On the Gender Gap in Financial Knowledge: Decomposing the Effects of Don't Know and Incorrect Responses*

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Objectives. Past studies have consistently shown that women have lower levels of financial knowledge than men, and hence there is a noticeable gender gap in financial knowledge. We reconsider the conventional measures of financial knowledge by disentangling *don't know* (DK) responses and incorrect answers and comparing the effect of these two disparate responses' on the gender gap in financial knowledge. *Methods.* Using data from the 2012 National Financial Capability Studies data set, we estimate a series of ordinary least squares regression and multinomial logit models of the gender gap in DK and incorrect responses. *Results.* We find a strong gender gap in financial knowledge, but with a twist: (1) men are more likely to offer correct answers; (2) women are slightly more likely to offer incorrect answers; but (3) women are considerably more likely to provide DK responses. Hence women may exhibit lower levels of financial knowledge because they lose the opportunity to hazard a guess and arrive at a correct answer based either on partial knowledge or on random chance. We consider the possibility that there are psychological processes at work involving risk acceptance and confidence in financial knowledge that prompt women to give DK responses at a rate higher than men. *Conclusion.* We suggest that future research should consider the relative roles of DK and incorrect responses in measuring financial knowledge.

Financial knowledge refers to the degree to which individuals have the necessary understanding and skills to manage their financial affairs. This is considered as an important tool necessary for individuals to make informed financial decisions, utilize financial services, and navigate the consumer market effectively (Reich and Berman, 2015). In the United States, as the reconstruction of financial markets continues to transform the way that financial services and products are provided, financial decisions have become more complex. Meanwhile, American families are more than ever making financial decisions regarding retirement preparation and health-care plans as responsibilities have increasingly been shifted to individuals from governments (Lusardi and Mitchell, 2011; Nadash and Day, 2014). Within this increasingly complex decision environment, the degree to which individuals have sufficient financial knowledge has become crucial in determining their current and long-term financial well-being.

In recent years, scholars have increasingly examined how well-equipped individuals and families are to make financial decisions, and extant research has revealed that the general public knows relatively little about money management (e.g., Hogarth and Hilgert,

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2002; FINRA, 2012). Low levels of financial knowledge are particularly prevalent among women, who are at greater risk of making uninformed financial decisions (e.g., Chen and Volpe, 2002; Danes and Haberman, 2007; Lusardi and Mitchell, 2007). Compared to men, women potentially have fewer financial resources over the life cycle due to a shorter career with disrupted periods for childrearing and caregiving for families (Hung, Yoong, and Brown, 2012). Women on average have a longer life expectancy than men, and they require more financial resources over the life span than do men (Fonseca et al., 2012; Hung, Yoong, and Brown, 2012).

Limited research has been conducted to understand the determinants of the gender gap in financial knowledge. Studies that explore gender differences in financial literacy have focused on the effects of socioeconomic and demographic factors and household specialization, but these studies leave the gender gap largely unexplained. Clearly, more work is necessary to understand a full range of explanations for this gender gap.

In this study we build on previous research by considering the possibility that at least some of the gender gap is due to how we measure and estimate models of financial literacy. We examine whether there is a difference in how men and women provide *correct*, *incorrect*, and *don't know* (DK) responses to survey items designed to measure financial literacy. Using National Financial Capability Studies (NCFS) data, in this study we aim to disentangle DK and incorrect responses to financial knowledge questions, and we then examine how these two disparate responses affect the gender gap in financial knowledge, as well as possible explanations for that gap. Further, we estimate regression and multinomial logit models of correct, incorrect, and DK responses, focusing attention on the possible explanatory role of individuals' risk acceptance and confidence in financial knowledge.

Literature Review

Financial Knowledge: Definition and Measurement

Financial knowledge has been defined in different ways. The most common component included in current definitions is the understanding of basic financial concepts and economic principles that facilitate the financial decision-making process (e.g., Lusardi, 2008; Lusardi and Mitchell, 2007; Mandell, 2006; Moore, 2003). Studies also use "financial knowledge" interchangeably with the term "financial literacy" (e.g., Chen and Volpe, 2002; Lusardi and Mitchell, 2011), although the latter is often considered a broader concept that includes not only knowledge but also application skills, confidence, and attitudes toward money management (Hung, Parker, and Yoong, 2009; Remund, 2010). Studies on financial knowledge often lack a clear definition, and scholars who include a definition often conceptualize financial knowledge implicitly so that readers must infer its meaning from a discussion of how it was measured. At present, there is little clear agreement on how to define financial knowledge or financial literacy.

There is even less agreement on how to measure financial knowledge. Existing financial knowledge measures vary substantially in terms of content domain, measurement strategy, format, and number of items. In terms of content, the most frequently used financial knowledge items fall into four categories: numeracy, cash-flow management, saving and borrowing, and investment (Hung et al., 2009; Huston, 2010). Some scholars focus on

one content area (e.g., Loke and Hageman, 2013), while others cover two or more areas (e.g., Borden et al., 2008). Scholars often employ either knowledge-based performance tests (e.g., Lusardi and Mitchell, 2011), subjective self-reports (e.g., Lyons, Chang and Scherpf, 2006), or both (e.g., Agnew and Szykman, 2005) to measure financial knowledge. There is also substantial variation in the format and number of items (cf., Chen and Volpe, 1998; Moore, 2003; Lusardi and Mitchell, 2011), though in many studies scholars simply count the number or percentage of correct responses. Counting incorrect and DK responses in the same way is commonplace in the literature, though some scholars consider the possibility that these two responses say different things about individuals' level of information (cf., Mondak, 1999; Mondak and Davis, 2001; Lusardi and Mitchell, 2011; Bucher-Koenen et al., 2016).

Gender and Financial Illiteracy

Regardless of how financial knowledge has been measured (Hung et al., 2009; Remund, 2010), the findings of research converge to indicate that low financial knowledge is particularly acute among certain subpopulations—for example, less educated, low income, minorities, the young, and the elderly (Chang and Lyons, 2008; Lusardi and Mitchell, 2011, 2014). Gender consistently emerges as a predictor of low levels of financial knowledge, as women tend to score lower than men on various financial knowledge measures, both in general (Hogarth and Hilgert, 2002; Hilgert, Hogarth, and Beverly, 2003) and in specific subsamples such as among the college educated (Zissimopoulos, Karney, and Rauer, 2008), high school and college students (Chen and Volpe, 2002; Mandell, 2006), college employees (Angew and Szykman, 2005), and low-income adults (Zhan, Anderson, and Scott, 2006).

The gender gap in financial knowledge also appears to be domain-specific, though there is some disagreement on this point. Compared to men, women often demonstrate far less knowledge in the area of credit management and investment, but women outperform men on daily money management activities (Lusardi and Mitchell, 2009; Hung, Yoong, and Brown 2012; Zhan, Anderson, and Scott, 2006). In contrast, Bucher-Koenen et al. (2016) suggest that women know little about financial matters in general and knowledge deficiency is not domain-specific. It appears that research on whether the gender-based financial knowledge gap is domain-specific remains inconclusive, though there is agreement that gender disparities in financial knowledge are persistent over time and with different methodologies.

What Explains Gender Differences?

The reasons for the gender gap in financial knowledge are little understood. In some studies, scholars have attributed the gender gap to socioeconomic characteristics. Bucher-Koenen et al. (2016) find that the knowledge gap between men and women is reduced after controlling for the effects of demographic covariates. Among relevant sociodemographic factors, educational attainment and income level exhibit large effects on gender disparities in financial knowledge (e.g., Fonseca et al., 2012). Scholars speculate that formal education serves as a foundation for gaining financial knowledge and skills; therefore, individuals with higher educational attainment are likely to have better understanding about financial matters (Bucher-Koenen et al., 2016; Perry and Morris, 2005). As for income, having

more available financial resources enables a variety of money management activities and thus helps with the accumulation of financial knowledge (Perry and Morris, 2005). Insofar as women and men differ in their socioeconomic attributes, it is possible that the gender gap in financial knowledge is at least partially explained by these socioeconomic differences.

Another possible mechanism through which gender differences are produced is household financial decision making. Family economists contend that gender-based labor division within household means that men are frequently responsible for making financial decisions for families, and it is through these activities that they are more likely than women to be exposed to financial information (Hsu, 2011; Fonseca et al., 2012). However, evidence that relates household labor division to financial knowledge is still lacking. Fonseca et al. (2012) find that men who are family financial managers exhibit higher levels of financial knowledge than those who are not, but this association is not observed for women. They also find that educational attainment, rather than the division of labor, is positively linked to financial knowledge and household financial decision making. However, these findings are still far from conclusive due to the limited set of financial decisions under study.

Gender Disparity in DK Response

Another possible source for the gender gap in financial knowledge is in how we measure the concept. Van Rooij, Lusardi, and Alessie (2011) indicate that the number of correct answers varies substantially with changes in the wording of the risk diversification questions, and Lusardi, Mitchell, and Curto (2012) find that answers to financial knowledge questions are sensitive to how the questions are phrased, particularly among female respondents. In addition to wording, the format of response options seems relevant to gender difference as well. Bucher-Koene et al. (2016) speculate that financial knowledge measures likely induce women to respond "don't know" when it offers such an option. In fact, research has shown that women are more likely than men to respond DK on various financial knowledge tests (Lusardi and Mitchell, 2009; Bucher-Koenen et al., 2016; Agnew et al., 2008). The greater tendency of women to give DK responses has been demonstrated internationally as well (Hung, Yoong, and Brown, 2012). The prevalence of DK response among women raises concerns about the role of measurement in shaping the gender gap in financial literacy.

Extant research on the gender gap in knowledge is not limited to the realm of financial knowledge. Rather, scholars have documented a gender gap in *political* and *economic* knowledge (Carpini and Keeter, 1993; Holbrook and Garand, 1996; Mondak, 1999) and noted the greater propensity of women to give DK responses. Lizette and Sidman (2009) suggest that the greater tendency of women to give DK responses indicates their low confidence in knowledge and/or risk aversion, rather than just ignorance. Scholars studying political knowledge also suggest that incorrect and DK answers imply different underlying processes (e.g., Garand, Guynan, and Fornet, 2004; Mondak, 1999). In particular, Mondak (1999) finds that women are significantly more likely than men to respond DK to political knowledge questions, and he suggests that women have "partial knowledge" that is hidden by a greater disposition to decline to answer knowledge questions. Mondak and Davis (2001) find that discouraging DK responses generally results in higher scores on political knowledge scales, though there is some disagreement on this point (Luskin and Bullock, 2011).

As noted, scholars have recognized the gender disparity in DK responses to financial knowledge questions. Bucher-Koenen et al. (2016) find that women in the United

States, the Netherlands, and Germany tend to give themselves lower scores in self-assessed knowledge and conclude that DK responses reflect not simply the lack of knowledge but rather the lack of confidence in their possessed knowledge. Indeed, low confidence in financial knowledge among women is mirrored by their self-rated financial knowledge relative to their partners. Hsu (2011) finds that only 16 percent of women in couples identify themselves as being the most knowledgeable about family finance in their households, and less than half report being at least equally knowledgeable as their male partners.

Having DK responses can also indicate the relatively low propensity of women to take risk. It is well documented that women are more risk averse than men in general (Croson and Gneezy, 2009), and this has been found to be especially the case in terms of making financial decisions (Van Rooij, Lusardi, and Alessie, 2011). Scholars argue that, due to their relatively high propensities to avoid risk, women are more likely to choose DK answers on questions for which they are uncertain as compared to their risk-seeking counterparts who likely choose to guess (Bucher-Koenen et al., 2016).

In this study, we draw on data from NFCS to consider the role played by DK responses and incorrect answers in shaping the gender gap in financial knowledge. Specifically, we consider whether the determinants of DK and incorrect answers differ, both in general and for men and women. We focus particular attention on the effects of risk aversion and confidence in financial knowledge—both of which differ for men and women—in shaping the gender gap in financial knowledge.

Methodology

Data and Sample

In this study, we use data from the state-by-state version of the 2012 NFCS, a nationally representative data set collecting data from approximately 500 respondents per state. A brief description of the survey upon which this data set is based is found in Appendix A.

Measures

Dependent Variables. The dependent variable of this study is financial knowledge, which is measured using five questions about interest rate, inflation rate, bond prices, mortgage, and risk diversification. Three of the five questions are multiple-choice questions and the other two items are true or false questions. Nominal variables are created for each financial knowledge question to indicate the correct answers (coded 2), incorrect answers (coded 0), and DK responses (coded 1). The response *prefer not to say* is considered as conveying similar information as a DK response, both indicating that respondents would rather not hazard a guess. Thus, *prefer not to say* response is also coded 1. The wording of the five questions is found in Appendix B.

Independent Variables. Since we aim in this study to find how men and women differ in providing DK responses, gender is the key independent variable and is measured as a dichotomy, with males coded as 0 and females coded as 1. If there is gender difference in financial knowledge, the coefficient for the gender variable should be negative in models of correct answers and positive in models of incorrect and DK responses. Other independent variables of this study include age, ethnicity, household income level, educational

TABLE 1

Ordinary Least Squares Estimates for Effects of Socioeconomic Variables on Number of Correct Response, Incorrect Response, and DK Response

	Correct		Incorrect		Don't Know	
	b	*z*	*b*	*z*	*b*	*z*
Gender	−0.374	−22.30***	0.006	0.49	0.368	22.21***
Age	0.222	34.83***	−0.080	−16.98***	−0.142	−22.53***
Education	0.267	45.23***	−0.106	−24.24***	−0.161	−27.61***
Income	0.011	1.99*	−0.020	−4.97***	0.009	1.72
Nonwhite	−0.320	−17.83***	0.239	17.93***	0.081	4.60***
Married	0.208	11.05***	−0.088	−6.29***	−0.120	−6.47***
Living with partner	0.025	1.56	0.000	−0.01	−0.024	−1.58
Full-time employment	−0.155	−8.91***	0.092	7.12***	0.063	3.68***
Number of children	−0.044	−4.62***	0.028	4.00***	0.016	1.67*
Risk acceptance scale	0.026	7.81***	0.034	14.10***	−0.060	−18.48***
Confidence	0.125	18.92***	0.069	14.12***	−0.194	−29.74***
Intercept	0.498	9.28***	0.997	25.09***	3.505	66.17***
N	24,209		24,209		24,209	
R^2	0.244		0.086		0.182	
F	711.48		208.07		489.70	
Prob(*F*)	0.000		0.000		0.000	

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

attainment, marital status, employment status, number of dependent children, confidence, and risk tolerance. The description of how each of these variables is measured is found in Appendix B, and the frequencies for these variables—both in total and separately for men and women—are found in Table B1.

Empirical Results

There are important differences in how men and women respond to financial knowledge questions. For the sake of brevity, in Appendix C we present a brief summary of Americans' levels of financial literacy, as well as of observed differences between men and women. One can see that men and women differ considerably in their propensities to provide correct, incorrect, and DK answers. Men are more likely to answer financial literacy questions correctly, while women are slightly more likely than men to give incorrect answers but substantially more likely to provide DK answers to these questions. Do these simple differences persist in the face of statistical controls for socioeconomic and demographic variables, risk acceptance, and confidence in financial literacy?

Multiple Regression Results

In Table 1, we present the results from ordinary least squares analysis in which we regress gender, socioeconomic and demographic variables, risk tendency, and confidence in financial knowledge on the number of correct, incorrect, and DK responses, respectively. Turning first to the results for the number of correct responses, we find that coefficient for gender is negative and highly significant ($b = -0.374$, $z = -22.30$); this indicates

that women provide fewer correct responses than men, controlling for the effects of other independent variables. With the exception of the variable for living with partner, all covariates in the model are significantly associated with respondents' level of financial knowledge. The estimates show that correct responses are higher among older ($b = 0.222$, $z = 34.83$), highly educated ($b = 0.267$, $z = 45.23$), high-income ($b = 0.011$, $z = 1.99$), and white ($b = -0.320$, $z = -17.83$) respondents. Married individuals exhibit higher financial knowledge levels than nonmarried individuals ($b = 0.208$, $z = 11.05$). Self-employed and full-time workers have lower levels of financial knowledge than others (i.e., part-time workers, disabled, and retired; $b = -0.155$, $t = -8.91$). Adults with more dependent children also have lower financial knowledge than those who have fewer or no dependent children ($b = -0.044$. $t = -4.62$). Finally, financial knowledge levels are higher among those who have a higher tendency to accept risk ($b = 0.026$, $t = 7.81$) and more confidence in their overall financial knowledge ($b = 0.125$, $t = 18.92$). It may well be that higher risk acceptance promotes information acquisition, and confidence in financial knowledge could reflect actual levels of financial knowledge, though Lusardi and Mitchell (2014) note that many Americans overstate their level of financial knowledge. We also suggest that these two attributes are likely to prompt respondents to offer an answer, even when they are unsure, and the result is that confident, risk-accepting individuals offer more correct answers that those who are risk averse and less confident.

In Table 1, we also consider the determinants of the number of incorrect responses to our financial knowledge items. Surprisingly, gender has a null effect on incorrect responses (b = 0.006, z = 0.49); contrary to expectations, women are no more and no less likely than men to provide incorrect responses to these items, once we control for the effects of other independent variables. The effects of the other independent variables in our model are generally consistent with expectations. Age ($b = -0.080$, $z = -16.98$), education ($b = -0.106$, $z = -24.24$), income ($b = -0.020$, $z = -4.97$), and married status ($b = -0.088$, $z = -6.29$) are negatively associated with the number of incorrect responses; older, highly educated, high-income, and married individuals are less likely to answer financial knowledge questions incorrectly. On the other hand, members of racial and ethnic minority groups ($b = 0.239$, $z = 17.93$), individuals who are employed full time or are self-employed ($b = 0.092$, $z = 7.12$), and those with many children ($b = 0.028$, $z = 4.00$) are more likely to provide incorrect answers to knowledge questions. We also find strong evidence that risk-accepting individuals ($b = 0.034$, $z = 14.10$) and those with confidence in their financial knowledge ($b = 0.069$, $z = 14.12$) are more likely to give incorrect responses; this suggests that the willingness to answer financial knowledge questions—either because of a willingness to risk an answer or because of individuals' confidence in what they think they know is high—is associated with a higher propensity to offer incorrect answers.

In Table 1, we also estimate the effects of gender and other demographic and socioeconomic variables on number of DK responses. Our results show that women are significantly more likely to offer DK responses than men ($b = 0.368$, $t = 22.21$), controlling for the effects of other covariates in the model. This represents about a third of a point on a scale that ranges from 0 to 5; this is not a huge effect, but gender clearly nudges women upward in terms of the number of DK responses. Most covariates are significantly related to the number of DK responses. Respondents who are older ($b = -0.142$, $z = -22.53$) and more educated ($b = -0.161$, $z = -27.61$) are significantly less likely to give DK responses than those who are younger and less educated. Respondents who are married ($b = -0.120$, $z = 6.47$) full-time workers or self-employed ($b = 0.063$, $z = 3.68$) and nonwhite ($b = 0.081$, $z = 4.60$) report more DK responses. In addition, individuals who

TABLE 2

Multinomial Logit Regression for Effects of Gender on Correct, Incorrect, and Don't Know Response to Specific Financial Knowledge Questions

	Incorrect/Correct		Don't Know/Correct	
	b	*t*	*b*	*t*
Interest rate	0.30	7.24***	0.35	7.52***
Inflation rate	0.43	11.11***	0.74	19.27***
Bond price	0.10	2.91***	0.59	16.66***
Mortgage	0.08	1.70*	0.24	5.93***
Risk diversification	0.17	3.34**	0.61	20.13***

$N = 24{,}209$.
***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

report higher willingness to take risk ($b = -0.060$, $z = -18.48$) and more confident about overall financial knowledge ($b = -0.194$, $z = -29.74$) are less likely to offer DK responses.

At this point, our findings fit neatly with our expectations. Women clearly have lower levels of financial knowledge than men, even after controlling for the effects of other independent variables that we know are related to financial knowledge. While there is no discernible gender gap in the propensity to provide incorrect responses to financial knowledge items, women do offer significantly fewer correct answers, and they are significantly more likely to provide DK answers than are men. The finding that men have higher levels of correct answers is consistent with findings from previous research on financial knowledge. However, the finding that women are more likely to provide DK responses suggests that the lower level of financial knowledge among women may be at least partly due to the greater propensity of women not to hazard a guess on financial knowledge items. If it is the case that women are less likely to hazard a guess on these questions, they lose the opportunity to arrive at a correct answer either based on partial knowledge or based on random chance; for men, the greater willingness to hazard a guess may result in the appearance of higher levels of knowledge when in fact they are just more likely to offer an answer to financial knowledge questions. It is noteworthy that this gender effect for DK responses remains in place even after controlling for the effects of risk acceptance and confidence in financial knowledge, both of which are higher for men and predispose individuals to have lower rates of providing DK answers. If the gender gap remains in place even after controlling for the effects of these variables, it suggests that there is something more about gender that results in a higher rate of DK responses for women.

Multinomial Logit Results

To further distinguish how gender influences individuals' propensities to provide correct, incorrect, and DK responses, in Table 2 we summarize results from five multinomial logit models that estimate the effect of gender on incorrect and DK responses to each of five financial knowledge questions, respectively, with correct response as excluded comparison (baseline) group. For the sake of brevity, we report only the gender coefficients and tests of statistical significance; the full model results are reported in Tables C3–C7.

As one can readily see, across all five models the gender coefficients are positive and statistically significant for the incorrect responses, indicating that women are more likely

TABLE 3

Predicted Probabilities for Correct, Incorrect, and Don't Know Responses to Specific Financial Knowledge Questions by Gender

	Correct		Incorrect		DK	
	Men	Women	Men	Women	Men	Women
Interest rate	0.824	0.772	0.105	0.132	0.072	0.096
Inflation rate	0.752	0.627	0.132	0.169	0.116	0.204
Bond price	0.332	0.260	0.369	0.320	0.300	0.421
Mortgage	0.828	0.802	0.076	0.080	0.096	0.118
Risk diversification	0.612	0.476	0.071	0.066	0.312	0.458
Mean	0.700	0.587	0.151	0.153	0.179	0.259
Mean gender difference	0.123		−0.002		−0.080	

$N = 24{,}209$.

than men to give incorrect responses for each of the five questions. Moreover, for all five questions, the gender coefficients for DK responses are positive and statistically significant, indicating that women are significantly more likely than men to provide DK responses, controlling for the effects of other independent variables in the model. It is important to note as well that there is a systematic pattern in the magnitudes of the coefficients: For all five questions, the gender coefficients for DK responses are of a larger magnitude than those for incorrect answers. This is particularly noticeable in the case of bond price questions: The effect of gender on giving a DK response ($b = 0.59$) is nearly six times larger than the effect of gender on giving an incorrect response ($b = 0.10$). Moreover, with the exception of the interest rate question, the multinomial logit coefficients for gender in the incorrect/correct comparison are substantially smaller than the coefficient for gender in the DK/correct comparison. It appears that gender has a stronger effect on DK responses than on incorrect responses, though gender has a significant effect for both the incorrect/correct and DK/correct comparisons.

To facilitate the interpretation of results from multinomial regressions, we generate predicated probabilities of providing a correct, incorrect, and DK response for both men and women on our five financial knowledge questions. These predicted probabilities are presented in Table 3 and are generated by holding our control variables constant at their means and varying the two values of the gender variable. As one can see, men clearly have a higher predicted probability of giving correct answers than women on all five items; controlling for the effects of other variables, men are more likely to give correct responses on the interest rate (0.824 vs. 0.772), inflation rate (0.752 vs. 0.627), bond price (0.332 vs. 0.260), mortgage (0.828 vs. 0.802), and risk diversification (0.612 vs. 0.476) items. On the other hand, the gender gap in predicted probabilities for incorrect responses is small and inconsistent. Women have a higher probability of incorrect answers on the interest rate (0.132 vs. 0.105), inflation rate (0.169 vs. 0.132), and mortgage (0.080 vs. 0.076) questions, but these differences are relatively small; on the other hand, men have a higher probability of incorrect answers on the bond price (0.369 vs. 0.320) and risk diversification (0.071 vs. 0.066) items. Finally, we see that there are discernible gender differences in DK responses on all five financial knowledge questions, with women significantly more likely to provide DK answers: interest rates (0.096 vs. 0.072), inflation rate (0.204 vs. 0.116), bond prices (0.421 vs. 0.300), mortgages (0.118 vs. 0.096), and risk diversification (0.458 vs. 0.312). In some cases the gender gap in DK responses is small (i.e., interest rates, mortgages), but in the

other cases there is a clear demarcation between men in women in their DK response rates. That these differences are both discernible and statistically significant even after controlling for the effects of other independent variables is indicative of a clear gender effect in DK responses.

On average, men are substantially more likely to give correct responses (0.700 vs. 0.587), while women are barely more likely to give incorrect responses (0.153 vs. 0.151) and moderately more likely to give DK responses (0.259 vs. 0.179). Overall, these findings suggest that gender generally does a better job in differentiating DK responses than in differentiating incorrect answers. The differences between men and women are typically larger for DK responses than for incorrect responses.

Discussion and Conclusion

Consistent with previous research, we find that women are less financially knowledgeable than men. Individuals can satisfy the knowledge standard by giving a correct response to a financial knowledge question, but they can demonstrate a lack of knowledge either by giving an incorrect answer or by responding that they do not know the answer and hence do not want to hazard a guess. Our findings indicate that women are far more likely than men to give DK responses, and the magnitude of gender effect on DK response is noticeably larger than the magnitude of the gender effect on incorrect responses, both in total and separately for each of the five financial knowledge questions. Simply, women are marginally more likely to give incorrect responses than men, but they are even *more* likely to give DK responses relative to men. This suggests that DK responses and incorrect responses are not necessarily interchangeable indicators of a lack of knowledge; rather, incorrect and DK responses are likely to have different determinants and may reflect different states of knowledge. While only a handful of financial knowledge studies explore this issue, there are a number of political knowledge studies that contend that DK responses possibly conceal partial knowledge and, arguably, are subject to different explanatory processes than incorrect responses (Mondak, 1999; Mondak and Davis, 2001; Garand, Guynan, and Fornet, 2004; but see Luskin and Bullock, 2011). Our study lends support to this latter claim by demonstrating the distinct effects of gender on DK responses and incorrect responses on financial knowledge questions.

If DK responses are not completely equivalent to incorrect response in representing the absence of knowledge, what do DK responses really measure? We suggest that there may be psychological processes at work that generate DK responses in a way that does not entirely describe the generation of incorrect responses. In previous studies on financial knowledge, scholars speculate that risk aversion and low confidence contribute to the choosing of DK responses (Van Rooij, Lusardi, and Alessie, 2011). Our findings lend some credence to this argument. We find that high levels of risk acceptance (and hence low levels of risk aversion) and individuals' confidence in their financial knowledge is *negatively* and strongly associated with the number of DK responses (Table 1) and with DK responses for individual items (see Tables C3–C7). On the other hand, risk acceptance and confidence in financial knowledge are *positively* and strongly related to the propensity of giving incorrect responses. Given that women are less willing to take risk and less confident about their financial knowledge, it is unsurprising that women provide substantially more DK responses than men in our study. As a result, the relative risk aversion and low confidence among women are interpreted as deficiency in individuals' levels of financial knowledge as some scholars routinely treat DK response as reflecting an absence of knowledge. This may well be a correct

interpretation, at least in part, but there is considerable debate remaining about whether DK responses conceal knowledge and whether DK responses indicate more than the mere deficiency of knowledge. It is possible that folding together DK and incorrect responses may affect the results of empirical studies of the determinants and effects of financial knowledge.

We suggest that there are at least two important paths for future research. First, it is important to consider further the processes that result in the gendered DK effect. How does the lower propensity among women to take risk (which includes answer survey questions) or to have confidence in their financial knowledge affect financial literacy? How does risk acceptance and confidence in financial knowledge work differently for men and women to facilitate a gender gap in DK responses? Are there other psychological attributes that both differentiate men and women and lead individuals to higher levels of DK responses? Second, it is important to consider the relative effects on DK and incorrect responses on various financial performance outcomes. If these two types of responses equally capture a lack of financial knowledge, we would expect that the effect of DK and incorrect responses on various measures of financial well-being would be similar. If we assume that individuals with high financial knowledge are more likely to be successful financially, do DK and incorrect responses have similar effects in lowering individuals' chances for financial prosperity? Answering this question would help scholars determine the relative importance of DK and incorrect responses to financial knowledge questions.

Appendix A: Brief Description of National Financial Capability Study

The NFCS was funded by the Financial Industry Regulatory Authority Investor Education Foundation and conducted by Applied Research and Consulting in hope of better understanding financial capability in the United States (Mottola, 2013). The first NFCS survey was conducted in 2009 with the second survey in 2012. The NFCS consists of three separate but related surveys conducted online—a national, a state-by-state, and a military survey—and questions included in each survey span a broad array of financial knowledge and behaviors. This study uses data collected in 2012 using the state-by-state survey, which is the largest data set among the three surveys.

The 2012 NFCS state-by-state data set includes data collected through an online survey of 25,509 individuals age 18 and older in the United States using nonprobability quota sampling approach. The sample has been weighted to be representative of the U.S. adult population in age by gender, ethnicity, education, and census division (Mottola, 2013). Data collection occurred from July to October 2012, and the average time respondents took to complete the survey was 15 min. The working sample consisted of 25,509 individuals, comprising all respondents who provided answers to the key questions used for the measurement of dependent and independent variables.

Appendix B: Variable Measurement

Dependent Variables

The following is the question wording for each of the five financial literacy questions used in our study, as well as the possible answers to these questions. Note that the correct answer to each question is in italics.

TABLE B1

Sociodemographic Characteristics of Sample

	Percentage (*n*)	Male (%) (*n* = 11,382, 44.62%)	Female (%) (*n* = 14,127, 55.38%)
Age			
18–24	10.12 (2,581)	3.83	6.28
25–34	16.79 (4,284)	7.14	9.66
35–44	16.81 (4,288)	7.25	9.56
45–54	20.45 (5,217)	9.46	10.99
55–64	19.01 (4,848)	8.89	10.12
65 or older	16.82 (4,291)	8.05	8.77
Ethnicity			
White	73.37 (18,715)	76.82	70.58
Nonwhite	26.63 (6,794)	23.18	29.42
Education			
Didn't complete high school	7.46 (1,903)	5.99%	8.65
Regular high school diploma	19.47 (4,966)	17.18	21.31
GED or alternative credential	6.25 (1,595)	6.20	6.29
Some college	33.0 (8,419)	33.81	32.36
College graduate	20.95 (5,343)	21.73	20.32
Postgraduate education	12.87 (3,283)	15.09	11.08
Marital status			
Married	56.14 (14,320)	57.49	55.04
Living with partner	7.94 (2,026)	6.77	8.89
Single	35.92 (9,163)	35.74	36.07
Number of Children			
No child/financially dependent children	61.33 (15,644)	65.98	57.58
1	16.63 (4,241)	14.81	18.09
2	18.73 (4,778)	16.73	20.34
3	3.32 (846)	2.48	3.99
Income			
<$15K	16.63 (4,241)	14.81	18.09
$15–25K	13.19 (3,364)	11.97	14.17
$25–35K	5.54 (1,414)	4.76	6.17
$35–50K	3.32 (846)	2.48	3.99
$50–75K	31.24 (7,968)	31.43	31.08
$75–100K	30.09 (7,676)	34.55	26.05
Employment self-employed	7.75 (1,977)	9.56	6.29
Full-time worker	36.15 (9,222)	43.50	30.23
Part-time worker	9.24 (2,405)	7.26	11.18
Homemaker	10.14 (2,586)	1.09	17.43
Full-time student	4.28 (1,091)	3.87	4.61
Disabled	5.34 (1,363)	5.25	5.42
Unemployed	8.24 (2,103)	8.26	8.23
Retired	18.67 (4,762)	21.23	16.61
Confidence			
1	1.80 (458)	1.38	2.15
2	1.91 (488)	1.57	2.19

Continued

TABLE B1

Continued

	Percentage (*n*)	Male (%) (*n* = 11,382, 44.62%)	Female (%) (*n* = 14,127, 55.38%)
3	4.99 (1,273)	3.99	5.80
4	14.52 (3,705)	12.47	16.18
5	33.45 (8,532)	32.41	34.28
6	27.25 (6,950)	30.57	24.56
7	13.36 (3,408)	15.53	11.61
Don't know	1.83 (467)	1.31	2.25
Prefer not to say	0.89 (228)	0.79	0.98
Risk acceptance			
1	15.90 (4,055)	11.64	19.32
2	8.45 (2,155)	6.54	9.97
3	11.17 (2,855)	9.43	12.58
4	9.54 (2,434)	8.45	10.42
5	12.14 (3,098)	12.19	12.10
6	11.60 (2,959)	12.28	11.05
7	11.85 (3,023)	14.51	9.71
8	8.49 (2,165)	11.64	5.95
9	3.29 (840)	4.77	2.10
10	4.36 (1,113)	6.12	2.94
Don't know	2.44 (622)	1.70	3.03
Prefer not to say	0.76 (195)	0.69	0.82

N = 25,509.

1. *Interest rate.* Suppose you had $100 in a savings account and the interest rate was 2 percent 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 $102, Exactly $102, Less than $102, Don't know, Prefer not to say.

2. *Inflation rate.* Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After one year, how much would you be able to buy with the money in this account? More than today, Exactly the same, *Less than today*, Don't know, Prefer not to say.
3. *Bond price.* If interest rates rise, what will typically happen to bond prices?

They will rise, *They will fall*, They will stay the same, There is no relationship between bond prices and the interest rates, Don't know, and Prefer not to say.

4. *Mortgage.* A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less.

True, False, Don't know, Prefer not to say.

5. *Risk diversification.* Buying a single company's stock usually provides a safer return than a stock mutual fund.

True, *False*, Don't know, and Prefer not to say.

Independent Variables

We include several socioeconomic/demographic variables as independent variables in our models. Age is coded in six groups: aged 18–24, 25–34, 35–44, 45–54, 55–64, and 65 and over. Ethnicity is measured as dichotomous variable, with coded 0 for white respondents and 1 for nonwhite respondents. Both level of education and marital status are categorical variables measured in the survey. Level of education is measured in a scale ranging from 0 (did not complete high school) to 6 (postgraduate education). Marital status is measured as two dichotomous variables: one is married (coded 1) and otherwise (coded 0), the other is living with partner (coded 1) and otherwise (coded 0). In the survey, the number of children is listed: 1, 2, 3, 4, or more, no financially dependent children, and do not have any children. This variable is coded 0 if no child/financially dependent child, 1 if have one child, 2 if have two children, 3 if have three children, 4 if have four or more children. Level of annual household income is also measured as a categorical variable: less than $15,000, at least $15,000 but less than $25,000, at least $25,000 but less than $35,000, at least $35,000 but less than $50,000, at least $50,000 but less than $75,000, at least $75,000 but less than $100,000, at least $100,000 but less than $150,000, and $150,000 or more. Employment is based on a variable that includes eight categories: self-employed, full-time worker, part-time worker, homemaker, full-time student, disabled, unemployed, and retired. This variable is coded 1 for individuals who are employed or self-employed, and 0 for otherwise.

We also include two additional independent variables that may explain individuals' level of financial literacy. Previous research suggests that choosing DK responses may reflect low confidence in financial knowledge and a low tendency of taking risk (Bucher-Koenen et al., 2016; Van Rooij, Lusardi, and Alessie, 2011), and gender gaps in DK responses may be due in part to gender differences on these two variables. Given this, we include two variables that measures confidence in financial knowledge and risk-taking tendency, respectively. In 2012 NFCS survey, confidence was measured on a scale of 1 (very low) to 7 (very high) based on the following question: How would you assess your overall financial knowledge? A higher rating indicates that respondents have high confidence in their levels of possessed financial knowledge.

Risk tendency is based on responses to the following question: *When thinking of your financial investment, how willing are you to take risk*? This variable is measured on a 10-point scale, ranging from 1 (not at all willing to take risk) to 10 (very willing to take risk). Hence, the higher rating is associated with a greater tendency to accept and take risk.

Appendix C: Description of Financial Knowledge Levels and Differences for Men and Women

There is considerable variation in how well Americans do on the various financial knowledge questions. As shown in Table C1, most respondents correctly answer the interest rate (76.9 percent) and mortgage (77.6 percent) questions, whereas slightly over half respondents give correct answers to inflation rate (64.1 percent) and risk diversification question (51.2 percent). However, less than a third of respondents (29.42 percent) answer the bond price question correctly. The percentages of correct response among women are lower than men on all five questions, ranging from about 6 percent lower on the mortgage question to 18 percent lower on risk diversification question. On average, women answer

TABLE C1

Distribution of Correct, Incorrect, and Don't Know Responses to Financial Knowledge Questions, in Total and by Gender

	Total			Men			Women		
	Correct	Incorrect	DK	Correct	Incorrect	DK	Correct	Incorrect	DK
Interest rate (%)	76.9 (19,616)	12.2 (3,120)	10.9 (2,773)	82.0 (9,334)	9.9 (1,127)	8.1 (921)	72.8 (10,282)	14.1 (1,993)	13.1 (1,852)
Inflation rate (%)	64.1 (16,351)	15.7 (4,016)	20.2 (5,142)	73.2 (8,332)	13.8 (1,570)	13.0 (1,480)	56.8 (8,019)	17.3 (2,446)	25.9 (3,662)
Bond price (%)	29.4 (7,505)	32.4 (8,272)	38.2 (9,732)	36.6 (4,163)	34.7 (3,948)	28.7 (3,271)	23.7 (3,342)	30.6 (4,324)	45.7 (6,461)
Mortgage (%)	77.6 (19,785)	8.3 (2,116)	14.1 (3,608)	81.2 (9,240)	7.7 (872)	11.2 (1,270)	74.6 (10,545)	8.8 (1,244)	16.6 (2,333)
Risk diversification (%)	51.2 (13,056)	7.5 (1,917)	41.3 (10,536)	61.7 (7,019)	8.1 (917)	30.3 (3,446)	42.7 (6,037)	7.1 (1,000)	50.2 (7,090)
Mean number	2.99	0.76	1.24	3.34	0.74	0.91	2.70	0.77	1.51

$N = 25{,}509$.

2.70 questions correctly compared to 3.34 for men. Women and men also differ across five questions in their propensity to give incorrect answers. On interest rate, inflation rate, and mortgage questions, women are 4.2, 3.5, and 1.2 percent more likely, respectively, to give incorrect answers than men. In contrast, men give a higher percentage of incorrect answers to the bond price and risk diversification questions (by margins of 4.1 and 1.0 percent, respectively).

It is in terms of DK responses that women exhibit consistently higher percentages than men. For all five questions, women have a higher share of DK responses than men; specifically, compared to men women are over 5 percent more likely to respond DK to the interest rate question and mortgage question, 13 percent more likely to the inflation question, 17 percent more likely to the bond price question, and 20 percent more likely to give DK response to the risk diversification question. In total, women have an average of 30.0 percent DK responses to these five questions, while for men DK responses are only 18.3 percent of all responses.

We summarize these gender differences by counting the number of correct, incorrect, and DK responses for each respondent. In Table C2 we present the count distribution for the number of correct, incorrect, and DK responses across the five financial knowledge items, both in total and separately for men and women. Among men, 54.4 percent answer either four or five of the financial knowledge items correctly, while among women only 32.5 percent meet this same standard. There is not much of a difference in the distribution of the number of incorrect responses for men and women, but there is quite a difference for men and women in the distribution for the number of DK responses across these five financial knowledge items. Among men, over three-fourths (76.2 percent) have either zero or one DK responses, compared to only 56.3 percent of women. Moreover, 22.4 percent of women have three or more DK responses, while only 11.8 percent of men meet this standard. Clearly, there is a difference in financial knowledge for men and women, with men considerably more likely to provide correct answers and women considerably more likely to provide DK answers.

TABLE C2

Count Distribution for Number of Correct, Incorrect, and Don't Know Responses Across Five Financial Knowledge Questions, in Total and by Gender

	Total			Men			Women		
	Correct	Incorrect	DK	Correct	Incorrect	DK	Correct	Incorrect	DK
0	6.7%	49.0%	40.7%	4.9%	50.0%	53.4%	8.1%	48.2%	30.4%
	(1,703)	(12,501)	(10,377)	(560)	(5,691)	(6,078)	(1,143)	(6,810)	(4,299)
1	10.9%	32.9%	24.5%	7.4%	33.2%	22.8%	13.6%	32.6%	25.9%
	(2,769)	(8,386)	(6,257)	(846)	(3,775)	(2,593)	(1,923)	(4,611)	(3,664)
2	17.4%	12.5%	17.2%	12.9%	11.2%	12.2%	21.1%	13.5%	21.2%
	(4,449)	(3,178)	(4,389)	(1,471)	(1,273)	(1,391)	(2,978)	(1,905)	(2,998)
3	22.9%	4.4%	8.8%	20.6%	4.2%	5.4%	24.8%	4.5%	11.6%
	(5,845)	(1,114)	(2,245)	(2,340)	(479)	(614)	(3,505)	(635)	(1,631)
4	25.9%	1.2%	4.6%	31.2%	1.3%	3.2%	21.7%	1.1%	5.8%
	(6,604)	(293)	(1,184)	(3,545)	(144)	(359)	(3,059)	(149)	(825)
5	16.2%	0.2%	4.1%	23.2%	0.2%	3.1%	10.8%	0.1%	5.0%
	(4,139)	(37)	(1,057)	(2,620)	(20)	(347)	(1,519)	(17)	(710)

$N = 25{,}509$.

TABLE C3

Multinomial Logit Regression of Effects of Gender on Correct, Incorrect, and Don't Know Responses to Interest Rate Question

	Incorrect/Correct		Don't Know/Correct	
Variable	*b*	*z*	*b*	*z*
Gender	0.299	7.24***	0.350	7.52***
Age	−0.047	−3.09**	−0.158	−9.54***
Education	−0.258	−17.87***	−0.286	−17.66***
Income	−0.034	−2.71**	−0.019	−1.36
Nonwhite	0.342	7.99***	0.245	5.10***
Married	−0.163	−3.58***	−0.183	−3.55***
Living with partner	0.039	1.10	−0.040	−1.01
Full-time employment	0.212	4.96***	0.239	4.96***
Number of children	0.010	0.45	0.015	0.60
Risk acceptance scale	0.020	2.57*	0.005	0.58
Confidence	−0.003	−0.19	−0.208	−12.74***
Intercept	−0.966	−7.50***	3.122	30.41**
N	24,209			
Pseudo-R^2	0.0460			
χ^2	1,570.95			
Percentage predicted correctly	0.784			
Proportional reduction in error	0.015			

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

TABLE C4

Multinomial Logit Regression of Effects of Gender on Correct, Incorrect, and Don't Know Responses to Inflation Rate Question

	Incorrect/Correct		Don't Know/Correct	
Variable	*b*	*z*	*b*	*z*
Gender	0.430	11.11***	0.742	19.27***
Age	−0.406	−28.15***	−0.404	−29.04***
Education	−0.266	−19.42***	−0.353	−26.30***
Income	−0.042	−3.62**	0.002	0.24
Nonwhite	0.425	10.79***	0.325	8.24***
Married	−0.191	−4.39***	−0.142	−3.38**
Living with partner	−0.010	−0.30	−0.015	−0.44
Full-time employment	0.007	0.19	0.120	3.07**
Number of children	0.972	4.85***	0.057	2.79**
Risk acceptance scale	0.075	10.00**	−0.035	−4.78***
Self-assessed financial knowledge	0.044	2.86**	−0.187	−13.44***
Intercept	0.596	4.84***	2.346	20.41***
N	24,209			
Pseudo-R^2	0.1083			
χ^2	4,798.74			
Percentage predicted correctly	0.677			
Proportional reduction in error	0.059			

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

TABLE C5

Multinomial Logit Regression of Effects of Gender on Correct, Incorrect, and Don't Know Responses to Bond Price Question

	Incorrect/Correct		Don't Know/Correct	
Variable	*b*	*z*	*b*	*z*
Gender	0.101	2.91**	0.586	16.66***
Age	−0.189	−13.79***	−0.217	−15.64***
Education	−0.215	−17.24***	−0.218	−17.27***
Income	−0.025	−2.20*	0.015	1.30
Nonwhite	0.323	8.68***	0.168	0.44
Married	−0.114	−2.92**	−0.103	−2.59**
Living with partner	−0.049	−1.46	−0.033	−0.96
Full-time employment	0.201	5.58***	0.021	0.58
Number of children	0.516	2.55	0.048	2.29*
Risk acceptance scale	−0.042	−6.15***	−0.130	−18.44***
Self-assessed financial knowledge	−0.050	−3.32**	−0.292	−19.92***
Intercept	2.126	17.85***	3.815	31.42***
N	24,209			
Pseudo-R^2	0.0607			
χ^2	3,214.64			
Percentage predicted correctly	0.479			
Proportional reduction in error	0.179			

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

TABLE C6

Multinomial Logit Regression of Effects of Gender on Correct, Incorrect, and Don't Know Responses to Mortgage Question

	Incorrect/Correct		Don't Know/Correct	
Variable	*b*	*z*	*b*	*z*
Gender	0.082	1.70*	0.245	5.93***
Age	−0.094	−5.36***	−0.232	−15.94***
Education	−0.291	−17.04***	−0.311	−21.45***
Income	−0.013	−0.89	0.025	1.92
Nonwhite	0.567	11.42***	0.492	11.66***
Married	−0.325	−6.04***	−0.409	−8.92***
Living with partner	0.012	0.30	−0.074	−2.11*
Full-time employment	0.357	7.04***	0.268	6.26**
Number of children	0.034	1.32	−0.019	−0.83
Risk acceptance scale	0.039	4.25***	−0.131	−1.65*
Self-assessed financial knowledge	−0.038	−2.07*	−0.228	−15.54***
Intercept	−0.980	−6.50***	1.240	10.07***
N	24,209			
Pseudo-R^2	0.0757			
χ^2	2,561.42			
Percentage predicted correctly	0.791			
Proportional reduction in error	0.015			

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

TABLE C7

Multinomial Logit Regression of Effects of Gender on Correct, Incorrect, and Don't Know Responses to Risk Diversification Question

	Incorrect/Correct		Don't Know /Correct	
Variable	*b*	*z*	*b*	*z*
Gender	0.172	3.34***	0.615	20.13***
Age	−0.328	−17.17***	−0.205	−17.41***
Education	−0.356	−19.66***	−0.296	−26.85***
Income	−0.041	−2.72**	−0.002	−0.21
Nonwhite	0.592	11.38***	0.256	7.72***
Married	−0.318	−5.43***	−0.271	−7.94***
Living with partner	−0.032	−0.71	−0.042	−1.44
Full-time employment	0.090	1.71*	0.078	2.46**
Number of children	0.131	5.04***	0.073	4.12***
Risk acceptance scale	0.067	6.77***	−0.125	−20.48***
Self-assessed financial knowledge	0.130	5.98***	−0.214	−17.41***
Intercept	−0.267	−1.57	3.122	s30.41***
N	24,209			
Pseudo-R^2	0.112			
χ^2	5,033.02			
Percentage predicted correctly	0.637			
Proportional reduction in error	0.230			

***$p < .001$; **$p < 0.01$; *$p < 0.05$.

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