity constraints, traumatic experiences due to the financial crisis, savings purposes, as well as households' degree of indebtedness, fail to explain why households do not possess subsidized pension products. Further, we do not believe that households are unaware of the availability of subsidized pension plans. Such products are the result of very popular governmental changes to the German retirement system initiated by the German Retirement Saving Act of 2001, also being accompanied by extensive media coverage and being promoted by both the German government as well as the financial services industry. According to a representative study by Cosmos Direkt (2011), 83% of German households are aware of the availability of Riester products. Thus, we perceive it to be rather unlikely that households in Germany are unaware of the availability of subsidized pension products. Rather, Coppola and Gasche (2011) describe that Riester products are rather complex and thus, many households might not engage in those products because they, for example, lack the necessary financial knowledge to do so. The findings in our study support this notion as we document that households with higher financial literacy and those who receive financial advice are more likely to hold subsidized pension products, indicating that they might have a better understanding of complex financial products. Our study emphasizes the relevance of financial literacy and financial advice for sound financial decision-making in increasingly complex financial markets.

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7. Appendix

Appendix II-1: Variable descriptions

Name	Description
Age	Ordinal variable that contains head of household's age.
Education	Ordinal variable that describes the respondent's highest degree of education/qualification: 1- Higher education entrance; 2- non-academic post-secondary education; 3- University degree or higher. Zero otherwise.
Excess liquidity	Dummy variable that equals one if households' holdings in bank deposits exceed households' six-month income, and zero otherwise.
Financial advice	Dummy variable that equals one if the respondent received financial advice during the last three years, zero otherwise. Corresponding PHF item: "Has your household used a consulting service at your principal bank in the past three years?" 1 - Yes; 2 - No.
Financial literacy	Ordinal variable measuring the number of correct answers to financial literacy questions. Corresponding PHF items:
	Question 1: Compound interest effect: "Let us assume that you have a balance of 100 EUR on your savings account. This balance bears interest at a rate of 2% per year and you leave it for 5 years on this account. How high do you think your balance will be after 5 years?" 1-More than 102 EUR [correct]; 2-Exactly 102 EUR; 3-Less than 102 EUR
	Question 2: Inflation: "Let us assume that your savings account bears interest at a rate of 1% per year and the rate of inflation is 2% per year. Do you think that in one year's time the balance on your savings account will be the same as, more than, or less than today?" 1-More than today; 2-The same as today; 3-Less than today [correct]
	Question 3: Diversification: "Do you agree with the following statement: 'Investing in shares of a company is less risky than investing in a fund containing shares of similar companies'?" 1-Agree; 2-Disagree [correct]
Homeowner	Dummy variable that equals one if the household is homeowner, and zero otherwise.
Household monthly net income	Continuous variable measuring households' monthly income (EUR).
Household net wealth	Continuous variable measuring households' net wealth (EUR). Net wealth is defined as household's gross wealth minus total outstanding debt.
Loss in financial assets due to financial crisis	Dummy variable that equals one if households experiences substantial losses in financial assets due to the financial crisis, and zero otherwise.
Male	Dummy variable that equals one if the respondent is male, and zero for female.
Married	Dummy variable that equals one if the respondent is married, and zero otherwise.
No. of children living in household	Ordinal variable measuring the number of children living in household.
Non-mortgage debt > financial assets	Dummy variable that equals one if households' outstanding non-mortgage debt exceeds households' financial assets, and zero otherwise.
Outstanding mortgage debt	Continuous variable measuring households' outstanding mortgage debt.
Outstanding non-mortgage debt	Continuous variable measuring households' non-mortgage debt. The total amount of outstanding non-mortgage debt includes outstanding balances of credit lines or over-drafts, outstanding balances of credit cards, and outstanding balances on all other non-collateralized loans (i.e., student loans, car loans, consumer loans, instalment loans, and private loans from relatives, friends and employers).
Receiving of larger gifts or inheritances	Dummy variable that equals one if the respondent (or any other household member) has ever received a larger gift or inheritance (i.e., money, residential real estate, usufruct, property, companies, securities or stocks, jewelry, furniture or art, life insurances, and other assets), and zero otherwise.

Appendix II-1: Variable descriptions - *continued*

Retired	Dummy variable that equals one if the respondent is retired, and zero otherwise.
Risk aversion	Ordinal variable capturing respondents' risk aversion on a scale from [0] - Very willing to take risks, to [10] Not at all willing to take risks.
Save regularly	Dummy variable that equals one if the household reports to save regularly each month, and zero otherwise.
Saving for retirement	Dummy variable that equals one if household reports that old-age provision to be their primary savings reason, and zero otherwise.
Self-employed	Dummy variable that equals one if the household is self-employed, zero otherwise.
Trust	Ordinal variable capturing respondents' general trust levels on a scale from [0] - I do not trust other at all, to [10] I trust others completely.
Unemployed	Dummy variable that equals one if the household is unemployed, and zero otherwise.
Value of household's main residence	Continuous variable measuring households' value of main residence.

Appendix II-2: Description of financial asset variables

Name	Description
Risky financial assets	Continuous variable measuring households' risky financial assets, including funds, stocks, bonds, and other risky financial assets.
Funds	Continuous variable measuring households' amount of funds held in portfolio.
Stocks	Continuous variable measuring households' amount of stocks held in portfolio.
Bonds	Continuous variable measuring households' amount of bonds held in portfolio.
Other risky financial assets	Continuous variable measuring households' amount of certificates and other risky financial assets held in portfolio.
Bank deposits	Continuous variable measuring households' amount of bank deposits, including checking accounts, positive balances on credit cards and savings accounts.
Checking accounts	Continuous variable measuring households' amount of money held in checking accounts and credit cards.
Savings accounts	Continuous variable measuring households' amount of money held in savings accounts.
Saving loan contracts	Continuous variable measuring households' amount of money held in saving loan contracts.
Pension products	Continuous variable measuring households' amount of money invested in pension products.
State-subsidized pension products	Continuous variable measuring households' amount of money held in state-subsidized pension products, including Riester or Rürup subsidized bank savings plans, saving loan contracts, mutual fund savings plans, classic pension plans, occupational pension plans, and other Riester or Rürup plans.
Non-subsidized pension products	Continuous variable measuring households' amount of money held in non-subsidized pension products, including occupational pensions, non-subsidized life insurance policies and other non-subsidized pension plans.
Total financial assets	Continuous variable measuring households' total financial assets (risky financial assets, bank deposits, saving loan contracts and pension products).

Appendix II-3: Performance analysis of subsidized pension plans

Yearly income	Single no children	Single 1 child	Married no children	Married 1 child	Married 2 children
10,000.00 €	2.97%	10.07%	6.43%	9.22%	10.62%
20,000.00 €	1.95%	4.22%	2.72%	6.12%	9.97%
40,000.00 €	2.72%	2.72%	1.95%	2.57%	4.02%
60,000.00 €	3.31%	3.31%	2.32%	2.32%	3.07%
90,000.00 €	3.31%	3.31%	2.94%	2.94%	3.23%

This table shows internal rates of returns for exemplary Riester contracts that started in 2010 and run for 30 years. As such con-tracts are heterogeneous in their design and underlying investments, we estimate internal rates of return only for the subsidies to illustrate their beneficial effect. Thus, we assume that the returns from the underlying investments do not exceed the costs of the Riester contracts and are used to cover them. Furthermore, we assume that the investors' yearly income does not change during the contract and that the investors chose the size of their contributions to receive the maximum potential subsidies. Finally, we assume that marital partners have only one income and that the subsidies for children are received for 20 years. The subsidies for children depend on their eligibility for child benefits. Children are eligible for child benefits as long as their education is not completed and they are under 25 years old.

Appendix II-4: Savings behavior in Germany (population level)

Name	German population N = 3,565 %	Amount of assets in €			
		Mean	Median	SD	N
Risky Financial Assets	23.14%	48,740	15,000	172,429	1,160
Funds	17.11%	28,756	10,000	91,765	799
Stocks	10.98%	28,552	8,980	116,625	664
Bonds	5.59%	48,384	15,800	119,779	345
Other risky fin. assets	2.39%	21,805	9,000	57,782	150
Bank deposits	91.04%	19,637	6,500	41,217	3,319
Checking accounts	82.45%	3,681	1,500	9,629	3,020
Savings accounts	71.17%	20,853	7,800	42,448	2,700
Saving loan contracts (excl. state-subsidized)	35.12%	7,481	3,700	13,915	1,289
Pension products	54.56%	32,888	14,300	59,856	2,081
State-subsidized pension products	25.97%	6,738	2,400	20,785	954
Non-subsidized pension products	47.10%	34,383	15,380	59,735	1,870
Total financial assets		52,152	20,000	125,701	3,447

This table shows population-level savings and investment behavior of German households ($N = 3,565$). Amounts of assets with positive values are conditional on owning the respective asset class. The data is weighted and representative for the German population. For a detailed variable description, we refer to Appendix II-2.

Appendix II-5: Summary statistics (population level)

	N	Mean	SD	Min.	10th	25th	Median	75th	90th	Max.
						German population				
Financial literacy	3,498	2.471	0.747	0	1	2	3	3	3	3
Financial advice	3,257	0.253	0.435	0	0	0	0	1	1	1
Risk aversion	3,562	6.354	2.391	0	3	5	7	8	10	10
Trust	3,558	5.413	2.131	0	3	4	5	7	8	10
Male	3,565	0.510	0.500	0	0	0	1	1	1	1
Married	3,565	0.502	0.500	0	0	0	1	1	1	1
No. of children living in household	3,565	0.458	0.856	0	0	0	0	1	2	6
Age	3,565	52.00	17.71	17	29	38	50	67	77	90
Education	3,565	0.526	0.837	0	0	0	0	1	2	3
Self-employed	3,565	0.068	0.251	0	0	0	0	0	0	1
Unemployed	3,565	0.052	0.222	0	0	0	0	0	0	1
Retired	3,565	0.322	0.467	0	0	0	0	1	1	1
Household monthly net income	3,565	2,326	2,324	100	830	1,250	1,900	3,000	4,000	100,000
Household net wealth	3,565	156,453	459,837	0	0	5,000	40,000	180,000	390,000	60,000,000
Value of household's main residence	3,565	90,961	156,400	0	0	0	0	150,000	260,000	3,600,000
Outstanding mortgage debt	3,565	24,016	72,747	0	0	0	0	0	89,000	1,800,000
Outstanding non-mortgage debt	3,565	3,350	14,769	0	0	0	0	1,300	7,100	362,000
Homeowner	3,565	0.418	0.493	0	0	0	0	1	1	1
Receiving of larger gifts or inheritances	3,565	0.273	0.446	0	0	0	0	1	1	1
Save regularly	3,565	0.560	0.496	0	0	0	1	1	1	1

This table reports population-level summary statistics of German households. The data is weighted and representative for the German population. We provide detailed variable descriptions in Appendix II-1.

Appendix II-6: Fraction of subsidized pension product owners across demographic profiles

	Fraction of SP owners				
	High (Yes)	Low (No)	Diff.	*t*-Stat.	N
Financial literacy	0.402	0.298	0.104	3.53***	2,228
Financial advice	0.472	0.328	0.144	4.11***	2,026
Risk aversion	0.336	0.396	-0.060	2.12**	2,261
Trust	0.396	0.345	0.051	1.77*	2,258
Male	0.338	0.401	-0.063	2.21**	2,261
Married	0.434	0.299	0.135	4.76***	2,261
No. of children living in household	0.528	0.268	0.260	9.10***	2,261
Age	0.327	0.407	-0.080	2.83***	2,261
Education	0.406	0.345	0.060	2.06**	2,261
Self-employed	0.288	0.377	-0.089	2.16**	2,261
Unemployed	0.231	0.380	-0.149	3.43***	2,261
Household monthly net income	0.475	0.266	0.210	7.55***	2,261
Household net wealth	0.412	0.328	0.084	2.96***	2,261
Homeowner	0.417	0.337	0.080	2.73***	2,261
Receiving of larger gifts or inheritances	0.422	0.348	0.074	2.29**	2,261
Save regularly	0.433	0.278	0.155	5.49***	2,261

This table reports the fractions of households holding subsidized pension products across demographic profiles. For example, the first row reports the fraction of households owning subsidized pension products distinguishing between the groups of households with high financial literacy vs. households with low financial literacy. Analogously, the second row compares the fractions of households holding subsidized pension products distinguishing between advised and unadvised households. For continuous variables, we use median splits to create high and low groups. The data we use is weighted and draws on a subsample of the representative PHF survey. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Appendix II-7: Determinants of households to invest in subsidized pension products (LPM model)

	Dependent: Subsidized pension product = YES				
	(1)	(2)	(3)	(4)	(5)
Financial literacy	0.0841***		0.0699***	0.0579***	0.0543***
	(0.0191)		(0.0206)	(0.0207)	(0.0210)
Financial advice		0.1438***	0.1375***	0.0948***	0.0766**
		(0.0350)	(0.0354)	(0.0348)	(0.0363)
Risk aversion				-0.0114*	-0.0101
				(0.0062)	(0.0062)
Trust				0.0031	0.0028
				(0.0068)	(0.0068)
Male				-0.0672**	-0.0728**
				(0.0288)	(0.0287)
Married				0.0140	0.0147
				(0.0344)	(0.0341)
No. of children living in household				0.1040***	0.1055***
				(0.0171)	(0.0170)
Age under 30				0.2470***	0.2404***
				(0.0507)	(0.0511)
Age 30 to 40				0.1790***	0.1611***
				(0.0469)	(0.0467)
Age 40 to 50				0.2077***	0.1965***
				(0.0421)	(0.0423)
Age 50 to 60				0.1283***	0.1158***
				(0.0389)	(0.0391)
Education				0.0138	0.0130
				(0.0171)	(0.0174)
Self-employed				-0.0898**	-0.0860**
				(0.0391)	(0.0394)
Unemployed				0.0019	0.0155
				(0.0503)	(0.0498)

Appendix II-7: Determinants of households to invest in subsidized pension products (LPM model) – *continued*

	Dependent: Subsidized pension product = YES				
	(1)	(2)	(3)	(4)	(5)
Income Q2				0.0370	0.0381
				(0.0448)	(0.0449)
Income Q3				0.1283***	0.1190**
				(0.0490)	(0.0494)
Income Q4				0.1522***	0.1380***
				(0.0534)	(0.0534)
Net wealth Q2				0.0231	0.0041
				(0.0432)	(0.0440)
Net wealth Q3				-0.0280	-0.0522
				(0.0482)	(0.0500)
Net wealth Q4				-0.0502	-0.0808
				(0.0585)	(0.0604)
Homeowner				0.0164	0.0105
				(0.0385)	(0.0392)
Receiving of larger gifts or inheritances				0.0214	0.0194
				(0.0339)	(0.0338)
Save regularly				0.0753**	0.0503
				(0.0328)	(0.0347)
Non-subsidized pension products					0.0631*
					(0.0349)
Saving loan contracts					0.0519*
					(0.0312)
Risky financial assets					0.0373
					(0.0382)
Observations	2,228	2,026	2,000	1,997	1,997
R^2	0.014	0.017	0.027	0.149	0.156
F-test	19.390	16.883	14.881	13.245	12.500
F-test *p*-value	0.000	0.000	0.000	0.000	0.000

In this table, we reestimate our main results from Table II-4 using a linear probability regression model (OLS) instead of the generic Probit model in Equation (1). Instead of average marginal effects, we report the coefficients estimates of the linear regression models. Analogously to Table II-4, specification (1) and (2) show the unconditional effect of financial literacy and financial advice on individual i's holding of subsidized pension products. Specification (3) shows the joint effects of financial literacy and financial advice on holding subsidized pension products. Specification (4) shows the conditional effect of financial literacy and financial advice on holding of subsidized pension products including the vector of control variables c_i. Finally, in specification (5) we present our baseline model, in which we further add a vector capturing other financial assets in the respondents' portfolios a_i to our regression model. We report detailed variable descriptions in Appendix II-1. The data we use is weighted and draws on a subsample of the representative PHF survey. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

III. Tapping and waving to debt: Mobile payments and credit card behavior

Co-authors: Andreas Walter

Own share: 90%

Tapping and waving to debt: Mobile payments and credit card behavior

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Abstract – This study investigates whether the use of mobile payment technology is associated with individuals' credit card (mis-)behavior. Using a sample of more than 25,000 US households, we find that individuals using their smartphones to conduct mobile payments are more likely to exhibit costly credit card behavior. In addition, conditional on using mobile payments, our results provide further evidence that frequent usage of mobile payments is related to individuals' costly credit card behavior. Thus, our findings suggest a relationship between innovative payment methods and increases in individuals' overall spending.

Keywords: Mobile payment, credit card behavior, spending behavior, household finance, pain of payment

JEL-Codes: D12, D18, G4, G21, O33

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1. Introduction

The increasing number of smartphone owners worldwide has paved the way for traditional banking payment services, and nonfinancial companies, such as Apple, Google, or PayPal, to attract new customers and open up new markets by extending their range of products and services, particularly with respect to offering innovative payment alternatives. One prominent example among innovative payment alternatives is mobile payment technology enabling customers to conduct payments with mobile devices, such as smartphones.[1] In particular, customers attempting to use their smartphones for mobile payments can store card information of credit or debit cards in mobile wallets on their smartphones. Once the card information has been stored in a mobile wallet, the smartphone can be used to conduct payments by, for example, tapping or waving it over a sensor (e.g., near field communication terminals) at the point of sale.

On the upside, mobile payments clearly provide substantial benefits for both customers and merchants, because they are immediate available and increase time efficiency at the point of sale (Polasik et al., 2013). However, on the downside, there are ample reasons to believe that mobile payments might increase individuals' overall spending. In this regard, studies reveal that the pain associated with paying varies between different payment methods (e.g., Prelec and Loewenstein, 1998; Soman, 2003). The principle behind the pain associated with paying refers to the transparency of these payment methods with cash being the most transparent method (Soman, 2003). More precisely, while parting with cash generates the highest felt pain of payment, the pain associated with less transparent payment methods, such as credit or debit cards, is much lower and is likely to increase individuals'

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[1] Mobile payment is here defined as conducting payments through mobile wallets stored on respondents' smartphones.

overall spending (e.g., Feinberg, 1986; Raghubir and Srivastava, 2008; Shah et al., 2016). Recent studies suggest that innovative payment methods, such as mobile payments, are even less transparent than debit or credit cards (Shah et al., 2016). However, potential consequences of using mobile payments on individuals' spending behavior and debt accumulation have hitherto, to the best of our knowledge, not been investigated.

Hence, in our study we assess how potential negative economic outcomes are related to mobile payment technology usage. In particular, this paper studies the relationship between using smartphones to conduct mobile payments and costly credit card behaviors, which we define as either making only the minimum payment, paying late fees or over the limit fees. These credit card behaviors are likely to occur when individuals highly increase their spending and have been shown to be particularly detrimental to individuals' financial situation (Bertaut, Haliassos, and Reiter, 2009). Since mobile payment users conduct payments through mobile wallets that are often connected to a credit card (Dodini et al., 2016; Trütsch, 2016), we conjecture that this payment method is even less salient compared to directly paying with credit cards, especially because individuals might not even recognize that the payment has occurred (Shah et al., 2016). Thus, we hypothesize that mobile payment users should be more likely to exhibit costly credit card behavior, because the pain associated with mobile payments is significantly lower, compared to the pain associated with conventional payment methods. In addition, if mobile payment users were more likely to exhibit costly credit card behavior, we would expect a relationship between respondents' likelihood to engage in costly credit card behavior and higher frequency of mobile payment usage. Hence, we hypothesize that frequent users of mobile payment technology are more likely to exhibit costly credit card behavior, compared to infrequent mobile payment users.

To test these hypotheses, we use data from the 2015 National Financial Capability Study (NFCS), which comprises both information on individuals' credit card behavior and a specific question asking respondents whether they use their smartphone to pay for products or services in person. Despite controlling for determinants that have been previously identified to affect individuals' credit card behavior, such as financial literacy, financial risk tolerance or financial situation (e.g., Lusardi and Tufano, 2015; Mottola, 2013), we contribute to the literature and find that using mobile payments is associated with a 4.9 percentage points increase in the likelihood to exhibit costly credit card behavior. Moreover, conditional on using mobile payments, our results provide some evidence that the frequency of mobile payment usage is strongly related to costly credit card behavior. We document that frequent users are approximately 5.0 percentage points more likely to exhibit costly credit card behavior, compared to infrequent mobile payment users. In the light of the already high levels of credit card debt in the US, our findings have important implications, because they suggest that mobile payments are strongly related to individuals' credit card debt accumulation.

2. Material and methods

To assess the relationship between mobile payment usage and individuals' credit card behavior, we use representative survey data from the 2015 National Financial Capability Study (NFCS) covering more than 25,000 US households. The NFCS provides a rich set of items related to individuals' sociodemographics as well as measures for financial literacy, and financial risk tolerance. Moreover, the NFCS comprises questions on certain credit card behaviors of which three behaviors, in particular, making only the minimum payment, paying late fees or being charged an over the limit fee, are likely to generate sizeable interest or fees (Lin et al., 2016). Thus, we measure costly credit card behavior using a dummy variable that equals

one if a respondent shows at least one of these three behaviors, zero otherwise.[2] In our sample, 36.2% of respondents exhibit at least one of these three costly credit card behaviors. To identify individuals that use mobile payment technology, we use a specific item in the NFCS that asks respondents whether they use their smartphone as a payment instrument. More precisely, mobile payment is here defined as using the smartphone to pay for a product or service in person at a store, gas station, or restaurant.[3] The mobile payment is executed, for example, by waving/tapping the mobile phone over a sensor at checkout, scanning a barcode or QR code using the mobile phone, or using some other mobile app at checkout (Lin et al., 2016). We classify respondents as users of mobile payment technology if they report to at least sometimes use their smartphone to pay for products and services in person at a store, gas station, or restaurant, and create a dummy variable 'User' that equals one for users, and zero for non-users, respectively. Throughout this study, we may use the term 'users' for respondents who use mobile payments and 'non-users' for those who do not use mobile payment technology.

3. Results

3.1. Descriptive analysis

Table III-1 presents descriptive statistics of US households distinguishing between users and non-users. To begin, 22.7% of respondents in our data report to be mobile payment users, which corresponds well to other survey data reporting 24% of the US population being mobile payment users (Dodini et al., 2016).[4] However,

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[2] For brevity, we combine the three costly credit card behaviors to one single measure. However, our main results do not change materially when we analyze each credit card behavior separately.

[3] The strict wording of this item allows us to isolate the effect of using the smartphone as a payment instrument in stores, rather than using the smartphone for purchases conducted online at home, such as shopping in Amazon.

[4] Using data from the Survey of Consumer Payment Choice in the United States, Trütsch (2016) shows that already 18% of respondents used mobile payments in 2012. The same survey has been conducted in 2015 again and results reveal that mobile payment usage increased to 23.3% (Greene, Schuh, and Stavins, 2017).

please note that mobile payment users may also use other payment methods, such as credit or debit cards, but we do not have information on the shares of each payment method used by an individual.

Table III-1: Demographic profiles of mobile payment users vs. non-users

This table reports demographic profiles for the whole sample of US households as well as for users and non-users of mobile payment technology separately. The data is weighted and representative for the whole US population. For detailed variable descriptions, please refer to Appendix III-1. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	US population	Users	Non-users	Diff.	T-stat	N
User	0.227					27,236
Financial literacy	3.301	2.937	3.423	-0.486	17.95***	26,502
Risk tolerance	5.186	6.795	4.693	2.101	48.22***	26,734
Female	0.514	0.439	0.537	-0.098	11.50***	27,564
Married	0.520	0.492	0.531	-0.038	4.47***	27,564
Children	0.647	0.620	0.659	-0.038	4.56***	27,564
White	0.650	0.498	0.697	-0.199	23.29***	27,564
Age < 35	0.305	0.547	0.230	0.317	38.17***	27,564
Age > 35 & <= 50	0.343	0.354	0.340	0.014	1.72*	27,564
Age > 50	0.352	0.099	0.430	-0.331	56.39***	27,564
Education	1.475	1.554	1.454	0.100	8.28***	27,564
Self-employed	0.071	0.074	0.070	0.004	0.86	27,564
Unemployed	0.065	0.061	0.066	-0.005	1.17	27,564
Income < $35k	0.358	0.321	0.366	-0.045	5.48***	27,564
Income > $35k & <= $75k	0.350	0.346	0.352	-0.007	0.80	27,564
Income > $75k	0.292	0.333	0.281	0.052	6.58***	27,564

In general, we find that mobile payment users are less financially literate and have higher levels of financial risk tolerance, compared to non-users. The use of mobile payment technology is more pronounced among the younger population. In particular, 54.7% of individuals younger than 35 use their smartphone to conduct mobile payments. In line with this finding, bivariate results suggest that users are more likely to be unmarried and childless. Finally, we document that users are more likely to be male and to possess higher levels of education and income. We provide detailed variable descriptions in Appendix III-1.

3.2. Regression analysis

3.2.1. Main results

In Table III-2, we present the results of a series of linear probability model regressions (LPM), in which we regress costly credit card behavior on mobile payment usage and a large set of control variables. Controls included are individuals' demographics, such as age, gender, marital status, income and educational level. Further, we control for individuals' financial literacy level and risk tolerance. Finally, we add financial controls (e.g., number of credit cards or having a checking account) and a set of debt type controls (e.g., outstanding mortgage or student loans) to control for individuals' debt behavior. The full set of control variables is comprised of all variables displayed in Appendix III-1. In column (1) of Table III-2 we present the main result of our study. We find that using mobile payment technology is strongly related to individuals' costly credit card behavior, although we control for a large number of factors previously identified to determine individuals' credit card behavior. In addition to being highly significant in statistical terms, this effect is also economically meaningful. The coefficient of mobile payment usage indicates that using mobile payments is associated with a 4.9 percentage points increase in the likelihood to exhibit costly credit card behavior.

The coefficients of the remaining variables, such as financial literacy, are in line with prior studies analyzing the determinants of individuals' costly credit card behavior (Mottola, 2013). In column (2), we investigate whether the frequency of mobile payment usage is related to respondents' likelihood to exhibit costly credit card behavior.

Table III-2: Mobile payments and costly credit card behavior

This table presents coefficients obtained from a LPM regression featuring an indicator variable for individuals' costly credit card behavior as the dependent variable. In column (1), the main explanatory variable 'User' is a dummy variable that equals one if the respondent reports to use her smartphone to pay for a product of service in person. In column (2), we analyze whether the frequency of mobile payment usage has an impact on costly credit card behavior. Hence, we restrict our sample to respondents that use mobile payment technology and include a dummy variable 'Frequent user' that equals one if the respondent reports to frequently use her smartphone for mobile payments, zero otherwise. The data is weighted and representative for the US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Dependent: Credit card misbehavior	
	Full sample	Mobile payment users
	(1)	(2)
User	0.0491***	
	(0.0102)	
Frequent user		0.0498***
		(0.0193)
Financial literacy	-0.0233***	-0.0207***
	(0.0026)	(0.0057)
Risk tolerance	0.0010	0.0005
	(0.0016)	(0.0038)
Female	0.0044	-0.0017
	(0.0072)	(0.0159)
Married	0.0005	-0.0136
	(0.0084)	(0.0192)
Children	0.0418***	0.0387**
	(0.0084)	(0.0194)
White	-0.0154*	0.0108
	(0.0084)	(0.0160)
Age > 35 & <= 50	-0.0173	-0.0310*
	(0.0106)	(0.0181)
Age > 50	-0.0972***	-0.0885***
	(0.0116)	(0.0271)
Education	-0.0111**	-0.0326***
	(0.0048)	(0.0111)
Self-employed	0.0321**	0.0073
	(0.0137)	(0.0317)
Unemployed	-0.0169	-0.0785*
	(0.0216)	(0.0455)
Income > $35k & <= $75k	-0.0087	0.0035
	(0.0105)	(0.0232)
Income > $75k	-0.0398***	-0.0284
	(0.0120)	(0.0268)
Intercept	0.3786***	0.4406***
	(0.0414)	(0.0699)
Additional controls	Yes	Yes
Observations	19,165	4,240
F-test	311.531	68.124
F-test p-value	0.000	0.000
R^2	0.315	0.279

The coefficient of 'Frequent user' in column (2) indicates that, conditional on using mobile payments, respondents that state to frequently use mobile payment technology are approximately 5.0 percentage points more likely to exhibit costly

credit card behavior, compared to users who state that they only sometimes use this technology. Overall, these results suggest that mobile payments are strongly related to increases individuals' spending behavior.

We also address concerns that the relationship between mobile payments and costly credit card behavior might be a statistical artifact by running Monte Carlo permutation tests in Appendix III-2. The p-value of 0.0000 indicates that we can reject the null hypothesis that there is no relationship between mobile payment usage and costly credit card behavior, indicating that our main finding is unlikely to be a statistical artifact. In unreported analyses, we reestimate our baseline regression using subsamples to control for various variables that might distort our results. For example, we rerun regressions using subsamples for different age and income groups, and exclude respondents that exhibited significant drops in income. Results do not change in any substantive way.

3.2.2. Robustness: Selection bias and endogeneity

In this section, we account for a potential selection bias of mobile payment usage, because respondents that use mobile payment technology can greatly differ in observable covariates compared to non-users, indicating that they show unequal (selection) probabilities to use mobile payment technology. To overcome this issue, we perform propensity score matching analysis (PSM) to account for the potential selection bias of individuals' likelihood to use mobile payments. First, we estimate a logistic regression featuring mobile payment usage as the dependent variable, including all of the variables in Table III-2 as control variables. Based on the propensity scores, we build a control sample of non-users that exhibit the same covariates as mobile payment users by matching users with their non-user sociodemographic 'twins' using a 1:1 nearest-neighbor matching approach without replace-

ment. This approach yields to a matched sample with well-balanced covariates between users (treated) and non-users (controls), i.e., there are no statistically significant differences between both groups after the matching.[5] Second, we reestimate the linear probability model regression from column (1) of Table III-2 using the matched (balanced) sample in Table III-3. As can be inferred from the results in Table III-3, the coefficient of 'User' is even slightly higher than in our baseline regression and is still highly statistically significant, indicating that our results are robust to a potential selection bias based on distributional differences in observable covariates between users and non-users of mobile payments.

Table III-3: Reestimation of main results using matched sample

In this table, we re-estimate our main results from column (1) of Table III-2 using the matched samples obtained from our PSM analysis. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Dependent: Credit card misbehavior
User	0.0639***
	(0.0123)
Intercept	0.3877***
	(0.0636)
Controls as in Table III-2	Yes
Observations	6,530
F-test	88.072
F-test p-value	0.000
R^2	0.270

Finally, in Table III-4, we attempt to address potential endogeneity issues related to our main explanatory variable 'User'. In particular, the coefficient of mobile payment usage in Table III-2 could be biased either due to reverse causality (i.e., respondents that exhibit costly credit card behavior are more likely to use mobile payments) or due to confounding (omitted) variables, which are both correlated with the use of mobile payment and the error term of the linear probability regression model.

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[5] Results are available upon request.

Table III-4: IV regression results

This table shows second stage IV GMM linear probability model estimates of our baseline model in column (1) of Table III-2 instrumenting mobile payment usage using generated instruments after Lewbel (2012). Standard errors are robust. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Dependent: Credit card misbehavior
User	0.0413***
	(0.0156)
Intercept	0.3706***
	(0.0362)
Controls as in Table III-2	Yes
Observations	19,165
F-test	424.840
F-test of excluded instruments (p-value)	0.000
R^2	0.315
Breusch-Pagan test for heteroscedasticity in first-stage regression (p-value)	0.000
Endogeneity test (p-value)	0.532
Hansen J statistic (p-value)	0.409

Despite controlling for a large number of variables, one possible omitted variable that could bias our results is individuals' lack of self-control. In this regard, studies have shown that lower levels of self-control are related to compulsive use of mobile phones (Billieux, 2012; Billieux, Van der Linden, and Rochat, 2008), and a lack of self-control has also been shown to affect individuals' debt behavior (Gathergood, 2012). Hence, omitting individuals' self-control from the linear probability regression model could lead to either under- or overestimation of the effect of mobile payment on credit card behavior.

To circumvent both reverse causality and omitted variable bias, we estimate a linear probability instrumental variable model. Because we lack external instruments for mobile payment usage, we resort to an IV method in which we instrument mobile payment usage using generated instruments after Lewbel (2012).[6] The instrumented coefficient of 'User' in Table III-4 remains economically and statistically significant, and the endogeneity test (p-value 0.532) indicates that the null hypothesis of the mobile payment's exogeneity cannot be rejected. Although our results

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[6] Please see especially Bannier and Schwarz (2018), Deuflhard, Georgarakos, and Inderst, (2017) or Meyll, Pauls, and Walter, (2017) for more details on the method proposed in Lewbel (2012).

suggest causality between mobile payments and costly credit card behavior, results might be interpreted with caution. This is due to the nature of survey data, which does not allow us to rule out any remaining endogeneity concerns. While this might present a data limitation of our study, future research might resort to experimental settings in order to mitigate any remaining endogeneity concerns.

4. Conclusion

This paper, based on data of a large representative US household survey, investigates the relationship between using mobile payment technology and individuals' credit card behavior. While research yet focused on the determinants of the adoption of mobile payment technology, potential economic consequences of using mobile payments have hitherto - to the best of our knowledge - not been investigated. In our study, we document that using smartphones to conduct mobile payments is strongly associated with individuals' likelihood to exhibit costly credit card behavior. Moreover, conditional on using mobile payments, our results provide further evidence that the frequency of mobile payment usage is strongly related to costly credit card behavior. Our results have important implications, because they reveal that mobile payments are associated with credit card debt accumulation of US households.

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6. Appendix

<div align="center">Appendix III-1: Variable descriptions</div>

Name	Description
Age < 35	Dummy variable that equals one if respondent's age is less than 35, zero otherwise.
Age > 35 & <= 50	Dummy variable that equals one if respondent's age is more than 35 and less than 50, zero otherwise.
Age > 50	Dummy variable that equals one if respondent's age is more than 50, zero otherwise.
Auto loan	Dummy variable that equals one if respondent reports to have any auto loans, zero otherwise.
Checking account	Dummy variable that equals one if the respondent owns a checking account, zero otherwise.
Children	Dummy variable that equals one if the respondent reports to have financially dependent children, zero otherwise.
Credit card misbehavior	Dummy variable that equals one if respondent shows at least one costly credit card misbehavior, zero otherwise. We relate credit card misbehavior to either paying the minimum payment, being charged a late fee or being charged an over the limit fee.
Education	Ordinal variable that describes the respondent's highest degree of education: 1 - Higher education entrance; 2 - Non-academic post-secondary education; 3 - University degree or higher. Zero otherwise.
Female	Dummy variable that equals one if respondent is female, zero otherwise.
Financial fragility	Dummy variable that equals one if respondent would have at least problems to come up with $2,000 if an unexpected need arose within the next month, zero otherwise.
Financial literacy	Ordinal variable measuring the number of correct answers to financial literacy questions, ranging from zero correct to six correct answers. For the exact wording of financial literacy questions (corresponding NFCS items: M6, M7, M8, M9, M10, M31) please refer to http://www.usfinancialcapability.org/downloads/NFCS_2015_State_by_State_Qre.pdf
Home equity loan	Dummy variable that equals one if respondent reports to have any home equity loans, zero otherwise.
Homeowner	Dummy variable that equals one if respondent reports to own her home, zero otherwise.
Income < $35k	Dummy variable that equals one if respondents' income is less than $35,000, zero otherwise.
Income > $35k & <= $75k	Dummy variable that equals one if respondents' income is more than $35,000 and less than $75,000, zero otherwise.
Income > $75k	Dummy variable that equals one if respondents' income is more than $75,000, zero otherwise.
Married	Dummy variable that equals one if respondent reports to be married, zero otherwise.
Mortgage loan	Dummy variable that equals one if respondent reports to have a mortgage on her home, zero otherwise.
Nonbank borrowing	Dummy variable that equals one if respondent has either taken out an auto title loan, a short-term "payday" loan, used a pawnshop or used a rent-to-own-store in the past 5 years, zero otherwise.
Number of credit cards	Categorical variable measuring respondent's number of credit cards (NFCS item F1) from 1 [one credit card] to 6 [more than 20 credit cards]. For exact number of credit cards, please refer to http://www.usfinancialcapability.org/downloads/NFCS_2015_State_by_State_Qre.pdf.
Rainy day funds	Dummy variable that equals one if respondent reports to have set aside rainy day funds that would cover expenses for 3 months, zero otherwise.
Risk tolerance	Ordinal variable that measures the respondents' willingness to take risks with financial investments risk on a scale from 1 [not at all willing] to 10 [very willing].
Risky assets	Dummy variable that equals one if respondent, not including retirement accounts, owns risky financial assets (e.g. stocks, bonds, mutual funds or other securities), zero otherwise.
Self-employed	Dummy variable that equals one if respondent is self-employed, zero otherwise.

<div align="right"><i>(continued on next page)</i></div>

Appendix III-1: Variable descriptions – *continued*

Shock: Drop in income	Dummy variable that equals one if respondent experienced a large and unexpected drop in income during the last twelve months, zero otherwise.
Student loan	Dummy variable that equals one if respondent reports to have outstanding student loans, zero otherwise.
Unemployed	Dummy variable that equals one if respondent is unemployed, zero otherwise.
Unpaid medical bills	Dummy variable that equals one if respondent reports to have any unpaid medical bills, zero otherwise.
User	Dummy variable that equals one if the respondent at least sometimes uses her smartphone to to pay for a product or service in person. Corresponding NFCS item: How often do you use your mobile phone to pay for a product or service in person at a store, gas station, or restaurant (e.g., by waving/tapping your mobile phone over a sensor at checkout, scanning a barcode or QR code using your mobile phone, or using some other mobile app at checkout)? 1 - Frequently; 2 - Sometimes; 3 - Never; 4 - Don't know; 5 - Prefer not to say.
White	Dummy variable that equals one if respondent's ethnicity is white, zero otherwise.

Appendix III-2: Permutation tests: Random assignment of mobile payment usage

This table reports p-values from Monte Carlo permutation tests in which we assign each respondent a random mobile payment user status. We use 10,000 random draws, indicating that we repeat the random procedure of assigning mobile payment usage to respondents 10,000 times, and reestimate our baseline regression from column (1) of Table III-2 for each random draw. The reported p-value presents the number of randomly permutated datasets that yield a regression coefficient larger than or equal to the reported coefficient for the variable 'User' from our regressions of costly credit card behavior on mobile payment usage and control variables in column (1) of Table III-2. All variables are defined in Appendix III-1.

	Dependent: Credit card misbehavior
User	0.0491***
p-value	*[0.0000]*
Controls as in Table III-2	Yes
Permutations	10,000

IV. The gender gap in 'Bitcoin literacy'

Co-authors: Christina E. Bannier, Florian Röder, Andreas Walter
Own share: 40%

The gender gap in 'Bitcoin literacy'[*]

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Abstract – Using nationally representative US data, we show that women possess weaker knowledge regarding the characteristics of Bitcoin compared to men. Investigating the determinants driving this gap, we find that socio-demographics and personality traits explain only a small share of the gap. Adding measures for actual and perceived financial literacy explains approximately 40 percent of the gender gap in Bitcoin literacy. Experience with digital technology, in contrast, does not have additional explanatory power. Our results indicate that closing gender gaps in financial literacy is important, but safeguarding financial well-being in increasingly digitalized financial systems becomes ever more complex.

Keywords: Bitcoin, Bitcoin literacy, financial literacy, gender gap, gender differences, household finance

JEL-Codes: D14, J16, O33

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1. Introduction

Over the last decade, a vast number of studies have consistently documented a gender gap in financial knowledge, indicating that women possess lower levels of financial knowledge compared to men (e.g., Bucher-Koenen et al., 2017; Fonseca et al., 2012; Lusardi and Mitchell, 2014). Unfortunately, policymakers and researchers around the world are still lacking satisfactory solutions to mitigate gender disparities in financial literacy (Fernandes, Lynch Jr., and Netemeyer, 2014).

At the same time, disrupting technologies in the financial industry, such as blockchain or artificial intelligence are on the rise, offering individuals novel investment opportunities. While some of those products might provide attractive investment opportunities, they also require individuals to possess specific knowledge about financial technologies (fintech) as well as a correct assessment of the underlying risks associated with such investments (e.g., Greimel-Fuhrmann, 2018).

Against this background, recent news reports raise serious concerns of a formation of novel gender gaps related to fintech knowledge (e.g., Bowles, 2018; Kuchler, 2018; Lam, 2017). In order to counteract this trend, a profound understanding of the underlying determinants driving potential gender gaps in fintech knowledge is of utmost importance. Somewhat surprisingly, studies on fintech-related knowledge are markedly sparse and, even more importantly, gender differences in fintech-related knowledge have, to the best of our knowledge, hitherto not been investigated.

Our study attempts to fill this gap by investigating potential gender differences in fintech knowledge and its underlying determinants with respect to the most prominent virtual currency: Bitcoin. To assess gender differences in 'Bitcoin literacy', we merge data from seven nationally representative US surveys administered

by the Understanding America Study (UAS) covering more than 2,500 individual respondents.

We contribute to the literature in multiple ways. First, we document a significant gender gap in Bitcoin literacy in the US, indicating that women possess weaker knowledge regarding the characteristics of Bitcoin compared to men. Second, we find that socio-demographic variables as well as personality traits explain only a small share of the gender gap in Bitcoin literacy. As a third contribution, we test whether gender differences in financial literacy explain the gender gap in Bitcoin literacy. Our results suggest that adding measures for actual and perceived financial literacy helps to explain approximately 40 percent of the gender gap in Bitcoin literacy. Finally, we control for potential gender differences in digital technology exposure, because sensible usage of fintech products also requires individuals to have a profound understanding of recent digital technologies. While being strongly related to Bitcoin literacy, we do not find any significant gender differences in the exposure to digital technology, indicating that technological experience is not likely to be the reason for the observed gender gap in Bitcoin literacy.

In general, our findings suggest that closing the gender gap in financial literacy might only serve as a partial remedy for closing the gender gap in Bitcoin literacy. More than half of the Bitcoin-literacy gender gap remains unexplained, even after controlling for technological experience. This finding raises serious concerns whether closing gender gaps in financial literacy will be enough to avoid diverging financial wealth levels due to the increasing use of financial technologies.

2. Data and variable measurement

To investigate a potential gender gap in Bitcoin literacy and its underlying determinants, we use data collected in the Understanding America Study (UAS),

which is a nationally representative household panel featuring a sample of approximately 6,000 US respondents. The UAS consists of a diverse set of survey waves that are of strong scientific and policy interest, including questionnaires related to individuals' financial literacy. A key feature of the UAS is that it allows us to link data across different surveys. We link data of seven different surveys that have been conducted between April 2015 and February 2018. All of our analyses are conducted using a sample of 2,533 individuals with non-missing values for all variables.[1] Next to a large set of socio-demographic control variables, we use information on individuals' 'BIG FIVE' personality traits, as well as measures for actual and perceived financial literacy. Because understanding fintech-related products requires understanding of financial concepts as well as of recent digital technology, we build a proxy variable to capture individuals' knowledge of digital technology and argue that exposure to digital technology is likely to be associated with better understanding of such technology. The *digital technology exposure index* ranges from 0 to 3, capturing three technology-related characteristics: Occupation with a strong exposure to computer technology, owning a Twitter account, and adoption of online and mobile banking services.[2] Table IV-1 reports the summary statistics of our sample. It shows the sample means of all explanatory variables, distinguishing between women and men, and also reports the differences between the two groups. Table IV-1 confirms prior findings on gender gaps in actual and perceived financial literacy, indicating that women show both lower levels of actual and perceived financial literacy. With regard to the *digital technology exposure index*, however, we find similar levels for women and men.

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[1] We drop all observations with missing values in any of our variables to ease interpretation and to ensure comparability of the results of our decomposition analysis in Table IV-3.

[2] We classify occupations to have a strong exposure to information technology when the job title includes the word 'computer'. For our classification, we follow the job code category listings in the Bureau of Labor Statistics Occupational Employment Statistics (https://www.bls.gov/oes/current/oes_stru.htm).

Table IV-1: Summary statistics

	Mean				
	All	Women	Men	Diff.	N
Panel A: Sociodemographics					
Female	0.470				2,533
Age	48.634	48.454	48.794	-0.339	2,533
Married	0.620	0.528	0.701	-0.172***	2,533
Education					
College graduate	0.419	0.446	0.396	0.050*	2,533
Some college	0.295	0.320	0.273	0.047*	2,533
High school graduate	0.246	0.210	0.277	-0.067**	2,533
Less than high school	0.040	0.024	0.054	-0.030**	2,533
Race					
Asian	0.033	0.031	0.034	-0.003	2,533
White	0.799	0.801	0.798	0.004	2,533
Black	0.093	0.104	0.083	0.021	2,533
Other	0.073	0.063	0.082	-0.020	2,533
Born in the US	0.917	0.920	0.914	0.006	2,533
Unemployed	0.036	0.043	0.030	0.013	2,533
Retired	0.154	0.158	0.151	0.007	2,533
Household income	122,811	118,030	127,044	-5,751	2,533
Household net wealth	409,757	433,805	388,469	39,108	2,533
Financial stress	0.416	0.475	0.363	0.112***	2,533
Political affiliation					
Democrats	0.375	0.425	0.331	0.095***	2,533
Republicans	0.326	0.294	0.355	-0.061**	2,533
No political party	0.226	0.229	0.223	0.006	2,533
Libertarian	0.041	0.031	0.050	-0.019*	2,533
Green party	0.013	0.010	0.015	-0.005	2,533
Other party	0.019	0.012	0.026	-0.015*	2,533
Panel B: Personality traits					
Openness	36.581	36.273	36.854	-0.582	2,533
Conscientiousness	36.886	36.911	36.864	0.047	2,533
Extroversion	26.657	27.133	26.236	0.898**	2,533
Agreeableness	35.915	36.686	35.231	1.455***	2,533
Neuroticism	20.805	21.622	20.081	1.542***	2,533
Panel C: Financial literacy and digital technology exposure					
Perceived financial literacy	7.852	7.641	8.039	-0.397***	2,533
Actual financial literacy	10.113	9.559	10.603	-1.045***	2,533
Digital technology exposure	1.191	1.182	1.200	-0.018	2,533

This table shows summary statistics of all explanatory variables used in our analysis, distinguishing between the subsample of women and men, respectively. The data is weighted and representative for the US population. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Our dependent variable 'Bitcoin literacy' is created from a set of six true-or-false questions, each assessing respondents' knowledge of a particular aspect of Bitcoin. The set of questions we use is similar, but not identical to the Bitcoin knowledge questions in the Bitcoin Omnibus Survey conducted by the Bank of

Canada (Henry, Huynh, and Nicholls, 2018). For each question, we build an indicator variable that equals one if respondents answer the respective question correctly, and zero otherwise. The Bitcoin literacy index sums up the number of correct answers and ranges from 0 to 6, respectively.

Table IV-2: Bitcoin literacy in the US					
	Mean				
	All	Women	Men	Diff.	N
Panel A: Bitcoin literacy questions (% of respondents providing correct answer)					
No third party (true)	0.714	0.707	0.720	-0.013	2,533
Recorded on public ledger (true)	0.183	0.173	0.192	-0.018	2,533
Total supply fixed (true)	0.196	0.164	0.225	-0.061***	2,533
Government-insured (false)	0.982	0.978	0.985	-0.007	2,533
Transfers irreversible (true)	0.164	0.114	0.208	-0.094***	2,533
Central repository (false)	0.774	0.763	0.784	-0.021	2,533
Panel B: Bitcoin literacy index					
Bitcoin literacy index	3.013	2.899	3.114	-0.215***	2,533

This table reports summary statistics for Bitcoin literacy in the US, distinguishing between the subsample of female and male respondents, respectively. Panel A shows the fraction of respondents providing correct answers to each of the six named features of Bitcoin. Panel B shows summary statistics of our constructed Bitcoin literacy index, which is defined as the sum of correct answers to the Bitcoin literacy questions, ranging from 0 to 6 correct answers. We provide detailed variable descriptions in Appendix IV-1. The data is weighted and representative for the US population. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table IV-2 shows descriptive statistics of our Bitcoin literacy index and the set of underlying questions. We document a significant gender gap in Bitcoin literacy (Panel B of Table IV-2), indicating that women possess weaker knowledge regarding the mechanisms underlying Bitcoin technology.[3] For detailed variable descriptions, please see Appendix IV-1.

3. Empirical results

To explain the documented gender gap in Bitcoin literacy, we decompose the difference in Bitcoin literacy between men and women by using a modified Blinder-Oaxaca counterfactual decomposition (Blinder, 1973; Oaxaca, 1973). The Blinder-

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[3] We provide detailed multiple linear regressions featuring Bitcoin literacy as the dependent variable in Appendix IV-2. The results suggest that the gender gap persists even after including all available control variables.

Oaxaca-decomposition has been employed to explain gender differences in financial literacy (e.g., Cupák et al., 2018; Fonseca et al., 2012). In our study, we choose a twofold counterfactual decomposition approach of the following form:

$$\bar{Y}_M - \bar{Y}_W = \underbrace{\overbrace{(\bar{X}_M - \bar{X}_W)'\beta^*}^{(I)}}_{explained} + \underbrace{\overbrace{\bar{X}'_M(\beta_M - \beta^*)}^{(II)} + \overbrace{\bar{X}'_W(\beta^* - \beta_W)}^{(III)}}_{unexplained} \qquad (1)$$

where $\bar{Y}_M - \bar{Y}_W$ denotes the outcome differential in Bitcoin literacy between the group of men (M) and women (W), and X is a vector capturing individual characteristics as well as a constant. β^* denotes a coefficient vector estimated from a pooled regression over the two groups, and β_M and β_W are the coefficients obtained from separately regressing Bitcoin literacy on the individual characteristics for the groups of men and women, respectively. The twofold decomposition divides gender-based differences in Bitcoin literacy into two parts. The first is the part of the gender gap that can be explained by differences in group characteristics, i.e. in predictors X (I). The second denotes the unexplained part and captures effects of positive discrimination in favor of men (II) as well as negative discrimination against women (III) but also considers effects due to unobserved (omitted) variables (Jann, 2008).

We report the results of various specifications of Equation (1) in Table IV-3. Specification (1) reports the unconditional gender gap in Bitcoin literacy excluding all other control variables X from our regression model. Next, we stepwise add control variables to our model, in order to show how much of the gender gap can be explained by the differences in the group characteristics X. In doing so, we control for group differences in socio-demographics (specification (2)), personality

traits (specification (3)), and financial literacy (specification (4)). Finally, we control for group differences related to the exposure to digital technology (specification (5)).

Table IV-3: Decomposing the gender gap in Bitcoin literacy

	(1)	(2)	(3)	(4)	(5)
Explained	0.0000	0.0184	0.0474*	0.0914***	0.0923***
	(0.0000)	(0.0217)	(0.0276)	(0.0310)	(0.0310)
Unexplained	0.2147***	0.1963***	0.1673***	0.1233**	0.1224**
	(0.0561)	(0.0550)	(0.0559)	(0.0567)	(0.0565)
Controls					
Sociodemographics	No	Yes	Yes	Yes	Yes
Personality traits	No	No	Yes	Yes	Yes
Financial literacy	No	No	No	Yes	Yes
Digital technology exposure	No	No	No	No	Yes

This table shows the results from a modified Blinder-Oaxaca counterfactual decomposition method (Blinder, 1973; Oaxaca, 1973) featuring Bitcoin literacy as the dependent variable. In specification (1), we report the unconditional gender gap in Bitcoin literacy excluding any control variables. Next, we assess how much of the gender gap in Bitcoin literacy can be *explained* by gender differences in socio-demographics (specification (2)), personality traits (specification (3)), actual and perceived financial literacy (specification (4)). Finally, in specification (5), we further control for gender differences in the exposure to digital technology. The *unexplained* part captures the proportion of the gender gap that cannot be explained by the included variables. We provide detailed variable descriptions in Appendix IV-1. The data is weighted and representative for the US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Figure IV-1 provides a graphical illustration of the decomposition results of Table IV-3 and reports the explained and unexplained parts of the total gender gap in Bitcoin literacy for the different specifications, expressed as a percentage.

The results in specification (1) show that the outcome differential in Bitcoin literacy is statistically and economically significant, indicating that women's Bitcoin literacy index is 0.2147 lower than men's.[4] This translates into a gender gap of 7.1% when referring to the sample mean of Bitcoin literacy (3.013). While socio-demographic variables and personality traits do help to explain the gender gap in Bitcoin literacy (specifications (2) and (3)), their additional explanatory power is only small. Adding measures for actual and perceived financial literacy in specification (4) helps to explain up to 42.6 % of the gender gap in Bitcoin literacy. The

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[4] This finding is in line with the results provided in Panel B of Table IV-2.

valued added by including the digital technology exposure index, in contrast, is negligible, indicating that the gender gap in Bitcoin literacy is unlikely to stem from gender differences in experience with digital technologies.

Figure IV-1: Decomposing the gender gap in Bitcoin literacy
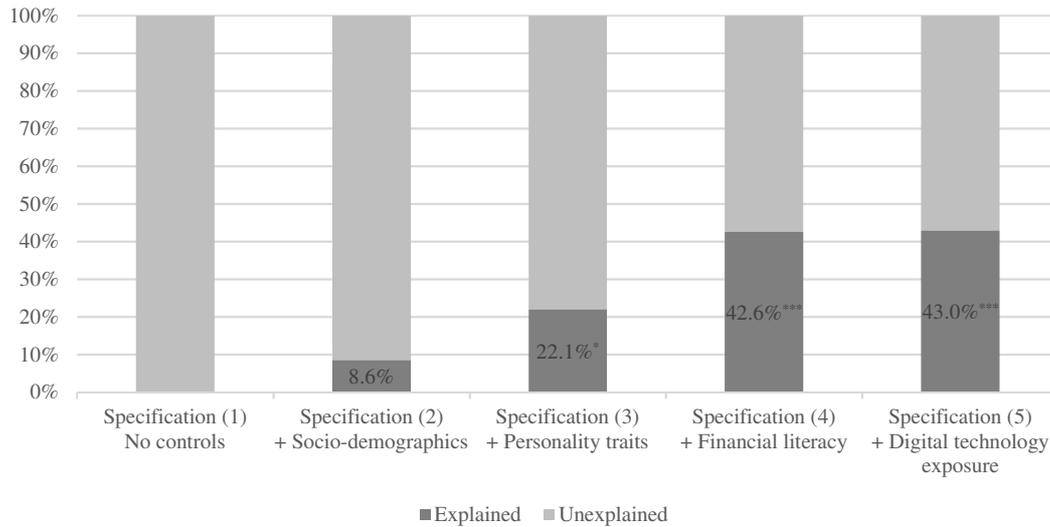
This figure provides a graphical illustration of the decomposition results analogously to the results from specifications (1) to (5) in Table IV-3. In specification (1), we report the unconditional gender gap in Bitcoin literacy excluding any control variables. Next, we assess how much of the gender gap in Bitcoin literacy can be *explained* by gender differences in socio-demographics (specification (2)), personality traits (specification (3)), actual and perceived financial literacy (specification (4)). Finally, in specification (5), we further control for gender differences in the exposure to digital technology. The *unexplained* part captures the fraction of the gender gap expressed as a percentage that cannot be explained by gender disparities in the included variables. We calculate the percentage values by dividing the unexplained part by the sample mean of Bitcoin literacy (see Panel B of Table IV-2). The data is weighted and representative for the US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

4. Conclusion

Using nationally representative US data, we report a significant gender gap in Bitcoin literacy and examine its determinants. Our results suggest that socio-demographic variables and personality traits only explain a small fraction of the gender gap. Adding measures for actual and perceived financial literacy allows to explain about 40 percent of the Bitcoin-literacy gender gap. We also assess whether disparities in individuals' exposure to digital technology exhibit explanatory power

on the Bitcoin-literacy gender gap. This does not turn out to be the case. Our results emphasize that closing gender gaps in financial literacy is certainly relevant but not sufficient to eliminate gender disparities in fintech-related knowledge.

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6. Appendix

Appendix IV-1: Variable descriptions

Name	Description	UAS survey
Panel A: Control variables		
Actual financial literacy	Ordinal variable measuring the number of correct answers to 14 financial literacy questions. For the specific wording of the financial literacy questions, please refer to https://uasdata.usc.edu/index.php.	1
Age	Ordinal variable measuring respondent's age.	General
Born in the US	Dummy = 1 if respondent is born in the US, and zero otherwise	General
Digital technology exposure	Ordinal variable measuring an individual's exposure to digital technology ranging from 0 to 3. The index is the sum of three dummy variables, capturing the following items: Occupation with strong exposure to computer technology, owning a Twitter account, and adoption of mobile and online banking services.	2, 18, 88
Education	Different dummy variables capturing respondent's educational level (either no high school, high school, some college or college).	General
Female	Dummy = 1 if respondent is female, and zero otherwise	General
Financial stress	Dummy = 1 for individuals that experienced major financial stress during the last three years, zero otherwise.	18
Household income	Continuous variable measuring household's yearly net income ($US).	24
Household net wealth	Continuous variable measuring household's total net wealth ($US).	24
Married	Dummy = 1 if respondent is married, and zero otherwise.	General
Perceived financial literacy	Ordinal variable measuring respondent's confidence in the ability to make financial decisions on a scale from 0 to 10 (highest confidence).	38
Personality traits	Ordinal variables measuring the Big Five personality traits: openness, conscientiousness, extroversion, agreeableness and neuroticism. For the items included in our measure, please see https://uasdata.usc.edu/index.php/.	1
Political affiliation	Different dummy variables capturing respondent's political affiliation (either Democrats, Republicans, No political party, Libertarian, Green party or other party).	117
Race	Different dummy variables capturing respondent's race (either Asian, White, Black or other).	General
Retired	Dummy = 1 if respondent is retired, and zero otherwise.	38
Unemployed	Dummy =1 if respondent is unemployed, and zero otherwise.	38
Panel B: Bitcoin literacy questions and index		
No third party	Dummy = 1 if the following question is correctly answered, and zero otherwise. Question: *Bitcoin allows for direct transactions between two parties without a third party involved (true).*	117
Recorded on public ledger	Dummy = 1 if the following question is correctly answered, and zero otherwise. Question: *All Bitcoin transactions are recorded on a distributed ledger that is publicly accessible (true).*	117
Total supply fixed	Dummy = 1 if the following question is correctly answered, and zero otherwise. Question: *The total supply of Bitcoin is fixed (true).*	117
Government-insured	Dummy = 1 if the following question is correctly answered, and zero otherwise. Question: *Bitcoin holdings are insured by the government (false).*	117
Transfers irreversible	Dummy = 1 if the following question is correctly answered, and zero otherwise. Question: *Bitcoin transfers are irreversible (true).*	117
Central repository	Dummy = 1 if the following question is correctly answered, and zero otherwise. Question: *All bitcoin transactions go through a central repository (false).*	117
Bitcoin literacy index	Ordinal variable measuring the number of correct answers to the 6 Bitcoin literacy questions.	117

Appendix IV-2: Determinants of Bitcoin literacy

	Dependent variable: Bitcoin literacy index				
	(1)	(2)	(3)	(4)	(5)
Female	-0.2147***	-0.1963***	-0.1673***	-0.1233**	-0.1224**
	(0.0561)	(0.0554)	(0.0561)	(0.0570)	(0.0570)
Perceived financial literacy				0.0265*	0.0237
				(0.0151)	(0.0150)
Actual financial literacy				0.0376***	0.0351***
				(0.0125)	(0.0125)
Digital technology exposure					0.0915**
					(0.0395)
Age		-0.0311***	-0.0284***	-0.0311***	-0.0307***
		(0.0109)	(0.0110)	(0.0109)	(0.0109)
Age2		0.0002**	0.0002*	0.0002**	0.0002**
		(0.0001)	(0.0001)	(0.0001)	(0.0001)
Married		0.0393	0.0573	0.0430	0.0376
		(0.0672)	(0.0674)	(0.0668)	(0.0668)
College graduate		0.1867	0.1795	0.0851	0.0525
		(0.1452)	(0.1450)	(0.1466)	(0.1495)
Some college		-0.0007	-0.0023	-0.0542	-0.0711
		(0.1451)	(0.1441)	(0.1459)	(0.1478)
High school graduate		-0.0515	-0.0329	-0.0454	-0.0551
		(0.1505)	(0.1490)	(0.1513)	(0.1530)
Asian		0.0778	0.0677	0.0523	0.0544
		(0.2059)	(0.2032)	(0.2042)	(0.2036)
White		-0.0760	-0.0622	-0.0858	-0.0785
		(0.1170)	(0.1175)	(0.1177)	(0.1187)
Black		0.0299	0.0572	0.0582	0.0387
		(0.1461)	(0.1483)	(0.1478)	(0.1479)
Born in the US		-0.2419*	-0.2512*	-0.2365*	-0.2364*
		(0.1407)	(0.1396)	(0.1376)	(0.1383)
Unemployed		-0.0103	-0.0265	0.0033	-0.0074
		(0.1427)	(0.1456)	(0.1411)	(0.1450)
Retired		0.0235	0.0218	0.0000	0.0020
		(0.0932)	(0.0927)	(0.0916)	(0.0908)
Income Q2		-0.0958	-0.0850	-0.1004	-0.1049
		(0.0871)	(0.0878)	(0.0892)	(0.0897)
Income Q3		-0.0660	-0.0504	-0.0736	-0.0839
		(0.0887)	(0.0893)	(0.0904)	(0.0907)
Income Q4		0.1310	0.1320	0.0922	0.0736
		(0.0937)	(0.0942)	(0.0963)	(0.0966)
Net wealth Q2		0.2155**	0.2244***	0.1956**	0.1947**
		(0.0854)	(0.0857)	(0.0854)	(0.0853)
Net wealth Q3		0.1404	0.1489*	0.0938	0.0915
		(0.0902)	(0.0902)	(0.0899)	(0.0892)
Net wealth Q4		0.2017**	0.2139**	0.1494	0.1463
		(0.0943)	(0.0945)	(0.0969)	(0.0963)
Financial stress		0.0082	-0.0067	-0.0011	-0.0080
		(0.0587)	(0.0598)	(0.0592)	(0.0592)

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<u>Appendix IV-2: Determinants of Bitcoin literacy - *continued*</u>

	(1)	(2)	(3)	(4)	(5)
			Dependent variable: Bitcoin literacy index		
Democrats		-0.0390	-0.0338	-0.0258	-0.0317
		(0.0757)	(0.0758)	(0.0748)	(0.0747)
Republicans		0.0261	0.0513	0.0465	0.0384
		(0.0756)	(0.0761)	(0.0761)	(0.0762)
Libertarian		0.1707	0.1839	0.1698	0.1591
		(0.1660)	(0.1650)	(0.1637)	(0.1626)
Green party		0.5116***	0.4797**	0.4606***	0.4436***
		(0.1894)	(0.1874)	(0.1772)	(0.1702)
Other party		0.2813	0.2728	0.3169	0.3422
		(0.2285)	(0.2230)	(0.2207)	(0.2188)
Openness			0.0092*	0.0078*	0.0073
			(0.0047)	(0.0047)	(0.0047)
Conscientiousness			-0.0116*	-0.0130**	-0.0122**
			(0.0061)	(0.0061)	(0.0061)
Extroversion			-0.0068	-0.0066	-0.0067
			(0.0045)	(0.0044)	(0.0044)
Agreeableness			-0.0031	-0.0027	-0.0032
			(0.0056)	(0.0056)	(0.0055)
Neuroticism			-0.0036	-0.0019	-0.0021
			(0.0054)	(0.0055)	(0.0055)
Observations	2,533	2,533	2,533	2,533	2,533
R²	0.0120	0.0762	0.0829	0.0926	0.0961

This table presents the results from a series of linear regressions featuring bitcoin literacy as the dependent variable. In specification (1), we report the unconditional effect of being female on Bitcoin literacy. Next, we stepwise add socio-demographic controls (specification (2)), personality traits (specification (3)) as well as measures for financial literacy (specification (4)). Finally, in specification (5), we further add the digital technology exposure model as an explanatory variable to our model. We provide detailed variable descriptions in Table A1 in the appendix. The data is weighted and representative for the US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

V. Consumer fraud victimization and financial well-being

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Own share: 50%

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Consumer fraud victimization and financial well-being[*]

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Abstract – Using nationally representative US data on individual level, we provide evidence of a strong negative association between consumer fraud victimization and individuals' perception of financial well-being. We show that this effect is homogenous among the population and mainly stems from victimization in terms of misrepresentation of information as well as misusage of money by third parties. We disentangle two potential channels through which victimization might reduce perceived financial well-being: psychological consequences (confidence loss in financial matters) and economic consequences (decreases in net wealth). Our results show that fraud is more negatively associated with a loss in one's own confidence in financial matters than with declines in individuals' net worth. Our findings suggest that victims might doubt their own abilities to handle financial matters, bearing substantial consequences for individuals' sound financial decision-making.

Keywords: Consumer fraud victimization, white-collar crime, financial well-being, well-being, household finance, consumer protection

JEL-Codes: K42, D14, D18

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1. Introduction

Recent research has shown that financial well-being is a key predictor of overall happiness (Netemeyer et al., 2017) and the OECD declares sustained financial well-being as the ultimate goal of all their financial education efforts (INFE, 2011). Low levels of financial well-being can have severe negative consequences both on individual and societal level. On individual level, a decline in financial well-being is associated with an increased probability of experiencing material hardship and struggling to make ends meet (CFPB, 2017b). On societal level, low financial well-being is related to declines in overall consumption and more reliance on social support (Brüggen et al., 2017). At the same time, financial well-being is strongly related to the level of poverty in a society (e.g., Griggs, 2013) as well as to the economic growth of a society (Sacks, Stevenson, and Wolfers, 2012).[1]

Given such wide-ranging negative consequences, researchers and policymakers have put in great effort to uncover underlying determinants of individuals' financial well-being. For instance, studies show that financial well-being is associated with contextual factors (e.g., technological development), interventions (e.g., nudging and framing) as well as personal factors (Brüggen et al., 2017). Such personal factors include socio-demographics and personality traits but also so called 'life events' (e.g., losing a job or getting divorced), which are likely to have strong impact on individuals' financial well-being (Brüggen et al., 2017; Luhmann et al., 2012). Somewhat surprisingly, studies analyzing the relationship between (negative) life events and individuals' financial well-being are markedly sparse.

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[1] Sacks et al. (2012) use data from the Eurobarometer survey and document a positive relationship between financial well-being and economic growth in 8 out of 9 countries.

Our study attempts to fill this gap by investigating a previously unconsidered negative life event – becoming a victim of consumer fraud – and its effect on individuals' perception of financial well-being. In contrast to individuals' actual financial well-being, perceived financial well-being does not only reflect individuals' level of comfort in meeting financial obligations, but also individuals' perception about having a feeling of financial security (e.g., CFPB, 2015, 2017a; Netemeyer et al., 2017).

In our study, we relate consumer fraud to any fraudulent financial transactions, in which individuals feel that they have been financially taken advantage of, including being sold *unsuitable products*, being a victim of *misrepresentation of information* (e.g., hidden fees or unclear transaction terms), but also experiencing *misusage of money by third parties* (e.g., embezzlement of investments). Thus, consumer fraud is not limited to financial misconduct committed by investment advisors (e.g., Dimmock, Gerken, and Graham, 2018), but also entails any intentional deceptions in terms of fraudulent offerings of goods and services (Titus, 2001). Consumer fraud, broadly defined, is a global and wide-spread phenomenon with international fraud prevalence rates of approximately 11% (van Dijk, van Kesteren, and Smit, 2007). Among the US population, more than 10% are being victimized by consumer fraud every year (K. B. Anderson, 2013) and the number of consumer complaints regarding fraudulent activities reported to the Consumer Financial Protection Bureau increased by 82% between 2015 and 2017 (CFPB, 2018).

We hypothesize that being victimized by consumer fraud might have a large impact on how individuals evaluate their financial situation, both in monetary terms, but also with regard to their feeling of financial security. Our hypothesis is based on findings in the literature providing evidence that consumer fraud victims often suffer from a multitude of negative consequences. Despite the direct monetary

costs incurred by victimization that are estimated to range from approximately \$40 to \$50 billion (Deevy, Lucich, and Beals, 2012), there is ample evidence that victimization is also associated with indirect costs. For instance, prior studies show that victims of fraud often suffer from psychological problems, including sleep deprivation, depression and even suicidal ideation (e.g., Ganzini, Mcfarland, and Bloom, 1990; Sechrest et al., 1998). More importantly, such indirect costs often outweigh the direct costs of victimization (Kieffer and Mottola, 2016).

Against this background, theory suggests that individuals who have not been victimized by negative life events, such as fraud, tend to perceive themselves as rather personally invulnerable (Perloff, 1983).[2] However, once an individual experiences victimization this feeling of personal invulnerability is strongly shattered (e.g., Aihio et al., 2017; Denkers and Winkel, 1998; Perloff, 1983; Spalek, 1999). In the context of our study, we argue that consumer fraud victimization might shatter the feeling of individuals' financial security – a key component of individuals' perceived financial well-being. Hence, we expect that, in contrast to non-victims that still tend to perceive themselves as rather personally invulnerable, fraud victims exhibit lower levels of financial well-being.

To test our hypothesis, we merge data from seven nationally representative surveys administered by the Understanding America Study (UAS). Our detailed data allows us to investigate whether and how the effect of consumer fraud victimization on financial well-being varies among subgroups of individuals and different types of fraud.

Our contribution to the literature is fourfold. First, we show that consumer fraud victimization is negatively associated with individuals' perception of financial

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[2] Individuals' excessive feeling of invulnerability is also well documented in Taylor and Brown (1988) and Weinstein (1980).

well-being. Second, we show that victimization exhibits homogenous detrimental effects on financial well-being among virtually all subgroups of individuals (e.g., different income and educational levels). Thus, our findings support the notion that the negative impact of consumer fraud victimization on financial well-being is a population-wide phenomenon. In our third contribution, we show that the negative effect of consumer fraud victimization mainly stems from two consumer fraud victimization types: Fraud in terms of *misrepresentation of information* as well as *misusage of money by third parties*. Fourth and finally, we disentangle potential channels through which consumer fraud victimization might alter individuals' perceived financial well-being: one's own confidence in financial matters and total net wealth. Our results show that while fraud is negatively associated with one's own confidence in financial matters, we do not find evidence in favor of an significant effect on individuals' net worth. This result reveals that victimized individuals seem to doubt their own financial abilities, which is likely to translate to lower levels of perceived financial well-being.[3]

We conduct several robustness checks, including a propensity matching analysis to control for a potential selection bias caused by factors such as differing age or wealth levels, which can possibly impact the likelihood of becoming a fraud victim (e.g., Lee and Soberon-Ferrer, 1997). More importantly, we thoroughly address concerns regarding potential endogeneity of consumer fraud victimization by means of an instrumental variable regression.

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[3] Confidence in financial matters is found to be a vital part in sound financial decision-making, especially in terms of retirement planning (Anderson, Baker, and Robinson, 2017; Parker et al., 2012), investments in risky financial assets or savings products (Bannier and Neubert, 2016; Tang and Baker, 2016), as well as handling of mortgages or loans (Allgood and Walstad, 2016; Farrell, Fry, and Risse, 2016). Thus, studies provide some evidence that losing part of confidence in one's own financial abilities will tremendously harm individuals' financial well-being.

Our study intersects literature of research fields in criminology, psychology and economics. While recent studies regarding fraud have mainly focused on the offender-side identifying reasons why financial fraud is committed (e.g., Andersen, Hanspal, and Nielsen, 2018a; Dimmock et al., 2018) and if so, where fraud geographically happens (Egan, Matvos, and Seru, 2018; Parsons, Sulaeman, and Titman, 2018), our study puts the spotlight on the victim-side of fraud and its severe consequences. Literature provides ample evidence that severe negative past experiences have a considerable impact on individuals' financial decisions, including individuals' risk taking behavior and stock market participation (e.g., Andersen, Hanspal, and Nielsen, 2018b; Malmendier and Nagel, 2011). In this context, studies show that exposure to consumer fraud victimization on state and community level is associated with a considerable loss in individuals' trust in financial institutions (e.g., Giannetti and Wang, 2016; Gurun, Stoffman, and Yonker, 2018). This loss in trust is likely to affect individuals' financial well-being, because less trusting individuals reduce their investments in risky assets in favor of deposits, which fail to generate positive inflation-adjusted returns (Gurun et al., 2018). As another wide-ranging consequence of fraud, Titus et al. (1995) report that 20% of consumer fraud victims personally suffer from financial or personal credit problems. Further, studies provide evidence that consumer fraud victimization is associated with psychological consequences that range from anger and disappointment amongst victims (Shichor, Sechrest, and Doocy, 2000) even to relationship-and marital problems (Button, Lewis, and Tapley, 2014). Likewise, becoming a victim of fraud is often followed by stress, depressions and health issues (FINRA, 2015), which often result in a lasting decrease in life-satisfaction (Staubli, Killias, and Frey, 2014). We contribute to the

literature and show that consumer fraud victimization is associated with a considerable decline in one's own confidence in financial matters, which can have severe impact on individuals' financial well-being.

2. Data and variable measurement

2.1. Sample collection

To assess the relationship between consumer fraud victimization and financial well-being, we use data collected in the Understanding America Study (UAS). The UAS is a nationally representative household panel recruited by the University of Southern California, featuring a sample of approximately 6,000 US respondents. In general, the UAS consists of a diverse set of survey waves (around 150 different surveys), covering numerous aspects, such as financial literacy, psychological attitudes, financial well-being and financial behavior. A key feature of the UAS is that it allows us to uniquely identify individuals across different surveys. The data we use were collected between April 2015 and August 2018. All surveys include time stamps featuring information on the date when a particular survey was taken. We exploit this information to partially mitigate concerns regarding reverse causality and drop respondents that completed the survey on financial well-being (UAS 38), before responding to the survey on consumer fraud victimization (UAS 18), resulting in a final sample of 4,857 individuals.

2.2. Measuring financial well-being

For our dependent variable, we use the Financial Well-Being Scale recently introduced by the Consumer Financial Protection Bureau (CFPB, 2017a). The CFPB defines financial well-being as "*a state of being 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*" (CFPB, 2017a, p. 6). To assess individuals' financial well-being (*FWB*) respondents are asked to evaluate

how well and how often 10 different statements and situations with regard to financial matters apply to them.[4] For instance, respondents were asked how well the statement "*I am securing my financial future*" describes their financial situation, with possible answers ranging from "*4 = Describes me completely to 0 = Does not describe me at all*". Another item asks respondents how often the statement "*I have money left over at the end of the month*" applies to them, with possible answers coded from "*4 = Always to 0 = Never*".[5] Respondents' answers to the 10-item questionnaire are then summed to an aggregate financial well-being score that can take on values ranging from 0 to 40, with higher values indicating higher levels of financial well-being. Instead of using the aggregate financial well-being score, we use a scoring procedure developed by the CFPB, which accounts for variations by item polarity, age group of respondent, and administration mode (self-administered vs. interviewer administered), resulting in a more precise score for each individual.[6] This score is captured in *FWB* and can take on values between 0 and 100 and is centered at 50, with higher values indicating higher levels of financial well-being.[7] We use this score in all of our main analyses and provide detailed descriptions as well as summary statistics of each item in Appendix V-2.

2.3. Measurement of consumer fraud victimization

To create a measure for consumer fraud victimization, we utilize a specific survey module available in UAS 18 that comprises in-depth information on individuals'

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[4] Please see Kahneman and Krueger (2006) for a discussion on the importance and measurement of subjective well-being in the context of surveys and self-reported data.

[5] Please note that six out of ten questions are reverse coded. For the reverse coded items, the categories "*does not describe me at all*" as well as *"never"* receive the highest value of four. We mark all reverse coded items in Appendix V-2.

[6] The method introduced by the CFPB accounts for item polarity, which tests whether the direction of the items (either negatively or positively worded) might have influenced individuals' responses.

[7] For a detailed description on the development of the CFPB Financial Well-Being Scale and the item response theory model employed, the reader is referred to the technical report of the CFPB (CFPB, 2017a).

consumer fraud victimization. To identify consumer fraud victims, we use the following survey item:

Do you feel like you have been taken advantage of on a major financial transaction in the last 3 years? Major means at least $1,000.

We build an indicator variable *Fraud* that equals one for respondents answering "yes" to this question (consumer fraud victims), and zero otherwise (non-victims). A key feature of our data is that respondents were further asked in what ways they were financially taken advantage of, which allows us to differentiate between various types of fraud. Respondents can choose different types of fraud that apply to them. For our analysis of fraud types, we differentiate between fraud regarding *unsuitable products* (e.g., products sold that were not requested), *misrepresentation of information* (e.g., hidden fees), *misusage of money by third parties* (e.g., embezzlement of investments), and *other* types of fraud. For each of the four preceding fraud types, we build an indicator variable that equals one if the respondent reports the respective fraud type, and zero otherwise.[8]

2.4. Descriptive statistics

In Table V-1, we report summary statistics for our explanatory variables (Panel A) as well as our dependent variable, the CFPB Financial Well-Being Scale (Panel B). Throughout our analyses, we include a large set of control variables that have been previously identified to affect financial well-being (see e.g., Brüggen et al., 2017). For instance, we include measures for respondents' financial literacy and confidence in financial matters (CFPB, 2017b), as well as whether the respondent

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[8] Please note that respondents can choose multiple fraud types, indicating that they might report fraud types of more than one group at the same time. For detailed descriptions on the fraud items, please refer to Appendix V-1. We further conduct some data cleansing steps to reduce potential measurement error in the variable *Fraud*. For detailed description of this procedure, we refer to Appendix V-3.

consulted a professional financial advisor for investment advice (Gerrans, Speelman, and Campitelli, 2014).

Table V-1: Sample characteristics

	US population					
	Mean	SD	Min.	Median	Max.	N
Panel A. Controls						
Financial literacy	9.147	3.133	0	9	14	4,836
Cognitive ability	3.431	1.942	0	3	8	4,857
Confidence	7.561	2.123	0	8	10	4,836
Trust	4.153	1.037	1	4	5	4,829
Emotional stability	3.746	1.151	1	4	5	4,832
Risk attitude	5.768	2.319	0	6	10	4,798
Investment advice	0.214	0.410	0	0	1	4,857
Female	0.527	0.499	0	1	1	4,857
Age	47.827	16.257	18	47	107	4,853
Married	0.560	0.496	0	1	1	4,857
Children	0.725	0.447	0	1	1	4,857
Ethnicity						
White	0.759	0.427	0	1	1	4,847
Black	0.131	0.338	0	0	1	4,847
Asian	0.027	0.162	0	0	1	4,847
Other	0.082	0.275	0	0	1	4,847
Education	1.230	0.623	0	1	3	4,770
Unemployed	0.056	0.230	0	0	1	4,857
Self-employed	0.067	0.249	0	0	1	4,857
Household income	105,367	142,318	0	71,284	2,604,000	4,672
Household net wealth	309,345	1,413,769	-6,875,099	54,048	81,450,000	4,833
Panel B. Financial well-being						
Financial well-being	54.228	12.622	14	54	95	4,823

This table reports summary statistics on variables used in our analysis. We provide detailed variable descriptions in Appendix V-1. The data is weighted and representative for the US population.

Furthermore, we include a comprehensive set of socio-demographic characteristics, including individuals' general trust, gender, age, marital status, having children, ethnicity, education, labor market status, household income and net wealth. We also control for individuals' risk attitude, emotional stability and cognitive ability, because those variables been shown to be strongly related to individuals' financial situation (e.g., Calvet and Sodini, 2014; Côté, Gyurak, and Levenson, 2010; Dohmen et al., 2011; Gustman, Steinmeier, and Tabatabai, 2012; McArdle, Smith, and Willis, 2009). In Panel B of Table V-1, we report summary statistics of our dependent variable financial well-being. The mean (median) financial well-being

score equals 54.2 (54), indicating that financial well-being of respondents in our sample is slightly higher than for the average respondent in the US population. For detailed variable descriptions, please see Appendix V-1. Subsequently, we provide the summary statistics of our main explanatory variable consumer fraud victimization and its underlying dimensions in Table V-2.

Table V-2: Consumer fraud victimization among US households

	US population (N = 4,837)
	Mean
Fraud	0.107
Unsuitable products	0.021
Misrepresentation of information	0.085
Misusage of money by third parties	0.019
Other	0.004

This table reports summary statistics on our main explanatory variable *Fraud* and its different categories and shows the fraction of US individuals reporting each type of consumer fraud victimization. We provide detailed variable descriptions in Appendix V-1. The data is weighted and representative for the US population.

Table V-2 shows that 10.7 percent of the population reports to be victimized by consumer fraud in the past three years, which is in line with findings in the 2011 Consumer Fraud in the United States Survey conducted by the Federal Trade Commission (K. B. Anderson, 2013). We document that *misrepresentation of information* seems to be the most prominent form of fraud with 8.5 percent of the population reporting victimization.[9]

3. Empirical results

3.1. Consumer fraud victimization and financial well-being

3.1.1. Main results

To examine the impact of consumer fraud victimization on individuals' financial well-being, we estimate the following linear regression model

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[9] In unreported analyses, we also assess who is being victimized by fraud. Our results are consistent with DeLiema et al. (2018) and Titus et al. (1995), who show that there is neither a single personal factor nor a typical stereotype that reliably predicts fraud victimization.

$$FWB_i = \beta_0 + \beta_1 Fraud_i + \gamma' \boldsymbol{c}_i + \varepsilon_i \tag{1}$$

where FWB_i denotes respondent i`s financial well-being, and *Fraud* is an indicator variable that equals one for consumer fraud victims, and zero otherwise. We supplement our regression model with a vector of control variables $\boldsymbol{c}_i$, capturing all variables displayed in Panel A of Table V-1.

Columns (1) and (2) of Table V-3 report coefficient estimates obtained from two specifications of Equation (1). In column (1), we report the unconditional effect of consumer fraud victimization on financial well-being excluding all other control variables from our model. The coefficient of *Fraud* reveals a statistically significant negative effect of consumer fraud victimization on individuals' financial well-being that amounts to -6.5. In other words, being victimized by consumer fraud reduces individuals' financial well-being by approximately 12 percent according to a sample mean of financial well-being of 54.2.[10] In specification (2), we add the vector of control variables $\boldsymbol{c}_i$ to our regression model. While the effect of consumer fraud victimization decreases in magnitude, the results in specification (2) still provide strong evidence in support of a statistically and economically significant impact of consumer fraud victimization on financial well-being. More precisely, in our baseline model in specification (2), we document that being victimized by fraud is associated with a decrease in individuals' financial well-being of -4.7 (or 8.7 percent) after controlling for a large set of factors that have been previously identified to explain variation in financial well-being.

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[10] In unreported analysis, we also estimated the regression model in equation (1) using the aggregated financial well-being score ranging from 0 to 40 as outlined in section 2.2. Results are robust to using this alternative measure of financial well-being and are available upon request.

Table V-3: Consumer fraud victimization and financial well-being

	Dependent variable: Financial well-being (FWB)		
	OLS		Instrumental variables
	(1)	(2)	(3)
Fraud	-6.5292***	-4.6650***	-4.1445***
	(0.8034)	(0.7223)	(1.5273)
Financial literacy		0.4358***	0.3937***
		(0.1003)	(0.0981)
Cognitive ability		0.1025	0.1019
		(0.1423)	(0.1444)
Confidence		1.2435***	1.2755***
		(0.1371)	(0.1338)
Trust		-0.1141	-0.1777
		(0.2337)	(0.2285)
Emotional stability		0.8898***	0.9313***
		(0.2165)	(0.2106)
Risk attitude		0.3251***	0.3407***
		(0.1103)	(0.1068)
Investment advice		1.3514**	1.3401**
		(0.5495)	(0.5339)
Female		0.2623	0.3318
		(0.4622)	(0.4506)
Age 30 to 40		-2.4651***	-2.3879***
		(0.7364)	(0.7257)
Age 40 to 50		-4.0391***	-4.2000***
		(0.7716)	(0.7550)
Age 50 to 60		-3.5154***	-3.4742***
		(0.7509)	(0.7316)
Age above 60		0.0909	0.3595
		(0.7839)	(0.7697)
Married		0.6536	0.4808
		(0.5061)	(0.4876)
Children		-0.9164	-1.0688*
		(0.5728)	(0.5635)
White		-0.1189	0.0049
		(0.9246)	(0.9006)
Black		1.3428	1.0923
		(1.1094)	(1.0830)
Asian		0.1840	0.0763
		(1.3314)	(1.2973)
Education		0.7143*	0.6781*
		(0.4215)	(0.4030)
Unemployed		-3.3692***	-3.6776***
		(0.9652)	(0.9237)
Self-employed		-0.6897	-0.7567
		(0.7705)	(0.7088)

Table V-3: Consumer fraud victimization and financial well-being - *continued*

	Dependent variable: Financial well-being (FWB)		
	OLS		Instrumental variables
	(1)	(2)	(3)
Income Q2		0.5967	0.7501
		(0.6726)	(0.6597)
Income Q3		2.0993***	2.3012***
		(0.6945)	(0.6801)
Income Q4		3.0523***	3.3762***
		(0.7810)	(0.7633)
Household net wealth Q2		0.8122	0.9371
		(0.6778)	(0.6690)
Household net wealth Q3		4.2239***	4.1430***
		(0.6833)	(0.6824)
Household net wealth Q4		9.0727***	9.0036***
		(0.8460)	(0.8283)
N	4,804	4,447	4,447
R^2	0.026	0.374	0.373
F-statistic first-stage regression			9.505
Endogeneity test (p-value)			0.863

Specification (1) and (2) of this table report coefficient estimates obtained from a linear regression model of the generic form

$$FWB_i = \beta_0 + \beta_1 Fraud_i + \gamma' c_i + \varepsilon_i.$$

Specification (1) shows the unconditional effect of *Fraud* on individuals i's financial well-being (*FWB*), excluding all control variables c_i. Specification (2) shows the conditional effect of *Fraud* on *FWB* including control variables c_i. In specification (3), we provide the second stage IV estimates from an instrumental variable regression of financial well-being on *Fraud* and all control variables from our baseline specification in column (2) of Table V-3 using generated instruments after Lewbel (2012). We provide detailed variable descriptions in Appendix V-1. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate p-values of p<.01, p<.05, and p<.10 respectively.

With respect to the remaining regressors, we confirm prior findings in the literature that financially literate and individuals with higher confidence with regard to financial matters show higher levels of financial well-being (CFPB, 2017b). Moreover, we document that financial well-being increases with higher levels of emotional stability and higher levels of risk attitude and is higher for individuals that received investment advice. With regard to emotional stability, our findings are confirmed by Côté et al. (2010) who find a close link between controlled emotions and well-being and financial success. With respect to risk taking and financial advice, studies have shown that both, risk taking (e.g., Dimmock et al., 2016; Kapteyn and Teppa, 2011) and financial advice (Shum and Faig, 2006) are positively correlated with stock market participation, which enables individuals to participate in the equity

premium, resulting in an improved financial situation (Campbell, 2006). With regard to age, we find that younger individuals report higher levels of financial well-being than the elderly. Not surprisingly, we also find unemployment to decrease, and higher income and net wealth to increase financial well-being.

Finally, in specification (3), we attempt to address potential endogeneity issues that could distort the observed effects between consumer fraud victimization and financial well-being. In our cross-sectional survey setting, endogeneity of consumer fraud victimization could potentially occur either due to reverse causality or the omission of relevant (confounding) variables that are both correlated with consumer fraud victimization and financial well-being. Although we control for a large set of variables, one possible omitted variable that could bias our results is individuals' *lack of self-control*, which is reflected in impulsive behavior and short-sightedness. In this regard, studies have shown that a lack of self-control is associated with a higher propensity of being victimized by fraud (e.g., Holtfreter et al., 2010; Reisig and Holtfreter, 2013). Likewise, a lack of self-control has also been shown to affect individuals' financial well-being, for example, in terms of unfavorable debt decisions (e.g., Gathergood, 2012). Because we cannot directly observe individuals' self-control, the omission of individuals' self-control in our baseline linear regression model could lead to either under- or overestimation of the effect of consumer fraud victimization on financial well-being. In order to control for endogeneity problems arising from both reverse causality and omitted variable bias, we resort to an instrumental variable regression approach using generated instruments after Lewbel (2012). We choose this approach because we lack appropriate external instrumental variables that would satisfy the exclusion restriction. Fortunately, the method introduced in Lewbel (2012) does not rely on the validity of external instruments,

such as in standard IV regressions, but exploits variations in higher moment conditions of the error distribution from a first-stage regression of consumer fraud victimization on covariates to achieve identification. However, the model only generates valid instruments that can be used for identification if the error term of the first-stage regression is heteroscedastic. We test for this assumption by performing both a White test and a Breusch-Pagan test, as recommended by prior literature (e.g., Bannier and Schwarz, 2018; Deuflhard, Georgarakos, and Inderst, 2018; Meyll and Walter, 2019). Both tests suggest that the error term of the first-stage regression is heteroscedastic, allowing us to make use of the generated instruments after Lewbel (2012).[11] We generate instruments by multiplying the residuals from the first-stage regression with each of the covariates, centered at their sample means. In column (3) of Table V-3, we report the second-stage estimates of this approach using the same controls as in our baseline model. We find that consumer fraud victimization is still significantly and negatively related to individuals' financial well-being. The endogeneity test can be rejected ($p = 0.86$) offering support for a causal relationship between consumer fraud victimization and financial well-being. Nevertheless, although our results suggest causality between consumer fraud victimization and financial well-being, the IV results should be interpreted with caution due to the nature of survey data, which does not allow us to rule out any remaining endogeneity concerns.

3.1.2. Heterogeneous effects of fraud

Next, we investigate whether and how the effect of consumer fraud victimization on financial well-being varies among subgroups of individuals. Analyzing potential differences in the impact of fraud on financial well-being among different subgroups

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[11] The results for the White test $\chi^2 = 420.73$ ($p < .01$) and the Breusch-Pagan test $\chi^2 = 245.42$ ($p < .01$) strongly support the assumption of heteroscedasticity in the first-stage regression of fraud victimization.

might provide valuable insights on how individuals cope with victimization. To test for heterogeneous treatment effects of consumer fraud victimization we separately interact our key explanatory variable *Fraud* with all variables included in regression specification (2) of Table V-3. All metric variables are dichotomized via median splits and the suffix _*high* denotes above-median values of observations for these variables. We estimate the following linear regression model

$$FWB_i = \beta_0 + \beta_1 Fraud_i + \beta_2 [Indicator\ variable_i]$$
$$+\beta_3 Fraud_i \times [Indicator\ variable_i] + \gamma' \boldsymbol{c}_i + \varepsilon_i \qquad (2).$$

Table V-4 presents the results row-wise by indicator variable. For instance, β_1 in the first row reports the effect of *Fraud* on financial well-being for the subgroup of the 50% less financially literate individuals (i.e., *Financial literacy_high* = 0), $\beta_1 + \beta_3$ denotes the effect of *Fraud* for the subsample of the 50% more financially literate individuals, and β_3 shows the difference in the effects of *Fraud* between financially illiterate and literate respondents, respectively. Analogously, the seventh row reports betas for unadvised individuals (β_1), advised individuals ($\beta_1 + \beta_3$) and the difference between the two groups (β_3).

Our analysis of treatment-effect heterogeneity provides two major results. First, we document that β_1 and $\beta_1 + \beta_3$ remain statistically significant in virtually every specification, indicating a homogenous negative effect of fraud on financial well-being among almost all subgroups. The only exception were fraud does not seem to affect financial well-being are unemployed individuals. Second, while the coefficients of consumer fraud victimization vary between subgroups, we do not document any significant differences except that *Fraud* seems to have a stronger effect on financial well-being of individuals with higher net wealth as captured by the coefficient β_3. This finding might be explained by the circumstance that wealthier individuals

possess a higher likelihood of suffering from a fraud victimization involving a considerably larger monetary amount. Hence, it is reasonable to believe that the negative impact of victimization is stronger for wealthy individuals, compared to other groups.

Table V-4: Heterogeneous effects of consumer fraud on financial well-being

| | Dependent variable: Financial well-being (FWB) | | | | |
	β_1	$\beta_1 + \beta_3$	β_3	N	R^2
Financial literacy_high	-3.9880***	-5.2706***	-1.2827	4,447	0.3696
	(1.0875)	(0.8751)	(1.3924)		
Cognitive ability_high	-3.9060***	-6.0180***	-2.1120	4,447	0.3746
	(1.0150)	(0.8757)	(1.3337)		
Confidence_high	-4.5542***	-5.4674***	-0.9133	4,447	0.3640
	(0.8164)	(1.4611)	(1.6682)		
Trust_high	-4.6040***	-4.7149***	-0.1109	4,447	0.3740
	(1.0150)	(1.0227)	(1.4354)		
Emotional stability_high	-4.4729***	-5.4666***	-0.9937	4,447	0.3734
	(0.8076)	(1.4807)	(1.6862)		
Risk attitude_high	-4.0035***	-5.5690***	-1.5654	4,447	0.3733
	(1.0487)	(0.9478)	(1.4170)		
Investment advice	-4.8616***	-3.7781***	1.0835	4,447	0.3742
	(0.8428)	(1.1831)	(1.4557)		
Female	-3.9594***	-5.2452***	-1.2859	4,447	0.3743
	(1.1457)	(0.9158)	(1.4663)		
Age_high	-3.9620***	-5.6890***	-1.7270	4,447	0.3577
	(1.0279)	(1.0248)	(1.4444)		
Married	-4.2117***	-5.0440***	-0.8323	4,447	0.3742
	(1.1101)	(0.9345)	(1.4459)		
Children	-5.0498***	-4.5376***	0.5122	4,447	0.3741
	(1.5074)	(0.8212)	(1.7153)		
White	-5.1233***	-4.4463***	0.6562	4,447	0.3735
	(1.5555)	(0.7797)	(1.7333)		
Education_high	-4.2360***	-5.8862***	-1.6503	4,447	0.3762
	(0.8542)	(1.2639)	(1.5237)		
Work unemployed	-4.6749***	-4.5290	0.1459	4,447	0.3741
	(0.7279)	(3.6322)	(3.7030)		
Self-employed	-4.6304***	-4.9888*	-0.3584	4,447	0.3741
	(0.7465)	(2.7155)	(2.8210)		
Household income_high	-3.8460***	-5.5348***	-1.6889	4,447	0.3733
	(1.0385)	(0.9928)	(1.4368)		
Household net wealth_high	-3.3641***	-6.4200***	-3.0559**	4,447	0.3583
	(1.0106)	(1.0369)	(1.4508)		

This table reports coefficient estimates obtained from a linear regression model of the generic form:

$$FWB_i = \beta_0 + \beta_1 Fraud_i + \beta_2[Indicator\ variable_i] + \beta_3 Fraud_i \times [Indicator\ variable_i] + \gamma' \boldsymbol{c}_i + \varepsilon_i.$$

Thus, for the first indicator variable *Financial literacy_high*, for example, β_1 reports the effect of being victimized by fraud on financial well-being for the group of financially illiterate individuals (i.e., *Financial literacy_high* = 0). $\beta_1 + \beta_3$ reports the effect of being victimized by fraud on financial well-being for the subsample of financially literate individuals, and β_3 shows the difference in the reported effects between financially illiterate and literate individuals, respectively. All metric variables are dichotomized via median splits. The variable suffix *_high* denotes above-median values of observations for a given variable. To gauge statistical significance of the estimated coefficients pertaining to ($\beta_1 + \beta_3$), each regression is rerun with rescaled values. The data is weighted and representative for the whole US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate *p*-values of p<.01, p<.05, and p<.10, respectively.

3.1.3. Consumer fraud victimization types

Following up on the finding that the negative effect of consumer fraud victimization on financial well-being is homogenous among the population, we now assess whether the negative effect of fraud on financial well-being varies between different types of fraud. To reveal potential variation in the effect of the distinct types of fraud, namely fraud regarding unsuitable products, misrepresentation of information, misusage of money by third parties, and other, we estimate the following linear regression model

$$FWB_i = \beta_0 + \omega' \boldsymbol{f}_i + \gamma' \boldsymbol{c}_i + \varepsilon_i \qquad (3)$$

where $\boldsymbol{f}_i$ denotes a vector of the four types of fraud that enters our regression model instead of the aggregate measure of consumer fraud victimization, and $\boldsymbol{c}_i$ shows the vector of control variables.

Table V-5: Consumer fraud victimization types and financial well-being

	Dependent variable: Financial well-being (FWB)	
	(1)	(2)
Fraud types		
Unsuitable products	-3.9887*	-2.0893
	(2.2075)	(1.3391)
Misrepresented information	-5.9006***	-4.5063***
	(1.0054)	(0.9629)
Misusage of money by third parties	-8.5344***	-5.7781***
	(2.4684)	(2.1542)
Other	-2.1752	-4.7080
	(5.7646)	(3.4902)
Controls	No	Yes
N	4,699	4,351
R²	0.019	0.370

This table reports coefficient estimates obtained from a linear regression model of the generic form:

$$FWB_i = \beta_0 + \omega' \boldsymbol{f}_i + \gamma' \boldsymbol{c}_i + \varepsilon_i.$$

To analyze the effect of various fraud types, we exclude 105 respondents with multiple fraud types in specification (1) to (3). Specification (1) shows the unconditional effects of the vector of various fraud types $\boldsymbol{f}_i$ on respondents' financial well-being (*FWB*), and in specifications (2), we report the conditional effects of fraud types including the vector of control variables $\boldsymbol{c}_i$. Reference category are respondents not being victimized by any fraud. The data is weighted and representative for the whole US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate *p*-values of p<.01, p<.05, and p<.10, respectively.

Table V-5 reports coefficient estimates obtained from various specifications of Equation (3). In specification (1), we show the unconditional effects of the four major fraud types, excluding all control variables. Analogously to our main analysis in Table V-3, we further add controls variables in specification (2) of Table V-5, respectively. Throughout specification (1) and (2) of Table V-5, we excluded 105 respondents reporting multiple fraud types, in order to ensure the interpretability of the coefficient estimates as well as to isolate the single effects of specific frauds. Thus, for example, a coefficient of unsuitable products in Table V-5 can be interpreted as the effect of being a victim of fraud regarding unsuitable products, compared to the (omitted) reference group of non-victims, holding all other fraud types constant at zero.

Our results in specification (1) of Table V-5 show that only two out of four fraud types seem to affect individuals' financial well-being. While the effect of fraud regarding unsuitable products and other are statistically insignificant (at the 5%-level), we document that fraud regarding misrepresentation of information and misusage of money by third parties are strongly related to financial well-being. Despite the coefficients of fraud regarding misrepresentation of information and misusage of money by third parties decreasing in magnitude, the economical relevance and statistical significance of both fraud types persists when we add control variables (specification (2)). Possible explanations for our findings entail that becoming a victim of a fraudulent case involving strongly misrepresented information lets victims doubt their own abilities to handle financial matters. For instance, victims in this case might start blaming themselves for being incapable of understanding important documents or to judge people providing the fraudulent information. Victims begin questioning their own abilities to manage financial transactions, leading to a loss in trust in own future financial decision making (Deem, 2000).

Likewise, becoming a victim of an embezzlement of investments (or other cases of misusage of money by third parties) might shatter victims trust in the financial system. Gurun et al. (2018) for instance, observe that fraud cases involving embezzlement of investments lead to a widespread loss of trust in financial advisors, resulting in withdrawals of assets. Distrusting financial advice, and thus parts of the financial system, can have detrimental impacts on individuals' financial decision making regarding, for example, stock market participation (c.f., Giannetti and Wang, 2016), leading to a decrease in financial well-being.

3.2. Assessing the channels of the effects of consumer fraud on financial well-being

In this section, we discuss two potential channels through which consumer fraud victimization might reduce individuals' financial well-being. In particular, we aim to disentangle whether the effect of consumer fraud victimization on financial well-being is rather due to changes in subjective evaluation or due to actual (objective) changes in individuals' financial situation. We choose confidence in financial matters as a potential subjective channel, since various studies provide ample evidence for a strong association between self-belief in own financial abilities and financial well-being (e.g., Anderson et al., 2017; Bannier and Schwarz, 2018; Farrell et al., 2016). As an objective channel, we choose total net wealth, a measure that has often been used to proxy for individuals' actual financial well-being (e.g., Brüggen et al., 2017; Gerrans et al., 2014; Greninger, 1996). Results in our baseline analysis in Table V-3 confirm that both factors are strongly associated with our measure of individuals' financial well-being offering some support that perceived financial well-being seems to be affected by both subjective and objective channels.[12]

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[12] Please refer to Table V-3 for the effects of confidence and household net wealth on financial well-being, respectively.

Table V-6: Assessing the channels of the effect of fraud on financial well-being

	Dependent variable: Confidence		Dependent variable: Household total net wealth	
	OLS	Instrumental variables	OLS	Instrumental variables
	(1)	(2)	(3)	(4)
Fraud	-0.3427**	-0.6408**	-35.0400	-21.1037
	(0.1629)	(0.3150)	(70.1644)	(65.5065)
Controls	Yes	Yes	Yes	Yes
N	4458	4,458	4,458	4,458
R^2	0.156	0.154	0.061	0.056
F-statistic first-stage regression		9.918		8.987
Endogeneity test (p-value)		0.236		0.411

In this table, we investigate two channels through which consumer fraud victimization might affect individuals' financial perception of financial well-being. In specification (1) and (2), the dependent variable is individuals' confidence with regard to financial matters, and in column (3) and (4), the dependent variable is household total net wealth (divided by $1,000). Specification (1) and (3) report the coefficients from linear regression models and column (2) and (4) provide the second stage IV estimates from instrumental variable regressions of confidence and household total net wealth on *Fraud* and all control variables from our baseline specification in column (2) of Table V-3 using generated instruments after Lewbel (2012). The data is weighted and representative for the whole US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate p-values of p<.01, p<.05, and p<.10, respectively.

In Table V-6, we regress confidence in financial matters (specification (1) and (2)), as well as total net wealth (specification (3) and (4)) on consumer fraud victimization and our set of control variables displayed in Panel A of Table V-1. Analogously to our baseline regression in Table V-3, we report both the results from linear regression models in specification (1) and (3), as well as the second-stage estimates from instrumental variable regressions using generated instruments after Lewbel (2012) in specification (2) and (4), respectively. Our results show that while consumer fraud victimization is negatively associated with one's own confidence in financial matters (both in OLS and IV models), we do not find evidence in favor of an economically meaningful and statistically significant effect on individuals' net wealth. Given that finding, we conclude that becoming a victim of consumer fraud deteriorates one's own financial confidence, resulting in considerable decreases in victims' financial well-being. In that, our results point to the fact that the indirect (psychological) costs of consumer fraud victimization, as denoted by a loss in confidence in one's own financial abilities, seem to outweigh the direct (monetary) costs in terms of losses in net wealth.

4. Further analyses

4.1. Controlling for a selection bias of being victimized by consumer fraud

As a first robustness check, we address potential concerns arising from unequal selection probabilities of being victimized by consumer fraud. For instance, studies show that fraud is often targeted among the elderly, indicating that they face higher probabilities of being victimized by consumer fraud than the younger population (e.g., DeLiema et al., 2018; Egan et al., 2018; Reisig and Holtfreter, 2013). To avoid a potential selection bias, we perform a propensity score matching analysis by matching each consumer fraud victim (treated individual) with non-victims (control individuals) based on their propensity score to become a victim of consumer fraud. We use a 1:1 nearest-neighbor matching approach including all variables as in our main model in column (2) of Table V-3 as control variables. In column (1) of Table V-7, we reestimate our main model (column (2) of Table V-3)), and in column (2), we reestimate the results of our main model using the matched sample, respectively. The coefficient of *Fraud* in column (2) is still highly statistically and economically significant, which allows us to conclude that our results seem to be robust to a potential selection bias resulting from distributional differences in observable co-variates between consumer fraud victims and non-victims.

Table V-7: Consumer fraud victimization and financial well-being:
propensity score matched samples

	Dependent variable: Financial well-being (FWB)	
	Unmatched (main results)	Matched sample
	(1)	(2)
Fraud	-4.6650***	-5.5006***
	(0.7223)	(0.9262)
Controls	Yes	Yes
N	4,447	948
R²	0.374	0.367

In this table, we present the results of a propensity score matching analysis, in which we match each consumer fraud victim (treated individual) with a non-victim (control group) based on her propensity score to be victimized by consumer fraud. For each treated individual, we use a 1:1 nearest-neighbor matching approach and match on all variables used in our baseline specification in column (2) of Table V-3. In specification (1), we replicate the results from our baseline model in column (2) of Table V-3 (i.e., unmatched sample), and in specification (2), we use the matched sample, respectively. The data is weighted and representative for the whole US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate p-values of p<.01, p<.05, and p<.10, respectively.

4.2. Alternative measurement of consumer fraud victimization

A point of criticism related to our measure of consumer fraud victimization might be that our item used to identify consumer fraud victims does not allow us to distinguish between consumer frauds actually happened in a legal sense and individuals' subjective feelings about being cheated. Unfortunately, our data at hand does not allow us to identify actual fraud cases in a legal sense. However, we exploit additional information in our dataset that allows us to measure whether victimized individuals reported the consumer fraud and/or submitted a complaint to any local, state or federal agency. We restrict our measure of consumer fraud victims to those victims who reported and/or submitted a complaint about the consumer fraud to any local, state or federal agency, leading to a substantial drop of 419 consumer fraud cases that do not meet this restricted criteria.[13] While also

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[13] In 2014, 1.5 million fraud-related complaints were actively reported by victims to the Federal Trade Commission as reported in their annual Consumer Sentinel Network Data Book (FTC, 2015). Although victims could have reported the fraud to different agencies, the discrepancy between the estimated number of annual fraud cases of 37.8 million (K. B. Anderson, 2013) (both reported and unreported) based on the FTC Consumer Fraud Survey and the 1.5 million actually registered complaints is very large, indicating a vast number of unreported fraud cases. Thus, looking at a relatively small fraction of actually reported frauds, we assume that once a fraud is reported it is most likely a more severe case that reflects a fraud in a legal sense, therefore supporting the rational of our test for robustness.

being a self-reported measure, we argue that it is very unlikely that actual consumer fraud victims would submit complaints to any agencies when the fraud would not have taken place. Thus, we argue that this restricted measure of consumer fraud victimization is more likely to reflect actual fraud cases in a legal sense.

Table V-8: Alternative measurement of consumer fraud victimization

	Dependent variable: Financial well-being (FWB)	
	(1)	(2)
Fraud	-4.6650***	
	(0.7223)	
Fraud reported to local, state or federal agency		-3.1626**
		(1.2998)
Controls	Yes	Yes
N	4,447	4,069
R²	0.3741	0.3705

In this table, we reestimate our main model from column (2) of Table V-3 using an alternative measure for consumer fraud victimization. Specification (1) replicates the main results from column (2) of Table V-3. In Specification (2), consumer fraud victimization refers to individuals who are victimized by consumer fraud and reported and/or submitted a complaint about the fraud to a local, state or federal agency. The data is weighted and representative for the whole US population. Tailor linearized standard errors are reported below the coefficients in parentheses. ***, **, * indicate *p*-values of p<.01, p<.05, and p<.10, respectively.

The results of this analysis are reported in Table V-8. Specification (1) replicates the results from our baseline analysis in column (2) of Table V-3, and in specification (2), we use the restricted measure of consumer fraud victimization. While the coefficient of consumer fraud victimization in specification (2) shows an economically smaller magnitude than in our baseline regression, our findings generally confirm that the effect of consumer fraud victimization is still negatively and statistically significantly related to individuals' financial well-being. We argue that the decrease in economic magnitude can be explained by the fact that victims who report their fraud might receive help by the respective agencies. In this context, if individuals receive help, they consequently might not feel 'left alone', which could mitigate the negative effect of victimization on financial well-being.

5. Concluding remarks

How do negative life events affect individuals' perception of financial well-being? In our study, we investigate consumer fraud victimization as a novel determinant for individuals' perception of financial well-being. Perceived financial well-being measures individuals' level of comfort in financial obligations, as well as individuals' perception about having a feeling of financial security. We show that consumer fraud victimization has a population-wide and significant negative impact on individuals' perception of financial well-being. Our results suggest that the negative effect of consumer fraud victimization mainly stems from two consumer fraud victimization types: Fraud in terms of misrepresentation of information as well as misusage of money by third parties. Identifying variations in the effects of distinct types of fraud on individuals' financial well-being is a particularly interesting and important issue, because governmental resources to support anti-fraud programs are constraint. In light of the current funding decisions over the CFPB budget (e.g., Friedman, 2018), our results might serve as a guidance for decision makers seeking to utilize the available resources in the most efficient way.

We discuss two potential channels through which consumer fraud victimization might reduce individuals' financial well-being: a loss in confidence in own financial abilities and decreases in total net wealth. Our results suggest that victimization strongly shatters one's own confidence to handle financial matters, which is likely to translate in lower levels of perceived financial well-being. Since individuals become more and more responsible for their well-being (e.g., Anderson et al., 2017; Bucher-Koenen and Ziegelmeyer, 2014; van Rooij, Lusardi, and Alessie, 2012; Stolper, 2018), especially in terms of decisions regarding retirement provision and investments, a loss in one's own confidence to handle financial matters bears substantial negative consequences for individuals' financial decision-making quality.

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7. Appendix

Appendix V-1: Variable descriptions

Name	Description	UAS survey
Panel A: Control variables		
Age	Ordinal variable measuring respondent's age.	General
Children	Dummy = 1 if respondent reports to have children living in household, and zero otherwise.	General
Confidence	Ordinal variable measuring respondent's confidence in the ability to make financial decisions on a scale from 0 to 10 (highest confidence).	UAS 38
Cognitive ability	Ordinal variable measuring the number of correct answers to 8 cognitive ability (numeracy) questions. For the specific wording, please see Weller et al. (2013).	UAS 1
Education	Ordinal variable that describes the respondent's highest degree of education: [1] - Higher education entrance; [2] - Non-academic post-secondary education; [3] - University degree or higher. Zero otherwise.	General
Emotional stability	Ordinal variable measuring respondent's level of emotional stability. Corresponding item "I am someone who is emotionally stable, not easily upset" with a corresponding scale ranging from [1] - Disagree strongly to [5] - Agree strongly.	UAS 1
Female	Dummy = 1 if respondent is female, and zero otherwise.	General
Financial literacy	Ordinal variable measuring the number of correct answers to 14 financial literacy questions. For the specific wording of the financial literacy questions, we refer to the survey codebook of UAS 1 at https://uasdata.usc.edu/index.php.	UAS 1
Household income	Continuous variable measuring households' yearly net income ($US).	UAS 24
Household net wealth	Continuous variable measuring households' total net wealth ($US).	UAS 24
Investment advice	Dummy = 1 if respondent received investment advice of a professional financial advisor or attorney, and zero otherwise.	UAS 18
Married	Dummy = 1 if respondent is married, and zero otherwise.	General
Race	Dummy =1 if respondent's race is either Asian, Black, White or other, and zero otherwise.	General
Risk attitude	Ordinal variable measuring individuals' risk attitude. Corresponding item "Are you generally a person who tries to avoid taking risks or one who is fully prepared to take risks?" with a corresponding scale ranging from [0] - Not at all willing to take risks [10] - Very willing to take risks.	UAS 20
Self-employed	Dummy =1 if respondent is self-employed, and zero otherwise.	UAS 38
Trust	Ordinal variable measuring respondent's general trust level. Corresponding item "I am someone who is generally trusting" with a corresponding scale ranging from [1] - Disagree strongly to [5] - Agree strongly.	UAS 1
Unemployed	Dummy = 1 if respondent is unemployed, and zero otherwise.	UAS 38
Panel B: Consumer fraud victimization measures and consumer fraud types		
Fraud	Dummy =1 if respondent answered "yes" to the following item: "Do you feel like you have been taken advantage of on a major financial transaction in the last 3 years? Major means at least $1,000", and zero otherwise.	UAS 18
Fraud reported to local, state or federal agency	Dummy =1 if respondent answered "yes" to the following item: "Do you feel like you have been taken advantage of on a major financial transaction in the last 3 years? Major means at least $1,000", and reported and/or submitted a complaint about the fraud to any local, state or federal agency, and zero otherwise.	UAS 18
Unsuitable products	Dummy = if respondent reports being a victim of fraud regarding unsuitable products (e.g., (additional) products sold there were needed), and zero otherwise.	UAS 18
Misrepresentation of information	Dummy = if respondent reports being a victim of fraud regarding misrepresentation of information (i.e., undisclosed fees, higher price than named, less product or service received than expected and unclear terms of transaction), and zero otherwise.	UAS 18
Misusage of money by third parties	Dummy = if respondent reports being a victim of fraud regarding misusage of money by third parties (e.g., embezzlement of investments by third parties, such as investment advisors), and zero otherwise.	UAS 18
Other	Dummy = if respondent reports being a victim of other fraud, and zero otherwise.	UAS 18

Appendix V-2: Financial well-being scale: item summary statistics

	% of US population					Item information
Panel A: This statement describes me	Com-pletely	Very well	Somewhat	Very lit-tle	Not at all	Reverse coded
I could handle a major financial transaction.	10.01%	19.70%	35.02%	18.62%	16.66%	No
I am securing my financial future.	9.31%	23.08%	38.24%	19.57%	9.80%	No
Because of my money situation, I feel like I will never have the things in want in life.	7.66%	10.93%	34.38%	30.45%	16.57%	Yes
I can enjoy life because of the way I'm management my money.	8.36%	24.73%	40.28%	19.38%	7.25%	No
I am just getting by financially.	11.71%	14.29%	35.22%	21.69%	17.09%	Yes
I am concerned that the money I have or will won't last.	15.88%	15.74%	37.97%	20.48%	9.93%	Yes
Panel B: This statement applies to me	Always	Often	Sometimes	Rarely	Never	
Giving a gift for a wedding, birthday or other occasion would put a strain on my finances for the month.	6.56%	9.96%	29.67%	34.02%	19.78%	Yes
I have money left over at the end of the month.	18.07%	22.89%	30.99%	18.38%	9.68%	No
I am behind with my finances.	5.58%	8.32%	21.44%	30.63%	34.03%	Yes
My finances control my life.	8.83%	13.92%	31.63%	27.79%	17.83%	Yes

This table reports summary statistics on the items sued to build the financial well-being scale. Please note that for the reverse code items in Panel A and B, the categories "*Not at all*" and "*Never*" receive the highest value of four. The data is weighted and representative for the whole US population.

Appendix V-3: Data cleansing procedure for consumer fraud item

We conduct some data cleansing steps to reduce potential measurement error in the variable *Fraud*. In this context, we exploit the information provided in the free-text response to *other* types of fraud in two ways. First, we assess whether the answer given in the free-text response matches a common definition of consumer fraud victimization. We follow the most common definition and define consumer fraud victimization as "*intentional deception or attempted deception of a victim with the promise of goods, services, or other benefits that are nonexistent, unnecessary, were never intended to be provided, or were grossly misrepresented*" (Titus, 2001, p. 57). We identify 112 observations that may not be classified as being victimized by consumer fraud and drop them from our analysis. In a second step, we assess whether the fraud type mentioned in the free-text variable for the remaining observations can be attributed to any of the other three fraud categories (e.g., *misrepresentation of information*). In doing so, we reclassify one respondent from *other* to *unsuitable products*, 29 respondents from *other* to *misrepresented information* and nine respondents from *other* to *misusage of money by third parties*, respectively. Detailed descriptions on the free-text variable capturing other fraud reasons and their mapping to other categories are available upon request. Please note that our results do not change materially when we do not reclassify the respondents. The results are available upon request.

Affidavit

Ich erkläre hiermit, dass ich die vorgelegten und nachfolgend aufgelisteten Aufsätze selbstständig und nur mit den Hilfen angefertigt habe, die im jeweiligen Aufsatz angegeben oder zusätzlich in der nachfolgenden Liste aufgeführt sind. In der Zusammenarbeit mit den angeführten Koautoren war ich mindestens anteilig beteiligt. Bei den von mir durchgeführten und in den Aufsätzen erwähnten Untersuchungen habe ich die Grundsätze guter wissenschaftlicher Praxis, wie sie in der Satzung der Justus-Liebig-Universität Gießen zur Sicherung guter wissenschaftlicher Praxis niedergelegt sind, eingehalten.

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Tobias Meyll

Bruchköbel, den 29.05.2019

Submitted Papers

I. Meyll, T., and Pauls, T. (2018): The gender gap in over-indebtedness. Finance Research Letters. doi:10.1016/j.frl.2018.12.007.

II. Meyll, T., Pauls, T., and Walter, A. (2019): Why do households leave money on the table? The case of subsidized pension products (working paper).

III. Meyll, T., and Walter, A. (2019): Tapping and waving to debt: Mobile payments and credit card behavior, Finance Research Letters 28, 381–387. https://doi.org/10.1016/j.frl.2018.06.009

IV. Bannier, C., Meyll, T., Röder, F., and Walter, A. (2019): The gender gap in 'Bitcoin literacy', Journal of Behavioral and Experimental Finance 22, 129–134. https://doi.org/10.1016/j.jbef.2019.02.008

V. Brenner, L., Meyll, T., Stolper, O., and Walter, A. (2019): Consumer fraud victimization and financial well-being (working paper).