

## **Take-up of Financial Education: Demographic Characteristics and Prior Knowledge**

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### **Author Note**

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**Abstract**

To help improve consumers' financial literacy, many policymakers and financial educators support financial education programs. However, some eligible consumers do not participate, limiting program effectiveness. The authors examine use of a homebuying and mortgage education website among more than 6,000 prospective homebuyers, documenting differences in take-up and duration of use by consumers' demographic characteristics, objective knowledge, and subjective knowledge. These analyses rely on a unique data match between surveys measuring consumers' characteristics and clickstream data tracking website use. The results show older participants and first-time homebuyers are more likely to take-up the website, but otherwise there is little relationship between observable demographics and take-up. Consistent with "Enrichment Theory," more objectively knowledgeable consumers have higher take-up rates. However, consistent with "feeling of knowing" theories, subjectively knowledgeable consumers show the opposite pattern, with an estimated decrease in take-up from 57% to 19% between the least and most subjectively knowledgeable, controlling for other factors. Subjectively knowledgeable consumers also use educational materials for a shorter duration. Our findings add to literature on consumer information search and inform policymakers about which consumers are likely to take-up online financial education.

*Keywords:* financial education, subjective knowledge, objective knowledge, information search, clickstream data

## **Introduction**

To help consumers make informed financial decisions, many policymakers support educational programs to raise consumers' financial literacy (World Bank 2014). Nevertheless, there is significant debate over these programs (Fernandes, Lynch, and Netemeyer 2014), as there is still “much to learn” about programs' costs and benefits (Lusardi and Mitchell 2014, p. 37). One issue in measuring the effectiveness of financial education is take-up – that is, who decides to participate – as programs cannot feasibly reach all consumers, and programs that only serve highly literate consumers are likely missing their intended audience. Research that does not account for voluntary differences in take-up can suffer from “selection bias,” where results are misleading because participants are not representative of a broader population (see Meier and Sprenger 2013). Unfortunately, because a significant proportion of the research on financial education programs uses data solely from participants (Collins and O'Rourke 2010), the issue of program take-up remains relatively unexamined. The primary purpose of this paper is to determine whether consumers who choose to take-up free online financial education differ from those who do not use education in terms of their demographic characteristics and prior knowledge. To do so, we analyze a unique data set containing survey measures of consumers' characteristics and self-reported use of financial education matched with website clickstream data capturing their take-up decisions and duration of use.

### **Correlates of financial education take-up**

Relatively few studies examine the types of consumers who are willing to take up financial education (Collins and O'Rourke 2010), as many do not collect data on non-participants (exceptions include Clark, Lusardi, and Mitchell 2017; Duflo and Saez 2003; Meier and Sprenger 2013). Indeed, we are unaware of any previous research studying take-up of

homebuying or mortgage education. As such, the closest research may be that examining the characteristics of individuals who seek out investment advice and education (see Bucher-Koenen and Koenen 2012; Kramer 2016; Lin and Lee 2004 and a review in Scholl et al. 2018).

Generally, these studies show that those with higher income and educational attainment are more likely to take up investment advice. Expanding this research into financial education, we ask:

*How does use of a financial education website correlate with consumers' demographic characteristics?*

### **Relationships between objective knowledge, subjective knowledge, and information search**

To understand take-up of financial education beyond demographic characteristics, we draw on a theoretical literature describing the relationship between prior knowledge and take-up of consumer product information (e.g., Klein and Ford 2003; Park and Lessig 1981). Starting with Brucks (1985), researchers interested in prior knowledge began to distinguish between objective and subjective knowledge. Objective knowledge is defined as “what is actually stored in memory,” whereas subjective knowledge is defined as “what individuals perceive that they know” (Brucks, 1985, p. 2). While these two measures can be highly correlated (Disney and Gathergood 2013; see Carlson et al. 2008), Alba and Hutchinson (2000) show that average subjective knowledge is often greater than average objective knowledge.

Table 1 shows research examining the relationship between prior knowledge and search for financial education, financial advice, and consumer product information. The first row of Table 1 suggests that, with few exceptions, there is a positive correlation between objective knowledge and information search. In contrast, the second row of the table shows significant disagreement regarding the relationship between subjective knowledge and search, with different researchers finding that this relationship is positive or negative. Finally, the bottom row of Table

1 shows research using proxies for knowledge, such as product experience. These papers also show a mix of empirical patterns.

[Insert Table 1 about here]

This variety in empirical findings leads to different theories about the relationship between prior knowledge and search, which vary in whether they emphasize the costs or benefits of search (see Stigler 1961). Research supporting “Enrichment Theory,” which posits a positive relationship between prior knowledge and search, suggests that having higher objective knowledge allows consumers to more easily process information, and having higher subjective knowledge allows consumers to perceive themselves as skilled processors of information (Johnson and Russo 1984; Ward and Lynch 2018). Either way, reduced processing costs lead to increased search. In contrast, research on the “feeling of knowing” suggests there is a negative relationship between prior knowledge and search (Wood and Lynch 2002; Kramer 2016). Consumers who objectively know more (or subjectively feel that they know more) have less to learn, and thereby perceive fewer benefits of searching (Schmidt and Spreng 1996). “Inverted u-shape” theories combine these two lines of thinking. Specifically, consumers with low objective knowledge have limited ability to process information because their knowledge structures are not well-developed, while consumers with high objective knowledge are not be motivated to search because they can assess products using preexisting knowledge (Johnson and Russo 1984). For subjective knowledge, those who feel ignorant may be too intimidated to search, while those who feel knowledgeable may believe they do not need to search. As such, only consumers with moderate levels of knowledge will search. Here, we ask:

*How does use of a financial education website relate to consumers' prior knowledge, as measured by (a) objective knowledge, (b) subjective knowledge, and (c) homebuying experience?*

Given prior literature, we expected that take-up would be positively correlated with consumers' objective knowledge and negatively correlated with consumers' homebuying experience.

### **Accuracy of self-reported measures of search**

The majority of research on information search analyzes data from laboratory studies or surveys (e.g., Ratchford, Lee, and Talukdar 2003; Urbany, Dickson, and Wilkie 1989).

Unfortunately, it is unclear whether surveys provide an accurate measurement of "search," behavior (see Krosnick 1999; Stone et al. 2000). We are aware of only one consumer search study that compared survey and non-survey data to examine the accuracy of reported search (Newman and Lockeman 1975). In this study, one of the authors "unobtrusively observed" (p. 218) women shopping at a department store, and recorded the number of information sources used and the time spent in the store. A few days later, the authors surveyed the women and asked them to report these measures. Newman and Lockeman (1975) found that the observational search amount was more than double than the surveyed search amount, suggesting that surveys may not always be a reliable way to measure consumer search. Therefore, in the current study, we gauge the overall accuracy of surveyed "search" by asking:

*Do survey and clickstream measures of take-up align, and show similar relationships with prior knowledge?*

### **Overview of the current research**

This study explores use of a financial education website by analyzing data from more than 6,000 prospective homebuyers. We examine four topics: (a) The demographic

characteristics associated with financial education use (measured through take-up and duration of use); (b) The demographic characteristics associated with objective and subjective mortgage knowledge; (c) The relationships between prior knowledge (objective knowledge, subjective knowledge, and experience) and financial education use; and, (d) The relationships between survey and clickstream measures of take-up, including whether they are similarly related to prior knowledge. We contribute to literature on consumer search by analyzing a large sample of participants who search in a natural setting. In contrast, research on the relationship between prior knowledge and search often relies on relatively small studies; the median sample size used in the studies shown in Table 1 is 268 participants. Our analyses provide information on whether the relationship between prior knowledge and financial education take-up is positive, negative, an inverted u-shape, or non-existent. Additionally, we help inform policy discussions on financial education by studying variation in financial knowledge and the characteristics of those who are likely to take-up financial education.

## **Method**

### **Participants**

Our data come from a longitudinal study of prospective U.S. homebuyers conducted in 2016 ([redacted for review]). Prospective homebuyers were recruited via email from Zillow.com, a real estate website, and were asked to participate in a government study on homebuying. We sent emails to prospective participants in four waves consisting of approximately 385,000, 1,056,000, 2,255,000, and 1,504,000 recruitment emails. In total, 98,872 potential participants responded to these initial invitations. We then screened respondents, requiring that they were involved in financial decisions in their household, planning to buy a house in the next three months, and not professionally involved in the real estate industry.<sup>1</sup> The screening procedures

retained 23,407 respondents. Of those, 19,394 completed a baseline enrollment survey and were randomly assigned to one of three groups. The current study examines the 6,461 prospective homebuyers who were assigned to the “online financial education” group. We retained data from the 6,277 participants who reported key survey measures of subjective and objective mortgage knowledge (see Survey Measures below), and omitted the remaining participants.

Table 2 displays characteristics of our participants as compared to the 2015 National Survey of Mortgage Originations (NSMO), a nationally representative survey of mortgage borrowers.<sup>ii</sup> The Table shows that, despite potential differences between prospective homebuyers (in our sample) and mortgage borrowers, many sample characteristics are similar. Our study had proportionally fewer participants with some college education or a college degree (but not those with post-graduate education) and fewer participants with superprime credit scores.

[Insert Table 2 about here]

## **Study Background**

**Study Duration and Activities.** Prospective homebuyers first completed an enrollment survey. They were then invited to follow-up surveys at two-week intervals until they bought a house or 12 weeks passed (see [redacted for review] for details). Those who missed two follow-up surveys were not invited to the remainder of the study. Among those who enrolled, 72.8 percent completed the first follow-up survey, and 43.3 percent missed two follow-up surveys.

At the end of every survey, participants were encouraged to visit a website containing educational material on how to buy a home and acquire a mortgage. The encouragement varied depending on participants’ reported progress searching for a home; representative language is: “You told us that you’re searching for a home, but don’t quite feel ready to buy. Perhaps you still have questions about the process, or want a better sense of what you’re getting into financially.



The Consumer Financial Protection Bureau's new Owning a Home Toolkit can help.<sup>iii</sup> The underlined text linked to [www.consumerfinance.gov/owning-a-home](http://www.consumerfinance.gov/owning-a-home).

After enrolling, participants also received a follow-up email thanking them for their participation and reminding them about the website (“In two weeks, we’ll contact you again to see how things are going. In the meantime, check out the Consumer Financial Protection Bureau’s free ‘Owning a Home’ tools. They’ll help you navigate the home buying process, ask the right questions, and choose a mortgage that’s right for you.”). Thus, between the enrollment survey and first follow-up survey, participants were asked to visit the educational website twice.

**Financial Education Website.** The financial education website contained comprehensive information on homebuying, including information on mortgage applications, comparing mortgages, and the mortgage closing process. As all participants stated that they were planning to buy a home in the next three months, this information was presented in what financial educators call a “teachable moment,” when it should have been most effective (Kaiser and Menkhoff 2017). Since the time of this study, the website has been updated and improved, thus our results may not fully reflect current materials.

#### **Clickstream data: Measuring take-up of financial education resources and extent of use**

We tracked take-up of the financial education website using unique hyperlinks in the survey and emails (see sample language in “Study Duration and Activities”). Clicking on these links created a cookie on participants’ browsers that detected future visits to the educational website. To protect participants’ privacy, the cookies did not record any information outside of the educational website, and all cookies were disabled at the end of the study. Furthermore, the clickstream data were anonymous and matched to survey data through a third-party. The clickstream data included information on website pages that participants visited, the time when

they entered each page, duration on each page, and the activities they performed. We examined take-up and the total time that participants spent on the website, following Couper et al. (2010).

**Calculating take-up.** We classified study participants who visited the financial education website as having “taken-up” the website. Overall, 37 percent of the study participants took up the website in the first two weeks and 47 percent of participants did so in total (Table 3).

[Insert Table 3 about here]

**Calculating extent of use through duration on website.** The website system captured the duration of visits in two ways. Activity within the website (e.g., from one financial education page to another) was captured precisely using timestamps. In contrast, activity that took participants off the website (including closing the website browser) was only captured through a backup timer. This timer checked for active use after a user entered a page, and recorded durations of 20 seconds, 1, 3, 5, or 10 minutes. There was no record after a 30-minute period of no mouse movement. We calculated the aggregate duration of all the pages a participant visited, using the backup timer for pages where the timestamp values were missing. This calculation means that visits of less than 20 seconds were recorded as zero seconds long.

Table 3 shows summary statistics on website usage. The distribution of durations was skewed; the median time spent on the website in the first two weeks was 264 seconds, but 11.4% of visitors had durations of zero seconds. These zero second durations included users who exited the website after less than 20 seconds, and were therefore not recorded by the timer system.

### **Survey data: Measuring take-up of financial education resources**

On all follow-up surveys (i.e., those administered after enrollment, during weeks two through 12), participants reported which of 11 information sources they used to gather general mortgage knowledge, including a “government website.”<sup>iv</sup> The specific wording was, “Since we

last heard from you, how often have you used the following sources to learn about the mortgage process and the kinds of mortgages generally available?” Participants could indicate how frequently they had used each source (never, once or twice, or three or more times).

Participants who indicated using a government website were directed to a follow-up question asking “Which government websites did you use to learn about the mortgage process and the kinds of mortgages generally available?” and saw a list of nine possible sources.<sup>v</sup> We classified respondents who reported the CFPB’s website as having taken-up the relevant financial education website, *Owning a Home*. This classification may undercount those who visited *Owning a Home*, as some participants may not have realized that it was a government website, and therefore missed the initial question that would allow them to choose this option. The two-step question structure was important for reducing contamination in associated research that required encouraging certain participants to visit that website ([redacted for review]). Table 3 shows that 6 percent of respondents to the first follow-up survey stated that they visited the website.

### **Survey data: Measuring prior knowledge and background characteristics**

**Objective knowledge.** Objective knowledge was measured using a 12-item multiple choice scale (see Supplementary Materials for questions and answers). Nine questions concentrated on mortgage knowledge. For example, one question asked “Typically, if a borrower pays extra toward their mortgage’s principal balance each month, how does that affect the borrower’s total mortgage costs over the life of the loan?” with response options of “The total costs are lower,” (correct) “The total costs are the same,” “The total costs are higher,” or “I don’t know.” These questions were designed in consultation with CFPB mortgage experts. They were

subsequently refined using cognitive interviews (Visser, Krosnick, and Lavrakas 2000) and an online survey with 103 consumers ([redacted for review]).

In addition, three questions asked about general financial literacy (Lusardi and Mitchell 2011). The two scales were originally designed as separate measures; however, factor analysis suggested one factor (eigenvalue = 4.84), and the two subscales were moderately correlated ( $r = 0.52, p < .001$ ). As such, we combined the measures and scored participants' responses so that they ranged from zero to twelve. "I don't know" responses were coded as incorrect.

**Subjective knowledge.** Subjective knowledge was calculated as the sum of six multiple choice questions eliciting consumers' confidence in their ability to evaluate mortgage information and navigate the mortgage lending process ( $\alpha = .82$ ; see Supplementary Materials for questions and answers). For example, one item asked, "How confident are you that you can tell when a mortgage offer is a bad deal?" with the response options of 0 = Not at all confident to 2 = Very confident. These questions were designed in consultation with CFPB mortgage experts and informed by research on consumers' perceived mortgage abilities (HUD 2017) and financial skills (CFPB 2017). They were subsequently refined using cognitive interviews (Visser, Krosnick, and Lavrakas 2000) and an online survey with 103 consumers ([redacted for review]).

**Psychological and economic characteristics.** The enrollment survey also collected participants' psychological and economic characteristics. Time preferences were measured using a series of two questions that asked respondents to trade-off between a smaller amount of money delivered sooner and a larger amount of money delivered later (e.g., "Hypothetically, would you prefer to receive \$20 today or \$25 in four weeks?"), yielding four groups (for a similar elicitation, see Read 2001). Risk preferences were measured in a similar way (e.g., "Hypothetically, which would you prefer: a 50% chance of getting \$35, or a 100% chance of

getting \$15?”), resulting in four categories (for a similar elicitation, see Hsee and Weber 1999).

We measured participants’ subjective numeracy using three items from Fagerlin et al. (2007) and internal versus external locus of control using four questions on individual agency (Rotter 1966).

We expected that participants who were more patient would be more likely to take-up financial education, consistent with Meier and Sprenger (2013). We did not have hypotheses about the remaining measures, and used them as controls.

**Demographic characteristics.** At the end of the enrollment survey, participants reported age, race, educational attainment, household income, and credit score (see Table 2). We also asked whether participants had previously bought a home, and if so, the year of their most recent home purchase (before 1999, 2000-2004, 2005-2007 or 2008 onward). Some literature has used product experience as a proxy for, or separate construct from, objective and subjective knowledge (Table 1). We follow this approach by controlling for homebuying experience in our analyses. Table 3 shows descriptive statistics for our primary measures, including participants’ homebuying experience, as well as correlations between them.

### **Analytic Plan**

The homebuying study lasted for 12 weeks after enrollment, allowing us to study take-up over 12 weeks. However, our primary analyses concentrate on take-up in the two weeks following enrollment. We emphasize this two-week period for two reasons. First, participants’ behavior affected communications about the website from weeks two through 12. Specifically, participants who stopped answering surveys were not encouraged to visit the website as much as those who continued (described in “Study Duration and Activities”), possibly leading to differences in take-up. Second, researchers have documented “mere measurement” and “panel conditioning” effects, where answering survey questions about certain topics can affect

respondents' behaviors and subsequent survey responses on those topics (e.g., Fitzsimons and Morwitz 1996; Halpern-Manners, Warren, and Torche 2014). Both of these factors are mitigated over the first two weeks, when all participants received the same number of reminders to visit the website and answered information search questions only once.<sup>vi</sup> We show results for the 12-week study period in each section below as a robustness check.

## Results

### **What demographic characteristics are associated with financial education take-up?**

We ran a logistic regression predicting take-up (versus no take-up) based on demographic characteristics (Table 4). Perhaps surprisingly, the results show that demographics did not generally predict take-up. The exceptions are that, controlling for other demographic characteristics, older participants were more likely to take-up the website than younger participants and Asians are more likely to use the website than members of other racial and ethnic groups. Prior homebuying experience was negatively related to website take-up; the more recent the homebuying experience, the less likely a participant was to use the website.

[Insert Table 4 about here]

**Robustness checks.** Demographic patterns were consistent when examining take-up over the entire 12-week study (Table 4). The results for the 12-week period additionally show that unmarried participants, participants who had children at home, and participants with lower self-reported credit scores were less likely to visit the website.

### **What demographic characteristics are associated with amount of website use?**

We ran a regression predicting the number of seconds that participants stayed on the website, using demographic characteristics. Conditional on visiting the website at all and controlling for other demographic characteristics, older participants (age 50+) spent less time on

the website than younger participants (age 18-29) (Table 5). Additionally, participants who reported having a real estate agent used the website for a longer time. No other demographic characteristics significantly correlated with the amount of time spent on the website.

**Robustness checks.** The second column of Table 5 shows that, when analyzing the 12-week period, participants aged 50 and above used the website for a significantly shorter period than younger participants. Additionally, participants who had purchased a home since 2007 used the website for less time than prospective first-time homebuyers.

[Insert Table 5 about here]

### **What demographic characteristics are associated with objective and subjective mortgage knowledge?**

Using linear regressions, we found that both objective and subjective knowledge were positively correlated with income, credit score, being married, being the sole financial decision maker, having a real estate agent, and prior homebuying experience (Table 6). Age and educational attainment were only significantly correlated with subjective knowledge; older and more educated participants were not more knowledgeable about mortgages on average, but they thought they knew more. Finally, Hispanic and Asian participants had lower objective knowledge than non-Hispanic White participants, and non-Hispanic White participants had higher subjective knowledge than those from all other groups (Table 6).

[Insert Table 6 about here]

### **What is the relationship between financial education take-up and prior knowledge?**

We used a logistic regression to predict take-up in the first two weeks after enrollment (versus no take-up) based on objective knowledge, subjective knowledge, and homebuying experience, controlling for psychological, economic, and demographic characteristics (Table 7

and Supplementary Materials for full regression table). This regression provides significantly more explanatory power than one that omits subjective and objective knowledge (likelihood ratio test  $\chi^2(2) = 178.78, p < 0.001$ ). The results show that, controlling for other characteristics, website take-up was more likely among participants with higher objective knowledge, and less likely among those with higher subjective knowledge. The coefficient for objective knowledge suggests that, for each one point increase in objective knowledge, the odds of take-up increase by a factor of 1.09. For a one point increase in subjective knowledge, the odds of take-up decrease by a factor of 1.14 ( $= 1/.875$ ).<sup>vii</sup> The results also suggest that participants with homebuying experience were less likely to take-up the website than those with no experience, and this difference was largest among those with recent homebuying experience (i.e., who had bought their most recent home in 2008 or later).<sup>viii</sup>

[Insert Table 7 about here]

An alternative way of understanding these results is to estimate the probability of take-up for consumers with different levels of objective and subjective knowledge (Figure 1). To do so, we model a consumer with average characteristics, and apply different levels of objective or subjective knowledge. Because certain combinations of objective and subjective knowledge are empirically rare (e.g., no participants have objective knowledge of 12 and subjective knowledge of zero), we simultaneously adjust both levels of knowledge using predicted sample averages. For example, when calculating take-up for a subjective knowledge score of three, objective knowledge is set to five, but when calculating take-up for subjective knowledge score of nine, objective knowledge is set to 7.4. Figure 1 shows that increased objective knowledge predicts an increase in take-up from approximately 26 to 46 percent, and increased subjective knowledge predicts a decline in take-up from approximately 57 to 19 percent.



[Insert Figure 1 about here]

To gauge the possibility of an inverted u-shape relationship between prior knowledge and take-up, we used three methods. First, we changed our regression models to include three levels of objective knowledge (low = 0-4, medium = 5-7, and high = 8-12) and subjective knowledge (low = 0-4, medium = 5-6, and high = 7-12), with cutoffs designed to provide a roughly even distribution of participants across the three categories, following Kiel and Layton (1981). This approach revealed monotonic relationships between take-up and prior knowledge. Second, in a separate model we included both linear and squared terms for objective and subjective knowledge. This approach showed very small coefficients on the squared terms, with varying statistical significance (odds ratio on objective<sup>2</sup> = 0.99,  $p = 0.05$ ; odds ratio on subjective<sup>2</sup> = 1.00,  $p = 0.07$ ). Finally, we used Lind and Mehlum's (2010) method, which is similar to that described by Simonsohn (2018), to look for a point at which the slope of the relationship changes signs. This test also fails to reject a monotonic relationship between prior knowledge and take-up. Thus, we conclude that there is no u-shape relationship between knowledge and take-up.

**Robustness checks.** We analyzed take-up throughout the entire 12-week study period (Table 7, column 2). Controlling for other characteristics, objective knowledge was positively correlated with take-up, while subjective knowledge was negatively correlated with take-up.

#### **What is the relationship between extent of financial education use and prior knowledge?**

We ran a linear regression on visit durations based on consumers' objective knowledge, subjective knowledge, and homebuying experience, controlling for psychological, economic, and demographic characteristics (Table 8). This expanded regression provides significantly more explanatory power than one that omits prior knowledge (likelihood ratio test  $\chi^2(2) = 13.94$ ;  $p = 0.001$ ). The results suggest that a one-point increase in subjective knowledge is correlated with a

35 second reduction in the time spent on the website, whereas a one-point increase in objective knowledge is correlated with a (not statistically significant) 17 second increase.<sup>ix</sup> Figure 2 shows these results graphically by plotting the predicted duration of participants' visits at each level of prior knowledge, using average consumer characteristics and measures of prior knowledge that are updated dynamically.

[Insert Table 5 and Figure 2 about here]

To test for an inverted u-shape relationship, we used the same three methods as for take-up. Neither the categories of prior knowledge (i.e., high, medium, and low), nor the quadratic terms showed any indication of a u-shape relationship ( $B$  on objective<sup>2</sup> = 2.93,  $p = 0.20$ ;  $B$  on subjective<sup>2</sup> = -1.34,  $p = 0.38$ ). The test developed by Lind and Mehlum (2010) also failed to reject a monotonic relationship between prior knowledge and duration.

**Robustness checks.** Using the entire 12-week study period, a linear regression model showed that a one-point increase in objective knowledge was associated with a 52 second increase in time spent on the website, while a one-point increase in subjective knowledge predicted a 48 second decrease in duration (Table 8, column 2). Prior homebuying experience was associated with a decrease in the time spent on the website; however, the statistical significance of this relationship varied. Results for prior knowledge were also consistent when accounting for potential measurement error by winsorizing times over 30 minutes or excluding durations recorded by the backup timer (see Limitations).

### **Do survey and clickstream measures of take-up align and show similar relationships with prior knowledge?**

To provide a comparison to past literature that relies on surveys, we compared survey and clickstream measures of take-up (Table 9). As shown, there is some mismatch between the two

sources, as the survey reports (5.9 percent of respondents in the first two weeks) indicate less use than the clickstream data (37.9 percent).<sup>x</sup> However, participants who reported going to the survey were fairly accurate; the top panel shows that in the first two weeks following the enrollment survey, 267 people reported using the website, of which 194 (72.7 percent) were located in the clickstream data. Similarly, among the 4,297 participants who did not report using the website, 2,761 (64.3 percent) were not located in the clickstream data. These patterns mean that there is a positive correlation between the two measures of take-up (see also Table 3).

[Insert Table 9 about here]

To study the relationship with prior knowledge, we ran a logistic regression predicting reported take-up as opposed to a clickstream measure of take-up (Table 7, column 3).<sup>xi</sup> As shown, the results were robust across the two data sources. For each one point increase in objective knowledge, the odds of reported take-up increased by a factor of 1.14. For a one point increase in subjective knowledge, the odds of take-up decreased by a factor of 1.07 ( $= 1 / .938$ ). Participants with previous homebuying experience were also less likely to report take-up.

### **General Discussion**

Assessments of financial education programs are limited by a lack of research on who decides to take up those programs (Collins and O'Rourke 2010; Lusardi et al. 2014). We examine this issue using both clickstream data and self-reported measures of take-up from a large number of prospective homebuyers over three months. In doing so, we first explored the relationship between take-up and consumers' demographic characteristics. Predicting take-up from demographic characteristics alone is difficult, as only age and previous homebuying experience were significantly related to take-up. In contrast to research on investment advice

(e.g., Scholl et al. 2018), we did not find consistent patterns between take-up and consumers' educational attainment or household income.

We next explored how consumers' demographic characteristics related to their prior knowledge, finding that income, credit score, being married, being the sole decision maker, having a real estate agent, and previous homebuying experience were positively correlated with both types of knowledge. Education and age were only positively correlated with subjective knowledge. Together with the findings above, these results show that younger consumers were both less knowledgeable and less likely to take up the free educational materials offered to them during this study. As such, policymakers may be particularly interested in focusing on younger homebuyers. At the same time, certain groups with low objective knowledge, such as first-time homebuyers, did take-up financial education; these individuals may require less outreach.

Third, we explored the relationship between take-up and consumers' prior knowledge, finding support for two theories. Consistent with "Enrichment Theory" (Johnson and Russo 1984), consumers with higher levels of objective knowledge are more likely to take up financial education about homebuying and mortgage shopping. Consistent with "feeling of knowing" theories (Wood and Lynch 2002), consumers with higher subjective knowledge are less likely to take up financial education and, when they do engage, use it for a shorter amount of time. Consumers with previous homebuying experience, a proxy for knowledge, were also generally less likely to take up financial education. These findings add to literature on consumer search, which continues to debate whether the relationship between prior knowledge and search is positive, negative, an inverted u-shape, or nonexistent (see Table 1 and Jiang and Rosenblum 2014). Our results are counter to prior null findings (e.g., Kramer 2016) and those suggesting an inverted u-shape relationship (e.g., Bettman and Park 1980; Raju, Lonial, and Mangold 1995).

Furthermore, the effects were large; for instance, moving from lowest to highest objective knowledge nearly doubled the likelihood of visiting the website, while going from highest to lowest subjective knowledge tripled the likelihood.

Finally, we examined the relationship between survey and clickstream measures of take-up. Despite some mismatch between the sources on an individual level (Table 9), we found that survey reports of search might be a reasonable proxy for actual search, as there was a positive correlation between the two measures, and estimated relationships with prior knowledge were similar across both. This comparison may increase confidence in research that relies primarily on self-reported search behavior, an issue that has to our knowledge, only been explored by Newman and Lockeman (1975).

### **Limitations and Directions for Future Research**

The primary limitation of the current study is that we did not manipulate consumers' homebuying experience, objective knowledge, or subjective knowledge, and therefore cannot say that changes in prior knowledge *cause* changes in financial education take-up. With correlational analyses, alternative explanations are possible. For example, consumers could consistently differ in their financial education take-up, leading to differences that now appear in our measures of prior knowledge. To explore such alternatives, research could examine whether the patterns between prior knowledge and take-up are robust when including other (currently unavailable) characteristics, such as maximizer tendencies, need for cognition, or conscientiousness. More directly, research could pursue experiments that manipulate prior knowledge and measure effects on information search. To our knowledge, only Wood and Lynch (2002) have experimented with prior knowledge in this way; consistent with our results, these authors find a negative relationship between subjective knowledge and search.

A second issue is potential measurement error with clickstream data, which comes in at least four forms. First, if a participant cleared their website browser's cookies and returned to the financial education website without using a customized hyperlink, we would omit the return visit. Second, if a user clicked on a customized link in one browser, and returned through a direct visit on another browser, we would not capture their direct visit. Third, users may have skipped the hyperlink altogether, and searched for the Owning a Home website. In that case, we would have completely missed their website use. Finally, we may have overestimated the duration of use among users who left the website open for an extended period without being present. Each of these issues may cause some noise that could affect our results.

Finally, while our research provides a robust analysis of financial education take-up, it does not examine outcomes like home or mortgage choice. Engaging in financial education could improve consumer outcomes by helping consumers to prepare for closing or identify better mortgage rates. Conversely, education could crowd-out other activities, like talking with real estate agents or lenders about the mortgage process. Research has shown that subjective knowledge may affect financial decision-making for outcomes beyond take-up (see Hadar, Sood, and Fox 2013), making it critical to test financial education programs for a variety of effects.

### **Policy Implications**

Policymakers considering financial education programs may be interested in using our results to inform policy design. In this section, we highlight three themes from this research that may be useful: (1) factors affecting take-up and use, (2) online education, and (3) targeted, “just in time” education.

**Factors affecting educational take-up and use.** To increase take-up, policymakers could experiment with different ways of advertising education, especially among groups that are

generally unlikely to engage. Consumers who feel unknowledgeable are more likely to use financial education, raising the possibility that illustrating low subjective knowledge may help increase their take-up. If policymakers cannot observe consumers' subjective knowledge, they could also try to target specific groups. For example, in this study, younger participants had lower take-up rates, and therefore may benefit most from additional encouragement.

A second question is how to keep users engaged; in the current research, many website visitors left after less than 20 seconds. An initial step could be to analyze clickstream data to understand which areas experience significant drop-off. These pages could also be subject to testing designed to understand users' reactions, particularly if reactions could vary across different groups. For example, older adults used the website for a shorter time than younger consumers in this research, so older adults may have different perceptions of usability. Finally, policymakers might draw on other research for ideas about increasing engagement. For instance, they might attempt to increase the number of opportunities that consumers are exposed to educational materials, as repeated exposure to visual displays increases liking, even for financial documents (Chin and Bruine de Bruin in press; Kunst-Wilson and Zajonc 1980).

**Online education.** Online education may offer significant benefits for policymakers. In particular, these programs are relatively inexpensive to disseminate, with the website here advertised to over 6,000 prospective homebuyers through a single email campaign. By allowing consumers to engage with financial information alone (versus with an observer present), online programs might receive also more attention (Chin and Beckett in press). Indeed, we find that online financial education may not be subject to the same demographic selection as traditional programs, as lower-income and less well educated respondents show take-up that is statistically indistinguishable from that of higher-income and better educated respondents, all else equal.

At the same time, online education might also neglect the needs of some consumers, such as those who prefer to have a teacher available to explain financial concepts. While we cannot speak to this question directly, other research suggests there is a positive correlation between speaking with others about financial topics and undertaking beneficial financial decisions such as enrolling in automatic savings (Middlewood et al. 2018). Future research should examine whether online programs underserve consumers who prefer these social interactions.

**Targeted, “just in time” financial education.** “Just in time” education (Fernandes, Lynch, and Netemeyer 2014), is designed to be relevant to consumers’ information needs. One practical challenge with targeted education is reaching consumers at the relevant decision point. For our research, we asked prospective homebuyers how likely they were to buy a home in the next three months. Without additional experimentation, it is unclear whether consumers needed to receive education further in advance (e.g., years earlier, to save a larger down payment) or closer to their home purchase. More generally, policymakers might need to think creatively about how to access consumers at the right times. The results here show a weak positive correlation between using a real estate agent and website take-up. As such, real estate agents may be one potential avenue for disseminating information to prospective homebuyers.

## **Conclusions**

Efforts to promote financial literacy and informed decision making will be more effective when consumers take advantage of educational resources that are available. By better understanding the psychological and demographic profiles and underlying decision-making processes of those who take-up financial education programs, it may be possible to design and distribute financial education materials in a more effective way.



### Endnotes

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<sup>i</sup> Of the 75,465 who were screened out, the majority (73%) were ineligible because they had recently bought a home or did not have plans to buy a home in the next three months. Other reasons for being ineligible were having no plans to use a mortgage (5%), not being involved in the mortgage decision (1%), working in the mortgage industry (1%), and failing to answer one or more of the screening questions.

<sup>ii</sup> The NSMO is conducted by the CFPB and the Federal Housing Finance Authority. The full report can be found here: [https://www.consumerfinance.gov/documents/6458/cfpb\\_NMDB-technical-report\\_6.0.pdf](https://www.consumerfinance.gov/documents/6458/cfpb_NMDB-technical-report_6.0.pdf). The NSMO data comes from a year before our study, but we do not expect characteristics of homebuyers to have changed dramatically over one year.

<sup>iii</sup> Another participant may have read, “You told us that you’ve found a home you want to buy and are ready to make an offer. Once you make an offer, things will start to move very fast. If you haven’t ready, now is the time to start thinking seriously about your mortgage options. The Consumer Financial Protection Bureau’s new Owning a Home Toolkit can help. Learn what interest rate you can expect, and how your mortgage choices affect your interest rate. Try out different scenarios, and learn how to negotiate with lenders. Visit today.”

<sup>iv</sup> The remaining ten sources were: a book about home buying; home buying or real estate website; mortgage lender or broker (includes banks and credit unions); real estate agent; builder; banker or financial planner; newspaper or magazine; housing counselor; friend, relative, or co-worker; or other.

<sup>v</sup> The sources were: Department of Housing and Urban Development (HUD); Federal Reserve Board (FRB); Consumer Financial Protection Bureau (CFPB); Department of Veteran’s Affairs (VA); US Department of Agriculture (USDA), also known as Rural Development (RD); my state’s website (including sites for veterans); my city’s website; or other.

<sup>vi</sup> Two weeks is the expected period between the enrollment survey and the first follow-up survey. However, 147 participants who went to the website after two weeks are counted in this group, as they still had not completed the first follow-up survey. We will refer to “two weeks” for the sake of expediency.

<sup>vii</sup> We run 5-fold cross validation, finding that the estimates for the subjective knowledge odds ratio range from 0.867 to 0.881 and the estimates for the objective knowledge odds ratio range from 1.085 to 1.103. All coefficients are significant in each iteration at the  $\alpha = .001$  level.

<sup>viii</sup> We also examine potential interactions between subjective knowledge, objective knowledge, and homebuying experience, finding that none of these interactions are significant (Supplementary Material Table 3). We choose to model each type of knowledge separately, rather than constructing a measure of “overconfidence,” following recommendations from Parker and Stone (2014).

<sup>ix</sup> We run 5-fold cross validation, finding that the estimates for subjective knowledge range from -41.7 to -27.4 and are significant at the  $\alpha = .01$  level in every iteration. The objective knowledge coefficient ranges from 8.9 to 29.7, and is not significant at the  $\alpha = .05$  level.

<sup>x</sup> Note that, as elsewhere, clickstream “users” include those with zero second durations.

<sup>xi</sup> We did not conduct analysis to predict reported duration because the survey did not ask participants how many seconds they spent using the website; omitting this question helped assuage concerns about overall survey burden.

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**Table 1.** Literature examining the relationship between prior knowledge and information search.

Knowledge Type	Relationship between Knowledge Type and Search			
	Positive	Negative	Inverted u-shape	No relationship/ambiguous
Objective knowledge	<b>Alyousif and Kalenkoski 2017;</b> Bachmann and Hens 2015; Bhattacharya et al. 2012; <b>Brucks 1985;</b> Bucher-Koenen and Koenen 2011; Calcagno and Monticone 2015; Feick and Price 1987; <b>Mishra and Kumar 2011;</b> Ward and Lynch 2018	<b>Meier and Sprenger 2013;</b> Miyake and Norman 1979	<b>Raju, Lonial, and Mangold 1995</b>	<b>Kramer 2016;</b> Rouet 2003
Subjective knowledge	<b>Alyousif and Kalenkoski 2017; Kiel and Layton 1981;</b> Lin and Lee 2004; Loibl and Hira 2009; Loibl et al. 2009; <b>Mishra and Kumar 2011;</b> Nilsson, Nordvall, and Isberg 2010; <b>Raju, Lonial, and Mangold 1995;</b> <b>Srinivasan and Ratchford 1991</b>	<b>Brucks 1985;</b> Duncan and Olshavsky 1982; <b>Kramer 2016;</b> Locander and Hermann 1979; Radecki and Jaccard 1995; <b>Wood and Lynch 2002</b>	<b>Klein and Ford 2003</b>	Urbany et al., 1989
Knowledge Proxy	<b>Klein and Ford 2003;</b> <b>Meier and Sprenger 2013</b>	Beatty and Smith 1987; Claxton, Fry, and Portis 1974; <b>Kiel and Layton 1981;</b> <b>Srinivasan and Ratchford 1991</b>	Bettman and Park 1980; Moorthy, Ratchford, and Talukdar 1997; Rao and Sieben 1992	Bennett and Mandell 1969; Rao and Monroe 1988; Johnson and Russo 1984

*Note.* The classification of knowledge type in this table reflects the authors' judgment and may deviate from the characterization given in the original work. For example, Locander and Hermann (1979) examine "specific self-confidence," an aggregate rating of how confident people are in their ability to assess goods in a purchase situation. We consider this rating to be a measure of subjective knowledge. Bolded citations indicate that the paper includes multiple knowledge types; therefore, these papers appear in multiple rows. Throughout the literature, search is measured in multiple ways, including how many product attributes consumers examine, the number of questions asked, the number of shops or sellers visited, and time spent searching.

**Table 2.** Demographic characteristics of study participants and comparison to the 2015 National Survey of Mortgage Originations (NSMO).

Variable	Sample Percent	NSMO Percent	Difference of >5 pct. pts
<b>Age</b>			
18-29	.172	.171	
30-39	.334	.329	
40-49	.206	.211	
50 and older	.285	.289	
Not reported	.003	--	
<b>Race</b>			
Non-Hispanic White	.694	.731	
Black	.092	.063	
Hispanic of Any Race	.097	.092	
Asian	.056	.076	
Other*	.045	.038	
Not reported	.016	--	
<b>Education</b>			
Less than high school	.006	.014	
High school or GED	.096	.102	
Some college**	.296	.234	X
College graduate	.318	.377	X
Postgraduate	.284	.273	
<b>Annual Household Income</b>			
Under \$35,000	.080	.071	
\$35,000 to \$49,999	.118	.116	
\$50,000 to \$74,999	.203	.226	
\$75,000 to \$99,999	.173	.178	
\$100,000 to \$174,999	.225	.266	
\$175,000 or more	.095	.143	
Not reported	.101	--	
<b>Credit score †</b>			
Subprime (<639)	.276	.111	X
Prime	.260	.296	
Superprime (720+)	.389	.592	X
<b>Married</b>			
	.585	.634	
<b>Repeat Homebuyer‡</b>			
	.573	.551	
<i>N</i>	6277	6188	

*Note.* \*Includes respondents who reported being American Indian/Alaska Native or Native Hawaiian/Pacific Islander and respondents who reported multiple race categories.

\*\*Includes associates and technical degrees.

†In the NSMO, credit scores are from Vantage, whereas in our sample they are self-reports. Statistics for the sample do not sum to 100% because participants could report “I don’t know.”

‡ In the NSMO, homebuyers are classified as first-time homebuyers (37.1%), investment, seasonal, or relative purchases (7.9%) or repeat homebuyers.

**Table 3.** Summary statistics and correlations between primary measures.

	N	M	SD	1	2	3	4	5	6	7
1. Objective knowledge	6277	6.54	2.90	--						
2. Subjective knowledge	6277	5.89	2.98	.40	--					
3. Ever bought house (0/1)	6251	0.57	0.49	.39	.30	--				
4. Take-up within first two weeks (clickstream data, 0/1)	6277	0.37	0.48	.05	-.13	-.07	--			
5. Take-up within 12 weeks (clickstream data, 0/1)	6277	0.47	0.50	.06	-.13	-.05	.81	--		
6. Take-up within first two weeks (survey data, 0/1)	4567	0.06	0.24	.06	-.02	-.06	.18	.15	--	
7. Duration within first two weeks (clickstream data, seconds)	2300	651.9	1152.6	.01	-.08	-.08	--	--	.15	--
8. Duration within 12 weeks (clickstream data, seconds)	2956	964.9	2139.0	.04	-.05	-.07	.11	--	.16	.55

*Note.* All correlations are significant at  $\alpha = 0.05$ , with the exceptions of the correlations between duration in the first two weeks (#7) and objective knowledge (#1), and survey data take-up (#6) and subjective knowledge (#2).

**Table 4.** Logistic regression results predicting financial education take-up from demographic characteristics.

	(1) Take-up within first two weeks (clickstream data) OR (s.e.)	(2) Take-up within twelve weeks (clickstream data) OR (s.e.)
Age (vs. 18-29)		
30-39	1.367*** (0.118)	1.423*** (0.1180)
40-49	1.494** (0.149)	1.673*** (0.1607)
50 and older	2.076*** (0.214)	2.265*** (0.2256)
Race/Ethnicity (vs. non-Hispanic White)		
Black	1.079 (0.105)	1.126 (0.1068)
Hispanic of any race	1.074 (0.0993)	1.066 (0.0957)
Asian	1.530*** (0.178)	1.418** (0.1646)
Other	0.911 (0.109)	0.978 (0.1113)
Education (vs. < high school)		
High school graduate or GED	0.890 (0.313)	0.883 (0.3009)
Some college	0.996 (0.343)	1.103 (0.3683)
College graduate	1.093 (0.378)	1.206 (0.4041)
Postgraduate studies	1.142 (0.396)	1.246 (0.4188)
Employment (vs. full-time)		
Part-time	0.889 (0.102)	0.858 (0.0940)
Not employed	0.897 (0.0699)	0.917 (0.0689)
Self-employed	0.957 (0.0903)	1.000 (0.0909)
Employment not reported	0.681 (0.424)	0.603 (0.3609)
Annual household income (vs. < \$35,000)		
\$35,000 to \$49,999	1.173 (0.144)	1.270** (0.1510)
\$50,000 to \$74,999	1.133 (0.130)	1.130 (0.1257)



\$75,000 to \$99,999	1.183 (0.142)	1.212* (0.1411)
\$100,000 to \$174,999	1.007 (0.122)	0.983 (0.1152)
\$175,000 or higher	0.945 (0.136)	1.010 (0.1395)
Income not reported	0.778 (0.107)	0.774* (0.1021)
Self-Reported Credit Score (vs. Subprime)		
Prime	1.114 (0.0858)	1.162** (0.0866)
Superprime	1.165* (0.0899)	1.252** (0.0936)
DK/Refused	0.854 (0.102)	0.908 (0.1028)
Married=0	0.900 (0.0628)	0.884* (0.0599)
Kids at home=1	0.910 (0.0556)	0.847** (0.0500)
Sole financial decision maker=1	1.077 (0.0752)	1.046 (0.0710)
Used real estate agent=1	1.064 (0.0585)	1.057 (0.0562)
Most recent home purchase (vs. none)		
Before 1999	0.714** (0.0731)	0.654*** (0.0657)
2000-2004	0.631*** (0.0632)	0.630*** (0.0610)
2005-2007	0.676*** (0.0653)	0.684*** (0.0640)
2008 or later	0.509*** (0.0418)	0.549*** (0.0430)
Observations	6227	6227
Pseudo $R^2$	0.021	0.023
<i>AIC</i>	8076.6	8481.3

*Note.* Odds ratios; standard errors in parentheses.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 5.** Linear regression results predicting website visit duration (seconds) from demographic characteristics.

	(1) Duration within first two weeks (clickstream) B (s.e.)	(2) Duration within twelve weeks (clickstream) B (s.e.)
Age (vs. 18-29)		
30-39	-40.87 (79.07)	21.09 (130.7)
40-49	-159.7 (92.29)	-141.9 (150.8)
50 and older	-325.6*** (93.02)	-323.9* (153.7)
Race/Ethnicity (vs. non-Hispanic White)		
Black	-43.71 (86.10)	-89.99 (142.4)
Hispanic of any race	-86.69 (82.51)	-112.3 (137.3)
Asian	-30.60 (97.41)	-111.0 (165.3)
Other	-238.5* (109.7)	-274.0 (177.5)
Education (vs. < high school)		
High school graduate or GED	-194.0 (318.7)	-484.2 (539.2)
Some college	-134.5 (312.0)	-190.3 (527.5)
College graduate	35.29 (313.5)	-98.23 (530.5)
Postgraduate studies	-55.93 (314.2)	-179.7 (531.8)
Employment (vs. full-time)		
Part-time	-135.7 (105.6)	-227.2 (174.9)
Not employed	48.55 (71.50)	-69.32 (116.4)
Self-employed	-114.9 (85.48)	77.97 (138.7)
Employment not reported	-378.6 (575.0)	504.3 (960.3)
Annual household income (vs. < \$35,000)		
\$35,000 to \$49,999	1.736 (110.8)	-9.089 (183.1)
\$50,000 to \$74,999	129.7 (104.8)	-10.71 (173.5)

\$75,000 to \$99,999	60.53 (109.0)	111.7 (180.6)
\$100,000 to \$174,999	-17.69 (111.1)	-77.86 (184.2)
\$175,000 or higher	113.7 (130.7)	100.1 (214.1)
Income not reported	193.1 (128.4)	51.02 (210.2)
Self-Reported Credit Score (vs. Subprime)		
Prime	76.03 (68.96)	232.7* (114.5)
Superprime	13.02 (68.76)	178.0 (114.2)
DK/Refused	112.0 (110.6)	100.9 (180.0)
Married=0	-14.80 (62.29)	-143.3 (102.6)
Kids at home=1	38.67 (54.39)	24.04 (89.98)
Sole financial decision maker=1	-14.00 (62.40)	-24.48 (103.2)
Used real estate agent=1	103.9* (49.42)	81.64 (81.28)
Most recent home purchase (vs. none)		
Before 1999	-2.584 (89.97)	-101.6 (150.6)
2000-2004	-106.3 (90.09)	-284.4 (148.5)
2005-2007	-116.3 (86.93)	-254.4 (142.9)
2008 or later	-142.0 (75.43)	-384.5** (121.9)
Observations	2284	2933
$R^2$	0.036	0.021
$AIC$	38676.9	53326.4

Note. Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 6.** Linear regression results predicting objective and subjective knowledge from demographic characteristics.

	(1) Objective knowledge B (s.e.)	(2) Subjective knowledge B (s.e.)
Age (vs. 18-29)		
30-39	-0.0519 (0.111)	0.298** (0.0941)
40-49	-0.200 (0.129)	0.275* (0.109)
50 and older	0.0550 (0.133)	0.791*** (0.113)
Race/Ethnicity (vs. non-Hispanic White)		
Black	-0.00597 (0.129)	-1.174*** (0.109)
Hispanic of any race	-0.593*** (0.122)	-1.049*** (0.103)
Asian	-0.889*** (0.157)	-0.602*** (0.132)
Other	0.000360 (0.154)	-0.613*** (0.130)
Education (vs. < high school)		
High school graduate or GED	0.577 (0.458)	0.782* (0.387)
Some college	0.354 (0.449)	1.356*** (0.379)
College graduate	0.361 (0.451)	1.881*** (0.381)
Postgraduate studies	0.242 (0.452)	2.147*** (0.382)
Employment (vs. full-time)		
Part-time	-0.186 (0.147)	-0.569*** (0.124)
Not employed	0.178 (0.102)	-0.220* (0.0859)
Self-employed	0.144 (0.123)	0.0356 (0.104)
Employment not reported	-0.474 (0.800)	-0.835 (0.676)
Annual household income (vs. < \$35,000)		
\$35,000 to \$49,999	0.184 (0.161)	0.403** (0.136)
\$50,000 to \$74,999	0.365* (0.151)	0.615*** (0.127)
\$75,000 to \$99,999	0.441**	0.941***

	(0.158)	(0.133)
\$100,000 to \$174,999	0.661***	1.389***
	(0.159)	(0.134)
\$175,000 or higher	0.934***	1.627***
	(0.187)	(0.158)
Income not reported	0.848***	0.799***
	(0.177)	(0.150)
Self-Reported Credit Score (vs. Subprime)		
Prime	0.513***	0.758***
	(0.101)	(0.0853)
Superprime	1.072***	1.299***
	(0.101)	(0.0855)
DK/Refused	0.128	-0.377**
	(0.152)	(0.129)
Married=0	-0.467***	-0.390***
	(0.0918)	(0.0775)
Kids at home=1	-0.200*	-0.0756
	(0.0801)	(0.0676)
Sole financial decision maker=1	0.217*	0.430***
	(0.0921)	(0.0778)
Used real estate agent=1	0.393***	0.145*
	(0.0722)	(0.0610)
Most recent home purchase (vs. none)		
Before 1999	1.275***	1.040***
	(0.136)	(0.115)
2000-2004	1.089***	1.158***
	(0.131)	(0.111)
2005-2007	1.143***	1.205***
	(0.127)	(0.107)
2008 or later	1.383***	1.496***
	(0.105)	(0.0885)
Observations	6227	6227
$R^2$	0.356	0.149
$AIC$	30344.6	28245.8

Note. Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 7.** Logistic regression results predicting financial education take-up.

	(1) Take-up within first two weeks (clickstream data)	(2) Take-up within twelve weeks (clickstream data)	(3) Take-up within first two weeks (survey data)
	OR (s.e.)	OR (s.e.)	OR (s.e.)
Objective knowledge	1.092*** (0.0142)	1.088*** (0.0137)	1.143*** (0.0358)
Subjective knowledge	0.874*** (0.00932)	0.879*** (0.00906)	0.940* (0.0234)
Most recent home purchase (vs. none)			
Before 1999	0.739** (0.0787)	0.675*** (0.0705)	0.557* (0.158)
2000-2004	0.631*** (0.0656)	0.625*** (0.0628)	0.538* (0.142)
2005-2007	0.684*** (0.0687)	0.691*** (0.0672)	0.627* (0.148)
2008 or later	0.513*** (0.0446)	0.552*** (0.0457)	0.415*** (0.0865)
Controls	Yes	Yes	Yes
N	6175	6175	4501
Pseudo $R^2$	0.050	0.050	0.053
Akaike information criterion	7800.6	8197.2	1997.4

*Note.* Odds ratios; standard errors in parentheses. Control variables include all demographic characteristics shown in Table 4, plus measures of risk preferences, external locus of control, subjective numeracy, and time preferences.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 8.** Linear regression results predicting website visit duration (seconds).

	(1) Duration within first two weeks (clickstream) B (s.e.)	(2) Duration within twelve weeks (clickstream) B (s.e.)
Objective knowledge	16.88 (11.73)	52.30** (19.16)
Subjective knowledge	-35.22*** (9.587)	-49.39** (15.64)
Most recent home purchase (vs. none)		
Before 1999	13.37 (91.81)	-129.09 (153.1)
2000-2004	-103.8 (91.36)	-308.6* (150.7)
2005-2007	-91.91 (88.77)	-260.3 (145.8)
2008 or later	-117.69 (78.17)	-400.7** (126.5)
Constant	798.1* (340.1)	1252.4* (573.0)
Controls	Yes	Yes
N	2269	2913
R <sup>2</sup>	0.046	0.030
Akaike information criterion	38430.7	52959.7

*Note.* Standard errors in parentheses. Control variables include all demographic characteristics shown in Table 5, plus measures of risk preferences, external locus of control, subjective numeracy, and time preferences.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 9.** Comparison of Survey Reports and Website Clickstream Data on Take-Up of Financial Education Website.

<b>Two Weeks after Enrollment</b>	N	Take-Up in Website Clickstream Data	
		Used website	Did not use website
Reported take-up in survey	267	194 (72.7% correct reports)	73
Did not report take-up	4296	1535	2761 (64.3% correct reports)
		1729	2834
<b>All 12 Weeks of Study</b>			
Reported take-up in survey	622	485 (78.0% correct reports)	137
Did not report take-up	4477	2102	2375 (53.0% correct reports)
		2587	2512

*Note.* Table displays the number of participants who reported take-up of the financial education website in their survey results compared to the number of participants who were recorded as using the website in the clickstream data. Respondents who did not answer follow-up surveys are omitted. The total number of participants in the 12-week panel is higher than the number in the two-week panel because some participants skipped the follow-up survey immediately following enrollment and returned later.



**Figure 1.** Predicted probability of financial education take-up for varying levels of prior knowledge.



*Note.* Results are based on regression results shown in Table 7, column 1. All control variables are set to average values. To account for the correlation between objective and subjective knowledge, subjective knowledge is set to a predicted value for the “objective knowledge” line, and vice versa. Shaded areas represent 95% confidence intervals.

**Figure 2.** Estimated duration of financial education website use (seconds) for varying levels of prior knowledge.



*Note.* Results are based on regression results shown in Table 8, column 1. All control variables are set to average values. To account for the correlation between objective and subjective knowledge, subjective knowledge is set to a predicted value for the “objective knowledge” line, and vice versa. Shaded areas represent 95% confidence intervals.