

RESEARCH IN ECONOMIC EDUCATION

## Financial literacy of high school students: Evidence from Germany

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### ABSTRACT

After graduating high school, underage individuals soon face ever more complex and important financial decisions. Pivotal to the development of improved financial literacy programs is a comprehensive examination of financial literacy levels and potentially related factors. The authors conducted a survey among German high school students and found similarly weak performances on standard financial literacy measures as have been documented for other samples. Female students and those with a low level of integration exhibit significantly lower financial literacy across measures. Additionally, basic financial literacy is related to mathematical skills, while sophisticated financial literacy is related to a student's general cognitive aptitude and foreign language skills. Subpopulations identified by these factors should be given attention in the development of more targeted financial literacy programs.

### KEYWORDS

Economic education;  
financial education;  
precollege education

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Individuals can make informed financial decisions only if they possess sufficient knowledge about the decision contexts that they are facing and the skills to apply this knowledge. Individuals who are not financially literate carry a higher risk of making decisions that are harmful to their financial well-being (Cole, Sampson, and Zia 2011). Low levels of financial literacy have been documented across various samples and have been found to be associated with the reluctance to plan for retirement (Lusardi and Mitchell 2007b), borrowing at higher interest rates (Stango and Zinman 2009), acquiring fewer assets (Lusardi and Mitchell 2007a), and a lower likelihood of participating in the stock market (Van Rooij, Lusardi, and Alessie 2011). Further examples are discussed in the comprehensive reviews by Hastings, Madrian, and Skimmyhorn (2013), Fernandes, Lynch, and Netemeyer (2014), and Lusardi and Mitchell (2014).

Given the ample empirical evidence that financial illiteracy is widespread, each of these findings is problematic on its own. The situation is further aggravated by two recent trends. First, in many developed countries, responsibility for an adequate retirement provision is shifted from governments and employers toward individuals (Braunstein and Welch 2002), forcing them to cope more autonomously with financial decisions (Oehler and Kohlert 2009). More complex decision situations may, in turn, make individuals feel less knowledgeable, and varying levels of perceived financial literacy have been shown to be predictive of financial behavior (Allgood and Walstad 2016). Second, financial products and services are becoming more numerous and feature-rich, which renders making an informed choice challenging in general, but particularly so for financially illiterate individuals (Oehler and Kohlert 2009). Furthermore, existing financial literacy programs have been found to exhibit limitations in terms of their long-term effectiveness, calling for more research on determinants of financial literacy and on how to improve financial education (e.g., Carlin and Robinson 2012; Mandell and Klein 2009).

While there are initiatives in many countries to promote financial education (e.g., OECD 2005; Oehler and Werner 2008), it is surprising that no dedicated financial education programs exist in Germany. If the youth in Germany have similar difficulties in acquiring financial literacy as those that have been documented in other countries, this lack of financial education becomes a serious concern. German adolescents regularly express their wish to receive more economic and financial education in school. For instance, 75 percent of 15- to 17-year-old students stated that they would like economic and financial topics to be more prominently featured in school, and 40 percent of that age group even responded that they would endorse implementing a dedicated subject (SCHUFA 2013). The results from other studies highlight the importance of enhancing financial literacy early in a student's life. For example, Bucciol and Veronesi (2014) showed a positive relationship between parental teaching of savings and a student's downstream financial outcomes. On a more general level, the Organisation for Economic Co-operation and Development (OECD) has set out a framework pertaining to national strategies for enhancing education programs and "recommend[s] the introduction of financial education as early as possible in individuals' lives and preferably through its inclusion in the school curriculum" (OECD 2012a, 15).

In this article, we report the results from a survey in which approximately 1,500 German tenth-grade students across the main high school types participated. Students in our sample were (on average) 16 years old, and thus only about two years away from their full contractual capability. Moreover, we discuss factors that are related to financial literacy to identify student groups with the highest need for targeted financial literacy programs.

## Institutional background

### *Financial literacy measures and related factors*

Various measures of financial literacy have been discussed in the literature (for an overview, see Hung, Parker, and Yoong 2009; Huston 2010). In this study, we employed the set of five basic and eight sophisticated financial literacy questions proposed by Lusardi and Mitchell (2009) (see also Van Rooij, Lusardi, and Alessie 2011). The basic financial literacy questions cover elementary financial concepts, such as compound interest or the time value of money, and the sophisticated financial literacy questions cover more specific topics related to investing and financial products, such as risk diversification or the risk-return relationship. This set of questions, or slight variations thereof, has been used in various studies and has been included in many panel surveys, for example, the RAND American Life Panel (ALP) (Lusardi and Mitchell 2009), the De Nederlandsche Bank Household Survey (Van Rooij, Lusardi, and Alessie 2011), the American Health and Retirement Study (HRS) (Lusardi and Mitchell 2011), and the German SAVE survey (Bucher-Koenen and Lusardi 2011). Basic and sophisticated financial literacy are usually strongly positively correlated, yet are found to describe two separate dimensions of financial literacy (Lusardi and Mitchell 2009; Van Rooij, Lusardi, and Alessie 2011).

Previous studies have administered these measures of financial literacy to adult samples. Its applicability to underage students can be supported by comparing it to the OECD (2012b) financial literacy framework, which has been specifically designed to measure financial literacy among adolescents. The content area of risk and reward is considered to be an important element in the OECD framework and relates to several of the basic and sophisticated financial literacy questions. It addresses the risk and return of financial products, benefits of diversification, effects of compounding, fluctuations in interest rates, and market volatility. The content area of planning and managing finances includes questions on the impact of compound interest on savings and the pros and cons of investment products. Additionally, the OECD framework includes items on calculating the interest on a loan over two years (numeracy) and on the impact of price changes on purchasing power (inflation).

The studies by Lusardi and Mitchell (2009) and Van Rooij and colleagues (2011) included the entire set of 13 financial literacy questions. Both studies found that financial literacy varies significantly with gender, educational attainment, and age. Female, less educated, or young subjects exhibited lower financial literacy compared to their male, better educated, or older counterparts. This held for both basic and sophisticated financial literacy (Van Rooij, Lusardi, and Alessie 2011). Additionally, Cole, Sampson, and

Zia (2011) emphasized the importance of the individual's cognitive abilities. They found subjects who performed better on a set of eight mathematics questions to show significantly higher financial literacy scores. Lusardi, Mitchell, and Curto (2010) provided further empirical evidence for the theoretical connectedness of financial and mathematical literacy (OECD 2012b). Moreover, the findings in Lusardi and colleagues (2010) pointed to the importance of parental wealth. Young adults from families owning stocks or retirement savings exhibited significantly higher financial literacy levels.

### Three-tier high school system in Germany

As a consequence of German federalism, individual states are in charge of the educational system in their respective jurisdiction. Mandatory school attendance begins at age six with four years of primary school (Dustmann 2004). Based on a recommendation by primary school representatives, students then proceed to one of three main secondary (high) school types: *Hauptschule*, *Realschule*, or *Gymnasium* (Winkelmann 1996). Students with the lowest achievements in elementary school are advised to attend the *Hauptschule*, where they receive an additional five or six years of general education as a basis for apprenticeship training. Within the *Hauptschule*, many states offer students the choice between two different degrees (e.g., MSW NRW 2013). Students pursuing the *Hauptschule Typ A* degree will receive education that primarily aims at preparing them for an apprenticeship. The *Hauptschule Typ B* degree is equivalent to the one obtained by attending the *Realschule*, thus allowing the highest performing students from the *Hauptschule* to obtain the qualification that is required for further schooling without the need to transfer to a *Realschule*. The distinction between these two degrees is important in knowledge contexts such as the one considered in this study because students pursuing the *Hauptschule Typ B* degree are (with respect to their learning abilities) more comparable to students at the *Realschule* than to students targeting the *Hauptschule Typ A* degree (e.g., MSW NRW 2005). *Realschule*, designed as an intermediate school, attracts students with intermediate grades and is intended to prepare students for apprenticeships or further schooling (Dustmann 2004). The students who performed best in elementary school are advised to go to the *Gymnasium*, where they complete an additional eight to nine years of general education and gain the qualification to enroll in technical colleges or universities (Winkelmann 1996).

Although Dustmann (2004) emphasized that the school systems in the 16 German states are comparable regarding the three tiers and teachers' qualifications, the curricula and teaching concepts may vary across states. Regardless of the high school type and state, German high school students receive economic education by means of either an infused subject or a stand-alone economic course (Weber 2002). There is an ongoing debate regarding which form is the most effective (e.g., Krol, Loerwald, and Müller 2011). Currently, dedicated financial education programs are not part of the curricula in Germany (MSJK NRW 2004).

## Survey design

### Sample

The survey was conducted in 2010 in a midsize German city in the state of North Rhine-Westphalia as part of a larger research project (see also Erner, Goedde-Menke, and Oberste 2015; Goedde-Menke, Erner, and Oberste 2016). In total, 1,540 tenth-grade students participated and were recruited from 25 schools across the three high school types: *Hauptschule* (eight schools), *Realschule* (eight schools), and *Gymnasium* (nine schools). The questionnaire comprised the 13 financial literacy questions, a separate research module on economic literacy, items eliciting a student's sociodemographic background, and items eliciting the student's attitudes and opinions concerning various topics. Students were asked to fill out the paper-based questionnaire in school during supervised sessions.

To incentivize complete and correct responses, a two-stage, incentive-compatible payment scheme was implemented. Only students who filled out their questionnaires completely and answered a randomly selected question correctly were entered into a drawing to win one of 25 shopping vouchers (valued at €25 each). Before beginning our analysis, we excluded data from 124 participants because the session supervisor identified them as being noncompliant with the test procedures, resulting in a sample of  $N = 1,416$ .

We compared the composition of our sample to the statistics on students and schools for the state of North Rhine-Westphalia, which is the most populous German state and the state where our study was conducted (MSW NRW 2010). The available statistics allowed us to assess the distributions of the number of students in this study relative to the total number of students in the state across high school types, level of integration, and gender. The share of students in our sample pursuing *Hauptschule Typ A* and *Hauptschule Typ B* degrees was 20.3 percent, whereas in North Rhine-Westphalia, the share of students pursuing these two degrees was 24.3 percent. The share of students in our sample attending a *Realschule* (*Gymnasium*) was 33.3 percent (46.3 percent) compared to 35.0 percent (40.7 percent) in the statewide distribution. With regard to a lower level of integration, there were slightly more students in our sample (18.6 percent) than at the state level (12.7 percent). For gender, a statewide statistic was available only for the total number of students across all grades. The share of male students in our sample was 48.9 percent compared to 49.8 percent in the statewide population. Although this comparison indicated that our sample composition did not deviate substantially from the statewide distribution, small differences could arise from the overrepresentation of *Gymnasium* students and underrepresentation of *Hauptschule* students. We conducted a robustness check using the statewide sampling weights, and (as expected) the average literacy levels turned out to be slightly lower. Overall, however, the results discussed in the following did not qualitatively change.

### Variable specifications

To measure basic and sophisticated financial literacy, we used the original questions of Lusardi and Mitchell (2009) but omitted the “do not know/refuse to answer” response option, in line with other financial literacy surveys for high school students (e.g., the Jump\$art survey [Mandell 2008] or the OECD framework [OECD 2012b]). All the questions were translated into German and checked against other studies, where available (e.g., Bucher-Koenen and Lusardi 2011). The amounts in United States dollars were replaced with the identical amounts in euros. We adjusted the wording of question B5 to account for the timing of our study.

Following the literature, we examined the percentage-correct score (PCS) over a block of literacy questions, calculated as the number of correct answers divided by the number of questions in that block (e.g., Walstad and Allgood 1999). The PCS over the five basic financial literacy questions is referred to as basic financial literacy, and the PCS over the eight sophisticated financial literacy questions is labeled as sophisticated financial literacy.

To verify that the measures’ reliabilities hold in our sample, we inspected the correlation matrices between items. For basic financial literacy, all pairwise correlations were significantly positive (all but one at  $p < .01$ ), suggesting a consistent measurement. For sophisticated financial literacy, items S3 and S6 stood out as they were not significantly correlated with the other sophisticated items, presumably due to the low rates of correct responses that were also found in previous studies (Lusardi and Mitchell 2009).

To inspect the robustness of the assumption that the PCS is a good indicator for the underlying latent ability trait, we fitted three-parameter logistic models for each of the two literacy components and estimated each student’s latent ability trait (THETA) according to item response theory (e.g., Knoll and Houts 2012). For both basic and sophisticated financial literacy, we found strong positive correlations between PCS and THETA ( $\rho = 0.93$ ,  $p < .01$  for basic financial literacy;  $\rho = 0.84$ ,  $p < .01$  for sophisticated financial literacy). We thus report only the results using the PCS.

Regarding the factors related to financial literacy, we employed the set of general knowledge factors used by Erner and colleagues (2015). These factors reflect the students’ general school proficiency levels and are expected to influence various knowledge areas. They can be classified as representing the learning

environment (institutionalized education quality), a student's sociodemographic factors (e.g., gender, age, income, social background), and the student's learning ability (e.g., intelligence or the ability to develop procedural knowledge as measured by their respective grades in German, mathematics, and the first foreign language).

Table 1 lists the variable specifications and summary statistics for the full sample (ALL) and split by high school track (HSA, HSB, RS, GYM). Most variables were dummy-coded or based on Likert-type scales. In addition to the variables listed in table 1, a categorical variable (HIGH\_SCHOOL\_TRACK) controlling for the four different high school tracks was included in the ALL model.

## Results

### Levels of financial literacy

Table 2 exhibits the summary statistics for the two financial literacy measures. We first present the results for basic financial literacy and then turn to sophisticated financial literacy, and for each of these two measures, we discuss the aggregate level followed by the question-level results. Table 2 also lists the question-specific guessing probabilities.

On average, the students in our sample answered 64.2 percent of the basic financial questions correctly, which is a significantly higher score than the average guessing probability (33.3 percent) for this measure ( $p < .01$ ). Only 34 out of 1,416 students were not able to provide a correct response to any of the questions. The results confirm the rank-ordering of the four high school tracks, with *Hauptschule Typ A* (*Gymnasium*) having the smallest (largest) mean score and the two other tracks placing in the middle. Financial literacy thus follows the general performance differences that are structurally inherent in the German school system. With this in mind, the aggregate average of 64.2 percent must be interpreted with caution because, for example, *Hauptschule Typ A* students answered only 43.3 percent of the questions correctly.

Turning to individual questions, the numeracy question (B1) yielded the highest number of correct responses across the board, which is not surprising given that high school students should be familiar with basic mathematical skills. However, it is striking that the only slightly more difficult question on compound interest (B2) exhibited a relatively sharp drop in correct responses. This indicates that high school students find it difficult to apply the mathematical concepts they know to different knowledge domains. The lowest scores were found for question B4, which addresses the time value of money. In particular, students from *Hauptschule Typ A* scored significantly lower than the guessing probability, meaning that this concept threw them off track when considering intertemporal choices. Regarding the two questions related to inflation, (B3) and (B5), it is interesting to note that the students scored higher on B5, which is phrased in an arguably more intuitive way, omitting the technical term "inflation." This can be interpreted as students having a basic understanding of the economic principle of price inflation without necessarily knowing the technical definition. This discrepancy was more pronounced for the two *Hauptschule* tracks, which is intuitive given the generally lower learning abilities in terms of factual knowledge of students pursuing *Hauptschule* degrees. These findings, taken together, lead to the conclusion that the students in our sample lacked a basic understanding of the long-term consequences of saving and investing.

With respect to the eight sophisticated questions, the students in our sample answered 53.6 percent of the questions correctly, which is (as expected) a lower level than for basic financial literacy. However, this percentage was significantly greater than the average guessing probability (35.4 percent) for this measure ( $p < .01$ ). Only 22 out of 1,416 students were unable to answer a single question correctly. The findings in terms of the rank-ordering of high school tracks were also found for the sophisticated financial literacy measure.

Turning to the individual questions, the two items with the worst results relative to their guessing probabilities were S3 and S6. While S3 is arguably a difficult question on the linkage between interest rate changes and bond prices, the results for S6 are more surprising. Essentially, the students performed statistically worse than if they had guessed, which holds for all high school tracks. The students believed

Table 1. Variable specifications and summary statistics.

	ALL		HSA		HSB		RS		GYM	
	(SD)		(SD)		(SD)		(SD)		(SD)	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Sample sizes										
Number of schools	25		8		–		8		9	
Number of classes	68		12		9		20		27	
Number of students	1,416		132		156		472		656	
Independent variables										
MALE	.49		.58		.65		.50		.42	
YOUNG	.07		.06		.01		.04		.11	
INTEGRATED	.81		.65		.53		.81		.92	
Gender. Dummy variable (1 = male, 0 = female)										
Being younger than average. Dummy variable (1 = 15 or younger, 0 = 16 or older)										
Level of integration. Dummy variable (1 = born in Germany and German spoken with parents, 0 = otherwise)										
ONLY_CHILD	.10		.07		.05		.10		.12	
HOUSEHOLD_BOTH_PARENTS	.71		.61		.66		.68		.76	
HOUSEHOLD_INCOME	.35		.09		.14		.31		.47	
Parents' income as proxied by housing situation (owning vs. renting) and occupational status (high-paying job vs. low-paying job). Dummy variable (1 = high, 0 = low)										
JOB	.48		.57		.54		.51		.44	
MEMBER_ORGANIZATION	.62		.29		.43		.61		.73	
IQ_COMPLEX	2.83	(1.08)	2.86	(1.11)	2.85	(1.18)	2.76	(1.09)	2.88	(1.03)
IQ_FUNCTION	3.27	(1.07)	2.89	(1.00)	3.20	(1.11)	3.19	(1.07)	3.42	(1.05)
GRADE_GERMAN	4.24	(0.83)	3.83	(0.75)	4.03	(0.72)	4.08	(0.79)	4.47	(0.84)
GRADE_MATH	4.17	(1.06)	3.90	(0.95)	3.96	(0.80)	3.92	(1.05)	4.44	(1.07)
GRADE_FOREIGN	4.25	(0.96)	3.84	(0.89)	3.83	(0.99)	4.09	(0.93)	4.54	(0.90)
Grade in first foreign language from last report card. 6 categories (1 = fail, 6 = excellent)										

Note: Mean (M) and standard deviation (SD) by high school track (ALL = All, HSA = Hauptschule Typ A, HSB = Hauptschule Typ B, RS = Realschule, GYM = Gymnasium). HSA and HSB are different degrees offered by the same high school type (Hauptschule), which is why the number of schools is listed only once.



**Table 2.** Aggregate and question-level summary statistics for financial literacy.

	GP (%)	ALL (%)	HSA (%)	HSB (%)	RS (%)	GYM (%)
Basic financial literacy	33.3	64.2***	43.3***	61.3***	58.8***	72.9***
B1 Numeracy	33.3	84.3***	65.9***	80.8***	82.0***	90.5***
B2 Compound interest	33.3	55.9***	40.2*	51.3***	47.5***	66.3***
B3 Inflation	33.3	64.8***	35.6	57.7***	57.0***	77.9***
B4 Time value of money	33.3	39.8***	20.5***	42.3**	36.4	45.6***
B5 Inflation/Money illusion	33.3	75.9***	54.5***	74.4***	71.0***	84.1***
Sophisticated financial literacy	35.4	53.6***	39.1**	45.8***	48.8***	61.8***
S1 Stock market functioning	25.0	52.0***	34.8**	50.0***	47.5***	59.3***
S2 Knowledge of mutual funds	25.0	49.4***	40.2***	39.1***	47.5***	55.2***
S3 Interest rate/Bond prices link	33.3	32.0	37.1	30.1	29.0*	33.5
S4 Safer: Company stock/Mutual fund	50.0	72.8***	50.8	66.7***	66.1***	83.5***
S5 Riskier: Stocks/Bonds	50.0	79.4***	62.1***	73.7***	73.9***	88.1***
S6 Long period returns	33.3	25.0***	20.5***	26.3*	23.1***	27.0***
S7 Highest fluctuation/Volatility	33.3	66.0***	37.9	39.7*	59.3***	82.6***
S8 Risk diversification	33.3	52.0***	29.5	40.4*	44.3***	64.9***

Note: Mean PCS by high school track (ALL = All, HSA = *Hauptschule Typ A*, HSB = *Hauptschule Typ B*, RS = *Realschule*, GYM = *Gymnasium*). Column GP lists the guessing probabilities. Asterisks indicate significance levels from two-sided *t*-tests (aggregate) and binomial probability tests (question-level) of the mean PCS against the guessing probability.

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$

that stocks do not have higher long-term returns compared to bonds or savings accounts. This may be related to this particular cohort of participants as they grew up during the 2000s, experiencing negative events in the stock market, ranging from the burst of the dot-com bubble at the beginning to the global financial crisis at the end of the decade. Students correctly perceived stocks as a high-risk investment (S5) but failed to realize their corresponding larger long-term return potential. That students were aware of the disadvantages of stocks without seeing their long-term benefits is a cause for concern as this may preclude them from investing in the stock market and thereby neglect what is still considered to be a building block of sufficient retirement wealth (Van Rooij, Lusardi, and Alessie 2011). The risk of students refraining from stock investments is aggravated by the fact that nearly half of them did not know what the functioning of a stock market is (S1). The final theme covered by the sophisticated questions is the one of risk diversification (S4 and S8). Relative to their guessing probabilities, both questions showed only medium levels of correct answers, with students from *Hauptschule Typ A* not being able to perform significantly better than they would have if they had randomly guessed. This finding also is problematic because it indicates that those students who are willing to invest in the stock market may not take advantage of its beneficial diversification effects and may thus assume unnecessarily large investment risks.

Particularly interesting is the comparison of our students' performance to the results from Bucher-Koenen and Lusardi (2011). Although Bucher-Koenen and Lusardi employed only three of the financial literacy questions (B1, B3, and S4), they were administered to a sample that was representative of the German population and, as such, featured a subject pool that shared a highly comparable background with the subject pool of our study in terms of educational, economic, and political institutions. Interestingly, the high school students in our sample achieved the same average share of correct answers over the three questions as the adult German population (74.0 percent). However, unpacking the aggregated performance reveals noticeable differences between questions. Although the students' higher share of correct answers on the numeracy question is not surprising given their frequent exposure to mathematics in school (84 percent vs. 82 percent), their higher performance with respect to the knowledge of risk and diversification is unexpected (73 percent vs. 62 percent). Apparently, German adults did not benefit

**Table 3.** Factors related to basic financial literacy.

	ALL <i>b</i> (SE)	HSA <i>b</i> (SE)	HSB <i>b</i> (SE)	RS <i>b</i> (SE)	GYM <i>b</i> (SE)
Independent variables					
MALE	0.070 (0.015)***	− 0.018 (0.035)	0.118 (0.052)**	0.061 (0.023)***	0.077 (0.020)***
YOUNG	0.047 (0.016)***	− 0.002 (0.050)	− 0.059 (0.080)	0.084 (0.053)	0.046 (0.013)***
INTEGRATED	0.046 (0.017)***	− 0.012 (0.052)	0.043 (0.067)	0.075 (0.027)***	0.043 (0.021)**
ONLY_CHILD	0.001 (0.024)	− 0.109 (0.073)	0.109 (0.057)*	0.010 (0.052)	0.003 (0.034)
HOUSEHOLD_BOTH_PARENTS	− 0.009 (0.012)	0.051 (0.066)	− 0.041 (0.059)	− 0.031 (0.024)	− 0.001 (0.011)
HOUSEHOLD_INCOME	0.002 (0.020)	0.067 (0.038)	− 0.062 (0.125)	0.064 (0.035)*	− 0.029 (0.022)
JOB	− 0.011 (0.013)	0.053 (0.058)	0.031 (0.048)	− 0.001 (0.019)	− 0.025 (0.017)
MEMBER_ORGANIZATION	0.028 (0.019)	− 0.031 (0.036)	− 0.005 (0.038)	0.012 (0.040)	0.048 (0.024)*
IQ_COMPLEX	0.010 (0.008)	− 0.008 (0.027)	− 0.009 (0.018)	0.022 (0.017)	0.012 (0.007)*
IQ_FUNCTION	0.014 (0.008)*	0.034 (0.032)	0.029 (0.033)	0.007 (0.019)	0.010 (0.007)
GRADE_GERMAN	− 0.006 (0.011)	− 0.040 (0.034)	0.022 (0.039)	− 0.012 (0.022)	− 0.003 (0.012)
GRADE_MATH	0.042 (0.006)***	0.030 (0.033)	0.079 (0.024)***	0.035 (0.012)***	0.043 (0.009)***
GRADE_FOREIGN	0.010 (0.009)	− 0.001 (0.025)	− 0.003 (0.026)	0.028 (0.017)*	0.005 (0.010)
HIGH_SCHOOL_TRACK_HSB	0.179 (0.042)***				
HIGH_SCHOOL_TRACK_RS	0.159 (0.038)***				
HIGH_SCHOOL_TRACK_GYM	0.257 (0.040)***				
Variance components					
Variance of school (Level 3)	0.000094	0.003221	0.000000	0.000000	0.000247
<i>n</i>	25	8	8	8	9
Variance of class (Level 2)	0.000000	0.000000	0.000000	0.000000	0.000000
<i>n</i>	68	12	9	20	27
Variance of residual (Level 1)	0.045194	0.045369	0.053111	0.047506	0.038341
<i>n</i>	1,118	93	104	358	563
Model fit					
Log-pseudolikelihood	143.64	9.56	5.07	37.41	117.70

Note: Coefficients (*b*) and robust standard errors (SE) from three-level mixed linear models with school and class random intercepts, estimated by high school track (ALL = All, HSA = *Hauptschule Typ A*, HSB = *Hauptschule Typ B*, RS = *Realschule*, GYM = *Gymnasium*).

\**p* < .10; \*\**p* < .05; \*\*\**p* < .01

from increased decision-making opportunities and related financial experience with respect to numeracy and the concepts of risk and diversification. However, German adults were better informed about the impact of inflation (78 percent) than the students in our sample (65 percent).

### Factors related to financial literacy

Tables 3 and 4 list results from linear models relating the set of general knowledge factors to financial literacy, for the full sample (ALL) and split by high school track (HSA, HSB, RS, GYM). The dependent variables are the respective PCS from the financial literacy measures. To account for the data structure that is commonly found in educational settings, with students nested in classes and classes nested in schools, we employed a three-level mixed linear model with school and class random intercepts (e.g., Woolley et al. 2013).

For basic financial literacy (table 3) and the ALL model, being male was associated with a 7-percentage-point higher literacy level. Students with a low level of integration exhibited significantly lower scores, with approximately half the effect size of gender. This finding is in line with the results obtained in other studies. For instance, in the 2012 PISA wave, the proportion of low achievers in mathematics was almost three times as large for first-generation migrant children than for non-migrant children in Germany, a discrepancy that can be attributed partly to language difficulties (European Commission 2013). Considering that basic financial literacy is closely related to mathematical principles, it is not surprising that the grade in mathematics had a significant impact. Per one grade unit in mathematics, the literacy level was higher by approximately four percentage points. The largest effect sizes were exhibited by the different high school track dummies, which is in line with the findings on mean differences and their origins, as discussed previously. On the track level, some findings are particularly striking. For *Hauptschule Typ B*, being an only child had a large positive effect size of approximately 11 percentage points. We conjecture that this could be driven by parents fostering their only child in this special track



**Table 4.** Factors related to sophisticated financial literacy.

	ALL <i>b</i> (SE)	HSA <i>b</i> (SE)	HSB <i>b</i> (SE)	RS <i>b</i> (SE)	GYM <i>b</i> (SE)
Independent variables					
MALE	0.061 (0.015)***	0.010 (0.077)	0.083 (0.057)	0.077 (0.027)***	0.053 (0.019)***
YOUNG	0.049 (0.014)***	0.014 (0.097)	0.121 (0.091)	0.018 (0.041)	0.060 (0.014)***
INTEGRATED	0.043 (0.013)***	0.043 (0.058)	0.067 (0.026)***	0.037 (0.012)***	0.026 (0.030)
ONLY_CHILD	−0.009 (0.019)	−0.025 (0.086)	0.056 (0.116)	0.024 (0.028)	−0.031 (0.023)
HOUSEHOLD_BOTH_PARENTS	0.006 (0.013)	0.054 (0.042)	−0.005 (0.032)	−0.025 (0.014)*	0.016 (0.021)
HOUSEHOLD_INCOME	−0.016 (0.013)	0.058 (0.085)	−0.008 (0.051)	0.005 (0.022)	−0.031 (0.016)**
JOB	−0.025 (0.011)**	−0.003 (0.028)	−0.071 (0.029)**	−0.011 (0.014)	−0.025 (0.019)
MEMBER_ORGANIZATION	0.013 (0.010)	0.019 (0.024)	−0.030 (0.039)	0.004 (0.021)	0.019 (0.006)***
IQ_COMPLEX	0.024 (0.005)***	−0.005 (0.010)	0.036 (0.014)***	0.019 (0.013)	0.028 (0.006)***
IQ_FUNCTION	0.006 (0.004)	0.007 (0.026)	−0.006 (0.013)	0.013 (0.006)**	0.001 (0.004)
GRADE_GERMAN	0.006 (0.011)	−0.016 (0.018)	−0.023 (0.039)	0.019 (0.012)	0.006 (0.016)
GRADE_MATH	0.013 (0.008)	0.020 (0.025)	0.034 (0.034)	0.001 (0.010)	0.019 (0.013)
GRADE_FOREIGN	0.022 (0.007)***	0.015 (0.014)	0.018 (0.011)*	0.025 (0.011)**	0.021 (0.011)**
HIGH_SCHOOL_TRACK_HSB	0.072 (0.021)***				
HIGH_SCHOOL_TRACK_RS	0.103 (0.024)***				
HIGH_SCHOOL_TRACK_GYM	0.197 (0.020)***				
Variance components					
Variance of school (Level 3)	0.000585	0.000000	0.000837	0.001148	0.000289
<i>n</i>	25	8	8	8	9
Variance of class (Level 2)	0.000274	0.000000	0.000000	0.001614	0.000000
<i>n</i>	68	12	9	20	27
Variance of residual (Level 1)	0.029701	0.032306	0.026835	0.032387	0.026167
<i>n</i>	1,118	93	104	358	563
Model fit					
Log-pseudolikelihood	367.93	27.65	39.23	97.27	224.43

Note: Coefficients (*b*) and robust standard errors (SE) from three-level mixed linear models with school and class random intercepts, estimated by high school track (ALL = All, HSA = *Hauptschule Typ A*, HSB = *Hauptschule Typ B*, RS = *Realschule*, GYM = *Gymnasium*).

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$

to allow him or her to obtain the degree equivalent to the *Realschule*. For the *Realschule*, level of integration and household income both had a significant impact. The already discussed mathematical affinity came into play here as well as for the *Gymnasium*. For the *Gymnasium*, being male, being younger than your peers, a higher level of integration, and being a member in an organization were significant factors positively related to financial literacy. Overall, female students, students with a lower level of integration, and students with lower mathematical skills are identified as having substantially lower basic financial literacy levels.

Turning to the sophisticated financial literacy measure (table 4), being male, younger than average, and integrated were significantly and positively related to the financial literacy levels, as they were for the basic financial literacy measure. Having a job was a hampering factor, possibly due to consuming time that would otherwise be available for learning. Interestingly, compared to the basic financial literacy measure, the grade in mathematics was no longer significant, but the grade in the first foreign language was significant as was the student's interest in complex problems. Recall that the basic financial literacy questions explicitly address numeracy, whereas sophisticated financial literacy requires students to more strongly combine various sorts of declarative knowledge in a more contextual frame. We conjecture that this process requires a different type of procedural knowledge similar to acquiring foreign language skills (Shuell 1986), making the grade in the first foreign language a significant factor related to sophisticated financial literacy.

## Conclusion

We surveyed tenth-grade students in Germany and examined their financial literacy levels and related factors. Overall, our results indicate that German high school students share the general lack of financial knowledge that has been found across various samples. On average, approximately two-thirds of the basic

financial literacy questions were answered correctly, and even fewer of the sophisticated financial literacy questions were answered correctly. As expected, this number varied as a function of the high school type, with students from the *Hauptschule* exhibiting substantially lower scores than students from the *Gymnasium*. Comparing the students' performance on a subset of literacy questions to a sample of German adults revealed that overall, the literacy levels were similar yet comprised differently. Interestingly, adults do not seem to easily obtain knowledge through financial experience, emphasizing the potential for financial literacy programs across all life stages.

We also find that literacy scores vary as a function of sociodemographic characteristics. Gender and level of integration are significantly related factors across both financial literacy measures, with female or less integrated students exhibiting lower knowledge levels. Additionally, lower mathematical skills are related to lower levels of basic financial literacy, while worse general cognitive aptitude and foreign language skills are related to lower levels of sophisticated financial literacy. These results are in line with previous studies using adult samples, suggesting that these demographic characteristics are systematically related to literacy levels, independent of institutional settings or experience. Given the importance of financial literacy for an individual's life, these subpopulations should receive particular attention in targeted financial literacy programs.

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