



# The medium is the message: Learning channels, financial literacy, and stock market participation

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## ABSTRACT

This paper investigates the effects of learning channels on stock market participation. More specifically, we investigate the direct effects of learning about financial matters from one's private network, financial advisors, and the media, as well as the moderating effects of financial literacy on the relationship between learning from these channels and stock market participation. Analyzing a unique cross-section data that combine survey data and bank register data on individual retail investors, we find that media is the only learning channel that increases the likelihood of owning stocks and the portfolio share invested in stocks. We also find that financial literacy has a significant moderating effect: Interactions point to the joint importance of learning from media and financial literacy for individuals' stock market participation. Our findings suggest implications to policymakers when designing financial education programs.

## 1. Introduction

The literature on household finance has paid increasing attention to factors that affect individuals' investments in stocks. Various papers show that individuals with higher financial literacy are more likely to participate in equity markets (Christelis, Jappelli, & Padula, 2010; Liao, Xiao, Zhang, & Zhou, 2017; Van Rooij, Lusardi, & Alessie, 2011; Yoong, 2011). The ability to understand investments and increased financial sophistication reduce cost barriers, encouraging participation (Jappelli & Padula, 2013). The positive correlation between financial literacy and probability of stock market participation has driven policymakers' efforts to increase financial literacy through financial education. The effects of such efforts are, however, not clear (Fernandes, Lynch Jr, & Netemeyer, 2014; Lusardi, 2019; Willis, 2011). Recent studies, therefore, call for more research on *how* individuals learn about financial matters (Hastings, Madrian, & Skimmyhorn, 2013). In this study, we investigate the relevance of three learning channels: private networks (i.e., family and friends), financial advisors, and media (i.e., newspapers, television, and internet sites) for individuals' stock market participation (stock ownership and portfolio shares in stocks).

The existing literature shows that investors' interaction with, or accessibility to certain information channels, alters financial behaviors.

Several studies find that interactions in one's social network affect stock market participation (Brown, Ivković, Smith, & Weisbenner, 2008; Girshina, Mathä, & Ziegelmeier, 2019; Haliassos, Jansson, & Karabulut, 2020; Hong, Kubik, & Stein, 2004). Such effects can be explained by cheaper information sharing, leading to reduced fixed participation costs. The strength of the ties does however matter to the extent of this effect: weak ties play the role of transmitting non-redundant information, thus having a positive effect on stock market participation, while strong ties have no such effect (Changwony, Campbell, & Tabner, 2015). Moreover, professional financial advisors could potentially provide cost reducing information. Studies however find that financial advisors are incentivized to cater to the interests of their employer (e.g., Foerster, Linnainmaa, Melzer, & Previtro, 2017; Inderst & Ottaviani, 2009). Thus, information might be biased towards alternative financial products. Furthermore, media offers a large variety of information and may therefore provide information that is relevant and non-redundant to the individual, resulting in reduced participation costs. Though such information may be extensive, media provides an interplay between emotions and logic, which make information transfer effective (Metcalfe & Mischel, 1999). Previous studies show that media is effective in transmitting information about financial matters (e.g. Berg & Zia, 2017; Hu, Li, Ngo, & Sosyura, 2020).

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The existing literature relies on measures of investors' interaction with, or accessibility to, certain information channels (e.g., family and friends, financial professionals, or financial news media) and, therefore, assumes that learning takes place during the interaction. The mechanism by which the three information channels affect stock market participation is however not completely known. We extend the literature by showing the explicit informational relevance of each learning channel to stock market participation. Our measures of learning channels are elicited from survey respondents' ratings of the importance of each channel for *learning* financial and economic matters. Therefore, we capture the source's capacity to provide information that in turn reduces participation costs.

While controlling for a number of individual characteristics, including risk-tolerance, wealth, education, and family status, our results indicate that media is an important learning channel in the context of stock market participation. Learning about financial markets and economic matters through media positively associates with stock ownership, as well as the share of the portfolio invested in stocks. An increase in learning through media from the lowest extent to the highest extent is, on average, associated with an increase of 11 percentage points (pp) in the probability of owning stocks (the sample stock market participation rate is about 27%) and an increase of 6 pp. in portfolio shares invested in stocks conditional on owning stocks (the sample mean of portfolio share in stocks conditional on owning stocks is only 5.9%). In contrast, learning from private networks or financial advisors has an insignificant effect on stock ownership and portfolio shares in stocks.

Research within educational psychology suggests that the effects of learning are strongly influenced by the individual's current knowledge (Ausable, Novak, & Hanesian, 1968; Biggs, 2011). Hence, it could be assumed that the effects of the learning channels on stock market participation are moderated by financial literacy. Accordingly, our analyses uncover evidence on the role of financial literacy in moderating the relation between learning channels and decision making, identifying either a reinforcing effect, or lack thereof, of financial literacy on the importance of the learning channels. We find a strong joint importance of learning from media and financial literacy for investing in stocks: The likelihood of participating in the stock market, and portfolio shares in stocks, increases with one's extent of learning from media only if the individual has high financial literacy. Conversely, the likelihood of participating in the stock market and portfolio shares in stocks increase with financial literacy only if the individual learns from media. For individuals with high financial literacy, an increase of learning through media from the lowest extent to the highest extent is associated with an increase of 13 pp. in the probability of owning stocks and an increase of 12 pp. in portfolio shares in stocks (conditional on owning stocks). For individuals with low financial literacy, learning through media has little association with stock ownership and portfolio shares in stocks. In contrast to learning through media, we find that the association between learning through one's private network or financial advisors and stock market participation is not moderated by financial literacy.

Our study contributes to the existing literature in two major aspects. First, rather than using the interaction with the channels as proxies, our study explicitly measures the importance of specific channels for investors when learning about financial and economic matters. The study also compares the effects of the channels on stock market participation. The deviation of our finding from some previous studies may indicate that *learning* about financial and economic matters from a specific channel is likely a different construct from *interacting* with that channel. For example, while prior studies find social interactions to increase stock market participation (e.g., Brown et al., 2008; Hong et al., 2004), we show that learning from family and friends about financial and economic matters is not associated with stock market participation or portfolio shares in stocks. Indeed, Balloch, Nicolae, and Philip (2015) argue that, when literacy is accounted for, sociability is no longer significant for participation.

Second, our study contributes to the discussion on whether and how

financial literacy and financial education enhance individuals' financial decision-making (e.g., Balloch et al., 2015; Fernandes et al., 2014; Van Rooij et al., 2011; Willis, 2011). To the best of our knowledge, our study is the first one that investigates how the individual's level of financial literacy moderates the relationship between learning channels and stock market participation. Our results provide important implications for policymakers when designing financial education programs. Our finding about the strong joint importance of learning through media and financial literacy indicates that policymakers should simultaneously promote both access to financial media and online financial information and financial education if they want to enhance direct stock market participation.

We structure the paper as follows. First, we review previous literature on the effects of private networks, financial advisors, and media on individuals' financial decision-making. We then describe the data and measurements used, followed by empirical analyses. The final section concludes.

## 2. Literature review

On an aggregate level, social ties may give access to information that reduces fixed stock market participation costs, thereby enhancing stock market participation (Brown et al., 2008; Changwony et al., 2015; Georganakos & Pasini, 2011; Hong et al., 2004; Liang & Guo, 2015). The social network theory, however, makes a clear distinction between weak ties, i.e., ties with acquaintances who one meets only occasionally, and strong ties, i.e., ties with family and close friends (Granovetter, 1973). While weak ties play a role in transmitting unique and nonredundant information across otherwise largely disconnected segments of social networks (Granovetter, 2005), strong ties to cohesive contacts can lead to a deficiency in acquiring new information and cognitive lock-in. Empirical studies on social interaction and stock market participation, however, generally make no distinction between tie strength (e.g., Georganakos & Pasini, 2011; Hong et al., 2004). A notable exception is Changwony et al. (2015), who show that weak ties (being active in social groups) and strong ties (talking to neighbors) differ in how social interaction influences stock market participation: Weak ties affect stock market participation, while strong ties have no effect on participation. A possible explanation for these findings could be that information obtained from strong ties is redundant, noisy, and lacks in quality, and that the instrumental value of social ties depends on the match between the information needed by the individual and the resources she can access through her contacts. Hence, the effect of learning from ones' private network (family and friends) on stock market participation is expected to be small.

Information provided by financial advisors could lower cost barriers and encourage participation. The literature shows that financial advisors may exert substantial influence over their clients' asset allocation (e.g., Foerster et al., 2017). For individuals with low financial capabilities, professional financial advice may affect stock market participation (Georganakos & Inderst, 2014). Financial advisors are, however, incentivized by commissions earned on recommended financial products. Thus, advice may be biased when financial advisors act as sellers of financial products (Inderst & Ottaviani, 2009). For example, Christoffersen, Evans, and Musto (2013), Egan (2019), Hackethal, Haliassos, and Jappelli (2012), Hoehle, Ruenzi, Schaub, and Schmid (2018), and Mullainathan, Noeth, and Schoar (2012) all show that brokers are more likely to recommend high-commission products. Advised portfolios commonly contain significantly less equity and more fixed income, and more mutual funds than securities (Kramer, 2016). This evidence may suggest that information obtained from financial advisors does not decrease participation costs to a large extent. Hence, it can be expected that learning from financial advisors has limited effect on stock market participation, specifically on direct stock market participation.

There is increasing evidence that media (i.e., television, printed newspapers online news sites, and websites) is an effective medium to

transmit information about financial matters. Berg and Zia (2017) find that educational commercials improve debt management. Hu et al. (2020) provide evidence that business TV helps households avoid some of the costliest financial mistakes related to mortgage refinancing. Explanations to these effects of media include cost effectiveness in terms of getting access to new information that is non-redundant, timely, and relevant. Media could also alter preferences, not only through the access to new information, but also through affecting the desirability of a certain outcome (La Ferrara, 2016). It is also well documented that media provides an interplay between emotions and logic, which can make transfer of information and decision making effective (Metcalf & Mischel, 1999). Hence, information obtained from media should have potential to reduce participation costs and we therefore expect that learning from media has a positive effect on stock market participation.

We extend previous findings in two ways. First, we focus on the three sources -private networks (family and friends), financial advisors, and media- as *learning* channels, examining their comparable effects on stock market participation. Extensive research within educational psychology points to the relevance of individual's current level of knowledge for effective learning processes (e.g. Ausubel et al., 1968). The amount and quality of current knowledge positively influence both knowledge acquisition and the capacity to apply higher-order cognitive problem-solving skills (Biggs, 2011). Trying to learn something without having adequate prior knowledge makes it difficult to relate the new information to existing knowledge (Tobias, 1994). We therefore also hypothesize that the effect of learning from the various channels on stock market participation is moderated by the individual's level of financial literacy.<sup>1</sup>

### 3. Data

Data are collected from one of Sweden's largest retail banks (the Bank, hereafter) with a market share of approximately 20% of the Swedish retail market and a client structure similar to the other three equally large banks. We collected two types of data: anonymized data from the Bank's register of individual retail customers (register data) and data from a survey sent to the Bank's retail customers included in the register sample (survey data). In the spring of 2013, we drew a random sample of 90,528 customers from the Bank's 2,254,420 Swedish customers. The conditions for including a customer in the sample was that the customer had an engagement with the Bank and was 18 years or older. The register data include individual-level demographic and socioeconomic data (age, gender, geographical location, income, financial assets, loans, and mortgages) collected in December 2013 and March 2016. We use register data collected in December 2013 in the main analysis. Register data from March 2016 is used in the robustness analysis.

We sent a questionnaire by post in the spring of 2013 to all customers in the register sample. An academic institution was the sender – and also the receiver of the responses – in order to achieve independence from the Bank. No reminders were sent. 16,062 respondents returned the survey yielding a response rate of 17.7%. In the survey, the respondents were asked to answer questions related to financial literacy and rate to what extent they learn about financial and economic matters from their private networks (i.e., family and friends), financial advisors (i.e., bank employees), and media (i.e. newspapers, television, and internet sites). In addition, the survey includes questions regarding additional

demographic and socioeconomic information, such as marital and family status, education, employment, and housing status. Of the returned surveys, 13,525 were completely answered. We excluded surveys answered by respondents that stated they were clients in more than one bank. The reason for this was to obtain a fair approximation of the respondent's total financial wealth and proportion invested in stocks. The data do not allow us to identify the amount invested through other banks. It is important to note that in Sweden, a vast majority makes investments (i.e. in stocks) through banks. Furthermore, in Sweden, there are very few independent financial advisors, hence most financial advice are received in interactions with banks. Financial wealth is operationalized as the total amount invested through the Bank, i.e., in savings accounts (deposits), mutual funds, and stocks. We include only respondents with positive deposits. The final sample size for which data were available for all variables amounts to 6871. See Table 1 for summary statistics.

We acknowledge that the response rate is relatively low, and that the sample used is a convenience sample. The response rate is, however, in line with similar studies (Kramer, 2016; Lusardi, Schneider, Tufano, Morse, & Pence, 2011). Comparing the survey data with the register data and the average Swedish population,<sup>2</sup> the sample represents the Swedish population, except that individuals responding to the survey are older, wealthier, and better educated. The average age in the sample is 54.6 years (std. dev. 16.9 years), which is higher than the bank register data (49.7 years) and the overall average age in Sweden, which is 41.2 years. The average age in Sweden, however, also includes individuals younger than 18, whereas our sample includes only individuals who are 18 years old or older. The sample financial wealth in 2013 is, on average, SEK 493,906 with a standard deviation of SEK 1,0 M. The survey financial wealth is higher than the average financial wealth for the Swedish population, whose average financial wealth amounts to SEK 305,000.<sup>3</sup> It is also higher than wealth reported in the bank's register data, where the average wealth is SEK 317,000. Education is measured according to five alternatives, from no finalized education to post-gymnasial education, three years or longer. The most common educational status is gymnasial education (equivalent to upper secondary school). Compared with the national average, this share is lower (29% compared with 45%), and the share of post-gymnasial education is higher (49% compared with 34%). Thus, the sample is better educated than Swedes in general.

In addition to age, wealth, and education, the models also include as controls the variables gender, large city (i.e., Stockholm, Göteborg, and Malmö), income, mortgage, work status, family status, housing, and risk tolerance. The gender variable (men = 1, women = 0), has a mean of 0.47, thus implicating more women than men in the sample. One-fifth of the sample – and the overall population – lives in three large cities (0.21). The mean monthly net income after tax averages SEK 17,817 in December 2013. This is in line with the income of the Swedish population, given the age structure of the sample. The average total debt level is SEK 362,036 in December 2013. The work status variable includes six alternatives: working full time or part time, retired, long-term sick leave, student, or unemployed. The most common work status is working full time (47%). The share of retired persons is higher in the sample than in the population at large, which is as expected, given the age structure of the sample. Family status includes the alternatives of being single, married, or living in a couples relationship, and having or not having children. The most common family status is being married or living in a couples relationship with children (43%). Housing includes four alternatives: rental apartment, tenant-owned apartment, house, or farmhouse. The most common housing status is house ownership. Compared with the housing situation in Sweden at large, the share of rental

<sup>1</sup> Von Gaudecker (2015) uncovers an important interaction of financial literacy and financial advice in the decision-making process. The return loss of households that seek advice either in their private network (with family and friends) or from professionals does not vary with financial literacy. Among households making autonomous decisions, the distribution of the return loss looks very similar only if they are endowed with the maximum level of financial literacy.

<sup>2</sup> Data on the Swedish population are collected from Statistics Sweden (SCB) [www.scb.se](http://www.scb.se).

<sup>3</sup> This information was reported in 2007, the most recent statistics available from Statistics Sweden.

**Table 1**  
Summary statistics.

| Variable                        | Mean    | Std.dev   | Median  | Min | Max     |
|---------------------------------|---------|-----------|---------|-----|---------|
| Participation 201,312           | 0.273   | 0.446     | 0       | 0   | 1       |
| Participation 201,603           | 0.256   | 0.436     | 0       | 0   | 1       |
| Share 201312*                   | 0.059   | 0.149     | 0       | 0   | 1       |
| Share 201603*                   | 0.057   | 0.152     | 0       | 0   | 1       |
| Private network                 | 3.345   | 1.799     | 3       | 0   | 7       |
| Financial advisor               | 3.099   | 1.730     | 3       | 0   | 7       |
| Media                           | 3.623   | 1.802     | 4       | 0   | 7       |
| Financial literacy              | 0.508   | 0.500     | 1       | 0   | 1       |
| Risk tolerance                  | 3.027   | 1.772     | 3       | 1   | 7       |
| Income_201,312                  | 17,817  | 12,118    | 16,573  | 0   | 208,000 |
| Income_201,603                  | 17,705  | 13,580    | 15,696  | 0   | 428,779 |
| Financial wealth_201,312        | 493,906 | 1,002,044 | 223,127 | 1   | 29,1 M  |
| Financial wealth_201,603        | 563,706 | 1,212,589 | 259,373 | 0   | 43,5 M  |
| Debt_201,312                    | 362,036 | 916,906   | 0       | 0   | 50 M    |
| Debt_201,603                    | 382,275 | 990,723   | 0       | 0   | 50 M    |
| Age                             | 54.64   | 16.86     | 57      | 18  | 97      |
| Large city                      | 0.211   | 0.408     | 0       | 0   | 1       |
| Gender                          | 0.474   | 0.499     | 0       | 0   | 1       |
| Work status                     | 5.280   | 1.895     | 6       | 1   | 7       |
| Long-term sick leave            | 0.011   | 0.102     | 0       | 0   | 1       |
| Pre-retired                     | 0.026   | 0.158     | 0       | 0   | 1       |
| Retired                         | 0.313   | 0.464     | 0       | 0   | 1       |
| Unemployed                      | 0.029   | 0.169     | 0       | 0   | 1       |
| Student                         | 0.038   | 0.191     | 0       | 0   | 1       |
| Part-time work                  | 0.114   | 0.318     | 0       | 0   | 1       |
| Full-time work                  | 0.470   | 0.499     | 0       | 0   | 1       |
| Family status                   | 2.974   | 1.211     | 3       | 1   | 5       |
| Single w/o children             | 0.228   | 0.420     | 0       | 0   | 1       |
| Single w children               | 0.041   | 0.198     | 0       | 0   | 1       |
| Couple w/o children             | 0.281   | 0.450     | 0       | 0   | 1       |
| Couple w children               | 0.428   | 0.495     | 0       | 0   | 1       |
| Others                          | 0.021   | 0.144     | 0       | 0   | 1       |
| Housing                         | 3.322   | 0.868     | 4       | 1   | 4       |
| Secondhand rental apartment     | 0.020   | 0.138     | 0       | 0   | 1       |
| Rental apartment                | 0.209   | 0.407     | 0       | 0   | 1       |
| Tenant-owned apartment          | 0.201   | 0.401     | 0       | 0   | 1       |
| Single-family home              | 0.570   | 0.495     | 0       | 0   | 1       |
| Education                       | 3.465   | 1.286     | 3       | 1   | 5       |
| No finalized education          | 0.098   | 0.298     | 0       | 0   | 1       |
| Pre-gymnasial                   | 0.118   | 0.323     | 0       | 0   | 1       |
| Gymnasial                       | 0.291   | 0.454     | 0       | 0   | 1       |
| Post-gymnasial                  | 0.204   | 0.403     | 0       | 0   | 1       |
| education<3 yrs                 |         |           |         |     |         |
| Post-gymnasial education ≥3 yrs | 0.288   | 0.453     | 0       | 0   | 1       |

This table presents summary statistics on the sample of 6871 survey respondents. The variables' means, standard deviations, medians, mins, and maxes are reported. For the control variables, we report risk tolerance, income, financial wealth, debt, age, whether the individual lives in a large city, gender, work- and family status, housing situation, and education. Income is the respondent's monthly income net of taxes. Income, wealth, and mortgage are stated in Swedish krona (SEK). Financial wealth is the respondent's total amount invested through the bank in savings accounts, mutual funds, and stocks. Debt is the respondent's total amount of debt (loans and mortgages). On December 31, 2013, SEK 1 was equivalent to USD 0.16. Work status, education, family status, and housing means and the percentage of the respondents that has indicated a certain alternative. Work status ranges from working full time to being far from employment (unemployed). Housing ranges from a low degree of ownership (rental apartment) to a high degree of ownership (single family home). Education ranges from a low level (no finalized education) to a high level (post-gymnasial ≥3 years) of education. Family status ranges from a low degree of relationship involvement (single without children) to a high degree of involvement (couple with children).

\* Conditional on participation.

apartments is lower (21% compared with 30%), and the share living in a single-family home is higher (57% compared with 43%). The share of tenant-owned apartments is in line with the national average. Risk tolerance is captured through the statement "I can accept losing part of my saving if the chance of getting a good return is great". Answers are

indicated on a seven-point Likert scale. The average score on risk tolerance is 3.0 (std. dev. 1.7).

### 3.1. Measurements of learning channels, financial literacy, and stock market participation

The extent to which individuals learn from the three channels – private network, financial advisor, and media – is captured by three questions: Learning from one's private network is captured by the question "I learn about economic matters and financial markets primarily from family and friends". Learning from financial advisors is captured by the questions "I learn about economic matters and financial markets primarily from the bank". As previously explained, there are very few independent financial advisors in Sweden, hence professional financial advice are received in interactions with banks. Learning from media is captured by the question "I learn about economic matters and financial markets primarily from media". Media refers to television, printed newspapers online news sites, and websites and not to interaction with friends through social media. Answers are indicated on a seven-point Likert scale ranging from totally disagree (1) to totally agree (7). As seen in [table 1](#), the mean of learning from one's private network is 3.34 (std. dev. 1.80), the mean of learning from financial advisor is 3.10 (std. dev. 1.73), and the mean of learning from media is 3.62 (std. dev. 1.80). In [Table 2](#) the distributions of answers across the 7-point Likert scales are reported as percentages.

Financial literacy in this paper is defined as knowledge about financial concepts, such as inflation and risk diversification (e.g., [Anderson, Baker, & Robinson, 2017](#); [Lusardi, 2008](#)). Financial literacy is measured through a quiz including six questions. We developed the questions in accordance with the Swedish context, and, therefore, they differ to some extent from questions used by, e.g., [Anderson et al. \(2017\)](#) and [Lusardi \(2008, 2012\)](#). In Sweden, a relatively large part of the population owns their own home or apartment (62% of the population, according to Statistics Sweden). Half of Swedish households have a mortgage, and a majority of these mortgages has variable interest rates. The central bank (the Riksbank) has an inflation target, and to understand the relationship between inflation, and nominal and real interest rates is relevant knowledge for Swedish citizens. In Sweden, it is relatively common to save directly in stocks (about 32% of the population) and in mutual funds (80% of the population), whereas direct bond investments are less common (8% of the population; per Swedish Investment Fund Association, 2016).<sup>4</sup> To know that mutual funds have different risk levels, and that saving in equity funds is riskier than saving in balanced or fixed-income funds, is therefore highly relevant. Other important concepts include the price/earnings (P/E) ratio and

**Table 2**  
Learning channels – distribution across the Likert scales.

|   | Percentage of responses across the 7-point scales |                   |       |
|---|---|-------------------|-------|
|   | Private network                                   | Financial advisor | Media |
| 1 | 21.4  | 24.9              | 17.7  |
| 2 | 16.1  | 17.6              | 13.0  |
| 3 | 15.5  | 15.9              | 15.0  |
| 4 | 19.0  | 19.2              | 20.4  |
| 5 | 14.0  | 12.6              | 16.6  |
| 6 | 9.0   | 6.1               | 12.0  |
| 7 | 4.9   | 3.6               | 5.3   |

[Table 2](#) reports the distribution across the 7-point Likert scales as the percentages of responses on each level of learning from private network, financial advisor and media, respectively.

<sup>4</sup> This includes only direct private saving and not pension savings managed by the pension system.

instruments such as equity-linked securities. Structured products have historically been very profitable and marketed by Swedish banks. Gunnarsson and Wahlund (1997) use a similar context-driven approach when measuring financial literacy in Sweden. The exact wording of the questions is reported in Table 3. Responses to these questions are reported in Table 4 (Panel A).

Most respondents answer the fifth question correctly; the percentage of incorrect answers is only 4.6%. Question number 6 has the lowest percentage of correct answers – 11.6% – and 80.5% state that they do not know the answer to this question. Note from panel B of Table 4 that only 3.8% answer all questions correctly, and on average respondents answers 2.0 questions correctly.<sup>5</sup>

We summarize the information about financial literacy in a financial literacy index and conduct factor analyses to explicitly take into account the differences between “incorrect” and “do not know” answers.<sup>6</sup> We construct two dummy variables for each of the six questions. The first dummy indicates if the question was answered correctly, while the other dummy variable refers to the “do not know” answers. Hence, we perform a factor analysis on 12 variables. We retain one factor that describes financial literacy (c.f. Van Rooij et al., 2011). Factor loadings are presented in Table A1.

Fig. 1A and B show the percentages distributions across the Likert scales. Fig. 1A (Fig. 1B) shows the distributions for individuals with low (high) levels of financial literacy across the Likert scales of learning channels. The figures show that individuals with high levels of financial literacy learn from media to a larger extent than individuals with low levels of financial literacy. Differences in learning from private networks and financial advisors are less distinct between the individuals with high financial literacy and those with low financial literacy.

We analyze stock market participation using two outcome variables constructed from the Bank’s register data. As previously explained, financial wealth includes the total amount invested through the Bank in deposits, mutual funds, and stocks. Because we only include respondents who have stated that they do not have any other banks, we expect that

**Table 3**  
Financial literacy questions.

| Question formulation   |
|--|
| (1) How high is the Riksbank’s inflation target? (i)1.0% (ii)2.0% (iii) 3% (iv)Do not know   |
| (2) If there is a risk that the inflation will exceed the inflation target, what should the Riksbank do? (i) Lower the repo rate (ii) Raise the repo rate (iii) Do nothing (iv) Do not know                      |
| (3) If the nominal interest rate is 5%, and the expected inflation is 2%, how high will the real interest rate be (approx.)? (i) 2.5% (ii)3.0%, (iii) 7.0% (iv) Do not know                                      |
| (4) A savings product where you will receive a guaranteed amount at maturity, and the return follows the equity market, is called: (i) Equity fund (ii)Hedge fund (iii) Equity-linked security (iv) Do not know  |
| (5) Mutual funds have different risk levels; which of these mutual fund types is generally viewed as having the highest risk? (i) Balanced fund (ii) Bond fund (iii) Equity fund (iv) Do not know                |
| (6) The definition of the P/E-ratio is (i) Price per share divided by earnings per share (ii) Price per share divided by own capital per share (iii) Price per share divided by sales per share (iv) Do not know |

The financial literacy questions, in the same order as posed in the questionnaire.

<sup>5</sup> These results can be compared with results on the advanced financial literacy questions presented in Van Rooij et al. (2011) where 5.0% answered all ten question correctly (mean 5.93).

<sup>6</sup> Xia, Wang, and Li (2014) perceive the respondent as overconfident if she/he does not select “I don’t know” but subsequently makes a wrong answer to financial literacy questions. Anderson et al. (2017) show that people who overestimate their financial literacy are less likely to select “I don’t know” but more likely to make a wrong answer. These respondents are also less likely to seek financial advice.

**Table 4**  
Financial literacy.

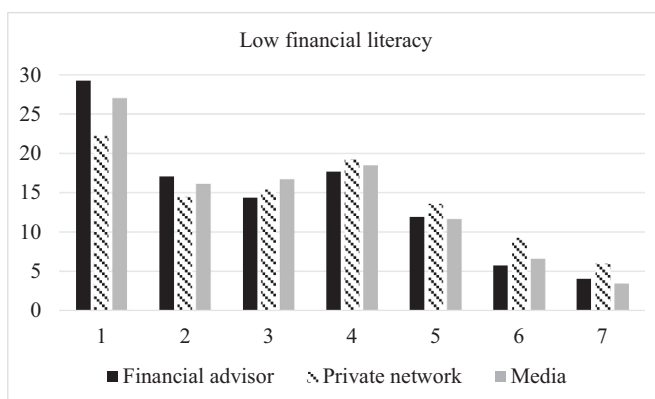
| Panel A: Percentage of correct, and incorrect and do not know answers (N = 6871) |      |      |      |      |      |      |
|--|------|------|------|------|------|------|
|  | Q1   | Q2   | Q3   | Q4   | Q5   | Q6   |
| Correct  | 30.1 | 33.2 | 27.2 | 26.9 | 69.1 | 11.6 |
| Incorrect  | 9.9  | 19   | 8.5  | 11.4 | 4.6  | 7.9  |
| Do not know  | 60   | 47.8 | 64.3 | 61.7 | 26.3 | 80.5 |

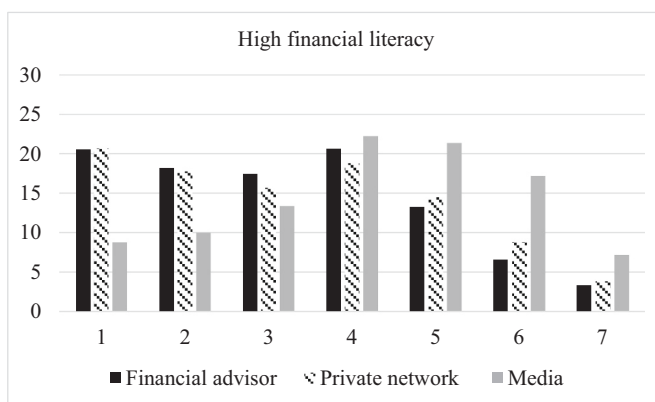
| Panel B: Distribution of number of correct, and incorrect and do not know answers (out of six questions) (N = 6, 871) |      |      |      |      |      |      |      |      |
|---|------|------|------|------|------|------|------|------|
|   | None | 1    | 2    | 3    | 4    | 5    | All  | Mean |
| Correct   | 22.5 | 25.7 | 17.3 | 14.2 | 10.0 | 6.6  | 3.8  | 2.0  |
| Incorrect   | 59.6 | 25.5 | 10.2 | 3.6  | 0.9  | 0.2  | 0    | 0.6  |
| Do not know   | 10.9 | 10.7 | 13.1 | 13.6 | 13.8 | 19.4 | 18.4 | 3.4  |

Panel A reports the proportion of households providing correct, incorrect, and “do not know” answers to each of the six financial literacy questions. Panel B reports the distribution of the number of correct, incorrect, and “do not know” answers on the six financial literacy questions.

A



B



**Fig. 1.** Learning channels and financial literacy.

Fig. 1A shows the distribution of answers on the three survey questions on learning channels for individuals with low financial literacy, and Fig. 1B shows the distribution for individuals with high financial literacy.

we achieve a fair approximation of the respondent’s total wealth. The first measure is an indicator variable for whether the individual owns stocks directly. We refer to this variable as *participation*. The second variable is a continuous variable for the share of financial assets held directly in stocks, conditional on participation. We refer to this variable as *share*. The data do not allow us to identify the character of the individuals’ mutual funds, i.e., whether or not the fund investments are in equity funds. In Sweden, 80% of the population between 18 and 75 years

have savings in mutual funds. This is the highest proportion in the world. Possible explanations include the low fees, easy access, and product transparency (Swedish Investment Fund Association, 2016). Hence, in terms of participation cost, the difference between deposits and mutual fund saving is potentially small. We, therefore, argue that our stock market participation variables reflects an active decision by the investor

$$Stock_i^* = \alpha + \beta_1 Private\ network_i \times Financial\ literacy_i + \gamma_1 Financial\ advisor \times Financial\ literacy_i + \theta_1 Media_i \times Financial\ literacy_i + \beta_0 Private\ network_i + \gamma_0 Financial\ advisor_i + \theta_0 Media_i + \lambda Financial\ literacy_i + \sum_k a_k^Z Z_{ki} + \varepsilon_i \tag{2}$$

to buy stocks. As shown in Table 1, 27% of the total sample owns stocks as of December 2013. On average, 5.9% of the individuals' financial wealth is direct ownership in stocks conditional on participation in December 2013.

#### 4. Financial literacy, learning channels, and stock market participation

Table 5 shows stock market participation according to use of learning channels and levels of financial literacy. Participation is higher among the individuals with higher levels of financial literacy across all three channels. Those who learn from private networks to a high extent show lower participation than those who learn from private networks to a low extent. However, those who learn from financial advisors (media) to a high extent show higher participation than those who learn from financial advisors (media) to a low extent.

From the correlations reported in Table 6, we observe that our key variables—, learning from one's private network, learning from financial advisors, learning from media, and financial literacy—are not highly correlated with each other. The highest correlation, 0.375, is between learning from media and financial literacy. Thus, financial literacy and the learning variables capture different investor characteristics.

### 5. Empirical analysis

#### 5.1. Empirical model

We use logit models to explain stock market participation from learning channel variables and financial literacy. The dependent variable, stock market participation (Participation), equals one if the individual owns stocks, and zero otherwise. The values of the learning channel variables are the individual's answers on a seven-point Likert scale in the survey described in Section 3.1. The financial literacy variable is defined based on the financial literacy index described in Section 3.1. It equals one if the individual's value of financial literacy index is at or above the sample median, and zero otherwise.

We use the latent variable  $Stock_i^*$  to determine stock market participation:

If  $Stock_i^* \geq 0$ ,  $Participation = 1$ .

If  $Stock_i^* < 0$ ,  $Participation = 0$ .

We estimate the following latent variable model:

$$Stock_i^* = \alpha + \beta Private\ network_i + \gamma Financial\ advisor_i + \theta Media_i + \lambda Financial\ literacy_i + \sum_k a_k^Z Z_{ki} + \varepsilon_i \tag{1}$$

where  $Z_{ki}$  is control variable  $k$  for individual  $i$ , and  $\varepsilon_i$  is an error term following the standard logistic distribution.

To study of the moderating effects of financial literacy on the relation between the learning channels and participation, we estimate

#### 5.2. The effect of financial literacy and learning channels on stock market participation

The results for eq. (1) and its variations are reported in Table 7. First, we examine the relationship between financial literacy and stock market participation (see column (1)) in the absence of considering learning channels. Consistent with the literature (e.g., with Van Rooij et al. (2011) and Balloch et al. (2015)), we find that financial literacy is positively associated with stock market participation, as the coefficient for financial literacy in column (1) is positive and statistically significant at 1%. Then, in columns (2) to (4), we examine how every learning channel is respectively associated with stock market participation while not controlling for financial literacy. The variable media is the only learning channel that increases with the likelihood of participating in the stock market. Its coefficient is positive and statistically significant at 1%. In contrast to media, private network and financial advisor have insignificant coefficients. When we consider all the learning channels as explanatory variables (see column (5)), our finding regarding their relationships with participation remains: the coefficient for media is statistically significant while the coefficients for private network and financial advisor stay insignificant. Finally, we use all the learning channel variables to explain participation while controlling for financial literacy. The result is shown in column (6). Comparing column (6) to column (5), we find that the coefficient of media becomes less statistically significant. This can be explained by the fact that financial literacy and media are positively correlated (see Table 6). Nevertheless, the coefficient of media remains positive and statistically significant (at 5%), indicating that the roles of financial literacy and media for stock market participation are not exchangeable.

The result in column (6) implies that individuals that score the lowest on media have 20% probability of participating in the stock market on average, compared to 31% average probability for those with the highest score on media. Moreover, individuals with low financial literacy have 20% probability of participating in the stock market on average, compared to 35% for those with high financial literacy. These remarkable gaps in the probability of stock market participation indicate that media and financial literacy are relevant for participation, given that the participation ratio in our sample is about 27% (see Table 1).

Our results from Table 7 regarding the relationship between learning

**Table 5**  
Stock market participation, learning channels, and financial literacy.

|                         | Low private network | High private network | Low financial advisor | High financial advisor | Low media | High media |
|-------------------------|---------------------|----------------------|-----------------------|------------------------|-----------|------------|
| Low financial literacy  | 23.0                | 17.9                 | 14.1                  | 24.7                   | 19.4      | 20.3       |
| High financial literacy | 40.4                | 31.5                 | 28.4                  | 39.0                   | 31.3      | 36.6       |

This table shows percentage participation in each group. Groups are defined according to levels of learning from private network, financial advisor and media and levels of financial literacy. High financial literacy is defined as a financial literacy index at, or above, the sample median (1). High private network, high financial advisor, and high media are defined as a score at, or above, the median. The median scores for private network, financial advisor are 3, 4, and 4, respectively.

**Table 6**  
Correlation matrix.

|                       | 1       | 2       | 3      | 4      | 5      | 7     |
|-----------------------|---------|---------|--------|--------|--------|-------|
| 1. Participation      | 1.000   |         |        |        |        |       |
| 2. Share              | 0.640*  | 1.000   |        |        |        |       |
| 3. Private network    | -0.078* | -0.051* | 1.000  |        |        |       |
| 4. Bank               | 0.150*  | 0.060*  | 0.068* | 1.000  |        |       |
| 5. Media              | 0.094*  | 0.098*  | 0.136* | 0.073* | 1.000  |       |
| 7. Financial literacy | 0.167*  | 0.151*  | -0.024 | 0.064* | 0.312* | 1.000 |

This table reports the Pearson correlations for the main variables in the sample. \* indicates significance at 1%

channels and stock market participation are consistent with the positive effects of access to financial media on stock market participation documented by Liang and Guo (2015). We also echo Balloch et al. (2015), who find that social interaction does not matter for participation when financial literacy is controlled for. However, we do not support the finding of Georgarakos and Inderst (2014) about the positive impact of professional financial advice on stock market participation. When comparing our results with findings in the existing literature on stock market participation, it is important to note the difference between our learning channel variables and similar variables used in the existing literature. While the variables in the literature (e.g., Balloch et al., 2015; Georgarakos & Inderst, 2014; Hong et al., 2004; Hu et al., 2020; Liang & Guo, 2015) measure the availability of certain channels, i.e., access to financial media and social network, etc., our channel variables capture individuals' strength of learning from the channels. Therefore, our analysis may directly indicate informational effects (or lack thereof) of different learning channels on participation. The striking contrast between the roles of learning channels may arise because different channels provide financial and economic information of different scope and depth.

With regard to the controlled socioeconomic and demographic variables, we find that wealth, debt, risk tolerance, and education are important drivers for participation. Men are more likely to participate than women are, people who are single without children are more likely to participate than people with other types of family status, and people who own their homes (tenant-owned apartment or single family home) are more likely to participate than people living in rental housing.

Next, using eq. (2), we analyze whether the relationships between learning channels and stock market participation are reinforced or weakened by financial literacy. Results are presented in Table 8. In columns (1) and (2), financial literacy is interacted with private network and financial advisor, respectively. The interaction terms of financial literacy with private network and financial advisors are insignificant, indicating no moderating effect from financial literacy on the relationship between learning from one's private network or financial advisors and participation. In column (3), we interact financial literacy with media. The coefficients of financial literacy and media are insignificant, while the coefficient for the interaction term of media and financial literacy is positive and statistically significant at 5%. As the coefficient of media in column (3) is associated with the partial effect of media when financial literacy equals zero, its insignificance indicates that the likelihood of participating in the stock market does not increase with media

if one has low financial literacy. Likewise, the insignificance of the coefficient for financial literacy indicates that the financial literacy variable is not associated with a higher likelihood of participation if one learns through media to the lowest extent. The significance of the interaction term suggests that financial literacy is a necessary condition for media, showing a positive partial effect on stock market participation and vice versa. These results regarding the joint importance of financial literacy and media remain when we include the interactions terms of financial literacy with the other learning channels (in column (4)).

To visualize the moderating effect of financial literacy on the relationship between media and stock market participation, we illustrate how the interaction of financial literacy and media is associated with the probability of investing in stocks. We group individuals in our sample based on their level of financial literacy and scores on media. For each group, we compute the average participation probability using the estimates in column (4) of Table 8. By doing so, we take into account heterogeneity in all variables across individuals. We see in Fig. 2 that, when the score on media increases, the average participation probability of the high financial literacy group increases at a remarkably higher rate than that of the low financial literacy group. As the score on media increases from the lowest end to the highest end, the average participation probability of the high financial literacy group increases from 26 pp. to 39 pp., while the probability of the low literacy group is increased from 18 pp. to 21 pp.

A possible explanation for our finding that financial literacy reinforces the relationship between learning through media and participation is that media provides wide-ranged information content. It requires pre-knowledge in economic and financial matters for individuals to select, understand, and use relevant information to make investment decisions.

### 5.3. The effect of financial literacy, learning channels, and portfolio shares in stocks

In this section, we explain respondents' portfolios shares in stocks. As portfolio shares in stocks are bounded from below at zero, we estimate tobit models to explain portfolio shares in stocks. We consider the same explanatory variables as in eq. (1) and eq. (2).

First, we examine how financial literacy and learning channels are associated, respectively, with portfolio shares in stocks. In the variants of tobit regressions presented in columns (1) to (5) Table 9, media and financial literacy are positively associated with portfolio shares in stocks with 1% statistical significance, and private network and financial advisor have insignificant relationships with portfolio shares in stocks. Analogous to the result regarding participation, the effect of financial literacy (media) becomes smaller when the variable media (financial literacy) is included in the regression (column (6)). However, the roles of these two variables for portfolio shares in stocks are not exchangeable because their coefficients remain strongly statistically significant.

Furthermore, we examine the economic relevance of media and financial literacy for portfolio shares in stocks. In column (6) of Table 9, where learning channels and financial literacy are all used to explain portfolio shares in stocks, the coefficient for media is 0.01; this means that the increase of media by one unit is associated with an increase of 1 percentage point in the portfolio shares invested in stocks for individuals who participate in the stock market. This corresponds to an increase of 6

**Table 7**  
Financial literacy, learning channels, and stock market participation.

| VARIABLES:                            | (1)                     | (2)                     | (3)                     | (4)                     | (5)                     | (6)                     |
|---------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Participation                         |                         |                         |                         |                         |                         |                         |
| Private network                       |                         | -0.0103<br>(0.0193)     |                         |                         | -0.0169<br>(0.0195)     | -0.0166<br>(0.0195)     |
| Financial advisor                     |                         |                         | 0.0138<br>(0.0193)      |                         | 0.0153<br>(0.0194)      | 0.0160<br>(0.0194)      |
| Media                                 |                         |                         |                         | 0.0514***<br>(0.0198)   | 0.0535***<br>(0.0200)   | 0.0421**<br>(0.0204)    |
| Financial literacy                    | 0.2255***<br>(0.0705)   |                         |                         |                         |                         | 0.1966***<br>(0.0721)   |
| Ln(income+1)                          | 0.0029<br>(0.0137)      | 0.0030<br>(0.0137)      | 0.0027<br>(0.0137)      | 0.0026<br>(0.0137)      | 0.0023<br>(0.0137)      | 0.0023<br>(0.0137)      |
| Ln(wealth+1)                          | 0.9655***<br>(0.0347)   | 0.9749***<br>(0.0346)   | 0.9708***<br>(0.0352)   | 0.9731***<br>(0.0346)   | 0.9667***<br>(0.0352)   | 0.9583***<br>(0.0353)   |
| Ln(debt+1)                            | 0.0148**<br>(0.0058)    | 0.0157***<br>(0.0058)   | 0.0156***<br>(0.0058)   | 0.0150***<br>(0.0058)   | 0.0146**<br>(0.0058)    | 0.0138**<br>(0.0058)    |
| Risk tolerance                        | 0.1169***<br>(0.0188)   | 0.1261***<br>(0.0187)   | 0.1232***<br>(0.0188)   | 0.1146***<br>(0.0191)   | 0.1138***<br>(0.0193)   | 0.1088***<br>(0.0194)   |
| Age                                   | 0.0062<br>(0.0155)      | 0.0072<br>(0.0156)      | 0.0079<br>(0.0155)      | 0.0074<br>(0.0155)      | 0.0059<br>(0.0156)      | 0.0045<br>(0.0156)      |
| Age <sup>2</sup>                      | 0.0000<br>(0.0001)      | 0.0000<br>(0.0001)      | 0.0000<br>(0.0001)      | 0.0000<br>(0.0001)      | 0.0001<br>(0.0001)      | 0.0001<br>(0.0001)      |
| Large city                            | -0.0513<br>(0.0476)     | -0.0486<br>(0.0475)     | -0.0488<br>(0.0475)     | -0.0546<br>(0.0477)     | -0.0541<br>(0.0477)     | -0.0548<br>(0.0477)     |
| Gender                                | 0.1590**<br>(0.0727)    | 0.2093***<br>(0.0711)   | 0.2197***<br>(0.0710)   | 0.1816**<br>(0.0717)    | 0.1786**<br>(0.0728)    | 0.1381*<br>(0.0744)     |
| Work status                           |                         |                         |                         |                         |                         |                         |
| Pre-retired                           | 0.2569<br>(0.4316)      | 0.2840<br>(0.4316)      | 0.2864<br>(0.4323)      | 0.2350<br>(0.4322)      | 0.2458<br>(0.4323)      | 0.2363<br>(0.4320)      |
| Retired                               | 0.0103<br>(0.3906)      | 0.0488<br>(0.3905)      | 0.0501<br>(0.3913)      | 0.0130<br>(0.3907)      | 0.0174<br>(0.3907)      | -0.0067<br>(0.3905)     |
| Unemployed                            | -0.2886<br>(0.4666)     | -0.2546<br>(0.4659)     | -0.2481<br>(0.4667)     | -0.2783<br>(0.4662)     | -0.2752<br>(0.4663)     | -0.2991<br>(0.4666)     |
| Student                               | -0.0498<br>(0.4709)     | 0.0067<br>(0.4703)      | 0.0075<br>(0.4709)      | -0.0339<br>(0.4708)     | -0.0293<br>(0.4709)     | -0.0676<br>(0.4711)     |
| Part-time                             | -0.2757<br>(0.3950)     | -0.2413<br>(0.3949)     | -0.2413<br>(0.3957)     | -0.2765<br>(0.3951)     | -0.2710<br>(0.3951)     | -0.2911<br>(0.3949)     |
| Full-time                             | -0.3280<br>(0.3849)     | -0.2962<br>(0.3849)     | -0.2928<br>(0.3857)     | -0.3248<br>(0.3850)     | -0.3165<br>(0.3850)     | -0.3358<br>(0.3848)     |
| Education                             |                         |                         |                         |                         |                         |                         |
| Below high school                     | 0.2639*<br>(0.1380)     | 0.2984**<br>(0.1375)    | 0.2962**<br>(0.1376)    | 0.2699*<br>(0.1380)     | 0.2690*<br>(0.1381)     | 0.2458*<br>(0.1385)     |
| High school                           | 0.3154**<br>(0.1298)    | 0.3646***<br>(0.1290)   | 0.3609***<br>(0.1290)   | 0.3262**<br>(0.1297)    | 0.3264**<br>(0.1298)    | 0.2933**<br>(0.1304)    |
| < 3 years education after high school | 0.3945***<br>(0.1326)   | 0.4510***<br>(0.1315)   | 0.4488***<br>(0.1315)   | 0.4078***<br>(0.1325)   | 0.4081***<br>(0.1325)   | 0.3694***<br>(0.1333)   |
| ≥ 3 years education after high school | 0.3229**<br>(0.1303)    | 0.3953***<br>(0.1285)   | 0.3941***<br>(0.1285)   | 0.3479***<br>(0.1296)   | 0.3500***<br>(0.1297)   | 0.2985**<br>(0.1311)    |
| Family status                         |                         |                         |                         |                         |                         |                         |
| Single with children                  | -0.5869***<br>(0.2027)  | -0.5837***<br>(0.2026)  | -0.5852***<br>(0.2025)  | -0.5778***<br>(0.2028)  | -0.5726***<br>(0.2028)  | -0.5752***<br>(0.2028)  |
| Married/cohabiting without children   | -0.2477***<br>(0.0933)  | -0.2308**<br>(0.0932)   | -0.2348**<br>(0.0931)   | -0.2466***<br>(0.0933)  | -0.2452***<br>(0.0934)  | -0.2550***<br>(0.0936)  |
| Married/cohabiting with children      | -0.4144***<br>(0.0951)  | -0.3998***<br>(0.0949)  | -0.4028***<br>(0.0948)  | -0.4111***<br>(0.0950)  | -0.4091***<br>(0.0951)  | -0.4180***<br>(0.0953)  |
| Other                                 | -0.6256*<br>(0.3779)    | -0.6041<br>(0.3792)     | -0.6013<br>(0.3788)     | -0.6171<br>(0.3812)     | -0.6176<br>(0.3814)     | -0.6332*<br>(0.3800)    |
| Housing                               |                         |                         |                         |                         |                         |                         |
| Rental                                | 0.5794<br>(0.4109)      | 0.6117<br>(0.4138)      | 0.6144<br>(0.4149)      | 0.6276<br>(0.4158)      | 0.6280<br>(0.4163)      | 0.5953<br>(0.4131)      |
| Tenant-owned apartment                | 0.7876*<br>(0.4106)     | 0.8322**<br>(0.4134)    | 0.8346**<br>(0.4145)    | 0.8365**<br>(0.4153)    | 0.8372**<br>(0.4158)    | 0.7966*<br>(0.4128)     |
| Single family home                    | 0.8573**<br>(0.4106)    | 0.8991**<br>(0.4133)    | 0.9000**<br>(0.4144)    | 0.9083**<br>(0.4153)    | 0.9088**<br>(0.4158)    | 0.8699**<br>(0.4128)    |
| Constant                              | -14.9522***<br>(0.7692) | -15.1426***<br>(0.7779) | -15.1903***<br>(0.7693) | -15.2390***<br>(0.7697) | -15.1101***<br>(0.7800) | -14.8808***<br>(0.7812) |
| Pseudo R2                             | 0.2631                  | 0.2619                  | 0.2619                  | 0.2677                  | 0.2628                  | 0.2638                  |
| Log likelihood                        | -2970.44                | -2975.42                | -2975.31                | -2972.21                | -2971.55                | -2967.83                |
| Observations                          | 6871                    | 6871                    | 6871                    | 6871                    | 6871                    | 6871                    |

This table shows the estimates of the logit regression (eqs. (1)) of stock market participation (participation) on learning channel variables, financial literacy, and a set of controls. Note: Standard errors are reported in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .



**Table 8**

Interaction of learning channels with financial literacy and stock market participation.

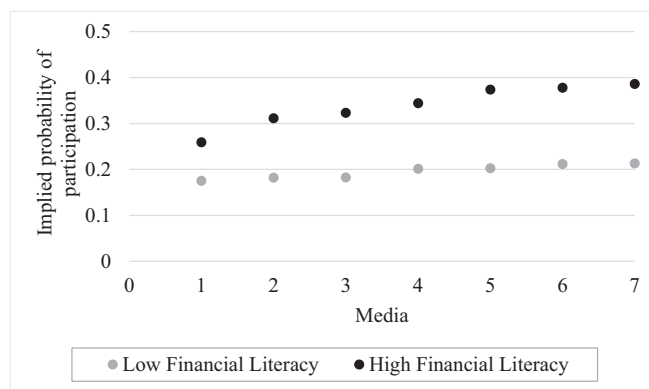
| Dependent variable:<br>Participation   | (1)                  | (2)                  | (3)                   | (4)                   |
|--|----------------------|----------------------|-----------------------|-----------------------|
| Private network                        | -0.0021<br>(0.0290)  | -0.0166<br>(0.0195)  | -0.0114<br>(0.0196)   | 0.0138<br>(0.0294)    |
| Financial advisor                      | 0.0160<br>(0.0194)   | 0.0109<br>(0.0285)   | 0.0210<br>(0.0195)    | 0.0172<br>(0.0285)    |
| Media                                  | 0.0409**<br>(0.0205) | 0.0425**<br>(0.0205) | -0.0184<br>(0.0309)   | -0.0243<br>(0.0315)   |
| Private network × financial literacy   |                      |                      |                       | -0.0433<br>(0.0378)   |
| Financial advisor × financial literacy |                      | 0.0094<br>(0.0379)   |                       | 0.0075<br>(0.0379)    |
| Media × financial literacy             |                      |                      | 0.1041***<br>(0.0397) | 0.1115***<br>(0.0403) |
| Financial literacy                     | 0.2804*<br>(0.1435)  | 0.1643<br>(0.1489)   | -0.1765<br>(0.1594)   | -0.0850<br>(0.2246)   |
| Controls                               | Yes                  | Yes                  | Yes                   | Yes                   |
| Pseudo R2                              | 0.2638               | 0.2638               | 0.2646                | 0.2648                |
| Log likelihood                         | -2967.60             | -2967.80             | -2964.38              | -2963.71              |
| Observations                           | 6871                 | 6871                 | 6871                  | 6871                  |

This table shows the estimates of the logit regression (eqs. (2)) of stock market participation on learning channel variables, financial literacy, and a set of controls. Note: Standard errors are reported in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

pp. in the portfolio shares in stocks as the score of media increases from the lowest (i.e., one) to the highest (i.e., seven). The coefficient for financial literacy is 0.0466, indicating that the portfolio shares in stocks increase by 4.66 pp. when financial literacy increases from low to high. Given that the sample mean of portfolio shares in stocks conditional on participation is only 5.9% (see Table 1), the coefficients for media and financial literacy suggest that these two variables have strong economic relevance for investing portfolio shares in stocks.

Although we find that media and financial literacy play different roles in enhancing stock market participation, it is possible that financial literacy partially mediates the effect of media on participation. In other words, one may become more financially literate by learning from media and hence participate in the stock market to a greater extent. In order to examine possible mediating effects of financial literacy, we use Baron and Kenny (1986)'s three steps approach to calculate the indirect effect of media (i.e. the effect of media on participation through the mediation of financial literacy) and the direct effect of media (i.e. the effect of media on participation when financial literacy stays constant). Further, we use Sobel (1982)'s method to test the significance of the mediation effect of financial literacy.<sup>7</sup> The indirect effect of media is statistically significant on both participation (estimate 0.0038, s.e. 0.0009) and portfolio shares in stocks (estimate 0.0015, s.e. 0.0003), suggesting that financial literacy does mediate the effect of media. Nevertheless, financial literacy only partially mediates the effect of media, because the direct effects of media are statistically significant.

<sup>7</sup> In order to carry out Baron and Kenney (1986)'s approach in a straightforward manner, we employ ordinary least squares (OLS) regressions. The approach consists of three steps. Step 1: Regress the dependent variables (i.e. participation or portfolio shares) on the independent variable *media*:  $Participation (Shares) = \alpha_1 + c \cdot media + \varepsilon_1$ , Step 2: Regress the mediator variable *financial literacy* on the independent variable *media* to confirm whether the independent variable is a significant predictor of the mediator:  $Financial literacy = \alpha_2 + a \cdot media + \varepsilon_2$ , Step 3: Regress *participation (shares)* on *media* and *financial literacy*  $Participation (Shares) = \alpha_2 + c' \cdot Media + b \cdot Financial literacy + \varepsilon_3$ ,  $c'$  is the total effect of *media* on *participation (shares)*.  $c'$  is the direct effect of *media*.  $ab$  is the indirect effect of *media*. According to Sobel (1982), the standard error estimate of indirect effect  $ab$  is  $\sqrt{a^2 S_b^2 + b^2 S_a^2}$ .



**Fig. 2.** Media, financial literacy, and average implied probability of participating in the stock market.

The figure shows the average implied probabilities of participating in the stock market of individuals grouped by the level of learning from media and financial literacy. The probabilities are computed using the estimates in column (4) of Table 8. The dark dots indicate the average probabilities of high financial literacy groups; the grey dots indicate the probabilities of low financial literacy groups.

The direct effect of media on Participation has an estimate of 0.0069 and s.e. 0.0029, and the direct effect on portfolio Shares has an estimate of 0.0036 and s.e. 0.001. Hence, the magnitudes of direct effects are about twice of the indirect effects. Therefore, improving financial literacy is not a sole channel for media to facilitate stock market participation. Learning from media may also provide other benefit such as non-redundant information about stock performance.

Next, we analyze whether financial literacy reinforces or weakens the relationship between learning channels and portfolio shares in stocks. Analogous to our finding regarding participation, the financial literacy is necessary for media to stimulate portfolio shares in stocks, and vice versa. This is suggested by column (3) of Table Table 10, where the interaction between media and financial literacy is strongly significant and positive while the constituent terms are insignificant. In Fig. 3, we plot the partial effect of media on investing portfolio shares in stocks and the 90% confidence intervals against financial literacy. We can see that the estimated partial effect of media on investing portfolio shares in stocks is positively associated with financial literacy. For an individual with high financial literacy, an increase in media by one unit is associated with an increase of about 2 pp. in the portfolio shares invested in stocks. This corresponds to an increase of about 12 pp. as media increases from the lowest (i.e., one) to the highest (i.e., seven). If financial literacy is lower, the increase of media is not associated with any significant increase in the portfolio shares invested in stocks. The interaction result concerning media support our aforementioned suggestion of promoting simultaneously both financial education and access to financial media and online financial information.

Similarly to our finding regarding participation, financial literacy does not moderate the relationship between learning from one's private network or financial advisors and portfolio shares invested in stocks, since the interaction terms of financial literacy with private network and financial advisor in columns (1) and (2) are not statistically significant.

#### 5.4. Robustness analysis

Individuals with different background may have different accessibility to certain information channels, which may affect the importance of the channels for equity investment. For example, highly educated individuals may easily understand and use the information from media while individuals with a lower level of education may tend to seek financial advice from their private network. Therefore, we investigate how certain background characteristics, i.e. education, age and wealth

**Table 9**  
Learning channels, financial literacy, and portfolio shares in stocks.

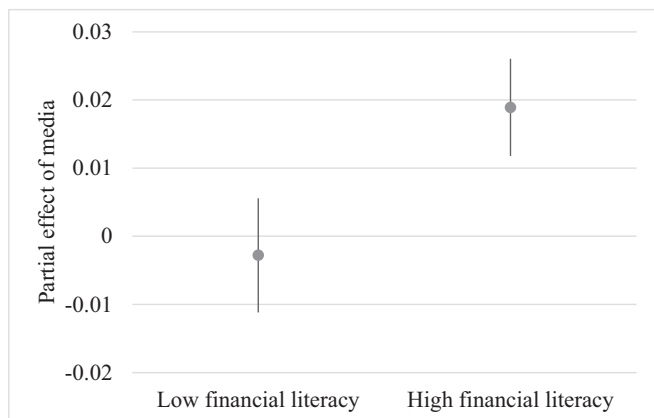
| VARIABLES:<br>Share                   | (1)                    | (2)                    | (3)                    | (4)                    | (5)                    | (6)                    |
|---------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Private network                       |                        | 0.0010<br>(0.0032)     |                        |                        | -0.0000<br>(0.0032)    | 0.0001<br>(0.0032)     |
| Financial advisor                     |                        |                        | -0.0035<br>(0.0032)    |                        | -0.0032<br>(0.0032)    | -0.0032<br>(0.0032)    |
| Media                                 |                        |                        |                        | 0.0127***<br>(0.0033)  | 0.0127***<br>(0.0033)  | 0.0100***<br>(0.0034)  |
| Financial literacy                    | 0.0543***<br>(0.0119)  |                        |                        |                        |                        | 0.0466***<br>(0.0121)  |
| Ln(income+1)                          | -0.0006<br>(0.0023)    | -0.0006<br>(0.0023)    | -0.0005<br>(0.0023)    | -0.0006<br>(0.0023)    | -0.0005<br>(0.0023)    | -0.0005<br>(0.0022)    |
| Ln(wealth+1)                          | 0.1365***<br>(0.0053)  | 0.1392***<br>(0.0053)  | 0.1402***<br>(0.0054)  | 0.1383***<br>(0.0053)  | 0.1392***<br>(0.0054)  | 0.1371***<br>(0.0054)  |
| Ln(debt+1)                            | 0.0025***<br>(0.0010)  | 0.0027***<br>(0.0010)  | 0.0027***<br>(0.0010)  | 0.0025***<br>(0.0010)  | 0.0025***<br>(0.0010)  | 0.0024**<br>(0.0010)   |
| Risk tolerance                        | 0.0208***<br>(0.0032)  | 0.0228***<br>(0.0031)  | 0.0233***<br>(0.0032)  | 0.0201***<br>(0.0032)  | 0.0205***<br>(0.0032)  | 0.0193***<br>(0.0032)  |
| Age                                   | -0.0006<br>(0.0025)    | -0.0001<br>(0.0026)    | -0.0002<br>(0.0025)    | -0.0003<br>(0.0025)    | -0.0003<br>(0.0026)    | -0.0006<br>(0.0025)    |
| Age <sup>2</sup>                      | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     |
| Large city                            | -0.0082<br>(0.0080)    | -0.0079<br>(0.0080)    | -0.0078<br>(0.0080)    | -0.0091<br>(0.0080)    | -0.0090<br>(0.0080)    | -0.0091<br>(0.0080)    |
| Gender                                | 0.0390***<br>(0.0121)  | 0.0529***<br>(0.0119)  | 0.0508***<br>(0.0119)  | 0.0443***<br>(0.0119)  | 0.0429***<br>(0.0121)  | 0.0332***<br>(0.0123)  |
| Work Status                           |                        |                        |                        |                        |                        |                        |
| Pre-retired                           | -0.0262<br>(0.0686)    | -0.0203<br>(0.0689)    | -0.0208<br>(0.0688)    | -0.0317<br>(0.0687)    | -0.0326<br>(0.0687)    | -0.0355<br>(0.0685)    |
| Retired                               | -0.0672<br>(0.0616)    | -0.0589<br>(0.0619)    | -0.0591<br>(0.0617)    | -0.0671<br>(0.0617)    | -0.0674<br>(0.0616)    | -0.0730<br>(0.0614)    |
| Unemployed                            | -0.1210<br>(0.0737)    | -0.1133<br>(0.0739)    | -0.1151<br>(0.0739)    | -0.1196<br>(0.0737)    | -0.1211<br>(0.0737)    | -0.1262*<br>(0.0735)   |
| Student                               | -0.0690<br>(0.0743)    | -0.0583<br>(0.0745)    | -0.0590<br>(0.0745)    | -0.0666<br>(0.0743)    | -0.0674<br>(0.0742)    | -0.0749<br>(0.0741)    |
| Part-time                             | -0.1203*<br>(0.0625)   | -0.1137*<br>(0.0628)   | -0.1138*<br>(0.0627)   | -0.1210*<br>(0.0626)   | -0.1214*<br>(0.0626)   | -0.1256**<br>(0.0624)  |
| Full-time                             | -0.1244**<br>(0.0607)  | -0.1182*<br>(0.0609)   | -0.1191*<br>(0.0608)   | -0.1246**<br>(0.0607)  | -0.1257**<br>(0.0606)  | -0.1298**<br>(0.0605)  |
| Education                             |                        |                        |                        |                        |                        |                        |
| Below high school                     | 0.0330<br>(0.0229)     | 0.0416*<br>(0.0229)    | 0.0419*<br>(0.0229)    | 0.0349<br>(0.0229)     | 0.0352<br>(0.0229)     | 0.0291<br>(0.0229)     |
| High school                           | 0.0442**<br>(0.0215)   | 0.0556***<br>(0.0215)  | 0.0562***<br>(0.0215)  | 0.0465**<br>(0.0216)   | 0.0468**<br>(0.0216)   | 0.0388*<br>(0.0216)    |
| <3 years education after high school  | 0.0549**<br>(0.0220)   | 0.0689***<br>(0.0219)  | 0.0690***<br>(0.0219)  | 0.0586***<br>(0.0220)  | 0.0586***<br>(0.0220)  | 0.0487**<br>(0.0221)   |
| ≥ 3 years education after high school | 0.0438**<br>(0.0216)   | 0.0609***<br>(0.0214)  | 0.0608***<br>(0.0213)  | 0.0497**<br>(0.0215)   | 0.0495**<br>(0.0215)   | 0.0370*<br>(0.0217)    |
| Family status                         |                        |                        |                        |                        |                        |                        |
| Single with children                  | -0.1086***<br>(0.0347) | -0.1091***<br>(0.0347) | -0.1089***<br>(0.0347) | -0.1069***<br>(0.0347) | -0.1070***<br>(0.0347) | -0.1073***<br>(0.0346) |
| Married/cohabiting without children   | -0.0364**<br>(0.0153)  | -0.0335**<br>(0.0154)  | -0.0329**<br>(0.0154)  | -0.0366**<br>(0.0154)  | -0.0362**<br>(0.0154)  | -0.0382**<br>(0.0153)  |
| Married/cohabiting with children      | -0.0492***<br>(0.0156) | -0.0468***<br>(0.0157) | -0.0465***<br>(0.0157) | -0.0486***<br>(0.0156) | -0.0484***<br>(0.0156) | -0.0501***<br>(0.0156) |
| Other                                 | -0.1266**<br>(0.0618)  | -0.1218**<br>(0.0620)  | -0.1220**<br>(0.0619)  | -0.1244**<br>(0.0619)  | -0.1244**<br>(0.0618)  | -0.1276**<br>(0.0617)  |
| Housing                               |                        |                        |                        |                        |                        |                        |
| Rental                                | 0.1231*<br>(0.0684)    | 0.1309*<br>(0.0690)    | 0.1299*<br>(0.0688)    | 0.1331*<br>(0.0687)    | 0.1322*<br>(0.0686)    | 0.1251*<br>(0.0682)    |
| Tenant-owned apartment                | 0.1662**<br>(0.0684)   | 0.1767**<br>(0.0689)   | 0.1760**<br>(0.0687)   | 0.1759**<br>(0.0687)   | 0.1752**<br>(0.0685)   | 0.1663**<br>(0.0681)   |
| Single family home                    | 0.1645**<br>(0.0683)   | 0.1745**<br>(0.0688)   | 0.1741**<br>(0.0687)   | 0.1749**<br>(0.0686)   | 0.1745**<br>(0.0685)   | 0.1658**<br>(0.0681)   |
| Constant                              | -2.1715***<br>(0.1247) | -2.2407***<br>(0.1267) | -2.2359***<br>(0.1249) | -2.2372***<br>(0.1247) | -2.2372***<br>(0.1263) | -2.1842***<br>(0.1262) |
| Pseudo R2                             | 0.3086                 | 0.3052                 | 0.3054                 | 0.3077                 | 0.3078                 | 0.3102                 |
| Log likelihood                        | -2140.93               | -2151.32               | -2150.81               | -2143.84               | -2143.35               | -2135.96               |
| Observations                          | 6871                   | 6871                   | 6871                   | 6871                   | 6871                   | 6871                   |

This table shows the estimates of the tobit regression of portfolio share in stocks on learning channel variables, financial literacy, and a set of controls. The dependent variable, portfolio share in stocks, is bounded at zero from below. Note: Standard errors are reported in parentheses; \*\*\* p < 0.01, \*\* p < 0.05, \*p < 0.1.

**Table 10**  
Interaction of learning channels with financial literacy and portfolio shares in stocks.

| Dependent variable: Share              | (1)                   | (2)                   | (3)                   | (4)                   |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| Private network                        | 0.0020<br>(0.0048)    | 0.0002<br>(0.0032)    | 0.0013<br>(0.0032)    | 0.0053<br>(0.0049)    |
| Financial advisor                      | -0.0032<br>(0.0032)   | -0.0008<br>(0.0048)   | -0.0020<br>(0.0032)   | 0.0008<br>(0.0048)    |
| Media                                  | 0.0098***<br>(0.0034) | 0.0097***<br>(0.0034) | -0.0028<br>(0.0051)   | -0.0042<br>(0.0052)   |
| Private network × Financial literacy   |                       |                       |                       | -0.0067<br>(0.0062)   |
| Financial advisor × Financial literacy |                       | -0.0042<br>(0.0063)   |                       | -0.0049<br>(0.0063)   |
| Media × financial literacy             |                       |                       | 0.0217***<br>(0.0066) | 0.0230***<br>(0.0067) |
| Financial literacy                     | 0.0574**<br>(0.0238)  | 0.0610**<br>(0.0247)  | -0.0312<br>(0.0264)   | 0.0029<br>(0.0374)    |
| Controls                               | Yes                   | Yes                   | Yes                   | Yes                   |
| Pseudo R2                              | 0.3103                | 0.3103                | 0.3120                | 0.3123                |
| Log likelihood                         | -2135.82              | -2135.74              | -2130.48              | -2129.59              |
| Observations                           | 6871                  | 6871                  | 6871                  | 6871                  |

This table shows the estimates of the tobit regression of portfolio share in stocks on learning channel variables, financial literacy, the interactions of learning channels with financial literacy, and a set of controls. The dependent variable, portfolio share in stocks, is bounded at zero from below. Standard errors are reported in parentheses; \*\*\* p < 0.01, \*\* p < 0.05, \*p < 0.1.



**Fig. 3.** Partial effect of media on portfolio shares in stocks. The figure shows the partial effect of media on portfolio shares in stocks, given different levels of financial literacy. The partial effect is calculated from the estimates in column (3) in Table Table 10. The grey dots indicate the marginal effects, and the vertical lines present the 90% confidence intervals.

influence the effect of learning channels and the interactive of learning channels on financial literacy on participation. For this purpose, using the median value of education/age/wealth as the threshold, we group individuals into a group with high level of education/age/wealth and a group with low level of education/age/wealth. Then we define a dummy variable D for the group with high level of education/age/wealth.

First, to analyze whether effects of learning channels on stock ownership vary between the groups defined based on education, age and wealth, we extend eq. (1) by including interaction of the learning channel variables with the group dummy variables. The interaction variables would reveal whether the effects of learning channels vary between groups.

From the logit regression results in Table Table 11, we can see that learning from private network or financial advisor is not associated with direct stock market participation, as the coefficients for private network

**Table 11**  
Effects of learning channels on stock market participation for groups with different background.

| Dependent variable: Participation | (1)                                   | (2)                             | (3)                                |
|-----------------------------------|---------------------------------------|---------------------------------|------------------------------------|
|                                   | D = 1<br>if education above<br>median | D = 1<br>if age above<br>median | D = 1<br>if wealth above<br>median |
| Private network × D               | -0.0325<br>(0.0372)                   | -0.0433<br>(0.0390)             | -0.0487<br>(0.0406)                |
| Financial advisor × D             | 0.0106<br>(0.0376)                    | 0.0035<br>(0.0386)              | -0.0190<br>(0.0425)                |
| Media × D                         | -0.0025<br>(0.0375)                   | -0.0221<br>(0.0385)             | -0.0650*<br>(0.0394)               |
| Private network                   | 0.0002<br>(0.0268)                    | 0.0058<br>(0.0304)              | 0.0071<br>(0.0354)                 |
| Financial advisor                 | 0.0116<br>(0.0269)                    | 0.0144<br>(0.0306)              | 0.0761**<br>(0.0371)               |
| Media                             | 0.0476*<br>(0.0276)                   | 0.0530*<br>(0.0312)             | 0.0901***<br>(0.0340)              |
| D                                 | 0.1711<br>(0.2222)                    | 0.4933**<br>(0.2471)            | 2.1991***<br>(0.2312)              |
| Financial literacy                | 0.2085***<br>(0.0717)                 | 0.1981***<br>(0.0721)           | 0.3231***<br>(0.0690)              |
| Control                           | Yes                                   | Yes                             | Yes                                |
| Observations                      | 6871                                  | 6871                            | 6871                               |

This table shows the estimates of the logit regression (eq. (1)) of stock market participation (Participation) on learning channels for groups with different background. Median education is 'high school', median age is 57, and median wealth is 223,127 SEK. Standard errors are reported in parentheses; \*\*\* p < 0.01, \*\* p < 0.05, \*p < 0.1.

and financial advisor as well as the coefficients for the interaction terms with D from column (1) to column (3) are all statistically insignificant. In columns (1) and (2), the coefficient for media is positive and statistically significant and the coefficient for media × D is insignificant, indicating that media plays an important role in direct stock market participation regardless of one's education and age. In comparison, the effect of media is heterogeneous across wealth groups. The positive coefficient for media in column (3) indicates that learning of media is strongly associated with direct stock market participation among less wealthy individuals. The coefficient for media × D is negative and statistically significant, indicating that the effect of media is weaker for wealthier individuals. More specifically, we test the sum of coefficient of media and coefficient of media × D and find it statistically insignificant. This suggests that learning from media is not associated with participating in the stock market for wealthier individuals. An explanation for the heterogeneous effect of media may be that wealthier individuals can easily afford the monetary cost of entering the stock market. Such lower monetary entry-barrier may offset the effect of lack of learning from media.

Next, we analyze how the interactive effects of learning channels and financial literacy on participation vary with level of education, age and wealth. We extend eq. (2) by interacting the main variables with D. Table Table 12 shows the logit regression results. In columns (1)–(3), none of the variables associated with private network and financial advisors have statistically significant coefficients. This means that private network and financial advisors do not have effects on participation among all the groups and that interactive effects of learning channels and financial literacy are insignificant among all the groups. In contrast, the coefficient for media × financial literacy is positive and statistically significant in all the columns indicating the joint importance of media and financial literacy for participation, which is in line the main finding from our baseline analysis in section (4.2). Furthermore, the coefficient for media × financial literacy × D is insignificant in all the columns, suggesting that the interactive effects of media and financial literacy

**Table 12**  
Interactive effects of learning channels and financial literacy on stock market participation for groups with different background.

| Dependent variable:<br>Participation       | (1)                                   | (2)                             | (3)                                |
|--|---------------------------------------|---------------------------------|------------------------------------|
|  | D = 1<br>if education<br>above median | D = 1<br>if age above<br>median | D = 1<br>if wealth above<br>median |
| Private network × financial literacy × D   | 0.0535<br>(0.0688)                    | -0.0132<br>(0.0702)             | -0.0581<br>(0.0743)                |
| Financial advisor × financial literacy × D | 0.0285<br>(0.0640)                    | -0.0741<br>(0.0662)             | 0.1035<br>(0.0754)                 |
| Media × financial literacy × D             | -0.0263<br>(0.0686)                   | 0.0071<br>(0.0696)              | -0.0766<br>(0.0718)                |
| Private network × financial literacy       | -0.0694<br>(0.0506)                   | -0.0477<br>(0.0563)             | -0.0030<br>(0.0652)                |
| Financial advisor × financial literacy     | -0.0078<br>(0.0496)                   | 0.0581<br>(0.0553)              | -0.0625<br>(0.0694)                |
| Media × financial literacy                 | 0.1210**<br>(0.0526)                  | 0.1020*<br>(0.0577)             | 0.1676***<br>(0.0642)              |
| Private network × D                        | -0.0586<br>(0.0554)                   | -0.0375<br>(0.0571)             | -0.0155<br>(0.0591)                |
| Financial advisor × D                      | -0.0049<br>(0.0525)                   | 0.0462<br>(0.0546)              | -0.0814<br>(0.0601)                |
| Media × D                                  | -0.0068<br>(0.0597)                   | -0.0092<br>(0.0610)             | -0.0127<br>(0.0630)                |
| Private network                            | 0.0413<br>(0.0373)                    | 0.0405<br>(0.0451)              | 0.0151<br>(0.0509)                 |
| Financial advisor                          | 0.0203<br>(0.0372)                    | -0.0136<br>(0.0442)             | 0.1196**<br>(0.0532)               |
| Media                                      | -0.0139<br>(0.0414)                   | -0.0194<br>(0.0483)             | -0.0148<br>(0.0535)                |
| Financial literacy                         | -0.0584<br>(0.2263)                   | -0.0489<br>(0.2260)             | 0.0094<br>(0.2168)                 |
| D  | 0.2325<br>(0.2272)                    | 0.4433*<br>(0.2499)             | 2.2008***<br>(0.2347)              |
| Controls                                   | Yes                                   | Yes                             | Yes                                |
| Observations                               | 6871                                  | 6871                            | 6871                               |

This table shows the estimates of the logit regression (eq. (2)) of stock market participation (Participation) on learning channels, and the interactions of learnings channels with financial literacy, for groups with different background. Median education is 'high school', median age is 57, and median wealth is 223,127 SEK. Standard errors are reported in parentheses; \*\*\* p < 0.01, \*\* p < 0.05, \*p < 0.1.

does not differ across groups.

Further, we study how background characteristics influence the effects of learning channels on portfolio shares in stocks. From the tobit regression results in Table Table 13, we see that learning from media has the same effect on portfolio shares in stocks regardless of one's level of education, age and wealth. This finding differs from the result shown in Table Table 12, that media has weaker effect for wealthier individuals. Our interpretation is that, although the effect of media on participating in the stock market may be offset by lower monetary entry-barrier for the wealthier individuals, they still need to learn about investment opportunities from media in order to increase their investment in stocks. Interestingly, learning from financial advisor shows heterogeneous effect on portfolio shares across the wealthier and the less wealthy group. The coefficient for financial advisor in column (3) indicates that learning from financial advisor is positively associated with portfolio shares in stocks for less wealthier individuals. The sum of coefficient of financial advisor and coefficient of financial advisor × D is statistically insignificant, suggesting that financial advisor does not play an important role in increasing wealthier investors' portfolio shares in stocks. Our finding regarding the heterogeneous effect of financial advisor is in line with the

**Table 13**  
Effects of learning channels on portfolio shares in stocks for groups with different background.

| Dependent variable:<br>Share | (1)                                   | (2)                             | (3)                                |
|------------------------------|---------------------------------------|---------------------------------|------------------------------------|
|                              | D = 1<br>if education above<br>median | D = 1<br>if age above<br>median | D = 1<br>if wealth above<br>median |
| Private network × D          | -0.0034<br>(0.0061)                   | -0.0049<br>(0.0065)             | -0.0079<br>(0.0068)                |
| Financial advisor × D        | -0.0002<br>(0.0062)                   | -0.0030<br>(0.0064)             | -0.0122*<br>(0.0072)               |
| Media × D                    | -0.0006<br>(0.0062)                   | -0.0051<br>(0.0064)             | -0.0006<br>(0.0066)                |
| Private network              | 0.0019<br>(0.0044)                    | 0.0023<br>(0.0051)              | 0.0036<br>(0.0058)                 |
| Financial advisor            | -0.0030<br>(0.0045)                   | -0.0013<br>(0.0052)             | 0.0131**<br>(0.0062)               |
| Media                        | 0.0108**<br>(0.0045)                  | 0.0125**<br>(0.0052)            | 0.0108*<br>(0.0056)                |
| D                            | 0.0257<br>(0.0371)                    | 0.1071***<br>(0.0411)           | 0.3473***<br>(0.0392)              |
| Financial literacy           | 0.0482***<br>(0.0121)                 | 0.0467***<br>(0.0121)           | 0.0682***<br>(0.0124)              |
| Control                      | Yes                                   | Yes                             | Yes                                |
| Observations                 | 6871                                  | 6871                            | 6871                               |

This table shows the estimates of the tobit regression of stock market participation (Share) on learning channels for groups with different background. Median education is 'high school', median age is 57, and median wealth is 223,127 SEK. Standard errors are reported in parentheses; \*\*\* p < 0.01, \*\* p < 0.05, \*p < 0.1.

existing studies (e.g. [Bluethgen, Gintschel, Hackethal, & Mueller, 2008](#); [Kramer, 2016](#)). In addition, the tobit regression results in Table Table 14 show the joint importance of media and financial literacy on portfolio shares in stocks irrespective one's level of education, age and wealth.

Summing up, we find that level of education and age do not influence the effects of the learning channels or the interactive effects of the channels and financial literacy. While this is an informative result by itself, it supports that our baseline analysis does not suffer from sample selection bias due to higher education and age of our sample compared to the Swedish population. As for the influence of wealth, learning from media remains important for less wealthier individuals. This supports that our baseline finding about media does not suffer from the fact that our sample is on average wealthier than the Swedish population. Therefore, we conjecture that our main finding regarding the importance of media and its joint importance with financial literacy may remain if our sample represents the Swedish population to a greater extent. Nevertheless, we suggest that policy makers should pay attention to the wealth-related nuance in learning channels. Our finding that less wealthy individuals seek help from financial advisors indicates the benefit of improving the quality of financial advice.

We now attend to another empirical issue that may lead to over-estimation in our results. The issue occurs if our dependent variables, participation and portfolio shares in stocks, are predictors for the explanatory variables, financial literacy, and learning channels. It is plausible that individuals may become more financially literate and pay more attention to financial news in the media as they obtain more experience in the stock market. We mitigate this potential reverse causality issue by using a larger interval between the time of the survey and the time of observing respondents' portfolios. To do so, we construct the dependent variables based on the information of respondents' portfolios observed in March 2016, which is three years after the time of the survey. Comparing the results (available upon request) obtained from using portfolio information in 2016 to the main results obtained from using portfolio information in 2013, we find that the signs and statistical

**Table 14**  
Interactive effects of learning channels and financial literacy on stock market participation for groups with different backgrounds.

| Dependent variable:<br>Share                  | (1)                                   | (2)                             | (3)                                |
|---|---------------------------------------|---------------------------------|------------------------------------|
|   | D = 1<br>if education<br>above median | D = 1<br>if age above<br>median | D = 1<br>if wealth above<br>median |
| Private network ×<br>financial literacy × D   | 0.0133<br>(0.0113)                    | 0.0004<br>(0.0116)              | -0.0072<br>(0.0124)                |
| Financial advisor ×<br>financial literacy × D | -0.0011<br>(0.0106)                   | -0.0114<br>(0.0110)             | 0.0087<br>(0.0127)                 |
| Media × financial<br>literacy × D             | -0.0054<br>(0.0114)                   | -0.0064<br>(0.0116)             | 0.0003<br>(0.0121)                 |
| Private network ×<br>financial literacy       | -0.0132<br>(0.0083)                   | -0.0099<br>(0.0094)             | -0.0017<br>(0.0105)                |
| Financial advisor ×<br>financial literacy     | -0.0044<br>(0.0082)                   | 0.0039<br>(0.0093)              | -0.0105<br>(0.0115)                |
| Media × financial<br>literacy                 | 0.0252***<br>(0.0087)                 | 0.0259***<br>(0.0097)           | 0.0243**<br>(0.0105)               |
| Private network × D                           | -0.0106<br>(0.0092)                   | -0.0062<br>(0.0095)             | -0.0027<br>(0.0097)                |
| Financial advisor × D                         | 0.0006<br>(0.0088)                    | 0.0036<br>(0.0092)              | -0.0168*<br>(0.0100)               |
| Media × D                                     | -0.0006<br>(0.0100)                   | 0.0029<br>(0.0102)              | -0.0030<br>(0.0105)                |
| Private network                               | 0.0101<br>(0.0062)                    | 0.0101<br>(0.0076)              | 0.0054<br>(0.0079)                 |
| Financial advisor                             | 0.0005<br>(0.0062)                    | -0.0024<br>(0.0074)             | 0.0199**<br>(0.0085)               |
| Media   | -0.0031<br>(0.0069)                   | -0.0061<br>(0.0082)             | -0.0026<br>(0.0084)                |
| Financial literacy                            | 0.0357<br>(0.0380)                    | 0.0983**<br>(0.0416)            | 0.3502***<br>(0.0398)              |
| D   | 0.0058<br>(0.0377)                    | 0.0095<br>(0.0376)              | 0.0158<br>(0.0384)                 |
| Controls                                      | Yes                                   | Yes                             | Yes                                |
| Observations                                  | 6871                                  | 6871                            | 6871                               |

This table shows the estimates of the tobit regression of stock market participation (Share) on learning channels, and the interactions of learning channels with financial literacy, for groups with different background. Median education is 'high school', median age is 57, and median wealth is 223,127 SEK. Standard errors are reported in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

significance of all the coefficients are almost the same. The coefficient of media becomes less significant (10% for participation and 5% for portfolio shares) when financial literacy is controlled. The interaction term of financial literacy and media is still significant at 1% for participation and portfolio shares.

Furthermore, in order to control for the possibility that the association between learning surveyed in 2013 and stock market participation in 2016 is explained by the fact that individuals' investment behavior are formed earlier in their lives and persist over time, we make an extension to the regressions of portfolio share in 2016. In the extended regressions (available upon request), we regress portfolio share in 2016

on learning surveyed in 2013 while controlling for prior investment behavior. We consider stock market participation in 2013 as a measure for prior investment behavior. The coefficients for the learning variables, therefore, reveal association between learning and portfolio share conditional on prior investment behavior. Our main findings remain: Media is an important learning channel; Financial literacy is a necessary condition for learning from media, and vice versa.

## 6. Conclusion

The literature on household finance has paid increasing attention to factors that affect individuals' investments in stocks. It is generally concluded that knowledge about financial aspects is important to participation in the stock market. The present study uses a sample of Swedish households to investigate the effect of learning through one's private networks, financial advisors, and media, as well as the interactive effect of financial literacy and these learning channels, on stock market participation. We conclude that learning about financial markets and economic matters through media is positively associated with stock market participation, as well as with the share of wealth invested directly in stocks. The direct effects from learning from private networks and financial advisors are insignificant. Investigating interactive effects, we find a positive significant effect of learning from media and financial literacy on stock market participation. We also conclude that the effect of financial literacy becomes insignificant, which indicates that the likelihood of participation does not increase with financial literacy if the individual does not learn from media. Similarly, the sole effect of learning from media has no effect. Our results thus indicate the joint importance of financial literacy and media as a learning channel.

It is possible that the effects of the various learning channels varies across countries. For example, the possibilities to learn from media may vary by Internet penetration. Furthermore, countries differ to the extent that they cultivate social relations. Sweden is an individualistic country (Hofstede, 1984), and it is possible that learning from close social contacts has other effects in more collectivistic cultures.

The findings made in the present study imply that if policymakers want to enhance stock market participation, our findings indicate they should promote at the same time both financial education and access to financial media and online financial information. The direct effects of learning from one's private networks and from financial advisors are insignificant. In contrast to learning from media, we find that financial literacy has no interactive effect on the relation between learning from ones' private network or financial advisors and stock market participation. Hence, compared to media, advice from family and friends and from financial advisors may be insufficient for individuals to overcome the information barrier of participating in the stock market.

## Declaration of Competing Interest

None.

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## Appendix

Table A1

Factor loadings for the six financial literacy questions. DK refers to “do not know.”

|   |         | Factor loadings |
|---|---------|-----------------|
| How high is the Riksbank's inflation target?  | Correct | 0.653           |
|   | DK      | -0.715          |
| If there is a risk that the inflation will exceed the inflation target, what should the Riksbank do?                          | Correct | 0.607           |
|   | DK      | -0.719          |
| If the nominal interest rate is 5%, and the expected inflation is 2%, how high will the real interest rate be (approx.)?      | Correct | 0.657           |
|   | DK      | -0.723          |
| A savings product where you will receive a guaranteed amount at maturity, and the return follows the equity market, is called | Correct | 0.605           |
|   | DK      | -0.656          |
| Mutual funds have different risk levels; which of these mutual fund types is generally viewed as having the highest risk?     | Correct | 0.566           |
|   | DK      | -0.596          |
| The definition of the P/E-ratio is  | Correct | 0.554           |
|   | DK      | -0.627          |

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