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### The relationship between trust, cognitive skills, and democracy - Evidence from 30 countries around the world

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#### Abstract

Based on highly comparable data from the OECD PIAAC Programme, this note analyzes the relationship between generalized trust and cognitive skills among 30 countries around the world. The results show that the strength and direction of the relationship is not a universal characteristic but varies substantially among countries worldwide. A detailed descriptive analysis of this variation provides evidence that the relationship strengthens with the level of democracy in a country. In a second step, German separation and reunification is used as external variation in the level of democracy in the German PIAAC subsample. The results support the evidence from the cross-country analysis. Thus, the institutional framework in a country not only shapes an individual's level of trust but also amplifies the relationship between individual characteristics such as cognitive skills and generalized trust.

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## 1. Introduction

Generalized trust<sup>1</sup> within a population has been increasingly recognized as an important characteristic of a society. At the macro level, higher trust has been shown to contribute to economic growth (e.g., Algan and Cahuc, 2010, 2013), and at the individual level, it has been shown to be correlated with a range of favorable characteristics such as health (Hamamura et al., 2017) and well-being (Bjørnskov, 2003).<sup>2</sup>

The decision whether to trust is essentially a cognitive task. Thus, individuals with higher cognitive skills should be better in judging whether someone is trustworthy. Recent contributions, both in economics and psychology, show a strong positive correlation between trust and cognitive skills (e.g., Carl and Billari, 2014; Corgnet et al., 2016; Hooghe et al., 2012; SturGIS et al., 2010), which is not driven by an individual's education. Using a self-assessment of numerical skills, Falk et al. (2018) showed that this positive correlation was also prevalent in a cross-country study covering a wide range of cultural contexts.

Putnam (1993) argued that trust is an important prerequisite of developing democratic institutions. This relationship might work in both directions since Heineck and Süßmuth (2013) and Rainer and Siedler (2009) showed that growing up under a non-democratic (repressive) regime lowers an individual's level of generalized trust. However, the institutional framework not only shapes an individual's level of trust but could also amplify the association between trust and cognitive abilities. In an ideal democratic setting, trust might be an optimal strategy, while in a less favorable set of institutions, this might not be the case. If individuals with higher cognitive abilities are more capable of judging this difference, the association between trust and cognitive abilities should increase with the level of democratic institutions in a country.<sup>3</sup>

This letter contributes to the literature by analyzing the relationship between trust, cognitive skills, and democracy i) by performing an international comparison based on highly comparable cross-country data that include more reliable measures of cognitive skills than previous cross-country studies and ii) by exploring a unique natural experiment within one single country (German separation and reunification).

## 2. PIAAC Data

I use highly comparable data on 30 countries from the OECD Programme for the International Assessment of Adult competencies (PIAAC).<sup>4</sup> The PIAAC data were collected in two rounds in 2011/12 and 2014/15 covering representative samples of the population aged 16-65 years for each included country or region.

The focus of PIAAC is on adult competencies; thus, the data include three detailed measures of adult cognitive skills: numerical skills, literacy skills, and problem-solving skills. Following Hanushek et al. (2015, 2017), this study focuses on the numeracy skill measure as a proxy for cognitive skills.<sup>5</sup> However, all presented results are robust to using the literacy skills score or to

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<sup>1</sup> This note analyzes generalized trust, i.e., trust in others.

<sup>2</sup> Anand and Poggi (2018) showed that there is a substantial association between trust and planning abilities.

<sup>3</sup> This would also support the notion of trust as a component of social intelligence (Yamagishi, 2001).

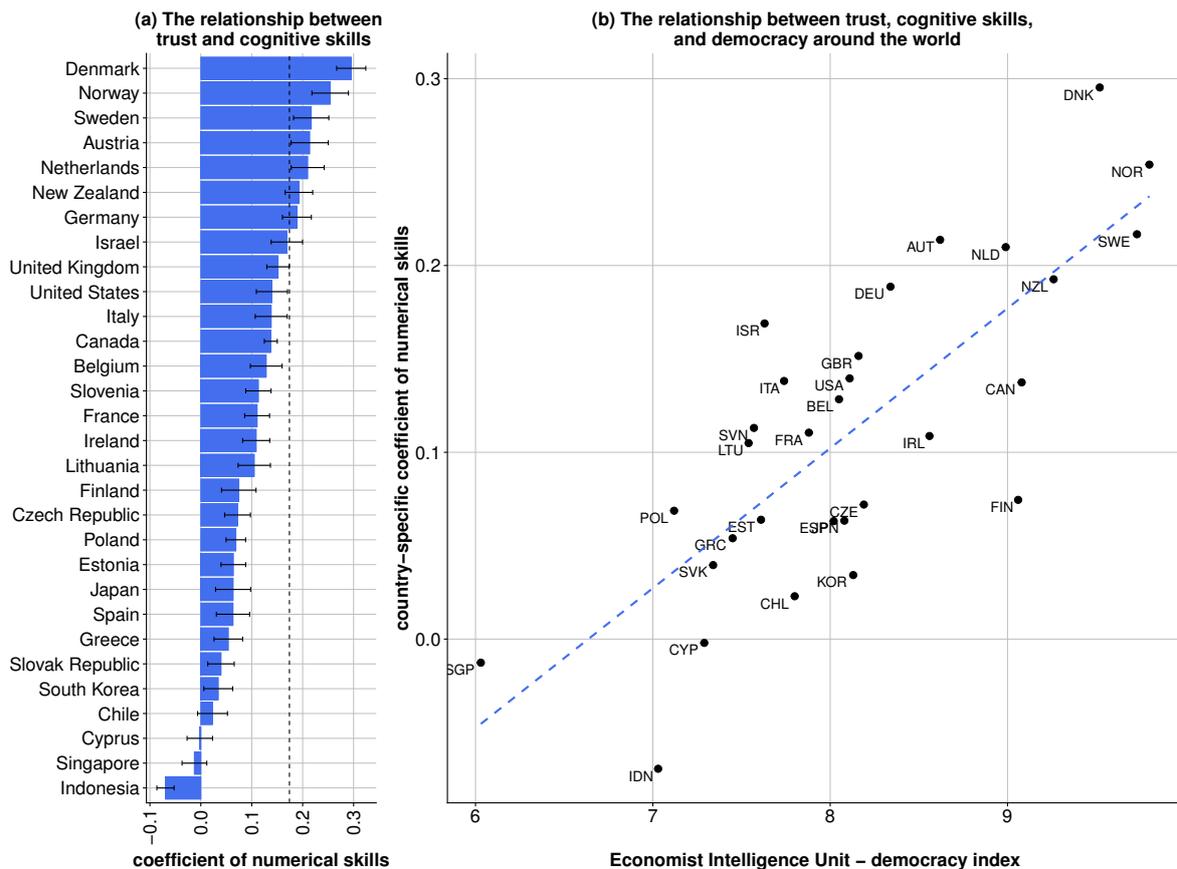
<sup>4</sup> Three countries out of the 33 PIAAC countries were excluded in this study. For Turkey, trust measures were not surveyed, and data on Australia was not available in the PIAAC public use file provided by the OECD. Russia was excluded due to problems that occurred during the PIAAC data collection (OECD, 2016).

<sup>5</sup> Following Hanushek et al. (2015), I use the first plausible value for numerical skills. However, the results are robust to using an average and/or a random draw of the ten values provided in the PIAAC data.

using a combined measure of literacy and numeracy skills.<sup>6</sup> The score is standardized to have a mean of zero and a standard deviation of one over all countries.

In addition to competencies, PIAAC collected information from an extensive background questionnaire, which included two measures of generalized trust: i) *There are only a few people you can trust completely*, and ii) *If you are not careful, other people will take advantage of you*. Both questions were answered via a 5-point Likert-type scale from 1, *strongly agree*, to 5, *strongly disagree*. The answers were averaged over both dimensions and standardized to have a mean of zero and a standard deviation of one.

**Figure 1:** The relationship between trust and cognitive skills around the world



Note: Panel (a): shown are estimated coefficients of standardized numerical skills test scores from OLS regressions of equation (1). Separate regressions for each country. PIAAC sample weights are applied. Error bars indicate 95 percent confidence intervals. The United Kingdom incorporates only England and Northern Ireland, Belgium incorporates only Flanders, and Indonesia incorporates only Jakarta. Source: PIAAC Public Use File. Panel (b): scatter plot of coefficients from panel (a) against the Economist Intelligence Unit democracy index for the respective country in the respective PIAAC survey year. Survey periods are 2011/12 for round-one countries and 2014/15 for round-two countries. The United Kingdom incorporates only England and Northern Ireland, Belgium incorporates only Flanders and Indonesia incorporates only Jakarta. Source: The Economist Intelligence Unit (2012, 2013, 2015, 2016), PIAAC Public Use File.

<sup>6</sup> The results are also robust to using the score on problem-solving skills. However, this data is not available for the full set of countries.

### 3. Trust, Cognitive Skills, and Democracy in an International Comparison

Panel (a) in Figure 1 depicts the coefficients  $\beta_1$  from separate (by country) OLS regressions of the form:

$$trust_i = \alpha + \beta_1 C_i + \beta_2 G_i + \beta_3 A_i + \beta_4 E_i + \beta_5 K_i + \beta_6 H_i + \varepsilon_i \quad (1)$$

where  $trust_i$  is the combined measure of trust of the individual described above and  $C_i$  is the numerical skill score,  $G_i$  is a gender indicator,  $A_i$  includes 5 age indicators,  $E_i$  is an indicator if the individual has tertiary education,  $K_i$  is an indicator if the individual has children, and  $H_i$  includes five indicators for an individual's subjective health.<sup>7</sup>  $\varepsilon_i$  is an idiosyncratic error.

The estimates depicted in Figure 1 show that the relationship between trust and cognitive skills substantially varies between countries. Out of the 30 countries, 26 countries show a positive statistically significant coefficient. However, the size of the coefficient ranges from 0.034 in South Korea to 0.295 in Denmark. For Chile, Cyprus, and Singapore, the coefficients are not significant, and for Indonesia, the coefficient is even significantly negative. The estimated coefficient for the pooled sample is 0.175 and is represented by a dashed vertical line. For most countries, the estimates support the discussed finding of a positive correlation between trust and cognitive skills when based on highly comparable data and comprehensive skill measures. However, in summary, the relationship between trust and cognitive skills is neither universally positive nor of the same magnitude for the different countries.

What factors can now explain the variation shown in panel (a) of Figure 1? The existing literature argues for a relationship between the level of trust and the level of democracy in a country, which could be amplified if the level of democracy also influences the association between trust and cognitive abilities.

This notion is analyzed in panel (b) of Figure 1. Here, the country level coefficients from panel (a) are plotted against the level of democracy as measured by the democracy index provided by the Economist Intelligence Unit (EIU). The index consists of five subdimensions, which are electoral process and pluralism, functioning of government, political participation, political culture, and civil liberties, and provides an aggregate score from 0-10 for each country.<sup>8</sup> Higher values of the index are associated with a higher level of democracy. All countries are assigned the index value for the respective PIAAC survey year.<sup>9</sup> Panel (b) of Figure 1 shows that there is a positive correlation between level of democracy and the strength of the relationship between trust and cognitive skills.<sup>10</sup>

Taken together, panel (a) and panel (b) of Figure 1 visualize the main result of this note. The relationship between trust and cognitive skills varies among the countries, and the level of democracy in the respective countries is able to explain a substantial part of this variation.

Table I provides the main results from estimating the model in equation (1), pooling all PIAAC countries and adding the EIU index (standardized) as an additional control variable. The first column shows that when including the EIU index and using individual characteristics as control variables, the coefficient for numerical skills is 0.163 for the pooled sample, and the coefficient of the EIU index is 0.174. This means that on average, an additional standard deviation in the EIU index (that is about the difference between Norway and Canada) is as-

<sup>7</sup> Including income information leaves the results virtually unchanged while substantially reducing the sample size. The results are robust to the exclusion of the health indicators.

<sup>8</sup> Details on the computation of the score can be found in The Economist Intelligence Unit (2012, 2013, 2015, 2016).

<sup>9</sup> If the survey period covers two years, the main survey year is used.

<sup>10</sup> The correlation between the country-level coefficients and the EIU index is estimated to be 0.776.

**Table I:** The relationship between trust, cognitive skills, and democracy (international sample)

	Pooled sample			Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Numerical skills	0.163*** (0.026)	0.174*** (0.025)	0.169*** (0.021)	0.134*** (0.018)	0.143*** (0.017)	0.138*** (0.014)	0.197*** (0.034)	0.210*** (0.033)	0.205*** (0.028)
EIU index	0.174*** (0.050)	0.171*** (0.047)	0.161*** (0.057)	0.155*** (0.045)	0.146*** (0.042)	0.135** (0.051)	0.193*** (0.054)	0.198*** (0.052)	0.190*** (0.062)
<b>Int. of numerical skills &amp; EIU index</b>		<b>0.077*** (0.026)</b>	<b>0.077*** (0.026)</b>		<b>0.069*** (0.025)</b>	<b>0.070*** (0.025)</b>		<b>0.092*** (0.028)</b>	<b>0.092*** (0.029)</b>
Ind. level char.	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country level char.	no	no	yes	no	no	yes	no	no	yes
Numb. of ind.	195,001	195,001	195,001	91,066	91,066	91,066	103,935	103,935	103,935

Note: Coefficients from OLS regressions. The dependent variable is a measure of trust. Trust and numerical skills are standardized at the world level. The level of democracy is operationalized by the Economist Intelligence Unit democracy index and standardized at the world level. The standard errors in parentheses are clustered at the country level. The individual-level characteristics include gender, age (5 categories), education (indicator for tertiary education), subjective health (5 categories), and an indicator if the individual has children. The country-level characteristics include the Gini index and annual GDP growth rate. All regressions are weighted by the PIAAC sample weights. “Int. of numerical skills & EIU index” means “Interaction effect of numerical skills and EIU index”. \*\*\* means significant at the 1 percent level; \*\* means significant at the 5 percent level; and \* means significant at the 10 percent level.

Source: The Economist Intelligence Unit (2012, 2013, 2015, 2016), PIAAC Public Use File, WIID3.4, Penn World Tables (v9.0).

sociated with a 0.174 standard deviation higher level of trust, supporting the finding from the literature that countries with a higher level of democracy are also characterized by a higher level of generalized trust in the population. The model in column 2 now includes an interaction term between numerical skills and the EIU index. The resulting coefficient of the interaction term is positive and significant while the two other coefficients remain largely unchanged.<sup>11</sup> To put this into perspective, the size of the interaction effect is about three-quarters of the size of the gender coefficient (-0.100; male) and thus not negligible. Finally, column 3 shows that including additional country-level characteristics for inequality (Gini index) and growth (annual GDP growth rate) does not alter the results.<sup>12</sup> Finally, analyzing effect heterogeneity by gender shows that the interaction term is significant for men and women, but the results seem to be more pronounced in the female sample than in the male sample (columns 4 to 9).

However, it is unclear whether these results would survive in a more causal analysis. Thus, in the next section, I draw on a unique natural experiment that varied the level of democracy for a whole region of a country - German separation and reunification.

#### 4. Trust, Cognitive Skills, and Democracy: Evidence based on a Natural Experiment

Although the end of the German Democratic Republic was initiated by protests from parts of the East German population, the process and timing of reunification can be argued to have been exogenous on the level of individuals living in former East Germany. Alesina and Fuchs-Schündeln (2007) provided a detailed discussion of the institutional setting before and after

<sup>11</sup> This finding is robust to the use of a categorical version of the EIU index, dividing the sample into Full democracies (17 countries) and Flawed democracies (13 countries).

<sup>12</sup> In a specification including country fixed effects the coefficient of numerical skills is 0.133 (0.011), the coefficient of the interaction term is 0.067 (0.015) and the coefficient of the EIU index is 0.006 (0.009). The third coefficient is not significant any more, since democracy only varies at the country level.

**Table II:** The relationship between trust, cognitive skills, and democracy (German sample)

	Pooled sample		Born before 1970	Born 1970 and later	Men	Women	Parents not highly educated	Parents highly educated
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Numerical skills	0.205*** (0.017)	0.226*** (0.019)	0.210*** (0.025)	0.270*** (0.031)	0.173*** (0.027)	0.292*** (0.028)	0.210*** (0.024)	0.243*** (0.042)
East	-0.167*** (0.033)	-0.149*** (0.034)	-0.246*** (0.044)	-0.021 (0.054)	-0.109** (0.049)	-0.209*** (0.047)	-0.157*** (0.044)	-0.151** (0.069)
<b>Int. of num. skills &amp; East</b>		<b>-0.088** (0.035)</b>	<b>-0.134*** (0.048)</b>	<b>-0.098* (0.055)</b>	<b>-0.035 (0.050)</b>	<b>-0.160*** (0.051)</b>	<b>-0.088* (0.050)</b>	<b>-0.113 (0.069)</b>
Ind. char.	yes	yes	yes	yes	yes	yes	yes	yes
N	3,963	3,963	2,346	1,617	1,964	1,999	2,415	1,281

Note: Coefficients from OLS regressions. The dependent variable is a standardized measure of trust. Standard errors are shown in parentheses. East is an indicator if an individual lived in East Germany before reunification. Weighted observations. “Int. of num. skills & East” means “Interaction effect of numerical skills and having lived in East Germany”. \*\*\* means significant at the 1 percent level; \*\* means significant at the 5 percent level; \* means significant at the 10 percent level. Source: PIAAC Public Use File, PIAAC German SUFv2.2.

reunification and concluded that German separation and reunification can be used to identify the long-run consequences of having lived under the non-democratic regime in East Germany.<sup>13</sup> Rainer and Siedler (2009) provided a discussion of this identification strategy with respect to differences in the level of generalized trust.

I use information on an individual’s place of living before the fall of the wall, which is included in the German extension to the PIAAC background questionnaire and is available in the German PIAAC SUF.<sup>14</sup> I restrict the sample to individuals who lived in either East or West Germany before 1989 and were born during the period of separation.<sup>15</sup> The analysis is based on the following regression:

$$trust_i = \pi + \gamma_1 C_i + \gamma_2 East_i + \gamma_3 East_i \cdot C_i + \gamma_4 X_i + \nu_i \quad (2)$$

where  $trust_i$  and  $C_i$  are the same measures as in equation (1), and  $X_i$  includes the full set of individual-level characteristics as in the international comparison.  $East_i$  is an indicator (0/1) if the individual lived in East Germany before the fall of the wall. Thus, the main parameter of interest is  $\gamma_3$ , the coefficient of the interaction term of  $East_i$  and the measure of numerical skills.

In the pooled sample (columns 1 - 2 of Table II), the results match and support those from the international comparison. Higher skills are associated with a higher level of trust. Having lived in East Germany before reunification, that means experiencing a lower level of democracy is associated with a lower trust level. This is in line with the results presented by Rainer and

<sup>13</sup> Over the last years, a number of authors have used this setting to identify the effect of living under a non-democratic (repressive) regime on a variety of outcomes. A list of contributions can be found for example in the introduction of Heineck and Süßmuth (2013). Thus, it is possible that other affected variables apart from the change from a repressive to a democratic regime affect trust and the interaction of trust with cognitive abilities. In addition, since substantial time elapsed between reunification and the data collection, the individuals could be exposed to a variety of other treatments. However, since the evidence from this exercise is in line and supports the evidence from the cross-country analysis presented above, I am confident that the measured effect can—at least to a substantial part—be attributed to the change in regimes.

<sup>14</sup> PIAAC German SUFv2.2 (DOI: 10.4232/1.12660).

<sup>15</sup> Individuals are included if they were born between 1949 and 1989.

Siedler (2009) and Heineck and Süßmuth (2013). The interaction effect of numerical skills and having lived in the East is negative, indicating that individuals who experienced growing up under a repressive non-democratic regime show a weaker correlation between abilities and trust.<sup>16</sup> This supports the finding from the international comparison that the relationship between trust and cognitive skills increases with the level of democracy.

Analyzing potential effect heterogeneity by birth cohort, gender, and parental background shows that the estimates of all subgroups support the findings from the pooled sample. However, the amplification effect of having lived in the East seems to be less pronounced in the male subsample.

## 5. Conclusion

This note contributes to the literature on determinants of generalized trust and how institutions shape trust. The results show that in most PIAAC countries, there is a positive relationship between generalized trust and cognitive skills. However, the strength of this relationship varies substantially. The results from the international comparison suggest that the association between trust and cognitive skills strengthens with the level of democracy in a country. Since this finding could be driven by reverse causality, among other factors, German separation and reunification was used as an external variation in the level of democracy to identify the effect in a more causal way. The results support the findings from the cross-country analysis.

The findings suggest that the institutional framework in a country not only shapes the level of trust of an individual but also works by amplifying the relationship between individual characteristics and generalized trust.

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<sup>16</sup> Again, the size of the interaction effect is non-negligible and about half the size of the coefficient of the gender indicator.

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