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Gender, country-level variables, and financial knowledge

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A gender gap in the financial knowledge of high school students has appeared over time in a variety of different countries, whereby male students tend to have more financial knowledge than female students (Atkinson & Messy, 2012; Lusardi, Mitchell & Curto, 2010). Previous research has attempted to explain this gender gap by exploring links between country-level variables and financial knowledge (Atkinson & Messy, 2012; Jappelli, 2010; Lo Prete, 2013). We built upon previous research by using data from the Programme of International Student Assessment (PISA) Financial Literacy Assessment and focusing on the potential influence that a country's macroeconomic indicators may have on individual student financial knowledge and the gender gap in financial knowledge. We utilized multilevel modeling procedures to best account for the variance in student performance and find that country-level variables do not seem to explain the gender gap in financial knowledge.

Keywords: country-level variables – financial literacy – gender – PISA

1 Introduction

Being financially knowledgeable is not just of individual concern, but it is also of global concern. The 2007-2009 financial crisis has shown the important relationship that exists between understanding the global financial system and making well-informed financial decisions (Klapper, Lusardi & Van Oudheusden, 2015; Lusardi, 2011). Around the world, recent economic conditions and financial crises have led to concerns about individual financial knowledge (Klapper et al., 2015; Lusardi & Mitchell, 2011; Widdowson & Hailwood, 2007). Additional research has suggested relationships between the economic landscape of a country and individual financial knowledge. Relationships between real gross domestic product (GDP) per capita and financial knowledge, the unemployment rate and financial knowledge, and income inequality and financial knowledge have been examined to explore if better financial outcomes for an entire country are correlated with increases in individuals' financial knowledge (Atkinson & Messy, 2012; Jappelli, 2010; Lo Prete, 2013). While correlations between a country's economic conditions and individual financial knowledge have been examined, few concrete statistical relationships have yet to be discovered.

The Organisation for Economic Co-operation and Development (OECD) defined financial literacy for the PISA dataset as the "knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such

knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life" (OECD, 2014a, p. 33). The analyses presented in this paper used hierarchical linear modeling (HLM), or multilevel modeling, to best account for the nested nature of the data. Through exploring a country's economic landscape, it was our hope to construct a more accurate picture of the international financial knowledge of high school-aged students as well as the gender gap in the financial knowledge of high school-aged students.

2 Literature review and research questions

2.1 Current findings in international financial literacy

Research has shown that most citizens of the world are financially illiterate. Adults in a variety of developed countries, including Germany, Russia, the United Kingdom, and the United States, have been found to lack basic financial knowledge and thus experience poorer financial outcomes, such as lower savings rates, lower wealth, and lower use of financial services (Atkinson & Messy, 2012; Klapper, Lusardi & Panos, 2012; Lusardi & Mitchell, 2011; Widdowson & Hailwood, 2007). Similar to adults, high school students around the world lack an understanding of financial matters (Borodich, Deplazes, Kardash & Kovzik, 2010; Cameron, Calderwood, Cox, Lim & Yamaoka, 2014; Lührmann, Serra-Garcia & Winter, 2012; Sohn, Joo, Grable, Lee & Kim, 2012). Results from the United States mimic results from around the world - American high school students lack a basic understanding of financial concepts in tests of financial knowledge, despite a growing number of financial education initiatives to combat this problem (Butters, Asarta & McCoy, 2012; Mandell & Klein, 2009; Peng, Bartholomae, Fox & Cravener, 2007; Walstad, Rebeck & MacDonald, 2010).

2.2 Gender gap in financial literacy

A gender gap in the financial knowledge of adults, whereby males have more financial knowledge than females, has been identified in many research studies (Atkinson & Messy, 2012; Förster, Happ & Maur, in this issue; Lusardi, 2011; Lusardi et al., 2010; Organisation of Economic Co-Operation and Development, 2013b). This is true for countries such as the Czech Republic, Germany, Ireland, Norway, Peru, South Africa, and the United Kingdom (Atkinson & Messy, 2012). Studies from the United States are no different, as American men tend to have more financial knowledge than American women do. Many of these findings come from studies of college students (Chen & Volpe, 1998, 2002; Manton, English, Avard & Walker, 2006), where male college students show greater levels of understanding of financial matters. Surveys

of American adults also show a gender gap favoring males (Lachance, 2014; Lusardi, 2011; Lusardi et al., 2010).

The gender gap in financial knowledge among high school-aged students is less clear. Some studies have shown that a gender gap favoring males does exist in countries such as Germany, Japan, New Zealand, and South Korea (Becchetti, Caiazza & Coviello, 2013; Jang, Hahn & Park, 2014; Lührmann et al., 2012). Yet, one study from South Korea found a gender gap favoring female high school students (Jang et al., 2014). Studies examining American high school students also reveal mixed results. Many studies found no significant difference in the financial knowledge of male and female high school students (Mandell & Klein, 2009; Tennyson & Nguyen, 2001; Walstad et al., 2010). Most recently, Hill and Asarta (2016) found that females performed slightly better than their male counterparts. Taken together, these studies seem to suggest that there is no gender gap in financial knowledge at the high school level in the United States. Other studies, however, point to a very prominent gender gap in financial knowledge in U.S. high schools (Butters et al., 2012; Lusardi et al., 2010; Peng et al., 2007; Varcoe, Martin, Devitto & Go, 2005). Thus, determining whether a gender gap in the financial knowledge of high school students exists requires further examination.

2.3 Macroeconomic variables and financial literacy

The literature regarding the relationship between macroeconomic variables and financial literacy is not extensive, but some macroeconomic variables do arise as being potentially statistically related to financial literacy. Gross domestic product was examined in some literature as a proxy measure for the wealth of a country. One international study found that GDP per capita was not related to economic and financial literacy (Jappelli, 2010). Expanding on that finding, Jappelli and Padula (2013) discovered that GDP growth was not related to financial literacy when analyzing a sample of European individuals over 50 years old. Income inequality, however, has been found to influence financial literacy (Lo Prete, 2013). More specifically, the author found, using Gini coefficients, that countries with less income inequality tended to have higher average levels of economic/financial literacy. Finally, the unemployment rate has been examined, as it was hypothesized that an increase in financial literacy would lead to higher employment and better employment outcomes for individuals. However, no relationship could be statistically determined in a study examining the country of Chile (Behrman, Mitchell, Soo & Bravo, 2010).

2.4 Research questions

Using the Programme of International Student Assessment (PISA) Financial Literacy Assessment, this study first examined financial knowledge around the world with a particular focus on gender. Then, country-level variables, such as real GDP per capita

and unemployment rates, are examined to determine if these variables influence a student's financial knowledge. Formally, the two research questions examined in this study are (1) How does financial knowledge vary by gender in students around the world? And (2) Are country-level variables related to a student's understanding of financial matters and to gender differences in financial knowledge?

3 Method

3.1 Data description

The inaugural Financial Literacy Assessment was administered in 2012 to students around the world as part of the Programme for International Student Assessment (PISA). A total of 29 041 students from 18 different countries completed the assessment. The countries who chose to administer the optional Financial Literacy Assessment were Australia, the Flemish Community of Belgium, the Czech Republic, Estonia, France, Israel, Italy, New Zealand, Poland, the Slovak Republic, Slovenia, Spain, and the United States (all OECD member countries); and Colombia, Croatia, Latvia, the Russian Federation, and Shanghai-China (non-OECD members) (OECD, 2014a).

To account for vast differences in educational systems around the world, the OECD targeted and sampled students between 15 years and three months of age, and 16 years and two months of age. A two-stage stratified sampling methodology was used to first select a sample of schools and then a sample of students within schools. In total, over 29 000 students from 5 260 schools completed the assessment. This sample of students is representative of around 9 million 15-year-old students from the 18 participating countries (OCED 2013a; 2014a). Students who completed the PISA Financial Literacy Assessment were required to complete a rotated-design, demographic questionnaire about themselves, as well as information about their families and home lives. Macroeconomic data for each country came from the World Bank. The measures included in our analyses were real GDP per capita, overall unemployment rates, and separate labor force participation rates for men and for women. All macroeconomic statistics were from the year 2011.

The assessment consisted of four 30-minute clusters of questions, two financial literacy clusters, one reading cluster, and one mathematics cluster. Each financial literacy cluster contained 40 test items, with a mix of multiple-choice and constructed response questions. The Financial Literacy Assessment measured a student's literacy with a proficiency measure rather than a raw score. Student "scores" were reported as plausible value (PV) data, and not as individual scores, to best account for the international nature of the dataset and the rotated design of the assessment. For the purpose of this study, PV scores represented likely proficiency measures for each

student (OECD, 2014a). Scores were reported as PV intervals, or ranges of estimated likely proficiencies to best represent the international population (OECD, 2014b).

3.2 Data statistics

The sample used in our analyses is smaller than the original sample of students who completed the Financial Literacy Assessment, as some students were missing data regarding their gender and/or their socioeconomic status. Individual student observations missing either of these variables were dropped from the analysis. The resulting sample includes 27 057 students from 4 927 schools in 18 countries. Table 1 presents sample sizes for both schools and students within each country.

Table 1: Sample Sizes for Schools and Students within Countries

Country (N = 18)	Number of participating schools	Number of participating students
OECD Member Countries/Economies		
Australia	745	3 132
Flemish Community (Belgium)	155	1 042
Czech Republic	240	1 007
Estonia	200	1 080
France	199	934
Israel	153	987
Italy	1 061	6 474
New Zealand	156	827
Poland	165	991
Slovak Republic	218	1 018
Slovenia	289	1 237
Spain	165	1 016
United States	151	1 071
Non-OECD Member Countries/Economies		
Colombia	315	1 902
Croatia	160	1 126
Latvia	190	895
Russian Federation	212	1 138
Shanghai-China	153	1 180
Total	4 927	27 057

Sample sizes varied greatly among countries and among schools. Italy had the largest number of participating schools at 1 061, and the United States had the smallest number of participating schools with 151 schools. Differing school sample sizes led to differing numbers of students participating within individual countries. Italy, once again, had the most students with 6 474 participating in the assessment, while New Zealand had the fewest students with 827 participants. Due to the differing sample sizes both at the student level and the school level, and to ensure there was not an overrepresentation of certain individuals and schools in the sample, the OECD provided student and school weights, as there were different probabilities in schools

and students being chosen for the assessment in the sampled countries (OECD, 2014a; 2014b).

The variables of interest in subsequent analyses occurred at the student level and the country level. At the student level, the student's gender (Male) and the student's socioeconomic status (ESCS) were examined. The variable ESCS is an indexed variable created by the OECD to account for socioeconomic differences across countries. At the country level, several variables were included to indicate a country's economic health at the time the assessment was administered. The variables used included real GDP per capita (GDP), labor force participation rate (LFPR), labor force participation rate for women (LFPRw), the unemployment rate (Unemp), and whether the country is an OECD member (OECD). Except for the variable OECD, all other country variables were obtained from the World Bank. The variable OECD was included in the original PISA Financial Literacy Assessment data. The variable GDP represents the real GDP per capita in 2011, and is measured in constant 2005 U.S. dollars. The variable LFPR represents the International Labour Organisation's (ILO) estimate of the percentage of all individuals 15 years of age or older who were members of the labor force in 2011, the year of analysis. The variable LFPRw is similar to LFPR, except that it represents the percentage of females 15 years of age or older who were members of the labor force in 2011. The variable Unemp represents the percentage of the total labor force that was not employed but was actively seeking work in 2011.

Table 2 depicts the means and standard deviations, in parentheses, for all variables of interest. In the sample, half of the students were female and half were male. The equal split was intentional, as the OECD targeted equal numbers of male and female students for the assessment. The mean of ESCS is -0.08. The interpretation of this indexed variable indicates that most students came from an average socioeconomic background. The average real GDP per capita was just over $20 000. This real GDP per capita is relatively high for an international sample; however, this finding seems appropriate given that the countries in the sample are mostly developed and industrialized.

Table 2: Sample Means for Student- and Country-Level Variables

Student-Level Variable	Mean (N = 27 057)	Explanation
Male	0.50 (0.50)	0 = Female; 1 = Male
Student's Socio-economic Status (ESCS)	-0.08 (0.96)	Index of economic, social, and cultural status
Country-Level Variable	**Mean (N = 18)**	**Explanation**
GDP	20 437.27 (12 858.23)	Real GDP Per Capita 2011 (in constant 2005 US$)
LFPR	0.60 (0.06)	Labor Force Participation Rate (%)
LFPRw	0.53 (0.06)	Labor Force Participation Rate - Women (%)
Unemp	0.10 (0.04)	Unemployment Rate (%)
OECD	0.72 (0.46)	0 = non-OECD member; 1 = OECD member

Annotations: GDP, LFPR, LFPRw, and Unemp were obtained via the World Bank at www.data.worldbank.org/. Standard deviations in parentheses.

Across the sample of countries, the average labor force participation rate is 60 %. Given the fact that women still have lower labor force participation rates than men, LFPRw is, not surprisingly, lower at an average of 53 %. The average unemployment rate in 2011 was 10 %. That average rate was relatively high at the time as many of the countries in the sample were experiencing the effects of the most recent global recession. Finally, around 72 % of the students in the sample came from OECD member countries.

An examination of gender differences in demonstrated financial knowledge, using independent samples t-tests, is provided in table 3. That table includes information on the average male performance, the average female performance, the difference between average male and female performance, and whether this difference is statistically significant.

Table 3: Differences in Student Performance by Country and Gender

Country (N = 18)	Male (M)	Female (F)	Difference (M – F)	Effect Size (Cohen's d)
OECD Member Countries/Economies				
Australia	517.50 (109.22)	519.62 (97.24)	-2.12	0.02
Flemish Community (Belgium)	553.31 (96.43)	543.17 (92.98)	10.14	0.11
Czech Republic	533.57 (90.13)	522.83 (86.75)	10.74	0.12
Estonia	529.63 (81.21)	532.51 (73.35)	-2.88	0.04
France	490.98 (111.65)	493.23 (88.61)	-2.25	0.02
Israel	485.35 (117.73)	483.01 (97.30)	2.34	0.02
Italy	478.28 (92.07)	468.29 (80.91)	9.99**	0.11
New Zealand	529.45 (128.20)	524.69 (101.79)	4.77	0.04
Poland	516.07 (87.75)	512.53 (75.06)	3.53	0.04
Slovak Republic	472.20 (107.29)	477.00 (105.01)	-4.80	0.04
Slovenia	465.63 (90.19)	474.30 (83.09)	-8.67	0.10
Spain	488.07 (87.17)	485.44 (81.87)	2.63	0.03
United States	493.43 (103.65)	493.01 (96.31)	0.42	0.00

Country (N = 18)	Male (M)	Female (F)	Difference (M – F)	Effect Size (Cohen's d)
Non-OECD Member Countries/Economies				
Columbia	398.11 (104.59)	392.07 (99.97)	6.04	0.06
Croatia	482.14 (88.68)	478.98 (79.73)	3.16	0.04
Latvia	494.94 (79.65)	505.65 (73.97)	-10.71*	0.14
Russian Federation	486.31 (92.34)	487.98 (83.25)	-1.67	0.02
Shanghai-China	601.45 (86.60)	602.38 (81.50)	-0.93	0.01
Average	500.91	499.82	1.09	0.01

Annotations: Standard deviations in parentheses. **p < .001; *p < .01

There exists no statistically significant difference between the average scores of male and female students across the overall sample of students. Despite this finding, two countries exhibit statistically significant differences in their mean scores for male and female students: Italy and Latvia. Interestingly, the financial knowledge gender gap in Italy favors male students, while the financial knowledge gender gap in Latvia favors female students. When examining effect sizes for each of these gender differences, in both cases, Cohen's d coefficient is less than 0.2, indicating the statistical differences between the means in both countries are trivial.

3.3 Estimation methods

Multilevel modeling has become increasingly popular in educational research, as most educational data is nested in hierarchical levels. Because of the nested nature of such data, an individual observation will share a certain amount of variance with other individual observations, and observations cannot be assumed to be independent of one another; students in the same school may be more similar to one another than different (Hofmann, 1997). Multilevel modeling accounts for shared characteristics, or variance, by estimating fixed effects at the lowest level (i.e. the student level) and then uses these fixed effects to estimate higher-level effects (Hofmann, 1997; Woltman, Feldstain, MacKay & Rocchi, 2012). In this study, fixed effects were first estimated at the student level (level 1) and then subsequently used in the estimation procedure to estimate effects at both the school level (level 2) and then the country level (level 3).

To examine the relationships between country-level variables, student financial knowledge, and the gender gap in financial knowledge, educational production functions in the style of Hanushek (1979; 1986) were estimated. Our standard educational production function was estimated using the following form:

$$Y_{isc}=\alpha+\beta_1 G_{isc}+\beta_2 X_{isc}+\beta_3 S_{isc}+\beta_4 C_{isc}+\varepsilon_{isc} \quad (1)$$

where Y_{isc} is the overall achievement in financial literacy for student i in school s in country c.

G_{isc} is a dummy variable taking the value of 1 if the student is female.
X_{isc} is a vector of student characteristics, other than student gender.
S_{isc} is a vector of school characteristics.
C_{isc} is a vector of country-level characteristics.
ε_{isc} is a normally distributed error term.

In a multilevel modeling framework, equations are estimated at each level of analysis. As such, separate equations were estimated at the student level, the school level, and the country level. Additionally, slopes-as-outcomes models were estimated to examine factors contributing to a potential gender gap in financial knowledge. The equations followed the functional form from Raudenbush and Bryk (2002) in a multilevel modeling framework. More specifically, the student-level equation took the following form:

$$Y_{ijk}=\pi_{0jk}+\pi_{1jk}(a_{ijk})+\varepsilon_{ijk} \quad (2)$$

where Y_{ijk} is a measure of financial knowledge for student i in school j in country k.

π_{0jk} is the intercept for school j in country k.
a_{ijk} is a vector of independent variables at the student level.
π_{1jk} are the student-level fixed effects.
ε_{ijk} is the student-level random effect (or variance).

The school-level equations made use of the fixed effects from the student level in their estimate. They thus took the following forms:

$$\pi_{0jk}=\beta_{00k}+r_{0jk} \quad (3)$$

$$\pi_{1jk}=\beta_{10k}+r_{1jk} \quad (4)$$

where π_{0jk} is the intercept for school j in country k.

π_{1jk} is the slope for school j in country k.
β_{00k} is the intercept for the school intercept for school j in country k.
β_{10k} is the intercept for the school mean for school j in country k.
r_{0jk} - r_{1jk} are the school-level random effects (or variance).

The country-level effects were modeled using separate equations and made use of the level-2 equations as outcomes. The equations took the following forms:

$$\beta_{00k}=\gamma_{000}+\gamma_{001}(W_{1k})+u_{00k} \quad (5)$$

$$\beta_{01k}=\gamma_{010}+\gamma_{011}(W_{1k})+u_{01k} \quad (6)$$

$\beta_{10k}=\gamma_{100}+\gamma_{101}(W_{1k})+u_{10k}$ (7)

$\beta_{11k}=\gamma_{110}+\gamma_{111}(W_{1k})+u_{11k}$ (8)

where γ_{000} is the average country intercept for country k.

W_{1k} is a vector of independent variables at the country level.

γ_{001} is the average effect of W on the country intercept.

γ_{010} is the average country slope.

γ_{011} is the average effect of W on the average country slope.

γ_{100} is the average intercept between countries.

γ_{101} is the average effect of W on the intercept between countries.

γ_{110} is the average difference between the countries' slopes.

γ_{111} is the average effect of W on the average difference between the countries' slopes.

$u_{00k} - u_{11k}$ represent the country-level random effects.

The multilevel models were estimated to examine differences across the international sample of students. Like previous research on international comparisons of student achievement, the socioeconomic status of the student was controlled for in all models estimated (Schmidt, Cogan & Houang, 2011). In addition, attempts to control for the opportunity to learn (OTL) yielded no accurate estimate of such a measure; the OTL measures tested did not account for any additional variance explained at the student level, and thus, no measure of OTL is included in any of the models.

4 Results

Table 4 presents multilevel regression estimates using both student- and school-level weights. First, model 1 controlled for the student's gender (Male) and socioeconomic status (ESCS). In model 1, the level-1 intercept and the variable ESCS were found to be statistically significant. Given that the independent variables were entered into the model as grand-mean centered, the intercept indicated that, on average, students scored 473.31 points. The coefficient on ESCS was positive and indicated that being a student from a higher socioeconomic background was associated with higher average financial knowledge. Male was not found to be statistically significant in this model specification, suggesting that there was no gender gap in achievement present.

Model 2 added the country-level variables OECD, GDP, LFPRw, and Unemp to examine the relationships between a country's economic situation and average student performance, as well as to examine how males and females scored on the assessment. Once again, the average performance (intercept) and ESCS coefficients were positive and statistically significant, indicating similar findings to those in

model 1. When examining the intercept as an outcome, OECD membership was significantly correlated with average student performance. The coefficient of 77.14 indicated that being a student from an OECD country was associated with an increase in financial knowledge scores of about 77 points. Yet, the finding was only marginally significant. Interestingly, no other country-level variables were significantly correlated with average student performance. Furthermore, when examining the gender slope as the outcome variable, none of the country-level variables were significantly correlated with gender.

Table 4: Multilevel Regression Estimates of Predictors of Financial Knowledge, Fixed Effects

	Model 1	Model 2	Model 3
Fixed Effects			
Level 1			
Intercept	473.31**	477.85**	481.81**
	(6.57)	(10.54)	(11.86)
Male	-0.01	0.68	0.53
	(1.38)	(3.22)	(3.15)
ESCS	29.80**	29.74**	29.83**
	(3.86)	(4.59)	(4.55)
Level 3 – Intercept-as-Outcome			
GDP		-0.002	-0.001
		(0.001)	(0.001)
OECD		77.14*	30.84
		(31.59)	(36.16)
LFPRw		420.09	
		(258.23)	
LFPR			-109.91
			(282.48)
Unemp.		-140.99	-120.29
		(189.42)	(201.55)

	Model 1	Model 2	Model 3
Level 3 – Gender Slope-as-Outcome			
GDP		-0.0002 (0.0004)	0.0002 (0.0004)
OECD		1.34 (9.25)	5.37 (9.74)
LFPRw		-7.12 (53.62)	
LFPR			32.41 (72.93)
Unemp.		-5.66 (61.59)	-12.20 (60.00)
% of level-1 variance explained	0.18	0.18	0.18
% of level-2 variance explained	0.31	0.31	0.34
% of level-3 variance explained	0.32	0.42	0.32

Annotations: Standard errors in parentheses. Level 2 is not included in this table, as analyses did not make use of any Level 2 variables. *p < .01; **p < .001

These results seem to suggest that the economic conditions within specific countries have little to no relationship with the gender gap in financial knowledge. Model 3 is similar to model 2 except that the variable LFPR was included instead of LFPRw. This new model yielded similar results to those found in model 2; again, none of the country-level variables were significantly correlated with either the intercept or the gender slope.

Table 5 shows the variance components, or random effects, at the school and country levels for the intercepts and gender variable using both the student- and school-level weights. In each of the three models estimated, the school intercepts and the country intercepts had statistically significant variance components, indicating that average scores for students vary depending on the school and the country. This finding further justifies the use of multilevel modeling for our analyses, as OLS cannot account for random effects. Gender randomly varied at the school level but not at the country level.

Table 5: Multilevel Regression Estimates of Predictors of Financial Knowledge, Error Variance

	Model 1	Model 2	Model 3
Error Variance/Random Effects			
Level 1 (Residual)	4468.24 (66.84)	4468.51 (66.84)	4468.38 (66.85)
Intercept (Levels 1 & 2)	2501.23** (50.01)	2504.33** (50.04)	2505.22** (50.05)
Gender (Levels 1 & 2)	2203.94** (46.95)	2188.17** (46.78)	2186.61** (46.76)
Intercept (Level 3)	821.99** (28.67)	702.43** (26.50)	857.33** (29.28)
Gender (Level 3)	1.61 (1.27)	0.65 (0.81)	1.32 (1.15)

Annotations: Standard deviations in parentheses. Level-1 residual values do not report statistical significance. *p < .01; **p < .001

5 Discussion

One goal of this study was to determine whether economic conditions within the student's home country influenced the student's financial knowledge as well as the gender gap in financial knowledge. For the sample of students participating in the 2012 PISA Financial Literacy Assessment, no overall gender gap in financial knowledge was found in the data, though a few individual countries exhibited a gender gap in knowledge. This overall finding is consistent with other research results derived from samples of U.S. high school students (Hill & Asarta, 2016; Walstad et al., 2010).

In terms of overall student performance, none of the country-level variables examined were correlated with average student performance. Findings here are similar to those of past research, which found no statistical relationships between GDP and financial knowledge, or between unemployment and financial knowledge (Behrman et al., 2010; Jappelli & Padula, 2013; Lo Prete, 2013). It is difficult to determine why macroeconomic indicators were not correlated with the financial knowledge of the students in the PISA sample. Many students in this sample are too young to work, thus affecting their role in the economy, which may have contributed to the findings. However, because the sample included many different countries, we cannot comment with certainty. Given that each country had different economic and cultural

landscapes, it is difficult to fully control for a student's economic and cultural surroundings within the student's home country. Yet, the fact that macroeconomic variables do not seem to influence financial literacy may strengthen the literature findings that support the idea that proper educational methods and teacher training are the key to success in personal finance education (Asarta, Hill & Meszaros, 2014; Harter & Harter, 2009).

Similar to overall student performance, the gender gap in achievement is not correlated with the country-level variables. There are a few possible reasons for the lack of a relationship in the findings. First, since no gender gap was found in analyses before adding the country-level variables, there may have not been a gender gap to explain. Secondly, there could have been a misspecification error in the country-level variables used. More specifically, incorrect regressors could have been examined. Furthermore, it may have been the case that some country-level variables were related to student financial knowledge, but the correct regressors were not included in the model. Efforts to avoid misspecification errors were taken early in the analysis process, but there are always possible contributing factors that could have been overlooked. The interpretations provided in this study discussed the coefficients of the fixed effects and possible implications, though the estimates presented were limited by both small standard errors and low amounts of variance explained.

It should be noted that the statistical power of the models estimated may be limited due to the small sample size at level 3 (the country level). When estimating multilevel models, the typical rule of thumb is to ensure that there are at least 30 observations or groups at each level of analysis (Bell, Morgan, Kromrey & Ferron, 2010a; Maas & Hox, 2005). However, given the limited number of countries that administered the PISA Financial Literacy Assessment, it was not possible to increase the number of groups (or countries) at level 3. Through a series of simulation studies, some authors argue that decreasing the number of groups will bias estimates (Bell et al., 2010a; McNeish & Stapelton, 2016), but others argue that this is not the case (Bell et al., 2010b; Maas & Hox, 2005). However, most agree that decreasing the number of groups for analysis will reduce the statistical power of the models (Bell et al., 2010b; Snijders, 2005). These simulation studies were conducted for 2-level multilevel models and are theoretical in nature rather than applied. Therefore, findings from previous research may not accurately apply to the models estimated in this study. Given the fact that it was impossible to increase the sample size at level 3, other measures are taken to ensure unbiased estimates and increased statistical power. Also, as this study uses cross-sectional data and regression analysis, causal relationships cannot be posited. While we can discuss potential relationships between the variables, we cannot comment on causal effects. Future research should attempt to examine different macroeconomic variables, causal effects, and expanded samples of students

from different countries to not only examine more countries but to also increase the country-level sample size, and samples of students from different time periods. Finally, future studies may want to lag the macroeconomic statistics by longer time periods (e. g., five or ten years prior to the Financial Literacy Assessment) to get a long-run sense of their potential influence on financial literacy.

Our work adds to the growing body of literature on the financial knowledge of high school-aged students around the world as well as on the gender gap in financial knowledge. Though few relationships between gender, country-level variables, and financial knowledge were discovered, future research should seek to better understand how country-level variables influence financial knowledge.

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