FINANCIAL SERVICES REVIEW

Financial Services Review 24 (2015) 119–137

Financial knowledge acquisition among the young: The role of financial education, financial experience, and parents' financial experience

Ning Tang[a,*], Paula C. Peter[b]

[a]*Department of Finance, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-8239, USA*

[b]*Department of Marketing, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-8239, USA*

Abstract

This article explores how financial education, financial experience, and parents' financial experience influence young adults' financial knowledge. We rely on a general model of learning to hypothesize the determinants of financial knowledge acquisition. Using data on 3,597 young adults from a national longitudinal survey, we find that financial education, financial experience, and parents' financial experience all exert a positive impact on young adults' financial knowledge. Moreover, these determinants work interactively. Both individual and parents' financial experience help narrow the gap in financial knowledge caused by lack of financial education.

JEL classification: D14; A2

Keywords: Financial literacy; Financial education; Financial experience; Parental socialization

1. Introduction

Young adults face unprecedented financial obligations and complexity in today's demanding financial environment. As they become financially independent from their guardians, they must make choices about student loans, debt, insurance, mortgages, and retirement

* Corresponding author. Tel.: +1-619-594-2082; fax: +1-619-594-3272.
E-mail address: ntang@mail.sdsu.edu (N. Tang).

1057-0810/15/$ – see front matter

funds. The financial decisions made early in life can have significant long-term economic and social effects (Montoya and Scott, 2013). Better financial behavior requires financial knowledge, specifically knowledge in essential personal finance concepts and products (Chen and Volpe, 1998; Jacobs-Lawson and Hershey, 2005; Van Rooij, Lusardi, and Alessie, 2011). Because choices made at the beginning of financial independence exert such a strong influence later, it is especially urgent that young people develop basic knowledge and skills in economics and finance (Shim et al., 2013). Alhenawi and Elkhal (2013) infer from their findings that to promote financial planning, we should strongly foster financial education at early stages of life.

Policymakers, the financial service industry and educators have promoted numerous programs and initiatives to combat low levels of financial knowledge among young people. For example, in 2009, 21 states required an economics course for high school graduation whereas 13 states required a personal finance course (Council for Economic Education, 2009). As of 2013, these numbers have been increased to 22 and 17, respectively (Council for Economic Education, 2014). In 2010, under the Dodd-Frank Act (H.R. 4173), the U.S. Congress created the Consumer Financial Protection Bureau to further promote financial education through its consumer engagement and education group. There also has been a surging interest in financial education by U.S. financial institutions and their associations (Worthington, 2006). Community Banker (2003) shows that in 2003, 98% of U.S. community banks sponsored financial literacy programs and 72% offered their own programs. Despite these efforts, lack of financial knowledge among young people is still widespread (see, e.g., Chen and Volpe, 1998; Mandell, 2009).

To formulate effective interventions to increase financial knowledge among the young, we need to identify and manage aspects that influence the process through which people acquire financial knowledge. In the past, the main focus has been on the formal education system to disseminate financial knowledge to young people. However, because of poor results, researchers and policymakers have started questioning the roles parents and personal experience play in effective financial knowledge learning. For example, Johnson and Sherraden (2007) show that students can successfully obtain necessary financial concepts by participating in programs that provide education as well as hands-on investment and management experience, such as "Save for America" and "Illinois Bank-at-School" programs. Lusardi, Mitchell, and Curto (2010) suggest parents' financial experience is an important variable affecting a young adult's financial knowledge in addition to financial education. Surveying financial literacy among college students, Chen and Volpe (1998) find that parents, participants' own mistakes, and school courses are all listed as people's sources of personal finance education. However, no study to our knowledge has tested for the concurrent roles of financial education, financial experience and parents' financial experience in reducing the gap in financial knowledge.

By taking a general model of learning from the education literature (Kolb, 1984) and applying it to financial knowledge learning, our study aims to identify the concurrent roles of financial education, financial experience, and parent's financial experience as determinants of financial knowledge acquisition. Moreover, the interaction among these variables is also explored. Results from subgroup analysis and Poisson regression based on 3,597 young adults from the 1997 National Longitudinal Survey of Youth indicate that financial educa-

tion, financial experience, and parents' financial experience all significantly improve young adults' financial knowledge. Moreover, they work interactively. Young adults lacking financial education benefit more from financial experience and parents' financial experience. That is, both individual and parents' financial experience can help narrow the gap in financial knowledge caused by lack of financial education.

The article offers two main contributions. First, the article adapts a solid model of learning from the field of education to the field of financial literacy to create a *Financial Knowledge Acquisition Framework*. Second, the article identifies three determinants of financial knowledge learning—financial education, financial experience, and parents' financial experience—and provides empirical evidence proving that these determinants significantly affect financial knowledge and operate interactively. Taken together, these contributions flesh out the theory behind financial knowledge acquisition and can be used to evaluate and improve financial education programs. Better programs mean youth more educated in financial knowledge and more prepared to make the crucial financial decisions faced at the beginning of financial independence.

The remainder of the article is organized as follows: Section 2 introduces the conceptual framework and hypotheses; Section 3 describes our data and measures; Section 4 shows the results; and Section 5 offers conclusions.

2. Conceptual framework and hypotheses

In discussing the major gaps in evaluation literature on financial education and counseling, Collins and O'Rourke (2010) indicate a lack of guiding theories in the literature. They pointed out that because of the lack of a prevailing theoretical framework in the field, most studies failed to cite a specific theory or understand the theoretical underpinnings of their work. We find that the Experiential Learning Theory (ELT) by Kolb (1984) in education research literature can help us fill the gap and we use it to guide our study. To our knowledge, this is the first study to use this theory to explain the acquisition of financial knowledge.

According to this model, an individual acquires knowledge through experiences (e.g., owning a stock or bond), observations (e.g., having parents with financial experience), and conceptualizations (e.g., receiving formal financial education) and then tests that knowledge through active experimentation (e.g., practice over time), which results in new experiences. Kolb's model implies the importance of experience and reflective observation with the phenomena being studied rather than merely conceptualizing it. When taken as a comprehensive theoretical framework, ELT can be used to explore learning processes and educational issues in various disciplines such as education, management, computer and information sciences, psychology, medicine, nursing, accounting, and law (see Kolb, Boyatzis, and Mainemelis, 1999 for a review). Perplexingly, no study to our knowledge has suggested the possible application of ELT to financial knowledge acquisition.

This research adopts Kolb's ELT model to financial knowledge acquisition and explores the determinants that may have an impact on financial knowledge. Conceptualizations, such as financial education acquired in the classroom, as well as experiences and observations, such as the ones acquired through personal and parents' financial experience, may all

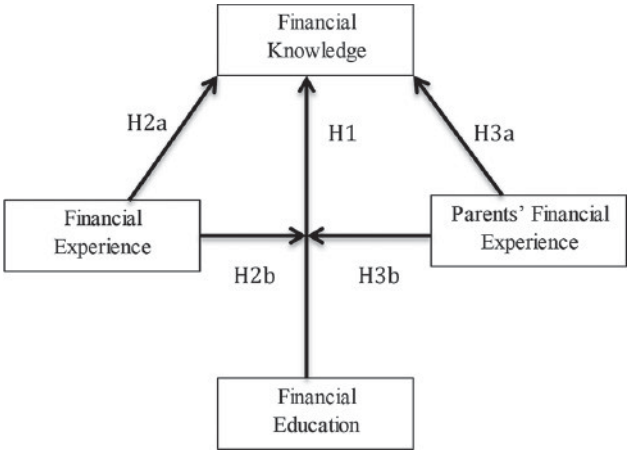

Fig. 1. Hypothesized financial knowledge acquisition framework.

influence financial knowledge acquisition. Moreover, we extend this model by considering the influence of financial experience and parents' financial experience on the effects of financial education on financial knowledge acquisition. Fig. 1 offers an illustration of Kolb's theoretical learning model adapted to the financial knowledge acquisition process. The focus of our research is to select proxy measures or examples for "financial education," "financial experience," and "parents' financial experience" components, and use empirical data to validate the hypothesized financial knowledge acquisition framework.

2.1. Financial education

According to the ELT model, coursework at school is the major source of conceptualization learning in the current education system. Therefore, financial education is expected to exert a positive impact on financial knowledge.

A burgeoning collection of literature has assessed how well financial education actually improves financial knowledge, but findings are not conclusive. Some research shows financial education has a positive effect on financial knowledge (see, e.g., Danes, Huddleston-Casas, and Boyce, 1999; Tennyson and Nguyen, 2001). Other studies find no significant effect (e.g., Mandell, 2009). Lyons, Rachlis, and Scherpf (2007) conclude that the discrepancy in mixed results regarding financial education effectiveness is because of differences in the programs various researchers evaluated and in the methods they used to evaluate those programs, or differences in *what* was measured and *how*. For example, self-reported financial education exposure measures might lead different results than college major measures, which seem to be less prone to selection bias.

To address this issue, this article uses college major to measure financial education exposure, which is less prone to selection bias; it also considers the concurrent roles of subjects' financial experience and their parents' financial experience to evaluate the effect of formal financial education at school, which we hypothesize has a positive effect on financial knowledge. Thus:

Hypothesis 1: Young adults should have higher level of financial knowledge if they

possess higher financial education considering the concurrent roles of financial experience and parents' financial experience.

2.2. Financial experience

In the 2001 Surveys of Consumers, respondents reported personal financial experience as the most important way they had learned cash-flow management, credit management, saving, and investment practices (Hilgert, Hogarth, and Beverly, 2003). Lyons, Rachlis, and Scherpf (2007) further confirm that personal experience impacts financial knowledge of credit and debt management. These findings are unsurprising in the context of the ELT model, where experience learning emphasizes the roles that direct experience and focused reflection play in increasing knowledge. This view has inspired numerous financial education campaigns that introduce programs focused on hands-on investment and management experience to traditional formal education. For example, the "Bank in School" program has students open a saving account at school, make deposits, calculate simple interest, and track their saving balance; the "Huntington Bank Kids' Club" program in Columbus, Ohio, provides students with an on-site school bank to promote hands-on experience learning at school (Consumer Bankers Association, 2002). The general assumption underlying these programs is that individual financial experience can help narrow the gap in financial knowledge caused by lack in financial education exposures.

Despite empirical evidence showing that direct personal financial experience affects financial knowledge, no study to our knowledge has systematically incorporated financial experience into a financial knowledge learning framework and tested whether it positively affects financial knowledge when taken with other influencing factors (i.e., financial education and parents' financial experience). Moreover, no study to our knowledge has explored the possibility for financial experience to compensate for lack of financial education. Thus:

Hypothesis 2a: Young adults should have higher levels of financial knowledge if they possess higher financial experience considering the concurrent roles of financial education and parents' financial experience.

Hypothesis 2b: Financial experience should positively impact financial knowledge especially in the absence of financial education.

2.3. Parents' financial experience

Significant family members, especially parents, present incomparable socialization influences on young adults' learning processes (Xiao et al., 2011). By interacting with parents, children develop consumer skills, knowledge, and attitudes. Even as they enter early adulthood, parental influence remains a potentially important socializing force (Bowen, 2002; Norvilitis and MacLean, 2010; Shim et al., 2013). In a survey of 924 students enrolled at various universities, 74% of women and 68% of men stated that they obtained their personal finance knowledge from their parents (Chen and Volpe, 2002). Furthermore, findings from the 2001 Parents, Youth, and Money survey suggest that parents who think they do an "excellent" or "good" job managing their money are more likely to provide their

children with financial guidance than those parents who think they do a "fair" or "poor" job managing their money (Employee Benefit Research Institute, 2001). Therefore, we expect financially experienced parents to be more capable of helping their children. We hypothesize that parents' financial experience positively influences youth financial knowledge and could help to narrow the gap in financial knowledge when financial education at school is not available. This leads us to our final hypotheses:

Hypothesis 3a: Young adults should have higher levels of financial knowledge if their parents possess higher financial experience considering the concurrent roles of financial education and financial experience.

Hypothesis 3b: Parents' financial experience should positively impact financial knowledge especially in the absence of financial education.

3. Data and measures

3.1. Data

This article uses data from the 1997 National Longitudinal Survey of Youth (NLSY97) provided by the U.S. Bureau of Labor Statistics. The NLSY97 is a nationally representative sample of the U.S. youth population. To reach a total sample of 8,984 respondents, NLSY97 interviewers screened 75,291 households in 147 primary sampling units that did not overlap (a primary sampling unit is a metropolitan area or, in nonmetropolitan areas, a single county, or group of counties). The longitudinal dataset follows the same group of respondents from 1997 (Wave 1) to 2010 (Wave 14), recording data annually. The survey contains extensive information on respondents' demographic and socioeconomic characteristics, family backgrounds, and educational experiences. Because few surveys simultaneously gather data on an individual's financial education, family background, and financial experience, few studies have evaluated how these three determinants of financial knowledge acquisition work together. The rich dataset from NLSY97 and its longitudinal feature enables us to fill this gap. Our study used 3,597 respondents from the NLSY97 dataset because these records had valid responses for all of our study variables.

3.2. Measures

3.2.1. Financial knowledge

The NLSY97 2007 survey (Wave 11) asked respondents the following three financial knowledge questions aimed at testing basic but fundamental financial concepts regarding risk diversification, interest rate, and inflation.

1. Do you think that the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund. (True/False)
2. Suppose you had $100 in a savings account and the interest rate was 2% per year.

After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, or less than $102? (A. More than $102; B. Exactly $102; C. Less than $102)

3. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account? (A. More than today; B. Exactly the same as today; C. Less than today)

These questions have been shown to differentiate well between financially knowledgeable and financially naïve respondents and were also included in the 2004 Health and Retirement Survey (HRS2004), the 2009 American Life Panel (ALP2009), and the 2009 National Financial Capability Study (NFCS2009; Lusardi and Mitchell, 2008, 2011; Lusardi, Mitchell, and Curto, 2010). Using the responses to these three financial knowledge questions, we created a financial knowledge score that sums the number of correct answers across the three questions. We use this financial knowledge score for the rest of our analysis.

3.2.2. Financial education

In surveys conducted from 1997 to 2007 (Waves 1 through 11), respondents were asked about their majors when they were in college. We associated majoring in economics and business management with higher financial education exposure. We consider this measure more reliable compared with self-reported data on financial education collected years after the respondents left school (e.g., Peng et al., 2007). It is expected that those who benefited more from financial education are more likely to remember and, therefore, report having such education. Therefore, self-reported data could cause selection bias in estimation (Collins and O'Rourke, 2010). In addition, Mandell and Klein (2007) point out that the low financial knowledge scores among young adults, even after they have taken a course in personal finance, are related to a lack of motivation to learn or retain these skills. Consequently, to mitigate the bias caused by students' motivation to acquire financial knowledge, we use college majors that are the choice of respondents to measure financial education exposures. It is noted that the selected sample also includes respondents who were not in college before 2007. Their value of exposure to college level financial education is set to zero.

3.2.3. Financial experience

We aggregated responses from the 1998 to 2007 surveys (Wave 2 through 11) on whether young adults invested in stocks, mutual funds, CDs, bonds, or T-bills. We used responses to evaluate respondents' financial experience *before* 2007.

3.2.4. Parents' financial experience

The 1997 survey (Wave 1) asked respondents' parents whether they had financial experience in stocks, bonds, or pension funds. We used this as indicator of parents' financial experience.

3.2.5. Covariates

Covariates include individual demographic and socioeconomic characteristics. We control for individual's gender (Wave 1), age (Wave 1), race (Wave 1), and income earned in 2006

(Wave 11). These factors have been shown to significantly impact one's financial knowledge (see, e.g., Lusardi, Mitchell, and Curto, 2010; Mandell, 2009; Worthington, 2006). We also control for young adults' education level in 2007 (Wave 11) and high school GPA collected in 1999 (Wave 3) as Lusardi, Mitchell, and Curto (2010) show that education attainment and cognitive ability affect financial knowledge. The highest educational attainment by parents is also included in covariates. Our final control variable is whether young adults asked parents about financial issues. This is to control for the opportunity children had to learn from their parents.

3.3. Summary statistics

Our study used a sample of 3,597 respondents who had valid responses for all of our study variables listed above. Table 1 summarizes data on respondents' financial knowledge, financial education exposure, personal financial experience, and parents' financial experience in our selected sample. The average financial knowledge score among young adults in the selected sample is 1.84 out of 3. Eighteen percent of the respondents majored in economics or business management in college before answering the financial knowledge questions in 2007. Respondents reported limited personal financial experience, with only 24.6% reporting that they had invested in stocks or bonds before 2007. Fifty-eight percent of parents reported that they had financial experience.

Our selected sample consists of young adults with an average age of 24 in 2007. Fifty percent of them are males; the sample earned an average annual income of $24,011 in 2006. The breakdown of ethnicities is: White (65.1%); Black (23.4%); American Indian, Eskimo, or Aleut (0.8%); Asian or Pacific Islander (1.4%); and other (9.4%). As of 2007, 26% of respondents in the selected sample had obtained a college degree, 3% had obtained a graduate degree, and 71% had not obtained a college degree. The average high school GPA was 2.89. Forty-one percent of respondents' parents had high school or less as their highest education attainment, and 31% had college or more. Seventy percent of young adults in the sample had asked their parents about financial issues.

4. Results

4.1. Subgroup analysis

We first adopted one-way analysis of variance (ANOVA) model to investigate whether there are any differences in mean financial knowledge scores in different subgroups. F-statistics from the test indicate whether the difference between the means of the subgroups is significant or not. Because the focus of the article is to examine the roles of financial education, financial experience, and parents' financial experience on financial knowledge, we defined subgroups by these three factors. The results are summarized in Table 2. It is found that all three components in our financial knowledge acquisition framework have significant impact on financial knowledge. Economics or business management majors scored higher than those who did not major in economics or business management. Respondents who had

Table 1 Summary statistics

	Mean	SD	Min	Max
Dependent variables				
Total financial knowledge score	1.84	.92	0	3
Independent variables				
Majored in economics or business management *before* 2007	18.0%	38.5%	0	1
Invested in stocks or bonds *before* 2007	24.6%	43.1%	0	1
Parents invested in stocks or bonds or had pension accounts	58.3%	49.3%	0	1
Covariates				
Male	50.1%	50.0%	0	1
Age in 2007	24.34	1.47	22	28
Race				
White	65.1%	47.7%	0	1
Black	23.4%	42.3%	0	1
American Indian, Eskimo, or Aleut	0.8%	9.1%	0	1
Asian or Pacific Islander	1.4%	11.6%	0	1
Other	9.4%	29.2%	0	1
Education				
Non-high school	11.8%	32.3%	0	1
High school	49.8%	50.0%	0	1
Some college	9.4%	29.1%	0	1
College	26.0%	43.9%	0	1
Graduate school	3.0%	17.1%	0	1
High school GPA	2.89	.59	.42	4
Income from wage and salary in 2006 (in $)	$24,011	$18,255	0	$175,000
Under $10,000	23.9%	42.6%	0	1
$10,000 to $25,000	37.7%	48.5%	0	1
$25,000 to $50,000	33.0%	47.0%	0	1
$50,000 or more	5.5%	22.8%	0	1
Parents' education				
Non-high school	10.8%	31.1%	0	1
High school	30.1%	45.9%	0	1
Some college	28.6%	45.2%	0	1
College	15.6%	36.3%	0	1
Graduate school	14.9%	35.6%	0	1
Ask parents about finance issues	70.1%	45.8%	0	1

$N = 3{,}597$.

The table shows the summary statistics of dependent variable, three independent variables, and covariates of our analysis. Mean, standard deviation, minimum and maximum values are reported.

financial experience had an average financial knowledge score of 2.19, compared with 1.73 by those who without financial experience. The difference is statistically significant. Our results also suggest that respondents whose parents had investment experience scored higher than their counterparts.

4.2. Poisson regression–main effects

In this section, we will test the concurrent roles of financial education, financial experience, and parents' financial experience on financial knowledge, after controlling for other covariates. Specifically, we evaluated the research hypotheses using Poisson regression.

Table 2 Subgroup analysis

	No. of obs.	Financial knowledge score
Financial education *before* 2007		
a. Majored in economics or business management *before* 2007	649	2.17
b. Did not major in economics or business management *before* 2007	2,948	1.77
F statistics		102.43***
Financial experience *before* 2007		
a. Invested in stocks or bonds *before* 2007	886	2.19
b. Did not invested in stocks or bonds *before* 2007	2,711	1.73
F statistics		173.04***
Parents' financial experience		
a. Parents invested in stocks or bonds or had pension accounts	2,096	1.99
b. Parents did not invest in stocks or bonds or had pension accounts	1,501	1.64
F statistics		123.15***

Mean financial knowledge scores for each subgroup are reported. F statistics from ANOVA test is used to indicate whether financial knowledge scores differ significantly between subgroups. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Previous research has used Poisson regression to model the count outcome of financial behaviors among young adult populations (Worthy, Jonkman, and Blinn-Pike, 2010). Poisson regression is more appropriate in this study than standard linear regression for several reasons. First, preliminary analyses of our data demonstrated that using linear regression models resulted in models generating out of bounds predictions. For example, predictions of young adults' financial knowledge scores may have values higher than three based on OLS regression. In addition, Poisson regression is more appropriate than linear regression because our dependent variable (financial knowledge score) is a discrete count variable, it is not overdispersed (e.g., financial knowledge scores' variance does not exceed its mean), and it fits the Poisson distribution well (Deviance goodness-of-fit test χ^2 (df) = 1808.14 (3580), $p > 0.99$; Pearson goodness-of-fit test χ^2 (df) = 1417.84 (3080), $p > 0.99$). Therefore, we ran Poisson regression to assess the effects of financial education, financial experience, parent's financial experience and their interaction effects on financial knowledge.

Coefficients in Poisson regression are the difference between the logs of expected counts, which is difficult to interpret intuitively. To help clarify our results, we report both the regression coefficients (β) and incidence rate ratios (IRRs), calculated as (e^{β}). IRRs are interpreted as the change in the rate ratio of financial knowledge scores for one unit change in the independent variable. In other words, an IRR < 1 (>1) implies a one unit increase in an independent variable will decrease (increase) the predicted rate of financial knowledge scores by a factor of the reported IRR for the independent variable.

Table 3 summarizes the results from Poisson regression model on the main effects of financial education, financial experience, and parents' financial experience on financial knowledge scores, after controlling for other covariates. We find that financial education significantly increases financial knowledge ($p < 0.01$), as does financial experience ($p < 0.01$) and parents' financial experience ($p < 0.10$). For example, choosing finance related subjects as college majors is associated with a 12% increase in financial knowledge score. Having financial experience and parents having financial experience increase the rate of

Table 3 Poisson regression results main effects

	IRR	Coefficient	Sig.	SE
Intercept	.95	−.05		.14
Factors				
Financial education *before* 2007	1.12	.11	***	.02
Financial experience *before* 2007	1.10	.10	***	.02
Parents' financial experience	1.04	.04	*	.02
Covariates				
Male	1.19	.17	***	.02
Age in 2007	.99	−.01		.01
Race (ref: White)				
Black	.94	−.06	***	.02
Indian	.97	−.03		.08
Asian	.97	−.03		.05
Other	.95	−.05	*	.03
Education	1.07	.07	***	.01
High school GPA	1.14	.13	***	.02
Income from wage and salary in 2006 (ref: under $10,000)				
$10,000 to $25,000	1.06	.06	***	.02
$25,000 to $50,000	1.12	.12	***	.02
$50,000 or more	1.16	.15	***	.03
Parents' education	1.03	.03	***	.01
Ask parents about finance issues	.96	−.04	**	.02
N	3597			
Wald χ^2 (df)	987.74 (16)			
AIC	10276.38			
BIC	10381.57			

The table shows the Poisson regression results. Dependent variable is the number of correct financial knowledge questions answered (0–3). Independent variables are respondents' financial education before 2007, financial experience before 2007 and parents' financial experience. Control variables include gender, age in 2007, race, education, high school GPA, respondents' income from wage and salary in 2006, parents' educational attainment, and whether respondents asked parents about finance issues. Regression coefficients (β), incidence rate ratios (IRRs) calculated as (e^{β}), significance level and standard error are reported.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

financial knowledge scores by 10% and 4% respectively. These results confirm hypotheses Hypothesis 1, Hypothesis 2a, and Hypothesis 3a.

With respect to the covariates in the study, there is a significant difference between men and women ($p < 0.01$) with respect to the expected number of correct financial knowledge questions answered. The results indicate, all else held constant, men are expected to exhibit 19% higher financial knowledge scores than women. Age is not statistically significant. Only Black and respondents belong to the "other" race group are significantly different from the reference group (White) with respect to financial knowledge level. All else equal, Black respondents report only 0.94 times as many correct financial knowledge questions as white respondents ($p < 0.01$). As expected, both respondents' and parents' educational attainment and respondents' income are highly significant and positively associated with financial knowledge ($p < 0.01$ for all variables). It is surprising to find that "ask parents about finance issues" predicts lower financial knowledge. One explanation could be that those who turn to parents for financial advice are more likely to be those who lack financial knowledge.

Table 4 Poisson regression results–interaction effects

	IRR	Coefficient	Sig.	SE
Intercept	.95	−.06		.14
Factors				
Financial education *before* 2007	1.20	.18	***	.03
Financial experience *before* 2007	1.12	.12	***	.02
Parents' financial experience	1.05	.05	**	.02
Financial education *before* 2007* Financial experience *before* 2007	.93	−.07	**	.03
Financial education *before* 2007* Parents' financial experience	.93	−.07	*	.04
Covariates				
Male	1.19	.18	***	.02
Age in 2007	.99	−.01		.01
Race (ref: White)				
Black	.94	−.06	***	.02
Indian	.96	−.04		.08
Asian	.98	−.02		.05
Other	.95	−.05	*	.03
Education	1.07	.07	***	.01
High school GPA	1.14	.13	***	.02
Income from wage and salary in 2006 (ref: under $10,000)				
$10,000 to $25,000	1.06	.05	**	.02
$25,000 to $50,000	1.12	.11	***	.02
$50,000 or more	1.16	.15	***	.03
Parents' education	1.03	.03	***	.01
Ask parents about finance issues	.96	−.04	**	.02
N	3597			
Wald χ^2 (df)	996.38 (18)			
AIC	10277.70			
BIC	10395.27			

The table shows the results of Poisson regression with interaction effects. Dependent variable is the number of correct financial knowledge questions answered (0–3). Independent variables are respondents' financial education before 2007, financial experience before 2007, parents' financial experience, interaction between financial education before 2007 and financial experience before 2007, and interaction between financial education before 2007 and parents' financial experience. Control variables include gender, age in 2007, race, education, high school GPA, respondents' income from wage and salary in 2006, parents' education attainment, and whether respondents asked parents about finance issues. Regression coefficients (β), incidence rate ratios (IRRs) calculated as (e^{β}), significance level and standard error are reported.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

4.3. Poisson regression–interaction effects

To evaluate Hypothesis 2b and Hypothesis 3b (the interaction effects), we incorporate interaction terms between financial education and financial experience, and between financial education and parents' financial experience into our Poisson regression model. The model is otherwise the same as the main effects only model. Before interpreting the coefficients on interaction terms in Table 4, it should be noted that there is a baseline difference in financial knowledge scores between those who had financial education in college and those who did not. After mean-centering, marginal means of financial knowledge scores estimated from

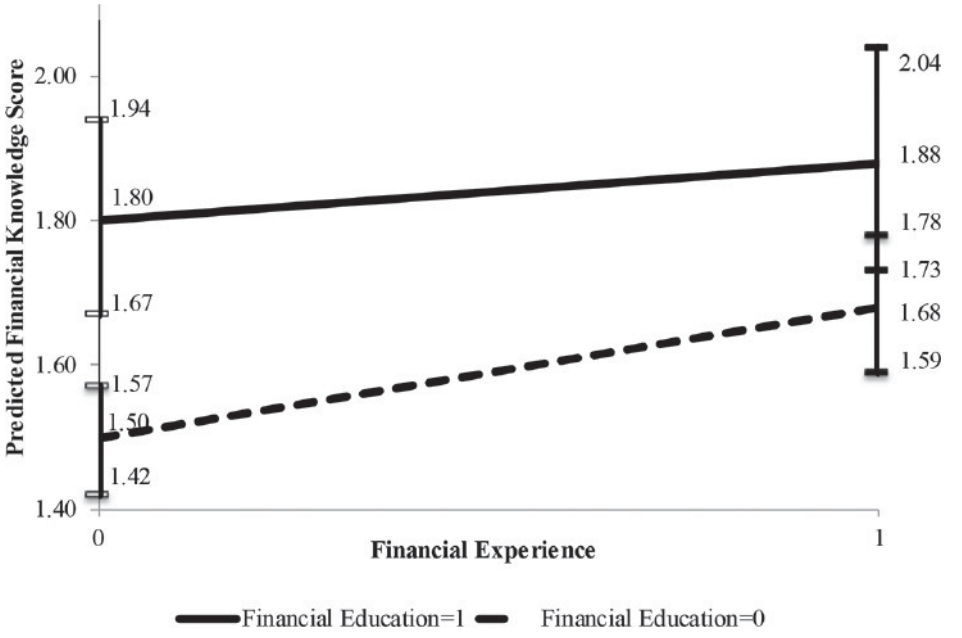

Fig. 2. Marginal means of financial knowledge score by Financial Education *Financial Experience (95% confidence interval).

Poisson regression for those who received financial education in college are 1.80 (SE = 0.07) and 1.50 for those who did not receive finance education in college (SE = 0.04). This difference needs special attention because Poisson regression coefficients can be interpreted as the *percentage* predicted change in financial knowledge scores expected by one unit change in a predictor, not the *unit* predicted change in financial knowledge scores (Coxe, West, and Aiken, 2009). Thus, an equal percentage change for those with and without financial education will ultimately result in an even greater difference in financial knowledge scores because those who had financial education in college have a higher baseline of predicted financial knowledge scores (i.e., as the value of any number becomes larger, a constant percentage change will result in an increasingly larger absolute change in the number).

For the aforementioned reasons, one intuitive and recommended approach to better understand the results of Poisson regression interactions is to visually plot the marginal predicted financial knowledge scores for those had financial education and those did not across values of each respective independent variable, holding all other variables constant at their mean or reference value (Coxe, West, and Aiken, 2009). Therefore, we depict these marginal mean plots in Figs. 2 and 3, along with Table 4 to demonstrate the interaction effects.

Table 4 shows that the positive relationship between financial experience and financial knowledge score is stronger among those who lack financial education than those who have it. The slope difference test is significant ($\beta = -0.07$, $p < 0.05$). These findings support Hypothesis 2b. The results indicate that, the financial knowledge gap between those who had finance education and those who did not will narrow as financial experience levels increase. Fig. 2 clearly depicts this point.

The positive relationship between parents' financial experience and financial knowledge score is stronger among those who lack financial education than those who have it. The

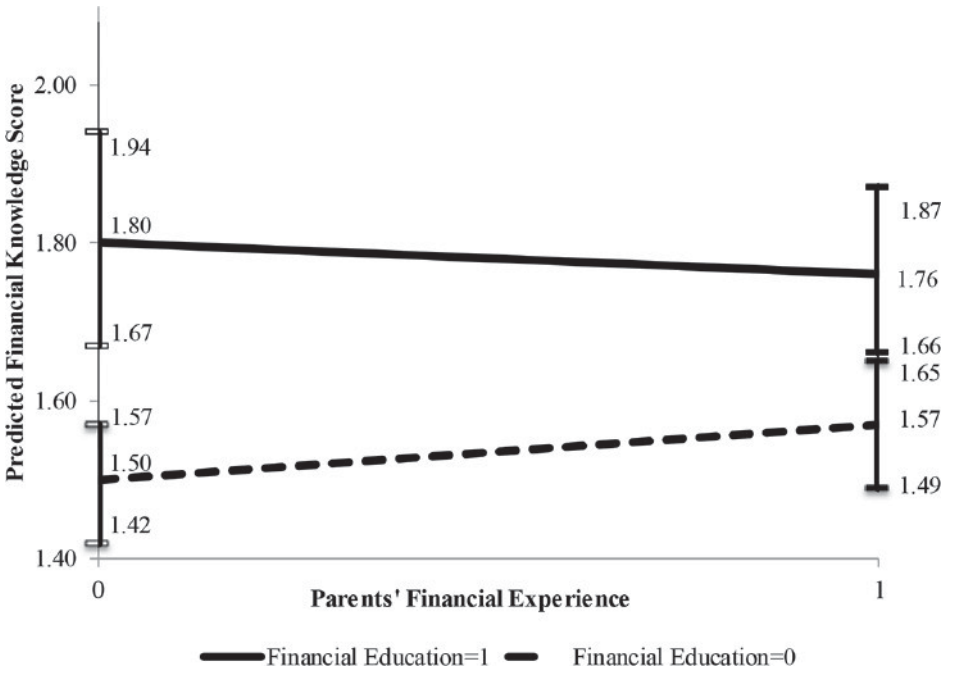

Fig. 3. Marginal means of financial knowledge score by Financial Education *Parents' Financial Experience (95% confidence interval).

difference is statistically significant ($\beta = -0.07$, $p < 0.10$). As depicted in Fig. 3, those who lacked financial education in college are able to narrow the gap with those who had financial education with respect to financial knowledge scores if their parents' have financial experience. For example, without parents' financial experience, having financial education is predicted to exhibit 0.30 (1.8 − 1.5) increase in financial knowledge score, but the difference is only 0.19 (1.76 − 1.57) when parents of young adults have financial experience. These findings support Hypothesis 3b.

4.4. Reverse causality issue

Our measure on financial education in college (college major) could subject the impact of financial education to a selection bias. A bias would arise if youth who are more financially knowledgeable are more likely to choose finance-related majors. Therefore, the positive relationship between college major in finance-related subjects and financial knowledge does not necessarily indicate that financial education in college improves financial knowledge. To mitigate the bias, we used college major data *before* 2007 when financial knowledge questions were asked in the baseline analysis in previous sections. That is, the students chose their majors before their financial knowledge were evaluated. This way we could reduce the possibility that financial knowledge affects college major choice. In addition, we test for the possibility that it is because financial knowledge affects college major choice that we found a positive relationship between them in Tables 3 and 4. Specifically, we follow Bernheim, Garrett, and Maki (2001) and create a new variable "financial education *after* 2007," which uses college major data *after* the financial knowledge questions were asked in

Table 5 Poisson Regression Results–Interaction Effects (College Major and Financial Experience *after* 2007)

	1. Financial Education *after* 2007				2. Financial Experience *after* 2007			
	IRR	Coefficient	Sig.	SE	IRR	Coefficient	Sig.	SE
Intercept	.75	−.29		.34	.94	−.06		.17
Factors								
Financial education	1.15	.14		.10	1.20	.18	***	.04
Financial experience	1.13	.12	***	.04	1.08	.08		.05
Parents' financial experience	1.09	.09	*	.05	1.05	.05	**	.02
Financial education* Financial experience	.97	−.03		.12	1.00	.00		.07
Financial education* Parents' financial experience	.83	−.19	*	.11	.92	−.08	*	.04
Covariates								
Male	1.22	.20	***	.04	1.21	.19	***	.02
Age in 2007	1.00	.00		.01	.99	−.01		.01
Race (ref: White)								
Black	.89	−.11	**	.05	.94	−.06	***	.02
Indian	.96	−.04		.16	.97	−.03		.08
Asian	.81	−.21		.14	.98	−.02		.06
Other	.97	−.03		.06	.93	−.07	**	.04
Education	1.05	.05	**	.03	1.07	.07	***	.01
High school GPA	1.17	.16	***	.04	1.14	.13	***	.02
Income from wage and salary in 2006 (ref: under $10,000)								
$10,000 to $25,000	1.04	.04		.05	1.04	.04	*	.02
$25,000 to $50,000	1.15	.14	***	.05	1.11	.10	***	.02
$50,000 or more	1.30	.26	***	.09	1.14	.13	***	.04
Parents' education	1.00	.00		.02	1.03	.03	***	.01
Ask parents about finance issues	.96	−.00		.04	.96	−.04	*	.02
N	591				2,885			
Wald χ^2 (df)	133.68 (18)				676.80 (18)			
AIC	1717.23				8235.23			
BIC	1800.49				8348.61			

The table shows the results of Poisson regression with interaction effects. Dependent variable is the number of correct financial knowledge questions answered (0–3). Independent variables in Model 1 are respondents' financial education after 2007, financial experience before 2007, parents' financial experience, interaction between financial education after 2007 and financial experience before 2007, and interaction between financial education after 2007 and parents' financial experience. Model 2 used financial education before 2007 and financial experience after 2007; other variables are the same as in Model 1. Control variables include gender, age in 2007, race, education, high school GPA, respondents' income from wage and salary in 2006, parents' education attainment, and whether respondents asked parents about finance issues. Regression coefficients (β), incidence rate ratios (IRRs) calculated as (e^{β}), significance level and standard error are reported.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

2007. We run Poisson regression as in the previous section and replace the variable indicating college major *before* 2007 with college major *after* 2007. As shown in Column 1 in Table 5, the effect of financial education *after* 2007 is not significant, which indicates that the difference in financial knowledge between individuals who chose finance-related majors versus those who chose non-finance related majors exists only after the major is chosen, not before. Therefore, it is exposure to financial education that improves one's

financial knowledge score, not financial knowledge that pushes one to become exposed to financial education (i.e., choose one of the finance-related majors).

Similarly, the positive relationship between financial experience and financial knowledge scores could be subject to reverse-causality bias, the problem commonly suffered by most studies on this topic. Given the positive correlation between financial experience and financial knowledge, it is hard to determine the direction of causality. The longitudinal feature of NLSY97 dataset allows us to mitigate and test for such bias. First, we only used financial experience *before* 2007 when financial knowledge questions were asked in our baseline analysis in the previous section. If the financial knowledge level is evaluated after the financial experience, to some extent, it reduces the possibility that financial knowledge affects financial experience. However, it is possible that financial knowledge is correlated over time. That is, not investing in stocks in the pre-question period may be a reflection of low financial knowledge, which is then explicitly measured by the questions asked later. To exclude such a possibility, we rerun the Poisson regression by using financial experience *after* 2007. The results are shown in Column 2 Table 5. The effect of financial experience *after* 2007 is not significant. The difference in financial knowledge between individuals who have financial experience and those who do not disappears if financial experience was measured after the financial knowledge question. Therefore, the positive correlation between financial knowledge and financial experience observed in Tables 3 and 4 is mainly caused by the effects of financial experience on financial knowledge. Our conclusions are robust.

5. Conclusions

Financial knowledge can lead to better decision-making. To formulate effective public policy interventions to increase financial knowledge among the young, we need to identify and manage aspects that influence the process through which individuals acquire financial knowledge. This article adapts Kolb's model of learning process, which relies on the concurrent roles of the educational, observational, and experiential components of knowledge acquisition. With a longitudinal study, we test the effects of three hypothesized factors on financial knowledge: financial education, financial experience, and parents' financial experience. Based on our results, all three factors significantly improve young adults' financial knowledge. Moreover, they work interactively. Young adults who do not have financial education benefit more from financial experience and parents' financial experience. Our results indicate the indispensable role of hands-on experience and parents' influence especially when school education is not available. Our findings have important implications for financial literacy program evaluation, design, and implementation.

Our model indicates that financial education, financial experience and parents' financial experience work concurrently and interactively on financial knowledge acquisition. Therefore, it's inappropriate to evaluate the effectiveness of one determinant independently from the other factors. For example, to evaluate the effectiveness of a personal finance curriculum, we need to consider students' previous financial experience and their parents' financial sophistication. Otherwise, the results can be biased. In addition, our results show that school-based education is not the only way young adults learn financial

knowledge. Both individual and parents' financial experience could help narrow the gap in financial knowledge caused by lack of financial education. Again, these findings can help in the design of better financial education programs. We encourage more policy support for community and family-based interventions, especially among those who lack formal financial education.

We would like to offer an evaluation of the three financial knowledge questions used in the NLSY97 survey. Although many studies use them, the questions mainly focus on evaluating how well respondents have grasped certain theoretical concepts. These questions may fail to capture the application-oriented knowledge learned from parents or gained through investment experience. This is part of the larger problem of a lack of rigorous measures of financial literacy for researchers to use in their studies (Huston, 2010; Schmeiser and Seligman, 2013; Volpe, Chen, and Liu, 2006). As measures of financial knowledge become more rigorous, the results of studies such as ours will become more exact and useful.

Another area of possible improvement is our *Financial Knowledge Acquisition Framework* measures. Our study uses college major as a proxy for financial education, and uses investment experience as a proxy for financial experience. Future studies can support and expand our theoretical framework by considering an array of variables that might fall under financial education and financial experience. For example, financial education in high school or state financial education curriculum mandates could be alternative measures of young adults' exposure to financial education. Studying the influence of financial experience in areas such as cash-flow management, credit management, savings, or retirement planning would be another productive avenue for future inquiry. It would also be interesting to extend our model by analyzing the difference in financial knowledge between other subgroups such as male versus female (Alhenawi and Elkhal 2013; Chen and Volpe, 1998). Last, as previous literature has argued, there are many unobservable factors that might influence the relationship between our variables of interest. The type of regressions that are reported in the text, even though we make attempt to address reverse causality, still suffer from omitted variables bias. To address this issue, future studies should use an experimental approach, where respondents are divided into "control" and "treatment" groups and exposed to different doses of financial education and experiential learning (see, e.g., Wiedrich et al., 2014).

References

Alhenawi, Y., & Elkhal, K. (2013). Financial literacy of U.S. households: Knowledge vs. long-term financial planning. *Financial Services Review, 22,* 211–244.

Bernheim, B. D., Garrett, D. M., & Maki, D. M. (2001). Education and saving: The long-term effects of high school financial curriculum mandates. *Journal of Public Economics, 80,* 435–465.

Bowen, C. F. (2002). Financial knowledge of teens and their parents. *Financial Counseling and Planning, 13,* 93–101.

Chen, H., & Volpe, R. P. (1998). An analysis of personal financial literacy among college students. *Financial Services Review, 7,* 107–128.

Chen, H., & Volpe, R. P. (2002). Gender differences in personal financial literacy among college students. *Financial Services Review, 11,* 289–307.

Collins, J. M., & O'Rourke, C. M. (2010). Financial education and counseling-still holding promise. *Journal of Consumer Affairs, 44,* 483–498.

Community Banker. (2003). Banks stepping up financial literacy efforts. *Community Banker, 12,* 71–72.

Consumer Bankers Association. (2002). *CBA 2002 Survey of Bank-Sponsored Financial Literacy Programs.* CBA Survey, April 2002. (available at https://www.faircredit.org/files/57.pdf).

Council for Economic Education. (2009). *Survey of the States – Economic, Personal Finance & Entrepreneurship Education in Our Nation's Schools in 2009*. (available at http://www.councilforeconed.org/wp/wp-content/uploads/2011/11/2009-Survey-of-the-States.pdf).

Council for Economic Education. (2014). *Survey of the States – Economic and Personal Finance Education in Our Nation's Schools 2014*. (available at http://www.councilforeconed.org/wp/wp-content/uploads/2014/02/2014-Survey-of-the-States.pdf).

Coxe, S., West, S. G., & Aiken, L. S. (2009). The analysis of count data: a gentle introduction to Poisson regression and its alternatives. *Journal of Personality Assessment, 91,* 121–136.

Danes, S. M., Huddleston-Casas, C., & Boyce, L. (1999). Financial planning curriculum for teens: impact evaluation. *Financial Counseling and Planning, 10,* 26–39.

Employee Benefit Research Institute. (2001). *Parents, Youth & Money 2001.* (available at http://www.ebri.org/surveys/pym-es.pdf).

Hilgert, M. A., Hogarth, J. M., & Beverly, S. G. (2003). Household financial management: The connection between knowledge and behavior. *Federal Reserve Bulletin, 2003,* 309–322.

Huston, S. J. (2010). Measuring financial literacy. *Journal of Consumer Affairs, 44,* 296–316.

Jacobs-Lawson, J. M., & Hershey, D. A. (2005). Influence of future time perspective, financial knowledge, and financial risk tolerance on retirement saving behaviors. *Financial Services Review, 14,* 331–344.

Johnson, E., & Sherraden, M. (2007). From financial literacy to financial capability among youth. *Journal of Sociology and Social Welfare, 34,* 119–146.

Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (1999). *Experiential Learning Theory: Previous Research and New Directions.* http://www.d.umn.edu/~kgilbert/educ5165-731/Readings/experiential-learning-theory.pdf.

Lusardi, A., & Mitchell, O. S. (2008). Planning and financial literacy: How do women fare? *American Economic Review*: *Papers and Proceedings, 98,* 413–417.

Lusardi, A., & Mitchell, O. S. (2011). Financial literacy and planning: Implications for retirement wellbeing. In O. S. Mitchell & A. Lusardi (Eds.), *Financial Literacy: Implications for Retirement Security and the Financial Marketplace* (pp. 17–39). Oxford: Oxford University Press.

Lusardi, A., Mitchell, O. S., & Curto, V. (2010). Financial literacy among the young. *Journal of Consumer Affairs, 44,* 358–380.

Lyons, A. C., Rachlis, M., & Scherpf, E. (2007). What's in a score? Differences in consumers' credit knowledge using OLS and quintile regressions. *Journal of Consumer Affairs, 41,* 223–249.

Mandell, L. (2009). *The Impact of Financial Education in High School and College on Financial Literacy and Subsequent Financial Decision Making*. (available at http://www.americasaves.org/elements/www.americasaves.org/file/Fin%20Behavior%20and%20Ed%20v2.pdf).

Mandell, L., & Klein, L. S. (2007). Motivation and financial literacy. *Financial Services Review, 16,* 105–116.

Montoya, D. Y., & Scott, M. L. (2013). The effect of lifestyle-based depletion on teen Consumer behavior. *Journal of Public Policy and Marketing, 32,* 82–96.

Norvilitis, J. M., & MacLean, M. G. (2010). The role of parents in college students' financial behaviors and attitudes. *Journal of Economic Psychology, 31,* 55–63.

Peng, T. M., Bartholomae, S., Fox, J. J., & Cravener, G. (2007). The impact of personal finance education delivered in high school and college courses. *Journal of Family and Economic Issues, 28,* 265–284.

Schmeiser, M. D., & Seligman, J. S. (2013). Using the right yardstick: Assessing financial literacy measures by way of financial well-being. *Journal of Consumer Affairs, 47,* 243–262.

Shim, S., Serido, J., Bosch, L., & Tang, C. (2013). Financial identity-processing styles among young adults: A longitudinal study of socialization factors and consequences for financial capabilities. *Journal of Consumer Affairs, 47,* 128–152.

Tennyson, S., & Nguyen, C. (2001). State curriculum mandates and student knowledge of personal finance. *Journal of Consumer Affairs, 35,* 241–262.

Van Rooij, M., Lusardi, A., & Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics, 101,* 449–472.

Volpe, R. P., Chen, H., & Liu, S. (2006). An analysis of the importance of personal finance topics and the level of knowledge possessed by working adults. *Financial Services Review, 15,* 81–98.

Wiedrich, K., Collins, M., Rosen, L., & Rademacher, I. (2014). *Financial Education and Account Access Among Elementary Students. Findings From the Assessing Financial Capability Outcomes (AFCO) Youth Pilot.* CFED Working Paper, April 2014.

Worthington, A. C. (2006). Predicting financial literacy in Australia. *Financial Services Review, 15,* 59–79.

Worthy, S. L., Jonkman, J., & Blinn-Pike, L. (2010). Sensation-seeking, risk-taking, and problematic financial behaviors of college students. *Journal of Family and Economic Issues, 31,* 161–170.

Xiao, J. J., Tang, C., Serido, J., & Shim, S. (2011). Antecedents and consequences of risky credit behavior among college students: Application and extension of the theory of planned behavior. *Journal of Public Policy & Marketing, 30,* 239–245.