

Kaiser, Tim; Oberrauch, Luis; Seeber, Günther

Working Paper

Measuring Economic Competence of Secondary School Students in Germany

Suggested Citation: Kaiser, Tim; Oberrauch, Luis; Seeber, Günther (2019) : Measuring Economic Competence of Secondary School Students in Germany, ZBW – Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/202639>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Measuring Economic Competence of Secondary School Students in Germany

Tim Kaiser^{ab}, Luis Oberrauch^a, and Günther Seeber^a

^a *University of Koblenz-Landau*

^b *German Institute for Economic Research (DIW Berlin)*

Abstract

We introduce a test of economic competence for German-speaking secondary school students and provide evidence from a large-scale assessment with 6,230 students from grades seven to ten. The article presents the development and psychometric properties of the scale, as well as an investigation of predictors of economic competence. We find evidence of a gender gap favoring male students, lower scores for students with a migration background, and parents' socioeconomic background being a predictor of test performance. Additionally, we document sizeable differences between tracks, as well as gains in economic competence across grades in the order of magnitude of 0.06 to 0.2 standard deviations per year. The article concludes with perspectives on an impact evaluation of a curriculum reform introducing mandatory economic education in secondary school.

JEL-Classification: A21

Keywords: Economic competence, economic literacy, item response theory, school economics

September 2, 2019

Acknowledgements: We appreciate comments from seminar participants in Hamburg, Freiburg, Tübingen, and St. Louis. We thank Sarah Hentrich, Laura Körber, Tobias Rolfes, and Miguel Luzuriaga for their work during different stages of this project. Additionally, we would like to appreciate research assistance by Ngoc Anh Nguyen and Lena Masannek.

Funding: This work was supported by *Stiftung Wüth.*

Data availability: Data and code are available at <https://dx.doi.org/10.17605/OSF.IO/EMWYJ>

Günther Seeber, Professor of Economic Education, University of Koblenz-Landau, D-76829 Landau, seeber@uni-landau.de

Tim Kaiser ([corresponding author](#)), Junior Professor of Economics and Economic Education, University of Koblenz-Landau and German Institute for Economic Research (DIW Berlin), D-76829 Landau, Germany (ORCID: <https://orcid.org/0000-0001-7942-6693>); kaiser@uni-landau.de.

Luis Oberrauch, Research Associate, University of Koblenz-Landau, D-76829 Landau, Germany; oberrauch@uni-landau.de

Measuring Economic Competence of Secondary School Students in Germany

1 Introduction

Living in a globalized market-economy requires individuals to be equipped with a certain set of knowledge and skills in order to cope with complex life situations. Despite the increasing relevance of economic competence, high school economic education mandates in Germany have been very limited and virtually non-existing in the past (cf. Brückner et al. 2015a; Remmele and Seeber 2012). As a consequence, research on the level of economic understanding of high school students in Germany remains scarce while most of the evidence on the levels and determinants of economic literacy among the young comes from the U.S. (Allgood et al. 2015; Becker et al. 1990; Siegfried and Fels 1979; Walstad 2001). Recently, however, the federal state of Baden-Württemberg has passed a curriculum reform introducing mandatory economic education as a separate school subject from grades 7 to 10 for all general education school types. Against this backdrop, our paper introduces a newly developed test of economic competence for pre-college students in German-speaking countries and discusses results from the first representative large-scale assessment of economic competence in Southwest Germany covering the grades seven to ten in all general education secondary school types. Our dataset includes test results from over 6,200 students that have not yet been exposed to mandatory economic education in school.

The results of our tests show correlations between socio-economic variables and the test score. These results confirm former studies on economic competence and literacy. We find a relevant gender gap in favor of male students as previous tests on economic and financial literacy did, starting with the ‘Test of Understanding in College Economics’ (Lumsden and Scott 1987) up to a recent competence test in German speaking Switzerland (Schumann and

Eberle 2014). Another significant factor predicting test scores is a migration background. In particular, when speaking a different language than German at home, students perform lower than their German speaking schoolmates. Additional relevant variables with a positive correlation to the test scores are the levels of self-reported competence in mathematics and reading, interest in economics, and the number of books at home. Our results also show an increase in test performance across school grades. The tracking system in Germany produces the strongest effect: students attending the *Gymnasium* – a school with the main goal to prepare for university – perform much better than students from other schools that end with secondary-one-level and typically prepare the students for vocational training.

This paper is structured into six further sections. Section 2 discusses economic education mandates in Germany and previous literature assessing facets of economic competence among German students. Section 3 describes the underlying competence model, the content of the administered competence test, and the process of item development. Section 4 describes our dataset. Section 5 discusses the psychometric properties of our measurement model and the empirical methods used to study variation in economic competence across grades, school-types, and observable student characteristics. Section 6 presents these results, and section 7 concludes with a discussion in the light of previous literature.

2 Context and Previous Literature

Economic education has traditionally not been part of school curricula in Germany. Despite the recent attention to the limited *financial* literacy of the young (see Lusardi and Mitchell 2014; Lusardi et al. 2010) and the OECD’s efforts to foster financial education in schools (e.g., OECD 2015), the federal states in Germany have long refrained from including economic aspects into school curricula. Germany did not participate in the PISA financial

literacy assessments of 2012 (OECD 2014) and 2015 (OECD 2017), and neither financial education nor economic education is taught as a separate subject: Personal finance is either covered as a part of “consumer education” – not taught in all school types and not as an own subject – or as part of a broader defined “economic education” that, so far, has been – depending on the specific federal state – integrated into school subjects such as civic education, political science, or geography. These school subjects usually focus on a systemic and social perspective (as opposed to the existing personal financial education mandates in the U.S., which focus on individual financial decision making). As a consequence of this heterogenous implementation of economic aspects into school subjects in Germany, no generally accepted content standards or core curricula exist.

The first German federal state to establish *economic education* as a mandatory subject in all types of general education secondary schools is Baden-Württemberg (Ministerium für Kultus, Jugend und Sport Baden-Württemberg 2016). New curricula in Germany are, independent from school type and domain, no longer content-, but competence-oriented (Weinert 2001). The curriculum of the newly introduced school subject, thus, focuses on competence goals defining learning outcomes for each grade. The underlying competence model of this curriculum is described in Retzmann et al. (2010) and Retzmann and Seeber (2016), and we highlight key characteristics of this conceptual model in the discussion of the test content and item development in the following section 3.

Since the school curriculum defines desired learning outcome as a domain-specific competence rather than knowledge of domain-specific content, we are unable to rely on the existing knowledge tests, such as the German version of the “Test of Economic Literacy” (TEL) (Beck and Krumm 1994; Soper and Walstad 1987; Walstad et al. 2013) to assess the level of economic competence of students. To date, the German version of the TEL is the most used instrument to assess economic knowledge of German school (and first-year university) students

(Happ et al. 2016, 2018; Müller, Fürstenau, and Witt 2007; Sczesny and Lüdecke 1998). Studies on university students have also used the German version of the “Test of Understanding of College Economics” (TUCE) (Brückner et al. 2015a, 2015b; Happ et al. 2016, Walstad and Rebeck 2008). Additionally, studies on *financial literacy* among high school and (first-year) university students have employed German versions of the “Test of Financial Literacy” (TFL) (Förster et al. 2017; Happ and Förster 2018;) and other tests that are primarily geared towards adults (e.g., Erner et al. 2016)¹.

A number of earlier tests and surveys have analyzed the influence of various variables on test scores. In line with Piaget’s structural-genetic approach some studies found a strong correlation between cognitive maturity and economic understanding (Berti and Bombi 1988; Furnham and Lewis 1986). Especially in childhood and adolescence, age is an essential predictor of economic knowledge and appears to be more important than early experiences in economic matters (Hutchings et al. 2002). Even adults perform better with increasing age (Gleason and Scyoc 1995), albeit most studies show an inverse-u-shape pattern between age and test scores (Lusardi and Mitchell 2014).

Another recurring result of many studies is the measurement of a gender gap. Women score significantly lower in economic knowledge and competence tests than men (Heath 1989). In Germany, the widely used translation of the Test of Economic Literacy (TEL) consistently produces worse results for female test persons (Müller et al. 2007; Sczesny and Lüdecke 1998). While the sources of the gender gap have not been adequately understood, to date, researchers have made sure to address potential measurement error resulting in worse performance for females. Walstad and Robson (1997) identified six items within the TEL discriminating female

¹ In addition, there are earlier studies from German-speaking countries aspiring to measure aspects of economic competence or knowledge (e.g., Würth and Klein 2001, Schumann and Eberle 2014, Macha, 2015). However, these studies are generally not available in English and focus on different conceptual models of economic competence. Additionally, raw data and items used in the performance tests have not been made publicly available, to date.

persons. After eliminating these items, the performance gap decreased but it still existed on a lower level. Global tests on financial literacy also found the gender gap in favor of men (Bucher-Koenen and Lusardi 2011; Bucher-Koenen et al. 2016; Erner et al. 2016; Grohmann 2016; Lusardi and Mitchell 2009). Recent competence tests in German speaking countries find the gap, as well (Schumann and Eberle 2014; Seeber et al. 2018). The first PISA-study on financial literacy (OECD 2014) provides evidence of disparate performance differences: In the aggregate the gender gap is not significant, but the distribution of tested persons on the different competence levels show relevant gender disparities.

Another factor of relevance is a migration background of students. Both PISA-assessments found a gap in favor of students without a history of migration (OECD 2014, 93; OECD 2017, 33). In 2015, these students performed 26 score points better in financial literacy “than immigrant students of similar socio-economic status” (OECD 2017, 33).

Further relevant explanations of score differences documented in several studies are: the socio-economic and educational background of parents (e.g., NCES 2006; OECD 2014), the performance in math and reading (e.g., Erner et al. 2016, 102; OECD 2017, 84), and experience with economic matters (e.g., Leiser and Ganin 1996; OECD 2014, 89).

A last relevant factor is due to the school system in German speaking countries that tracks students after leaving primary school on the basis of an estimated learning potential. All tests on financial and economic literacy or competence point in a similar direction: Students who attend the highest track perform better than students of the same school grade attending other school types (e.g., Seeber et al. 2018; Macha 2015; Schumann and Eberle 2014; Müller et al. 2007; Würth and Klein 2001).

While most of the above-mentioned tests generally document deficits in economic *knowledge* among school students and are suitable to study the variation in economic knowledge of the young, they are not suitable to assess progress in learning in economic

competence. Thus, we develop a measure of economic competence that is more closely aligned with the desired competence goals as learning outcomes. The following section introduces the underlying conceptual model of economic competence that serves as the starting point in defining the test content and guiding the development of test items.

3 Content and Item Development

The basis for the content of the test follows from the conceptual model of economic competence underlying the economic education curriculum in Baden-Württemberg. This conceptual model defines economic competence as the ability to act and decide adequately in economically shaped life situations (see Remmele and Seeber 2012; Retzmann and Seeber 2016; Retzmann et al. 2010). The reference to life situations in defining learning goals has a long tradition in the German debate on the subject specific pedagogy of school economics. This definition includes the willingness and motivation to apply the competence in problem solving. To specify individual requirements in competence and to be able to operationalize test items, it is necessary to define the relevant life situations. The authors of the conceptual competence model differentiate three roles to represent, economically shaped life situations (Retzmann et al. 2010, 7): individuals as *consumers* of goods and services, individuals as wage- or self-employed *income earners*, and individuals as tax paying and voting economic *citizens*. The model encompasses three areas of economic competence referring to the overall goals of general education, “i.e., enabling students to act autonomously, responsibly and appropriately [...] (Remmele and Seeber 2012, 196).” Each of these areas, that are co-present in economically relevant life situations, is identified by three domain-specific competences one should possess in order to meet fundamental requirements in economically shaped life situations (i) *Decision-making and rationality*: Individuals make economically reasonable decisions while pursuing

their own legitimate interest. (ii) *Relationships and interaction*: Individuals recognize and consider the economic interests of others in social interactions. (iii) *System and order*: Individuals understand economic mechanisms and economic core concepts as well as the corresponding institutions of political order.

Combining competence areas and life situations leads to a matrix that comprises contextually assigned competences (see Table 1). The conceptual idea of competences is that these are "prerequisites for meeting complex demands" (OECD 2001, 6). "Practice may be specific, but competences are generally linked to the individual and not to the specific situation in which they are required" (Retzmann and Seeber 2016, 14). Individuals apply similar competences in varying situations. Table 1 presents the economically relevant life-situations. The definition of three competence areas leads to competence requirements with different perspectives of social aggregation (individual, group, and societal level). The table shows the main categories of economic competence, three in each area².

[Table 1 near here]

The table describes cognitive competences, i.e., procedural and declarative knowledge, as well as well-informed and reasonable judgments. Our test of economic competence, thus, aims at measuring cognitive abilities. Nevertheless, by definition, competence also comprises volitional, social and motivational aspects of problem solving in various situations (Weinert 2001)³.

² The authors of the model subdivided these into three further competence requirements each (Retzmann et al. 2010, 10). The table's structure reflects the understanding of competence as independent from concrete practice by writing the requirements across the life situations. That is the reason why our test of economic competence does not need to allocate the same number of test items to all defined life situations.

³ Previous competence assessments in German-speaking countries typically use Weinert's definition and reduce the motivational and volitional aspect to an inquiry in interest on economic issues (e.g., Schuman and Eberle, 2014). We complement the measure of cognitive competencies with an elaborate scale on interest in economics and attitudes toward economic phenomena.

Even though the competence model has influenced various school curricula in the past, no common content standards or recognized core curricula in school economics exist. However, the authors of the model underlying our test define competence standards as outcome requirements for different school grades and, thus, present an adequate framework for item development (Retzmann et al. 2010, 25ff.). In addition, we analyzed five different school curricula implemented in three different federal states to identify economic core concepts and contexts. A last source of inspiration for content development is a published concept of school economic education with a detailed proposal for curriculum contents (Kaminski, Eggers, and Burkhard 2008). We extracted requirements for grade 7 to 10 out of the school curricula, and standards for grades 9 and 10 out of the two other documents. Next, we looked for overlapping contents to identify topics marked as relevant in the majority of the considered sources and created at least two items on these obviously important topics. The three topics named in all documents are market-forces and prizes, structural change, and cashless payment transactions.

Next, we allocated all of the identified topics to life situations in the competence model. We developed three types of items in the style of the PISA financial literacy test (OECD 2014, 34ff.): selected response items (SR), constructed response with objective scoring items (CROS), and constructed response with subjective scoring items (CRSS). All items started with a short vignette describing the task. We included some items not developed by us or slightly adapted items from other assessments for our purpose. We adopted the three most used on financial literacy (e.g., Lusardi and Mitchell 2014) as well as an item (invoice) from the PISA financial literacy test (OECD 2014, 44). These are not part of our core test (Appendix B). We adapted two items from National Assessment of Educational Progress (NAEP) with the Question IDs “2012-12E5#16” and “2012-12E5#17” which are included in the final scale (items number 8 and 16, Appendix B).

We piloted a first draft of a set of 30 items in an explorative pre-test with one class of grade 9 in order to get an early insight in items' discriminatory power. Next, we developed a set of 166 items. Three academic experts in economic education evaluated our items qualitatively with regard to domain-specific content validity and item difficulty (for a timeline of our validation strategy see appendix figure A1). The validation exercise led to a revision of items and to the exclusion of 47 items deemed unsuitable. In November 2015, we piloted the remaining 119 items (75 SR, 7 CROS, 37 CRSS) with 223 students from eleven different classes of all school types from grade 9 to 11. Using item response theory, we scaled the items with the 1PL model (Rasch-model). Finally, we conducted a second pilot with 92 students in February 2016. The pilot included those items that had been revised, because distractors showed no acceptable discriminatory power, or the wording of the context description seemed not to be precise enough. We included 22 of the earlier items in an unchanged version to serve as anchor items.

In a next step, we evaluated the psychometric quality of items using different criteria. For example, item-total correlation needed to be above 0.2 (Ebel and Frisbie 1991; OECD 2014), INFIT and OUTFIT values needed to be between 0.8 and 1.20 (Wright and Linacre 1994; OECD 2014) and the absolute value of the Q3-statistics had to be smaller than 0.3 (Monseur et al. 2011). After further removing items with non-acceptable values, we selected 57 items to be included in the main cross-sectional study in May/June 2016.

After the cross-sectional assessment of students in grades 7 to 10, we began collecting repeated cross-sections and panel-data in a longitudinal study starting with 7th grade students in the school year of 2017/2018 (see also Oberrauch and Kaiser 2018 and timeline in Figure A1)⁴. We developed 12 new items with lower difficulty-levels to be included in this longitudinal

⁴ This ongoing large-scale longitudinal assessment follows students of the last cohort without mandatory economic education and the following cohort (the first cohort with mandatory economic education) until the end of 10th grade to estimate the impact of economic education on economic competence, attitudes, and behavior.

assessment in order to have a larger set for these younger students. Thus, we repeated the described validation process for this combined set of 30 items, and also conducted one in-depth “think-aloud-test” with three 7th grade school students. The items employed in the cross-sectional study and the lower-difficulty items developed for the longitudinal-study form the basis for our comprehensive “test of economic competence” (TEC).

We aspired to develop items covering all competence areas and life situations. Yet, the distribution of items in the final scale is not in a perfect balance due to the limitations of the curricula and educational standards used as sources in the item-development. Out of the 31 items of the final scale, 9 items are framed to be within the life-situation as a “consumer“, 12 items fall within the life-situation as “earner of wage income or income from self-employment“, and 10 items are framed to refer to the life-situation as a “citizen“. Since we model economic competence as a one-dimensional construct, however, perfect balance across life-situations (and competence areas) is not a necessary condition for construct validity of the test.

[Table 2 near here]

The relative frequency of items within competence areas in our final version of the “TEC”, i.e., items that determined the results after all validation processes, are shown in Table 2. The allocation to competence areas is a reflection of a subject’s perspective: personal action, interacting with others or as a group, judging as an observer: 7 items belong to the competence area „decision and rationality (D+R)“, 6 items fall within the competence area „relationships and interaction (R+I)“, and 18 items are in the area of „system and order“ (S+R). Due to the sources of our item development process, there is a predominance of the competence area „System and Order “. Curricula and competence requirements in Germany appear to focus more on a systemic and/or social view than, e. g., on everyday situations as an employee or as a

consumer. Our item selection reflects the relative weights of content areas within competence-oriented curricula, and thus, contributes to content-validity. The next section describes the sampling procedure and statistical validation of our performance test.

4 Sampling and Descriptive Statistics

The aggregated student-level data consist of representative samples from the above-mentioned cross-sectional competence study (Seeber et al. 2018) and two waves from the ongoing longitudinal study, leading to a total sample size of 6,230 school students ranging from grade 7 to 10 (see timeline in appendix Figure A1). The sampling of all three samples follows the same procedure: First, we partition the whole population of interest, i.e., all students in the respective grade visiting a public school in the German federal state of Baden-Wuerttemberg, into subgroups by school type and the degree of urbanization (see also Oberrauch and Kaiser 2018). Next, we follow a two-stage cluster sampling procedure with selection of schools in the first stage and a random selection of one class per school in the second stage. The number of schools in each stratum is adapted to the proportions of strata in the target population. Beside these explicit stratification variables, we use school size as an implicit stratification variable. To avoid overrepresentation of schools, we size strata and deploy systematic sampling using sampling intervals in each stratum. Within the IRT analysis, we compensate remaining disproportionalities by means of design weights calculated by the inverse of student selection probability. The final sample consists of 6,230 students in 315 schools. Within the three competence studies, we surveyed basic demographics at the individual level as well as school characteristics at the cluster level.

Table 3 shows summary statistics of the final sample. The dependent variable *WLE* denotes the estimated person ability from the one-parametric IRT-Model and *WLE.500* denotes its transformation to a mean of 500 with standard deviation of 100 as commonly used in

educational large-scale assessments. We define migration background *mig* as at least one of the student parents having been born abroad. In our sample, 39 percent of students show a migration background. Moreover, we ask students about their primary language in their childhood represented by variable *native*. 64 percent in our sample spoke *German*, 25 percent spoke German and another language (*bilingual*) and 11 percent spoke a foreign language (*non-native*). In terms of socio-economic background represented by the variable *book*, we asked students how many books (excluding schoolbooks and magazines) are available in their household on a scale from 1 (none) to 6 (several bookshelves). The variable shows a mean value of 3.53 with a standard deviation of 1.62. We control for students' school performance by asking for self-reported reading capabilities (*selfread*) ($M = 3.87$, $SD = 0.74$), mathematical capabilities (*selfmath*) ($M=3.47$, $SD = 0.93$) and general school performance (*selfall*) ($M=3.61$, $SD=0.68$) all on a scale from 1 (low) to 5 (high). In addition, we asked participants about their interest in economics (*interesteco*) ($M=2.49$, $SD=0.77$) and their opinion about the importance of economic knowledge (*interestimp*) ($M=3.02$, $SD=0.73$).

[Table 3 near here]

Labor income is captured by asking participants if they have a student's job (*ownsalary*). In order to assess correlations between economic competence and financial experience, we ask students whether they have a bank account and ATM card, and also how often they use both on a scale from 1 (never) to 7 (daily). Due to the collinearity of all four variables, we create a standardized summary index of all four components (*bank exp*) based on the method described in Kling et al. (2007). The mean survey duration (*interview time*) is 32.05 minutes ($SD=12.41$).

At the school level, 50 percent of sampled students are visiting the 7th, 22 percent the 8th, 13 percent the 9th and 15 percent the 10th grade. In terms of school type, 39 percent visit the

most sophisticated school type (*GYM*) while 50 percent visit the lower tier school types (*RS* and *WS*). 11 percent attend the recently introduced comprehensive school type (*GMS*). Further variables at the school level are *school size* (on average 653 students, $SD=221.5$), the percentage of students within one class who didn't speak German as primary language in their childhood (*% non-natives/class*, $M=34.51$, $SD=19.7$) and the degree of urbanization (*urbanization*) ($M=2.03$, $SD=0.84$) on a scale from 1 (low) to 3 (high).

5 Model and Methods

Item analysis is based on Item Response Theory (IRT) where manifest item responses attribute to a latent ability indicating a probabilistic relationship between person ability level and solving an item correctly. One key requirement for conducting an IRT analysis is the unidimensionality of the measured construct, which means all items measure the same latent ability. In all three studies, principal component analysis revealed eigenvalues from 7.27 to 10.42 for the first component, which accounts for 22.04 to 22.17 percent of total variance. Eigenvalues for the second component ranged from 1.63 to 2.45, which suggests the dominance of the first components and thus the unidimensionality for the single scales as well as the combined scale. Another important criterion is the local independence of item responses, which implies these must only correlate due to the underlying ability. By keeping the underlying ability constant, Q3 statistics (Yen 1984) showed a mean residual correlation of -0.04 ($SD=0.03$). With regard to reliability, Cronbach's alpha (Cronbach 1951) ranges from 0.79 to 0.81 in all three studies indicating a consistent measure of economic competences.

5.1 Item Response Theory

Compared to using raw sum scores, one main benefit of IRT models lies in the sample independency. Since individual students are not confronted with the entire item battery, the number of observations differs across items. Moreover, we implemented computer adaptive

testing (CAT) in the cross-sectional competence study (Seeber et al. 2018). We addressed these issues by means of the one-parameter logistic model (Rasch model; Rasch 1960), which makes estimated item statistics despite sample size disparities comparable (specific objectivity). The 1-PL Rasch Model is defined as

$$P(X_j = 1 | \theta_v, \sigma_i) = \frac{\exp(\theta_v - \sigma_i)}{1 + \exp(\theta_v - \sigma_i)} \quad (1)$$

θ_v represents the ability of person v and σ_i the difficulty of item i on a common logit scale. Item calibration follows the MMLE method (*Marginal Maximum Likelihood Estimation*) (Bock and Aitkin 1981). For evaluation of item fit, we use weighted mean square residuals (INFIT) as well as the unweighted fit (OUTFIT) (Wright und Panchapakesan 1969). Values close to 1 indicate good model fit while misfit thresholds suggestions range from 0.5 to 1.5 (Ames und Penfield 2015; Ayala 2009). Item discrimination is assessed by the point biserial correlation between estimated person abilities and item response (corrected item total correlation). Table 4 shows results for the one parametric IRT model, where *Freq* represents the percentage of correct response, *rit_c* corrected item total correlation, and σ the estimated item difficulty. EAP-Reliability was 0.74.

[Table 4 near here]

With regard to item discrimination, corrected item total correlations range from 0.19 to 0.47 which suggests sufficient overall internal consistency of the measurement scale. Item fit indices range within narrow threshold suggestions. The distribution of person abilities along with item difficulties (wright map) is shown in Figure A2 in the Appendix.

As most of the items are presented in a multiple-choice format, one may be concerned that test instrument may be prone to guessing behavior. Also, some items, especially those with

graphs or more sophisticated instructions, could be affected by inattention of high ability participants. The four parameter IRT model (Barton and Lord 1981) takes both potential issues into account by including a guessing and an inattention parameter that graphically represent a lower and upper asymptote of the item characteristic curve. As the commonly used fit index ($S - \chi^2$) (Orlando and Thissen 2003) cannot be computed with high amounts of missing responses (as is always the case in adaptive testing), we compare IRT model fit using G^2 (McKinley and Mills 1985) and χ^2 (Yen 1981) statistics. In [Table A2](#) in the appendix the IRT model with four parameters shows the most significant ($p < 0.01$) deviations from model predictions (6 for both indices) while the model with two parameters (Birnbaum 1968) merely shows two (χ^2) and three (G^2) deviations. Comprehensive G^2 and χ^2 statistics are listed in supplementary [Table A3](#). Although there are just slight differences in deviations across IRT models with one to four parameters, results need to be viewed with caution. Both indices rely on (potentially biased) person ability estimates, which might result in invalid item fit statistics (Ames and Penfield 2015). For test applicators without sample size disparities across items, we recommend using a fit statistic based on observed summated scores. Moreover, we provide parameter estimates from all four IRT models in [Table A1](#).

5.2 Differential Item Functioning and Convergent Validity

In order to ensure test fairness and construct-validity, we examined differential item functioning (DIF) among certain subgroups. One reason for the occurrence of DIF may be the unintentional measurement of additional abilities, which are distributed unevenly among subgroups. Within an IRT context, an item displays DIF when students with the same ability level have different probabilities of solving the item correctly (Lord 1980; Thissen et al. 1993). Thereby we scaled subgroups separately and tested the estimated parameters for statistical

differences (Dorans and Holland 1992). As DIF statistics often are subject to interpretation difficulties, we follow the common classification from Educational Testing Services (Zieky 1993). The ETS approach transforms the Mantel-Haenszel odds ratio α_{MH} to the logistic definition of the delta scale using the formula specified in Holland and Thayer (1986), $\Delta - DIF_{MH} = -2.35 \ln(\alpha_{MH})$. Based on effect size and significance, DIF is then classified into three categories, where $\Delta - DIF_{MH}$ assesses effect size and Mantel-Haenszel statistics MH_{χ^2} (Mantel and Haenszel 1959) evaluates significance by following a χ^2 -distribution. Table A4 shows thresholds for all three DIF categories (e.g., Zwick 2012).

We conducted DIF analyses by means of four different split criteria (gender, migration background, mother tongue, and books at home). Variables with more than two categories were dichotomized. Table 5 shows significance levels represented by MH statistics, DIF magnitude represented by transformed odds ratios and their classification into the ETS scheme for all four DIF categories.

[Table 5 near here]

Results show for split criterion *migration status* negligible DIF, while for split criterion *mother tongue* only one item shows statistically significant effects with negligible magnitude (category B) to the disadvantage of the focal group non-native speakers. With regard to socio-economic background, two items show moderate disadvantages for participants with up to 100 books at home. For split criterion *male* four moderate DIF effects with different signs were detected. In essence, most items show non-significant DIF (category A) while no item shows strong DIF (category C) indicating overall test fairness of the TEC.

With regard to convergent validity, we analyze correlations to other common economic capability measures. Within our ongoing longitudinal study, we assigned a reduced item set of

the Test of Economic Literacy (TEL; Soper and Walstad 1987, translated by Beck and Krumm 1994) to a subsample of 8th grade students and a common economic knowledge test to 9th grade students. This test includes questions about the unemployment rate in Germany or about the required minimum age to take out a loan. Supplementary [Figure A4](#) shows correlations between person ability estimates from these two measures and the Test of Economic Competence (TEC). The analysis reveals meaningful correlations with the knowledge test ($r = .513, p < .01$) as well as with the TEL ($r = .431, p < .01$) indicating a satisfactory relation to a well-established measure of economic capabilities. The remaining unexplained variance may be attributed to the additional focus on judgment and problem solving in economic shaped life situations within the TEC scale.

5.3 Missing Data

Since participation in the competence-assessment is voluntary, the analysis of missing values reflects possible reasons and consequences from *item* nonresponse. We are not able to observe reasons for denying participation in the competence assessment (i.e., unit-nonresponse). We generally exclude participants with more than 50 percent missing data in the competence measure from our analyses. For all other respondents, we deal with missing values by implementing various procedures based on variable type. In educational large-scale assessments missing values in the test can either be coded as “not available” (missing) or “wrong” (0). Both approaches have drawbacks: In the former, non-responses are treated as ignorable, i.e., as if participants had no opportunity to solve the item in the first place. This method potentially leads to the overestimation of ability estimates, since non-response could signal the inability to solve the item correctly. The latter approach violates IRT assumptions as every missing is determined to be zero (i.e., incorrectly solved) in advance. This method leads to an underestimation of the levels of competence since the item-nonresponse does not

necessarily have to reflect inability to solve an item correctly. As the latter approach tends to show more statistical bias (e.g., Rose et al., 2010), we set omissions in competence items as “not available”. Additionally, we employ a multiple imputation method in order to correct for measurement error in the estimated latent competence measures from the IRT model (plausible values) (Wu 2005). This approach handles the unknown standard errors of estimated values of the latent trait (competence) as missing values and imputes them in from predicted values of a latent regression model (see also Oberrauch and Kaiser 2018). Next, we account for nonresponse in the student-level covariates, since nonresponse correlates significantly with competence measure (see [Table A4](#) in Appendix A) and ignoring this pattern would lead to severe biases in our estimates. We address this issue by employing multiple imputation by chained equations (MICE, van Buuren and Oudshoorn 2000).

5.4 Regression Model

We analyze predictors of economic competences by means of a random-intercept regression model, which accounts for the nested structure of the data. The model takes the form

$$\theta_{i,j}^{PV} = \beta_{0,j} + \beta_{i,j}X_{i,j} + \varepsilon_{i,j}^* \quad (2)$$

$\theta_{i,j}^{PV}$ represents the competence measure that is imputed and pooled from latent regression (plausible values) of participant i in school j . $\beta_{0,j}$ represents a composition of mean competence value γ_{00} and group dependent deviation $u_{0,j}$, i.e., $\beta_{0,j} = \gamma_{00} + u_{0,j}$. $X_{i,j}$ is a vector of predictors at the individual and school levels, and $\varepsilon_{i,j}^*$ represents clustered standard errors at the school-level. To account for sensitivity in model-selection, we choose the covariates to be included in $X_{i,j}$ by means of a LASSO-regression (see Appendix [Table A6](#)). All variables that we considered theoretically relevant have also been selected as predictors in this data-driven approach.

6 Results

Figure 2 shows the results of the random-intercept regression with a total sample size of 6,230 students, as specified in equation 2. The coefficient estimates are non-standardized, and the results are reported on the economic competence scale with mean 500 and a standard deviation of 100. All continuous variables have been centered around the mean, in order to ease the interpretation of the estimated intercept.

[Figure 2 near here]

We start with a discussion of relevant predictors at the student-level. We find that *males* achieve 16.82 point higher test score, on average, than *females*, migrants score 22.59 points lower than students without a migration background, and a one unit increase in the variable *book* (i.e., a proxy for the socio-economic status of the parents) is associated with an increase of 6.29 points. Thus, a one standard-deviation unit increase in the variable *book* is associated with an increase of 10.45 points (i.e., ten percent of a standard deviation) in economic competence. A one unit increase in self-reported student abilities in math (*selfmath*) and reading (*selfread*) are associated with a 10.39 and 14-point increase in economic competence, respectively. Thus, an increase of one standard deviation unit in self-reported math abilities is associated with an increase of 7.7 percent of a standard deviation in economic competence, and a one standard deviation unit increase in self-reported reading abilities is associated with an increase of 13 percent of a standard deviation in economic competence. Next, a one unit increase in *interestimp*, is associated with an increase of 9.14 points on the competence scale (i.e., a one-SD-unit increase in interest is associated with an increase of 6.8 percent of a standard deviation in economic competence). We include the total *time* (in minutes) spent on the survey model as a proxy for student effort on the test. We find that a one-minute increase in total survey

duration, is associated with a 2.02-point higher score (i.e., a one-SD-unit increase in total survey duration is associated with an increase in economic competence of 26 percent). Finally, students with prior work experience (*ownsalary*) score 5.54 points lower on the test.

Next, we investigate average differences between *grades*. In comparison to students in the 7th grade (omitted category), students in 8th grade score 12.35 points higher, and students in 9th grade score 17.17 points higher. Note that difference 4.82-point difference between 8th grade and 9th grade is not statistically significant. Students in 10th grade, however, score 39.73 points higher than students in 7th grade, 27.38 points higher than students in 8th grade, and 22.56 points higher than students in the 9th grade. In [Table A4](#) we look at heterogenous effects of gender by grade and find that the gender gap is especially evident among students in the higher grades. Additionally, we look at average differences across school types. In comparison to students in the comprehensive school type (*GMS*) (which is the omitted category in the regression), students in the lowest track school (*WS*) score, on average, 14.22 lower on the competence test. Students on the second lowest track (*RS*), however, score 14.46 points higher than students in the comprehensive school type and 28.68 points higher than the students in the lowest track (*WS*). Students in the highest track (*GYM*) score 59.04 points higher than the students in the comprehensive school type, 44.36 points higher than students in the second lowest track (*RS*), and 73.26 points higher than the lowest track school (*WS*). Other school-level covariates, such as the degree of *urbanization* and the proportion of non-native-speakers per class (*%non-natives/class*) show zero or relatively small effects, respectively. An increase of one percentage point of non-native-speakers per class is associated with a 0.27-point decrease in economic competence at the individual level.

7 Discussion

This paper has introduced a test of economic competence for German speaking students in secondary school grades seven to ten. The proposed test is characterized by adequate psychometric properties and non-differential item functioning with regard to gender and other observable student-characteristics, thus, enabling potential test users to employ the developed items in a range of (German-speaking) contexts. Researchers and practitioners may refer to Table 4 and Appendix B to choose items of different difficulties (σ). While the proposed scale includes items with a range of difficulties to accommodate children and youth of different ability levels (i.e., children from grade seven to ten), one may also choose to limit the number of items presented to the respondents to those with lower and medium difficulty (grade 7), or to medium to high difficulty (grade 10).

Using this test, we have revealed important predictors of economic competence among children and youth in Southwest Germany in the absence of formal instruction in economics in school. The results tend to confirm formerly explored tendencies with regard to different subgroups of tested students. We interpret these results as further indicating the validity of our measurement scale.

Specifically, we document differences in economic competence across grades that are in the order of magnitude of 6 to 20 percent of a standard deviation unit per year. The estimated difference between 7th graders and 8th graders amounts to about 0.12 SD units while the difference between 8th graders and 9th graders is estimated to be only five percentage points of a standard deviation and, thus, statistically insignificant. The difference between grades 9 and 10, on the other hand, is large and estimated to be about 20 percent of a standard deviation. Comparing these average differences across grades to results from longitudinal assessments in other domains such as math and reading achievement (Hill et al. 2008, p.173) shows that these results are about half the size of the annual gain in these domains. We attribute this difference in learning to the absence of specific learning opportunities since economics is not part of the

curriculum for the students in our sample, yet. Since the German system is characterized by early tracking of students into different ability tracks, we also note that some important differences between these school types exist. Students in the highest track (*Gymnasium*) outperform students in a comprehensive school type (with children of all ability levels) by almost 60 percent of a standard deviation. The difference between the lowest track (*Werkrealschule*) and the highest track amounts to three quarters of a standard deviation. And the difference between the mid-tier track (*Realschule*) and the highest track still amounts to almost 45 percent of a standard deviation. These large average differences are challenging, since the inequality in economic competence may not be easily addressed by making economic education mandatory. We hypothesize that a large fraction of this difference may be attributed to differences in the students' socio-economic background. Previous studies have shown that parental socio-economic status and the opportunity to discuss economic matters at home is a strong predictor of student abilities in the economic domain (Grohmann et al. 2015; OECD 2014, 2017; Shim et al. 2009, 2010, 2015). Student achievement in other domains in Germany is also strongly dependent on the socio-economic background of parents and the PISA results for Germany consistently show higher than the OECD average correlations between parental affluence and the students test results.

Next, we turn to a discussion of important student-level determinants. Specifically, we find that male students outperform female students by 0.16 standard deviation units, on average. This gender gap is less evident in the lower grades but increases to almost a quarter of a standard deviation by grade 10. This finding is generally in line with other international research on financial- and economic literacy among children, youth, and adults (e.g., Heath 1989; Davies et al. 2005; Lusardi and Mitchell 2008, 2014; Lusardi and Mitchell 2008; Bucher-Koenen and Lusardi 2011; Walstad 2013; Brückner et al. 2015a; Erner et al. 2016). The gender gap favoring male students is very similar in magnitude to the gender gap in mathematics achievement of

German students documented in PISA 2015 (cf. OECD 2016) and about two times the average gender gap across thirteen OECD countries participating in the PISA *financial literacy* assessment of 2012 (OECD 2014, p. 80). Other important student-level determinants include a proxy for the parents' educational background (number of books at home), a migration background of the student, and whether student's have prior work experience from student jobs. These results are all consistent with the interpretation that socio-economically disadvantaged students perform worse on the test.

Little is known about whether formal instruction in economics is able to reduce the gender gap and the gap between children of higher and lower socio-economic background. While the recent years have seen an increase of rigorous experimental and quasi-experimental impact evaluations of economic (and financial) education in schools (see Bruhn et al. 2016; Frisanco 2018, 2019; Cole et al. 2016; Brown et al., 2016; Urban et al. 2018; Kaiser and Menkhoff 2018) little is known whether differential treatment effects by gender or other observable student-characteristics exist. Our studied sample belongs to the last cohort of students without mandatory economic education. Thus, we are currently implementing a longitudinal assessment of students of the next cohort (with mandatory economics education) until the end of 10th grade to arrive at difference in difference estimates of the economic education impacts. The predictors of economic competence identified in this research, thus, serve as important variables regarding the investigation of heterogenous effects in response to mandatory economic education.

References

- Allgood, S., W. B. Walstad, and J. J. Siegfried. 2015. Research on Teaching Economics to Undergraduates. *Journal of Economic Literature* 53(2): 285-325.
- Ames, A. J., and R. D. Penfield. 2015. An NCME Instructional Module on Item-Fit Statistics for Item Response Theory Models. *Educational Measurement: Issues and Practice* 34(3): 39-48.
- Barton, M. A., and F. M. Lord. 1981. An upper asymptote for the three-parameter logistic item-response model. *ETS Research Report Series* 1981 1: i-8.
- Beck, K., and V. Krumm. 1994. Economic Literacy in German-Speaking Countries and the United States. Methods and First Results of a Comparative Study. In *An International Perspective on Economics Education*, ed W. B. Walstad, 183-201. Boston: Springer.
- Berti, A. E., and A. S. Bombi. 1988. *European monographs in social psychology. The Child's Construction of Economics*. New York, NY: Cambridge University Press.
- Birnbaum, A. 1968. Some Latent Trait Models and Their Use in Inferring an Examinee's Ability. In *Statistical theories of mental test scores*, ed. F. M. Lord and M. R. Novick, 397-479. Reading: Addison-Wesley.
- Bock, R. D., and Aitkin, M. 1981. Marginal maximum likelihood estimation of item parameters: Application of an EM algorithm. *Psychometrika* 46(4): 443-459.
- Brown, M., J. Grigsby, W. van der Klaauw, J. Wen, and B. Zafar. 2016. Financial Education and the Debt Behavior of the Young. *Review of Financial Studies* 29 (9): 2490–522.
- Bruhn, M., L. de Souza Leao, A. Legovini, R. Marchetti, and B. Zia. 2016. The impact of high school financial education: Evidence from a large-scale evaluation in Brazil. *American Economic Journal: Applied Economics* 8(4): 256–95.
- Brückner, S., M. Förster, O. Zlatkin-Troitschanskaia, and W. B. Walstad. 2015a. Effects of prior economic education, native language, and gender on economic knowledge of first-year students in higher education. A comparative study between Germany and the USA. *Studies in Higher Education* 40(3): 437–453.
- Brückner, S., M. Förster, O. Zlatkin-Troitschanskaia, R. Happ, W. B. Walstad, M. Yamaoka, and T. Asano. 2015b. Gender Effects in Assessment of Economic Knowledge and Understanding: Differences Among Undergraduate Business and Economics Students in Germany, Japan, and the United States. *Peabody Journal of Education* 90(4): 503–518.
- Bryk A. S., and S. W. Raudenbush. 1992. *Hierarchical Linear Models in Social and Behavioral Research: Applications and Data Analysis Methods*. Newbury Park, CA: Sage Publications
- Bucher-Koenen, T. and A. Lusardi. 2011. Financial Literacy and Retirement Planning in Germany. *Journal of Pension Economics and Finance* 10(4): 565–584.

- Bucher-Koenen, T., A. Lusardi, R. J. M. Alessie, and M. C. J. van Rooij. 2016. How financially literate are women? An Overview and new Insights. *Journal of Consumer Affairs* 51(2): 255-283.
- Colander, D., and J. Holmes. 2007. Gender and graduate economics education in the US. *Feminist Economics* 13(2): 93-116.
- Cole, S., A. Paulson, and G. K. Shastry. 2016. High School Curriculum and Financial Outcomes: The Impact of Mandated Personal Finance and Mathematics Courses. *Journal of Human Resources* 51(3): 656–698.
- Cronbach, L. J. 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16(3): 297-334.
- Davies, P., Mangan, J., and S. Telhaj. 2005. Bold, Reckless and Adaptable? Explaining Gender Differences in Economic Thinking and Attitudes. *British Educational Research Journal* 31(1): 29-48.
- de Ayala, R. J. 2009. *The theory and practice of item response theory*. New York: The Guilford Press
- Dorans, N. J., and P. W. Holland. 1992. Dif detection and description: Mantel-Haenszel and standardization. *ETS Research Report Series* 1992 1: i-40.
- Ebel, R. L., and D. A. Frisbie. 1991. *Essentials of educational measurement*. 5th ed. Englewood Cliffs, NJ: Prentice Hall.
- Erner, C., M. Goedde-Menke, and M. Oberste. 2016. Financial literacy of high school students: Evidence from Germany. *Journal of Economic Education* 47(2): 95–105.
- Förster, M., R. Happ, and D. Molerov. 2017. Using the U.S. Test of Financial Literacy in Germany—Adaptation and validation. *Journal of Economic Education* 48(2): 123-135.
- Frisancho, V. 2018. The Impact of School-Based Financial Education on High School Students and their Teachers: Experimental Evidence from Peru. *Inter-American Development Bank Working Paper No. 871*.
- Frisancho, V.. 2019. The Impact of Financial Education for Youth. *Economics of Education Review*, <https://doi.org/10.1016/j.econedurev.2019.101918>.
- Furnham, A., and A. Lewis 1986. *The Economic Mind. The Social Psychology of Economic Behaviour*, Brighton: Harvester.
- Gleason, J., and L. J. van Scyoc. 1995. A report on the economic literacy of adults. *Journal of Economic Education* 26: 203-210.
- Grohmann, A., Kouwenberg, R., and L. Menkhoff. 2015. Childhood roots of financial literacy. *Journal of Economic Psychology* 51: 114–133.

Grohmann, A. 2016. The gender gap in financial literacy: income, education, and experience offer only partial explanations. *DIW Economic Bulletin* 46: 531–537.

Happ, R., M. Förster, O. Zlatkin-Troitschanskaia, and V. Carstensen. 2016. Assessing the Previous Economic Knowledge of Beginning Students in Germany: Implications for Teaching Economics in Basic Courses. *Citizenship, Social and Economics Education* 15(1): 45–57.

Happ, R., O. Zlatkin-Troitschanskaia, and M. Förster. 2018. How Prior Economic Education Influences Beginning University Students' Knowledge of Economics. *Empirical Research in Vocational Education and Training* 10(1).

Happ, R., and M. Förster. 2019. The relationship between migration background and knowledge and understanding of personal finance of young adults in Germany. *International Review of Economics Education* 30: 1-14.

Hastings, J. S., B. C. Madrian, and W. L. Skimmyhorn. 2013. Financial literacy, financial education, and economic outcomes. *Annual Review of Economics* 5: 347–373.

Heath, J. 1989. An Econometric Model of the Role of Gender in Economic Education. *American Economic Review: Papers & Proceedings* 79(2): 226-230.

Hill, C. J., H. S. Bloom, A. R. Black, and M. W. Lipsey. 2008. Empirical Benchmarks for Interpreting Effect Sizes in Research. *Child Development Perspectives* 2(3): 172–177.

Holland, P. W., and D.T. Thayer. 1986. Differential item functioning and the Mantel-Haenszel procedure. *ETS Research Report Series* 1986 2: 1-24.

Hutchings, M., M. Fülöp, and A. van den Dries. 2002. Introduction: young people's understanding of economic issues in Europe. In *Young People's Understanding of Economic Issues in Europe*, ed. M. Hutchings, M. Fülöp and A. van den Dries, 1-16. Stoke on Trent: Trentham Books.

Kaiser, T., and L. Menkhoff. 2017. Does Financial Education Impact Financial Literacy and Financial Behavior, and If So, When? *World Bank Economic Review* 31(3): 611–630.

Kaiser, T., and L. Menkhoff. 2018. Financial Education in Schools: A Meta-Analysis of Experimental Studies, (CESifo Working Paper no. 7395).

Kaminski, H., K. Eggert, and K.-J. Burkard. 2008. Konzeption für die ökonomische Bildung als Allgemeinbildung von der Primarstufe bis zum Abitur. [Concept for Economic Education as General Education from Primary Schools to University-Entrance Diploma]. Bundesverband Deutscher Banken. Berlin.

Kling, J. R., J. B. Liebman, and L. F. Katz. 2007. Experimental analysis of neighborhood effects. *Econometrica* 75(1): 83–119.

Leiser, D., and M. Ganin. 1996. Economic Participation and Economic Socialisation. In *Economic Socialization. The economic Beliefs and Behaviours of Young People*, ed. P. Lunt and A. Furnham, 93–109. Cheltenham, UK: Edward Elgar Pub.

- Lord, F. M. 1980. *Applications of Item Response Theory to Practical Testing Problems*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Lumsden, K. G., and A. Scott. 1987. The economics student reexamined: Male-Female differences in comprehension. *Journal of Economic Education* 18(4): 365–375.
- Lusardi, A. and O. S. Mitchell. 2008. Planning and Financial Literacy: How Do Women Fare? *American Economic Review: Papers and Proceedings* 98(2): 413-417.
- Lusardi, A., and O. S. Mitchell. 2009. *How Ordinary Consumers Make Complex Economic Decisions: Financial Literacy and Retirement Readiness* (NBER Working Paper no. 15350). National Bureau of Economic Research. Cambridge, MA.
- Lusardi, A., O. S. Mitchell, and V. Curto. 2010. Financial Literacy among the Young. *Journal of Consumer Affairs* 44(2): 358–380
- Lusardi, A., and O. Mitchell. 2014. The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature* 52(1): 5–44.
- Macha, K. 2015. *Ökonomische Kompetenz messen. Theoretisches Modell und Ergebnisse der Economic Competencies Study (ECOS) [Measuring Economic Competences. Theoretical Model and Results of the Economic Competences Study (ECOS)]*. Berlin: LIT Verlag.
- Mantel, N., and W. Haenszel. 1959. Statistical aspects of the analysis of data from retrospective studies of disease. *Journal of the National Cancer Institute* 22: 719-748
- McKinley, R. L., and C. N. Mills. 1985. A Comparison of Several Goodness-of-Fit Statistics. *Applied Psychological Measurement* 9(1): 49-57.
- Ministerium für Kultus, Jugend und Sport Baden-Württemberg. 2016. Gemeinsamer Bildungsplan der Sekundarstufe I. Wirtschaft / Berufs- und Studienorientierung (WBS) [Combined Secondary I-Curriculum. Economics/Vocational Orientation]. Stuttgart. Accessed January 4, 2018. <http://www.bildungsplaene-bw.de/Lde/LS/BP2016BW/ALLG/SEK1/WBS>.
- Monseur, C., A. Baye, D. Lafontaine, and V. Quittre. 2011. PISA test format assessment and the local independence assumption. *Ieri Monographs Series. Issues and Methodologies in Large-Scale assessments* 4: 131–158.
- Müller, K., B. Fürstenau, and R. Witt. 2007. Ökonomische Kompetenz sächsischer Mittelschüler und Gymnasiasten [Economic Competence of Saxonian High School Students]. *Zeitschrift für Berufs- und Wirtschaftspädagogik* 103(2): 227–247.
- NCES (National Center for Education Statistics). 2006. *The nation's report card: Economics 2006*.
- Oberrauch, L. and T. Kaiser. 2018. Economic competence in early secondary school: Evidence from a large-scale assessment in Germany. Kiel: ZBW – Leibniz Information Centre for Economics.

OECD. 2001. *Definition and selection of competencies: Theoretical and conceptual foundations (DeSeCo)*, Background Paper, Revised December 2001. <http://www.oecd.org/education/skillsbeyond-school/41529556.pdf>.

OECD. 2014. *PISA 2012 Results: Students and Money. Financial Literacy Skills for the 21st Century*. Paris: OECD Publishing.

OECD. 2015. *National strategies for financial education. OECD/INFE policy handbook*. Paris: OECD Publishing.

OECD (2016). *PISA 2015 Results (Volume I): Excellence and Equity in Education*. Paris: OECD Publishing.

OECD. 2017. *PISA 2015 Results (Volume IV): Students' Financial Literacy*. Paris: OECD Publishing. <http://dx.doi.org/10.1787/9789264270282-en>.

Orlando, M. and D. Thissen. 2003. Further Investigation of the Performance of S - X2: An Item Fit Index for Use With Dichotomous Item Response Theory Models. *Applied Psychological Measurement* 27(4): 289-298.

Rasch, G. 1960. *Probabilistic models for some intelligence and attainment tests*. Copenhagen: Danish Institute for Educational Research

Remmele, B., and G. Seeber. 2012. Integrative Economic Education to Combine Citizenship Education and Financial Literacy. *Citizenship, Social and Economics Education* 11(3): 189-201.

Retzmann, T., and G. Seeber. 2016. Financial Education in General Education Schools: A Competence Model. In *International Handbook of Financial Literacy*, ed. C. Aprea, E. Wuttke, K. Breuer, N. K. Koh, P. Davies and B. Greimel-Fuhrmann, 9-23. Singapore: Springer.

Retzmann, T., G. Seeber, B. Remmele, and H.-C. Jongebloed. 2010. Educational Standards for Economic Education at All Types of General-Education Schools in Germany. Final Report to the Gemeinschaftsausschuss der deutschen gewerblichen Wirtschaft (Working Group „Economic Education“). Accessed January 4, 2018. <https://www.uni-koblenz-landau.de/de/landau/fb6/sowi/iww/team/Professoren/seeber/EducationalStandards>.

Robitzsch, A. 2019. sirt: Supplementary item response theory models. R package version 3.1-80.

Schumann, S., and F. Eberle. 2014. Ökonomische Kompetenzen von Lernenden am Ende der Sekundarstufe II [Economic Competence of Learners at the End of Secondary 2]. *Zeitschrift für Erziehungswissenschaft* 17(S1): 103–126.

Shim, S., B. L. Barber, and N. A. Card. 2010. Financial socialization of first-year college students: The roles of parents, work and education. *Journal of Youth and Adolescence* 39: 1457–1470.

- Shim, S., B. L. Barber, and A. C. Lyons. 2009. Pathway to life success: A conceptual model of financial well-being for young adults. *Journal of Applied Developmental Psychology* 30: 208–723.
- Shim, S., J. Serido, C. Tang, and N. Card. 2015. Socialization process and pathway to healthy financial development for emerging adults. *Journal of Applied Developmental Psychology* 38: 29–35.
- Siegfried, J. and R. Fels. 1979. Research on Teaching College Economics: A Survey. *Journal of Economic Literature, American Economic Association* 17(3): 923-969.
- Sczesny, C., and S. Lüdecke. 1998. Ökonomische Bildung Jugendlicher auf dem Prüfstand: Diagnose und Defizite [Economic Education of Youth on the Test Bench. Diagnosis and Deficits]. *Zeitschrift für Berufs- und Wirtschaftspädagogik* 94(3): 403–420.
- Seeber, G., L. Körber, S. Hentrich, T. Rolfes, and B. Haustein. 2018. *Ökonomische Kompetenzen Jugendlicher in Baden-Württemberg. Testergebnisse für die Klassen 9, 10 und 11 der allgemeinbildenden Schulen*. [Economic Competence among Adolescents in Baden-Württemberg. Results for Grades 9, 10, and 11 in General Education Schools] Künzelsau: Swiridoff.
- Soper, J. C., and W. B. Walstad. 1987. *Test of economic literacy. Examiner's Manual*. 2nd Edition. New York: Joint Council on Economic Education.
- Thissen, D., L. Steinberg, and H. Wainer. 1993. Detection of differential item functioning using the parameters of item response models. In *Differential item functioning*, ed. P. W. Holland and H. Wainer, 67-113. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Tibshirani, R. 1996. Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society* 58(1): 267–288.
- Urban, C., M. Schmeiser, J. Michael Collins, and A. Brown. 2018. The effects of high school personal financial education policies on financial behavior. *Economics of Education Review*. <http://doi.org/10.1016/j.econedurev.2018.03.006>
- Walstad, W. B. 2001. Economic Education in U.S. High Schools. *Journal of Economic Perspectives* 15(3): 195-210.
- Walstad, W. B. 2013. Economic Understanding in US High School Courses. *American Economic Review* 103(3): 659-63.
- Walstad, W. B., and D. Robson. 1997. Differential item functioning and male-female differences on multiple-choice tests in economics. *Journal of Economic Education* 28(2): 155–171.
- Walstad, W. B. and K. Rebeck. 2008. The Test of Understanding of College Economics. *American Economic Review* 98(2): 547-51.
- Walstad, W. B., K. Rebeck, and R. B. Butters. 2013. The Test of Economic Literacy: Development and Results. *Journal of Economic Education* 44(3): 298–309.

- Weinert, F. E. 2001. Concept of Competence: A Conceptual Clarification. In *Defining and Selecting Key Competencies*, ed. D. S. Rychen and L. H. Salganik, 45-65. Seattle, WA: Hogrefe & Huber.
- Wright, B. D., and J. M. Linacre. 1994. Reasonable Mean-Square Fit Values. *Rasch Measurement Transactions* 8(3): 370.
- Wright, B.D., and N. Panchapakesan. 1969. A Procedure for Sample-Free Item Analysis. *Educational and Psychological Measurement* 29(1): 23-48.
- Wu, M. 2005. The role of plausible values in large-scale surveys. *Studies in Educational Evaluation* 31: 114-128
- Würth, R., and H. J. Klein. 2001. *Wirtschaftswissen Jugendlicher in Baden-Württemberg. Eine empirische Untersuchung [Economic Knowledge of Youth in Baden-Württemberg. An Empirical Study]*. Künzelsau: Swiridoff.
- van Buuren, S. and K. Oudshoorn. 2000. *Multivariate Imputation by Chained Equations: MICE V1.0 User's Manual*, volume Pg/Vgz/00.038. TNO Prevention and Health, Leiden
- Yen, W. M. 1981. Using Simulation Results to Choose a Latent Trait Model. *Applied Psychological Measurement* 5(2): 245-262.
- Yen, W. M. 1984. Effects of Local Item Dependence on the Fit and Equating Performance of the Three-Parameter Logistic Model. *Applied Psychological Measurement* 8(2): 125-145.
- Zieky, M. 1993. Practical questions in the use of DIF statistics in test development. In *Differential item functioning*, ed P. W. Holland and H. Wainer, 67-113. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Zwick, R. 2012. A Review of ETS Differential Item Functioning Assessment Procedures: Flagging Rules, Minimum Sample Size Requirements, and Criterion Refinement. Educational Testing Service. *Princeton Research Report*, ETS RR-12-08.

Table 1: Competence areas and life situations

<i>Competence Areas</i>	<i>Life Situations</i>		
	Consumers	Earners	Citizens
A Decision-making and Rationality	⇒ analyze economically shaped situations ⇒ analyze and evaluate consequences of actions ⇒ recognize courses of actions		
B Relationships and Interaction	⇒ analyze and understand constellations of interest ⇒ analyze, shape and evaluate co-operations ⇒ analyze relationship structures		
C System and Order	⇒ analyze markets ⇒ analyze economic systems and regulatory orders ⇒ evaluate policies, and politics economically		

Table 2: Distribution of Items across Competence Areas and Life Situations

<i>Competence Areas</i>	<i>Life Situations</i>			<i>Row total</i>
	Consumers	Earners (incl. entrepreneurs)	Citizens	
A Decision-making and Rationality	2	5	0	7 (23%)
B Relationships and Interaction	4	4	0	8 (19%)
C System and Order	6	6	4	16 (58%)
<i>Column Total</i>	12 (39%)	15 (48%)	4 (13%)	31 (100%)

Table 3: Summary Statistics

	Obs,	Mean	Std. Dev.	Min	Max
<i>Student level</i>					
WLE.500	6,229	500	100	130.72	967.75
WLE	6,229	-0.01	1.05	-3.89	4.91
male	6,230	0.54	---	0	1
age	6,102	14.59	1.27	12	21
mig	5,958	0.39	---	0	1
mother tongue					
German	5,982	0.64	---	0	1
bilingual	5,982	0.25	---	0	1
non-native	5,982	0.11	---	0	1
book	5,947	3.53	1.62	0	6
selfread	6,225	3.87	0.74	1	5
selfmath	6,217	3.47	0.93	1	5
selfall	6,211	3.61	0.68	1	5
interesteco	6,158	2.49	0.77	1	4
interestimp	6,145	3.02	0.73	1	4
ownsalary	5,917	0.72	---	0	1
bank_exp	5,770	0.00	0.83	-1.03	2.07
interview time	6,230	32.01	11.82	2.79	120
<i>School level</i>					
grade					
7	6,230	0.50	---	0	1
8	6,230	0.22	---	0	1
9	6,230	0.13	---	0	1
10	6,230	0.15	---	0	1
school type					
GYM	6,230	0.39	---	0	1
RS	6,230	0.34	---	0	1
WS	6,230	0.16	---	0	1
GMS	6,230	0.11	---	0	1
school size	6,139	652.75	221.50	172	1,321
% non-natives/class	6,230	34.51	19.70	0	100
urbanization	6,139	2.03	0.84	1	3

Note: Due to insufficient item responses, we couldn't estimate weighted likelihood estimators (WLE) for one participant. However, within the subsequent regression analysis, the missing value is imputed by means of plausible value procedures (see Chapter 5.3). With regard to interview time, we set severe outliers to the maximum allowed survey time (120 minutes)

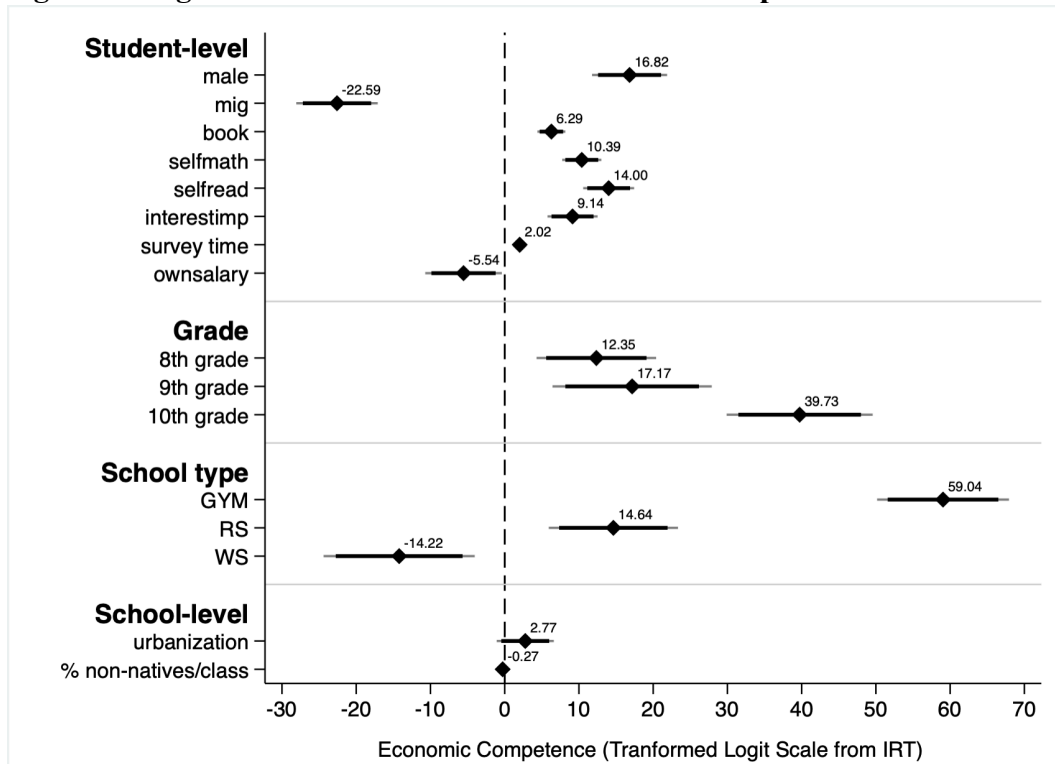
Table 4: One Parameter IRT Estimates for TEC Items

Item	n	Freq	σ (SE)	rit_c	Infit[p-val.]	Outfit[p-val.]	Assessment year	A	B	C
1	5,781	0.68	-0.84 (0.03)	0.35	0.97[0.04]	0.96[0.00]	2016, 2017, 2018			x
2	1,704	0.82	-1.38 (0.07)	0.36	0.95[0.19]	0.95[0.13]	2016	x		
3	4,454	0.73	-1.24 (0.04)	0.21	1.03[0.03]	1.07[0.00]	2017, 2018	x		
4	5,570	0.53	-0.1 (0.03)	0.37	0.95[0.00]	0.97[0.00]	2016, 2017, 2018		x	
5	4,019	0.66	-0.84 (0.04)	0.30	1.00[0.78]	0.97[0.04]	2017, 2018	x		
6	5,725	0.66	-0.75 (0.03)	0.26	1.03[0.00]	1.08[0.00]	2016, 2017, 2018		x	
7	1,727	0.66	-0.43 (0.05)	0.47	0.92[0.00]	0.97[0.14]	2016			x
8	5,771	0.56	-0.24 (0.03)	0.35	0.97[0.00]	0.97[0.01]	2016, 2017, 2018	x		
9	5,278	0.55	-0.32 (0.03)	0.31	0.99[0.17]	1.00[0.90]	2016, 2017, 2018			x
10	4,486	0.63	-0.82 (0.03)	0.33	0.98[0.17]	0.97[0.01]	2016, 2017, 2018			x
11	1,645	0.56	-0.11 (0.05)	0.37	0.96[0.03]	1.06[0.00]	2016		x	
12	4,039	0.63	-0.69 (0.04)	0.37	0.95[0.00]	0.92[0.00]	2017, 2018	x		
13	4,006	0.62	-0.67 (0.04)	0.34	0.97[0.03]	0.95[0.00]	2017, 2018			x
14	4,210	0.54	-0.28 (0.03)	0.37	0.95[0.00]	0.93[0.00]	2017, 2018	x		
15	5,710	0.4	0.52 (0.03)	0.31	1.00[0.77]	1.03[0.00]	2016, 2017, 2018		x	
16	1,074	0.44	0.26 (0.06)	0.21	1.06[0.01]	1.14[0.00]	2016			x
17	5,390	0.31	0.95 (0.03)	0.32	1.00[0.91]	1.05[0.00]	2016, 2017, 2018			x
18	5,633	0.36	0.7 (0.03)	0.26	1.00.05[0]	1.10[0.00]	2016, 2017, 2018			x
19	5,635	0.36	0.73 (0.03)	0.37	0.98[0.11]	1.01[0.00]	2016, 2017, 2018			x
20	5,297	0.25	1.19 (0.03)	0.32	0.97[0.13]	0.97[0.36]	2016, 2017, 2018		x	
21	5,816	0.3	1.03 (0.03)	0.19	1.09[0.00]	1.19[0.00]	2016, 2017, 2018			x
22	5,769	0.4	0.56 (0.03)	0.21	1.09[0.00]	1.15[0.00]	2016, 2017, 2018			x
23	1,658	0.33	1.2 (0.05)	0.45	0.91[0.00]	0.98[0.29]	2016			x
24	5,323	0.21	1.44 (0.04)	0.21	1.02[0.29]	1.08[0.00]	2016, 2017, 2018		x	
25	540	0.54	1.07 (0.09)	0.28	1.00[0.91]	1.16[0.00]	2016			x
26	529	0.52	1.02 (0.09)	0.22	0.99[0.78]	1.12[0.00]	2016		x	
27	554	0.45	1.42 (0.09)	0.24	1.00[0.86]	1.13[0.00]	2016			x
28	5,480	0.13	2.24 (0.04)	0.23	1.00[0.90]	1.24[0.00]	2016, 2017, 2018		x	
29	576	0.36	1.81 (0.09)	0.22	1.02[0.62]	1.16[0.00]	2016	x		
30	515	0.34	2.07 (0.1)	0.28	0.98[0.68]	1.10[0.02]	2016			x
31	1,496	0.13	2.73 (0.08)	0.28	0.98[0.76]	1.02[0.70]	2016			x

Table 5: Differential Item Functioning Analyses

Item	DIF <i>male</i>			DIF <i>migration status</i>			DIF <i>mother tongue</i>			DIF <i>books at home</i>		
	MH ₂	Δ - DIF	ETS	MH ₂	Δ - DIF	ETS	MH ₂	Δ - DIF	ETS	MH ₂	Δ - DIF	ETS
1	0.42	0.10	A	0.28	0.08	A	0.00	0.00	A	0.61	0.12	A
2	14.68	1.27	B	1.33	-0.38	A	2.40	-0.52	A	3.56	-0.63	A
3	5.03	-0.41	A	0.13	0.07	A	0.26	0.09	A	3.91	0.36	A
4	15.40	-0.59	A	4.69	-0.34	A	3.30	-0.29	A	8.58	-0.45	A
5	36.73	-1.10	B	0.00	0.00	A	0.93	0.18	A	0.04	-0.04	A
6	13.85	-0.58	A	0.90	0.15	A	3.83	0.31	A	2.77	0.26	A
7	0.03	0.05	A	3.52	-0.53	A	3.57	-0.55	A	15.09	-1.09	B
8	0.44	0.10	A	0.16	-0.06	A	0.11	-0.05	A	2.43	-0.23	A
9	10.91	-0.51	A	0.52	0.11	A	3.58	0.30	A	0.21	-0.07	A
10	30.46	-0.94	A	2.69	-0.28	A	2.05	-0.25	A	0.16	-0.07	A
11	8.08	0.77	A	0.04	-0.06	A	0.00	0.00	A	2.82	-0.46	A
12	0.51	0.13	A	12.99	-0.65	A	5.79	-0.44	A	0.30	0.10	A
13	11.77	-0.61	A	0.01	-0.02	A	0.94	-0.18	A	2.90	-0.31	A
14	1.38	-0.20	A	0.00	0.00	A	0.10	0.06	A	5.34	-0.40	A
15	11.38	-0.51	A	0.02	0.02	A	1.77	0.22	A	0.53	0.11	A
16	1.11	0.34	A	0.16	0.13	A	0.28	0.18	A	1.29	0.37	A
17	0.60	-0.13	A	1.09	0.18	A	0.87	0.17	A	6.13	0.40	A
18	0.28	0.08	A	0.00	0.01	A	0.18	0.07	A	11.39	0.52	A
19	1.58	-0.20	A	10.68	0.53	A	8.50	0.48	A	1.96	0.22	A
20	10.45	0.56	A	0.01	0.02	A	0.11	0.06	A	8.30	-0.50	A
21	10.77	0.52	A	25.57	0.83	A	29.51	0.91	A	41.62	-1.02	B
22	0.06	0.04	A	4.08	0.32	A	2.75	0.27	A	30.78	0.84	A
23	9.13	0.85	A	0.44	-0.21	A	0.93	-0.31	A	3.72	-0.56	A
24	8.30	-0.52	A	14.54	0.71	A	9.96	0.60	A	6.56	0.46	A
25	2.57	0.73	A	0.45	-0.38	A	3.98	-1.22	B	1.27	-0.57	A
26	3.39	0.85	A	1.01	0.57	A	0.77	0.53	A	1.09	0.53	A
27	9.73	1.43	B	0.54	0.42	A	0.15	-0.24	A	0.00	0.01	A
28	0.00	0.01	A	4.69	0.49	A	2.93	0.40	A	0.82	0.19	A
29	0.61	-0.36	A	0.51	-0.43	A	0.00	-0.04	A	2.61	0.81	A
30	0.07	0.13	A	0.82	-0.61	A	0.00	0.02	A	0.00	0.02	A
31	11.07	-1.31	B	1.91	-0.68	A	2.04	-0.76	A	4.94	-0.99	A

Figure 1: Regression Estimates for the Random Intercept Model



Notes: This figure shows regression coefficients from the Random Intercept model with 90% and 95% CIs at an estimated intercept of 466.23. Predictor variable selection was obtained by the regularization method LASSO (Tibshirani 1996). The dependent variable “economic competence” is imputed and pooled from latent regression (Plausible Values). Non-categorical variables are mean-centered. Intra-class correlation is 0.34. Number of observations is $n = 6,230$ students within 315 schools. For detailed results see Table A4. Adjusted R^2 is 0.42.

Appendix

(online appendix not intended for print publication)

to accompany

**“Measuring Economic Competence
of Secondary School Students in Germany”**

Appendix A: Supplementary tables and figures

Appendix B: TEC items

Appendix A: Supplementary tables and figure

Table A1: Numbers of Insignificant Fit Statistics

	1-PL	2-PL	3-PL	4-PL
χ^2	2	2	3	6
G^2	4	3	3	6

Note: χ^2 uses Yen's Q_1 variant which uses a fixed amount of group bins. G^2 statistics follows similar method based on the likelihood-ratio test. Fit statistics are calculated using R package *mirt*. Number of deviations for $p < 0.01$ ***

Table A2: 1-4-PL-Model: Parameter Estimates and Standard Errors

Item	1-PL		2-PL				3-PL						4-PL							
	b	se.b	a	se.a	b	se.b	a	se.a	b	se.b	c	se.c	a	se.a	b	se.b	c	se.c	d	se.d
1	-0.84	0.03	1.18	0.03	-0.77	0.03	1.66	0.06	-0.17	0.03	0.27	0.01	1.62	0.06	-0.21	0.03	0.25	0.01	1.00	0.01
2	-1.38	0.07	1.41	0.06	-0.99	0.05	1.78	0.10	-0.41	0.05	0.31	0.03	3.00	0.29	-0.18	0.04	0.43	0.03	0.97	0.01
3	-1.24	0.04	0.69	0.02	-1.67	0.05	0.71	0.02	-1.64	0.05	0.00	0.02	1.01	0.04	-1.71	0.05	0.00	0.03	0.91	0.01
4	-0.10	0.03	1.15	0.04	-0.09	0.03	1.16	0.04	-0.08	0.03	0.00	0.01	1.46	0.05	-0.16	0.03	0.04	0.01	0.92	0.01
5	-0.84	0.04	0.98	0.04	-0.89	0.04	1.54	0.09	-0.07	0.04	0.33	0.01	1.50	0.08	-0.11	0.04	0.31	0.01	1.00	0.01
6	-0.75	0.03	0.75	0.02	-0.96	0.04	0.76	0.02	-0.94	0.04	0.00	0.02	1.13	0.05	-0.63	0.04	0.19	0.02	0.92	0.01
7	-0.43	0.05	1.49	0.07	-0.20	0.04	1.46	0.07	-0.18	0.04	0.00	0.02	1.65	0.09	-0.24	0.04	0.00	0.02	0.96	0.01
8	-0.24	0.03	1.08	0.04	-0.24	0.03	1.75	0.07	0.36	0.03	0.25	0.01	2.98	0.18	0.30	0.02	0.30	0.01	0.92	0.01
9	-0.32	0.03	1.00	0.04	-0.34	0.03	1.04	0.04	-0.31	0.03	0.01	0.01	2.06	0.12	-0.20	0.03	0.20	0.01	0.86	0.01
10	-0.82	0.03	1.09	0.04	-0.83	0.03	1.51	0.07	-0.29	0.03	0.23	0.01	3.00	0.21	-0.25	0.03	0.34	0.01	0.91	0.01
11	-0.11	0.05	1.14	0.06	-0.01	0.05	1.14	0.06	0.02	0.05	0.00	0.02	3.00	0.32	0.11	0.04	0.19	0.02	0.84	0.01
12	-0.69	0.04	1.23	0.05	-0.66	0.03	1.96	0.10	-0.04	0.03	0.29	0.01	2.23	0.13	-0.05	0.03	0.30	0.01	0.98	0.01
13	-0.67	0.04	1.15	0.04	-0.67	0.03	1.32	0.05	-0.44	0.03	0.10	0.01	1.31	0.05	-0.55	0.03	0.06	0.02	0.99	0.01
14	-0.28	0.03	1.24	0.05	-0.30	0.03	1.64	0.07	0.03	0.03	0.15	0.01	1.82	0.09	0.00	0.03	0.17	0.01	0.97	0.01
15	0.52	0.03	0.85	0.03	0.59	0.03	1.03	0.04	0.80	0.03	0.08	0.01	1.16	0.05	0.71	0.03	0.10	0.01	0.94	0.01
16	0.26	0.06	0.60	0.07	0.44	0.10	0.92	0.10	1.00	0.10	0.18	0.02	0.94	0.10	0.99	0.10	0.19	0.02	1.00	0.04
17	0.95	0.03	0.86	0.03	1.08	0.04	1.99	0.09	1.25	0.03	0.16	0.01	3.00	0.20	0.98	0.03	0.18	0.01	0.84	0.02
18	0.70	0.03	0.68	0.02	0.97	0.04	1.79	0.10	1.37	0.04	0.23	0.01	1.75	0.09	1.38	0.04	0.23	0.01	1.00	0.02
19	0.73	0.03	1.01	0.03	0.75	0.03	1.55	0.06	0.98	0.03	0.12	0.01	1.67	0.07	0.92	0.03	0.13	0.01	0.96	0.02
20	1.19	0.03	1.14	0.03	1.08	0.03	1.26	0.04	1.09	0.03	0.02	0.01	3.00	0.20	0.38	0.03	0.07	0.01	0.60	0.01
21	1.03	0.03	0.49	0.02	1.88	0.06	1.66	0.09	1.85	0.05	0.21	0.01	1.92	0.12	1.81	0.04	0.22	0.01	1.00	0.03
22	0.56	0.03	0.51	0.02	0.99	0.05	1.13	0.05	1.62	0.05	0.24	0.01	1.82	0.15	1.03	0.05	0.27	0.01	0.76	0.02
23	1.20	0.05	1.47	0.07	1.11	0.04	2.32	0.15	1.22	0.03	0.08	0.01	3.00	0.24	1.07	0.03	0.09	0.01	0.90	0.02
24	1.44	0.04	0.74	0.02	1.90	0.05	1.49	0.06	1.63	0.04	0.10	0.01	2.40	0.18	0.98	0.04	0.11	0.01	0.64	0.02
25	1.07	0.09	0.97	0.13	1.20	0.09	1.44	0.22	1.77	0.09	0.24	0.03	1.71	0.27	1.88	0.09	0.30	0.03	1.00	0.04
26	1.02	0.09	1.00	0.13	1.15	0.09	1.13	0.15	1.18	0.08	0.00	0.04	2.23	0.40	1.26	0.08	0.20	0.03	0.84	0.03
27	1.42	0.09	1.04	0.12	1.54	0.08	1.07	0.13	1.55	0.08	0.00	0.03	3.00	0.71	1.30	0.08	0.19	0.03	0.69	0.03
28	2.24	0.04	0.75	0.02	2.85	0.06	2.66	0.15	1.95	0.03	0.08	0.00	3.00	0.21	1.69	0.04	0.08	0.00	0.75	0.03
29	1.81	0.09	0.69	0.08	2.21	0.12	1.33	0.16	2.46	0.11	0.18	0.02	1.96	0.29	2.41	0.10	0.23	0.02	1.00	0.08
30	2.07	0.10	1.08	0.10	2.16	0.09	1.81	0.21	2.21	0.08	0.11	0.02	3.00	0.46	2.17	0.07	0.16	0.02	1.00	0.05
31	2.73	0.08	1.09	0.05	2.71	0.08	1.14	0.05	2.63	0.07	0.00	0.01	1.15	0.05	2.62	0.07	0.00	0.01	1.00	0.06

Note: Parameters and standard errors are calculated with R package *sirt* (Robitzsch 2019). Due to computational limitations caused by sample size disparities, an upper bound for discrimination parameter estimates ($a < 3$) is set in the 4-PL model.

Table A3: G^2 and χ^2 Fit Statistics

Item	χ^2								G^2							
	1-PL		2-PL		3-PL		4-PL		1-PL		2-PL		3-PL		4-PL	
	χ^2	p	χ^2	p	χ^2	p	χ^2	p	G^2	p	G^2	p	G^2	p	G^2	p
1	166.87	0.00	94.33	0.00	74.92	0.00	86.78	0.00	186.74	0.00	103.95	0.00	81.04	0.00	94.54	0.00
2	66.02	0.00	24.82	0.00	20.89	0.00	12.15	0.06	73.09	0.00	26.55	0.00	23.61	0.00	12.66	0.05
3	46.65	0.00	54.66	0.00	84.21	0.00	104.45	0.00	47.62	0.00	55.34	0.00	85.01	0.00	105.65	0.00
4	176.57	0.00	92.87	0.00	125.54	0.00	116.36	0.00	194.21	0.00	101.22	0.00	151.41	0.00	153.99	0.00
5	87.03	0.00	62.51	0.00	53.08	0.00	62.35	0.00	96.81	0.00	69.44	0.00	57.86	0.00	69.22	0.00
6	36.23	0.00	52.42	0.00	86.34	0.00	67.46	0.00	37.82	0.00	54.29	0.00	90.67	0.00	70.60	0.00
7	118.50	0.00	54.89	0.00	55.85	0.00	57.65	0.00	136.82	0.00	64.56	0.00	68.41	0.00	52.07	0.00
8	133.15	0.00	75.40	0.00	48.06	0.00	27.70	0.00	145.04	0.00	81.92	0.00	51.09	0.00	29.13	0.00
9	128.49	0.00	92.88	0.00	118.58	0.00	71.79	0.00	137.97	0.00	99.84	0.00	131.19	0.00	76.21	0.00
10	148.47	0.00	116.32	0.00	110.89	0.00	79.91	0.00	160.15	0.00	124.20	0.00	117.16	0.00	83.62	0.00
11	58.60	0.00	35.06	0.00	31.45	0.00	21.20	0.00	62.16	0.00	36.43	0.00	34.53	0.00	20.76	0.00
12	164.46	0.00	103.03	0.00	73.86	0.00	65.35	0.00	189.90	0.00	116.57	0.00	80.94	0.00	71.37	0.00
13	125.71	0.00	86.87	0.00	114.25	0.00	146.26	0.00	139.37	0.00	97.09	0.00	132.18	0.00	177.85	0.00
14	175.71	0.00	100.26	0.00	91.08	0.00	80.73	0.00	197.41	0.00	113.04	0.00	101.17	0.00	91.11	0.00
15	52.62	0.00	53.87	0.00	45.64	0.00	43.35	0.00	54.43	0.00	55.97	0.00	47.37	0.00	45.94	0.00
16	16.91	0.05	37.17	0.00	36.26	0.00	25.30	0.00	18.14	0.03	39.63	0.00	38.10	0.00	25.88	0.00
17	84.64	0.00	100.78	0.00	43.59	0.00	30.01	0.00	90.46	0.00	107.81	0.00	45.99	0.00	31.05	0.00
18	29.49	0.00	70.21	0.00	26.47	0.00	33.34	0.00	30.33	0.00	73.47	0.00	27.24	0.00	34.83	0.00
19	140.45	0.00	92.26	0.00	59.96	0.00	61.84	0.00	154.54	0.00	101.04	0.00	63.42	0.00	66.15	0.00
20	154.82	0.00	91.48	0.00	77.73	0.00	35.82	0.00	161.85	0.00	95.69	0.00	80.30	0.00	36.24	0.00
21	58.07	0.00	50.57	0.00	33.53	0.00	35.87	0.00	57.66	0.00	50.88	0.00	33.68	0.00	36.28	0.00
22	25.88	0.00	42.57	0.00	34.84	0.00	22.60	0.00	25.10	0.00	43.93	0.00	35.29	0.00	22.87	0.00
23	101.17	0.00	48.65	0.00	25.32	0.00	17.72	0.01	113.26	0.00	55.31	0.00	28.83	0.00	20.03	0.00
24	42.22	0.00	60.28	0.00	45.63	0.00	31.91	0.00	43.07	0.00	60.62	0.00	45.40	0.00	32.13	0.00
25	15.35	0.00	16.69	0.00	17.07	0.00	22.23	NA	16.59	0.00	17.78	0.00	12.79	0.00	22.87	0.00
26	9.44	0.02	11.86	0.00	9.37	0.01	6.88	NA	3.32	0.19	2.07	0.15	0.82	NA	7.12	NA
27	17.38	0.00	15.41	0.00	12.41	0.00	3.20	NA	11.64	0.01	17.23	0.00	13.80	0.00	3.30	NA
28	99.65	0.00	123.94	0.00	70.10	0.00	25.34	0.00	92.46	0.00	118.37	0.00	67.66	0.00	25.33	0.00
29	4.71	0.19	5.23	0.02	4.51	0.03	7.04	NA	5.38	0.15	5.38	0.07	4.53	0.03	6.97	NA
30	11.09	0.00	9.42	0.01	7.08	NA	12.18	NA	11.12	0.01	9.34	0.01	6.95	0.01	11.80	NA
31	26.22	0.00	14.72	0.02	12.10	0.03	11.53	0.02	26.16	0.00	14.65	0.02	12.04	0.03	11.28	0.02

Table A4: Missing proportions

Variable	Missing fraction	d
age	0,02	-0,13
bankaccount	0,06	-0,13
bankcontrol	0,35	-0,34
bankEC	0,06	-0,22
bankECuse	0,54	-0,22
book	0,05	-0,22
interesteco	0,01	-0,52
interestimp	0,01	-0,31
mig	0,04	-0,17
native	0,04	-0,14
nows salary	0,24	-0,02
owns salary	0,05	-0,17

Notes: Remaining covariates (see table 1) are fully observed; Cohen's d effect size is expressed in standard deviation units and shows standardized mean difference between the group with missing values for this variable and group with fully observed data for each variable.

Table A5: Complete Regression Results from the Random Intercept Model

<i>Dependent Variable: Economic Competences (Plausible Values)</i>							
	(1)	(1b)	(2)	(3)	(4)	(5)	(6)
male	12.622*** (2.07)	9.125*** (2.90)	13.617*** (2.05)	11.191*** (2.04)	11.248*** (2.04)	16.083*** (2.00)	16.386*** (2.00)
age	-7.095*** (1.38)	-7.041*** (1.38)	-6.040*** (1.36)	-3.732*** (1.33)	-3.552*** (1.33)	-2.788** (1.29)	-3.068** (1.29)
migrant	-25.612*** (2.29)	-25.647*** (2.29)	-25.719*** (2.25)	-24.059*** (2.18)	-22.930*** (2.23)	-22.235*** (2.18)	-22.141*** (2.18)
book	10.745*** (0.72)	10.750*** (0.72)	9.423*** (0.72)	6.936*** (0.71)	6.879*** (0.71)	6.523*** (0.69)	6.478*** (0.69)
grade	29.933*** (2.63)		27.769*** (1.88)	25.932*** (1.83)	25.272*** (1.83)	15.358*** (1.82)	
grade8		25.195*** (7.29)					13.140*** (3.66)
grade9		53.960*** (8.96)					16.439*** (4.99)
grade10		81.066*** (8.93)					51.679*** (5.54)
male × grade8		-3.663 (5.32)					
male × grade9		13.875** (6.43)					
male × grade10		15.972*** (5.97)					
GYM			74.665*** (5.14)	66.661*** (5.00)	65.607*** (5.44)	60.906*** (5.01)	62.404*** (4.90)
RS			15.100*** (5.13)	13.042*** (4.97)	13.075*** (5.04)	15.001*** (4.64)	15.336*** (4.52)
WS			-16.751*** (5.64)	-17.747*** (5.46)	-13.822** (5.57)	-13.736*** (5.15)	-12.286** (5.04)
selfmath				11.379*** (1.21)	11.360*** (1.21)	9.754*** (1.17)	9.629*** (1.17)
selfread				11.451*** (1.49)	11.437*** (1.49)	13.228*** (1.45)	13.249*** (1.45)
selfall				3.662** (1.72)	3.609** (1.72)	2.855* (1.67)	2.644 (1.67)
interesteco				3.446** (1.54)	3.484** (1.54)	2.708* (1.50)	2.643* (1.50)
interestimp				12.719*** (1.62)	12.648*** (1.62)	8.712*** (1.58)	8.630*** (1.58)
urbanization					3.280* (1.84)	3.634** (1.68)	3.556** (1.63)
schoolsize					-0.004 (0.01)	-0.001 (0.01)	-0.001 (0.01)
% non-natives/cl.					-0.232*** (0.09)	-0.246*** (0.08)	-0.238*** (0.08)
bank.exp						-1.237 (1.26)	-1.168 (1.26)
time						2.045*** (0.10)	2.121*** (0.10)
ownsalary						-4.971** (2.17)	-4.895** (2.17)
constant	497.454*** (3.38)	469.828*** (4.49)	472.311*** (4.69)	476.570*** (4.67)	475.763*** (4.66)	477.891*** (4.86)	461.885*** (4.56)
N (students)	6,230	6,230	6,230	6,230	6,230	6,230	6,230
N (schools)	315	315	315	315	315	315	315
R-squ (individual)	0.061	0.063	0.058	0.118	0.118	0.168	0.167
R-squ (school)	0.507	0.511	0.883	0.890	0.895	0.922	0.930

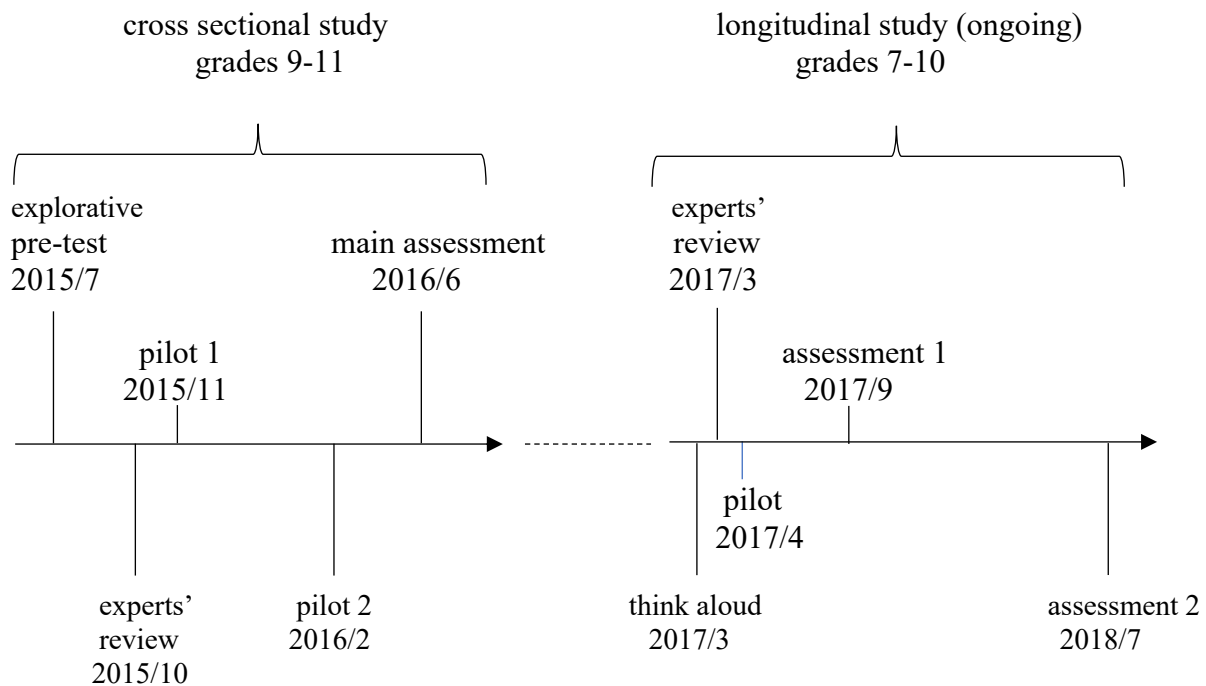
Notes: * p<0.10, ** p<0.05, *** p<0.01. R-squared values are based on *Fisher's z* transformation and follows the multilevel approach specified in Bryk and Raudenbush (1992). Covariates are drawn from 20 multiple imputations. Overall missing cases: 753. Standard errors are cluster robust based on 315 schools. Intra-class correlation is 0.35. Variance Inflation Factors with the complete variable set show a maximum value of 3.86 (Mean = 1.81),

Table A6: Lasso regression

Step	Cp	R-square	Action
1	4065.8616	0.0000	
2	3658.7849	0.0428	+GYM
3	2757.5560	0.1374	+time
4	1519.8643	0.2673	+book
5	1387.2579	0.2814	+migrant
6	1271.4591	0.2937	+selfread
7	1194.6423	0.3020	+selfmath
8	1121.3295	0.3099	+% non-natives/class
9	871.4100	0.3362	+interestimp
10	479.7073	0.3775	+WS
11	377.1846	0.3884	+age
12	254.0481	0.4015	+male
13	130.5020	0.4147	+interesteco
14	129.8447	0.4150	+urbanization
15	74.9084	0.4209	+RS
16	29.0944	0.4259	+selfall
17	20.8167	0.4270	+ownsalary
18	21.8944	0.4271	+schoolsize
19	19.0000*	0.4276	+bank_exp

Note: * indicates the smallest value for Cp. Lasso regression is conducted without multiple imputations.

Figure A1: Timeline



We started with an explorative pre-test of 30 items in July, 2015 to get an insight into proper item construction. Subsequently, we created 166 items to be rated by three academic experts of economic education. The first pilot was conducted with 223 school students and included 119 items that had passed the experts rating. The validation ended with a second pilot with 92 school students (40 items). The cross-sectional study in 2016 comprised 57 items and was conducted 124 schools with 2,333 students.

The longitudinal study started with students of grade 7 who have not attended particular lessons in economics. Items of the former cross-sectional study and new items got validated in a first step in a think-aloud-test with three school students. Next, two academic experts reviewed these items for content quality and item difficulty. The following pilot included 40 items in 20 classes (359 students). The first assessment with 7th grade students (no particular lessons in economics) comprised 33 items and was conducted with 1,687 students. The second assessment with grade 8 students (no lessons) and grade 7 students (first cohort with lessons) used the 30 validated items of the first assessment with 2,808 students.

Figure A2: Wright Map

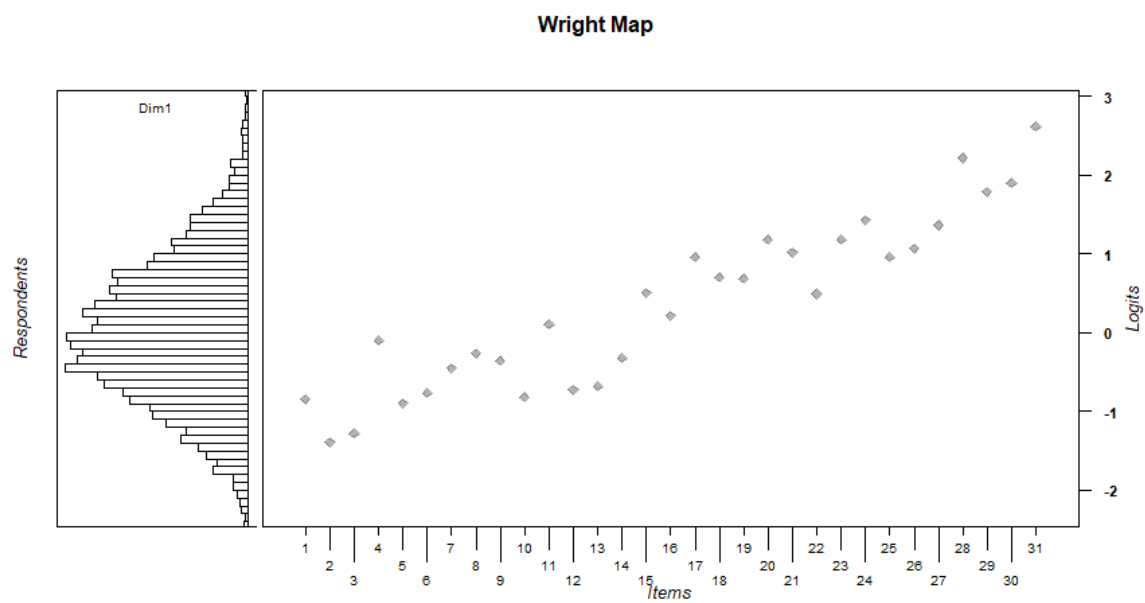
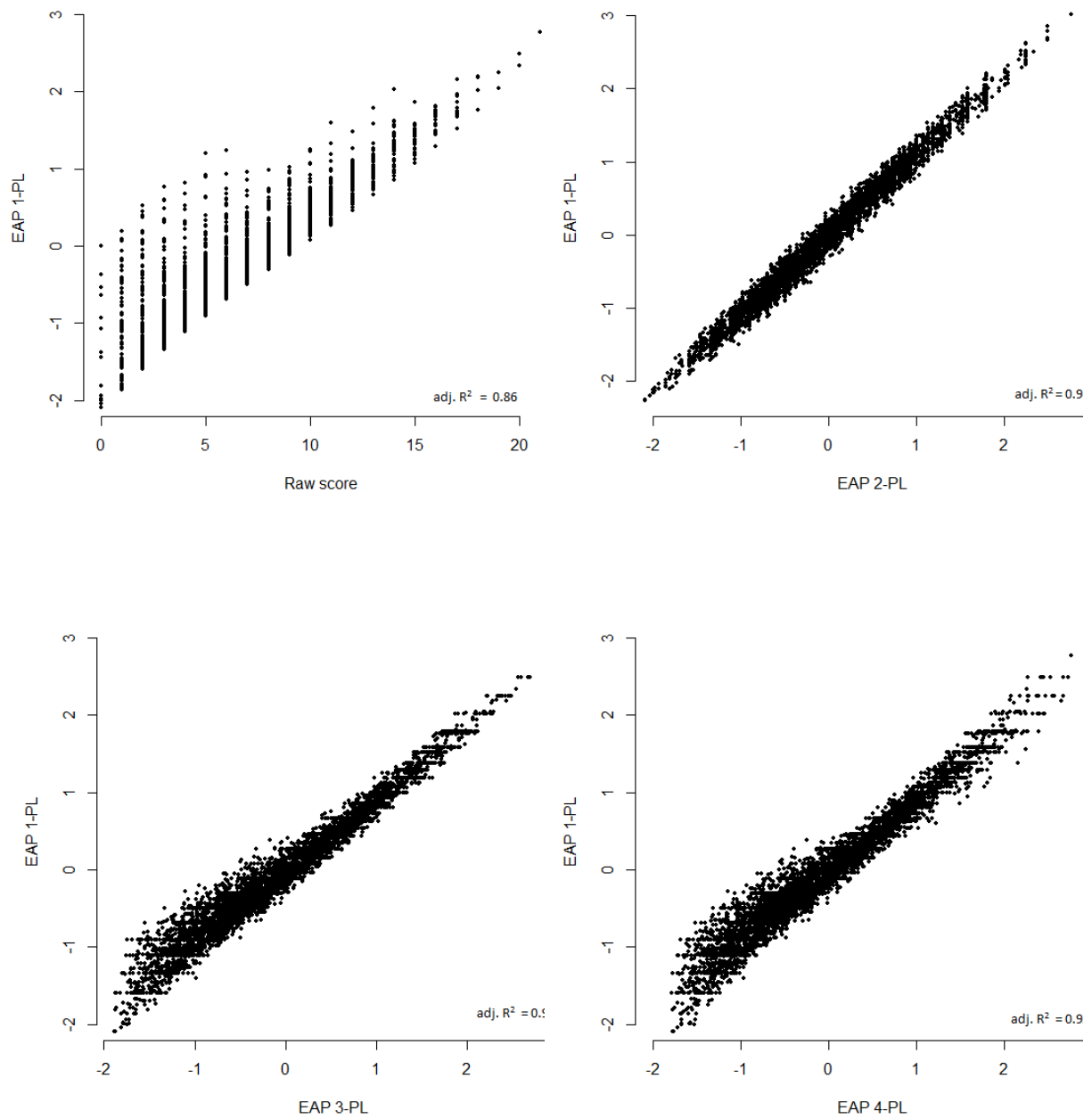
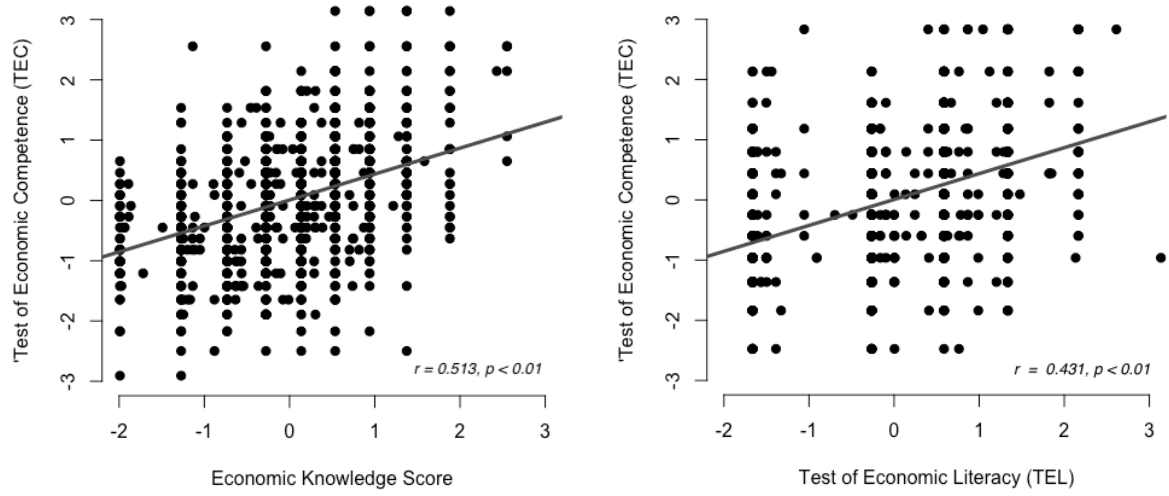


Figure A3: Correlations between Estimated Person Abilities depending on IRT Model Employed



Notes: IRT Person estimates based on expected a posteriori (EAP) measures, which rely on estimated model parameters and response patterns for given cases. Estimation is conducted with R package sirt.

Figure A4: Correlations between TEC Scores, Economic Knowledge scores and TEL Scores



Appendix B: TEC items

1) In the 1960s, many shoes were still produced in Germany. Today, most shoes are imported from abroad. What is the reason for this?

- ☐ Labor costs are higher in Germany than abroad.
- ☐ Shoes are produced by machines nowadays.
- ☐ German shoe manufacturers were bought by foreign companies.
- ☐ The shoes produced in Germany were of lower quality.
- ☐ The kinds of shoe produced in Germany have gone out of fashion.

2) Which statement about investing in shares is correct?

- ☐ Investing in shares is more secure than a savings account.
- ☐ Investment in shares can lead to losses.
- ☐ Investing in shares leads to constant income from interest.
- ☐ Investing in shares leads to constant income from dividends.

3) One day, the bakery “Backblech” mistakenly bakes more pumpkin-seed bread rolls than usually can be sold. Which measure would you recommend to the bakery Backblech on this day?

- ☐ Give away the remaining pumpkin-seed bread rolls.
- ☐ Increase the price of pumpkin-seed bread rolls on this day.
- ☐ Reduce the price of all of the bakery’s products.
- ☐ Offer the pumpkin-seed bread rolls at a lower price

4) Fairtrade is a kind of supervised trade with manufacturers in developing countries. Why are some people willing to spend a larger amount of money for Fairtrade products than for the respective conventional products?

5) After three years, the management of the cinema “Cinex” has increased the price per ticket for the evening screening from €8.00 to €8.50. What is the most plausible reason for this price-increase?

- ☐ The management has decided to donate more money.
- ☐ A competing cinema has opened in the town.
- ☐ The cinema’s running costs have increased.
- ☐ The management want to offset losses incurred through theft at the snack counter.

6) There is a regular flea market at school before the summer holiday. Emma in Class 8A owns the newest version of a popular video game she received from her aunt in the U.S. and which will only be released in Germany next year. She is considering selling it at the flea market. Which statement is correct?

- ☐ She would receive a comparatively high amount for the game this year
- ☐ She would receive a comparatively low amount for the game
- ☐ She would receive as much this year as she would receive next year
- ☐ She would not be able to sell the game this year
- ☐ She would not be able sell the game next year

7) An entrepreneur has set up a company manufacturing medical technology. When will the company start to generate profit? As soon as...

- ☐ the medical technology is sold in stores.
- ☐ income from the sales of the medical technology covers employees' monthly wages
- ☐ the company has crowded out all competing manufacturers of medical technology
- ☐ income from the sales of the medical technology covers monthly wages and the cost of renting manufacturing space.
- ☐ income from the sales of the medical technology is higher than all accrued costs.

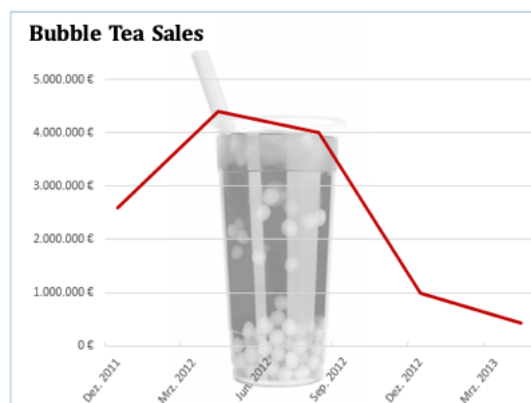
8) Michael had left school at age 16 and entered vocational training. How will Michael's income likely develop in comparison with the income of his former classmates, who continue their schooling and will later graduate from college?

- ☐ Michael's income will be higher than the income of his former classmates both now and in the future.
- ☐ Michael's income will be higher than the income of his former classmates now, but lower in the future.
- ☐ Michael's income will be lower than the income of his former classmates both now and in the future.
- ☐ Michael's income will be lower than the income of his former classmates now, but higher in the future.

9) For years, the number of jobs in manufacturing has been declining in Germany. Which of the following reasons leads to less and less jobs related to the manufacturing of goods?

- ☐ The majority of goods are sold online.
- ☐ Technology has replaced human labor.
- ☐ People no longer want to do physical work nowadays.
- ☐ Manufacturing machines have become too expensive.
- ☐ None of the above statements is correct.

10)



This figure shows how the sales of bubble tea in Germany have developed in the course of 16 months. What can you conclude from the figure about sales of bubble tea?

- ☐ Bubble tea was banned in Germany since August 2012.
- ☐ Bubble tea continues to be sold profitably in Japan.
- ☐ Bubble tea is dangerous to health.
- ☐ Bubble tea was sold relatively little since August 2012.

11) In 1923, inflation in Germany was extremely high. With respect to the inflations' effect on retailers, which of the following statements is correct? Please select only one of the following answers:

- ☐ The inflation had no effect on retailers.
- ☐ They could set aside money for leaner times.
- ☐ They could pay their employees a higher salary.
- ☐ They no longer accepted cash as a means of payment.

12) An employer, Angela Zapp, wants to give the employees of her company, "Zapp Wohnanlagen", a higher salary. What is a consequence she can expect?

- ☐ A decrease in manufacturing costs.
- ☐ A decrease in her profits.
- ☐ A decrease in product quality.
- ☐ A decrease in customer satisfaction.

13) The Marone family runs the ice-cream parlor Fantasia in the town center. This year, the family increase the price per scoop from €1.00 to €1.20. What effects does the increase in price have on the ice-cream parlor's revenue?

- ☐ The revenue will decrease because of the price increase.
- ☐ The revenue will increase because of the price increase.
- ☐ The revenue will remain the same despite the price increase.
- ☐ The revenue depends on how the customer base reacts.

14) Ms. Müller runs a dental surgery and makes €200 per hour. Today she is considering closing the surgery one hour earlier in order to mow the lawn at home. However, she could also hire a gardener for €50. Which statement is correct?

- ☐ She should mow the lawn herself in order to save the expense of the gardener.
- ☐ She should mow the lawn herself because she could do just as quickly.
- ☐ She should hire the gardener in order not to lose her income.
- ☐ It makes no difference because both cases involve one hour's work.

15)



Ben and Luca are traveling to Hungary. Luca exchanged euro for forint at the bank counter in Germany, and also paid with his credit card in Hungary. The official ex-change rate remained the same throughout

the entire holiday. At home, Luca notices that the exchange rate for credit card payments was better for him than the exchange rate at the bank counter.

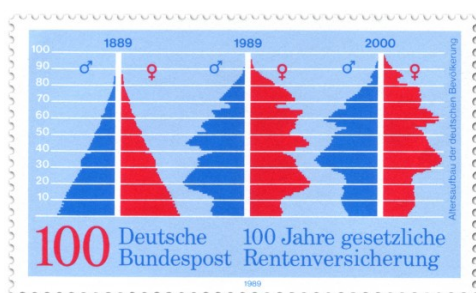
Why is this?

- ☐ The euro-forint exchange rate is always cheaper in Germany than in Hungary.
- ☐ The euro-forint exchange rate is always cheaper in Hungary than in Germany.
- ☐ There are more costs involved in exchanging bills than in converting money by machine.
- ☐ There are more costs involved in converting money by machine than in exchanging bills.

16) A sharp increase in the price of gasoline causes only a small decrease in the amount of gasoline sold in the short term. Why is this?

- ☐ Gasoline is a luxury good.
- ☐ The cost of gasoline makes up a large part of a household's expenditure.
- ☐ Gasoline cannot be easily replaced with something else.
- ☐ Taxes on gasoline are high.
- ☐ Vehicles do not need much gasoline nowadays.

17) Age distribution of the German population



(German stamp on the occasion of the 100 years anniversary of social insurance)

Pensions are funded through payments by employees, employers, and a state subsidy from tax revenue. The graphics on the stamp show the age distribution of people living in Germany in the years 1889, 1989 and 2000. What problem presents itself now and in the future for the state pension system?

- ☐ The pensions of more and more beneficiaries have to be covered by fewer and fewer employed contributors.
- ☐ Before 1889, there were more contributors than pensioners who received payments.
- ☐ The contributions paid by the many employed people in 2000 will significantly decrease in value due to inflation.
- ☐ The contributions paid in by the many employed people in 2000 exceed the payments to pensioners.
- ☐ The contributions paid in by the few people born in the post-war years are insufficient to pay their pensions now.

18) The state supports the work of consumer advice and consultation centers. These allow citizens to get ...

- ☐ information about products independently of the manufacturers.
- ☐ information about products independently of the state.
- ☐ information about what the state consumes.
- ☐ information about how the state is financed.
- ☐ None of the above statements is correct.

19) The following excerpt from the income tax scale shows the tax burden in absolute numbers and in percent for a given annual income.

Taxable annual income	Tax payment	Taxes (in %) relative to taxable income
€ 8,400	€ 0	0%
€ 10,000	€ 237	2.37%
€ 20,000	€ 2,611	13.06%
€ 40,000	€ 8,918	22.30%
€ 60,000	€ 16,938	28.23%
€ 70,000	€ 21,138	30.20%

The tax progression has a specific policy-objective. Which statement about this objective is correct?

- ☐ Nobody should earn too much.
- ☐ Everybody should be taxed equally.
- ☐ Income after tax should be equally high for everybody.
- ☐ Earners of higher incomes should contribute more to funding state expenditures.
- ☐ Everybody should contribute an equal amount to funding state expenditures.

20) Two friends, Emil and Kadir, go to the bank. Emil borrows €1000 from the bank, Kadir deposits €1,000 into his savings account. After one year, Emil wants to pay back the money, and Kadir wants to withdraw his money.

- ☐ Emil has to pay back €1,000. Kadir receives €1,000.
- ☐ Emil has to pay back €1,000. Kadir receives more than €1,000.
- ☐ Emil has to pay back more than €1,000. Kadir receives €1,000.
- ☐ Emil has to pay back more than €1,000. Kadir receives more than €1,000; the amount is the same for both of them.
- ☐ Emil has to pay back more than €1,000. Kadir receives more than €1,000; Emil's amount is higher than Kadir's.

21) The government decides that Germany's economy is to be strengthened by increased consumption. In order to stimulate consumption, the Federal Parliament could...

- ☐ decrease VAT.
- ☐ set lower prices.
- ☐ increase income taxes.
- ☐ set higher prices.
- ☐ increase wages.

22) After completing his apprenticeship, Jonas continues to work for the same company as a painter. His pay slip is as follows:

Jonas' payslip		July 2015
Gross wage		€2015.00
Income tax	€209.00	
Church tax	€16.72	
Solidarity tax	€11.49	
Total after tax		€1777.79
Health insurance	€165.24	
Nursing insurance	€28.72	
Pension scheme	€180.40	
Unemployment insurance	€30.23	
Total social security	€404.59	
Net wage		€1365.20
Total gross wage 2015	€15,005.00	
(January-July)		

Jonas pays into the statutory pension scheme every month. His employer also pays in the same amount for him. What are these contributions used for?

- ☐ They are paid out to current pensioners.
- ☐ They are saved for Jonas' pension.
- ☐ They are saved for all employees at Jonas' company.
- ☐ They are saved for all employees that will retire at the same time as Jonas.
- ☐ They enter general public expenditure

23) Why did the Cartel Office sanction these companies?

ZEITUNG ONLINE
ECONOMY

HOME POLITICS ECONOMY SOCIETY CULTURE KNOWLEDGE DIGITAL STUDIES CAREER

Home > Economy > Price fixing: Cartel Office sanctions Aldi, Rewe, Edeka and Haribo

Price fixing

Cartel Office sanctions Aldi, Rewe, Edeka and Haribo

The competition supervisor has imposed fines on several retail groups and manufacturers of branded products for price fixing on confectionery, coffee and beer.

June 18, 2015 11:45
44 Comments


- ☐ Retail prices were not agreed upon with the Cartel Office.
- ☐ The major retail groups had fixed the prices without smaller competitors.

- ☐ The retail groups had not stuck to the prices set by the Cartel Office for confectionery, coffee and beer.
- ☐ Manufacturers are not allowed to be involved in retail groups' price fixing.
- ☐ Price fixing between companies is not allowed at all.

24) Nina's parents run several car dealerships for new and used cars. Compare Nina's mother with one of her salespeople: Which of the following characteristics or capabilities does she as a businesswoman certainly need more than the salesmen and -women that she employs?

- ☐ Knowledge of the cars' driving characteristics
- ☐ Decisiveness
- ☐ Friendliness
- ☐ Punctuality
- ☐ Good conversation skills

25) Finya got a gift of €2,000 from her grandparents for her sixteenth birthday. She would like to deposit the money into a bank-account. She finds these offers online:



From \$1500 fixed-term deposit: Get a bonus!

Set up your account today and secure 2% annual interest – guaranteed for your chosen fixed saving term

Compound interest effect through annual credit of your interest at the end of the year

Starting from a deposit of \$1500, you can receive a fixed saver bonus at the end of the fixed term:

\$24 for 24 month,
\$36 for 35 month and
\$50 for 48 month

T & S Bank Institute

From \$200 fixed-term deposit we provide:

- ★ 2.1% interest on a fixed-term deposit with a term of 12 month or more – extendable annually!
- ★ With a fixed term of 60 month or more, 2.2% interest with annual payout
- ★ Compound interest effect after the first extension of the fixed term

★ **The online bank with a spark**

T & S Bank Institute and BonusBank mention the effect of compound interest. What does this mean?

- ☐ The interest rate is highest in the first year.
- ☐ The interest rate rises from year to year.
- ☐ Interest will be paid the following year on interest paid out.
- ☐ The amount of money invested has an effect on the interest rate.
- ☐ The interest rate increases with annual credit.
- ☐ None of the above statements is correct.

26) Banks pay savers lower interest than they demand from borrowers. Name one reason for this.


27) Mr. Schneider receives a wage increase. He sees on his bank statement that, starting in January, he received almost exactly 1% more in his wage from his employer compared with January the previous year. The inflation rate for the previous year was 2%. Which statement is correct? Please select only one of the following answers:

- ☐ Mr. Schneider can afford more with his January wage than he could 12 months ago.
- ☐ Mr. Schneider can afford just as much with his January wage as he could 12 months ago.
- ☐ Mr. Schneider can afford less with his January wage than he could 12 months ago.
- ☐ There is no connection

28) Nina's parents run several car dealerships for new and used cars. Her mother has listed various corporate goals for the car dealership and says: "The most important thing for me is to make as much profit as possible!" Which of the other goals will most likely conflict with this?

- ☐ Sell a lot of used cars.
- ☐ Decrease costs.
- ☐ Organize childcare for employees' children.
- ☐ Have good relationships with suppliers of replacement parts.
- ☐ Retain the car dealership's customers long-term.

29) Peter is 18 years old, still goes to school and, apart from his pocket money, has no income. He is interested in opening a checking account, and finds the following two offers online:

<p>The C-Bank checking account for everyone</p> <ul style="list-style-type: none"> • Secure €100 credit¹ • Free account maintenance • Free cash withdrawal in Germany at all C-Bank cash machines with the free C-Bank card • Free cash withdrawal in Europe (in euro) with a credit card • If you need it: Free credit card • Free banking app • Low overdraft cost: Only 7.74% pa (subject to change, 7/15/2015) <p style="background-color: #0056b3; color: white; text-align: center; padding: 5px;">Open a checking account now ></p> <p><small>¹You will receive €100 credit if three wages of at least €1200 are paid in within 6 months of opening the account.</small></p>	<p style="text-align: center;"> Gemeinschaftsbank S.E., Berlin</p> <p style="text-align: center;">CheckingPlus account</p> <ul style="list-style-type: none"> > Checking account with €50 starting balance > Account maintenance free > Cash without charge: with a card from other 9000 MoneyGroup cash machines across Germany > Free ec/Maestro card > Large network of branches in Germany > With a credit card (credit rating required) <p style="background-color: #f4a460; text-align: center; padding: 5px;">Open online now</p>
---	--

If one compares both checking accounts with regard to the account maintenance charge, which statement is correct?

- ☐ C-Bank has the better offer.
- ☐ Gemeinschaftsbank has the better offer.
- ☐ Both banks' offers are equally good.
- ☐ It is not possible to make a statement.

30) The prices of electricity and asparagus increase significantly. Compare the short-term effect of the price increase on the quantity of the two products demanded.

31) In the event of illness with statutory health insurance, services cost the same for all contributors. However, despite receiving the same services, employees with a higher income have to pay higher contributions. Provide one reason for this.