Fearless Woman: Financial Literacy and Stock Market Participation

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Confidence and the Gender Gap in Financial Literacy

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Introduction

These papers are part of a long-term research agenda

- Measuring financial literacy (the big three)
- Assessing the gender gap in financial literacy
  - A consistent finding around the world
  - Women less confident in their knowledge, especially regarding financial matters (e.g. Chen&Volpe, 2002)
- Does the gender gap matter? Examining stock market participation
- Does the gender gap matter? Examining stock market participation
  - Important for stock market participation and retirement planning

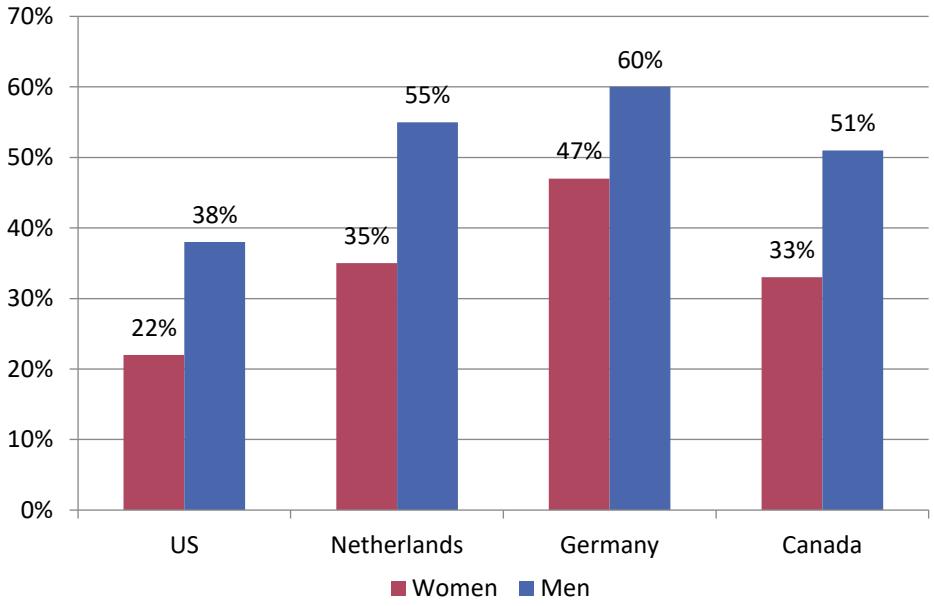
The „Big 3“ financial literacy questions

1) **Interest:** *Suppose you had 100€ in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?* ***More than 102€*** */ Exactly 102€ / Less than €102 /* *Do not know/ Refuse to answer*
2) **Inflation:** *Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? More than today / Exactly the same /* ***Less than today*** */* *Do not know / Refuse to answer*
3) **Risk:** *Please tell me whether this statement is true or false. “Buying a single company’s stock usually provides a safer return than a stock mutual fund.”*
   True / ***False*** */* *Do not know / Refuse to answer*

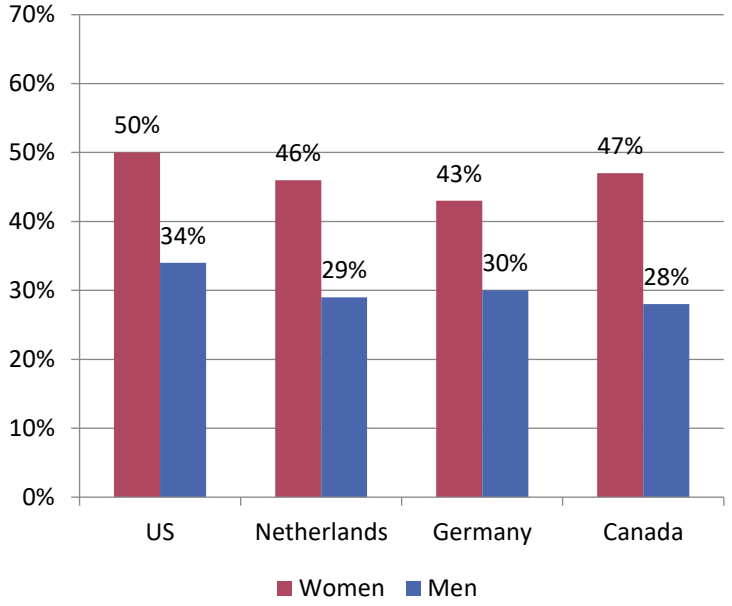
Gender Differences in Financial Literacy

Similar findings across countries

Financial knowledge by gender (% answering 3 Qs correctly)



At least one "don't know" answer, by gender



- Very robust findings of large gender differences in financial knowledge
- Women are much more likely to say "I do not know"

Bucher-Koenen, Lusardi, Alessie, van Rooij (2017) "How financially literate are women? An overview and new insights", *Journal of Consumer Affairs*

Research Questions and Contribution

- What lies behind the gender gap in financial literacy?
- Why do women answer with “do not know“ more frequently?
- Is it due to a lack of knowledge or lack of confidence?

Is lack of confidence or lack of financial knowledge related to gender differences in stock market participation?

Evidence from a Survey Experiment

The Survey Experiment

Sample and structure of the experiment

- DNB Household Panel (DHS)
- Representative online survey of Dutch households
- We include household heads and their partners, age 18+.

Module 1: May 2012

Included the "Big 3" Questions:

Interest | Inflation | Risk

One of the answer options was:

Do not know

Module 2: June/July 2012

Included the "Big 3" Questions:

Interest | Inflation | Risk

But now, we removed the DK-option:

~~*Do not know*~~

Instead, after each of the 3 questions we asked for confidence levels:

On a scale from 1 to 7, How confident are you in this answer?

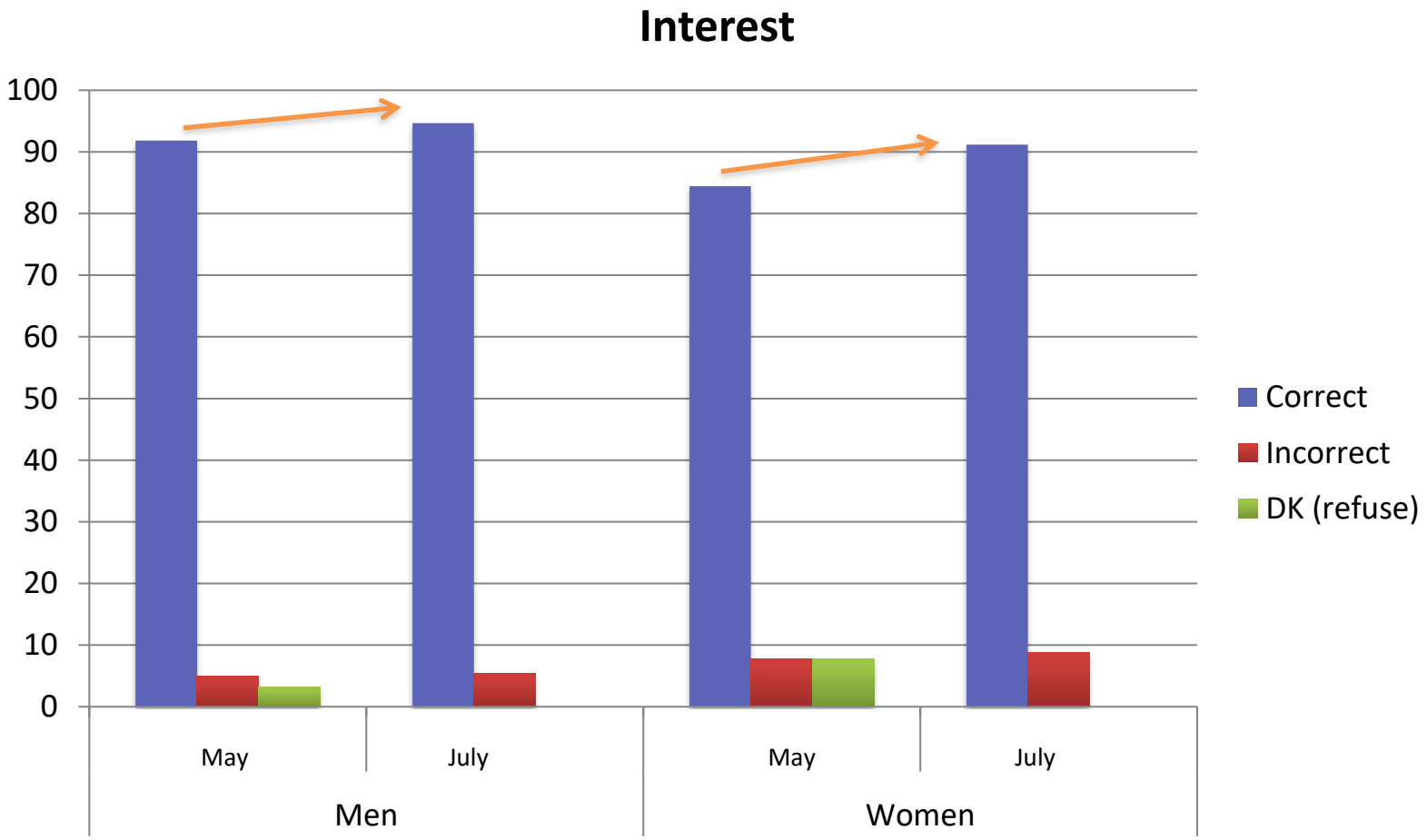
The Survey Experiment

Additional details on the sample

- **Sample**:
  - Completed both questionnaire modules, N=1532,
  - 861 (56.2%) are men and 671 (43.8%) are women.
- **Attrition**: No significant effects of gender or financial literacy on dropping out after the first module (N=222).
- **Learning**: Answers to financial literacy questions in 2nd module for refreshers (N=445) do not differ significantly from participants in both modules.

Descriptive Statistics

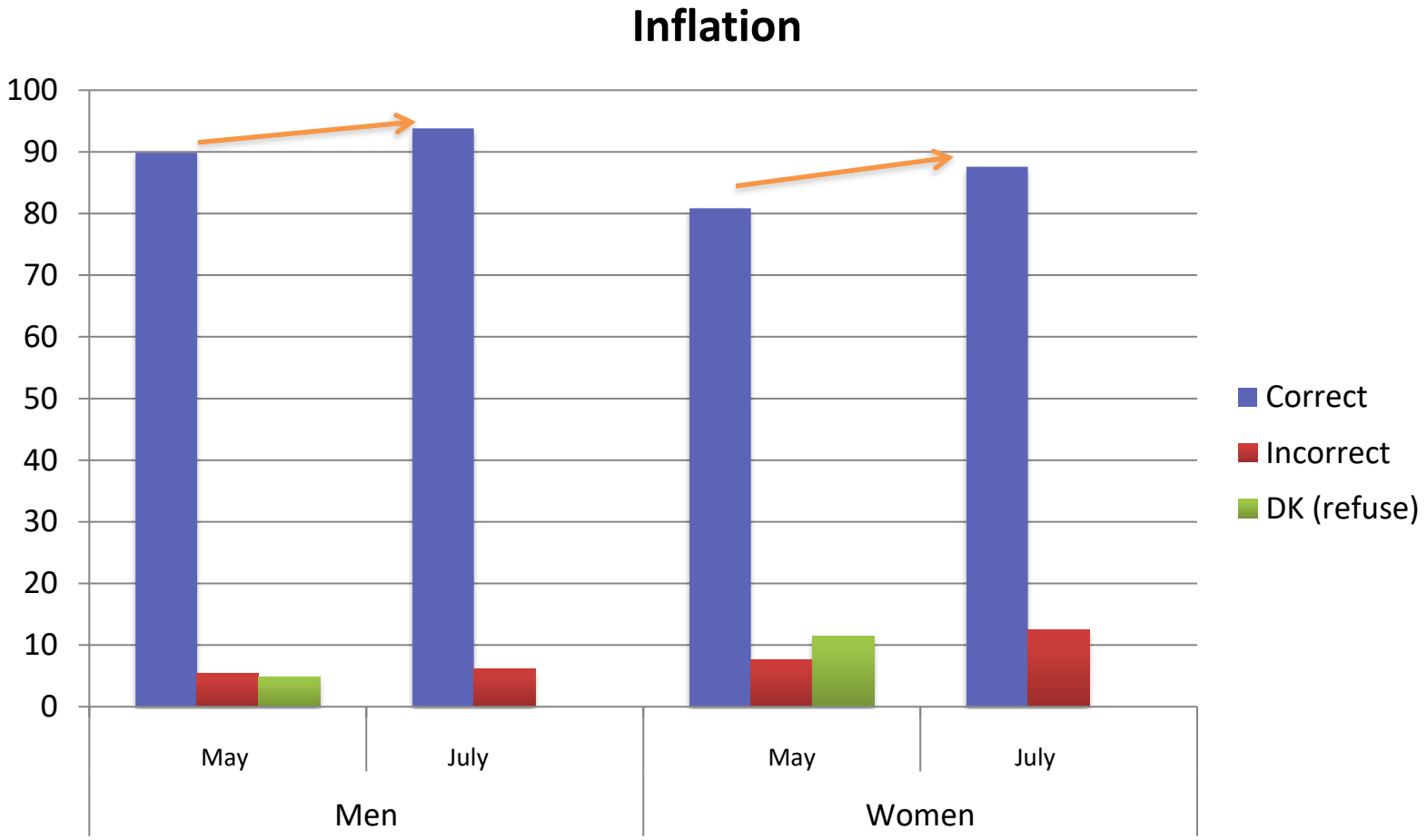
Comparing answers in 1st module (May) and 2nd module (July)



Significant improvement in the probability to give a correct answer for men and women (test against random answering). Gender gap decreases from 7.5 to 3.5 pp.

Descriptive Statistics

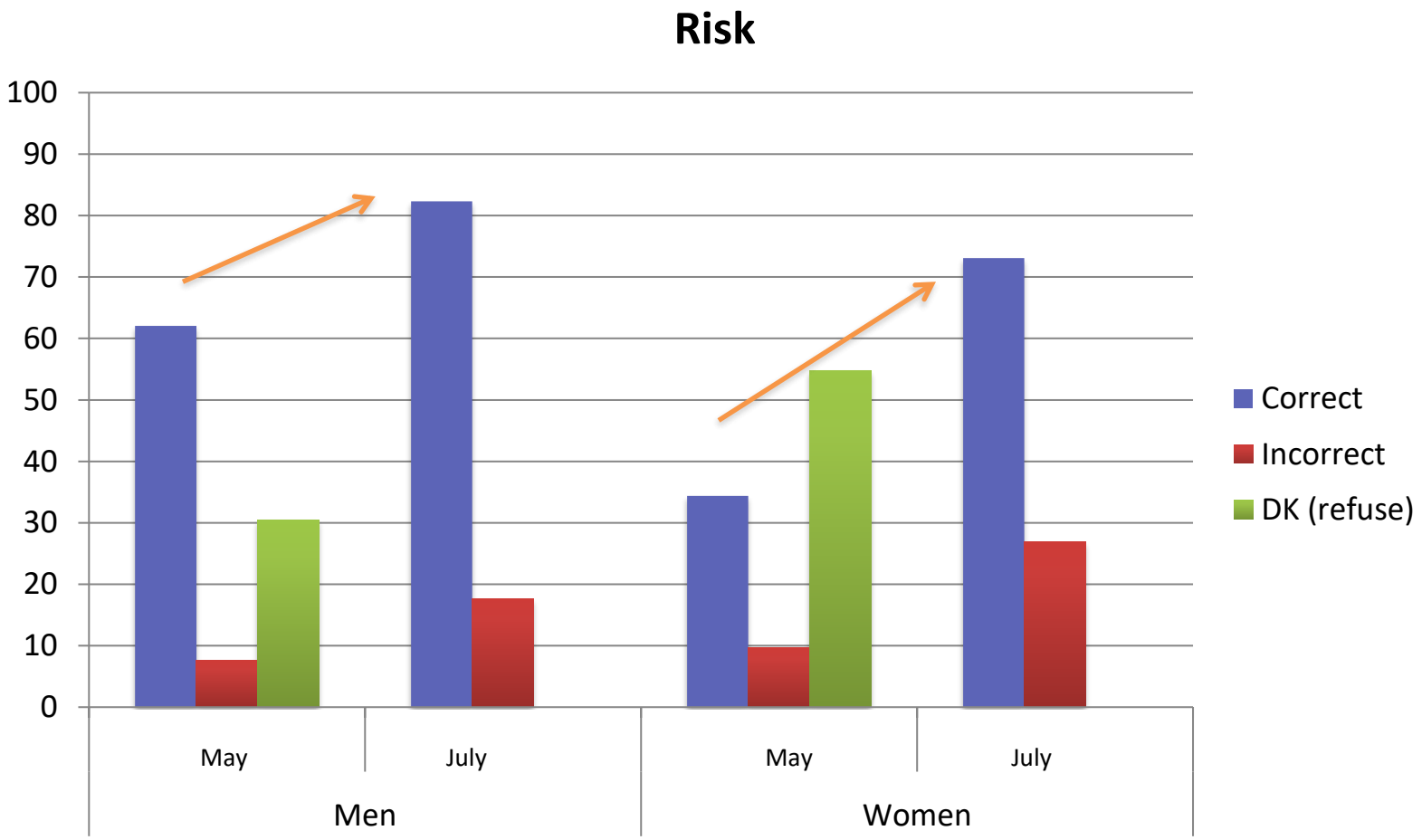
Comparison of answers in 1st module (May) and 2nd module (July)



Significant improvement in the probability to give a correct answer for men and women (test against random answering). Gender gap decreases from 9.2 to 6.2 pp.

Descriptive Statistics

Comparison of answers in 1st module (May) and 2nd module (July)



Significant improvement in the probability to give a correct answer for men and women (test against random answering). Gender gap decreases from 27.5 to 9.4 pp.

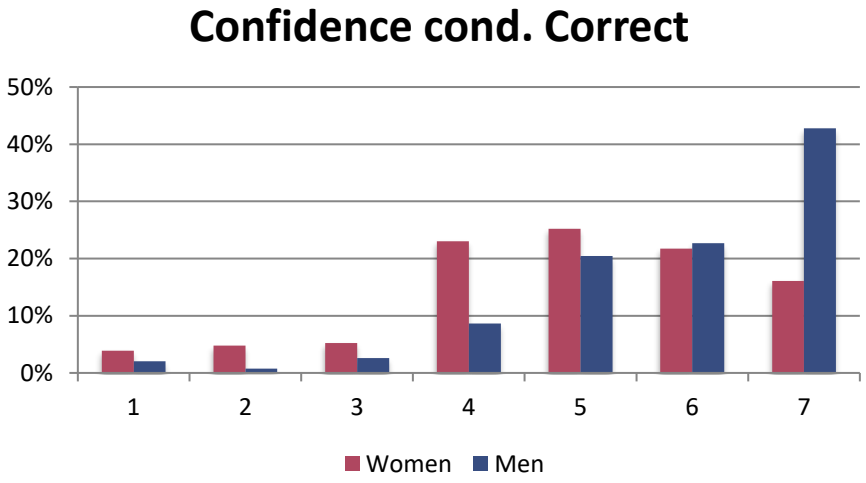
Descriptive Statistics

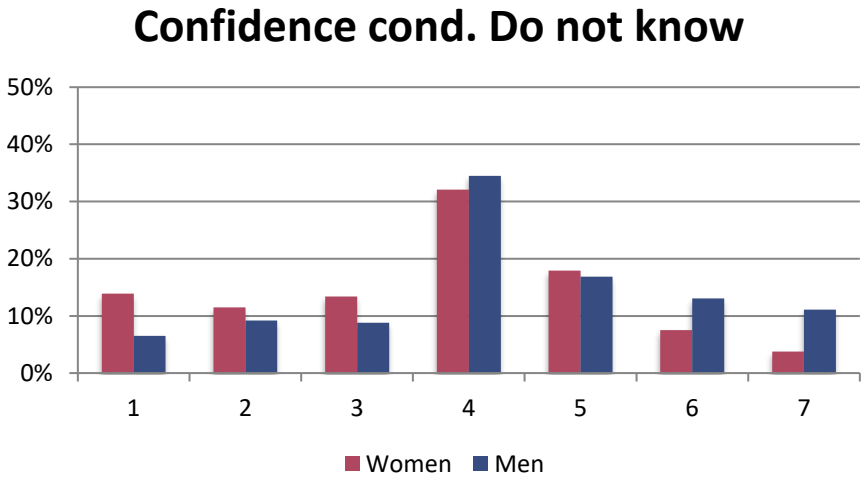
Consistent and inconsistent answering behavior across modules

		Men			Women	
	May	incorrect	correct	do not know	incorrect	correct	do not know
July							
A. Interest:							
incorrect		23.26	3.54	29.63	28.3	4.95	30.77
correct		76.74	96.46	70.37	71.7	95.05	69.23
Total		100	100	100	100	100	100
B. Inflation:							
incorrect		41.3	2.72	33.33	30.77	7.02	38.46
correct		58.7	97.28	66.67	69.23	92.98	61.54
Total		100	100	100	100	100	100
C. Risk Diversification:							
incorrect		38.46	10.32	27.38	47.69	12.55	32.27
correct		61.54	89.68	72.62	52.31	87.45	67.73
Total		100	100	100	100	100	100

Descriptive Statistics

Confidence measure conditional on answers in May





Women report substantially lower confidence levels in module 2 – both when knowing the right answer and when choosing the DK-option in module 1.

Table 3. Confidence in Financial Literacy

	All			Men			Women		
Confidence and financial literacy	*N*	Mean	SD	*N*	Mean	SD	*N*	Mean	SD
Panel A: Interest									
Overall confidence	1,532	6.34	1.35	861	6.52	1.24	671	6.11	1.44
Conditional on incorrect	96	5.45	1.74	43	5.47	1.86	53	5.43	1.66
Conditional on correct	1,357	6.52	1.15	791	6.64	1.11	566	6.35	1.19
Conditional on "do not know"	79	4.39	1.88	27	4.81	1.62	52	4.17	1.98
Panel B: Inflation									
Overall confidence	1,532	5.97	1.58	861	6.34	1.36	671	5.49	1.72
Conditional on incorrect	98	4.87	1.91	46	4.96	1.99	52	4.79	1.86
Conditional on correct	1,314	6.25	1.34	773	6.53	1.15	541	5.84	1.49
Conditional on "do not know"	120	3.83	1.69	42	4.33	1.56	78	3.56	1.70
Panel C: Risk diversification									
Overall confidence	1,532	4.82	1.73	861	5.33	1.60	671	4.15	1.66
Conditional on incorrect	130	4.85	1.48	65	5.34	1.31	65	4.35	1.48
Conditional on correct	764	5.55	1.47	533	5.84	1.35	231	4.90	1.53
Conditional on "do not know"	638	3.93	1.64	263	4.31	1.63	375	3.66	1.60

Overconfidence not an issue

Table A2.3: Consistent and inconsistent answers conditional on choosing an answer in May

	Men	Women	All
A. Interest			
Consistent incorrect	1.20	2.42	1.72
Inconsistent incorrect July/correct May	3.36	4.52	3.85
Inconsistent correct July / incorrect May	3.96	6.14	4.89
Consistent correct	91.49	86.91	89.54
Pearson chi2(3) = 8.6402 Pr = 0.034			
B. Inflation			
Consistent incorrect	2.32	2.70	2.48
Inconsistent incorrect July/correct May	2.56	6.41	4.18
Inconsistent correct July / incorrect May	3.30	6.07	4.46
Consistent correct	91.82	84.82	88.88
Pearson chi2(3) = 20.1887 Pr = 0.000			
C. Risk diversification			
Consistent incorrect	4.18	10.47	6.26
Inconsistent incorrect July/correct May	9.20	9.80	9.40
Inconsistent correct July / incorrect May	6.69	11.49	8.28
Consistent correct	79.93	68.24	76.06
Pearson chi2(3) = 21.6536 Pr = 0.000			

Issues with directly observed measures

Rationale for developing an econometric latent class model

1. The **May measure** (module 1) corresponds to **Big 3 approach**
   - includes “do not know”-option.
   - reflects both knowledge and *confidence*.
2. On the other hand, the **July measure** (module 2)
   - forces individuals to answer, and therefore is not confounded by confidence.
   - contains measurement error (due to guessing) and is upward biased as a result.
3. On average, women display lower confidence in their answers compared to men irrespective of their chosen answers.

Econometric model takes these observations into account, deriving an empirical measure of ‘true financial knowledge’

Measuring and decomposing financial literacy: A latent class model

Econometric Model - Definitions

The central latent variable and observable information

We define the following **latent variable for 'true knowledge'** (not observed) for each financial literacy question:

$\tilde{y}_{ik} = 1$ if respondent *i* truly 'knows' the correct answer to literacy question k (*k*=1,2,3),

$\tilde{y}_{ik} = 0$ otherwise.

Observed proxies for this variable:

y_{ik}^{m} answer to literacy question *k* in May; 0 (incorrect), 1 (correct), 2 (do not know);

y_{ik}^{j} answer to question *k* in July; 0 (incorrect) and 1 (correct);

$conf_{ik}^{j}$ answer to the confidence question on a scale from 1 to 7.

Econometric Model - Intuition

Predicted probability of '*true financial literacy*'

Our **goal**: **Predict** the probability that a respondent **truly knows** the answer to literacy question *k* based on background characteristics x_i and on the variables y_{ik}^m, y_{ik}^j and $conf_{ik}^j$:

$$P(\tilde{y}_{ik} = 1 | x_i, y_{ik}^m = l_k, y_{ik}^j = m_k, conf_{ik}^j = z_k), k = 1,2,3$$

Summary measure of financial literacy:

$$finlit_i = \sum_{k=1}^{3} P(\tilde{y}_{ik} = 1 | x_i, y_{ik}^m = l_k, y_{ik}^j = m_k, conf_{ik}^j = z_k)$$

Econometric Model – Approach

The latent class model

Let $g_{ik} = 3 \cdot y_{ik}^{j} + y_{ik}^{m}$, so that it can take on values 0,…,5.

The log-likelihood of our latent class model is based on the conditional multinomial density of g_{ik}:

$$P\left(g_{ik} = g \middle| x_i, conf_{ik}^{j} = z_{ik}\right)$$

This conditional probability can be written as a weighted average of two multinomial probabilities:

$$\begin{aligned}
&P\left(g_{ik} = g \middle| x_i, conf_{ik}^{j} = z_{ik}\right) \\
&= P\left(g_{ik} = g \middle| \tilde{y}_{ik} = 1, x_i, conf_{ik}^{j} = z_{ik}\right) P\left(\tilde{y}_{ik} = 1 \middle| x_i, conf_{ik}^{j} = z_{ik}\right) \\
&+ P\left(g_{ik} = g \middle| \tilde{y}_{ik} = 0, x_i, conf_{ik}^{j} = z_{ik}\right) P\left(\tilde{y}_{ik} = 0 \middle| x_i, conf_{ik}^{j} = z_{ik}\right) \\
&= \alpha_g^1(x, z_k) P\left(\tilde{y}_i = 1 \middle| x_i, conf_{ik}^{j} = z_{ik}\right) \\
&+ \alpha_g^0(x, z_k) P\left(\tilde{y}_i = 0 \middle| x_i, conf_{ik}^{j} = z_{ik}\right)
\end{aligned}$$

Econometric Model – Approach

Identifying assumptions

- We assume that

  1. $P\left(\tilde{y}_{ik} = 1 \middle| x_i, conf_{ik}^{j} = z_k\right) = P(\tilde{y}_{ik} = 1 | x_i) = \Phi(x_i'\beta_k)$ (Probit)

  2. $P\left(g_{ik} = g \middle| \tilde{y}_{ik} = 1, x_i, conf_{ik}^{j} = z_k\right) = \alpha_g^1(x, z_k) = \alpha_g^1(z_k)$ (Multinomial Logit)

  3. $P\left(g_{ik} = g \middle| \tilde{y}_{ik} = 0, x_i, conf_{ik}^{j} = z_k\right) = \alpha_g^0(x, z_k) = \alpha_g^0(z_k)$ (Multinomial Logit)

- Then we can write

$$P\left(g_{ik} = g \middle| x_i, conf_{ik}^{j} = z_k\right) = \alpha_g^1(z_k)\,\Phi(x_i'\beta_k) + \alpha_g^0(z_k)\,\Phi(-x_i'\beta_k)$$

Latent class model (IV)

- We assume that

  1. $P\left(\tilde{y}_{ik} = 1 \middle| x_i, conf_{ik}^{j} = z_k\right) = P(\tilde{y}_{ik} = 1|x_i) = \Phi(x_i'\beta_k)$ (Probit)

  2. $P\left(g_{ik} = g \middle| \tilde{y}_{ik} = 1, x_i, conf_{ik}^{j} = z_k\right) = \alpha_g\left(z_k; \gamma_k^1\right)$: Mult. Logit, g=4 ref. group

  $(y_{ik}^{m} = y_{ik}^{j} = 1\ correct\ answers\ in\ May\ and\ July)$

  3. $P\left(g_{ik} = g \middle| \tilde{y}_{ik} = 0, x_i, conf_{ik}^{j} = z_k\right) = \alpha_g\left(z_k; ; \gamma_k^0\right)$ (Mult Logit, g=0 ref. group)

- Then we can write

$$P\left(g_{ik} = g \middle| x_i, conf_{ik}^{j} = z_k\right) = \alpha_g\left(z_k; \gamma_k^1\right)\Phi(x_i'\beta_k) + \alpha_g\left(z_k; \gamma_k^0\right)\Phi(-x_i'\beta_k)$$

- Identification problem

the parameter vector $(\gamma_k^{1\prime}, \gamma_k^{0\prime}, \beta_k')'$ is observationally equivalent with $(\gamma_k^{0\prime}, \gamma_k^{1\prime}, -\beta_k{}')'$ in the sense that they both result in the same probability distribution of observable data.

Econometric Model – Approach

Identifying assumptions

- We have made the following additional assumptions:

1. $\alpha_0^1(z_k) = P\left(g_{ik} = 0 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 0, y_i^j = 0 \middle| \tilde{y}_i = 1, conf_{ik}^j = z_k\right) = 0, z_k = 1, .., 7$
2. $\alpha_1^1(z_k) = P\left(g_{ik} = 1 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 1, y_i^j = 0 \middle| \tilde{y}_i = 1, conf_{ik}^j = z_k\right) = 0, , z_k = 1, .., 7$
3. $\alpha_2^1(z) = P\left(g_{ik} = 2 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 2, y_i^j = 0 \middle| \tilde{y}_i = 1, conf_{ik}^j = z_k\right) = 0, , z_k = 1, .., 7$
4. $\alpha_3^1(z) = P\left(g_{ik} = 3 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 0, y_i^j = 1 \middle| \tilde{y}_i = 1, conf_{ik}^j = z_k\right) = 0, , z_k = 1, .., 7$
5. $\alpha_4^0(z) = P\left(g_{ik} = 4 \middle| \tilde{y}_{ik} = 0, conf_{ik}^j = z_k\right) = P\left(y_i^m = 1, y_i^j = 1 \middle| \tilde{y}_i = 0, conf_{ik}^j = z_k\right) = 0, , z_k = 1, \ldots, 7$
6. $\alpha_5^0(z) = P\left(g_{ik} = 5 \middle| \tilde{y}_{ik} = 0, conf_{ik}^j = z_k\right) = P\left(y_i^m = 2, y_i^j = 1 \middle| \tilde{y}_i = 0, conf_{ik}^j = z_k\right) = 0, , z_k = 6,7$

Latent class model (V): Identifying assumptions

1. $\alpha_0^1(z_k) = P\left(g_{ik} = 0 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 0, y_i^j = 0 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = 0, z_k = 1, .., 7$
   (if a resp truly knows the answer to FL question, he/she will not pick a wrong answer twice.)

2. $\alpha_1^1(z_k) = P\left(g_{ik} = 1 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 1, y_i^j = 0 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = 0, z_k = 1, .., 7$
3. $\alpha_3^1(z_k) = P\left(g_{ik} = 3 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 0, y_i^j = 1 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = 0, z_k = 1, .., 7$
   (conditional on true knowledge, resp will not answer correctly in May and incorrectly in July or vice versa)

4. $\alpha_2^1(z) = P\left(g_{ik} = 2 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = P\left(y_i^m = 2, y_i^j = 0 \middle| \tilde{y}_{ik} = 1, conf_{ik}^j = z_k\right) = 0, z_k = 1, .., 7$
   (Resp. with true knowledge who pick a "dk" response in May, would never answer incorrectly in July.)

5. $\alpha_4^0(z) = P\left(g_{ik} = 4 \middle| \tilde{y}_{ik} = 0, conf_{ik}^j = z_k\right) = P\left(y_i^m = 1, y_i^j = 1 \middle| \tilde{y}_{ik} = 0, conf_{ik}^j = z_k\right) = 0, z_k = 6,7$
   (Given that resp. doesn't have true knowledge ($\tilde{y}_{ik} = 0$) and given high confidence ($conf_{ik}^j = 6,7$), the probability of giving the correct answer twice is 0.)

Econometric Model – Final Outcome

Empirical estimate of 'true' financial literacy

Once we estimate the parameters, for each financial literacy question, we can calculate:

$$P\left(\tilde{y}_{ik}=1\middle|g_{ik}=g,conf_{ik}^{j}=z_{ik},x_i\right)=\frac{\alpha_g^1(z_{ik};\gamma^1)\Phi(x_i'\beta)}{\alpha_g^1(z_{ik};\gamma^1)\Phi\left(x_i'\beta\right)+\alpha_g^0(z_{ik};\gamma^0)\Phi(-x_i'\beta)}$$

This can be interpreted as *the posterior probability of having true knowledge* (our latent variable) which results after updating using the information from the two surveys (Bayes' rule).

And we can compute our measure of financial literacy:

$$finlit_i=\sum_{k=1}^{3}P(\tilde{y}_{ik}=1|g_{ik}=g,conf_{ik}^{j}=z_k,x_i)$$

Latent class model (VII)

- Notice that the posterior distribution of $\tilde{y}_{ik}$ is degenerate if the following conditions are met:
  - $P\left(\tilde{y}_{ik} = 1 \middle| g_{ik} = g, x_i, conf_{ik}^{j}\right) = 1$ if $\alpha_g^0\left(conf_{ik}^{j}; \gamma_k^0\right) = 0$
  - $P\left(\tilde{y}_{ik} = 1 \middle| g_{ik} = g, x_i, conf_{ik}^{j}\right) = 0$ if $\alpha_g^1\left(conf_{ik}^{j}; \gamma_k^1\right) = 0$

- So, $\tilde{y}_{ik} = 0$ with certainty if
  - respondents answer inconsistently over time (once correctly, once incorrectly),
  - answer incorrectly two times, or
  - pick the "do not know" answer in the May module and an incorrect answer in the July module.

- $\tilde{y}_{ik} = 1$ with certainty if he/she answers the financial literacy questions correctly two times (with a high conf level in July confidence level)

Latent class model VIII

- For respondents who provide a ”DK” answer in May and a correct one in July, the LCM is used to predict the probability of true knowledge,

$$0 < P\left(\tilde{y}_{ik} = 1 \middle| g_{ik} = 5, x_i, conf_{ik}^{j}\right) < 1$$

Results

Overview of Results

Financial literacy and gender gap using different measures

	Total	Gender Difference (Men-Women)
Panel A: May measure		
Interest	88.6	7.5
Inflation	85.8	9.2
Risk	49.9	27.5
Financial literacy measure	2.24	0.44
Panel B: July measure		
Interest	93.2	3.5
Inflation	91	6.2
Risk	78.3	9.4
Financial literacy measure	2.62	0.19
Panel C: true financial literacy		
Interest	87.6	5.7
Inflation	86.3	8.8
Risk	63.8	13.8
Financial literacy measure	2.38	0.31

Multivariate Regression Results

The gender gap in financial literacy (OLS regression)

	May	July	True literacy
Panel A. Only gender			
Female	-0.442***	-0.190***	-0.307***
	(0.0386)	(0.0291)	(0.0354)
Adjusted R^2	0.067	0.024	0.035
Panel B. With controls for age, income, education, marital status			
Female	-0.361***	-0.147***	-0.245***
	(0.0394)	(0.0301)	(0.0362)
Adjusted R^2	0.156	0.094	0.157

Economic Consequences (OLS)

Effects of different fl-measures on stock market participation

	No controls	May	July	True literacy
Financial Literacy		0.090***	0.055***	0.069***
		(0.0105)	(0.0097)	(0.0103)
Gender	-0.136***	-0.046***	-0.072***	-0.063***
	(0.0207)	(0.0212)	(0.0213)	(0.0213)
Controls+	no	yes	yes	yes
N	1532	1532	1532	1532
Adjusted R^2	0.022	0.137	0.117	0.123

Controls+: Age, income, education, marital status

Financial Literacy and Underconfidence

Quantifying underconfidence and its economic effects

- **Underconfidence** can be defined directly from our model
- Calculate the **prob of true knowledge conditional on a DK-answer** in the May and a correct answer in July

$$\text{und\_conf} = \sum_{k=1}^{3} \mathrm{P}\left(\tilde{y}_{ik} = 1 \middle| y_{ik}^{m} = 2, y_{ik}^{j} = 1, \text{conf}_{ik} = z, x_i\right) \cdot I\left(y_{ik}^{m} = 2, y_{ik}^{m} = 1, \right)$$

	OLS I	OLS II	GMM I	GMM II
Financial Literacy	0.069***	0.071***	0.183**	0.180**
true literacy	(0.0101)	(0.0100)	(0.082)	(0.0705)
Underconfidence		-0.061***	-0.056	-0.066***
		(0.0094)	(0.113)	(0.0099)
Gender	-0.063***	-0.044**	-0.015	-0.013
	(0.0213)	(0.0212)	(0.0368)	(0.0318)
R^2	0.132	0.150	0.094	0.098

Using DKs as Proxy

Effects of different fl-measures on stock market participation

	True Finlit	True+ Underconf	May Finlit	May Finlit + # of DKs
Financial Literacy	0.069***	0.0714***	0.0901***	0.0666***
	(0.0103)	(0.0102)	(0.0105)	(0.0187)
Gender	-0.063***	-0.044**	-0.0461**	-0.0443**
	(0.0213)	(0.0212)	(0.0212)	(0.0213)
Controls+	yes	yes	yes	yes
N	1532	1532	1532	1532
Adjusted R^2	0.122	0.140	0.137	0.138

Controls+: Age, income, education, marital status

Conclusion

Policy implications

- Financial literacy matters
- Need to improve the levels of financial literacy, in particular among women
- **More research (!)** necessary to understand how to also instill confidence, in particular among women, Jha and Shao, 2024.
- *Fearless Girl* symbolizes this suggestion

Financially, women on average know less than men –
but they know more than they think they know.

Confidence and the Gender Gap in Financial Literacy

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Contribution

We extend & simplify approach of Bucher-Koenen et al. (2021):

- Survey experiment: forced responses, follow-up questions on confidence
- Design: between subjects instead of within-subjects
- Adjust for guessing → no latent class model to estimate "true knowledge"

Contribution to literature on financial literacy measurement (Aristei & Gallo, 2022; Chen & Garand, 2018; Davoli, 2023; Hospido et al., 2024; Kaiser et al., 2023; Ranyard et al., 2020; Tinghög et al., 2021)

- propose design & method to disentangle knowledge & confidence
- both dimensions are associated with financial behavior
- simple & cost-efficient, applicable in cross-sectional studies

Setup

Between-subjects experiment

- Randomized survey experiment in Germany, 4,927 respondents aged 30+, interviewed Oct–Dec 2020
- "Big-3" financial literacy questions & two debt literacy questions (Lusardi & Mitchell, 2011; Lusardi & Tufano, 2015)

Control (75%)

- Standard mode, incl. "do not know" (DNK) and refusal

Treatment (25%)

- Forced answers: no DNK or refusal
- Follow up: *"How confident are you about your answer?"* (11-point Likert item) + *"I don't know, I guessed"*

Financial literacy questions (slightly adjusted)

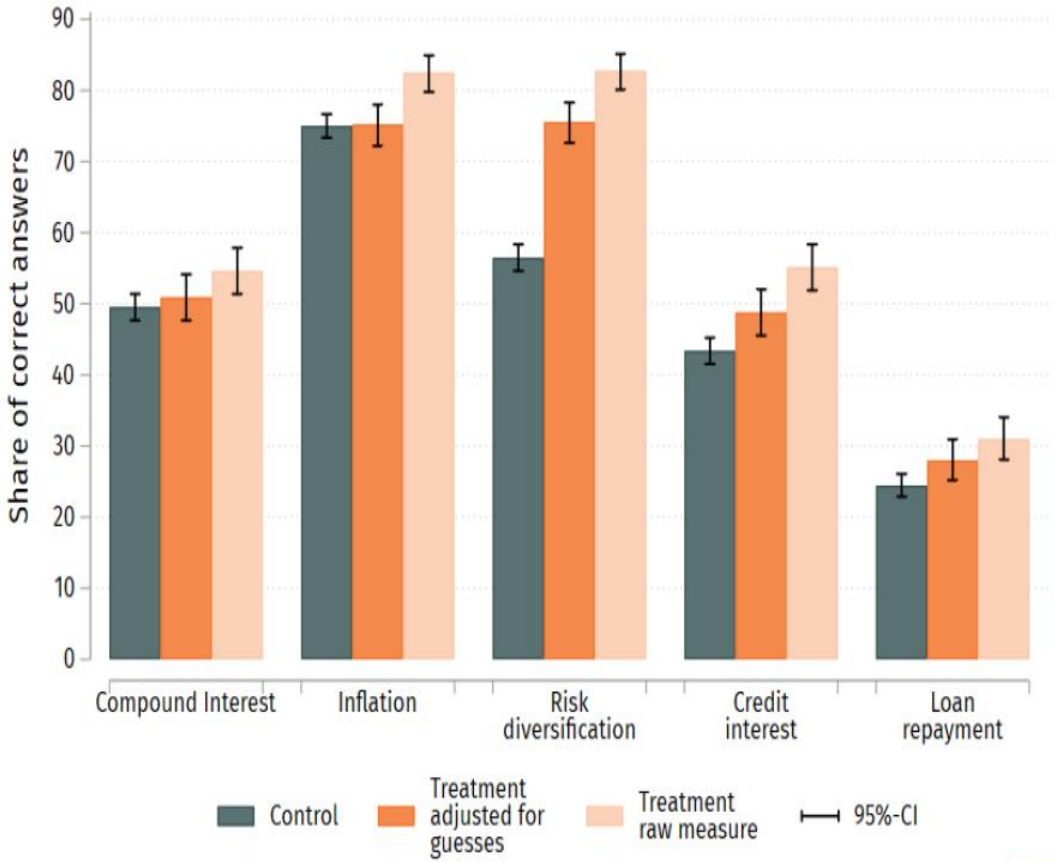
1. **Compound interest question:** Suppose you had EUR 100 in a savings account and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow?
   More than EUR 110 / Exactly EUR 110 / Less than EUR 110 / *Do not know* / *No response*

4. **Credit interest question:** Suppose you take out a bank loan of EUR 1.000 and the interest rate you are charged is 20% per year compounded annually. If you do not pay anything off, at this interest rate, how many years would it take for the amount you owe to double?
   Less than 2 years / **2 to less than 5 years** / 5 to less than 10 years / 10 years or more / *Do not know* / *No response*

5. **Loan repayment question:** Suppose you have taken out a bank loan of EUR 3,000. You pay a minimum payment of EUR 30 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many years would it take to eliminate your debt?
   Less than 5 years / Between 5 and 10 years / Between 10 and 15 years / **Never, the debt will remain** / *Do not know* / *No response*

Results

"Raw" and "adjusted" financial literacy



- Remove noise: adjust for **guessing**
- More correct answers for 3 out of 5 questions

▸ Follow-up ▸ vG guessing ▸ Surveys-M ▸ Surveys-F

Table 3: Responses to the financial literacy questionnaire in treatment and control group, by gender

	Men	Women	Difference (M-W)	P-Value
Panel A: Control group				
Mean correct in Big-3	2.030	1.597	0.432***	(0.000)
Mean correct in FL-5	2.881	2.107	0.773***	(0.000)
Observations	1825	1890	3715	
Panel B: Treatment (unadjusted)				
Mean correct in Big-3	2.298	2.114	0.185***	(0.000)
Mean correct in FL-5	3.336	2.823	0.513***	(0.000)
Observations	551	661	1212	
Panel C: Treatment (adjusted)				
Mean correct in Big-3	2.183	1.874	0.310***	(0.000)
Mean correct in FL-5	3.140	2.478	0.662***	(0.000)
Observations	551	661	1212	

Table 7: Gender gap in confidence in answer to financial literacy questions across correctness of response and gender

	All			Men			Women		
	N	mean	sd	N	mean	sd	N	mean	sd
Confidence: Compound Interest									
Overall confidence	1104	7.17	3.02	513	7.97	2.57	591	6.46	3.21
Cond. on incorrect	484	6.43	3.15	188	7.18	2.89	296	5.91	3.22
Cond. on correct	620	7.75	2.79	325	8.46	2.23	295	6.97	3.12
Confidence: Inflation									
Overall confidence	1102	7.62	2.74	524	8.33	2.31	578	6.95	2.93
Cond. on incorrect	164	4.87	2.73	70	5.62	2.48	94	4.33	2.78
Cond. on correct	938	8.15	2.41	454	8.76	1.97	484	7.53	2.64
Confidence: Risk Diversification									
Overall confidence	1105	7.55	2.70	519	8.21	2.27	586	6.94	2.91
Cond. on incorrect	185	6.21	2.77	81	6.69	2.68	104	5.82	2.80
Cond. on correct	920	7.82	2.60	438	8.50	2.07	482	7.17	2.87

Table: Financial literacy & stock market participation (SMP)

	(1) Control	(2) Control	(3) Treat. raw	(4) Treat. raw	(5) Treat. adj.
No. correct in 'Big-3' (std.)	0.0784***	0.0610***	0.0576***	0.0345**	0.0347*
	(0.00734)	(0.0107)	(0.0117)	(0.0120)	(0.0139)
DNK/Refusals in 'Big-3' (std.)		-0.0244*			
		(0.00953)			
Av. confidence in 'Big-3' (std.)				0.0767***	0.0677***
				(0.0131)	(0.0150)
Female	-0.0512***	-0.0498***	-0.0490	-0.0154	-0.0173
	(0.0146)	(0.0146)	(0.0261)	(0.0269)	(0.0270)
Socioecon. controls	YES	YES	YES	YES	YES
N	3715	3715	1212	1212	1212
Adj. R2	0.197	0.198	0.214	0.234	0.233

Note: Robust SEs in parentheses, $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. Socioeconomic controls include marital status, no. of children in hh, age, education, retirement status, risk aversion, homeownership status, monthly net income, dummies for East Germany and retirement status.

- Knowledge and confidence associated with financial behavior
- Standard mode overstates association of financial literacy and SMP

▸ FL-5 ▸ Robust: low conf.

Conclusion

Main insights

Financial knowledge and confidence

- We differentiate two channels for the observed gender gap in financial literacy: a gap in *knowledge (2/3)* and a gap in *confidence (1/3)*

- We are able to estimate whether a respondent *truly knows* the correct answer and therefore get a better measure that matters for behavior

Financial literacy and confidence matter

- They both explain stock market participation