UNIVERSITY OF CAMBRIDGE

The financial skills of adults across the world. New estimates from PIAAC.

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Our research

- PIAAC - comprehensive study of adult skills and competencies

- PIAAC has not been used to study important issue of ***financial literacy***

- We report on subset of PIAAC questions to look at financial literacy in the global population

Why focus on financial literacy?

- People make difficult financial decisions
- Increasingly complex financial products
- Many struggle with basic calculations and financial concepts
- Led to large number of policy initiatives in both developed and developing countries
  - Klapper, Lusardi, & Van Oudheusden, 2015; Lusardi, 2005, 2015; Lusardi, Mitchell, & Curto, 2010; OECD/INFE, 2016; OECD/INFE, 2013a; Klapper et al. 2015

MEASURING FINANCIAL LITERACY

Financial literacy is a broad concept

- Financial knowledge and ***skills***

- Attitudes towards money

- Financial behaviours including financial planning and money management

  – OECD, 2005

Measuring financial literacy

- ‘Big Three’ – financial concepts, numeracy and risk
  - Lusardi & Mitchell, 2011

- Broader measures that encompass measurement of financial attitudes and behaviors (like saving or budgeting)
  - Calderone, Fiala, Mulaj, Sadhu, & Sarr, 2014; Carpena, Cole, Shapiro, & Zia, 2015; Drexler, Fischer, & Schoar, 2014

Measuring financial literacy at scale

- OECD launched financial education project 2002

- Large-scale implementation of the OECD/INFE toolkit
  - Review of financial literacy surveys and measures
  - Core instrument - 24 core questions designed to capture financial knowledge, behaviour and attitudes
  - Used in 14 countries – detailed patterns of knowledge, attitudes and behaviours

OECD/INFE, 2013b, 2015

Measuring financial literacy at scale

- Financial literacy component in PISA (Age 15 tests)

- Numeracy and financial literacy are unsurprisingly correlated in PISA
  - 62% of the variation in financial literacy scores reflects variation in maths/reading skills

- But financial literacy is **distinct**

- Some countries perform poorly on financial literacy given their level of numeracy
  - Australia, Brazil, Chile, Italy, Lithuania, the Netherlands, Poland, the Slovak Republic and Spain

- Reflective of different education system approaches?

Why PIAAC ?

- Global and comparative
- PIAAC captures **working age** population and **skill** levels
- Measures skills developed during education and in the workplace
- Younger age groups in PIAAC can tell us something about outputs from education system

DATA

PIAAC

- Separate country analyses
- Stratified, clustered sample: replication weights applied in analysis
- Median sample size per country 1746
- Australia excluded as data is under restricted use license

PIAAC items

• PIAAC numeracy assessment not designed to measure financial literacy, doesn't cover financial concepts like risk

BUT…

• Four questions required participants to use basic numeracy skills to solve an everyday financial problem
  – e.g. working out change when shopping
  – e.g. interpreting a graph of basic financial information

Items

- Item A: basic calculation in an everyday financial context

- Item B: calculation within a basic, everyday financial context

- Item C: interpreting a basic line graph, computational burden very low; focus on interpretation

- Item D: most computationally burdensome, application of straightforward numeracy skills to financial problem

Mock example

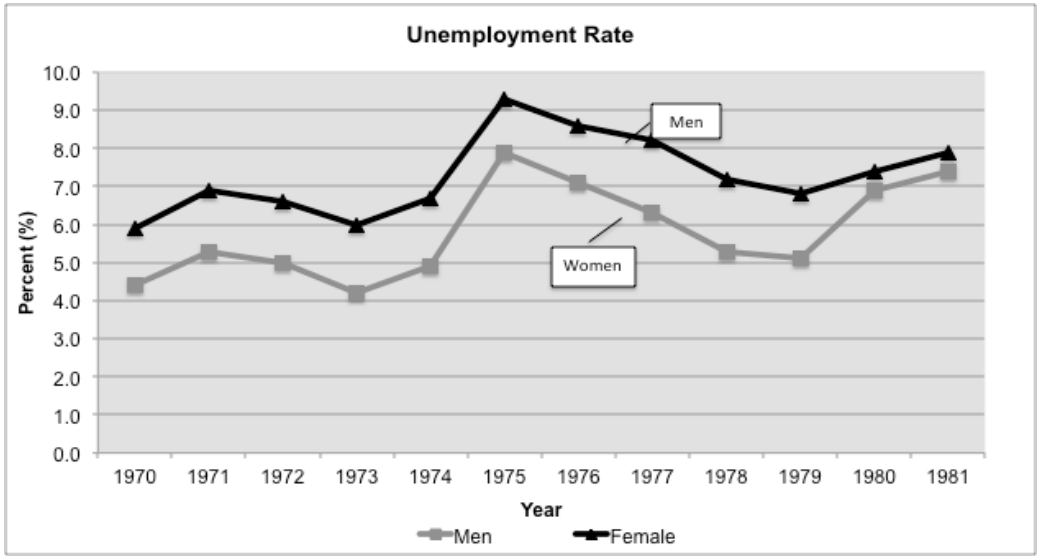
- *Item A (code = C602A502)*

- Suppose, upon your trip to the grocery store you purchase four types of tea packs: Chamomile Tea ($4.60), Green Tea ($4.15), Black Tea ($3.35) and Lemon Tea ($1.80).

- If you paid for all these items with a $20 bill, how much change would you get?

Mock example

- Item C (code = C620A612).
- Estimate the approximate average unemployment rate for men over the 12-year period.



Covariates of interest

- Age
- Gender
- Three categories of education level
  - Low = ISCED 3C short and below (lower-secondary education or less)
  - Medium = ISCED 3 or 4 (upper-secondary and post-secondary non-tertiary)
  - High = ISCED 5 or 6 (tertiary education)

METHODOLOGY

Methodology - analysis

- • 95% Confidence intervals to reflect uncertainty when presenting rankings

- Regression model for each country

$$y_i = \alpha + \theta_1 . G_i + \theta_2 . A_i + \beta_6 . E_i + \varphi_i$$

- G_i = Gender
- A_i = Age group (ten-year age intervals)
- E_i = Education level (three groups)

RESULTS

Some striking weaknesses in adults' financial skills

- A quarter of adults cannot work out how much change they should receive from a shop

- One-in-three adults struggle to work out the price they have to pay for a product when they are given a 'per unit' (e.g. per litre, per kilo) cost

- Half of the population across the 31 countries cannot read a simple financial line graph

- Most adults struggle to calculate more difficult discounts

What do the items capture?

- Correlation with PIAAC domains – full sample

	Item A	Item B	Item C	Item D
Literacy	0.28	0.43	0.35	0.45
Numeracy	0.33	0.51	0.41	0.55
Problem solving	0.25	0.35	0.29	0.40

- Data suggests that there is variation in individuals' ability to interpret data that is distinct from calculation skill (numeracy)

Correlation at country level between items

	Item A	Item B	Item C	Item D
Item A	-			
Item B	0.600	-		
Item C	0.464	0.433	-	
Item D	0.537	0.517	0.774	

Not just measuring mathematics skill
Age 16-24 age group

	All countries	Excluding Russia
Correlation PISA maths with Item A	0.401	0.567
Correlation PISA maths with Item B	0.295	0.306
Correlation PISA maths with Item C	0.698	0.696
Correlation PISA maths with Item D	0.583	0.581

Variation across countries

- Some nations perform comparatively well across all four items
  - e.g. Japan, Singapore, Estonia

- Some nations do relatively poorly across the piece
  - e.g. Turkey, Russia, England

PIAAC financial skills rank by item

	Item A		Item B		Item C		Item D	
	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI
Japan	89%	91%	65%	69%	57%	62%	58%	63%
Singapore	81%	84%	63%	67%	45%	51%	43%	48%
South Korea	81%	84%	38%	42%	42%	46%	35%	38%
Lithuania	78%	83%	73%	78%	35%	40%	33%	41%
Estonia	79%	81%	70%	73%	50%	54%	42%	46%
Austria	77%	82%	73%	76%	43%	47%	45%	50%
Finland	77%	81%	71%	74%	54%	58%	40%	47%
Denmark	77%	81%	65%	69%	51%	55%	40%	45%
New Zealand	76%	80%	62%	68%	46%	53%	41%	46%
Sweden	76%	79%	68%	73%	48%	54%	40%	46%
Norway	76%	80%	67%	70%	52%	59%	44%	48%
Netherlands	74%	77%	70%	74%	52%	58%	45%	49%
Slovakia	73%	77%	72%	77%	41%	48%	42%	47%
Cyprus	73%	77%	67%	71%	37%	43%	37%	43%
Belgium	72%	77%	71%	75%	49%	56%	41%	46%

PIAAC financial skills rank by item

	Item A		Item B		Item C		Item D	
	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI	Lower CI	Upper CI
Canada	73%	76%	59%	63%	47%	51%	42%	46%
Germany	72%	77%	65%	70%	46%	53%	41%	47%
Poland	71%	76%	65%	69%	42%	47%	26%	44%
Slovenia	70%	75%	56%	61%	49%	53%	34%	41%
USA	70%	74%	55%	61%	39%	46%	30%	36%
Greece	68%	75%	64%	69%	26%	32%	26%	34%
France	70%	72%	62%	65%	40%	43%	33%	36%
Ireland	69%	72%	59%	65%	36%	40%	34%	41%
Chile	66%	74%	38%	47%	20%	28%	9%	14%
Italy	67%	72%	60%	65%	28%	34%	25%	30%
Spain	65%	68%	59%	62%	33%	38%	28%	31%
England + NI	63%	68%	57%	62%	39%	47%	32%	39%
Israel	63%	68%	55%	61%	33%	40%	37%	41%
Czech Republic	62%	68%	66%	71%	50%	58%	38%	47%
Turkey	49%	55%	46%	52%	20%	24%	14%	20%
Russia	37%	43%	31%	37%	40%	51%	29%	36%

Gender

- In some nations men consistently perform better than women (sig difference across all 3 out of 4 items, 5% level)
  - Netherlands, Belgium, Sweden, the United States, Canada and (particularly) Turkey

- Other countries, largely in Eastern Europe, have less of a gender gap or favour women
  - Poland, Lithuania, Czech Republic, Estonia, Slovenia, Slovakia, along with Russia and Italy

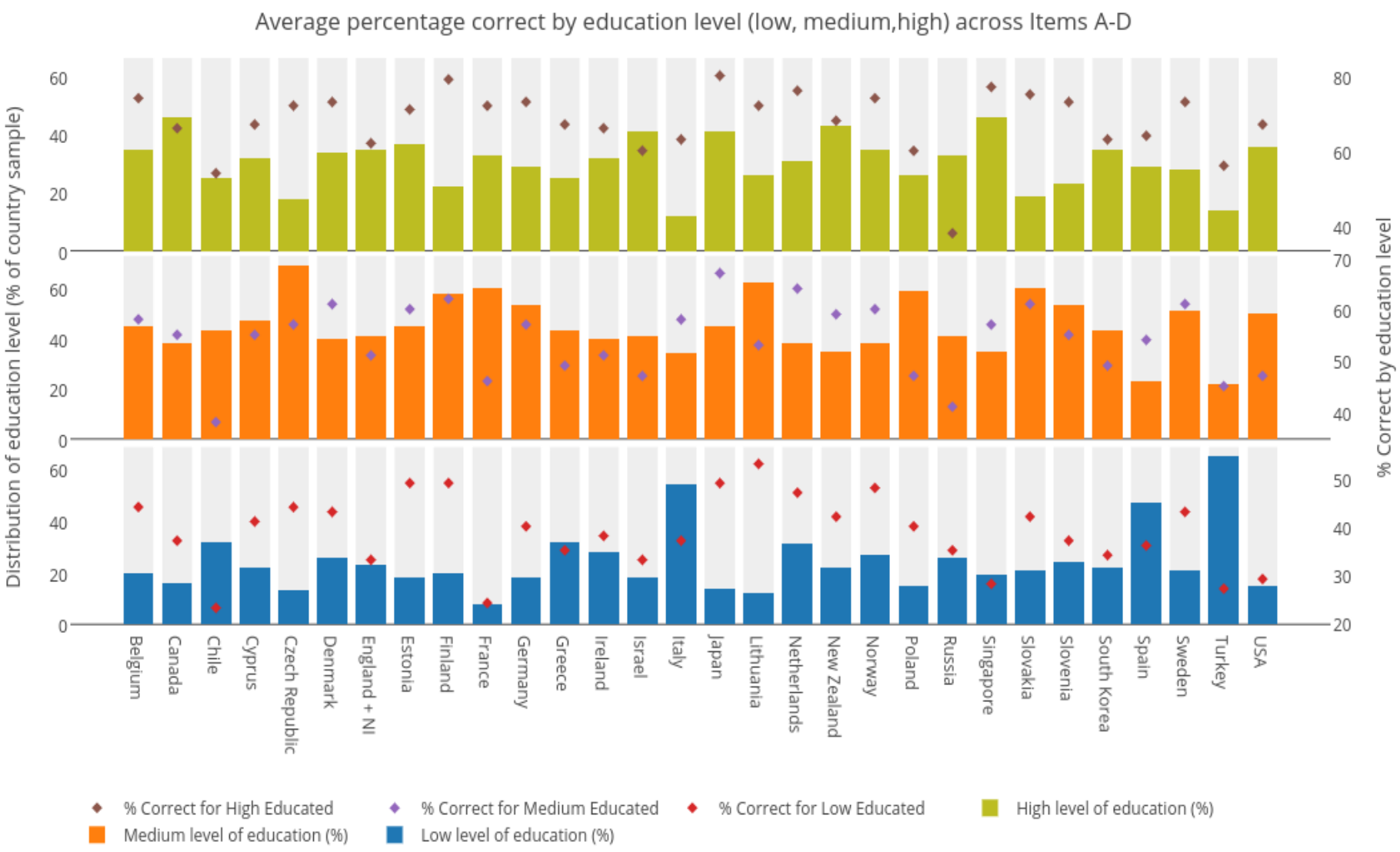
- Gender gaps bigger amongst older age groups

Education level

- Inequality in financial literacy across education groups

- France and Singapore particularly unequal
  - Difference on most items of around 40 to 50 percentage points between the top and bottom education groups
  - Affects different proportions of population

- United States and Slovenia also have large differences by education groups


Average percentage correct by education level (low, medium,high) across Items A-D
Distribution of education level (% of country sample)
% Correct by education level
0
20
40
60
80
Belgium
Canada
Chile
Cyprus
Czech Republic
Denmark
England + NI
Estonia
Finland
France
Germany
Greece
Ireland
Israel
Italy
Japan
Lithuania
Netherlands
New Zealand
Norway
Poland
Russia
Singapore
Slovakia
Slovenia
South Korea
Spain
Sweden
Turkey
USA
% Correct for High Educated
% Correct for Medium Educated
% Correct for Low Educated
High level of education (%)
Medium level of education (%)
Low level of education (%)

Age

- Performance peaks at age 25-to-34
- Declines thereafter – consistent with OECD/INFE
- In some nations, such as England, the relationship between age and capability is flat
- Countries that have expanded their education systems, recently such as Singapore and Spain, have steep age trajectory

Regression results item C – case studies

	Denmark	Germany	Singapore	USA	UK	Average
Female	-0.094	-0.045	-0.046	-0.104	-0.102	**-0.072**
Age_25_34	-0.116	-0.091	-0.095	-0.083	-0.006	**-0.096**
Age_35_44	-0.111	-0.038	-0.186	-0.072	0.015	**-0.102**
Age_45_54	-0.089	-0.164	-0.130	-0.161	0.020	**-0.136**
Age_55_Plus	-0.154	-0.118	-0.178	-0.165	0.000	**-0.154**
Medium	0.246	0.182	0.222	0.168	0.167	**0.204**
High	0.424	0.363	0.540	0.344	0.395	**0.418**
Constant	0.433	0.398	0.303	0.371	0.190	**0.376**

Base case: Male, Age 16-24, Low educated

Caveats

- Limited number of items

- Cross sectional analysis – don't understand how financial skills of adults develop and deteriorate with age

- Results descriptive, with no attempt made to determine cause and effect

- Robust impact evaluation of interventions to boost adults' financial skills is needed

Conclusions

- Some countries have populations with relatively low financial skills
  - Includes middle income countries, such as Turkey, Israel, Russia and Chile
  - And large, mature OECD economies such as England, Spain and Italy

- Overall, younger workers have better financial skills which is encouraging
  - Not true for a few countries such as England, Russia

Conclusions

- Results for young adults 16 to 24-year-olds correlate with PISA mathematics scores (correlation of approx. 0.6)

- But not for all countries…
  - Russia high performer on PISA financial literacy not in PIAAC
  - England and South Korea low performers on PIAAC

- Financial education in schools, colleges and universities needed to ensure young people are equipped with the core financial skills that they need

- But also have older adults who have worse skills and perhaps greatest need for financial planning

Conclusions

- Need for adult interventions to boost financial skills – informed by data

- Dedicated financial literacy component would be of substantial interest in future rounds of the PIAAC assessment
  - Consistency across data is key

- Would complement other initiatives (OECD/INFE, PISA) but also give a broader perspective

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PIAAC assessment design

- Some took paper test, others computer
- Adaptive test for computer based assessment
- Variables that determine the test questions taken are:
  - Computer experience
  - Education level
  - Native speaker
  - Performance on the six core literacy and numeracy test questions

Methodology – multiple imputation

- Logistic model with item level multiple imputation
  - Assumes item-level data are Missing-At-Random (MAR)
  - Participants with certain characteristics more likely to be assigned certain test questions but we know variables that determine this

- MI includes variables that determine the set of test questions participants were assigned and covariates

- Robustness – complete case analysis
  - MI and CC correlations >0.9

$$log\frac{(\pi_i)}{(1-\pi_i)} = \beta_1.G_i + \beta_2.C_i + \beta_3.N_i + \beta_4.P_i + \beta_5.A_i + \beta_6.O_i + \beta_7.U_i + \beta_8.Core1_i + \beta_9.Core2_i + \beta_{10}.Lit\_score_i$$

- π_i = Probability of correct response to the question
- G_i = Gender
- C_i = Respondents' self-reported computer experience
- N_i = Native language speaker
- P_i = Took the test on paper or computer
- A_i = Age group (ten-year age intervals)
- E_i = Educational group (three categories)
- U_i = Respondents reported use of calculating budgets at work (five categories)
- $Core1_i$ = score on first score stage, $Core2_i$ = score on second score stage
- Lit_score_i = score on the PIAAC literacy test (first plausible value only)

Methodology – multiple imputation

- Imputations estimated separately by country
- Final response weights applied
- Multiple Imputation by Chained Equations (MICE) is used
  - Ten imputed values for each of the four test questions
- Ten imputations are treated as item-level 'plausible values' in our analysis, incorporating the uncertainty in our results due to the 'missing data' (i.e. due to PIAAC's use of an adaptive test design)

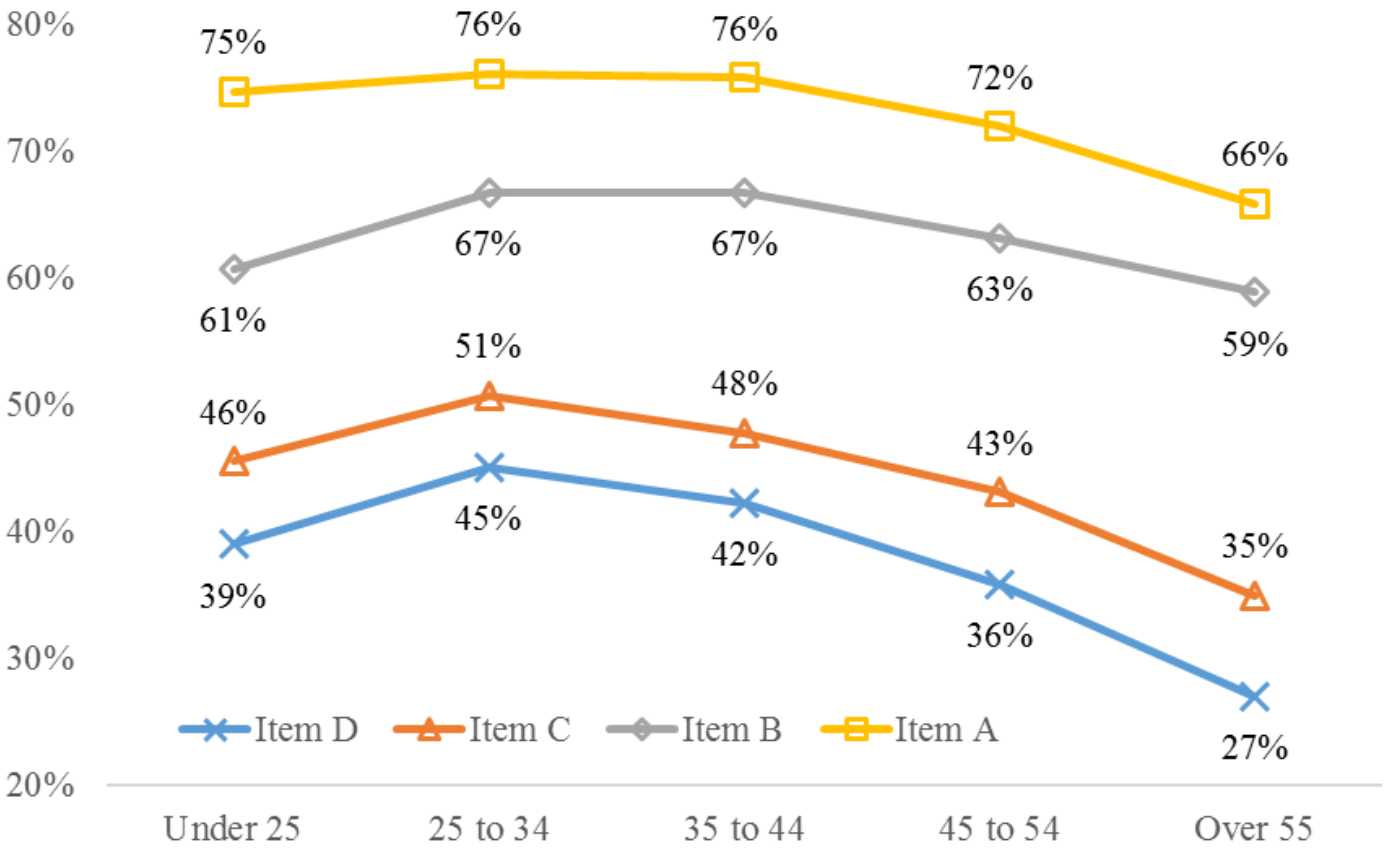
% Gender gap in responses – positive favours women

	Item A	Item B	Item C	Item D
Poland	**7%***	4%	**-5%***	1%
Slovenia	**6%***	1%	**-6%***	-4%
Lithuania	**5%***	2%	**-7%***	1%
Cyprus	**5%***	1%	-4%	**-6%***
Russia	5%	2%	2%	1%
Finland	**5%***	-3%	-3%	**-7%***
France	**5%***	-2%	**-9%***	**-5%***
Slovakia	4%	1%	**-7%***	-1%
New Zealand	**4%***	-1%	**-8%***	**-10%***
Estonia	**3%***	0%	**-7%***	-2%
USA	3%	**-7%***	**-10%***	**-8%***
South Korea	3%	**-6%***	**-10%***	-2%
Ireland	3%	-3%	**-9%***	**-8%***
Denmark	2%	-1%	**-8%***	**-9%***
Average	**1%**	**-3%**	**-7%**	**-7%**

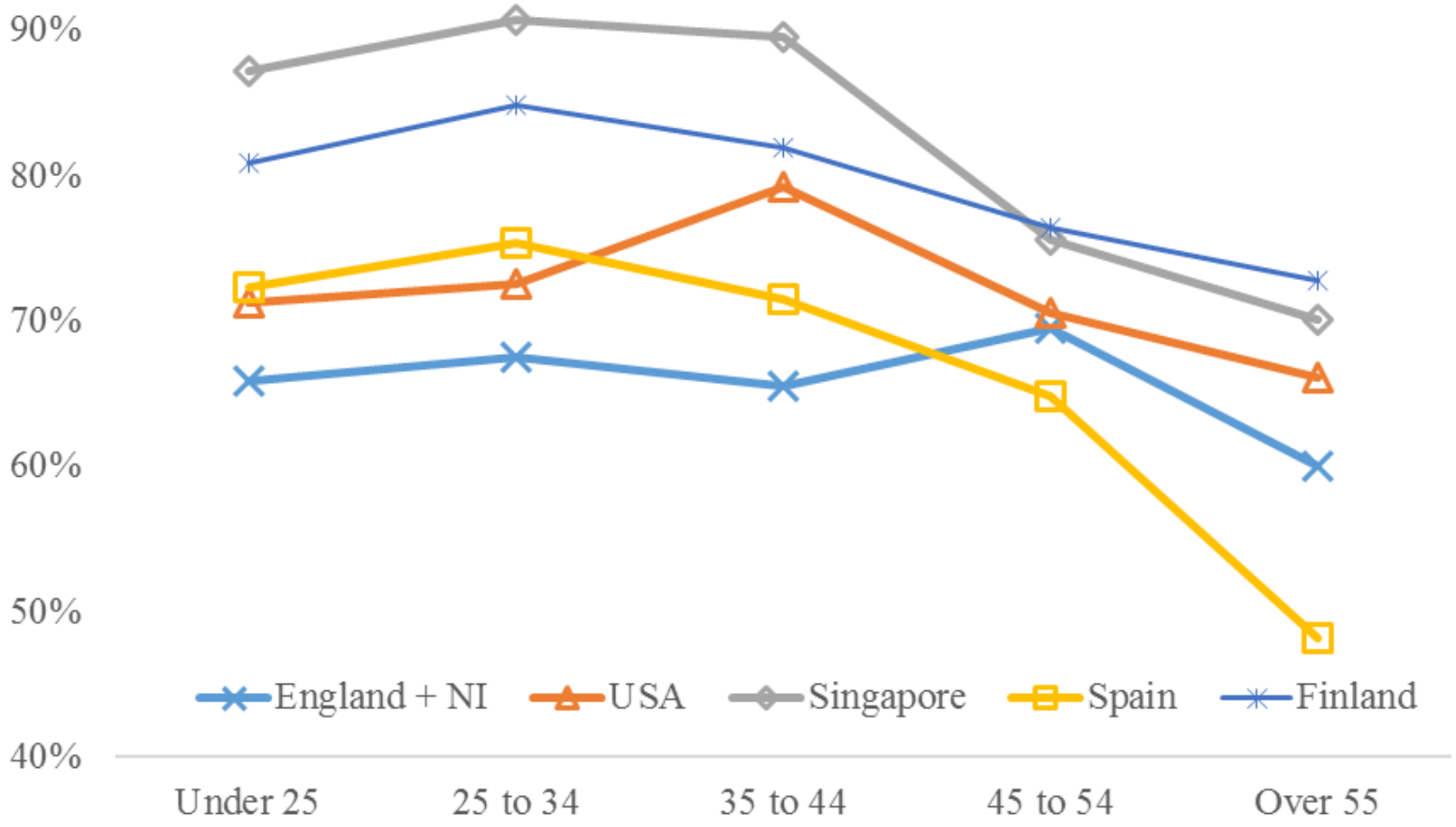
PPT Gender gap in responses – positive favours women

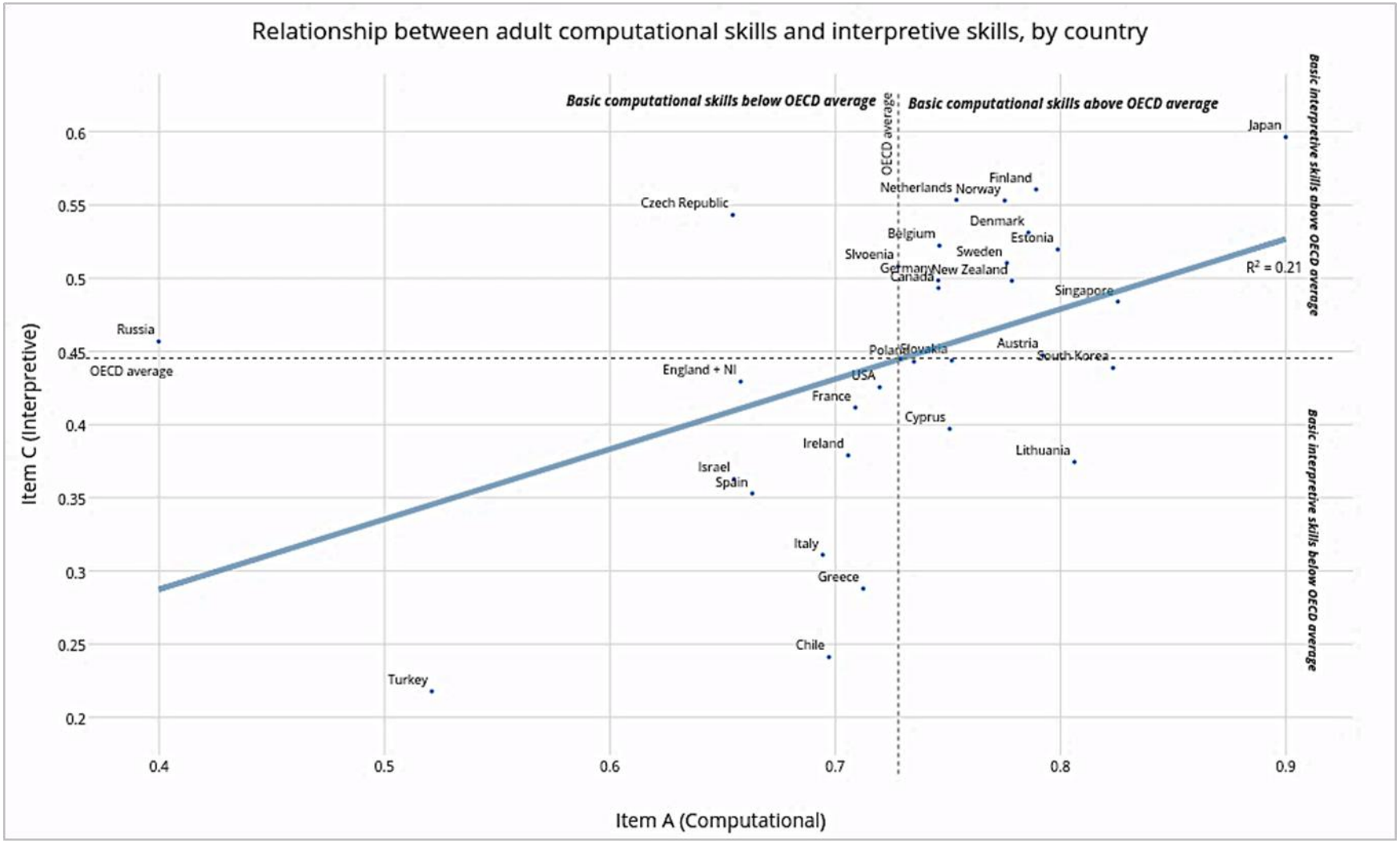
	Item A	Item B	Item C	Item D
Czech Republic	2	2	**-8 ***	-5
England + NI	2	-5	**-10 ***	**-10 ***
Spain	1	-1	**-9 ***	**-9 ***
Japan	0	-2	**-8 ***	**-8 ***
Italy	0	-4	-3	-3
Canada	0	**-9 ***	**-6 ***	**-6 ***
Singapore	0	-3	-7	**-7 ***
Austria	-1	-4	**-9 ***	**-14 ***
Israel	-1	**-10 ***	**-9 ***	-5
Sweden	-1	**-7 ***	**-8 ***	**-16 ***
Norway	-1	1	-6	**-14 ***
Germany	-1	**-11 ***	-5	**-13 ***
Greece	-2	0	**-10 ***	-2
Belgium	-2	**-8 ***	**-10 ***	**-16 ***
Netherlands	-3	**-10 ***	**-11 ***	**-12 ***
Chile	-6	**-7 ***	-3	**-9 ***
Turkey	**-15 ***	**-12 ***	**-8 ***	**-7 ***
Average	**1**	**-3**	**-7**	**-7**

Relationship with age – cross country averages



Relationship with age varies by country (Item A)




Relationship between adult computational skills and interpretive skills, by country
Basic computational skills below OECD average
Basic computational skills above OECD average
OECD average
Basic interpretive skills above OECD average
Basic interpretive skills below OECD average
Item C (Interpretive)
Item A (Computational)
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.4
0.5
0.6
0.7
0.8
0.9
Japan
Finland
Netherlands
Norway
Czech Republic
Denmark
Belgium
Estonia
Slvoenia
Sweden
Germany
New Zealand
Canada
Singapore
Russia
Austria
Poland
Slovakia
South Korea
OECD average
England + NI
USA
France
Cyprus
Ireland
Lithuania
Israel
Spain
Italy
Greece
Chile
Turkey
R² = 0.21