



Gender differences in financial literacy

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Main topics

This paper is part of a long term project

- Measuring financial literacy
 - The Big Three
- Assessing the gender gap in financial literacy
 - A consistent finding around the world
- Does the gender gap matter? Examining stock market participation
 - Important for saving and growing wealth
 - Investing is what people identify with “finance”
- What to do to address the gender gap

Measuring financial literacy

Big Three

1. “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
 - Don't know
 - Refuse to answer
2. “Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, with the money in this account, would you be able to buy...”

 - More than today
 - Exactly the same as today
 - Less than today
 - Don't know
 - Refuse to answer
3. “Do you think the following statement is true or false? *Buying a single company stock usually provides a safer return than a stock mutual fund.*”

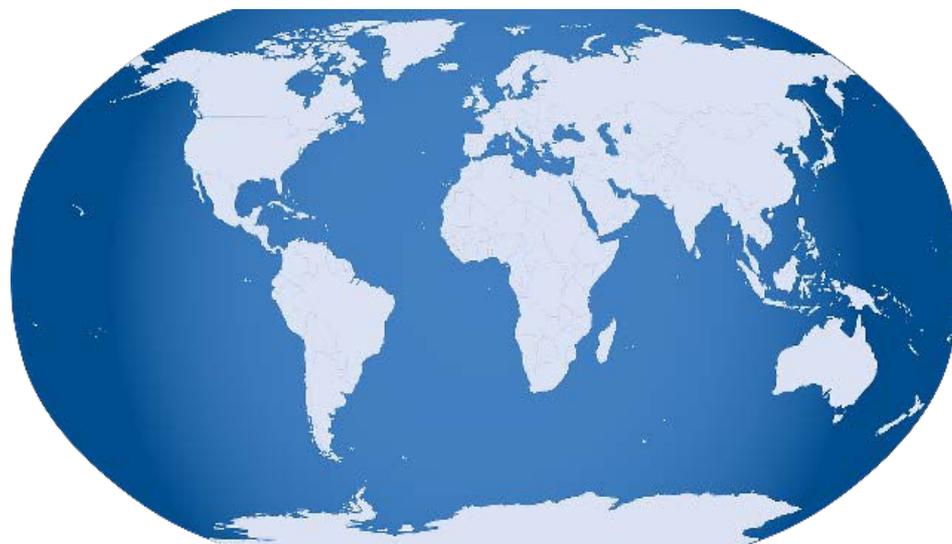
 - True
 - False
 - Don't know
 - Refuse to answer

Extensive evidence about financial literacy

Coordinated effort with many researchers around the world

Evidence from 15 countries:

- ❖ USA
- ❖ The Netherlands
- ❖ Germany
- ❖ Italy
- ❖ Russia
- ❖ Sweden
- ❖ New Zealand
- ❖ Japan
- ❖ Australia
- ❖ France
- ❖ Switzerland
- ❖ Romania
- ❖ Chile
- ❖ Canada
- ❖ Finland
- ❖ and many more



How much do Americans know?

Distribution of responses across the U.S. population (2009 National Financial Capability Survey)

Distribution of Responses to Financial Literacy Questions (%)

	Responses		
	<i>Correct</i>	<i>Incorrect</i>	<i>DK</i>
Interest rate	65%	21%	13%
Inflation	64%	20%	14%
Risk diversif.	52%	13%	34%

NB: Only 30% correctly answer all 3 questions; less than half (46%) got the first two questions right.

How much do Canadians know?

Distribution of responses in the Canadian population (2012 CSA Investor Index Survey)

Distribution of Responses to Financial Literacy Questions (%)

	Responses		
	<i>Correct</i>	<i>Incorrect</i>	<i>DK</i>
Interest rate	78%	13%	9%
Inflation	66%	18%	16%
Risk diversif.	59%	10%	31%

NB: 42% correctly answered all three questions; 58% got the first two questions right.

How much do Germans know?

Distribution of responses across the German population (2009 SAVE)

Distribution of Responses to Financial Literacy Questions (%)

	Responses		
	<i>Correct</i>	<i>Incorrect</i>	<i>DK</i>
Interest rate	82%	7%	11%
Inflation	78%	5%	17%
Risk diversif.	62%	6%	32%

NB: About half (53%) correctly answer all 3 questions; 72% got the first two questions right.

How much do the Dutch know?

Distribution of responses across the Dutch population (2010 Dutch Central Bank Household Survey)

Distribution of Responses to Financial Literacy Questions (%)

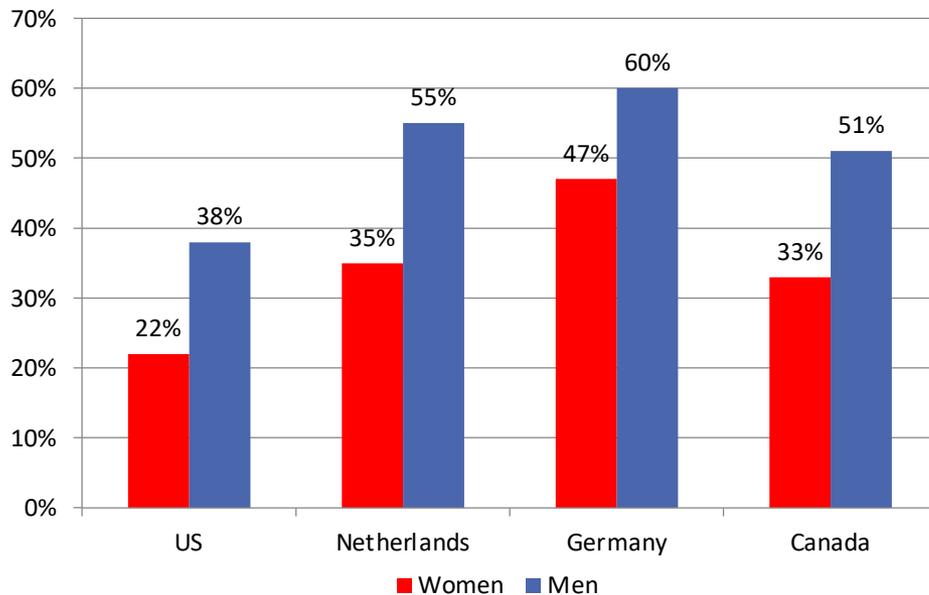
	Responses		
	<i>Correct</i>	<i>Incorrect</i>	<i>DK</i>
Interest rate	85%	5%	9%
Inflation	77%	8%	14%
Risk diversif.	52%	13%	33%

NB: About half (45%) correctly answer all 3 questions; 73% got the first two questions right.

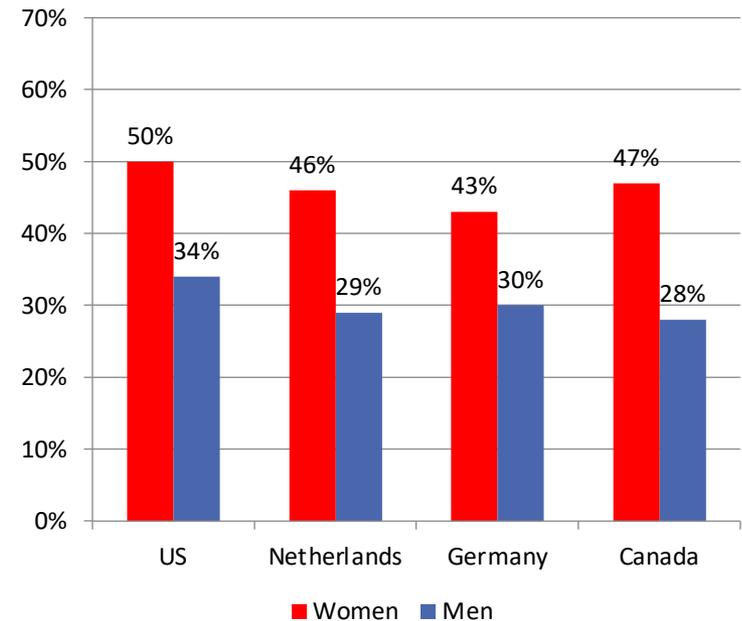
Gender differences in financial literacy

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

- What lies behind the gender gap in financial literacy?
- Why do women answer “do not know” more frequently?
- Does it matter for financial behavior?



Does the measurement of financial literacy affect our understanding and predictions with regard to financial decisions and economic outcomes?

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

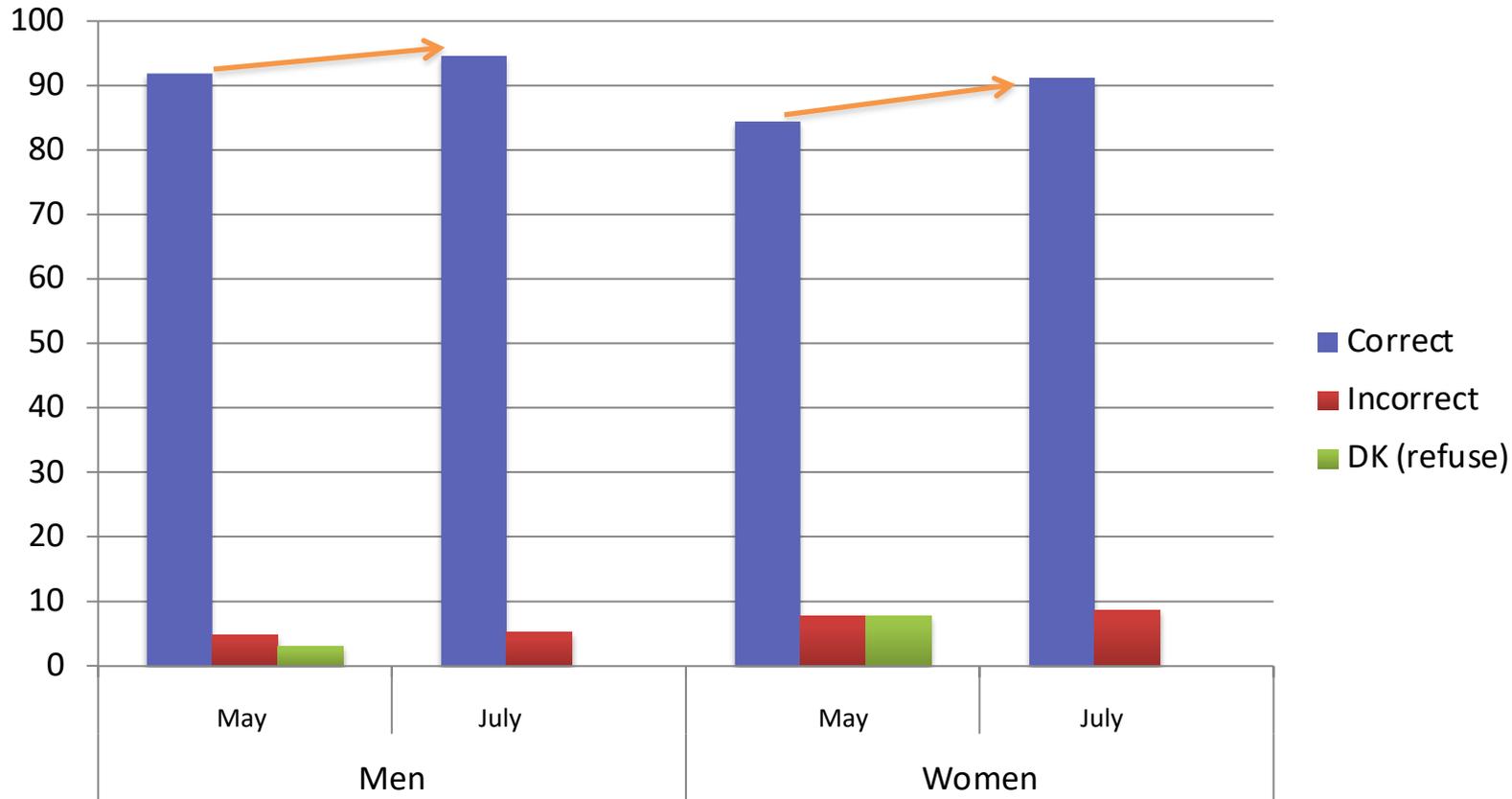
Additional details on the sample

- **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.
- **Learning:** Answers to financial literacy questions in 2nd module for refreshers (N=445) do not differ significantly from participants in both modules.

Descriptive statistics

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

Interest

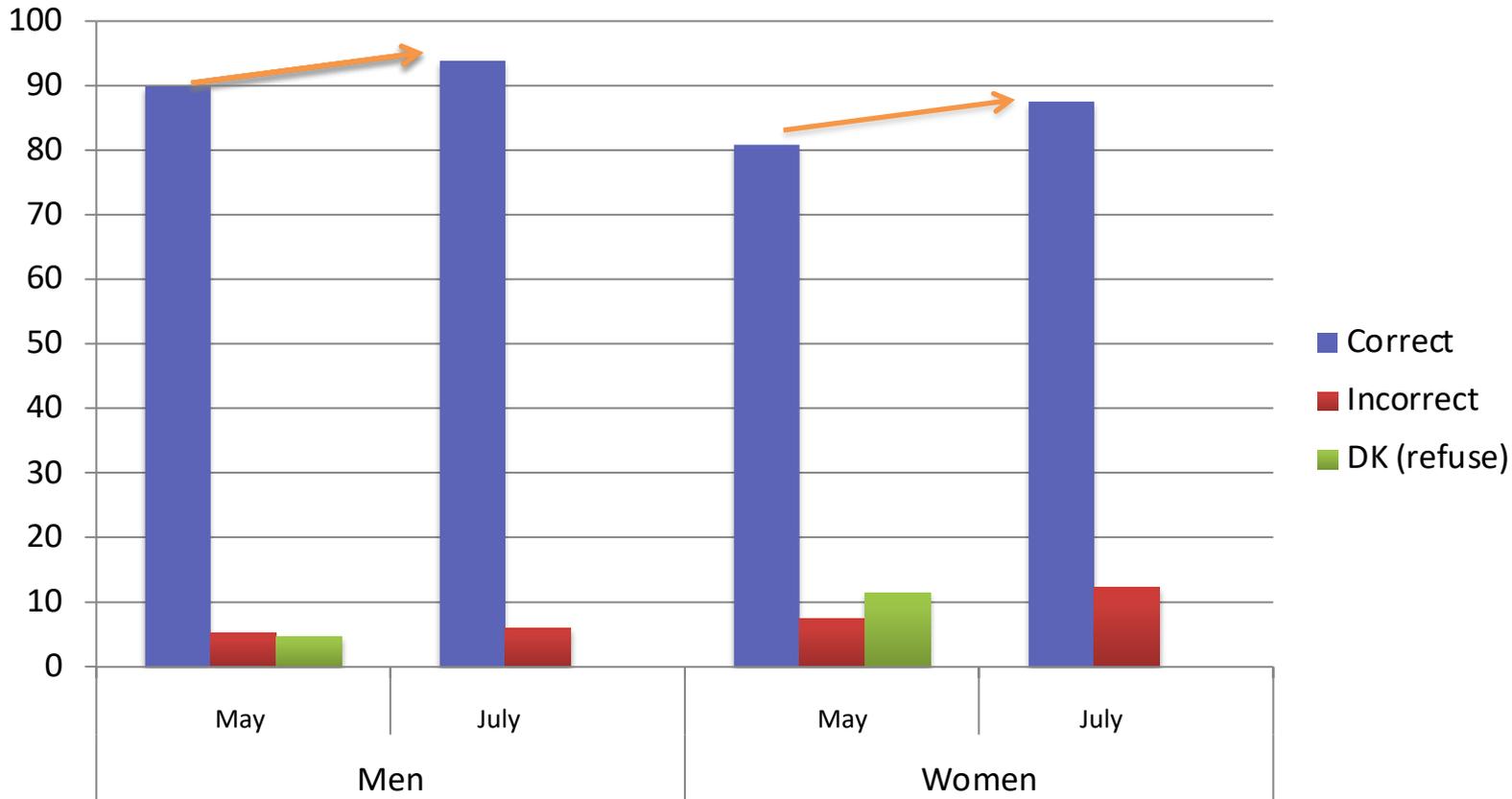


Significant improvement in the probability to give a correct answer for men and women (test against random answering). Gender gap decreases from 7.5 to 3.5 pp.

Descriptive statistics

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

Inflation

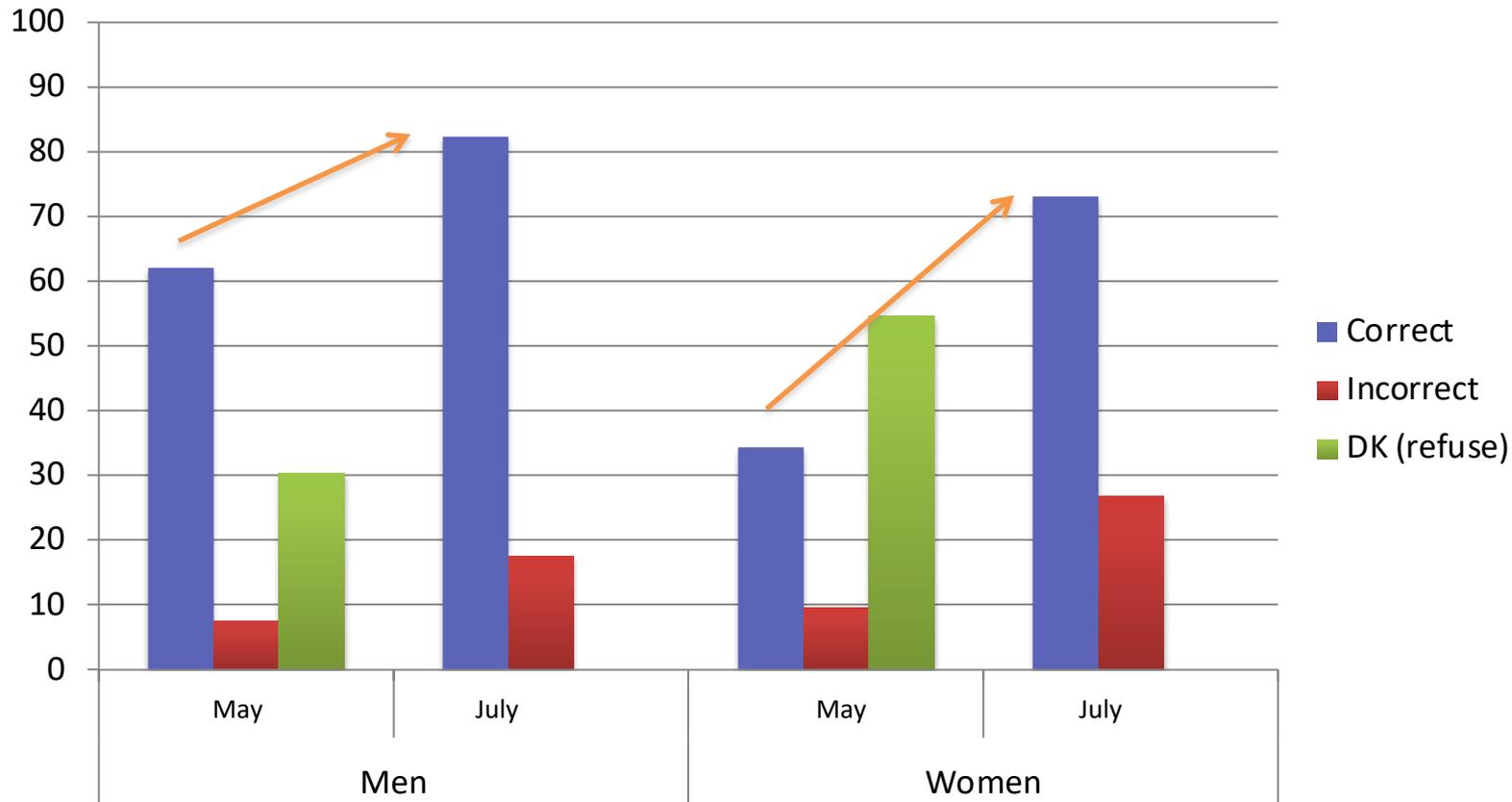


Significant improvement in the probability to give a correct answer for men and women (test against random answering). Gender gap decreases from 9.2 to 6.2 pp.

Descriptive statistics

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

Risk diversification



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

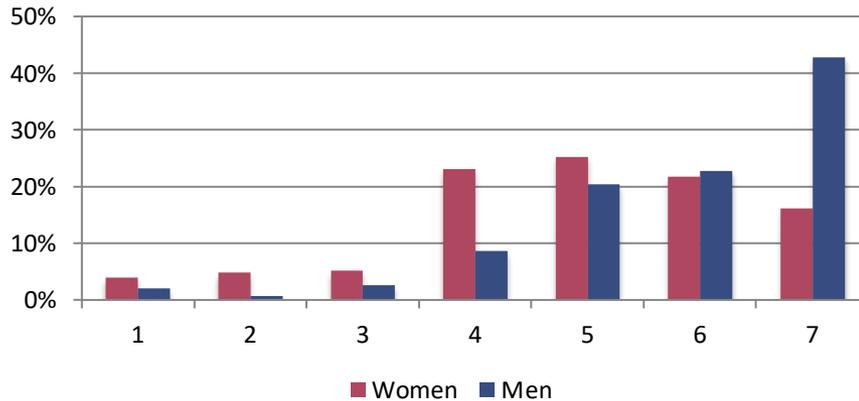
Consistent and inconsistent answering behavior across modules

		Men			Women		
<i>July</i>	<i>May</i>	incorrect	correct	do not know	incorrect	correct	do not know
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

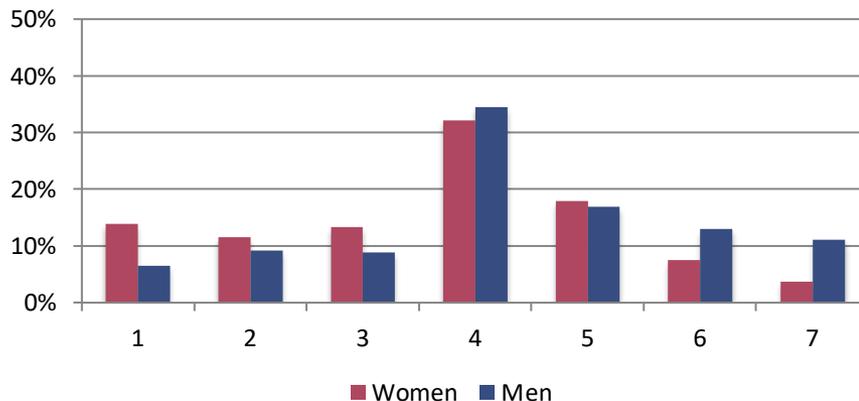
Descriptive statistics

Confidence measure conditional on answers in May for Risk Q

Confidence cond. Correct



Confidence cond. Do not know



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

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:

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

Latent class model (III)

- Let $g_{ik} = g = 3y_{ik}^j + y_{ik}^m$, $y_{ik}^j = 0,1$; $y_{ik}^m = 0,1,2$; $g = 0, \dots, 5$
- The log-likelihood of our latent class model is based on the conditional multinomial density of g_{ik} :

$$P(g_{ik} = g | x_i, \text{conf}_{ik}^j = z_k)$$

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

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

Latent class model (IV)

- We assume that

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

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

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

- Then we can write

$$P(g_{ik} = g | x_i, \text{conf}_{ik}^j = z_k) = \alpha_g^1(z_k) \Phi(x_i' \beta_k) + \alpha_g^0(z_k) \Phi(-x_i' \beta_k)$$

Latent class model (V): Identifying assumptions

- We have made the following additional assumptions:

1. $\alpha_0^1(z_k) = P(g_{ik} = 0 | \tilde{y}_{ik} = 1, conf_{ik}^j = z_k) = P(y_i^m = 0, y_i^j = 0 | \tilde{y}_i = 1, conf_{ik}^j = z_k) = 0, z_k = 1, \dots, 7$

2. $\alpha_1^1(z_k) = P(g_{ik} = 1 | \tilde{y}_{ik} = 1, conf_{ik}^j = z_k) = P(y_i^m = 1, y_i^j = 0 | \tilde{y}_i = 1, conf_{ik}^j = z_k) = 0, z_k = 1, \dots, 7$

3. $\alpha_2^1(z) = P(g_{ik} = 2 | \tilde{y}_{ik} = 1, conf_{ik}^j = z_k) = P(y_i^m = 2, y_i^j = 0 | \tilde{y}_i = 1, conf_{ik}^j = z_k) = 0, z_k = 1, \dots, 7$

4. $\alpha_3^1(z) = P(g_{ik} = 3 | \tilde{y}_{ik} = 1, conf_{ik}^j = z_k) = P(y_i^m = 0, y_i^j = 1 | \tilde{y}_i = 1, conf_{ik}^j = z_k) = 0, z_k = 1, \dots, 7$

5. $\alpha_4^0(z) = P(g_{ik} = 4 | \tilde{y}_{ik} = 0, conf_{ik}^j = z_k) = P(y_i^m = 1, y_i^j = 1 | \tilde{y}_i = 0, conf_{ik}^j = z_k) = 0, z_k = 1, \dots, 7$

6. $\alpha_5^0(z) = P(g_{ik} = 5 | \tilde{y}_{ik} = 0, conf_{ik}^j = z_k) = P(y_i^m = 2, y_i^j = 1 | \tilde{y}_i = 0, conf_{ik}^j = z_k) = 0, z_k = 6, 7$

Latent class model (VI)

- Once we have estimated the parameters we can compute $P(\tilde{y}_{ik} = 1 | g_{ik} = g, conf_{ik}^j = z_k, x_i)$ by applying Bayes' rule:

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

- ..and we can compute our measure of financial literacy:

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

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	0.45
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	0.28

Multivariate regression results

The gender gap in financial literacy (OLS regression)

	May	July	True literacy
Panel A. Only gender			
Female	-0.442*** (0.0386)	-0.190*** (0.0291)	-0.284*** (0.0352)
Adjusted R ²	0.067	0.024	0.035
Panel B. With controls for age, income, education, marital status			
Female	-0.361*** (0.0394)	-0.147*** (0.0301)	-0.225*** (0.0362)
Adjusted R ²	0.156	0.094	0.143

Summary

- The financial literacy scores in May reflect both knowledge and confidence in answering.
- The July measure is likely to be a noisy proxy for true knowledge as respondents who do not know the answer will guess it.
- The estimated “true knowledge” measure minimizes both the measurement error and the bias due to confidence which particularly makes a difference for women.
- About 1/3 of the gender gap is due to confidence.

Economic consequences (OLS)

Effects of different fl-measures on stock market participation

	No controls	May	July	True literacy
Financial Literacy		0.090*** (0.0105)	0.055*** (0.0097)	0.067*** (0.0101)
Gender	-0.136*** (0.0207)	-0.046*** (0.0212)	-0.072*** (0.0213)	-0.065*** (0.0213)
Controls+	no	yes	yes	yes
N	1532	1532	1532	1532
Adjusted R ²	0.022	0.137	0.117	0.122

Controls+: Age, income, education, marital status

Economic consequences (IV)

Taking potential reverse causality/omitted variables into account

- **Instrument:** Economics in high school
- **3 groups:** None, some, DK

	May	July	True literacy
Financial Literacy	0.192*** (0.0671)	0.222*** (0.0842)	0.204*** (0.0751)
Gender	-0.003 (0.0369)	-0.031 (0.0308)	-0.024 (0.0325)
First stage F-stats	14.19	9.19	11.26

Further controls: Age, income, education, marital status

Financial literacy and underconfidence

Quantifying underconfidence and its economic effects

- **Underconfidence** can be defined directly from our model
- Specifically, we calculate the **prob of true knowledge conditional on a DK-answer** in the first wave

$$\text{und_conf} = \sum_{k=1}^3 P(\tilde{y}_{ik} = 1 | y_{ik}^m = 2, \text{conf}_{ik} = z, x_i) \cdot I(y_{ik}^m = 2)$$

	OLS I	OLS II	GMM I	GMM II
Financial Literacy	0.067***	0.070***	0.183**	0.180**
true literacy	(0.0101)	(0.0100)	(0.082)	(0.0705)
Underconfidence		-0.062***	-0.056	-0.066***
		(0.0094)	(0.113)	(0.0099)
Gender	-0.065***	-0.047**	-0.015	-0.013
	(0.0213)	(0.0211)	(0.0368)	(0.0318)
R ²	0.132	0.150	0.094	0.098

Economic consequences (using DKs)

Effects of different fl-measures on stock market participation

	True Finlit	True+ Underconf	May Finlit	May Finlit + # of DKs
Financial Literacy	0.0672*** (0.0101)	0.0707*** (0.0100)	0.0901*** (0.0105)	0.0666*** (0.0187)
Gender	-0.0646*** (0.0213)	-0.044** (0.0212)	-0.0461** (0.0212)	-0.0443** (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

Conclusions

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

Conclusions (cont.)

Policy implications

- Financial literacy matters
- Need to improve the levels of financial literacy, in particular among women
- To be more effective, programs should also instill confidence, in particular among women
- *Fearless Girl* symbolizes this suggestion

Conclusions (cont.)

- In a low interest rate environment, investing in the stock market is particularly important
- It can affect wealth inequality:
 - In other research, Lusardi, Michaud and Mitchell (JPE, 2017) show that financial literacy (pre-pandemic) can explain more than 30% of the wealth inequality close to retirement
- Women have suffered disproportionately from the pandemic and being able to manage wealth and risk is even more important in a post-pandemic world

What to do

- We need financial education in school, including universities
- We need financial education/wellness programs in the workplace, targeted to women
- We need to change the culture about money, it is not “men business”
- We need a statue of a ‘national’ *fearless girl* in front of every stock exchange around the world
- “Role” models can help, including mothers who work or women in top places in finance

What to do (cont.)

Personal Finance course at GW since 2013

- Extensive coverage of risk and risk management
- Paying attention to gender differences in financial literacy
- Material available for free on our website



What to do (cont.)

Financial wellness programs in the workplace

- A focus on financial education as part of workplace financial wellness programs can help employees
- We have designed programs targeted to women
- Visit GFLEC's work on Workplace Financial Wellness:
<https://gflec.org/initiatives/workplace-financial-wellness/>



What to do (cont.)

My policy work in Italy



Annamaria Lusardi Appointed Director of Italy's New Financial Education Committee

This appointment supports GFLEC's vision of promoting the development of a financially literate world.

- In July 2017, I was appointed by Italy's Minister of Economy and Finance as director of the new Financial Education Committee
- The Committee designed a national strategy for financial literacy
- Many initiatives targeted to women
- Women (and the young) are the main target of the Committee in 2021 (as part of the new 3-year program)

What to do (cont.)

Encouraging girls and women



What to do (cont.)

Encouraging girls and women

