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Working Paper

Understanding the Gender Gap in Economic Literacy – Evidence from Germany

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Lucy Haag, Luis Oberrauch, Taiga Brahm, and Martin Biewen

Abstract

Economic literacy has far-reaching consequences on savings and investments and ultimately affects individual financial well-being. Several studies report a gender difference in economic literacy in favor of males, disadvantaging women and posing a threat to gender equality. However, there is limited evidence addressing the factors underlying the gender gap. Using a representative sample of German high school students (N=1,958), we investigate gender differences in students' economic literacy. Additionally, we examine potential explanatory factors for the gap that have been reported in previous studies focusing more narrowly on financial literacy and personal finance. Results confirm a substantial gender gap in economic literacy favoring boys (0.25 SD). Regression models and Oaxaca-Blinder decomposition analyses reveal math ability and interest in economics as important drivers for the gender gap. Self-efficacy and risk aversion are further factors accounting for the gap while most socialization variables appear to have little relevance. Including effort as a control variable increases the gap, suggesting that the gap may have been underestimated in previous studies that did not consider this factor. Our study provides important implications for policy interventions to mitigate the gender gap in economic literacy.

JEL Codes: A20 (Economic Education and Teaching of Economics), A21 (Pre-college)

Keywords: economic literacy; gender gap; high school economics; Oaxaca- Blinder decomposition

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1. Introduction

Economic literacy has become increasingly relevant in today's complex and globalized economy. Sound economic and financial competencies are essential for individuals to make informed economic decisions and participate in the market economy. Research focusing on a narrower subset of economic literacy (i.e., financial literacy) has shown that test scores predict various financial behaviors, such as savings and investments (Bucher-Koenen et al. 2017; Lusardi and Mitchell 2011). Challenges such as demographic change and the complex financial products highlight the need for profound competencies (Tinghög et al. 2021). Thus, economic literacy is relevant both for the individual's financial prosperity as well as societal welfare and social justice.

One recurring result in previous studies is the gender gap in economic (and financial) literacy, i.e., women often score lower on economic and financial tests (Klapper and Lusardi 2020), posing a threat to gender equality. Gender differences in economic competence (in Germany) may already emerge during the teenage years and widen between grades 7 and 10 (see Oberrauch and Kaiser 2020 for Germany). As these competencies might influence important economic life decisions of young people, for example, regarding career and study choices, (future) investments and savings, exploring the roots of the gender gap is highly relevant and could be beneficial in counteracting the gap. However, evidence regarding explanations of this gap in economic literacy remains scarce as previous literature mainly focuses on the financial subdomain (i.e., a narrower subset of economic literacy) (Driva, Luehrmann, and Winter 2016; Tinghög et al. 2021; Bucher-Koenen et al. 2021; Fonseca et al. 2012).

This study has two main objectives. First, it investigates the gender difference in economic literacy of German secondary school students before they must make important career decisions. Second, potential explanatory factors for the gap are examined.

Previous research focusing on financial literacy suggests that computational ability, effort, socialization effects and confidence, among others, are potential drivers of the gender gap (Bucher-Koenen et al. 2017; Driva, Luehrmann, and Winter 2016). A study on economic literacy by Oberrauch and Brahm (2023) with a similar sample reports gender differences for 10th graders. In this study, math ability and interest are seen as mediators and potential explanations for the gender gap. We go beyond previous research by adding multiple other variables and using an internationally recognized test instrument.

Generally, most studies focus only on one factor and large parts of the gap remain unexplained (Yao, Rehr, and Regan 2022). In light of the large amount of existing evidence, we consider the gender gap in economic literacy as given. This paper aims to explain the gender differences in economic literacy by jointly investigating previously examined explanatory factors. Thus, our (preregistered) hypothesis is as follows:

There are several factors that partially account for the gender gap:

a. computational ability (Bottazzi and Lusardi 2021; Brückner, Förster, Zlatkin-Troitschanskaia, Happ, et al. 2015)
b. effort (Oberrauch and Brahm 2023)
c. interest in economics (Lührmann, Serra-Garcia, and Winter 2015; Förster and Happ 2019)
d. socialization effects (e.g., stereotypes, financial discussions with parents) (Driva, Luehrmann, and Winter 2016; Agnew and Cameron-Agnew 2015)
e. confidence (Aristei and Gallo 2022; Davies, Mangan, and Telhaj 2005; Bucher-Koenen et al. 2021)
f. experience (Rudeloff, Brahm, and Pumptow 2019; Shim et al. 2010)

g. attitudes towards economic topics (Agnew and Cameron-Agnew 2015; Oberrauch, Kaiser, and Seeber 2023)
h. and economic preferences (esp. risk preference) (Le Fur and Outreville 2022; Filipiak and Walle 2015).

To test these hypotheses, we conducted a survey with a representative sample (N=1,958) of secondary school students in Southwest Germany. The questionnaire covered items on economic literacy through a competence test adapted to the German context (TEC (Oberrauch, Kaiser, and Seeber 2023)) and an internationally used test (TEL (Walstad, Rebeck, and Butters 2013)). Furthermore, it included the mentioned explanatory factors for the gender gap. We applied descriptive and multivariate analyses, as well as Oaxaca-Blinder decomposition procedures to quantify the explanatory power of demographic, cognitive and attitudinal factors explaining the gender gap.

Our findings confirm the gender gap in favor of boys with a performance difference of approximately 0.25 standard deviation units (SD). Additionally, we find significant gender differences regarding the explanatory factors, showing that boys score higher on the math test, are more interested in economics, more risk-tolerant, have higher self-efficacy and exert less effort during the test. Further analyses reveal math ability and interest as the most important drivers of the gender gap. Test-taking effort and risk aversion are associated with the gender gap, while beliefs in their own capabilities (i.e., self-efficacy) appear to be less relevant. Several socialization variables that have been found relevant in previous studies do not account for the gender gap in this study, including stereotypes (Driva, Luehrmann, and Winter 2016) and the age of the first financial discussion with the parents (Agnew and Cameron-Agnew 2015).

Our study adds to previous research on explanatory factors for the gender gap. To the best of our knowledge, this is the first study to investigate the effects of multiple

explanatory factors from different areas (preferences, cognitive, affective and socialization factors) simultaneously. Accounting for multiple explanatory factors is important to rule out spurious relationships due to omitted variables. Additionally, the two tests allow us to draw comparisons with national and international studies. Unlike most other studies, we use data from a relatively young target group. Policy implications can be derived to improve economic literacy and reduce gender differences among the young.

The remainder of the paper is structured as follows: First, section 2 presents the theoretical background. Section 3 explains the sampling process and methods for data analysis. Results of the descriptive and multivariate analyses as well as the decomposition are presented in section 4. In section 5, the results are discussed, and a conclusion is drawn.

2. Theoretical Background

a. Research on economic literacy

In today's globalized market with challenges such as inflation, rising interest rates and complex financial products, economic literacy is becoming increasingly important for citizens to make daily life decisions and plan for the future. There are several definitions for economic literacy. In the American context, the Council for Economic Education (CEE) defined *The Voluntary National Content Standards* as a guide for economic education at the high school level. According to these standards, economic literacy enables students to effectively participate in a complex economy and to become "better-informed workers, consumers and producers, savers and investors, and most important, citizens" (Council for Economic Education 2010, ix). These standards are the basis for the Test of Economic Literacy by Walstad et al. (2013), which has been frequently used

in international studies (Förster and Happ 2019; Happ, Kato, and Rüter 2021). In recent decades, financial literacy has been the focus of a considerable body of research (Klapper and Lusardi 2020; Lusardi and Mitchell 2023). As financial literacy can be considered a part of economic literacy, we include research results on both the narrower financial and the broader economic domain in this section.

Economic and financial literacy are found to be low in studies all over the world (Goyal and Kumar 2021). Literacy levels seem to be even lower among certain subgroups, such as women, the older population and people with low education levels (Bucher-Koenen et al. 2017; Lusardi and Mitchell 2011). Research shows that economic and financial literacy impact real-life decision-making and behavior. People with higher literacy levels are more likely to participate in the stock market and plan for retirement (Bucher-Koenen et al. 2021; van Rooij, Lusardi, and Alessie 2011). They tend to have higher savings and better overall financial well-being (Bannier and Schwarz 2018). Considering these practical consequences, the reportedly low economic literacy levels, especially for certain subgroups, are a cause for concern.

Several factors serve as predictors for economic and financial literacy. Similar to other educational outcomes, the socioeconomic status of respondents or parents of respondents as well as migration background are predictive of literacy levels (Kaiser, Oberrauch, and Seeber 2020; Oberrauch and Kaiser 2020). In line with this, learners in higher school tracks (Kaiser, Oberrauch, and Seeber 2020) or with higher math ability (Arnold and Rowaan 2014; Oberrauch and Kaiser 2020) perform better. Students' motivation and interest in economic topics are additional factors predictive of economic literacy (Arnold and Rowaan 2014; Oberrauch and Brahm 2023; Oberrauch and Kaiser 2020). Family financial socialization, e.g. parental role modeling and discussions with parents, is also found to influence financial outcomes such as knowledge, financial

behaviors and financial wellbeing (LeBaron and Kelley 2021). Moreover, several studies show that prior economic education is positively associated with economic knowledge (Brückner, Förster, Zlatkin-Troitschanskaia, and Walstad 2015; Kaiser and Menkhoff 2020).

b. The gender gap in economic literacy

For a number of reasons, women are economically disadvantaged. The gender wage gap, career interruptions due to family planning and lower pension entitlements are some examples that impact women's financial well-being (Arellano, Camara, and Tuesta 2018; Boll and Lagemann 2019). Thus, counteracting the gender gap in economic literacy, increasing especially women's financial planning, participation in financial markets and overall well-being is crucial to increase gender equality.

The gender gap is a frequently reported phenomenon in economic (and financial) literacy. It has been reported both in international studies (Brückner, Förster, Zlatkin-Troitschanskaia, and Walstad 2015; Oberrauch, Kaiser, and Lusardi 2024; Walstad and Rebeck 2002) and in the German context for various age groups (Förster and Happ 2019; Kaiser, Oberrauch, and Seeber 2020). The gap is evident for students before receiving economic education (Oberrauch and Kaiser 2020) as well as afterwards (Oberrauch and Brahm 2023). The PISA financial literacy data for 15-year-olds show mixed results on the gender gap. Across all countries, there are no significant gender differences. However, in a number of countries, test results are higher for males than for females (e.g. Italy, USA, Canada) (Oberrauch, Kaiser, and Lusardi 2024). Generally, the gender gap is less evident in Eastern European and Asian countries (Grohmann et al. 2021; Oberrauch, Kaiser, and Lusardi 2024; Authors under review).

Several explanatory factors have been found to partially account for the gender gap. First, math ability explains parts of the disparity. Several studies show that the gender

gap is larger in questionnaire items requiring computation (Brückner, Förster, Zlatkin-Troitschanskaia, Happ et al. 2015) and that the gap narrows when controlling for math ability (Oberrauch and Brahm 2023; L. Yu et al. 2021). Confidence may be another driver of the gap as women typically exhibit lower levels of (financial) self-efficacy and choose the 'do not know' option more often than men (Bucher-Koenen et al. 2017; Furrebøe and Nyhus 2022). A potentially important determinant of the gender gap in economic literacy are factors related to socialization. There are several aspects of socialization. Both boys and girls tend to be prejudiced about gender roles, attributing higher financial knowledge to males. When accounting for these stereotype beliefs, the gender gap becomes smaller in some studies (Bottazzi and Lusardi 2021; Driva, Luehrmann, and Winter 2016). Children may also be affected by their parents' decisions. Evidence suggests that parents have financial discussions with boys at an earlier age than with girls, partly accounting for the gender gap (Agnew and Cameron-Agnew 2015). A further possible driver of the gender gap is interest as males are often more interested in economic topics (Förster and Happ 2019; Oberrauch and Brahm 2023). A final important factor are risk attitudes, which are typically positively correlated with financial literacy (L. Yu et al. 2021).

However, several studies conclude that large parts of the gender gap in economic and financial literacy remain unexplained when focusing on only one or a small number of explanatory factors. Thus, in this study, we combine findings from previous research and simultaneously investigate the effects of a large number of explanatory factors, with the aim of quantifying their individual explanatory power for the gender gap. To this end, we use a large and representative sample of German high school students. The institutional context of our study will be briefly introduced in the next section.

c. Economic education within the German school system

The significance of economic literacy has been reflected in recent decisions within the German school system, with efforts to strengthen economic education. The German education system has a decentralized structure with each of the 16 federal states being responsible for their education system. While in most federal states economic education is integrated within a combined subject (i.e. with geography, social and/or political science), the federal state of Baden-Württemberg introduced the subject "Economics and Vocational Orientation" as a stand-alone subject in 2016. The educational standards for the subject of economics in Baden-Württemberg specify several learning objectives and competencies to be achieved through economic education. These range from analyzing economic life situations to evaluating economic policies. Individuals should be enabled to articulate their interests and act autonomously and responsibly in the economic domain, considering the individual, societal and systemic perspectives. Additionally, the standards emphasize the practical application of the acquired competencies in real-life situations where individuals act as consumers, income earners and citizens (Kaiser, Oberrauch, and Seeber 2020; Retzmann 2016; Retzmann et al. 2010). The Test of Economic Competence (TEC) is based on these educational standards. In addition to the differences between the states, there are different school types within the German secondary educational system, distinguishing between the highest level, "Gymnasium", an intermediate and base level ("Realschule" and "Werkrealschule") as well as an integrated school type ("Gemeinschaftsschule"). To obtain a comprehensive overview of all students, all four school types are included in this study.

3. Methods and Context

This section describes the study context, data collection process, items and empirical

strategy of the study. The Ethics Committee of the first author's institution reviewed and approved the study procedures and materials.

a. Data collection and sample

The study was conducted in the federal state of Baden-Württemberg in Germany, targeting 10th graders in general schooling, excluding special needs education. Since the curriculum revision in Baden-Württemberg in 2016, economics is taught as a mandatory subject in general schooling from grade 7 or 8 (depending on the school type) one hour per week. Thus, the target group had received at least two school years of economic education when participating in the study.

We conducted a cross-sectional survey with 10th graders in Baden-Württemberg. For the sampling process, we categorized schools into four different school types and three degrees of urbanization (high, medium, low), resulting in 12 strata. Based on this stratification, we employed a two-stage sampling process (see also Oberrauch and Kaiser 2020). First, schools were randomly selected from the total population of schools in Baden-Württemberg. Second, one 10th grade per school was randomly selected. In two rounds, we contacted 534 and 531 schools. The share of schools in each stratum was adjusted to match the stratum's proportional representation within the population. Participation was voluntary both at the school and at the student level. Informed consent has been obtained from both the students and the students' parents. Providing (monetary) incentives is not possible in this school context. Thus, the data/sample is restricted by limited participation at the school and student level. The final sample comprises 92 schools (116 classes) and 2104 students (Table A1 in the appendix shows the sample distribution across strata). During a 90-minute school lesson supervised by their teacher, students completed the online questionnaire. Data were collected at the beginning of the school year, in the period from 16th October 2023 until 24th November 2023.

b. Test instruments and items

The questionnaire comprised two performance tests regarding economic literacy. First, we used the short version of the Test of Economic Competence (TEC) measuring the cognitive component of economic competence (Oberrauch, Kaiser, and Seeber 2023). This version consisted of twelve multiple-choice questions and was specifically developed for secondary school students in Baden-Württemberg based on the current curriculum (Kaiser, Oberrauch, and Seeber 2020). It is based on a conceptual framework that identifies relevant life situations for the individuals as consumers, income earners and economic citizens (Kaiser, Oberrauch, and Seeber 2020; Retzmann et al. 2010). The test takes into account different perspectives as students should be able to consider the individual perspective, a social perspective and a systemic perspective in order to decide autonomously and responsibly in economic life situations (Kaiser, Oberrauch, and Seeber 2020; Retzmann et al. 2010). In terms of content, the items cover, for example, supply and demand, markets and prices, inflation and interest (Oberrauch, Kaiser, and Seeber 2023). Furthermore, we included a short scale of the Test of Economic Literacy (TEL) (Walstad, Rebeck, and Butters 2013) in a translated version, validated for the German context (Happ, Zlatkin-Troitschanskaia, and Förster 2018)[1]. The TEL was developed for students in the United States. Its contents are based on the "Voluntary National Content Standard in Economics", including topics such as decision-making, competition, supply and demand, among several other content areas. The TEL items are classified by three different cognitive levels: knowledge, comprehension and application (Walstad, Rebeck, and Butters 2013). None of the items require computations. Both tests have been

[1] We thank the colleagues from the University of Mainz for the opportunity to use items from the German version of the TEL ("WiwiKom-Test"). This test was funded by the Ministry of Education and Research with the funding grant number 01PK11013A. Copyright © 2014 JGU Mainz, FB 03, Wirtschaftspädagogik I, Mainz. All rights reserved. For more information visit http://www.wipaed.uni-mainz.de/ls/1085_ENG_HTML.php.

previously validated and applied in research (Oberrauch, Kaiser, and Seeber 2023; Walstad, Rebeck, and Butters 2013).

In addition to the instruments described above, our questionnaire included the Berlin Numeracy Test (Cokely et al. 2012), three additional math items (Schwartz et al. 1997) to test students' math ability, as well as four Raven matrices testing cognitive abilities (Raven 1936). In order to analyze explanations for the gender gap, we added a number of potential explanatory factors based on previous research (Authors under review). These factors include general confidence and self-efficacy (Beierlein et al. 2012; Robins, Hendin, and Trzesniewski 2001), comprising items like "I can rely on my skills in difficult situations." (Likert scale). We also analyze socialization factors, including stereotypical thinking. Based on Driva et al. (2016), we employ statements that students rate on a Likert scale (e.g., "Men are usually more interested in finances than women"). In addition, we assess socialization through parents, in particular, discussions with parents about economics and finances (Agnew and Cameron-Agnew 2015) and how often students discuss money matters with their parents (Bottazzi and Lusardi 2021). We also ask about previous practical experiences (e.g., side jobs, ownership of a bank account, …) and whether the students' social environment supports their interest in economics. These items are based on the Theory of Planned Behavior (TPB, Ajzen 1991), suggesting that expectations and attitudes of other people can influence interest and behavior. We also cover students' interest in economics through ten items also used in Oberrauch and Seeber (2022) (e.g., "I am interested in economics", "I follow economic news"). Finally, we assess attitudes regarding competition (e.g., "Life would be very boring without competition") (Fülöp, Berkics, and Roland-Lévy 2008; Oberrauch and Seeber 2022).

Since this was a low-stakes test without incentives for the students, (missing) effort might be one problem restraining the validity of the test. Based on students'

response times, we, therefore, calculate the response time effort (RTE) for the TEC and the TEL, serving as indicators for effort in test taking (Wise and Kong 2005). Following Wise and Ma (2012), we identify rapid guessing behavior by applying a normative time threshold of 10 % of the mean response time per item. For each individual, we calculate the RTE for the TEC and the TEL separately with the final values displaying the response behavior/rapid guessing behavior.

c. Scaling and scoring

Scaling. In large-scale educational assessments, researchers measure latent traits such as student proficiency through discrete item responses. They typically employ a psychometric measurement framework based on Item Response Theory (IRT) to estimate these latent (i.e. unobserved) proficiency scores from manifest (i.e., observed) item responses. The IRT models commonly used in these assessments assume the conditions of local independence and unidimensionality. Local independence indicates that the probability of a correct response to an item depends only on the student's latent trait and not on their responses to other items. Unidimensionality refers to the assumption that the responses are influenced by a single latent trait.

For both measures, these requirements have been verified, allowing for a reliable estimation of item parameters and proficiency scores for each item set. As in international large-scale assessments such as PISA and TIMMS, we estimate item characteristics and proficiency scores using a two-parameter logistic IRT model (2PL) (Birnbaum 1968). The model defines a probability for solving an item correctly as a function of item

difficulty, person ability, and discriminatory power of an item[2], graphically represented by Item Characteristic Curves (ICC) (Figure 1).

The Item Response Theory (IRT) model enables researchers to investigate key item characteristics. The discrimination parameter, which represents the slope of the Item Characteristic Curve (ICC), quantifies how effectively an item discriminates between students with varying proficiency levels. The difficulty parameter, represented by the location of the ICC, quantifies the latent trait level required to solve an item correctly. Our results, presented in Appendix Table A2, demonstrate that the TEC items effectively discriminate, with most point estimates exceeding 1.[3] The estimated difficulty parameters show that the TEC items address a wide range of ability levels. The analysis of the TEL items reveals that items 1 and 9 lack discriminatory power; therefore, we exclude these items from subsequent analyses.

[insert Figure 1 here]

Differential Item Functioning. Item Response Theory (IRT) models operate under the assumption of measurement invariance, which posits that estimated parameters are consistent regardless of which subgroup the examinees come from. If measurement variance occurs, the items may be capturing an additional construct, potentially violating the assumption of unidimensionality. To detect item-level bias, researchers commonly rely on methods based on Differential Item Functioning (DIF) (Holland and Wainer 2012; Thissen, Steinberg, and Wainer 1993). An item displays DIF when members of different groups (e.g., men or women) exhibit different probabilities for endorsing an item while

[2] The probability of solving an item correctly is formally given by $P(\mathrm{X}_j = 1 \mid \theta_v, \sigma_i, \alpha_i) = \frac{\exp[\alpha_i(\theta_v - \sigma_i)]}{1+\exp[\alpha_i(\theta_v - \sigma_i)]}$, where θ_v represents the student's proficiency level of person v, σ_i denotes the item's difficulty of an item i, and $\alpha_i$is the item's discrimination parameter.

[3] We follow conventional textbook guidelines according to which values above 1 indicate sound discriminatory power (e.g. Baker 2001)

keeping ability levels **θ** constant. In an IRT context, an item is flagged with DIF when the item analysis reveals different Item Characteristic Curves (ICC) for different subgroups of the test population. We, therefore, tested both scales for DIF across three (dichotomous) demographic characteristics that are typically associated with proficiency in the economic domain: gender (i.e., male or female), socio-economic background approximated by the number of books at home, and the primary language spoken at home (foreign language or German).

We estimate model parameters across two binary categories separately and test for statistical differences. In line with international large-scale assessments (e.g., PISA), we categorize these differences into the well-established ETS scheme (Zwick 2012). This approach combines transformed effect sizes (see Dorans and Holland (1992), for details) and its significance following a $\chi 2$-distribution ($MH\chi 2$ statistic) into a three-stage classification scheme (A, B and C) to assess the severity of DIF. "A" denotes no or negligible DIF, "B" denotes negligible to moderate DIF and "C" indicates moderate to severe DIF. As shown in Appendix Table A3, our analysis reveals that no item of the TEC scale exhibits moderate or severe DIF across all demographic indicators, whereas item 5 of the TEL scale is flagged with DIF in favor of native children. Therefore, we remove item 5 of the TEL scale from further analyses.

Scoring. While various methods provide the possibility to estimate a single point estimate of ability for each respondent [4], they do not fully account for the uncertainty and variability inherent in the measurement process. Consequently, educational assessments such as PISA and TIMMS employ the method of plausible values (PV) (Kaplan and Su

[4] The traditional method is Maximum Likelihood Estimation (MLE), which seeks the θ value that maximizes the likelihood of observing the given response pattern. As MLE estimates can be biased when responses are at the extremes, Warm (1989) introduced Weighted Likelihood Estimation (WLE) which adjusts the likelihood function by assigning greater weights to more informative items

2016; Wu 2005). This approach generates multiple plausible scores for each respondent, with each representing a reasonable estimate of the respondent's true ability by capturing a range of possible abilities a student may possess (Mislevy et al. 1992). Based on the two-parameter logistic IRT model (Birnbaum 1968), we generate ten plausible values for each participant for both outcomes. In the subsequent analyses, the statistic of interest is calculated individually for each plausible value and then averaged.

4. Results

In this section, we first report results of the descriptive analysis, analyzing mean differences between genders. We then conduct a multivariate analysis, identifying variables that affect the gender gap. In the third part, we decompose the gender gap in economic literacy and analyze the underlying factors applying the Oaxaca Blinder decomposition method.

a. Descriptive Analysis

After excluding observations without information about students' gender, our sample includes N=1,958 observations, of which 965 (49.28%) are male and 993 (50.72%) are female. The mean age is 15.46 and about 56% of the participants are in the highest school track ("Gymnasium" (GYM)). In order to compare variables among genders, we calculate means and standard deviations for the variables separately for males and females, displayed in Table 1. Table 1 also shows mean differences, standard errors and p-values, based on a linear regression with gender as the only predictor and cluster-robust standard errors (Oberrauch and Brahm 2023). As many of these variables are shown to be related with economic and financial literacy (e.g., Croson and Gneezy 2009; Fonseca and Lord 2020; Hermansson and Jonsson 2021; Skagerlund et al. 2018), comparing them for girls'

and boys' can give first hints about the relevant variables to explain the gender gap in economic and financial literacy.

Table 1 shows that more boys in the sample grew up as native speakers. The girls' parents tend to have a higher level of education than those of boys. Thus, these variables are included as controls in the multivariate analysis (4b) and the decomposition (4c).

Boys have higher math skills, displayed in better math grades (grades ranging from 1=very good to 6=insufficient in the German school system) and a higher test score (IRT score) in the math test. Girls and boys exhibit significant differences regarding interests and attitudes. We find that girls tend to be more risk averse and show lower self-efficacy. They are less interested in economic topics and the school subject economics and less prone to competition. Approximated by the RTE (see chapter 3b), girls exhibit more effort in taking both economics tests than boys.

As in previous studies, we find significant gender differences in economic literacy in favor of male participants. In both economic tests, boys score higher than girls. While boys answer on average 7.72 out of 12 questions correctly in the TEC, girls give 6.84 correct answers. Correct answers in the TEL were lower for both genders with boys reaching an average of 4.68 out of 12 points and girls scoring 3.99 points. Plausible values for the TEC and TEL represent the students' ability in standard deviation units based on the Rasch model (see section 3c).

In standard deviation units, the gender gap is very similar for both tests, showing that girls' economic literacy is 0.25/0.26 SDs lower than that of boys (the competence distribution for boys and girls is outlined in Figure A1 in the appendix).

[insert Table 1 here: descriptive statistics]

b. Multivariate Analysis

In this section, we present the results of two multiple regression analyses to show which variables are able to partially explain the gender gap. In Tables 2 and 3, the standardized IRT-score for the TEC and TEL serve as dependent variables, respectively, calculated from 10 multiple imputations (plausible values). Non-categorical variables are standardized (mean=0, SD=1). We sequentially add variables to the regression that might affect the gender gap in economic literacy and include cluster robust standard errors. All models include the control variables age, school type, socioeconomic status and cognition. The bivariate correlation table (appendix Table A4) shows that predictor variables are not correlated with $r > 0.41$, indicating that multicollinearity is not a major problem (Alin 2010). We address missing responses in multi-item scales by employing a multiple imputation approach based on a Principal Component Analysis (PCA) model, described in Josse and Husson (2016). This approach leverages the underlying structure of the data to generate plausible values for missing entries, thereby preserving the variability and relationships inherent in the original dataset.

Table 2 shows results for the TEC. Model 1 reveals a significant gender difference with males outperforming females by 0.25 standard deviation units ($p<0.01$). Including effort increases the gender coefficient to 0.3 SD, suggesting that if boys and girls exerted the same effort, the gender gap in economic literacy would be even wider. Adding math ability (model 3), the gender point estimate reduces by almost 0.08 SD, indicating that math ability is a relevant factor in explaining gender differences in economic literacy. In model 4 and 5, we add the variables interest and attitudes towards competition. Both variables are predictors for economic literacy levels, however, only interest reduces the gender coefficient. Adding preferences (model 6) increases the gender estimate, with risk preferences significantly affecting economic literacy. The gender coefficient reduces

when adding socialization variables like stereotypes, students' support in their (family) environment and the age of the first financial discussion (model 7). The last two columns show regression results of the TEC for boys and girls separately. Differences for the genders lie in attitudes towards competition and risk aversion, which seem more predictive for girls' economic literacy.

[insert Table 2 here: multiple regression of TEC]

Table 3 shows results for the TEL. Results are similar to the TEC in several ways. The gender difference in model 1 amount to 0.24 SD, which increases when controlling for effort (model 2). Again, math ability is an important predictor for economic literacy and reduces the gender gap. The same is true for interest in economics and a positive attitude towards competition. When looking at the separate models for males and females, interest, attitudes towards competition and effort are only significant for males, differently from the TEC.

[insert Table 3 here: multiple regression of TEL]

Overall, the multivariate analyses show that gender (female) remains negatively associated with economic literacy across all models for both tests. Controlling for potential explanatory variables reduces the gender gap in the TEC (TEL) from 0.25 (0.24) to 0.19 (0.15). For both tests, holding *effort* constant increases the gap. Math ability and effort are the variables most predictive of economic literacy and affect the gender variable most in both tests. The goodness of fit shows R^2 values from 0.31 (model 1) to 0.37 (model 7) for the TEC and values from 0.13 to 0.15 for the TEL.

c. Oaxaca-Blinder Decomposition

These results of the multivariate analyses are a first partial confirmation of our hypothesis, since several factors account for the gender gap. The sub-hypotheses are further explored

through the Oaxaca-Blinder decomposition, quantifying the amount of the gender gap that is accounted for by specific variables (Blinder 1973; Oaxaca 1973). This method is frequently used to examine group differences and discrimination regarding wages (Stanley and Jarrell 1998) but also in other fields, including financial literacy (Grohmann and Schoofs 2021; Yao, Rehr, and Regan 2022). The decomposition divides the gender gap in outcomes into a part that results from differences in explanatory variables (endowments, i.e., the 'explained' part) and a part that is due to differences in returns to these variables (coefficients, i.e. the 'unexplained' part). The decomposition may also include an interaction effect between endowments and coefficients (threefold decomposition), which is the version we use in our study.

We carry out the threefold Oaxaca-Blinder decomposition using the Stata command *oaxaca* by Jann (2008), based on a linear model[5]. The mean difference in economic literacy between males and females[6] is divided into three parts[7]: endowments (group differences due to differences in the levels of the predictor variables), coefficients, (differences in returns to these variables including differences in the intercept), and an interaction term (accounting for potential interactions between differences in endowments and coefficients), see Jann (2008).

We conduct the decomposition for the TEC and TEL, decomposing the mean differences between girls' and boys' average PVs for both tests. We include the same

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[5] $\theta = X'_i\beta_i + \varepsilon_i,\ E(\varepsilon_i) = 0 \quad i \epsilon (M, F)$, where θ represents proficiency levels based on the TEC and TEL, vector X containing various demographic, cognitive, and attitudinal predictors, and a constant. β denotes the slope and intercept and Ɛ the idiosyncratic error term (Jann 2008).

[6] $R = E(\theta_M) - E(\theta_F)$

[7] $R = E(\theta_M) - E(\theta_F) = E + C + I$, where E denotes endowments, that is group differences due to differences in the levels of the predictor variables and can be described by $E = \{E(X_M) - E(X_F)\}'\beta_F$. C denotes the contribution of coefficients including differences in the intercept: $C = E(X_F)'(\beta_M - \beta_F)$. The interaction term I accounts for interactions between endowments and coefficients: $I = \{E(X_M) - E(X_F)\}'(\beta_M - \beta_F)$ (Jann 2008). The interaction effect represents effects that arise because one group has higher/lower endowments *and* higher lower coefficients for a particular factor.

control variables as in the regression (i.e., age, socioeconomic background, etc., see Table A5 for details). A recurring challenge arises when incorporating categorial variables, as the decomposition estimates are influenced by the base category. Thus, we follow the approach described in Yun (2005) that suggests the use of normalized effects for binary indicators.

For both tests, we estimate two models: The first model includes cognitive and affective explanatory factors (e.g., math ability, interest, self-efficacy); the second model includes socialization factors (e.g. stereotypes, age of first financial discussion). In the appendix, we also include the full models, including all variables (Figure A2, Table A7).

Results of the cognitive and affective factors for the TEC and TEL are displayed in Figure 2 (Table A5). The gender gap in this model amounts to 0.27 SD for both tests. Considering the TEC (TEL), of this gap, 0.0558 SD/20.34% (0.079 SD/30%) can be explained through endowments and 0.1808 SD/65.98% (0.148 SD/55.9%) through coefficients, while the rest is due to interaction effects (Table A5). The error bars in Figure 1 represent 95 % confidence intervals. The endowments display differences between variables that account for the gender gap in economic literacy. The coefficients display differences in the payoffs to variables between the genders, also described as the part of the gap remaining unexplained by differences in variables.

Looking at the endowments first, two variables stand out. First, as suggested by the regression results, effort is a negative confounder and accounts for a large part of the endowments for the TEC, indicating that girls' greater effort reduces the gender gap. Second, boys perform better in the math test, explaining a substantial part of the endowments (30.5% of the overall gap) regarding the TEC and thus the largest part of the gap (numbers for the TEL differ and are reported in Table A5). Furthermore, boys have a higher interest in economics, also accounting for a significant part of the endowments

(8.4 % of the overall difference). Girls in this sample are more risk averse than boys (see Table 1). As risk aversion is positively correlated with economic literacy (see Table 2), this has a positive effect on girls' economic literacy and accounts for a negative share of the gap. The bar representing self-efficacy slightly lies outside the confidence interval for the TEL, indicating that boys' higher self-efficacy explains a part of the gender gap for the TEL, but not the TEC.

Looking at the coefficient effects, girls tend to benefit more from a higher math ability and interest in economics, while making more effort benefits boys. However, all coefficient effects are relatively small in magnitude when compared to the endowment effects, and most of them are statistically insignificant. It is remarkable that the coefficient effect is entirely dominated by the intercept, i.e. the large unexplained part of the gender gap of 0.1808 SD/65.98% (0.148 SD/55.9%) is not related to differences in the returns to the explanatory variables included in this study but to general differences between the genders captured by the residual term (see results for `Constant' in Table A5).

[insert Figure 2 here: Decomposition, cognitive and affective variables]

Figure 3 (Table A6) shows the decomposition results for the socialization factors. Regarding both tests, the explained part only accounts for a small part of the overall gender difference (4% (TEC), 6.9 % (TEL)). The socialization variables, students' social environment and the earlier financial discussions contribute only slightly to the gap; they have relatively high standard errors and thus are subject to uncertainty. Again, the intercept accounts for the largest part of the coefficients.

[insert Figure 3 here: Decomposition, socialization variables]

General models including both cognitive/affective and socialization variables regarding the TEC and TEL are included in the appendix (Figure A2 and Table A7).

Our main hypothesis can be partially confirmed by these results, as a subset of the examined variables account for parts of the gender gap. Our findings show that computational ability and interest in economics are the most relevant observable drivers of the gender gap in economic literacy. Higher effort exerted by girls at test time diminishes the observed gender gap, a mechanism that appears to have been overlooked by previous studies that did not account for this factor. Lower risk aversion also benefits girls, while socialization effects only slightly affect the gender gap. Nevertheless, although we examine a large number and variety of variables, a large part of the gender gap in economic literacy remains unexplained, suggesting the need for further research.

5. Discussion and conclusion

Participation in the complex market economy and financial markets requires sound economic competencies (Lusardi and Mitchell 2014). The gender gap in economic literacy puts women at a disadvantage regarding economic decision-making and overall financial well-being (Hasler and Lusardi 2017). Examining the potential causes of the gap at a relatively young age is crucial to counteract these causes in the future and strengthen females' economic literacy and overall gender equality before many relevant economic decisions must be made.

The size of the gender gap which we find for German secondary students (about 0.25 SD) holds for the German (TEC) as well as the international test instrument (TEL) and is similar to previous studies for Germany (Oberrauch and Brahm 2023; Oberrauch and Kaiser 2020). Compared with meta-evidence, the knowledge gap between girls and boys amounts to about three quarters of a school year when relying on a subset of economic competences (Kaiser and Menkhoff 2020). In a similar vein, the PISA financial literacy assessment indicates a gender gap in financial literacy of 15-year-olds in countries like Italy, USA and Canada, while other countries show no significant gap

(Oberrauch, Kaiser, and Lusardi 2024). As Germany did not participate in the PISA financial literacy test, our results add to previous literature and suggest that financial literacy levels differ between genders in Germany.

Consistent with previous research, girls and boys also exhibit significant differences regarding several variables that have been shown to underly the gap in previous studies. We find that girls tend to be more risk averse (Charness and Gneezy 2012; Dohmen et al. 2011) and show lower self-efficacy (Bucher-Koenen et al. 2021). They are less interested in economic topics (Förster and Happ 2019) and less open to competition (Oberrauch and Seeber 2022). According to their self-assessment, boys are more supported in their economic interest by their social environment than girls. Gender differences in social support are reported in other economic contexts, for example, entrepreneurship (Molino et al. 2018). Approximated by the RTE (see chapter 3b), girls also exert significantly more effort when taking the tests compared to boys (Anaya and Zamarro 2024; Oberrauch and Brahm 2023).

Regression results show that the gender gap remains substantial when including several control variables. Results further indicate that including effort as control variable increases the gender gap. As girls typically invest more effort than boys in (low stakes) tests (Anaya and Zamarro 2024; Oberrauch and Brahm 2023), keeping effort constant increases the gap. Thus, the gender differences may have been underestimated in other studies which did not control for effort. Higher computational ability in favor of boys explains the largest part of the gender gap among the included variables, even though the economic literacy tests do not require explicit computational skills. The gender difference we observe in the math test is clearly in favor of boys with a gender difference of almost 0.5 SD. This difference exceeds the math performance gap in Germany reported in the latest PISA study (about 0.1 SD) (OECD 2023). The higher difference in our study could

be explained by the focus on probability calculation and understanding statistics in the Berlin Numeracy Test, while PISA assesses general mathematical competence. Our findings suggest a substantial gender gap in probability theory and statistics, underscoring the importance of these mathematical subfields with regard to economic literacy although no computation was needed for the economic literacy items. This also shows the general relevance of mathematical skills for economic literacy and suggests that the gap could be even wider if the economic literacy items required calculations. Interest in economics is also shown to benefit boys, reducing the gap when kept constant. With our study, we partly reproduce previous results by Oberrauch and Brahm (2023), demonstrating the relevance of math ability and interest for gender differences in economic literacy. We add to the literature by using the decomposition method, which makes it possible to quantify the explained part of the gender gap. Beyond that, we investigate students' attitudes and socialization variables in addition to the often investigated math ability and interest. Studies considering risk attitudes mostly report that risk aversion is negatively correlated with financial literacy (Hermansson and Jonsson 2021; K.-M. Yu et al. 2015; Le Fur and Outreville 2022). To our knowledge, it has not been investigated in relation to economic literacy yet. Surprisingly, in our data, risk aversion is positively related with economic literacy. Decomposition results reveal that being more risk averse benefits girls' economic literacy, reducing the gender gap. A potential explanation might be that risk preferences are often investigated in connection with investment decisions. As financial investments are not relevant for our young sample yet, risk preferences might have a different impact than for adults.

While other studies show that self-efficacy and/or confidence explain a part of the gender gap (Bucher-Koenen et al. 2017), this can only be confirmed for the Test of Economic Literacy in our study. This is possibly due to measurement error and

differences between measurements. For example, while we quantify confidence through self-reporting, other studies use 'don't know' answers. Alternatively, self-efficacy could be a more relevant factor in the narrower domain of financial literacy and actual investment decisions, and less relevant for economic literacy (Oberrauch and Brahm 2023). While positive attitudes towards competition and economic literacy are correlated (Table A4), these attitudes do not account for the gender gap. In line with this, Oberrauch and Brahm (2023) did not find a connection between attitudes towards money and the gender gap.

It is somewhat surprising that most of the socialization variables do not account for a significant part of the gender gap. Previous studies not only suggest an influence of financial socialization on outcomes like knowledge and behavior, but also show that financial socialization differs for male and female children (LeBaron and Kelley 2021). While studies show that stereotypes (Driva, Luehrmann, and Winter 2016) and the age of the first financial discussion (Agnew and Cameron-Agnew 2015) explain part of the gap, our decomposition does not suggest an effect of the stereotype index on the gender gap. An earlier age of the first financial discussion is positively correlated with economic literacy (Table A4) but does not account for the gender gap. This is in line with findings by Yao et al. (2022) who state that financial education at school and financial experiences are more important in shaping the gender gap than family socialization. However, especially for this sample of rather young students, we would have expected family socialization to play a more important role (Gudmunson and Danes 2011). This underscores the difficulty of quantifying the effect socialization has on gender differences.

Limitations. There are several limitations to this study. First, due to the research design we identify relationships between the variables but cannot establish causal links.

Furthermore, the variables (e.g., economic literacy, confidence, experiences, …) may exhibit reverse causation. For example, we cannot assess whether economic literacy scores build on confidence or whether higher economic literacy leads to higher confidence levels (or both). Experimental studies could shed light on causal relationships although a convincing causal research design remains challenging.

Second, as there are no consequences for bad test performance (since our study consisted of low stakes tests), this can affect students' motivation and lead to missing values. We accounted for this by including the response time effort (RTE) in the analyses. Nevertheless, a large part of the gender gap remains unexplained. Some variables that have been shown to explain parts of the gap in other studies (e.g. socialization) do not play a significant role in our analysis. This could be due to differences in measurement. As previous studies have shown, females are more uncertain in economic and financial literacy tests and choose the 'do not know' option more frequently. As we do not offer this option, we might provoke guessing behavior and underestimate uncertainty. Another explanation is possible multicollinearity, which can occur through including many independent variables. However, as we showed earlier, multicollinearity does not seem to be a major problem in our study. It is also the case that the factors that are statistically insignificant in our study remain statistically insignificant when potentially collinear variables are removed from the analysis.

It was our aim to provide a comprehensive overview of previously found explanatory factors. However, some factors, in particular socialization, are difficult to measure. Including several proxy variables (discussion with parents, stereotypes etc.) does not account for the gap in this sample. Yet, literature suggests that there is a connection between gender stereotypes, self-concepts and gender differences in interests and educational and vocational outcomes, for example, regarding STEM subjects

(Ambady et al. 2001; Ertl, Luttenberger, and Paechter 2017; Gunderson et al. 2012). Alternative ways to quantify socialization processes or a more qualitative approach may be an alternative option to investigate socialization processes relating to economic literacy in future research. Furthermore, we do not consider test or item format as a potential driver of the gender gap. Possibly, females are disadvantaged through the multiple choice formats used in our survey. However, evidence on this is inconclusive (Siegfried and Wuttke 2019). Through investigating differential item functioning, we exclude the possibility that the gender difference stems from individual items.

Implications. From an educational policy perspective, reducing the gender gap is an important task. The far-reaching consequences of economic literacy affecting individual decisions, personal finances and general prosperity reinforce the relevance of exploring the causes of the gender gap. As the gender gap already exists at a young age, approaching this issue at the secondary school level in general schooling is reasonable in order to reach students before they make important career and study choices and take decisions about future investments. Evidence suggests positive effects of education interventions in the domain of financial literacy on knowledge and behavior (Kaiser et al. 2022). Based on the results of our study, three major starting points for interventions can be identified: a) computational skills, b) students' interest in economics and c) self-efficacy. Since fostering students' computational skills would fall outside the realm of economics education, we will focus on students' interest and self-efficacy and sketch potential ideas for inside and outside the classroom. Within school-based economics education, it is worthwhile to reflect upon the examples used in textbooks and provide examples that are relevant either for both genders or that explicitly address female students as their interest in the subject is lower. Concerning self-efficacy, it was found in other subjects that role play simulations can foster self-efficacy (Duchatelet et al. 2021).

Furthermore, vicarious experience, i.e. watching a peer succeed in financial tasks, could boost students' self-efficacy (Driscoll 2005; Bandura 1997). Another possibility could be to provide active learning opportunities inside and outside of the classroom, for instance, in the form of student companies which have shown some effects on students' economic literacy (Grewe and Brahm 2020). Overall, our results on gender differences can be considered by policymakers and educators and incorporated in the classroom and other education programs.

Through this study, we contribute to the literature in at least three ways: We confirm and extend insights into explanatory factors for the gender gap of (German) school students. By applying two tests, one adapted to the local context and an international one, we allow for international comparability of our results. Furthermore, we show that including effort in literacy studies leads to differentiated effects. An appropriate measurement of effort could, thus, be relevant for future research on economic literacy.

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Tables and Figures

Table 1. Descriptive statistics

Variable	Male	Female	Difference [SE]	p-value
Individual characteristics				
Age (in years)	15.57 (3.662)	15.346 (2.275)	-0.224 [0.141]	0.116
German native speaker (1/0)	0.842 (0.365)	0.769 (0.422)	-0.073 [0.017]	0
<25 books at home (1/0)	2.83 (1.511)	2.784 (1.554)	-0.045 [0.08]	0.571
Education of mother (1/0)	0.38 (0.486)	0.462 (0.499)	0.083 [0.023]	0.001
Education of father (1/0)	0.445 (0.497)	0.497 (0.5)	0.052 [0.023]	0.028
Math grade (1-6)	2.69 (0.999)	2.827 (1.068)	0.137 [0.043]	0.002
WBS grade (1-6)	2.384 (0.795)	2.381 (0.826)	-0.002 [0.042]	0.954
Cognitive ability (0-4)	2.03 (1.352)	2.087 (1.27)	0.057 [0.067]	0.4
Math ability (IRT)	0.303 (1.266)	-0.202 (1.108)	-0.505 [0.061]	0
School data				
Highest school track (gym) (1/0)	0.577 (0.494)	0.559 (0.497)	-0.018 [0.028]	0.532
School stratum	3.601 (2.524)	3.834 (2.73)	0.233 [0.153]	0.131
School size	606.088 (224.664)	611.338 (220.941)	5.25 [13.299]	0.694
Urbanization (1-3)	2.149 (0.836)	2.069 (0.841)	-0.08 [0.045]	0.081
Interest and Attitudes				
Risk aversion (1/0)	0.491 (0.5)	0.615 (0.487)	0.124 [0.023]	0
Self-efficacy (1-5)	3.614 (0.712)	3.417 (0.7)	-0.196 [0.03]	0
TPB (1-5)	3.102 (0.868)	2.925 (0.878)	-0.176 [0.046]	0
Interest in WBS (1-5)	2.982 (0.863)	2.709 (0.833)	-0.272 [0.044]	0
Interest in economics in general (1-5)	0.248 (0.958)	-0.22 (0.98)	-0.467 [0.053]	0
Attitude towards competition (1-5)	0.078 (0.958)	-0.004 (0.983)	-0.082 [0.043]	0.06
Effort TEC (0-1)	0.946 (0.139)	0.976 (0.088)	0.029 [0.006]	0
Effort TEL (0-1)	0.936 (0.158)	0.969 (0.092)	0.033 [0.007]	0
Economic/Financial literacy				
TEC Sumscore (0-12)	7.716 (3.047)	6.837 (2.69)	-0.879 [0.143]	0
PV TEC (mean)	0.111 (0.936)	-0.138 (0.81)	-0.249 [0.041]	0
TEL Sumscore (0-12)	4.683 (2.413)	3.992 (2.102)	-0.691 [0.103]	0
PV TEL (mean)	0.121 (0.837)	-0.116 (0.751)	-0.236 [0.035]	0

Note: The table presents means (M) and standard deviations (SDs) by gender. Mean differences, standard errors and p-values are calculated on the basis of a linear regression model with gender as only predictor and cluster-robust standard errors.

Table 2. Multiple regression predicting economic literacy scores (TEC) (multiple imputations/PVs)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Male	Female
Female	-0.247***	-0.301***	-0.221***	-0.196***	-0.195***	-0.202***	-0.189***		
	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.04]	[0.045]		
Effort (RTE)		0.235***	0.23***	0.227***	0.226***	0.23***	0.24***	0.253***	0.219***
		[0.022]	[0.025]	[0.024]	[0.024]	[0.022]	[0.024]	[0.027]	[0.044]
Math ability			0.232***	0.229***	0.221***	0.215***	0.21***	0.23***	0.188***
			[0.022]	[0.022]	[0.022]	[0.023]	[0.025]	[0.037]	[0.033]
Interest				0.053**	0.056**	0.056**	0.047	0.052	0.045
				[0.018]	[0.018]	[0.019]	[0.026]	[0.037]	[0.032]
Attitude towards competition					0.078***	0.079***	0.075***	0.03	0.107***
					[0.019]	[0.018]	[0.022]	[0.029]	[0.031]
Risk aversion						0.058**	0.064**	0.055	0.079**
						[0.019]	[0.021]	[0.028]	[0.028]
Present bias						-0.01	-0.009	-0.009	-0.004
						[0.017]	[0.019]	[0.029]	[0.024]
Self-efficacy						0.026	0.03 [0.02]	0.043	0.017
						[0.019]		[0.029]	[0.028]
Stereotypes							0.006	0.001	0.003
							[0.02]	[0.029]	[0.028]
Age of first financial discussion							-0.044 *	-0.058 *	-0.031
							[0.021]	[0.027]	[0.031]
Theory of Planned Behavior							0.008	0.021	-0.006
							[0.026]	[0.037]	[0.035]
Bank account							0.09	0.103	0.086
							[0.056]	[0.096]	[0.076]
Intercept	-0.247***	-0.177***	-0.107 *	-0.121 *	-0.116 *	-0.114 *	-0.152 *	-0.223 *	-0.297***
	[0.067]	[0.06]	[0.056]	[0.055]	[0.055]	[0.056]	[0.073]	[0.105]	[0.09]
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	1914	1893	1774	1774	1774	1743	1533	738	795
N (clusters)	105	105	104	104	104	104	104	101	102
Adj.R-Squ.	0.305	0.349	0.359	0.362	0.369	0.371	0.37	0.386	0.333
F-Stat.	70.683	108.411	85.014	78.822	76.334	67.278	50.691	30.065	26.057

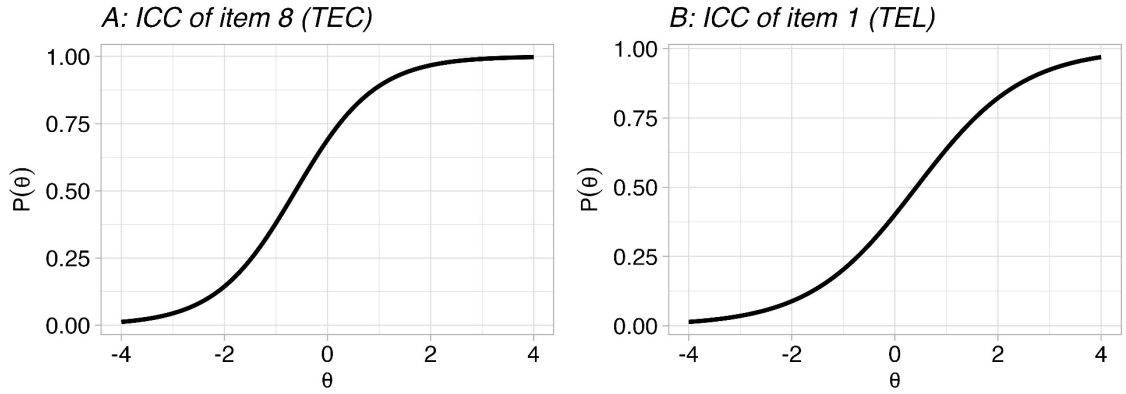
Note: The table shows regressions including the controls age, school type, mother tongue, books at home, education of mother and father and cognition. Standard errors are clustered. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Standard errors in parentheses.

Table 3. Multiple regression predicting economic literacy scores (TEL) (multiple imputations/PVs)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Male	Female
Female	-0.235*** [0.045]	-0.266*** [0.045]	-0.218*** [0.047]	-0.181*** [0.048]	-0.18*** [0.048]	-0.173*** [0.049]	-0.154** [0.059]		
Effort (RTE)		0.139*** [0.021]	0.134*** [0.022]	0.132*** [0.022]	0.131*** [0.023]	0.128*** [0.023]	0.135*** [0.027]	0.155*** [0.03]	0.072 [0.051]
Math ability			0.171*** [0.027]	0.167*** [0.027]	0.161*** [0.027]	0.153*** [0.027]	0.139*** [0.028]	0.147*** [0.041]	0.135*** [0.043]
Interest				0.08*** [0.024]	0.081*** [0.024]	0.082*** [0.024]	0.109*** [0.031]	0.136*** [0.045]	0.081 [0.041]
Attitude towards competition					0.051** [0.02]	0.055** [0.02]	0.073*** [0.024]	0.078 * [0.037]	0.068 * [0.033]
Risk aversion						0.037 [0.025]	0.049 [0.027]	0.03 [0.04]	0.069 [0.035]
Present bias						-0.031 [0.024]	-0.017 [0.026]	-0.039 [0.035]	0.001 [0.035]
Self-efficacy						0.038 [0.021]	0.039 [0.022]	0.017 [0.037]	0.05 [0.031]
Stereotypes							0 [0.026]	-0.007 [0.037]	-0.003 [0.038]
Age of first financial discussion							-0.006 [0.025]	-0.01 [0.033]	-0.016 [0.039]
Theory of Planned Behavior							-0.039 [0.032]	-0.036 [0.044]	-0.035 [0.043]
Bank account							0.012 [0.078]	0.029 [0.108]	0 [0.109]
Intercept	-0.148** [0.067]	-0.111 [0.065]	-0.034 [0.069]	-0.055 [0.071]	-0.052 [0.07]	-0.049 [0.071]	-0.066 [0.098]	-0.134 [0.133]	-0.176 [0.12]
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	1914	1896	1775	1775	1775	1744	1534	738	796
N (clusters)	105	105	104	104	104	104	104	101	102
Adj.R-Squ.	0.13	0.141	0.146	0.151	0.154	0.157	0.149	0.171	0.098
F-Stat.	28.425	37.867	31.242	29.817	28.145	23.387	16.225	12.543	6.764

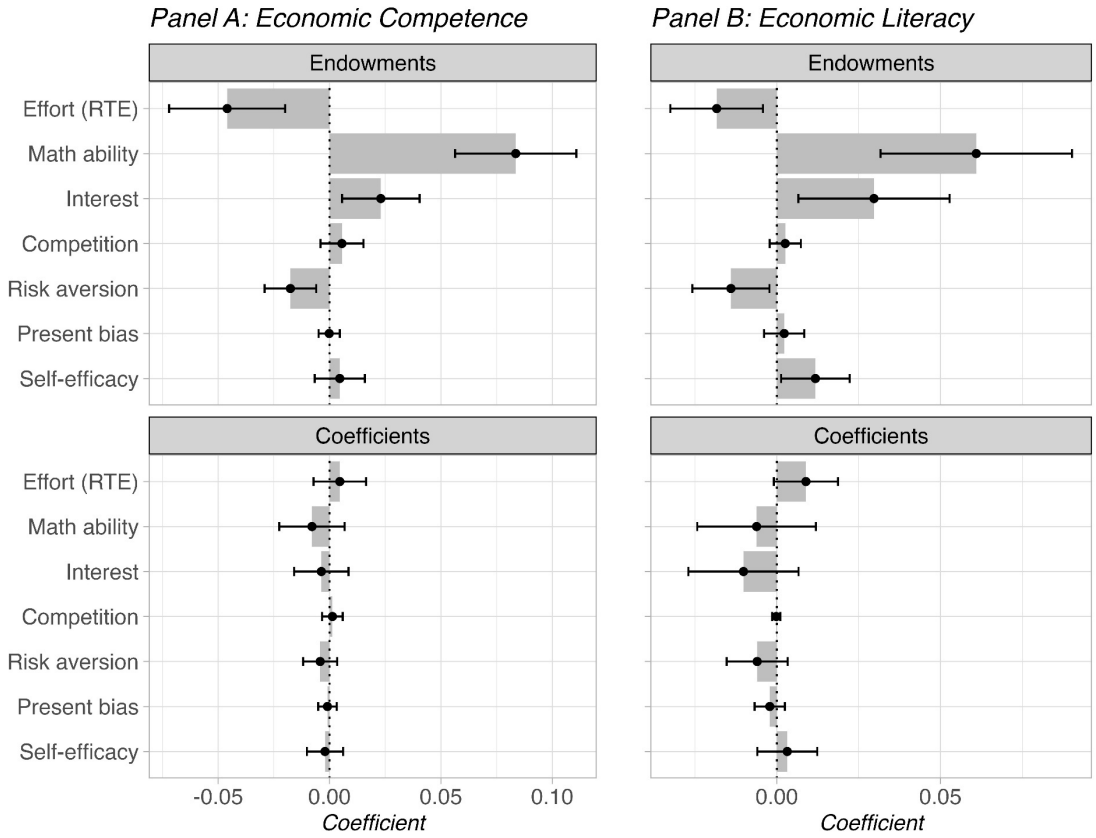
Note: The table shows regressions including the controls *age*, *school type*, *mother tongue*, *books at home*, *education of mother and father* and *cognition*. Standard errors are clustered. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Standard errors in parentheses.

Figure 1: Item characteristic curves (ICC) for selected items of the TEC and TEL



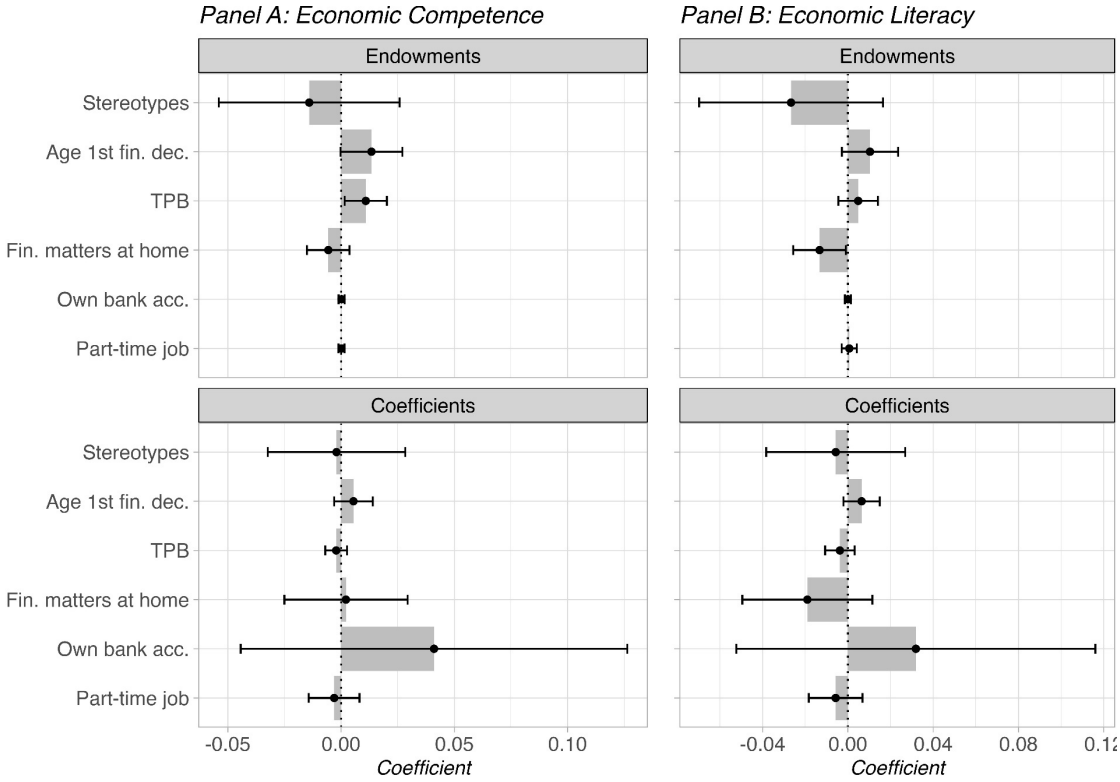
Notes: This figure shows Item Characteristic Curves (ICC) for item 8 of the TEC scale and for item 1 of the TEL scale based on the two-parameter logistic IRT described in Birnbaum (1968). Ability estimates $\hat{\theta}$ outside the range of [-4, 4] are truncated.

Figure 2. Decomposition results of the gender gap in economic literacy including cognitive and affective variables



Notes. The figure displays threefold Oaxaca Blinder decomposition results. Error bars represent 95% confidence intervals. The model includes the controls *age*, *school type*, *mother tongue*, *books at home*, *education of mother and father* and *cognition*. Standard errors are clustered.

Figure 3. Decomposition results of the gender gap in economic literacy including socialization variables



Notes. The figure displays threefold Oaxaca Blinder decomposition results. Error bars represent 95% confidence intervals. The model includes the controls *age*, *school type*, *mother tongue*, *books at home*, *education of mother and father* and *cognition*. Standard errors are clustered.

ONLINE APPENDIX

to accompany

Understanding the Gender Gap in Economic Literacy – Evidence from Germany

Table A1. Sampling proportions

		Population			Sample			
Stratum	**School type**	**n**	**%**	**% school-level**	**n**	**%**	**% school-level**	**Diff.**
1	GYM	119010	19.37	42.50	469	23.95	56.59	-4.58
2		74968	12.20		354	18.08		-5.88
3		67143	10.93		285	14.56		-3.63
4	RS	67676	11.01	30.41	281	14.35	27.22	-3.34
5		56999	9.28		107	5.46		3.81
6		62185	10.12		145	7.41		2.71
7	GMS	48529	7.90	23.06	53	2.71	14.86	5.19
8		47676	7.76		94	4.80		2.96
9		45513	7.41		144	7.35		0.05
10	WRS	3892	0.63	4.03	5	0.26	1.33	0.38
11		10865	1.77		0	0.00		1.77
12		10009	1.63		21	1.07		0.56

Note: The table displays the sampling proportions of the school types in the population and in this sample as well as the difference. Abbreviations are used as follows: GYM (*Gymnasium*) = highest school level, RS (*Realschule*) = intermediate school level, GMS (*Gemeinschaftsschule*) = integrated school type, WRS (*Werkrealschule*) = base level.

Table A2. Item characteristics

Test of Economic Competence (TEC)						Test of Economic Literacy (TEL)					
Itemno.	N	Freq.	r	$\hat{a}$ [SE]	$\hat{b}$ [SE]	Itemno.	N	Freq.	r	$\hat{a}$ [SE]	$\hat{b}$ [SE]
1	1932	0.792	0.376	1.431 [0.062]	-1.245 [0.044]	1	1919	0.344	0.098	0.321 [0.022]	2.067 [0.151]
2	1937	0.839	0.363	1.665 [0.071]	-1.406 [0.043]	2	1900	0.448	0.263	0.818 [0.054]	0.294 [0.06]
3	1950	0.773	0.311	1.042 [0.045]	-1.414 [0.056]	3	1926	0.355	0.258	0.864 [0.048]	0.803 [0.059]
4	1932	0.57	0.504	2.047 [0.094]	-0.231 [0.029]	4	1920	0.288	0.154	0.505 [0.026]	1.904 [0.102]
5	1940	0.744	0.375	1.264 [0.057]	-1.081 [0.046]	5	1931	0.43	0.329	1.201 [0.064]	0.307 [0.043]
6	1970	0.837	0.333	1.347 [0.055]	-1.577 [0.05]	6	1897	0.421	0.156	0.444 [0.04]	0.757 [0.107]
7	1973	0.625	0.29	0.806 [0.048]	-0.72 [0.061]	7	1874	0.303	0.172	0.545 [0.03]	1.639 [0.095]
8	1951	0.677	0.375	1.232 [0.06]	-0.763 [0.044]	8	1916	0.388	0.199	0.622 [0.042]	0.803 [0.079]
9	1959	0.587	0.344	1.009 [0.057]	-0.414 [0.05]	9	1899	0.296	0.023	0.083 [0.005]	10.468 [0.608]
10	1968	0.424	0.336	0.991 [0.057]	0.381 [0.051]	10	1948	0.747	0.176	0.643 [0.03]	-1.824 [0.084]
11	1937	0.318	0.275	0.851 [0.044]	1.05 [0.061]	11	1905	0.401	0.245	0.797 [0.05]	0.584 [0.063]
12	1929	0.441	0.266	0.717 [0.051]	0.383 [0.068]	12	1925	0.289	0.174	0.497 [0.026]	1.92 [0.104]
						13	1884	0.407	0.215	0.64 [0.046]	0.646 [0.077]
						14	1918	0.245	0.164	0.545 [0.025]	2.206 [0.1]
						15	1883	0.357	0.173	0.535 [0.035]	1.17 [0.093]

Note: The table displays IRT statistics for the TEC and TEL, including the discrimination parameter $\hat{a}$ and the difficulty parameter $\hat{b}$. r represents the point-biserial correlation between the item response and the total score (corrected-item total correlation). Based on the results, TEL items 1 and 9 exhibit a lack of discriminatory power and are thus excluded from subsequent analyses.

Table A3. Differential Item Functioning

	Gender *(Focal group: male)*			**Mother tongue** *(Focal group: non-native)*			**Books at home** *(Focal group: <100 books)*		
Item no.	*MHχ2*	*Δ-DIF*	ETS	*MHχ2*	*Δ-DIF*	ETS	*MHχ2*	*Δ-DIF*	ETS
Panel A: Test of Economic Competence (TEC)									
1	-0.1466	0.3445	A	0.2923	-0.6869	A	0.1660	-0.3901	A
2	0.4198	-0.9865	A	-0.1260	0.2961	A	0.0749	-0.1760	A
3	0.1864	-0.4380	A	-0.3118	0.7327	A	-0.2321	0.5454	A
4	0.0446	-0.1048	A	0.2097	-0.4928	A	0.2927	-0.6878	A
5	0.0148	-0.0348	A	0.0765	-0.1798	A	-0.0860	0.2021	A
6	0.2464	-0.5790	A	-0.0062	0.0146	A	0.0380	-0.0893	A
7	-0.4147	0.9745	A	-0.0612	0.1438	A	-0.0219	0.0515	A
8	0.0426	-0.1001	A	-0.2087	0.4904	A	0.0976	-0.2294	A
9	0.1289	-0.3029	A	-0.0409	0.0961	A	-0.0074	0.0174	A
10	-0.3080	0.7238	A	-0.1024	0.2406	A	-0.1301	0.3057	A
11	-0.0829	0.1948	A	0.3350	-0.7873	A	0.0648	-0.1523	A
12	-0.1313	0.3086	A	-0.0563	0.1323	A	-0.2566	0.6030	A
Panel B: Test of Economic Literacy (TEL)									
1	0.3399	-0.7988	A	-0.1014	0.2383	A	-0.2564	0.6025	A
2	0.0840	-0.1974	A	0.0837	-0.1967	A	-0.0164	0.0385	A
3	-0.2181	0.5125	A	0.0731	-0.1718	A	0.2047	-0.4810	A
4	-0.0898	0.2110	A	-0.0629	0.1478	A	-0.1283	0.3015	A
5	-0.2609	0.6131	A	0.7559	-1.7764	C	0.4437	-1.0427	B

6	0.1595	-0.3748	A	-0.0433	0.1018	A	-0.2482	0.5833	A
7	0.1246	-0.2928	A	-0.4019	0.9445	A	0.0318	-0.0747	A
8	-0.0411	0.0966	A	0.0235	-0.0552	A	0.1405	-0.3302	A
9	0.1186	-0.2787	A	-0.3550	0.8342	A	-0.4774	1.1219	B
10	-0.1962	0.4611	A	0.2672	-0.6279	A	0.2658	-0.6246	A
11	0.0378	-0.0888	A	-0.0147	0.0345	A	0.1512	-0.3553	A
12	-0.1997	0.4693	A	-0.0600	0.1410	A	0.1546	-0.3633	A
13	-0.0984	0.2312	A	0.0180	-0.0423	A	-0.1003	0.2357	A
14	0.2683	-0.6305	A	-0.4863	1.1428	B	-0.1734	0.4075	A
15	-0.0285	0.0670	A	0.3042	-0.7149	A	0.0080	-0.0188	A

Notes: The table displays Differential Item Functioning for the TEC and TEL separately. *Δ – DIF* is the Mantel-Haenszel delta difference as described in section 3 and *MHχ2* its significance based on the χ2-distribution. The ETS classification scheme categorizes "A" as no or negligible DIF, "B" as negligible to moderate DIF and "C" as moderate to severe DIF. Based on this scheme, TEL item 5 is flagged with DIF and excluded from further analyses.

.

Figure A1. Competence distribution

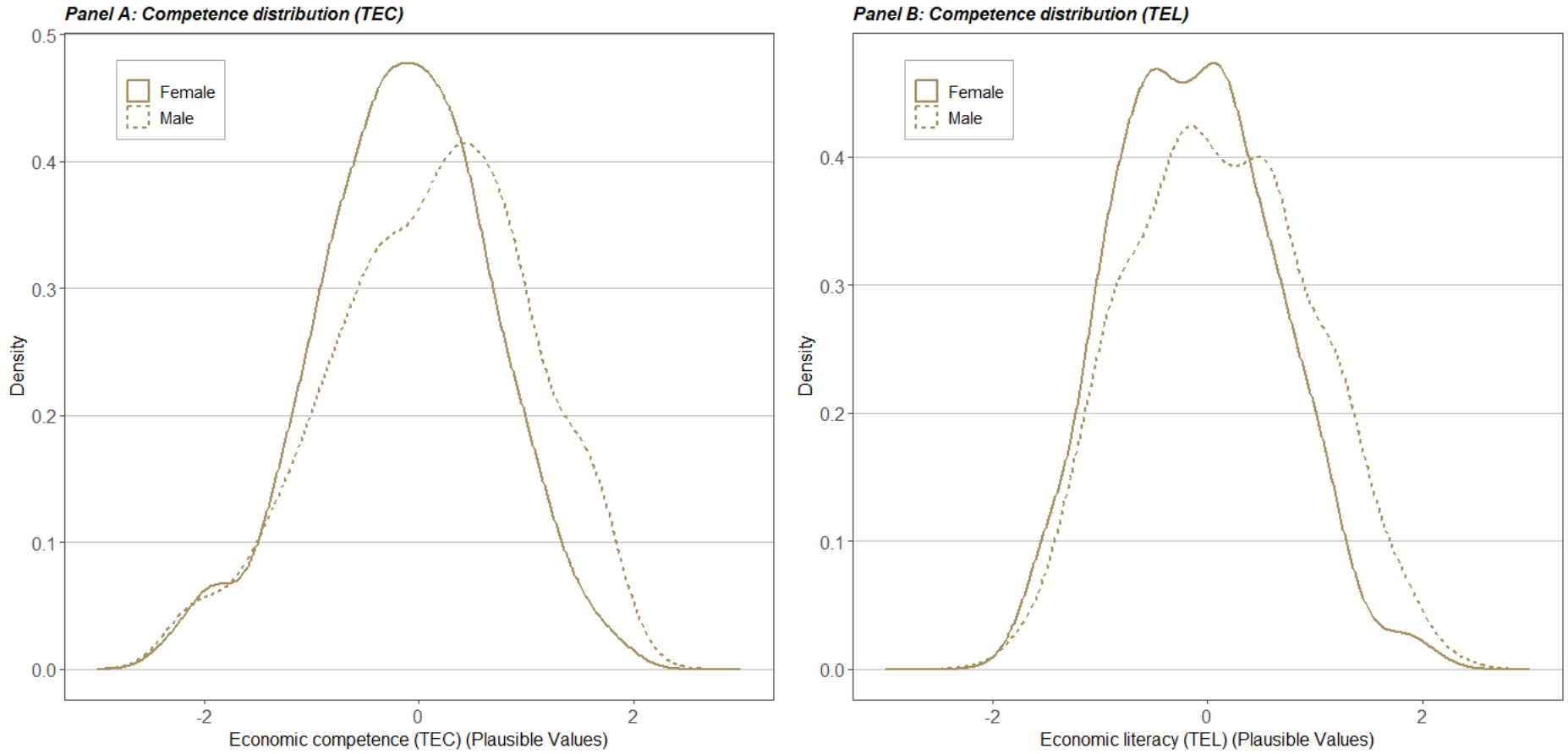


Table A4. Bivariate Correlations

	(1) Female	(2) Age	(3) Mother tongue	(4) Books	(5) Edu mother	(6) Edu father	(7) School type	(8) Cognition	(9) TEC	(10) TEL	(11) Math	(12) RTE	(13) Interest	(14) Competition	(15) Risk aversion	(16) Present bias	(17) Self-efficacy	(18) Stereotypes	(19) Age fin. disc.	(20) TPB	(21) Fin. matters	(22) Bank account
(1)	1.00																					
(2)	-0.04	1.00																				
(3)	-0.09***	-0.09***	1.00																			
(4)	-0.01	0.01	0.25***	1.00																		
(5)	0.04	-0.03	0.13***	0.33***	1.00																	
(6)	0.02	-0.03	0.15***	0.33***	0.61***	1.00																
(7)	-0.02	-0.04	0.11***	0.32***	0.27***	0.25***	1.00															
(8)	0.02	-0.08***	0.07***	0.22***	0.16***	0.15***	0.28***	1.00														
(9)	-0.16***	-0.09***	0.19***	0.33***	0.27***	0.26***	0.41***	0.49***	1.00													
(10)	-0.14***	-0.05*	0.14***	0.24***	0.17***	0.18***	0.31***	0.38***	0.60**	1.00												
(11)	-0.22***	-0.12***	0.17***	0.27***	0.21***	0.21***	0.41***	0.36***	0.55***	0.41***	1.00											
(12)	0.13***	-0.16***	0.06*	0.10***	0.13***	0.12***	0.16***	0.23***	0.36***	0.25***	0.20***	1.00										
(13)	-0.23***	0.02	0.03	0.10***	0.06*	0.07**	0.07**	0.02	0.16***	0.17***	0.12***	0.02	1.00									
(14)	-0.04	-0.01	0.07**	0.12***	0.08***	0.11***	0.10***	0.14***	0.20***	0.15***	0.18***	0.05*	-0.00	1.00								
(15)	0.12***	-0.04	0.00	-0.03	-0.03	-0.02	-0.02	0.05*	0.07**	0.06**	0.03	0.05*	-0.03	-0.08***	1.00							
(16)	0.06**	-0.04	0.04	-0.04	-0.07**	-0.01	0.02	-0.02	-0.06**	-0.08***	-0.07**	0.01	-0.12***	-0.09***	-0.04	1.00						
(17)	-0.12***	-0.05*	0.06**	0.11***	0.09***	0.08***	0.13***	0.15***	0.17***	0.14***	0.19***	0.09***	-0.00	0.00	-0.08***	-0.08***	1.00					
(18)	-0.36***	-0.00	-0.03	-0.10***	-0.12***	-0.07**	-0.05*	-0.11***	-0.03	-0.02	0.03	-0.10***	0.00	0.00	-0.09***	0.01	-0.00	1.00				
(19)	0.11***	-0.03	-0.10***	-0.17***	-0.15***	-0.14***	-0.08***	-0.04	-0.15***	-0.07**	-0.12***	0.13***	-0.14***	-0.05*	0.03	0.04	-0.02	0.02	1.00			
(20)	-0.10***	0.03	0.07**	0.12***	0.11***	0.09***	0.12***	0.07**	0.19***	0.14***	0.13***	0.03	0.60***	0.34***	-0.04	-0.08**	0.01	0.05*	-0.05*	1.00		
(21)	-0.10***	0.00	-0.02	0.04	0.06**	0.05	0.01	-0.04	0.01	-0.02	0.01	-0.10***	0.26***	0.02	-0.10***	-0.09***	0.02	0.06*	-0.14***	0.18***	1.00	
(22)	-0.02	-0.06*	0.31***	0.20***	0.12***	0.16***	0.09***	0.03	0.16***	0.10***	0.09***	0.02	0.13***	0.07**	-0.09***	0.07**	0.03	-0.03	-0.09***	0.13***	0.08***	1.00
(23)	0.02	0.03	0.01	0.02	0.09***	0.08***	0.02	-0.01	0.01	-0.04	0.03	-0.03	0.09***	0.05*	-0.15***	-0.02	0.01	-0.01	-0.03	0.07**	0.08**	0.14***

Table A5. Decomposition results of the gender gap in economic literacy including cognitive and affective variables

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**
Overall	Group 1 (male)	0.223	0.049	4.538	0.000	0.126	0.319		0.202	0.039	5.199	0.000	0.126	0.278	
	Group 2 (female)	-0.051	0.042	-1.228	0.220	-0.134	0.031		-0.064	0.036	-1.768	0.077	-0.135	0.007	
	Difference	0.274	0.041	6.752	0.000	0.195	0.354		0.265	0.038	7.039	0.000	0.192	0.339	
	Endowments	0.056	0.034	1.650	0.099	-0.010	0.122	20.341	0.079	0.027	2.957	0.003	0.027	0.132	29.895
	Coefficients	0.181	0.033	5.467	0.000	0.116	0.246	65.978	0.148	0.038	3.896	0.000	0.074	0.223	55.946
	Interaction	0.037	0.028	1.353	0.176	-0.017	0.092	13.681	0.038	0.030	1.238	0.216	-0.022	0.097	14.159
Endowments	Schooltype	0.002	0.005	0.447	0.655	-0.007	0.011	0.769	0.002	0.005	0.469	0.639	-0.008	0.013	0.930
	Mother tongue	0.010	0.004	2.362	0.018	0.002	0.019	3.800	0.005	0.004	1.170	0.242	-0.003	0.014	1.905
	Books	0.001	0.005	0.160	0.873	-0.009	0.011	0.301	0.000	0.001	0.170	0.865	-0.003	0.003	0.092
	Edu mother	-0.007	0.004	-1.620	0.105	-0.015	0.001	-2.557	0.002	0.003	0.579	0.563	-0.004	0.007	0.611
	Edu father	-0.001	0.002	-0.630	0.528	-0.004	0.002	-0.384	-0.003	0.004	-0.979	0.328	-0.010	0.003	-1.311
	Cognition	-0.003	0.007	-0.383	0.702	-0.016	0.011	-0.934	-0.001	0.003	-0.410	0.682	-0.008	0.005	-0.491
	RTE	-0.046	0.013	-3.458	0.001	-0.072	-0.020	-16.779	-0.018	0.007	-2.549	0.011	-0.033	-0.004	-6.937
	Math	0.084	0.014	6.013	0.000	0.056	0.111	30.503	0.061	0.015	4.084	0.000	0.032	0.090	22.966
	Interest	0.023	0.009	2.590	0.010	0.006	0.040	8.396	0.030	0.012	2.518	0.012	0.007	0.053	11.185
	Competition	0.006	0.005	1.131	0.258	-0.004	0.015	2.030	0.003	0.002	1.046	0.295	-0.002	0.007	0.962
	Risk aversion	-0.018	0.006	-2.976	0.003	-0.029	-0.006	-6.417	-0.014	0.006	-2.340	0.019	-0.026	-0.002	-5.296
	Present bias	0.000	0.002	-0.068	0.946	-0.005	0.005	-0.060	0.002	0.003	0.713	0.476	-0.004	0.008	0.841
	Self-efficacy	0.005	0.006	0.796	0.426	-0.007	0.016	1.673	0.012	0.005	2.200	0.028	0.001	0.022	4.436
Coefficients	Schooltype	0.014	0.010	1.353	0.176	-0.006	0.033	4.980	0.000	0.006	-0.029	0.976	-0.013	0.012	-0.071

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**
	Mother tongue	0.009	0.022	0.423	0.672	-0.034	0.053	3.412	0.019	0.024	0.788	0.431	-0.029	0.067	7.237
	Books	-0.001	0.002	-0.446	0.656	-0.004	0.003	-0.302	0.001	0.003	0.457	0.647	-0.004	0.007	0.505
	Edu mother	-0.005	0.004	-1.298	0.194	-0.013	0.003	-1.834	-0.001	0.004	-0.325	0.745	-0.008	0.006	-0.437
	Edu father	0.001	0.002	0.401	0.689	-0.003	0.004	0.268	-0.001	0.002	-0.422	0.673	-0.006	0.004	-0.395
	Cognition	0.001	0.004	0.305	0.761	-0.006	0.009	0.426	0.004	0.005	0.668	0.504	-0.007	0.014	1.343
	RTE	0.005	0.006	0.764	0.445	-0.007	0.016	1.681	0.009	0.005	1.773	0.076	-0.001	0.019	3.345
	Math	-0.008	0.007	-1.055	0.291	-0.023	0.007	-2.883	-0.006	0.009	-0.671	0.502	-0.024	0.012	-2.339
	Interest	-0.004	0.006	-0.593	0.553	-0.016	0.009	-1.351	-0.010	0.009	-1.189	0.234	-0.027	0.007	-3.848
	Competition	0.001	0.002	0.542	0.588	-0.003	0.006	0.470	0.000	0.001	-0.297	0.766	-0.001	0.001	-0.071
	Risk aversion	-0.004	0.004	-1.084	0.278	-0.012	0.003	-1.540	-0.006	0.005	-1.270	0.204	-0.015	0.003	-2.272
	Present bias	-0.001	0.002	-0.452	0.651	-0.005	0.003	-0.350	-0.002	0.002	-0.925	0.355	-0.007	0.002	-0.822
	Self-efficacy	-0.002	0.004	-0.494	0.621	-0.010	0.006	-0.747	0.003	0.005	0.678	0.497	-0.006	0.012	1.195
	Constant	0.175	0.040	4.346	0.000	0.096	0.254	63.749	0.140	0.045	3.086	0.002	0.051	0.228	52.575
Interaction	Schooltype	0.002	0.005	0.443	0.658	-0.007	0.011	0.769	0.000	0.001	-0.029	0.977	-0.002	0.002	-0.012
	Mother tongue	0.002	0.006	0.421	0.674	-0.009	0.014	0.886	0.005	0.007	0.775	0.438	-0.008	0.018	1.907
	Books	0.000	0.002	-0.158	0.874	-0.004	0.003	-0.098	0.000	0.003	0.171	0.864	-0.005	0.006	0.180
	Edu mother	0.006	0.005	1.370	0.171	-0.003	0.015	2.302	0.001	0.004	0.326	0.744	-0.007	0.010	0.548
	Edu father	-0.001	0.002	-0.396	0.692	-0.005	0.003	-0.289	0.001	0.003	0.417	0.677	-0.004	0.006	0.426
	Cognition	0.000	0.001	-0.240	0.811	-0.002	0.001	-0.066	-0.001	0.002	-0.357	0.721	-0.004	0.003	-0.223
	RTE	-0.006	0.008	-0.761	0.446	-0.023	0.010	-2.328	-0.013	0.007	-1.756	0.079	-0.028	0.002	-4.932
	Math	0.017	0.015	1.100	0.271	-0.013	0.046	6.074	0.013	0.019	0.682	0.495	-0.024	0.050	4.895
	Interest	0.008	0.013	0.597	0.551	-0.017	0.033	2.787	0.021	0.017	1.215	0.224	-0.013	0.055	7.949

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**
	Competition	-0.003	0.003	-1.047	0.295	-0.010	0.003	-1.268	0.001	0.002	0.343	0.732	-0.002	0.004	0.198
	Risk aversion	0.007	0.007	1.101	0.271	-0.006	0.021	2.712	0.011	0.008	1.298	0.194	-0.005	0.027	4.010
	Present bias	0.002	0.004	0.459	0.646	-0.006	0.010	0.689	0.004	0.004	0.981	0.326	-0.004	0.013	1.604
	Self-efficacy	0.004	0.008	0.497	0.619	-0.012	0.020	1.513	-0.006	0.009	-0.686	0.493	-0.024	0.012	-2.392

Note: The table displays results of a threefold Oaxaca Blinder decomposition. Standard errors are clustered.

Table A6. Decomposition results of the gender gap in economic literacy including socialization variables

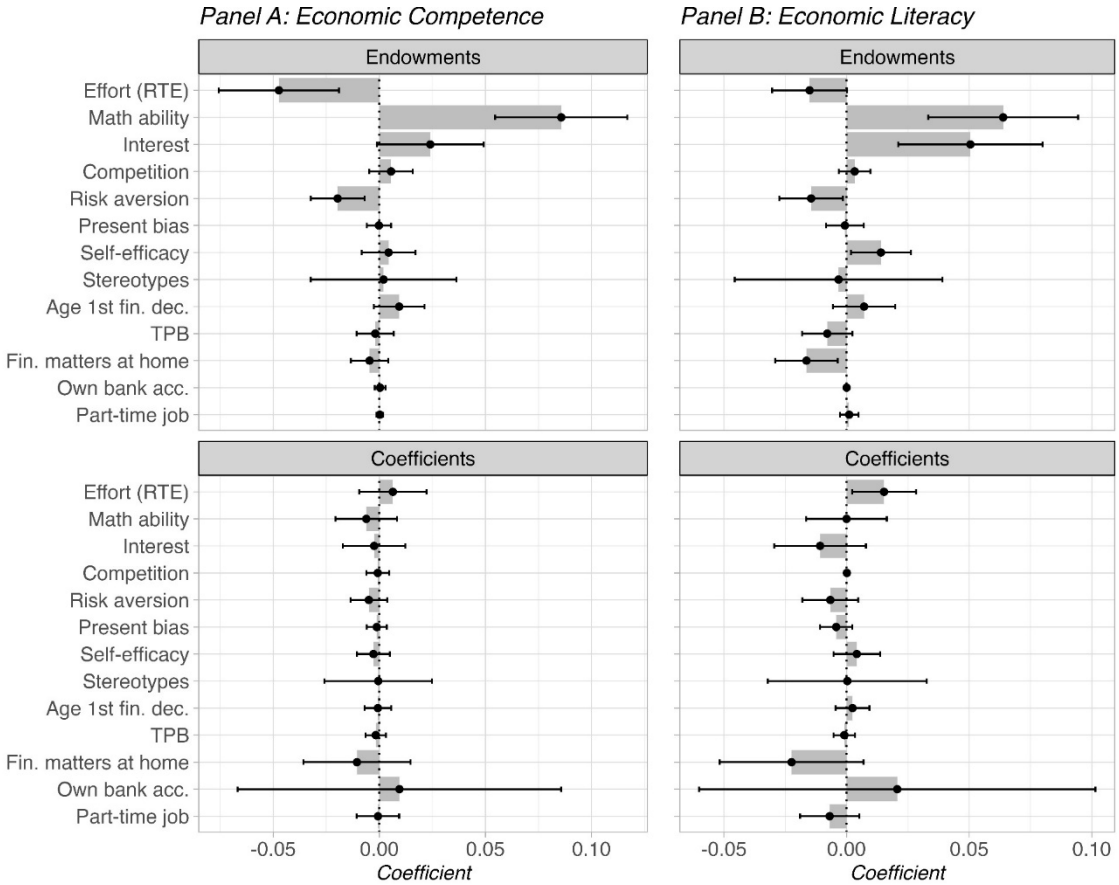
		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**
Overall	Group 1 (male)	0.240	0.049	4.849	0.000	0.143	0.337		0.207	0.041	4.995	0.000	0.126	0.288	
	Group 2 (female)	-0.024	0.044	-0.539	0.590	-0.110	0.063		-0.039	0.038	-1.046	0.295	-0.113	0.034	
	Difference	0.264	0.041	6.362	0.000	0.182	0.345		0.246	0.042	5.833	0.000	0.164	0.329	
	Endowments	0.011	0.034	0.313	0.754	-0.055	0.076	3.992	-0.017	0.028	-0.601	0.548	-0.072	0.038	-6.869
	Coefficients	0.256	0.037	6.923	0.000	0.183	0.328	97.017	0.245	0.049	5.029	0.000	0.150	0.341	99.481
	Interaction	-0.003	0.034	-0.078	0.938	-0.070	0.064	-1.008	0.018	0.036	0.504	0.614	-0.053	0.089	7.388
Endowments	Schooltype	0.008	0.009	0.920	0.358	-0.010	0.026	3.201	0.008	0.009	0.914	0.361	-0.009	0.025	3.211
	Mother tongue	0.011	0.005	2.181	0.029	0.001	0.020	4.090	0.004	0.005	0.792	0.429	-0.005	0.013	1.465
	Books	0.000	0.007	0.046	0.964	-0.014	0.015	0.127	0.000	0.003	0.046	0.964	-0.006	0.006	0.056
	Edu mother	-0.005	0.004	-1.335	0.182	-0.012	0.002	-1.912	0.002	0.003	0.737	0.461	-0.003	0.007	0.818
	Edu father	-0.002	0.003	-0.612	0.541	-0.007	0.004	-0.619	-0.003	0.004	-0.621	0.535	-0.011	0.005	-1.030
	Cognition	-0.007	0.011	-0.645	0.519	-0.030	0.015	-2.775	-0.004	0.006	-0.638	0.524	-0.016	0.008	-1.628
	Stereotypes	-0.014	0.020	-0.691	0.489	-0.054	0.026	-5.344	-0.027	0.022	-1.212	0.225	-0.070	0.016	-10.814
	Age fin. discussion	0.013	0.007	1.922	0.055	0.000	0.027	5.091	0.010	0.007	1.545	0.122	-0.003	0.024	4.210
	TPB	0.011	0.005	2.288	0.022	0.002	0.020	4.133	0.005	0.005	1.023	0.306	-0.004	0.014	1.963
	Fin. matters at home	-0.006	0.005	-1.184	0.237	-0.015	0.004	-2.152	-0.013	0.006	-2.104	0.035	-0.026	-0.001	-5.387
	Bank acc.	0.000	0.001	0.326	0.745	-0.001	0.002	0.083	0.000	0.001	0.005	0.996	-0.001	0.001	0.001
	Job	0.000	0.001	0.267	0.789	-0.001	0.001	0.068	0.001	0.002	0.368	0.713	-0.003	0.004	0.267
Coefficients	Schooltype	0.011	0.009	1.150	0.250	-0.008	0.029	4.127	0.001	0.008	0.168	0.867	-0.014	0.016	0.525
	Mother tongue	-0.024	0.024	-1.032	0.302	-0.071	0.022	-9.235	0.010	0.028	0.350	0.726	-0.045	0.065	4.004

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**
	Books	-0.002	0.003	-0.605	0.545	-0.007	0.004	-0.619	0.001	0.002	0.381	0.703	-0.003	0.005	0.315
	Edu mother	-0.007	0.005	-1.375	0.169	-0.016	0.003	-2.545	0.002	0.005	0.462	0.644	-0.007	0.012	0.895
	Edu father	0.004	0.003	1.048	0.294	-0.003	0.010	1.343	0.000	0.003	-0.079	0.937	-0.007	0.006	-0.109
	Cognition	0.013	0.007	1.782	0.075	-0.001	0.026	4.747	0.008	0.008	1.096	0.273	-0.007	0.023	3.362
	Stereotypes	-0.002	0.015	-0.132	0.895	-0.032	0.028	-0.775	-0.006	0.017	-0.343	0.732	-0.038	0.027	-2.311
	Age fin. discussion	0.005	0.004	1.254	0.210	-0.003	0.014	2.074	0.006	0.004	1.487	0.137	-0.002	0.015	2.619
	TPB	-0.002	0.002	-0.881	0.379	-0.007	0.003	-0.825	-0.004	0.004	-1.057	0.290	-0.011	0.003	-1.518
	Fin. matters at home	0.002	0.014	0.155	0.877	-0.025	0.029	0.818	-0.019	0.016	-1.222	0.222	-0.049	0.011	-7.711
	Bank acc.	0.041	0.044	0.942	0.346	-0.044	0.126	15.573	0.032	0.043	0.743	0.458	-0.052	0.116	12.940
	Job	-0.003	0.006	-0.538	0.591	-0.014	0.008	-1.168	-0.006	0.006	-0.895	0.371	-0.018	0.007	-2.332
	Constant	0.220	0.056	3.903	0.000	0.110	0.331	83.502	0.219	0.056	3.942	0.000	0.110	0.328	88.802
Interaction	Schooltype	0.004	0.004	0.812	0.417	-0.005	0.012	1.387	0.000	0.003	0.166	0.868	-0.005	0.006	0.176
	Mother tongue	-0.006	0.006	-0.992	0.321	-0.017	0.006	-2.188	0.002	0.007	0.348	0.728	-0.011	0.016	0.949
	Books	0.000	0.002	-0.046	0.964	-0.005	0.004	-0.039	0.000	0.001	0.045	0.964	-0.002	0.002	0.020
	Edu mother	0.006	0.005	1.202	0.229	-0.003	0.014	2.088	-0.002	0.004	-0.454	0.650	-0.010	0.006	-0.734
	Edu father	-0.002	0.003	-0.582	0.560	-0.007	0.004	-0.623	0.000	0.002	0.079	0.937	-0.003	0.003	0.050
	Cognition	-0.003	0.004	-0.619	0.536	-0.011	0.006	-1.030	-0.002	0.003	-0.565	0.572	-0.008	0.004	-0.729
	Stereotypes	0.004	0.031	0.132	0.895	-0.058	0.066	1.576	0.012	0.034	0.343	0.732	-0.055	0.078	4.697
	Age fin. discussion	-0.012	0.009	-1.348	0.178	-0.029	0.005	-4.521	-0.014	0.009	-1.652	0.098	-0.031	0.003	-5.709
	TPB	0.006	0.006	1.039	0.299	-0.005	0.017	2.265	0.010	0.007	1.371	0.170	-0.004	0.025	4.165
	Fin. matters at home	-0.001	0.007	-0.155	0.877	-0.015	0.013	-0.416	0.010	0.008	1.175	0.240	-0.006	0.026	3.920
	Bank acc.	0.001	0.002	0.435	0.664	-0.003	0.005	0.345	0.001	0.002	0.409	0.682	-0.003	0.004	0.287

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**proportion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**proportion of overall gap (%)**
	Job	0.000	0.001	0.317	0.751	-0.002	0.003	0.149	0.001	0.002	0.359	0.719	-0.003	0.005	0.297

Note: The table displays results of a threefold Oaxaca Blinder decomposition. Standard errors are clustered.

Figure A2. Decomposition results of the gender gap in economic literacy including all variables



Note. The figure displays threefold Oaxaca Blinder decomposition results. Error bars represent 95% confidence intervals. The model includes the controls *age*, *school type*, *mother tongue*, *books at home*, *education of mother and father* and *cognition*. Standard errors are clustered.

Table A7. Decomposition results of the gender gap in economic literacy including all variables.

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap**
Overall	Group 1 (male)	0.253	0.048	5.226	0.000	0.158	0.348		0.218	0.041	5.384	0.000	0.139	0.298	
	Group 2 (female)	-0.022	0.043	-0.505	0.613	-0.106	0.063		-0.035	0.038	-0.923	0.356	-0.109	0.039	
	Difference	0.275	0.043	6.455	0.000	0.191	0.358		0.253	0.042	5.999	0.000	0.170	0.336	
	Endowments	0.062	0.041	1.503	0.133	-0.019	0.142	22.460	0.089	0.037	2.369	0.018	0.015	0.162	35.074
	Coefficients	0.166	0.037	4.487	0.000	0.093	0.238	60.256	0.135	0.053	2.528	0.011	0.030	0.239	53.218
	Interaction	0.048	0.038	1.240	0.215	-0.028	0.123	17.284	0.030	0.050	0.590	0.555	-0.069	0.128	11.708
Endowments	Schooltype	0.004	0.005	0.942	0.346	-0.005	0.013	1.551	0.005	0.006	0.955	0.339	-0.006	0.017	2.146
	Mother tongue	0.007	0.004	1.756	0.079	-0.001	0.015	2.650	0.002	0.004	0.494	0.622	-0.007	0.011	0.870
	Books	0.001	0.006	0.089	0.929	-0.011	0.013	0.198	0.000	0.002	0.102	0.919	-0.004	0.005	0.090
	Edu mother	-0.005	0.004	-1.328	0.184	-0.012	0.002	-1.812	0.002	0.003	0.762	0.446	-0.003	0.007	0.801
	Edu father	-0.001	0.002	-0.540	0.589	-0.004	0.002	-0.297	-0.002	0.003	-0.641	0.521	-0.009	0.004	-0.858
	Cognition	-0.002	0.007	-0.344	0.731	-0.016	0.011	-0.887	-0.001	0.003	-0.371	0.711	-0.007	0.005	-0.443
	RTE	-0.047	0.014	-3.272	0.001	-0.076	-0.019	-17.212	-0.015	0.008	-1.934	0.053	-0.030	0.000	-5.968
	Math	0.086	0.016	5.396	0.000	0.055	0.117	31.195	0.064	0.016	4.099	0.000	0.033	0.094	25.244
	Interest	0.024	0.013	1.872	0.061	-0.001	0.049	8.731	0.050	0.015	3.362	0.001	0.021	0.080	19.960
	Competition	0.006	0.005	1.058	0.290	-0.005	0.016	2.018	0.003	0.003	1.008	0.313	-0.003	0.010	1.307
	Risk aversion	-0.020	0.006	-3.039	0.002	-0.032	-0.007	-7.155	-0.014	0.007	-2.178	0.029	-0.027	-0.001	-5.711
	Present bias	0.000	0.003	-0.070	0.944	-0.006	0.006	-0.075	-0.001	0.004	-0.173	0.863	-0.008	0.007	-0.269
	Self-efficacy	0.004	0.006	0.676	0.499	-0.008	0.017	1.584	0.014	0.006	2.242	0.025	0.002	0.026	5.535
	Stereotypes	0.002	0.018	0.113	0.910	-0.032	0.036	0.723	-0.003	0.022	-0.151	0.880	-0.046	0.039	-1.290
	Age fin. discussion	0.009	0.006	1.538	0.124	-0.003	0.021	3.411	0.007	0.006	1.099	0.272	-0.006	0.020	2.821
	TPB	-0.002	0.004	-0.431	0.666	-0.011	0.007	-0.701	-0.008	0.005	-1.508	0.132	-0.018	0.002	-3.125

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap**
	Fin. matters at home	-0.005	0.005	-1.020	0.308	-0.013	0.004	-1.674	-0.016	0.007	-2.508	0.012	-0.029	-0.004	-6.466
	Bank acc.	0.000	0.001	0.262	0.793	-0.002	0.003	0.122	0.000	0.000	0.056	0.955	-0.001	0.001	0.011
	Job	0.000	0.001	0.305	0.760	-0.001	0.002	0.089	0.001	0.002	0.545	0.585	-0.003	0.005	0.419
Coefficients	Schooltype	0.016	0.011	1.399	0.162	-0.006	0.038	5.735	0.003	0.008	0.358	0.720	-0.013	0.018	1.117
	Mother tongue	-0.006	0.024	-0.259	0.796	-0.053	0.040	-2.232	0.014	0.026	0.549	0.583	-0.037	0.065	5.622
	Books	-0.002	0.003	-0.609	0.542	-0.008	0.004	-0.652	0.001	0.002	0.426	0.670	-0.003	0.005	0.344
	Edu mother	-0.007	0.005	-1.499	0.134	-0.016	0.002	-2.552	0.001	0.005	0.185	0.853	-0.008	0.010	0.335
	Edu father	0.002	0.003	0.758	0.449	-0.003	0.007	0.732	0.000	0.003	-0.066	0.948	-0.007	0.006	-0.085
	Cognition	0.002	0.005	0.349	0.727	-0.008	0.012	0.652	0.003	0.007	0.379	0.705	-0.011	0.017	1.086
	RTE	0.006	0.008	0.787	0.431	-0.010	0.022	2.323	0.015	0.007	2.297	0.022	0.002	0.028	6.049
	Math	-0.006	0.007	-0.830	0.407	-0.021	0.008	-2.230	0.000	0.008	0.000	1.000	-0.016	0.016	-0.001
	Interest	-0.002	0.008	-0.325	0.745	-0.017	0.012	-0.889	-0.011	0.010	-1.133	0.257	-0.029	0.008	-4.268
	Competition	-0.001	0.003	-0.281	0.779	-0.006	0.005	-0.280	0.000	0.001	0.221	0.825	-0.001	0.001	0.048
	Risk aversion	-0.005	0.004	-1.129	0.259	-0.014	0.004	-1.809	-0.007	0.006	-1.141	0.254	-0.018	0.005	-2.621
	Present bias	-0.001	0.002	-0.501	0.616	-0.006	0.004	-0.442	-0.004	0.003	-1.264	0.206	-0.011	0.002	-1.675
	Self-efficacy	-0.003	0.004	-0.699	0.484	-0.011	0.005	-1.006	0.004	0.005	0.857	0.391	-0.005	0.014	1.644
	Stereotypes	-0.001	0.013	-0.040	0.968	-0.026	0.025	-0.189	0.000	0.017	0.019	0.985	-0.032	0.033	0.127
	Age fin. discussion	-0.001	0.003	-0.225	0.822	-0.007	0.006	-0.263	0.002	0.004	0.691	0.489	-0.004	0.009	0.960
	TPB	-0.002	0.002	-0.696	0.486	-0.006	0.003	-0.616	-0.001	0.002	-0.417	0.676	-0.005	0.003	-0.370
	Fin. matters at home	-0.011	0.013	-0.820	0.412	-0.036	0.015	-3.841	-0.022	0.015	-1.497	0.134	-0.052	0.007	-8.865
	Bank acc.	0.009	0.039	0.244	0.807	-0.067	0.086	3.452	0.021	0.041	0.502	0.616	-0.060	0.101	8.173
	Job	-0.001	0.005	-0.129	0.897	-0.011	0.009	-0.240	-0.007	0.006	-1.120	0.263	-0.019	0.005	-2.728
	Constant	0.178	0.054	3.280	0.001	0.071	0.284	64.604	0.122	0.058	2.102	0.036	0.008	0.236	48.326

		Test of Economic Competence							Test of Economic Literacy						
group.	**var.**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap (%)**	**Coef.**	**Std. Err.**	**tstat**	**pval**	**conf. low**	**conf. high**	**propor-tion of overall gap**
Interaction	Schooltype	0.005	0.006	0.928	0.353	-0.006	0.017	1.986	0.001	0.003	0.345	0.730	-0.005	0.007	0.399
	Mother tongue	-0.001	0.006	-0.258	0.796	-0.013	0.010	-0.536	0.003	0.006	0.542	0.587	-0.009	0.016	1.374
	Books	0.000	0.003	-0.089	0.929	-0.006	0.005	-0.088	0.000	0.001	0.100	0.920	-0.003	0.003	0.054
	Edu mother	0.006	0.005	1.251	0.211	-0.003	0.015	2.066	-0.001	0.004	-0.185	0.854	-0.008	0.007	-0.272
	Edu father	-0.001	0.002	-0.530	0.596	-0.005	0.003	-0.380	0.000	0.002	0.065	0.948	-0.003	0.003	0.044
	Cognition	0.000	0.001	-0.246	0.806	-0.002	0.001	-0.074	0.000	0.001	-0.269	0.788	-0.003	0.002	-0.133
	RTE	-0.008	0.010	-0.780	0.435	-0.028	0.012	-2.898	-0.019	0.009	-2.140	0.032	-0.037	-0.002	-7.582
	Math	0.015	0.017	0.860	0.390	-0.019	0.049	5.421	0.000	0.020	0.000	1.000	-0.040	0.040	0.001
	Interest	0.006	0.017	0.326	0.745	-0.028	0.039	2.009	0.024	0.021	1.161	0.246	-0.017	0.066	9.659
	Competition	-0.004	0.004	-0.997	0.319	-0.012	0.004	-1.410	0.001	0.002	0.303	0.762	-0.003	0.004	0.215
	Risk aversion	0.009	0.007	1.151	0.250	-0.006	0.023	3.108	0.011	0.010	1.164	0.245	-0.008	0.031	4.513
	Present bias	0.002	0.005	0.510	0.610	-0.007	0.012	0.899	0.009	0.006	1.423	0.155	-0.003	0.020	3.372
	Self-efficacy	0.007	0.009	0.713	0.476	-0.011	0.024	2.375	-0.010	0.011	-0.881	0.378	-0.031	0.012	-3.821
	Stereotypes	0.001	0.026	0.040	0.968	-0.051	0.053	0.385	-0.001	0.034	-0.019	0.985	-0.067	0.066	-0.259
	Age fin. discussion	0.002	0.007	0.226	0.821	-0.012	0.015	0.572	-0.005	0.007	-0.705	0.481	-0.020	0.009	-2.071
	TPB	0.005	0.006	0.799	0.424	-0.007	0.018	1.845	0.003	0.006	0.435	0.663	-0.010	0.015	1.089
	Fin. matters at home	0.005	0.007	0.803	0.422	-0.008	0.018	1.914	0.011	0.008	1.407	0.160	-0.004	0.027	4.456
	Bank acc.	0.000	0.001	0.180	0.857	-0.001	0.001	0.042	0.000	0.001	0.279	0.780	-0.002	0.003	0.125
	Job	0.000	0.001	0.126	0.900	-0.002	0.002	0.047	0.001	0.003	0.548	0.584	-0.004	0.006	0.544

Note: The table displays results of a threefold Oaxaca Blinder decomposition. Standard errors are clustered.