FINANCIAL SERVICES REVIEW

Financial Services Review 24 (2015) 77–99

Do financial networks matter in retirement investment decisions? Evidence from Generation Yers

Yunhyung Chung[a], Youngkyun Park[a,*]

[a]*College of Business and Economics, University of Idaho, 875 Perimeter Drive MS 3161, Moscow, ID 83844-3161, USA*

Abstract

Using experimental survey data collected from a sample of Generation Yers, we examine the joint influence of financial literacy and financial networks on individual retirement investment decisions. We find, first, that financial literacy and financial network intensity (the network strength with the financially literate) are positively related to stock allocation. Second, the positive relationship between financial literacy and stock allocation, however, is significant only among those having high financial network intensity. This finding suggests that the positive effects of financial literacy documented in the literature can be limited to only those who have strong networks with the financially literate.

Jel classification: G11; J26

Keywords: Retirement investment decisions; Financial networks; Financial literacy

1. Introduction

While the financial environment becomes complex and volatile, individual financial decision-making has been considered an important factor of determining an individual's financial well-being. Thus, a large body of research has investigated what factors influence financial decision-making and has found that financial literacy is a key determinant in many areas such as money management, credit, investment, and retirement planning (e.g., Campbell, 2006; Lusardi & Tufano, 2009; Moore, 2003; Perry & Morris, 2005). However,

* Corresponding author. Tel.: +1-208-885-7154; fax: +1-208-885-5347.
E-mail address: youngpark@uidaho.edu (Y. Park)

1057-0810/15/$ – see front matter

financial literacy alone may not be able to improve financial behaviors substantially (e.g., Fernandes, Lynch, & Netemeyer, 2014; Kiviat & Morduch, 2012).[1] Because of the fast-changing financial product offerings and industry environment, acquiring and processing up-to-date financial knowledge and information is quite challenging even to those who are financially literate (Willis, 2011). Consequently, individual investors often rely on other people to make investment decisions, instead of solely on their own knowledge.

Relatively recently, research on financial decision-making has begun to recognize the importance of social interactions in individual investment decisions. Because individual investors may be able to reduce time and effort to acquire financial knowledge and information through social interactions with others, "social" people are more likely to participate in financial markets than others who do not engage in social interactions (Brown, Ivković, Smith, & Weisbenner, 2008; Duflo & Saez, 2002; Hong, Kubik, & Stein, 2004; Ivković & Weisbenner, 2007; Kaustia & Knupfer, 2012; Lu, 2011). In line with this argument, research on social networks in management finds that individuals may acquire a high volume of and diverse work-related knowledge and information through frequent communication with co-workers or experts who have task-related knowledge (Hansen, Mors, & Lovas, 2005; McFadyen & Cannella, 2004; Reinholt, Pedersen, & Foss, 2011; Wang & Noe, 2010). Because tacit and confidential knowledge tend to be shared only with whom people trust (Nahapiet & Goshal, 1998; Yli-Renko, Autio, & Sapienza, 2001) and transferred through strong network ties (Chung & Jackson, 2013; Hansen, Podolny, & Pfeffer, 2001), strong connections with people who are financially literate may facilitate individuals to obtain reliable and opportune information for investments without excessive time and effort.

Drawing on the literature on financial literacy and social networks, we propose that an individual investor's decision-making may be affected by not only his or her financial knowledge but also social networks. Among various types of social networks (e.g., career advice networks and task information networks), we focus on individuals' social networks for acquiring financial or investment information, which are dubbed "financial networks." While prior studies focused on social activities, few studies examined how social networks influence investment decisions.[2] Thus, this study aims to fill this gap by taking account of financial networks in discussing individuals' investment decisions. Among financial network characteristics, we focus on *financial network intensity*, defined as communication frequency with the financially literate, because frequent interactions with the financially literate may enable an individual investor to acquire critical and reliable information and knowledge for his or her investments.

Taken together, we examine how financial knowledge and financial network intensity are associated with individual investment decisions. Among various individual investment decisions, we consider the following sequential decision-making process for retirement investment: first, whether an individual investor chooses a default investment option or not and, second, when selecting "no default," to what extent he/she allocates contributions to stocks. For this examination, we collected experimental survey data from senior business college students at age 20–26 in 2012, who belong to the Generation Y (ages 18–35 in 2012). Most of them will enter an early stage of their working career upon graduation and likely become defined contribution plan participants. We chose this sample because retirement investment decisions in their early career may significantly affect their retirement

wealth. Once new employees make a retirement investment decision, they tend to stick with the status quo and avoid changing their retirement investment portfolio (Choi, Labibson, Madrian, & Metrick, 2004, 2006; Madrian & Shea, 2001). In addition, given that the Social Security trust fund is projected to be exhausted in 2034 and at that time that Social Security will be able to cover only 75% of scheduled benefits (Social Security and Medicare Boards of Trustees, 2014), how to construct a retirement portfolio would be more important to Generation Yers than older generations.

With a sample ($N = 97$) of senior students in a business college, first, a choice of no default in a retirement plan is positively associated with financial literacy (or financial knowledge), but not significantly associated with financial network intensity (or the network strength with the financially literate).[3] Second, respondents' contribution allocation to stock funds is positively associated with financial literacy or financial network intensity. Third, financial literacy does not interact with financial network intensity on a choice of a default option, but they interact with each other on respondents' contribution allocation to stock funds in a retirement portfolio. In an additional analysis on the interaction effect, the positive effects of financial literacy on stock allocation in a retirement portfolio are significant only among those who have high financial network intensity.[4] The interaction between financial literacy and financial network intensity also affects how much respondents' retirement portfolios deviate from age-appropriate stock allocations, the deviation that is evaluated with respect to the *Morningstar Lifetime Allocation Indexes*. We find that those with a high level of financial literacy have smaller deviations from the age-appropriate stock allocations only when they have strong networks with the financially literate.

This study enhances an understanding of retirement investment decision-making and long-term financial planning. While extant research finds financial literacy as a key determinant in retirement investment decision-making and long-term financial planning (e.g., Alhenawi & Elkhal, 2013; Lusardi & Mitchell, 2007a, 2007b), our research finds that financial literacy and social networks interplay in retirement investment decision-making. Specifically, the positive effects of financial literacy on retirement investment decisions documented in the literature can be limited to only those who have strong networks with financially literate people.

The results of this study may also provide practical implications to individual investors, financial planners, and employer-sponsored financial education programs. To improve investment decisions, individual investors' own financial knowledge alone may not be enough; when they synthesize their own financial knowledge and the knowledge acquired through interactions with the financially literate, their investment decisions can be significantly enhanced. Therefore, our findings shed light on the importance of financial networks with family, co-workers, and professional financial planners when individual investors make investment decisions. Finally, employer-sponsored financial education programs may be designed not only to elevate employees' financial knowledge but also to provide more opportunities to build networks for financial advice (such as more opportunities to communicate with financial planners or advisors).

The remainder of the article is organized as follows. Section 2 provides a literature review on financial literacy, financial network intensity, and retirement investment decisions and addresses hypotheses. Section 3 describes the sample, survey instruments, and model

specification to test the hypotheses. Section 4 presents regression results indicating that financial literacy and/or financial network intensity can affect retirement investment decisions. Section 5 concludes with a summary of findings and suggestions for future research.

2. Financial literacy, financial network intensity, and retirement investment decisions

Managing an investment portfolio requires an individual investor to spend significant time and effort in understanding various finance concepts such as asset returns, volatility, and covariance between asset returns. Thus, information costs—for example, costs of acquiring and processing information about risks and returns—represent a significant barrier for individual investors to build their own investment portfolio (Christelis, Jappelli, & Padula, 2010; Vissing-Jørgensen, 2003). Building on the notion of information cost, we argue that individual investors' financial literacy and financial networks reduce information cost, which consequently influences their retirement investment portfolios.

2.1. Financial literacy

Information costs for investments may be substantially large for people who have low financial knowledge and skills (Vissing-Jørgensen, 2003). Because they have to spend significant time and effort in acquiring and processing financial information, they may give up the costly process for investment decision-making and seek a simple solution (Bettman & Park, 1980). Agnew and Szykman (2005) find that individual investors with a low level of financial knowledge are likely to opt for a default investment option more often than those with a high level of financial knowledge. In addition, Choi et al. (2004) find from several 401(k) plans that young, female, and low-income participants with short tenure, who are typically associated with a low level of financial literacy (Banerjee, 2011; Hung, Parker, & Yoong, 2009; Lusardi & Mitchell, 2007a), are more likely to choose a default investment option than others. Based on the theoretical and empirical findings in the previous literature, we argue that individuals who have little knowledge of finance are more likely to select a default investment option than those who have much knowledge of finance. On the contrary, individuals with a high level of financial literacy are more likely to choose no default and build their own retirement investment portfolio than those with a low level of financial literacy. In this respect, we hypothesize the following:

H1a: Financial literacy is positively associated with a choice of "no default" in a retirement plan.

Individual investors who are financially literate may be able to reduce the costs of acquiring and processing financial information and, as a result, increase stockholding.[5] Because financial literacy helps reduce the fixed costs of acquiring and processing financial

information (e.g., Vissing-Jørgensen, 2003),[6] financially literate investors are likely to hold stocks (van Rooij et al., 2011; Yoong, 2010).[7] In addition, once individual investors acquire financial knowledge or information, they may apply this knowledge or information to a larger volume of the risky asset with an increase in the expected rate of return (Delavande, Rohwedder, & Willis, 2008). In this respect, we expect that individual investors with a high level of financial literacy are likely to allocate more contributions to stocks than those with a low level of financial literacy, all else being equal.

H1b: Financial literacy is positively associated with stock allocation in a retirement investment portfolio.

2.2. Financial network intensity

Individuals' investment decisions are affected by not only their own financial literacy but also social interactions such as word-of-mouth or observational learning (Banerjee, 1992; Bikchandani et al., 1992; Ellison & Fudenberg, 1993, 1995). For example, individuals' investment behavior is affected by investment decisions or outcomes of their co-workers (Duflo & Saez, 2002; Lu, 2011) or neighbors (Brown et al., 2008; Hong et al., 2004; Ivković & Weisbenner, 2007; Kaustia & Knupfer, 2012) because social interactions, like financial literacy, may be able to reduce the costs of acquiring and processing financial information.

Network ties can serve both instrumental/informational and expressive/social purposes (Balkundi & Harrison, 2006; Cascioaro & Lobo, 2008). This study focuses on the instrumental role of networks, assuming that instrumental external ties are most relevant to acquiring financial knowledge and information. For instrumental external ties, the network strength (in terms of communication frequency) with the financial literate is of our particular interest; the costs of acquiring and processing information related to investment may be reduced by frequent interactions with people who are financially knowledgeable. Social network literature documents that frequent communications generate "strong ties" and, thus, trust between people in the network (e.g., Krackhardt, 1992). Trustworthy information built on frequent communications in one's networks, then, can affect his or her investment decisions (e.g., Guiso, Sapienza, & Zingales, 2008).[8] Because people tend to share critical and confidential knowledge only with whom they trust (Nahapiet & Goshal, 1998; Yli-Renko, Autio, & Sapienza, 2001), frequent interactions with people who have high financial literacy may provide individuals easy access to a high quality of investment and knowledge. Therefore, through social networks with the financially literate, individuals may acquire reliable and opportune information for their investments.

Drawing on the studies on social network, we expect that financial network intensity, indicating the relationship strength with the financially literate, may influence individuals' investment decisions. Specifically, for a given default investment option, we expect that

individual investors who have strong networks with the financially literate are likely to build their own retirement portfolio instead of selecting a default option. Thus, we hypothesize the following:

H2a: Financial network intensity is positively associated with a choice of "no default" in a retirement plan.

A strong relationship with people who have a high level of financial literacy may also encourage individuals to increase stock allocation in their retirement investment portfolio. Because individuals are likely to obtain critical and reliable financial or investment information through frequent interactions with the financially literate, they may significantly be able to reduce time and effort to obtain and process the information necessary for their investments. Individuals usually have limited time and effort to spend on constructing a retirement portfolio. Thus, strong networks with financially literate people (i.e., high financial network intensity) may enable individual investors to easily obtain investment information with lower costs and, as a result, to increase stockholdings. In this regard, we hypothesize the following:

H2b: Financial network intensity is positively associated with stock allocation in a retirement investment portfolio.

2.3. Interactions of financial literacy and financial network intensity

In the previous sections, we developed the hypotheses that financial literacy or financial network intensity affects individuals' investment decisions for retirement. The two factors may also interact for retirement investment decisions. Specifically, we argue that financially knowledgeable individuals are more likely to build their own portfolio and increase stock allocations when they have higher financial network intensity (i.e., stronger networks with the financially literate) than otherwise. Individual investors who have high financial knowledge may have greater ability to understand broad and diverse knowledge about financial investment obtained through interactions with the financially literate. In addition, financially knowledgeable investors may easily synthesize their own financial knowledge and the knowledge acquired through social networks with the financially literate. As a result, financial networks may enable individual investors with high financial literacy to reduce their opportunity cost of obtaining and processing financial knowledge, which consequently eases their investment decision-making. Hence, we argue that individual investors' financial network intensity complements their financial literacy: any positive effects of financial literacy on retirement investment decisions would be stronger among those having high financial network intensity than those having low financial network intensity. Accordingly, we expect the following:

H3a: Financial network intensity interacts with financial literacy on the selection of a default investment option in a retirement plan.

H3b: Financial network intensity interacts with financial literacy on stock allocation in a retirement investment portfolio.

3. Sample, survey instruments, and model specification

3.1. Sample and procedure

To examine the effects of financial literacy and financial network intensity on investment decisions, we collected data from 111 senior college students in a business school located in the northwestern United States, using a traditional paper-and-pencil survey in the classroom in Spring and Fall 2012 semesters. To enhance survey participants' calculation accuracy, calculators were distributed at the beginning of the survey. Students who participated in the survey received class engagement credits. Four respondents who were 35 or older and 10 respondents who did not provide all the information are excluded from the sample, resulting in a sample of 97 respondents.

3.2. Experimental survey design, model specification, and measures

3.1.1. Investment decisions for retirement

Using an experimental survey method, we developed a scenario regarding investment decisions in a context of a 401(k) plan. In the scenario, we asked respondents to assume that they were recently hired and asked to make investment decisions for a 401(k) plan with an array of investment options provided by a company. We assessed two dependent variables from sequential retirement investment decisions. First, survey respondents were asked to make a decision for a default investment option, which is a money market fund. If a respondent did not choose the default option, then he or she was asked to build his or her own retirement portfolio from an array of investment options: 10 different mutual funds including a money market fund.[9] The information for each fund was provided in a separate brochure so that survey participants could compare investment objectives, strategies, expenses, risk and return, and the performance of the funds. The fund information was provided using actual funds in the marketplace, but actual fund names including fund family names were not disclosed in the brochure to prevent respondents from selecting a fund only because of their familiarity with fund family names. Table 1 summarizes fund information provided for survey participants. Respondents were asked to use the fund information and allocate their contributions as a percentage to each fund up to the total contribution of 100%.

3.1.2. Model specification

To reflect respondents' sequential investment decisions, we estimate the following Heckman two-stage selection model:

Table 1 Summary fund information provided for survey participants

Fund types
1. Money market fund (designated as a default investment option)
2. Small-cap growth fund
3. Mid-cap blend fund
4. Large-cap value fund
5. Large-cap growth fund
6. Foreign small/mid-cap blend fund
7. Foreign large-cap value fund
8. Short-term bond fund
9. Intermediate-term bond fund
10. Inflation-protected bond fund
Fund information
1. Investment objective
2. Principal investment strategies
3. Principal investment risks
4. Annual expense ratio
5. Return and risk
a. Three-year average return, *SD*, and Sharpe ratio
b. Five-year average return, *SD*, and Sharpe ratio
6. 10-year total annual returns (a bar graph including data labels)

Notes: The information for ten funds was provided in a separate brochure so that survey participants could compare investment objectives, strategies, expenses, risk and return, and the performance of the funds. The fund information was provided using actual funds in the marketplace, but actual fund names including fund family names were not disclosed in the brochure to prevent respondents from selecting a fund due to family names.

$$\text{Selection: } s_i^* = \gamma_0 + \gamma_1 FL_i + \gamma_2 FN_i + \gamma_3 (FL_i FN_i) + \gamma_4 Z_i + u_i \tag{1}$$

$$s_i = 1 \quad \text{if} \quad s_i^* > 0 \quad \text{and} \quad s_i = 0 \quad \text{if} \quad s_i^* \leq 0$$

$$\text{Stock allocation: } y_i = \beta_0 + \beta_1 FL_i + \beta_2 FN_i + \beta_3 (FL_i FN_i) + \beta_4 W_i + \varepsilon_i \tag{2}$$

We use the Heckman two-stage selection model because the two-stage selection model would overcome a potential selection bias problem that the error term (ε_i) in Eq. (2) can be correlated with the error term (u_i) in Eq. (1). In the selection equation, the dependent variable (s_i) is a dummy, which indicates whether individual i chooses the default option—that is, a money market fund—or not. If a respondent selects "no default," the variable takes a value of 1 and otherwise 0. In the stock allocation equation, the dependent variable (y_i) indicates individual i's contribution allocation to stock funds as a percentage. Stock allocation (y_i) is calculated by summing respondent i's contribution allocations to domestic and international stock funds as a percentage. As key independent variables, the model includes FL_i and FN_i, which indicate individual i's financial literacy and financial network intensity, respectively, and their interaction term ($FL_i FN_i$). Z_i and W_i indicate a set of control variables for the selection equation and the stock allocation equation, respectively.

3.1.3. Financial literacy

To measure an individual's financial literacy, first, we assume that financial literacy can be captured by a level of financial knowledge, following prior studies on financial literacy (e.g., Alhenawi and Elkhal, 2013; Collins, 2012; Hilgert et al., 2003; Lusardi and Mitchell,

Table 2 Summary of questions for financial networks

Question 1. During the five years, how often have you talked to each person to acquire financial and/or investment information?
0 = Never
1 = Once a year or less
2 = Several times a year
3 = Once a month
4 = 2–3 times a month
5 = Once a week or more
Question 2. Indicate to what extent each person has financial knowledge.
1 = Very little
2 = Below average
3 = Average
4 = Above average
5 = Very high

Notes: Survey respondents were asked to list the first and last name initials of up to 10 people (including spouse/partner, parents, siblings, relatives, friends, coworkers, financial planners or advisors, and others) who they believe are most important to their financial or investment decisions. For each person respondents listed, they were also asked to answer the above two questions about communication frequency and financial literacy.

2007a). Next, to evaluate respondents' financial knowledge, we use a battery of five questions from the National Financial Capability Study supported by the FINRA Investor Education Foundation. These questions cover fundamental concepts of economics and finance, such as calculations about interest rates and inflation, the relationship between interest rates and bond prices, the relationship between interest payments and maturity in mortgages, and risk diversification.[10] A higher score indicates a higher level of financial literacy.

3.1.4. Financial network intensity

Following Chung and Jackson (2013) and Reinholt, Pedersen, and Foss (2011), we use an egocentric network technique to assess respondents' financial network intensity. Respondents list the first and last name initials of up to 10 people (including spouse/partner, parents, siblings, relatives, friends, co-workers, financial planners or advisors, and others) who they believe are most important sources to their financial or investment decisions. Limiting the list of possible contacts to 10 people may not allow respondents to describe their entire financial networks, but constraining the number of contacts listed has the benefit of making data collection more feasible (Morrison, 2002).

For each person in their network, respondents provide scores to answer two questions: communication frequency and a level of financial knowledge (see Table 2). Using the responses to the two questions, we yield an individual's financial network intensity measured by communication frequency with the financially literate in his or her financial networks. We define individual i's financial network intensity (FN_i) as follows:

$$FN_i = \frac{\sum_{j=1}^{J}(CFREQ_{ij} \times NFK_{ij})}{MaxZ_i} \quad \text{for} \quad j = 1, 2, \ldots, J\ (\leq 10) \tag{3}$$

First, individual i identifies persons (j) in his or her financial network (called "alters"), but the number of alters is constrained up to 10 ($J \leq 10$). J indicates the total number of persons in individual i's financial networks. Second, individual i evaluates communication frequency with a person j in his or her network ($CFREQ_{ij}$), using a scale of 0 (never) to 5 (once a week or more) (Table 2: Question 1). We assume that a large value of communication frequency indicates a strong relationship with a person in one's network. Third, individual i evaluates the financial literacy of person j, using a scale of 0 (very little) to 5 (very high) (Table 2: Question 2). The responses are converted to a binary variable (NFK_{ij}), which indicates whether person j in individual i's network is financially literate or not. NFK_{ij} takes a value of one for a response of "above average" or "very high" and a value of zero for a response of "very little," "below average," or "average." Fourth, because NFK_{ij} is zero for person j's average or lower financial literacy in individual i's network, the numerator in the Eq. (3) is computed by summing up individual i's communication frequencies with only the financially literate in his or her network. Finally, individual i's network strength with the financially literate is evaluated with respect to the maximum possible value ($MaxZ_i$) that the individual can have from the relationships with the financially literate. $MaxZ_i$ is defined as a product of J, the maximum possible value of $CFREQ_{ij}$ ($= 5$), and the maximum possible value of NFK_{ij} ($= 1$) for individual i. For example, when individual i has five persons in his or her financial networks, his or her maximum possible value ($MaxZ_i$) is 25 ($= 5 \times 5 \times 1$). Thus, individual i's financial network intensity (FN_i) takes a value between 0 and 1; a larger value of FN_i indicates greater network strength with the financially literate.

3.1.5. Control variables

Respondents' network size, investment experience, risk tolerance, grade point average (GPA), current mood state, and demographic backgrounds are included as control variables.

First, following Hansen et al. (2001), we define network size as the total number of persons from whom a respondent acquires financial or investment information. Those who have a larger size of network may have more chances to obtain a broader spectrum of information and knowledge (e.g., Chung and Jackson, 2013; Gargiulo, Ertug, and Galunic, 2009).

Second, we include respondents' risk tolerance, following prior studies on financial risk tolerance and investment behavior (e.g., Gibson, Michayluk, and Venter, 2013; Guiso et al., 2008; Hong et al., 2004; van Rooij et al., 2011; Yoong, 2010). Respondents' decisions on a choice of a default option and stock allocation may be affected by their risk tolerance. To measure risk tolerance, we use a battery of 13 items developed by Grable and Lytton (1999).[11]

Third, we control for investment experience. We expect that a respondent's prior investment experience may influence his or her decisions on a choice of a default option and stock allocation. Thus, survey participants were asked to answer whether they have owned any stocks or mutual funds during the past five years. When a respondent answers "Yes" in either stocks or mutual funds, the respondent is regarded as one who has investment experience.

Fourth, we control for the current mood state by including the 20-item Positive Affect and Negative Affect Scale (PANAS; Watson et al., 1988), relying on the findings of the literature on personality and social psychology that risk perceptions and associated choices are

significantly influenced by the mood state (or feelings) at the moment of decision making (e.g., Forgas, 1995; Isen, 2000; Leith and Baumeister, 1996; Loewenstein et al., 2001).

Fifth, we control for respondents' GPA. Individuals who have high academic performance are likely to have a stronger belief in their ability than those who have low academic performance (Bandura, 1993, 1997; Becker and Gable, 2009). Thus, we expect that respondents having a higher GPA are less likely to choose a default investment option. Respondents' GPA, however, is excluded from the stock allocation equation because there is no previous evidence on the relationship between GPA and the propensity to invest in stocks. Furthermore, the exclusion of GPA from the stock allocation equation avoids any problems for identification with the Heckman two-stage selection model.[12] Thus, we assume that respondents' GPA has no direct effect on stock allocation.

Finally, we control for individual demographic characteristics: gender (female = 1), age, and ethnicity (White = 1, otherwise = 0).

4. Results

4.1. Descriptive statistics

Table 3 presents descriptive statistics of the sample. The mean score of respondents' financial literacy is 4.1, which is greater than the 3.4 that Lusardi (2011) reported for college graduates or higher in the national survey sample of 1,488 adults in 2009. The higher score of financial literacy may result from our sample characteristics that all respondents are business students. For financial networks, the respondents in the sample identify, on average, 4–5 people from whom they have obtained financial or investment information. The average financial network intensity is 0.28. This indicates that, for example, when a respondent has five persons in his or her financial network who all are financially literate, he or she has contacted one person at the frequency of "once a month" but the other four persons at the frequency of "once a year or less." For risk tolerance, our respondents have an average score of 26.49, which is close to the average scores of 28.83 and 27.03 reported by Grable and Lytton (2003) and Grable, Lytton, and O'Neill (2004), respectively. About 39% of our respondents have investment experience. Female respondents consist of 41% of the sample. Respondents' age ranges from 20 to 26 with a mean age of 22.1. About 87% of the respondents are White. Panel B of the table reports correlation coefficients between respondents' selection of "no default," stock allocation, financial literacy, and financial network variables. In particular, the variables of financial literacy, financial network size, and financial network intensity are not significantly correlated with each other. Hence, an inclusion of these three variables in the same regression equation would not incur significant multi-collinearity problems among the variables.

4.2. Effects of financial literacy and financial network intensity on retirement investments

To examine the effects of financial literacy and financial networks on respondents' investment decisions for retirement, we use the Heckman two-stage selection model de-

Table 3 Sample descriptive statistics and correlation
Panel A: Descriptive statistics

Variables	Number of obs.	Min	Max	Median	Mean	*SD*
Financial literacy (score)	97	2	5	4	4.09	0.84
Financial network:						
Size	97	1	10	4	4.60	2.46
Intensity	97	0	0.92	0.25	0.28	0.22
Risk tolerance (score)	97	18	37	26	26.49	4.20
Investment experience (yes = 1)	97	0	1	0	0.39	0.49
Gender (female = 1)	97	0	1	0	0.41	0.49
Age	97	20	26	22	22.06	1.20
Ethnicity (White = 1)	97	0	1	1	0.87	0.34
GPA	97	1.90	4.00	3.11	3.14	0.41
Current mood state:						
Positive (score)	97	17	46	37	37.24	5.22
Negative (score)	97	10	33	18	18.56	5.02
Selection of a default option ("no default" = 1)	97	0	1	1	0.66	0.48
Contribution allocation to stock funds (for only those selecting "no default")	64	0	1.00	0.50	0.52	0.20

Panel B: Correlations of selection of no default, stock allocation, financial literacy, and financial networks

	1	2	3	4	5
1. Selection of "no default"	1.000				
2. Stock allocation (for only those selecting "no default")	—	1.000			
3. Financial literacy	0.365**	0.390**	1.000		
4. Financial network size	0.096	−0.162	−0.113	1.000	
5. Financial network intensity	0.128	0.399**	0.120	−0.084	1.000

**$p < 0.01$.

scribed in Eqs. (1) and (2). Column 1 of Table 4 presents regression results of the two-stage selection model: Column 1a presents probit regression results for decisions on the default option (the first stage), whereas Column 1b presents ordinary least square regression results for stock allocation (the second stage). About two-thirds of the 97 respondents select "no default," and they build their own retirement portfolios. Since we ask respondents to build their retirement investment portfolios only when they answer "no default" for the default investment option (a money market fund), the two-stage selection model would overcome a potential selection bias problem that the error term (ε_i) in the stock allocation equation is correlated with the error term (u_i) in the selection equation.

First, respondents' financial literacy is significantly positively related to a choice of "no default" (Column 1a) and stock allocation (Column 1b). For example, if a respondent's financial literacy score increases from 4 to 5 (the largest score), the probability of selecting "no default" increases by 0.189 (from 0.708 to 0.897) and stock allocation increases by 12.7 percentage points (from 48.4 to 61.0%), with the other variables held at their mean values. The results support hypotheses *H1a* (a positive relationship between financial literacy and a

Table 4 Regression results: Default investment option and contribution allocation to stock funds

Dependent variables	(1)		(2)	
	(1a) Selection of no default (first stage)	(1b) Contribution allocation to stock funds (second stage)	(2a) Selection of no default (first stage)	(2b) Contribution allocation to stock funds (second stage)
Financial literacy (score)	0.715**	0.127**	0.768**	0.111**
	(0.222)	(0.035)	(0.235)	(0.035)
Financial network size	0.104	0.006	0.109	0.003
	(0.069)	(0.009)	(0.070)	(0.008)
Financial network intensity	0.794	0.268**	0.650	0.184*
	(0.751)	(0.091)	(0.744)	(0.087)
(Financial literacy) × (Financial network intensity)			−0.734	0.269*
			(0.699)	(0.107)
Risk tolerance (score)	−0.033	0.017**	−0.034	0.016**
	(0.042)	(0.005)	(0.042)	(0.005)
Investment experience (yes = 1)	0.938*	0.088	0.962*	0.085
	(0.385)	(0.049)	(0.387)	(0.046)
Gender (female = 1)	−0.051	0.048	−0.027	0.036
	(0.345)	(0.041)	(0.350)	(0.039)
Ethnicity (White = 1)	0.011	0.162**	0.110	0.121*
	(0.456)	(0.061)	(0.470)	(0.059)
Current mood state				
Positive (score)	0.011	0.012*	0.007	0.013**
	(0.032)	(0.004)	(0.032)	(0.004)
Negative (score)	−0.077*	−0.001	−0.079*	<0.001
	(0.037)	(0.005)	(0.037)	(0.005)
GPA	1.065**		1.040*	
	(0.408)		(0.412)	
Constant	−4.839*	−1.281**	−1.511	−0.675**
	(3.389)	(0.290)	(1.990)	(0.228)
λ: Mill's ratio	0.149		0.137	
[*p*-value]	[0.065]		[0.071]	
Observations	97	64	97	64
Pseudo R^2	0.305		0.313	
Adjusted R^2		0.514		0.567

Notes: When an interaction term of *Financial literacy* and *Network intensity* is included in Column 2, the variables of *Financial literacy* and *Network intensity* are centered with respect to the mean. This centering, however, does not affect the coefficients and their significance. Standard errors are in parentheses.

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

choice of "no default") and *H1b* (a positive relationship between financial literacy and stock allocation).

Second, financial network intensity is not significantly related to a selection of "no default" (Column 1a), but it is significantly positively related to stock allocation (Column 1b). For example, a respondent's stock allocation increases by 2.7 percentage points as his or her network intensity increases by 10%. The results do not support hypothesis *H2a* (a positive relationship between financial network intensity and a choice of "no default") but do support *H2b* (a positive relationship between financial network intensity and stock allocation).

Accordingly, the results reported in Columns 1a and 1b suggest that when making a decision on whether or not to choose a default option, respondents are likely to rely on their financial literacy but not on their financial networks. However, when constructing a retirement portfolio such as determining stock allocations, respondents are likely to draw on both their financial literacy and financial networks. Hence, financial literacy and financial network intensity were positively associated with stock allocation.

In addition, respondents' investment experience, current mood state, and GPA are significantly related to their selection on the default investment option (Column 1a) or stock allocation (Column 1b). First, when a respondent has any investment experience during the past five years, he or she is likely to select "no default" but not likely to significantly increase stock allocation. Second, different mood states involve different investment tasks. A negative (or unpleasant) mood state is significantly related to a choice of the default investment option whereas a positive (or pleasant) mood state is not. This may be because a negative mood state inhibits people from making rational decision-making because of excessive stress (Leith and Baumeister, 1996). In addition, a positive (pleasant) mood state is likely to increase stock allocation in a retirement portfolio, but a negative mood state is not. Because people who have a positive mood state tend to underestimate the possibility of loss, they are more willing to take a risk (Au, Chan, Wang, & Vertinsky, 2003; Seo, Goldfarb, & Barret, 2010). Respondents' GPA is positively related to a choice of "no default," as expected.

4.3. Interaction effects of financial literacy and financial network intensity

In addition to the main effects of financial literacy and financial network intensity on investment decisions for retirement, we hypothesized that the two variables interact with each other. Column 2 of Table 4 presents regression results of the Heckman two-stage selection model that includes an interaction term of financial literacy and financial network intensity. The interaction term is not significantly related to respondents' selection of the default option (Column 2a), not supporting hypothesis *H3a*. The interaction term, however, is significantly positively related to stock allocation (Column 2b), supporting hypothesis *H3b*. The positive sign of the interaction term indicates a complementary effect between financial literacy and financial network intensity on stock allocation in a retirement portfolio.

To further examine the interaction effect, following Aiken and West (1991), we depict respondents' contribution allocation to stock funds with respect to two different levels of financial literacy and financial network intensity. A high or low level is defined by 1 *SD* above or below the mean, respectively. Fig. 1 shows that the relationship between financial literacy and stock allocation is positive and significant in a high level of financial network intensity (with a slope of 0.171, p-value < 0.001), but this relationship is not significant in a low level of financial network intensity (with a slope of 0.050, p-value $= 0.300$). The results suggest that the positive effects of financial literacy on stock allocation documented in the literature (e.g., van Rooij et al., 2011; Yoong, 2010) are limited to those who have a high level of financial network intensity (i.e., high network strength with the financially literate).

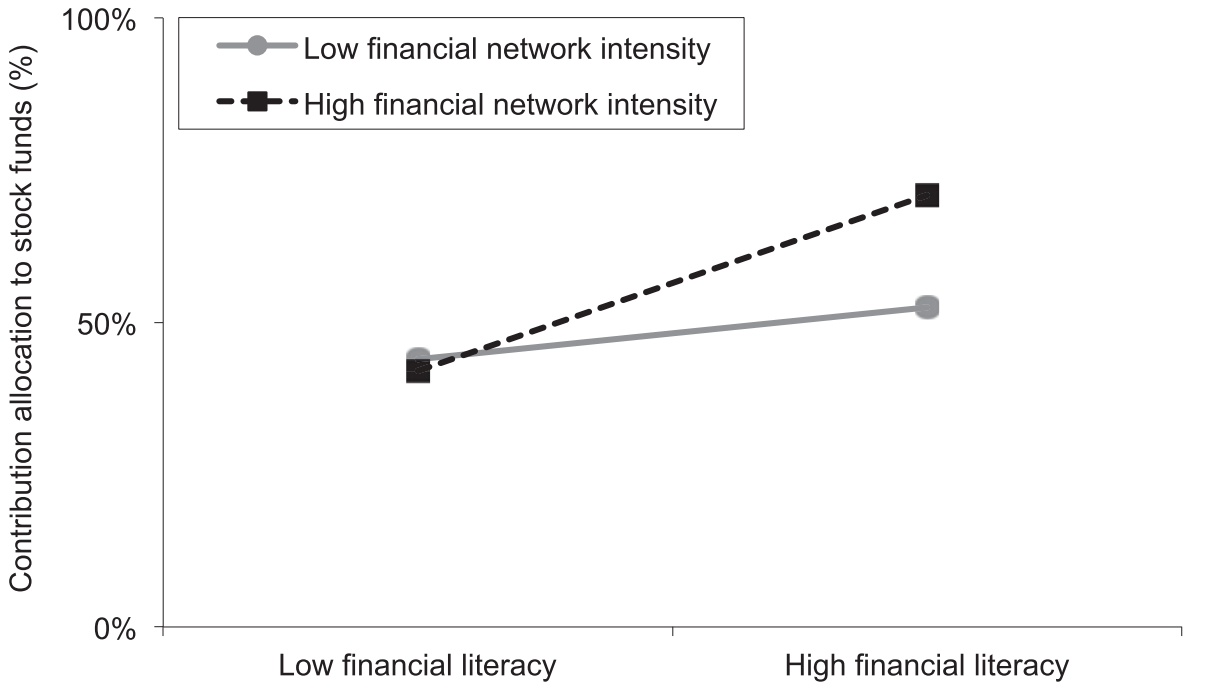

Fig. 1. Interaction effects of financial literacy and network intensity on contribution allocation to stock funds. *Notes*: This figure depicts the interaction effects based on the regression results in Column 2b of Table 4.

4.4. Effects of financial literacy and financial network intensity on stock allocation: Deviation from age-appropriate stock allocations

Among those who select "no default" and build their own retirement portfolio with the 10 mutual funds offered, some respondents may not construct an appropriate portfolio—for example, too little or too much stock allocation. In this section, we attempt to see whether respondents construct an appropriate retirement investment portfolio based on their age and risk tolerance level, focusing on stock allocation. For doing this, we use as a benchmark the 2012 *Morningstar Lifetime Allocation Indexes*—U.S. Investors (Morningstar, 2012). The *Morningstar Indexes* provide the information of asset allocation over lifetime for three different risk profiles: aggressive, moderate, and conservative. We assume that the asset allocations of the *Morningstar Indexes* represent age-appropriate ones for retirement.

To calculate any deviation of respondents' stock allocation from the stock allocations of the *Morningstar Indexes*, we use the following formula:

$$Dev_i = |y_i - Index_k| \tag{4}$$

where the variable y_i indicates individual i's contribution allocation to stock funds as a percentage and where $Index_k$ indicates stock allocations of the *Morningstar Indexes* for k = aggressive, moderate, or conservative. A k is determined according to a respondent's risk tolerance level: for example, if a respondent's risk tolerance level is low, a conservative allocation of the *Morningstar Indexes* is regarded as his or her appropriate asset allocation. A respondent's risk tolerance is categorized into three levels based on his or her risk tolerance score. A *low* level of risk tolerance is defined with scores of less than 24, a *medium*

level with scores of 24–32, and a *high* level with scores of more than 32. The threshold scores of 24 and 32 are derived from the findings of Grable and Lytton (2003) and Grable et al. (2004).[13]

Those who selected "no default" have constructed their retirement portfolios with a deviation of 7.2–80.9 percentage points from the age-appropriate stock allocations. The mean deviation is 35.8 percentage points (Panel A of Table 5). To examine how the deviation is related to respondents' financial literacy and financial network intensity, we estimate a Heckman two-stage selection model that includes the deviation from the age-appropriate stock allocations as a dependent variable in the second stage. The model also includes an interaction term of financial literacy and financial network intensity.

Panel B of Table 5 presents the regression results for the deviation from the age-appropriate stock allocations based on respondents' age and risk tolerance level. Column 1b shows that the deviation is significantly negatively related to financial literacy and financial network intensity. In addition, the interaction term of financial literacy and financial network intensity is significantly negatively related to the deviation. The negative sign of the interaction term indicates a complementary effect between financial literacy and financial network intensity on reducing the deviation from the benchmark stock allocations.

To further examine the interaction effects, we depict the deviation from the age-appropriate stock allocation with respect to two different levels of financial literacy and financial network intensity. A high or low level is defined by 1 *SD* above or below the mean, respectively, as in Fig. 1. Fig. 2 shows that the effect of financial literacy on the deviation is significant in the high financial network intensity (with a slope of -0.156, p-value < 0.001), but is not significant in the low financial network intensity (with a slope of -0.056, p-value $= 0.212$). The results indicate that a reduction of the deviation from the age-appropriate stock allocation by enhancing financial literacy would be effective only among those who have a high level of financial network intensity (i.e., strong relationships with the financially literate).

5. Conclusion

This article examines the role of financial literacy and financial network intensity in retirement investment decisions of Generation Yers. With a complete sample of 97 senior business college students, aged 20–26 in 2012, we find first that when a money market fund is designated as a default investment option, respondents who have high financial literacy are more likely to select "no default," but their financial networks are not significantly related to their choice. Second, respondents who have high levels of financial literacy or financial network intensity are likely to allocate more contributions to stock. Third, financial literacy and financial network intensity significantly interact on stock allocation in a retirement portfolio. Specifically, the positive effect of financial literacy on stock allocation is significant in the high financial network intensity, but the financial literacy effect is not significant in the low financial network intensity. Last, when respondents construct their retirement portfolios, stock allocations are largely deviated from the age-appropriate stock allocations given their age and risk tolerance level. The deviations, however, are significantly reduced

Table 5 Contribution allocation to stock funds: Deviation from age-appropriate allocations
Panel A: Descriptive statistics

	obs.	Min	Max	Median	Mean	*SD*
Deviation from age-appropriate stock allocations	64	0.072	0.809	0.383	0.358	0.174

Panel B: Regression results

Dependent variables	(1-a) Selection of no default (first stage)	(1-b) Deviation of stock allocation (second stage)
Financial literacy (score)	0.768**	−0.106**
	(0.235)	(0.032)
Financial network size	0.109	−0.001
	(0.070)	(0.008)
Financial network intensity	0.650	−0.169*
	(0.744)	(0.080)
(Financial literacy) × (Financial network intensity)	−0.734	−0.223*
	(0.699)	(0.097)
Risk tolerance (score)	−0.034	−0.009
	(0.042)	(0.005)
Investment experience (yes = 1)	0.962*	−0.077
	(0.387)	(0.042)
Gender (female = 1)	−0.027	−0.037
	(0.350)	(0.036)
Ethnicity (White = 1)	0.110	−0.103
	(0.470)	(0.054)
Current mood state:		
Positive (score)	0.007	−0.013**
	(0.032)	(0.004)
Negative (score)	−0.079*	−0.001
	(0.037)	(0.005)
GPA	1.040*	
	(0.412)	
Constant	−1.511	1.345**
	(1.990)	(0.209)
λ: Mill's ratio	−0.135	
[*p*-value]	[0.051]	
Observations	97	64
Pseudo R^2	0.313	
Adjusted R^2		0.513

Notes: The variables of *financial literacy* and *network intensity* are centered with respect to the mean. This centering, however, does not affect the coefficients and their significance. Standard errors are in parentheses.
**$p < 0.01$; *$p < 0.05$.

when financially knowledgeable respondents have strong relationships with the financially literate.

Our findings contribute to an understanding of how financial literacy and financial networks are jointly associated with individual investors' decision-making. Although most previous studies argue that financial literacy is a key determinant of individual investors' decision-making, our study shows that both financial literacy and financial network intensity

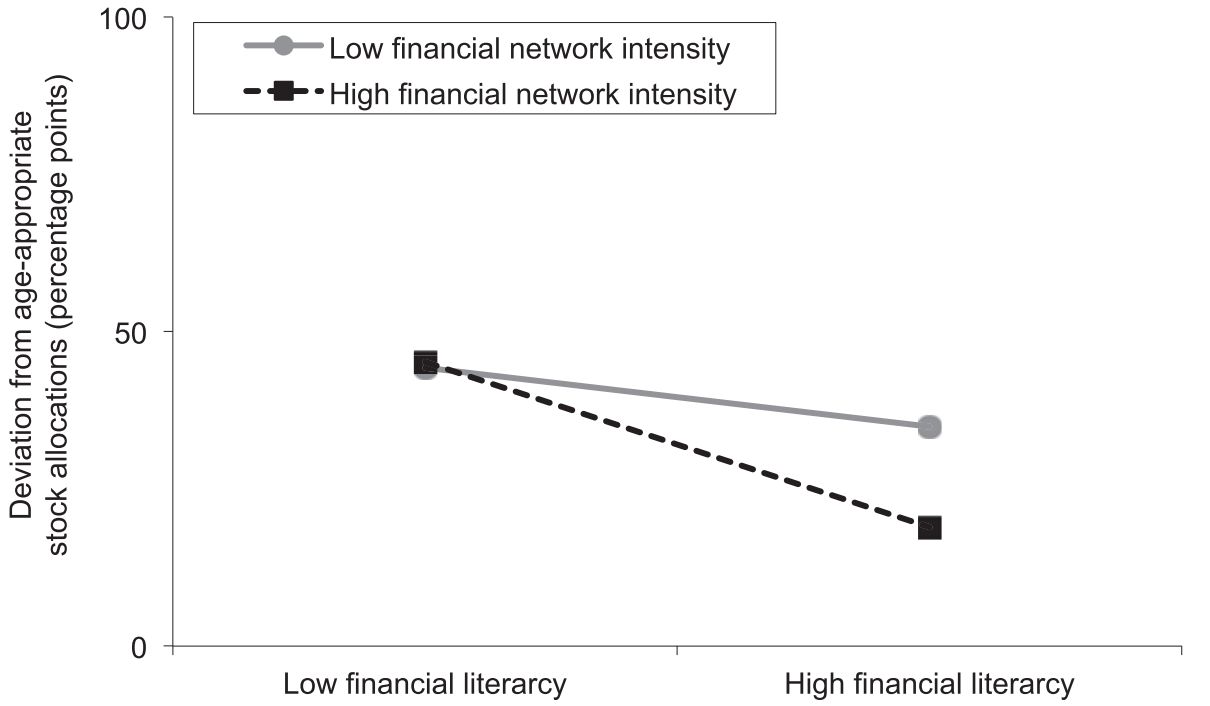

Fig. 2. Interaction effects of financial literacy and network intensity on the deviation from age-appropriate stock allocations. *Notes*: This figure depicts the interaction effects based on the regression results in Column 1b, Panel B of Table 5.

are critical factors influencing individuals' investment decision-making. In particular, the significant interaction between financial literacy and financial network intensity suggests that financial literacy and financial networks are *complementary* to each other. This finding implies that an individual's retirement investment decisions can be significantly enhanced when his or her financial knowledge is synthesized with the knowledge acquired through social networks with the financially literate. This result also provides an insight into employer-sponsored financial education. For retirement investments, individual investors may not always use the information provided by employers, but rather rely on their social networks (e.g., Duflo & Saez, 2002, 2003). Thus, for those who are likely to lack social networks with the financially literate, employers need to provide more opportunities to build networks for financial advice with financial planners or advisors because financial planners or advisors may be able to be substituted for their financial networks.

Although this study contributes to the literature that pertains to financial literacy, social interactions, and investment behavior in retirement plans, it has several limitations. First, this study does not use actual contribution allocations of defined contribution plan participants. Thus, the results from our sample may not represent actual investing behavior of defined contribution plan participants. Second, because of the small sample size, the results in the study may not represent the investing behavior of Generation Yers as a whole. Third, because the sample consists of college students who tend to have a higher level of risk tolerance (e.g., Gilliam, Chatterjee, & Grable, 2010) and have less investing experience than the general investing population, the results may be biased towards allocating more contributions to risky assets. Despite these limitations, our study using an experimental survey design (i.e.,

providing respondents a scenario of retirement investments and having them make investment decisions) provides an implication for Generation Yers' retirement investments: financial literacy combined with financial networks could increase the effectiveness of any efforts for enhancing their investment decisions. This could also be applied to improving long-term financial planning such as budgeting and saving. Therefore, future research is called for to collect field data from those who engage in the first-time retirement investment or long-term financial planning and investigate how their financial literacy and financial networks jointly influence their decision-making quality.

Notes

1 Several recent articles provide excellent literature reviews on the effects of financial literacy and financial education on financial outcomes (e. g., Collins & O'Rourke, 2010; Fernandes, Lynch, & Netemeyer, 2014; Hastings, Madrian, & Skimmyhorn, 2013).
2 Prior studies on social interactions focused on social activities, such as visiting neighbors and attending church (Hong et al., 2004), asking for advice about products and brands (Brown et al., 2008), and participating in a sport or social club, or a political or community-related organization (Christelis, Jappelli, & Padula, 2010).
3 In this article, respondents' financial literacy is measured with their financial knowledge, as in most prior studies on financial literacy (e. g., Alhenawi & Elkhal, 2013; Collins, 2012; Lusardi & Mitchell, 2007a; Robb, Babiarz, & Woodyard, 2012; van Rooij et al., 2011; Yoong, 2010), while respondents' financial network intensity is measured with their network strength with financially literate ones. We will discuss financial literacy and financial network intensity in more detail in Section 3.
4 The complementary effects of financial literacy and financial network intensity on contribution allocation to stock funds are similar to the finding of Collins (2012). He finds that individuals with a higher level of financial literacy are more likely to receive financial advice.
5 Several studies on stock-market participation show that information and transaction costs deter people from participating in the stock market (e.g., Haliassos & Bertaut, 1995; Vissing-Jorgensen, 2003).
6 For example, Vissing-Jorgensen (2003) mentions that once people understand diversification, they can apply their insights to a larger portfolio without cost.
7 Van Rooij et al. (2011) use the information of respondents' economics education in school as an instrument for financial literacy and find a positive relationship between financial literacy and stock-market participation.
8 Guiso et al. (2008) explore a relationship between trust and stock market participation. Using Dutch and Italian survey data, they find that less trusting individuals are less likely to be stockholders.
9 Since this survey was conducted in a context of a 401(k) plan, the survey participants were informed before the survey that they could rebalance their retirement portfolio later at no cost.

10 For the exact wording of the five questions, see the survey questions posted to the website of the National Financial Capability Study, http://www.usfinancialcapability.org/survey_data.html.

11 We use the items of Grable and Lytton (1999), instead of questions about hypothetical gambles over lifetime income in the Health and Retirement Study (HRS), because most of our survey participants may not be familiar with the questions used in the HRS because of their little or limited full-time work experience. Our respondents' median (mean) full-time work experience is only 0.5 years (1.8 years).

12 We include *GPA* in the selection equation but not in the stock allocation equation. The variable *GPA* works as an *exclusion restriction*. The Heckman two-stage selection model should have at least one exclusion restriction; otherwise, the second stage of Heckman two-stage model is likely to suffer from a collinearity problem, which provides imprecise estimates as a result (Wooldridge, 2002).

13 Grable and Lytton (2003) report an average score of 28.83 and a *SD* of 4.49 with a sample of 303 respondents, while Grable et al. (2004) report an average score of 27.03 and a *SD* of 5.18 with a sample of 421 respondents. As a range of a medium level of risk tolerance, we use the common interval of ±one *SD* from the two studies, which is a range of 24–32.

Acknowledgments

The authors would like to thank Michele O'Neill and anonymous referees for their helpful comments.

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