Gender, confidence and financial literacy

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We find a substantial **gender gap** in financial literacy. Women are significantly more likely to answer with „**do not know**“. This **gap persists** across different **countries, subgroups, and knowledge domains**.

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?
Survey Experiment
SAMPLE:
• DNB Household Panel (DHS)
• Online survey representative of Dutch-speaking households
• We include panel members who are household heads and their partners, age 18 and older

DESIGN:
• 3 classic financial literacy questions asked twice
• First survey (May 2012): Financial literacy questions including a “Do not know/refuse” option
• Second survey (June /July 2012): Same questions without a “Do not know option”, after each question ask for confidence in the answer
Set Up Week 1 (May 2012):

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
Set Up Week 2 (June/July 2012):

- Questions without the “Do not know” and “refuse to answer” options (DK)
- After each question – **Confidence:**
  
  *On a scale from 1 to 7, How confident are you in this answer?*
  
  1 - not confident at all ... 7 - completely confident
• **Sample restrictions:**
  – Only households without missing answers in the financial literacy questions in week 1 or 2 (drop N=30, 1.35%)

• **Week 1:** N= 1,748

• **Week 2:** N= 1,973 (incl. refresher)

• **Sample for the analysis:** complete questionnaire in both weeks, N=1,532; 861 (56.2%) are men and 671 (43.8%) are women.

• **Attrition:** no sign. effects of gender or financial literacy on dropping out after week 1

• **Learning:** answers to financial literacy questions in week 2 for refreshers (N=445) do not differ significantly from participants in both weeks.
Results
Descriptives

Answers Week 1 and Week 2

Significant improvement in the probability to give a correct answer for men and women.

Interest

- Correct
- Incorrect
- DK (refuse)
Significant improvement in the probability to give a correct answer for men and women.
Significant improvement in the probability to give a correct answer for men and women.
## Descriptives

### Consistent and inconsistent answering across waves

<table>
<thead>
<tr>
<th>A. Interest:</th>
<th>incorrect</th>
<th>correct</th>
<th>don't know</th>
<th>incorrect</th>
<th>correct</th>
<th>don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survey May</strong></td>
<td></td>
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<tr>
<td><strong>Survey July</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>incorrect</td>
<td>23.26</td>
<td>3.54</td>
<td>29.63</td>
<td>28.3</td>
<td>4.95</td>
<td>30.77</td>
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<tr>
<td>correct</td>
<td>76.74</td>
<td>96.46</td>
<td>70.37</td>
<td>71.7</td>
<td>95.05</td>
<td>69.23</td>
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<tr>
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<td>100</td>
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<td>100</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>B. Inflation:</th>
<th>incorrect</th>
<th>correct</th>
<th>don't know</th>
<th>incorrect</th>
<th>correct</th>
<th>don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>incorrect</td>
<td>41.3</td>
<td>2.72</td>
<td>33.33</td>
<td>30.77</td>
<td>7.02</td>
<td>38.46</td>
</tr>
<tr>
<td>correct</td>
<td>58.7</td>
<td>97.28</td>
<td>66.67</td>
<td>69.23</td>
<td>92.98</td>
<td>61.54</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
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<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Risk Diversification:</th>
<th>incorrect</th>
<th>correct</th>
<th>don't know</th>
<th>incorrect</th>
<th>correct</th>
<th>don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>incorrect</td>
<td>38.46</td>
<td>10.32</td>
<td>27.38</td>
<td>47.69</td>
<td>12.55</td>
<td>32.27</td>
</tr>
<tr>
<td>correct</td>
<td>61.54</td>
<td>89.68</td>
<td>72.62</td>
<td>52.31</td>
<td>87.45</td>
<td>67.73</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
What about confidence conditional on being correct, incorrect, do not know? e.g. Risk Q

Descriptives

Confidence cond. Correct

Confidence cond. Incorrect

Confidence cond. Do not know
A small 'model' of measuring financial literacy
Stylized facts that are the basis of our model for measuring financial literacy

1. Answering behavior changes when deleting the DK option.
2. Respondents who gave a DK answer in May are correct with a high likelihood in July.
3. Fraction of correct answers increases also due to gambling.
4. DK responses in May are correlated with confidence July.
A model of true financial literacy and confidence

\[ \tilde{y}_{ik} = 1 \text{ if respondent } i \text{ 'knows' the correct answer to question } k \text{ ("true knowledge"),} \]

\[ \tilde{y}_{ik} = 0 \text{ otherwise;} \]

\[ \text{sure}_{ik} = 1 \text{ if respondent } i \text{ is sure about his/her answer on question } k; \]

\[ \text{sure}_{ik} = 0.5 \text{ some intuition but not completely sure;} \]

\[ \text{sure}_{ik} = 0 \text{ totally not sure (‘random guessers’).} \]
Suppose we make the reasonable assumption that if people know the answer they do not randomly guess:\textsuperscript{10}

\[ P(\tilde{y}_{ik} = 1, \text{sure}_{ik} = 0) = 0 \quad (1) \]
Assumption 2

1. \( \tilde{y}_{ik} = 0, sure_{ik} = 1 \Rightarrow y^j_{ik} = 0, y^m_{ik} = 0, dk^m_{ik} = 0 \)

2. \( \tilde{y}_{ik} = 1, sure_{ik} = 1 \Rightarrow y^j_{ik} = 1, y^m_{ik} = 1, dk^m_{ik} = 0 \)

3. \( \tilde{y}_{ik} = 1, sure_{ik} = 0.5 \Rightarrow \) 
   \[\begin{align*}
   &a) y^j_{ik} = 1, y^m_{ik} = 1, dk^m_{ik} = 0 \\
   &b) y^j_{ik} = 1, y^m_{ik} = 0, dk^m_{ik} = 1
   \end{align*}\]

4. \( \tilde{y}_{ik} = 0, sure_{ik} = 0.5 \Rightarrow \) 
   \[\begin{align*}
   &a) y^j_{ik} = 0, y^m_{ik} = 0, dk^m_{ik} = 0 \\
   &b) y^j_{ik} = 0, y^m_{ik} = 0, dk^m_{ik} = 1
   \end{align*}\]

5. \( \tilde{y}_{ik} = 0, sure_{ik} = 0 \Rightarrow \) 
   \[\begin{align*}
   &a) y^j_{ik} = 1, y^m_{ik} = 1, dk^m_{ik} = 0 \\
   &b) y^j_{ik} = 1, y^m_{ik} = 0, dk^m_{ik} = 0 \\
   &c) y^j_{ik} = 1, y^m_{ik} = 0, dk^m_{ik} = 1 \\
   &d) y^j_{ik} = 0, y^m_{ik} = 1, dk^m_{ik} = 0 \\
   &e) y^j_{ik} = 0, y^m_{ik} = 0, dk^m_{ik} = 0 \\
   &f) y^j_{ik} = 0, y^m_{ik} = 0, dk^m_{ik} = 1
   \end{align*}\]
A model of true financial literacy and confidence

\[
P(\tilde{y}_{ik} = 1) = P(\tilde{y}_{ik} = 1, \text{sure}_{ik} = 1) + P(\tilde{y}_{ik} = 1, \text{sure}_{ik} = 0.5) =
\]
\[
P(y_{ik}^j = 1, y_{ik}^m = 1) + P(y_{ik}^j = 1, y_{ik}^m = 0, d_k^m = 1) -
\]
\[
P(y_{ik}^j = 1, y_{ik}^m = 1, d_k^m = 0, \text{sure}_{ik} = 0) -
\]
\[
P(y_{ik}^j = 1, y_{ik}^m = 0, d_k^m = 1, \text{sure}_{ik} = 0) \quad (2)
\]
Identification of confidence

1. $\text{sure}_{ik} = 1$ if the following criteria are jointly met
   
   (a) $dk^m_{ik} = 0$ (a ‘fully confident’ respondent uses the option)
   
   (b) $y^j_{ik} = y^m_{ik}$ (one should answer consistently over time. Notice that we need the May and July data to check this requirement)
   
   (c) $\text{confidence}^j_{ik} = 6, 7$ \(11\)

2. $\text{sure}_{ik} = 0.5$ if
   
   (a) (($dk^m_{ik} = 0, y^j_{ik} = y^m_{ik}$) and $\text{confidence}^j_{ik} = 3, 4, 5$) OR
   
   (b) ($dk^m_{ik} = 1$ and $\text{confidence}^j_{ik} \geq 3$)

3. $\text{sure}_{ik} = 0$ otherwise
Given the ‘observed’ value for $\text{sure}_{ik}$ we also ‘observe’ $\tilde{y}_{ik}$ which is defined as follows (in Stata language):

$$\tilde{y}_{ik} = (y_{ik}^j == 1)*((y_{ik}^m == 1&\text{sure}_{ik} \geq 0.5) + (d_{ik}^m == 1&\text{sure}_{ik} == 0.5))$$

(7)

Alternatively, we may proxy true knowledge $\tilde{y}_{ik}^j$ using July information only:

$$\tilde{y}_{ik}^j = (y_{ik}^j == 1&\text{sure}_{ik}^j \geq 0.5)$$

(8)

Below, we will compare the measures of true knowledge and the May and July answers to learn about the best way to measure financial knowledge.
## Results

### Alternative Financial Literacy Measures

(N=1,532)

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>July</th>
<th>May-July</th>
<th>Corr. July</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: 3 Questions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td>88.58%</td>
<td>93.15%</td>
<td>86.23%</td>
<td>90.60%</td>
</tr>
<tr>
<td>Inflation</td>
<td>85.77%</td>
<td>90.99%</td>
<td>83.29%</td>
<td>86.81%</td>
</tr>
<tr>
<td>Risk</td>
<td>49.87%</td>
<td>78.26%</td>
<td>65.99%</td>
<td>70.43%</td>
</tr>
<tr>
<td><strong>Panel B: Number correct</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>4.90%</td>
<td>0.59%</td>
<td>3.98%</td>
<td>2.94%</td>
</tr>
<tr>
<td>1</td>
<td>11.49%</td>
<td>4.83%</td>
<td>10.90%</td>
<td>7.38%</td>
</tr>
<tr>
<td>2</td>
<td>38.12%</td>
<td>26.17%</td>
<td>30.74%</td>
<td>28.59%</td>
</tr>
<tr>
<td>3</td>
<td>45.50%</td>
<td>68.41%</td>
<td>54.37%</td>
<td>61.10%</td>
</tr>
</tbody>
</table>
### Results

The gender gap in financial literacy using 4 financial literacy measures (OLS)

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>July</th>
<th>May-July</th>
<th>Corr. July</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Only gender</td>
<td>-0.441***</td>
<td>-0.189***</td>
<td>-0.323***</td>
<td>-0.299***</td>
</tr>
<tr>
<td></td>
<td>(0.0386)</td>
<td>(0.0291)</td>
<td>(0.0393)</td>
<td>(0.0363)</td>
</tr>
<tr>
<td>B. With controls for age, income, education, marital status</td>
<td>-0.359***</td>
<td>-0.146***</td>
<td>-0.245***</td>
<td>-0.234***</td>
</tr>
<tr>
<td></td>
<td>(0.0393)</td>
<td>(0.0301)</td>
<td>(0.0404)</td>
<td>(0.0372)</td>
</tr>
</tbody>
</table>
Does it matter for stock market participation?

<table>
<thead>
<tr>
<th></th>
<th>No controls</th>
<th>May</th>
<th>July</th>
<th>May-July</th>
<th>corr. July</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Literacy</td>
<td>0.0901***</td>
<td>0.0549***</td>
<td>0.0665***</td>
<td>0.0632***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0105)</td>
<td>(0.00970)</td>
<td>(0.0102)</td>
<td>(0.00977)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.136***</td>
<td>-0.0461***</td>
<td>-0.0715***</td>
<td>-0.0647***</td>
<td>-0.0653***</td>
</tr>
<tr>
<td></td>
<td>(0.0207)</td>
<td>(0.0212)</td>
<td>(0.0213)</td>
<td>(0.0214)</td>
<td>(0.0214)</td>
</tr>
<tr>
<td>Controls+</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>N</td>
<td>1532</td>
<td>1532</td>
<td>1532</td>
<td>1532</td>
<td>1532</td>
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<tr>
<td>R2</td>
<td>0.023</td>
<td>0.147</td>
<td>0.126</td>
<td>0.132</td>
<td>0.130</td>
</tr>
</tbody>
</table>

+controls for age, income, education, marital status
### IV Results

**Instrument: Economics in high school**
(3 groups: no education, some education, DK)

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>July</th>
<th>May-July</th>
<th>Corr. July</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial Literacy</strong></td>
<td>0.192***</td>
<td>0.222***</td>
<td>0.196***</td>
<td>0.192***</td>
</tr>
<tr>
<td></td>
<td>(0.0671)</td>
<td>(0.0842)</td>
<td>(0.0714)</td>
<td>(0.0699)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>-0.00335</td>
<td>-0.0310</td>
<td>-0.0259</td>
<td>-0.0256</td>
</tr>
<tr>
<td></td>
<td>(0.0369)</td>
<td>(0.0308)</td>
<td>(0.0321)</td>
<td>(0.0314)</td>
</tr>
<tr>
<td><strong>First stage F-stats</strong></td>
<td>14.19</td>
<td>9.189</td>
<td>11.78</td>
<td>11.99</td>
</tr>
</tbody>
</table>
How to measure financial literacy?

• Ask the same questions twice with and without DK, exploit cross-question consistency and confidence
• Only use questions without DK + confidence measure (gives similar results)
Summary

• Gender gap in financial literacy decreases but does not disappear when deleting the “Do not know option”.
• Gender gap is both: a gap in knowledge and a gap in confidence.
• Deleting DK option introduces measurement error due to guessing.
• Important from a policy perspective for the design of financial education programs.
5. Conclusion

Work in progress

- Check robustness by changing the threshold on the confidence measure
- Use other financial outcomes (retirement planning)
- Latent class measurement model for financial literacy
Thank you!
Model

Measuring confidence using only the July information

1. \( \text{sure}_{ik}^j = 1 \) if \( \text{confidence}_{ik}^j = 6,7 \)

2. \( \text{sure}_{ik}^j = 0.5 \) if \( \text{confidence}_{ik}^j = 3,4,5 \)

3. \( \text{sure}_{ik}^j = 0 \) if \( \text{confidence}_{ik}^j = 1,2 \)