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Do women have lower levels of financial literacy, or are they opting out? A look at the non-response gender bias in financial literacy measurement

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Abstract

Men consistently appear to outperform women on standard financial literacy tests. However, could the results be because of inherent gender bias in measurement tools? This study investigates the reasons for women selecting the non-response option in financial literacy questions, including numerical self-efficacy, risk aversion, and confidence. Our analysis finds evidence that women answer more questions than men utilizing the non-response option. A sustained lack of confidence with financial information is the primary reason. These results are important for shaping policy and providing resources that close the gap in measurement and ability.

JEL classifications: G53; G40

Keywords: Financial literacy; Women; Gender studies; Measurement bias; Financial literacy education

1. Introduction

Financial education is recognized as a core component of the financial empowerment of individuals and the overall stability of the financial system (OECD, 2017). The Organization for Economic Co-operation and Development (OECD) defines financial literacy as "a combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately achieve individual financial well-being" (2017, p. 13).

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Measuring financial literacy aptitude is important for benchmarking progress and to inform strategies for financial education. A large survey of adult financial literacy in OECD countries shows that, on average, fewer than half of adults (48%) could answer 70% of the financial knowledge questions correctly, or in other words, meet the minimum target score (OECD, 2017). Respondents need help understanding diversification and compounding interest, with only 60% able to understand diversification and 27% able to calculate both simple interest and recognize the added benefit of compounding over five years. These two concepts are essential for people to recognize the consequences of financial decisions, such as paying only the minimum repayment on credit cards and saving for financial security in retirement.

The difference between the percentage of men and women achieving the minimum target score for financial knowledge in G20 countries stands at 11 percentage points, with men significantly more likely to achieve this score than women in all but three of the countries with comparable data (China, Indonesia, and the Russian Federation; OECD, 2020a). This finding is consistent across many studies, with reasons for the disparity pointing largely to men and women having different levels of interest in money (Chen & Volpe, 2002; Lusardi et al., 2010).

This study recognizes widespread gender differences in financial literacy but takes a closer look at gender differences in the measurement tools. Accordingly, we offer insight as to why women may score lower on financial literacy question sets, particularly if the question set is multiple-choice and provides an "unsure" option. There is a growing body of literature that identifies different factors leading to a gender difference in the decision to skip a question (Riener & Wagner, 2017).

The mathematics education literature is of particular interest, given the mathematical skills required in financial decisions. Gender differences in mathematics learning in favor of males have persisted since the 1970s (see seminal work by Fennema & Sherman [1977] and a comprehensive summary of early research by Leder, 1992). Multiple explanations for the difference, such as early experience, biological constraints, educational policy, and cultural context contribute to performance gaps, the ability to solve challenging mathematical problems, and interest and participation in mathematics learning (Halpern et al., 2007). As assessment of mathematical performance is usually via an examination under time constraints, some research has posited that it is the performance under the conditions, rather than knowledge, that explains the difference. Research consistently evidences reduced performance for females under time constraints, with recent studies positing increased risk aversion as a potential cause (Dilmaghani, 2020). Therefore, selecting an answer when the respondent is not sure if it correct, is risky behavior more likely to be demonstrated by men, than avoiding the risky behavior and selecting a "do not know" response, more often demonstrated by women.

Accordingly, we draw on research from studies conducted on gender differences in mathematical testing, such as that by Niederle and Vesterlund (2010) who find that women tend to have a higher number of skipped questions in a multiple-choice test, especially when the task is competitive. They posit that there is a negligible gender difference in math ability, but men embrace a competitive environment and have higher self-perceived skill levels. Therefore, when completing a test under a competitive setting, men pick an answer and

tackle difficult questions, and women tend to choose the less challenging option more often, that is, skipping questions or selecting the 'I don't know' answer. Niederle and Vesterlund (2010) note that further research is needed to strengthen conclusions that can be drawn from women's responses to the math tests, including as an example in the area of single-sex schooling.

The novel contribution of this study is to investigate gender bias in one set of questions that measures financial literacy performance. We study the non-response option as the decision science and education literature identifies women tending to pick this option, while men do not. We regress purported determinants of non-response, such as gender, numerical ability, risk aversion, and confidence on the binary non-response for each of the three financial literacy questions and a sum of non-responses. We find that there is a large gender effect, that is, women choose the non-response more often than men, and urge researchers to consider more deeply the formulation of questions.

This paper is structured as follows. Section 2 briefly reviews the literature. Section 3 explains the empirical methodology and the data employed in the analysis. Section 4 presents the results and a discussion of the findings.

2. Literature review

Research in the area of gender differences in financial literacy is growing, with many studies reporting sizeable gender differences in adult financial literacy scores (Hung et al., 2009; Lusardi & Mitchell, 2009; Lusardi & Tufano, 2009a, 2009b; Lusardi et al., 2010). For example, Zissimopoulos, Karney, and Rauer (2008) find that less than 20% of middle-aged college-educated women can answer a basic compound interest question compared with about 35% of college-educated men of the same age. Gender gaps in financial literacy exist for a variety of demographic and socioeconomic groups, including teenagers (Bottazzi & Lusardi, 2016; Driva et al., 2016), university students (Gerrans & Heaney, 2019), and migrants (Karunarathne & Gibson, 2014). Gender gaps may also be related to low levels of education, income, wealth, and health, as these are other factors associated with poor financial literacy (West & Worthington, 2018); however, Rothwell and Wu (2019) find that gender differences are persistent even when accounting for exposure to financial education.

Many researchers suggest that women score lower because they either do not know basic facts, terminology or personal finance concepts, or they do not perform well in mathematics-related questions (Agnew & Cameron-Agnew, 2015; Chen & Volpe, 1998, 2002; Goldsmith & Goldsmith, 1997; Volpe et al., 1996). Goldsmith and Goldsmith (1997) suggest that women have lower scores than men because women, in general, are less interested in the topics of "Investments" and "Personal Finances." They find that people's financial literacy is related to their self-perception of their knowledge in personal finance. Men have higher self-perceived education of investments than women, and men are found to be more knowledgeable than women. Gerrans et al. (2014) investigate the link between financial literacy and participants' satisfaction with their own financial situation and find financial knowledge drives good

financial behavior in men and financial satisfaction, but for women, this link is not evident; instead, financial status has a strong impact on financial satisfaction for women.

Interestingly, there is no evidence of a gender gap in financial literacy in children, despite the prevalence for adults. For example, Agnew and Cameron-Agnew (2015) did not find a significant difference by gender in financial literacy quiz scores for 14-year-olds, but do observe a gender difference in first-year tertiary students. The recent Program for International Students Assessment (PISA) report on financial literacy performance in 15-year-old high school students in OECD countries finds that boys scored two points higher than girls, although this difference is not regarded as statistically significant (OECD, 2020b). Emerging research, however, finds that boys and girls are treated differently by their parents regarding money conversations which have a long-lasting effect (Agnew & Cameron-Agnew, 2015). For example, a New Zealand study found boys receive more pocket money than girls even though both spend 2.4 hours a week doing chores (Wade, 2013). West and de Zwaan (2020) identify differing financial socialization pathways to building financial literacy in men and women, with higher levels of financial literacy in women linked to more frequent money conversations in the home when they were children. This suggests that while performance metrics indicate equality on average in boys and girls, their experiences with money in these formative years are different and may have lasting impacts.

The widening financial literacy deficit we observe in women as they age may be due to contextual factors. Several structural features in our society affect women's relationship to money, including the gender pay gap and women's contribution to unpaid and caring roles. It is well-documented that women, on average, earn less than men for the same work (Cassells et al., 2009). Other factors, including, gender stereotypes, lower wages for female-dominated industries, inflexible working conditions, time out of the workforce due to caring roles, and gender discrimination are found to contribute to this difference (Alcon, 1999; Anthes & Most, 2000; Timmermann, 2000). Consequently, comparatively low incomes of women mean fewer resources to support the growth of confidence in future opportunities, and more attention to everyday financial issues, thwarting retirement planning activity (Larisa et al., 2021). Labor market status and occupation have been found to explain 16% of the financial literacy gender gap in a study of Australian adults (Preston & Wright, 2019).

Family economists contend that gender-based labor division within the household means that men traditionally and frequently make the majority of financial decisions for families, and it is through these activities that they are more likely than women to be exposed to financial information (Bucher-Koenen et al., 2017; Fonseca et al., 2012; Hsu, 2011). Therefore, the gender gap is magnified as those making financial decisions further enhance their financial knowledge through feedback effects (Fonseca et al., 2012; Lusardi & Mitchell, 2014; Lusardi et al., 2017; Ward & Lynch, 2019).

This brief review provides insight into the challenges faced by policymakers and educators seeking to improve overall financial literacy, when barriers exist for half the population. This study does not downplay the importance of addressing broader gender biases by accusing measurement tools of being inaccurate but rather aims to focus attention on the unique role gender plays in the field of financial knowledge. By so doing, we hope to position gender as a key consideration in the measurement and analysis of financial literacy.

3. Conceptual framework

While a variety of financial literacy measures have emerged in recent years (such as that by Knoll & Houts, 2012), the "big three" questions initially designed by Lusardi and Mitchell persist. The three questions were originally designed for the *2004 US Health and Retirement Study* and incorporate principles of simplicity, relevance, brevity and capacity to differentiate. They were consequently added to the *2007–08 National Longitudinal Survey of Youth* (NLSY), the *2008 American Life Panel*, and the *2009 Financial Capability Study* (Lusardi & Mitchell, 2011). In Australia, they were added to the *Household, Income and Labor Dynamics in Australia* (HILDA) panel data in 2016 (Wilkins & Lass, 2018). Many studies of smaller cohorts have adopted these questions in a wide variety of contexts. Since Lusardi and Mitchell published an overview of financial literacy studies in 2011, there have been another half a million journal articles published on the broad topic of financial literacy.

The first question is designed to measure the capacity to do a simple calculation; the second question measures an understanding of inflation; and the third question gauges knowledge of risk diversification:

1. Suppose you had $100 in asavings 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. 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. 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

Criticisms of the questions include the reliance on self-assessment, misunderstanding the question (especially if data are collected via phone interview), and sensitivity to question

framing (Lusardi & Mitchell, 2011; Worthington, 2013). Further, there are criticisms over whether these three questions assess domain knowledge or general mathematical skills, particularly the first question (Schuhen & Schurkmann, 2014). With the second question, respondents need to understand inflation and interest concepts, and apply mathematical skills. It is not clear whether the respondents apply their knowledge or take a random guess, given the multiple-choice format of the questions (Schuhen & Schurkmann, 2014). As with all data collection, these criticisms need to be considered when interpreting results. There is also very little agreement on how to measure financial knowledge. We propose that there is a further important factor to consider and draw from the decision science literature. This literature is building evidence that women and men are distinctly different (in aggregate) in their approach to decision-making under uncertainty, such as presented in multiple-choice questions (Baldiga, 2014; Espinosa & Gardeazabal, 2010; Stumpf & Stanley, 1996; Tannenbaum, 2012).

Decision science research uses experiments or competitions to assess gender differences in question responses. Research finds the importance of the result affects performance significantly for women, such as high stakes university entrance exams. This may be because women dislike high-pressure situations or competitive settings, especially in mathematical tasks (Niederle & Vesterlund, 2007, 2010). For example, Pekkarinen (2015) finds that women are less likely than men in Finland to gain entry to university because in the entrance exam, women skipped more questions than is optimal to maximize the probability of acceptance. Baldiga (2014) also finds that when a penalty is imposed for wrong answers, women answer fewer questions than men, even after controlling for knowledge of the material, levels of confidence, and risk preferences. Espinosa and Gardeazabal (2010) conducted a field experiment by switching the incentive to provide a reward for skipping questions. This was found to increase the number of omissions, but mostly by women. Even with the incentive to provide a non-response, men tend to provide an answer.

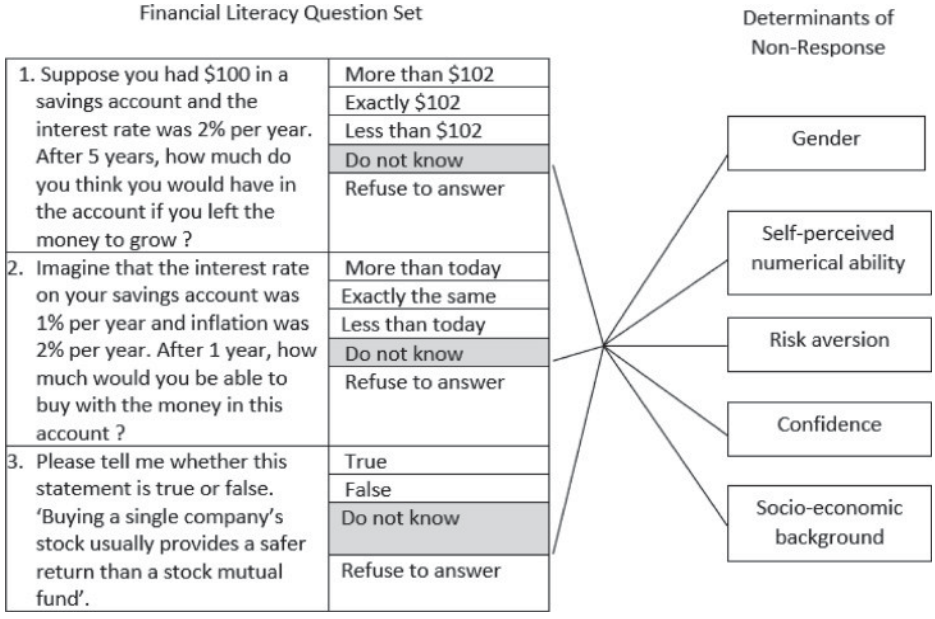
Further evidence of women behaving differently in high-stakes tasks is provided by the risk aversion literature, where women are consistently found to be more risk-averse than men (West & Worthington, 2013, 2014). If answering questions at random risks losing an incentive or points, individuals can avoid this risk by not answering (Charness & Gneezy, 2012; Croson & Gneezy, 2009).

Many researchers find that women are consistently risk averse in many domains, and in the domain of test-taking women display risk aversion when avoiding answering a question if they are not sure and will lose points or an incentive (Charness & Gneezy, 2012; West & Worthington, 2014).

Confidence is another factor being considered. Men have been found to be more overconfident than women in male-specific tasks, like numeracy (Barber & Odean, 2001). This relates to fulfilling stereotype expectations, as individuals (conditional on ability) are less willing to contribute ideas in areas that are stereotypically outside of their gender's domain (Coffman, 2014). This behavior is found in some studies of school-age children in which boys are shown to outperform girls when facing novel problems presented in standardized tests and girls are more confident answering questions about familiar material (Kimball, 1989; Loewen et al., 1988). Riener and Wagner (2017) find that girls are underconfident and underestimate their ability to provide the correct answer, and this is consistent with the stereotype threat (Riener & Wagner, 2017).

Finally, there is limited evidence that socioeconomic status is significantly linked to decision-making behavior, but Riener and Wagner (2017) find a small indication that it is. In their experiment involving a standardized test in schools and the Kahneman (2003) dual model of thinking, they find pupils in vocational schools answer questions according to the automatic System 1 while pupils in high schools seem to answer according to the effortful System 2.

Synthesis of the decision science evidence directs our investigative attention to including factors relating to self-perceived numeracy ability (Niederle & Vesterlund, 2007), risk aversion (Charness & Gneezy, 2012), overconfidence (Barber & Odean, 2001; Coffman, 2014), and socioeconomic background (Riener & Wagner, 2017). This results in the following model of financial literacy non-response:



4. Methodology

This study uses data from a survey of 420 students from an Australian university in 2019. Students were invited to participate via a broadcast email, and we use a monetary prize draw to incentivize and increase participation (Yu et al., 2017). The survey consisted of 64 questions on various topics involving money, including financial stress, financial advice, student loans, and financial knowledge. The final sample consists of 266 respondents after screening for full responses to the variables of interest for this study. The descriptive statistics of the respondents shown in Table 1 are overweight to women (74%), being 23 years old or younger and earning less than $19,999 per annum. Participants who identified gender as non-binary were excluded due to the small number of respondents. We also note the difficulty in controlling for bias due to students being confident in money matters because they have chosen to study related topics like a business. An inspection of the fields of the study shows a statistical difference in participation in "Business and Management" by men

Table 1 Descriptive statistics of sample

Parameter	Women (n = 196)	Men (n = 70)
	Proportion of total sample	Proportion of total sample
Age		
What age category are you in?		
1–23 or younger	0.500	0.443
2–24 to 29	0.250	0.314
3–30 to 39	0.158	0.171
4–40 to 49	0.056	0.043
5–50 to 59	0.031	0.014
6–60 or over	0.005	0.014
INC		
What is your current annual income, including paid work, government benefits, and other financial support?		
0–Don't know/prefer not to answer	0.097	0.157
1–$0	0.056	0.086
2–$1–$19,999	0.357	0.400
3–$20,000–$39,999	0.255	0.143
4–$40,000–$59,999	0.117	0.086
5–$60,000–$79,999	0.061	0.029
6–$80,000–$99,999	0.041	0.043
7–Above $100,000	0.015	0.057
Field of study		
Agriculture and environment	0.015	0.014
Architecture and built environment	0.005	0.014
Business and management[a]	0.209	0.500
Communications	0.015	0.000
Computing and information systems	0.010	0.029
Creative arts	0.056	0.043
Dentistry	0.015	0.014
Engineering	0.010	0.029
Health services and support	0.102	0.043
Humanities, culture, and social sciences	0.097	0.143
Law and paralegal studies[a]	0.122	0.014
Medicine	0.056	0.029
Nursing	0.031	0.000
Psychology	0.077	0.029
Rehabilitation	0.020	0.014
Science and mathematics	0.077	0.043
Social work[a]	0.056	0.000
Teacher education	0.026	0.043
Tourism, hospitality, personal services, sport, and recreation	0.026	0.000
Veterinary science	0.005	0.000

Note. [a]*T* tests show that the participation in this field of study is significantly different between women and men in this sample.

(i.e., more men than women as a proportion of the gender group). Conversely, participation in "Law and Paralegal Studies" and "Social Work" is statistically significant in favor of women. Accordingly, the interpretation of results needs to consider the limitation that the men in our sample are mainly in the Business and Management field of study, which may

have influenced their financial knowledge and field of study bias is proposed as an area of further research. We are also not able to infer from the data the reasons why participants select the answer they do. Investigation using larger data sets and other research methods—such as interviews and focus groups—would contribute to the body of knowledge.

The financial literacy questions are presented in this survey so that answers collected are "yes," "no," "unsure," and "prefer not to answer," a slight variation to the Lusardi and Mitchell (2011) specification. "No" is the correct answer for all three questions. We code the responses to "unsure" as a binary variable and include this binary for answers to each financial literacy question (i.e., interest "unsure" is *INTUNS,* inflation "unsure" is *INFUNS* and diversification "unsure" is *DIVUNS*), and a total out of the three (*UNS*), which can take the form of 0 (no non-responses) to 3 (3 non-responses). We use proxies from the available survey questions to quantify the direction and magnitude of the effect of the hypothesized determinants of *UNS*.

The decision-making literature highlights the importance of self-perceived ability in numerical tasks as a determining factor for non-response. We identify a proxy for this variable from the survey questions and take the opportunity to broaden the variable set, as the question asks for self-perceived ability in math, reading, writing, and financial knowledge at school age. The OECD PISA study of 15-year-olds finds a close link between financial literacy, numeracy, and literacy. On average, girls outperform boys in reading, and boys outperform girls in mathematics and the averaging out explained the small variation between genders (OECD, 2020a). We include all three proxies, as women may have marginally different pathways to being financially literate than men (reading vs. math). Self-perceived ability (*NUM)* is proxied by the question below regarding math (*NUM*), reading (*READ*), writing (*WRIT*), and financial knowledge (*FIN)*:

"Thinking about when you were in year 7 at school, how did you perform in the topics below compared with other children in your class?
Much better
Better
About the same
Worse
Much worse."

We recode a score of 1 through 5, with 5 indicating a high level of self-perceived ability for the responses.

A risk aversion metric (RISK) is taken from a well-known question that appears in the HILDA Survey:

"Which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash? That is, cash used for savings or investments.
I take substantial financial risks expecting to earn substantial returns
I take above-average financial risks expecting to earn above-average returns
I take average financial risks expecting average returns
I am not willing to take any financial risks
I never have any spare cash."

We recode a score of 1 through 5, where 5 indicates a high willingness to take risks.

Finally, we use the following question to proxy for confidence (CONF), and appears in the Ohio National Student Financial Wellness Study:

"I am confident I can manage my finances.
Describes me completely
Describes me very well
Somewhat describes me
Describes me very little
Does not describe me at all
Not applicable"

We recode from 1 through 6, with 6 indicating a high level of confidence in managing finances.

Unfortunately, the data does not contain a reasonable proxy for socioeconomic status (SES). Measures considered included using the postcode of current accommodation that could be linked to the Socio-Economic Indexes For Areas (SEIFA) index; however, this indicator would likely not be representative of family SES as students often move to city areas to study. We also tested this question:

"Again thinking about when you were in year 7 at school, on a scale of 1 to 10, with 10 being a high level of financial satisfaction, rate the level of household financial satisfaction as best you can at this time."

However, regression results were not significant and due to the limitation of the question it was dropped from further analysis.

The probit model fits a maximum likelihood model with a dichotomous dependent variable coded as 0/1, and is given as

$$Pr(y_j \neq 0|x_j) = \varphi(x_j\beta)$$

where y_j is *UNS*, x_j is the set of predictor variables (*NUM*, *RISK*, *CONF*) and φ is the standard cumulative normal. We report coefficients, robust standard errors, and marginal effects.

5. Analysis

The financial literacy question set, coding of variables and descriptive statistics are provided in Table 2. The responses to the three financial literacy questions show that more respondents choose the correct answer for compound interest (71.9% of women and 80% of men), followed by inflation (42.3% women and 65.7% men), and diversification (29.1% women and 58.6% men). The percentage of wrong answers is marginally higher for men for all three questions, with the highest percentage of wrong answers given for inflation (15.7% of men and 14.8% of women). Overall, we observe knowledge of the concept of diversification is particularly lacking, followed closely by knowledge of inflation.

There is a marked gender difference in the responses to "unsure." Women chose the "unsure" option more frequently than men. For compound interest, the difference is over 10 percentage points (16.8% vs. 5.7%), for inflation the difference is over 15 percentage points (37.2% vs. 15.7%), and for diversification, it is nearly 30 percentage points (60.2% vs. 31.4%). What is interesting is that the ratio of women choosing "unsure" relative to men is falling as the level of difficulty increases. For compound interest, the ratio is 2.9 (0.168/0.057), for inflation it is 2.3 (0.372/0.157), and for diversification it is 1.9 (0.602/0.314).

Table 2 Descriptive statistics of financial literacy questions

Financial literacy questions		Women	Men
Compound interest			
If you invested $100 today and the interest rate was 2% per year your bank account balance after five years would be exactly $102.			
	Yes	0.066	0.114
	No	0.719	0.800
	Unsure (INTUNS)	0.168	0.057
	Prefer not to answer	0.046	0.029
After 1 year you would be able to buy more than today if you invested $100 in your bank account today at an interest rate of 1% per year when inflation is 2% per year.			
	Yes	0.148	0.157
	No	0.423	0.657
	Unsure (INFUNS)	0.372	0.157
	Prefer not to answer	0.056	0.029
Diversification			
Buying shares in a single company usually provides a safer return than buying units in a managed share fund.			
	Yes	0.056	0.100
	No	0.291	0.586
	Unsure (DIVUNS)	0.602	0.314
	Prefer not to answer	0.051	0.000
Total unsure responses (UNS)			
	0	0.321	0.571
	1	0.327	0.343
	2	0.240	0.071
	3	0.112	0.014

The descriptive statistics for self-perceived numerical ability, risk aversion, and confidence are provided in Table 3. Men report higher levels of ability in NUM, and FIN, while women report higher levels in READ and WRIT. Men are much more willing to take financial risks (24.3% of men report taking above-average risk compared with 6.1% of women) and have more confidence than women with managing finances (31.4% of men compared with 21.9% of women).

The probit model estimates, including coefficients, robust standard errors, and levels of significance are reported in Table 4. The first model reported (1) is on the total number of UNS responses. This is followed by the "unsure" responses to each of the three financial literacy questions such as with regard to interest (INTUNS) (2), inflation (INFUNS) (3), and diversification (DIVUNS) (4). The Pseudo R2 shows the best fit is for model (4), followed by (1), (3), and (2). The regressions show that being WOM is the overwhelmingly dominant characteristic for choosing "unsure." The coefficients for WOM are significant at the 0.05 level or higher, and coefficients range from 0.510 to 0.706, indicating that if a non-response is recorded there is more than a 50% chance the respondent is a woman.

Self-perceived ability with financial knowledge, FIN, is significant and negative in models (1), (3), and (4), increasing in magnitude in the model (4). Thus, respondents who recall having better financial knowledge than their peers at school are less likely to select a non-response answer to a financial knowledge question. Hence, we infer, as other studies do, that

Table 3 Descriptive statistics of explanatory parameters

Parameters	Women	Men
Self-perceived ability		
Maths (NUM)		
5 Much better	0.250	0.386
4 Better	0.321	0.243
3 About the same	0.281	0.214
2 Worse	0.133	0.129
1 Much worse	0.015	0.029
Reading (READ)		
5 Much better	0.485	0.286
4 Better	0.270	0.429
3 About the same	0.199	0.271
2 Worse	0.046	0.014
1 Much worse	0.000	0.000
Writing (WRIT)		
5 Much better	0.403	0.300
4 Better	0.270	0.257
3 About the same	0.250	0.357
2 Worse	0.077	0.071
1 Much worse	0.000	0.000
Financial knowledge (FIN)		
5 Much better	0.082	0.071
4 Better	0.194	0.271
3 About the same	0.571	0.543
2 Worse	0.138	0.100
1 Much worse	0.015	0.014
Risk aversion (RISK)		
5 I take substantial financial risks expecting to earn substantial returns	0.005	0.100
4 I take above-average financial risks expecting to earn above-average returns	0.061	0.243
3 I take average financial risks expecting average returns	0.306	0.357
2 I a.m. not willing to take any financial risks	0.367	0.214
1 I never have any spare cash	0.260	0.086
Overconfidence (CONF)		
6 Describes me completely	0.219	0.314
5 Describes me very well	0.321	0.386
4 Somewhat describes me	0.332	0.229
3 Describes me very little	0.082	0.057
2 Does not describe me at all	0.041	0.014
1 Not applicable	0.005	0.000

having an early interest in money enables people to acquire and build knowledge, especially regarding key financial concepts. Further to this point, RISK is significant only in the model (4). Remembering that diversification is the most difficult question and requires an understanding of managing risk through diversification, it makes sense that those who indicate a willingness to take risks are willing to select an answer response rather than a non-response. In this sample, the RISK parameter may proxy for both risk-taking knowledge and risk-taking behavior, or it is hard to distinguish between the two.

Numerical ability is significant in model (2) with a negative coefficient. Respondents who have higher levels of self-perceived ability in mathematics are less likely to record an "unsure" response to the question with the least difficulty—interest. In this model for the "unsure" response to the interest question, only WOM and NUM are significant. Finally,

Table 4 Probit model parameter estimates of non-responses

Parameter	(1) UNS	(2) INTUNS	(3) INFUNS	(4) DIVUNS
FEM	0.510**	0.695**	0.686***	0.613
	0.198	0.302	0.224	0.200
NUM	−0.064	−0.205**	−0.064	0.007
	0.084	0.106	0.087	0.085
READ	0.061	−0.038	0.078	0.062
	0.156	0.183	0.157	0.152
WRIT	0.035	−0.070	−0.111	−0.002
	0.139	0.171	0.144	0.138
FIN	−0.263**	−0.018	−0.272**	−0.305
	0.115	0.148	0.123	0.115
RISK	−0.129	0.057	−0.048	−0.153
	0.088	0.107	0.093	0.087
CONF	−0.051	−0.078	−0.033	−0.049
	0.080	0.094	0.081	0.080
AGE	−0.130*	−0.071	−0.102	−0.105
	0.079	0.096	0.083	0.078
INC	−0.065	−0.025	−0.081	−0.048
	0.056	0.070	0.060	0.056
Cons	1.592*	−0.013	0.851	1.237
	0.639	0.772	0.650	0.635
Pseudo R^2	0.095	0.071	0.087	0.100
LR χ^2	33.74***	15.16***	28.97***	36.89

Notes. *$p < .10$, **$p < .05$, ***$p < .01$.

AGE records a significant and negative relationship with UNS in the model (1). Therefore, older people are less likely to record an "unsure" response.

6. Discussion

Investigation into the disparity between women and men in measuring financial literacy performance is important. Women tend to live longer than men, have lower earnings, and have fewer retirement savings and are thus a vulnerable cohort (Cassells et al., 2009). The research documenting low levels of financial literacy provides evidence that investing in financial literacy is one pathway to improving saving and spending behaviors and overall financial stability (OECD, 2020b).

In this study, we take a closer look at how financial literacy is measured. We draw our hypothesis that women make more non-responses than men from the decision science literature, and find that more women select the non-response option than men in financial literacy questions. Most men select an option other than "unsure" (57%); whereas, only 32% of women select an option other than "unsure." The proportion of women who select unsure responses is about double that of men for all three questions.

We infer from the regression results that having an interest in money matters at school age is important. An understanding of risk concepts or risk-taking behavior is also important for selecting an answer as opposed to a non-response option. This confirms prior work by Charness and Gneezy (2012). We were surprised that early confidence does not translate

into current money confidence as the CONF parameter is not significant in any models. However, this may be because it is an accurate self-assessment of the respondent's ability.

7. Implications

For researchers and educators, more work is to be done on understanding gender bias in financial literacy metrics. Is it the style of questions that is problematic for women? Is it the language used?

Perhaps open-ended questions would elicit a more contextual understanding of knowledge about money matters by allowing qualitative aspects of respondents' social experience, values, and cultural diversity to be included (Hunter & Sawatzki, 2019). Or, perhaps in adulthood, women are focused on financial management tasks different from investing, but nonetheless important. Thus, a sophistication may exist that is not captured by financial literacy metrics such as balancing budgets and making financial decisions for the immediate and extended family (Blue & O'Faircheallaigh, 2018). In addition, work continues in schooling on how to make effective links between knowledge and financial decisions in practice. Some researchers have raised concerns on the efficacy of financial education in schools and there is still work to be done on the integration of money matters across a range of topics (not just mathematics) and incorporation of social justice and cultural issues (Blue et al., 2018; Sawatzki, 2014).

Gender-inclusive measurement of knowledge, literacy, and capability in financial matters is one step in liberating women from predesigned social structures and norms that may be enforcing myths about women's capability in the realm of finance. This study has found that a shift in mindset may be needed when developing methodologies for measuring financial literacy to account for gender differences, and when interpreting the results of biased measurement instruments. These results contribute to this urgent area of research in framing a more inclusive financial research agenda and finance system for current and future generations.

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