



**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

- 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

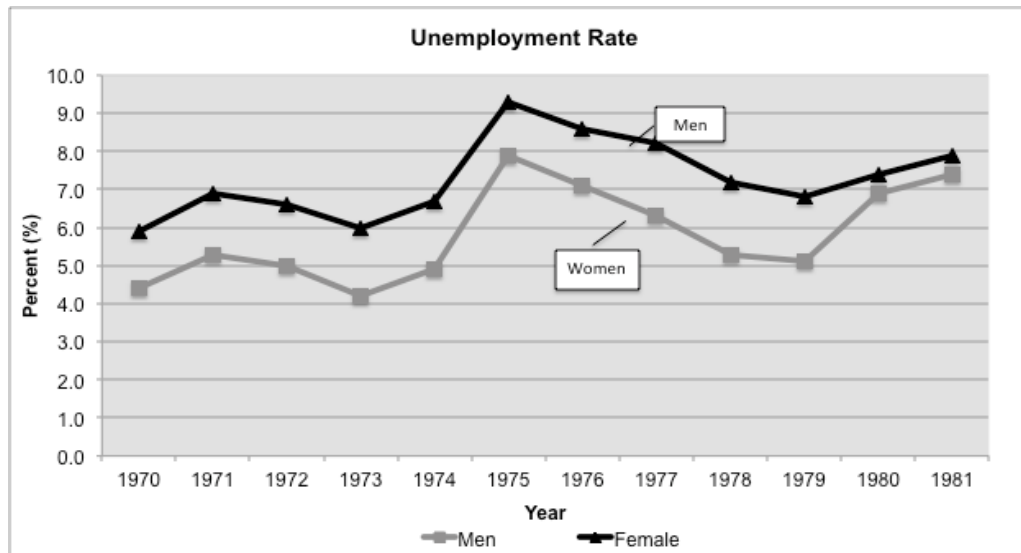
- Item A: basic calculation in an everyday financial context
- Item B: calculation within a basic, everyday financial context
- Item C: interpreting a basic line graph, computational burden very low; focus on interpretation
- Item D: most computationally burdensome, application of straightforward numeracy 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

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

- $G_i$  = 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

	<b>Item A</b>	<b>Item B</b>	<b>Item C</b>	<b>Item D</b>
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

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	<b>Item A</b>	<b>Item B</b>	<b>Item C</b>	<b>Item D</b>
Item A	-			
Item B	0.600	-		
Item C	0.464	0.433	-	
Item D	0.537	0.517	0.774	

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## 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%

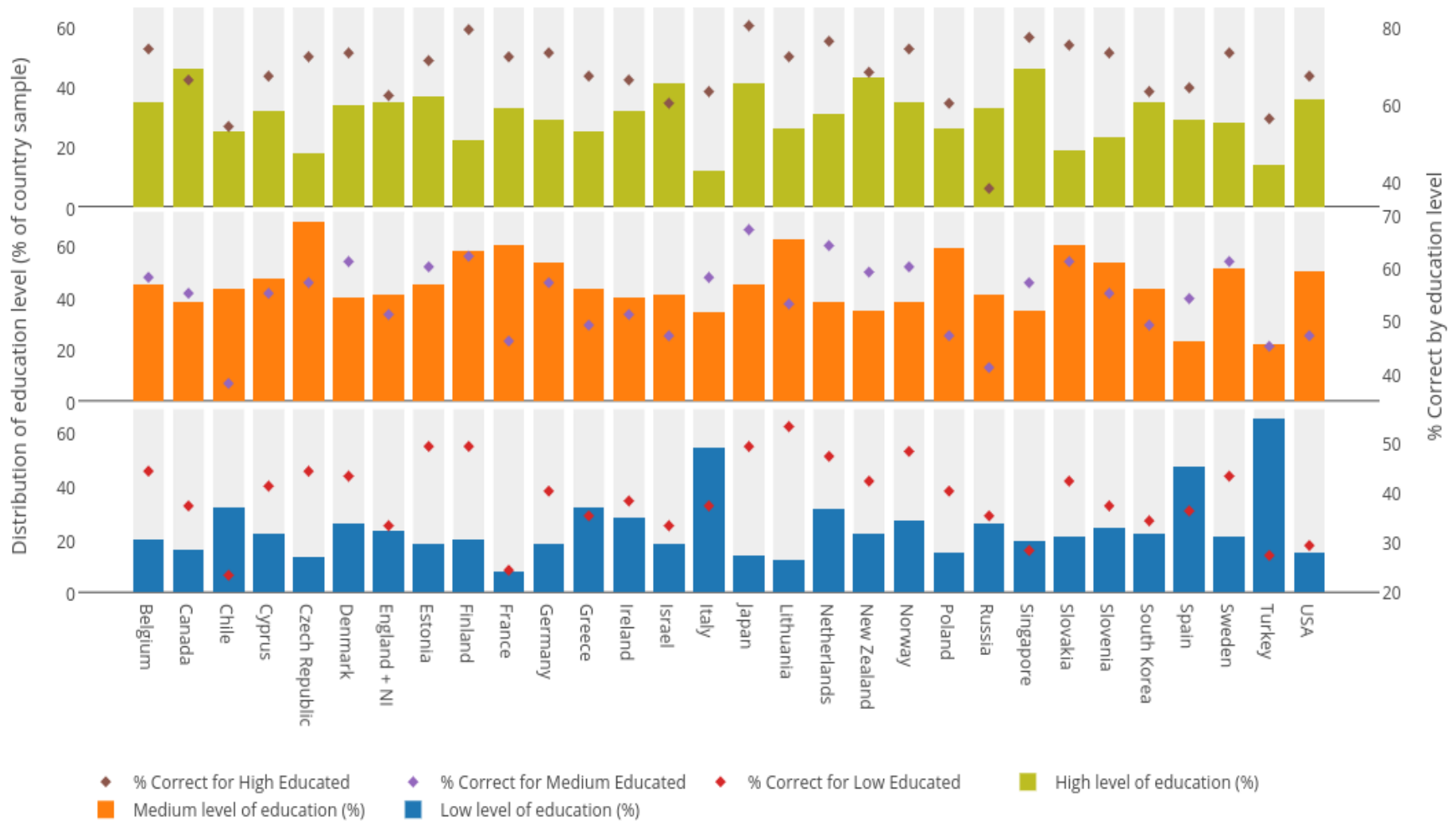
# Gender

- 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



# 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	<b>-0.072</b>
Age_25_34	-0.116	-0.091	-0.095	-0.083	-0.006	<b>-0.096</b>
Age_35_44	-0.111	-0.038	-0.186	-0.072	0.015	<b>-0.102</b>
Age_45_54	-0.089	-0.164	-0.130	-0.161	0.020	<b>-0.136</b>
Age_55_Plus	-0.154	-0.118	-0.178	-0.165	0.000	<b>-0.154</b>
Medium	0.246	0.182	0.222	0.168	0.167	<b>0.204</b>
High	0.424	0.363	0.540	0.344	0.395	<b>0.418</b>
Constant	0.433	0.398	0.303	0.371	0.190	<b>0.376</b>

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  $>0.9$



$$\log \frac{(\pi_i)}{(1 - \pi_i)}$$

$$= \beta_1 \cdot G_i + \beta_2 \cdot C_i + \beta_3 \cdot N_i + \beta_4 \cdot P_i + \beta_5 \cdot A_i + \beta_6 \cdot O_i + \beta_7 \cdot U_i + \beta_8 \cdot Core1_i + \beta_9 \cdot Core2_i + \beta_{10} \cdot Lit\_score_i$$

- $\pi_i$  = 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)

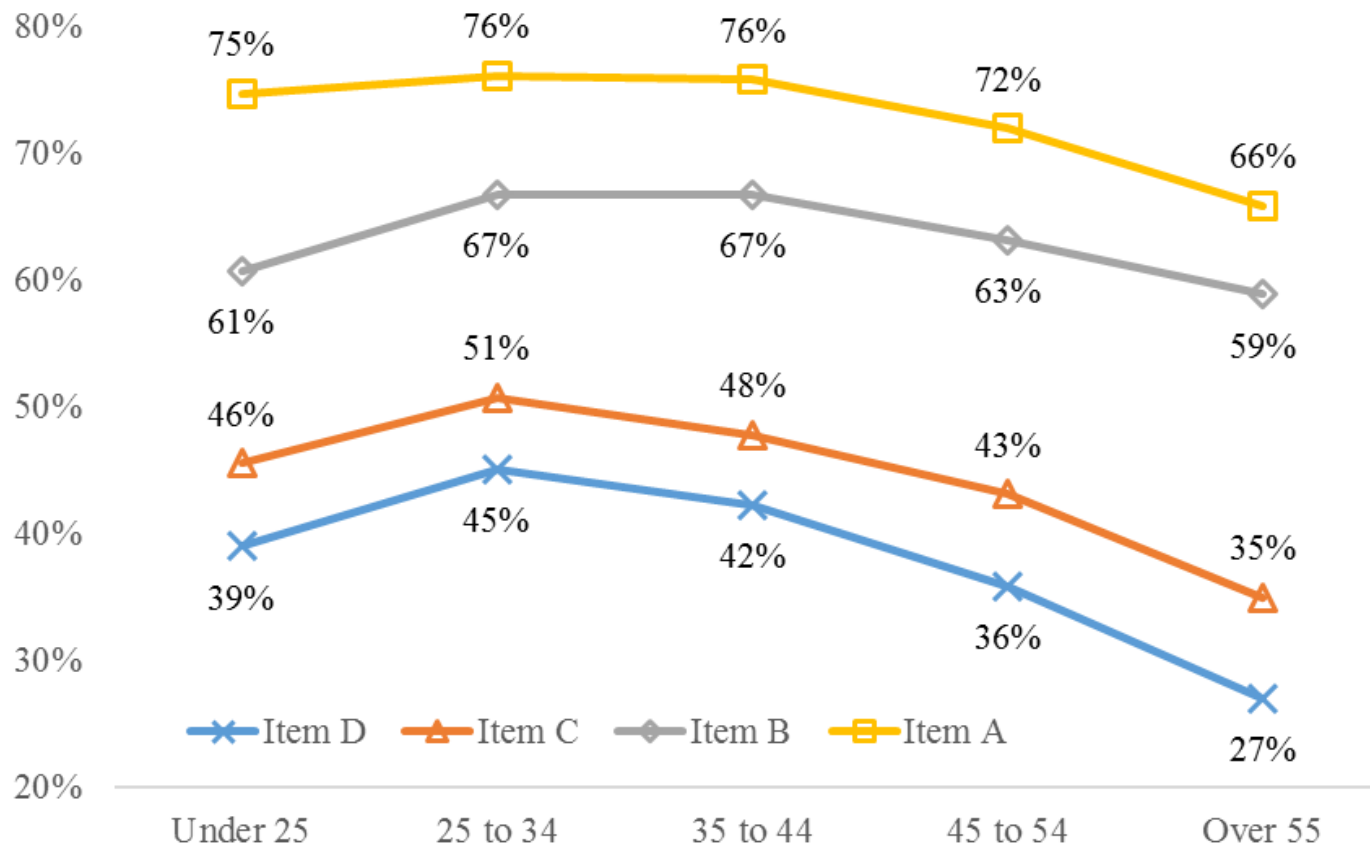
## % Gender gap in responses – positive favours women

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

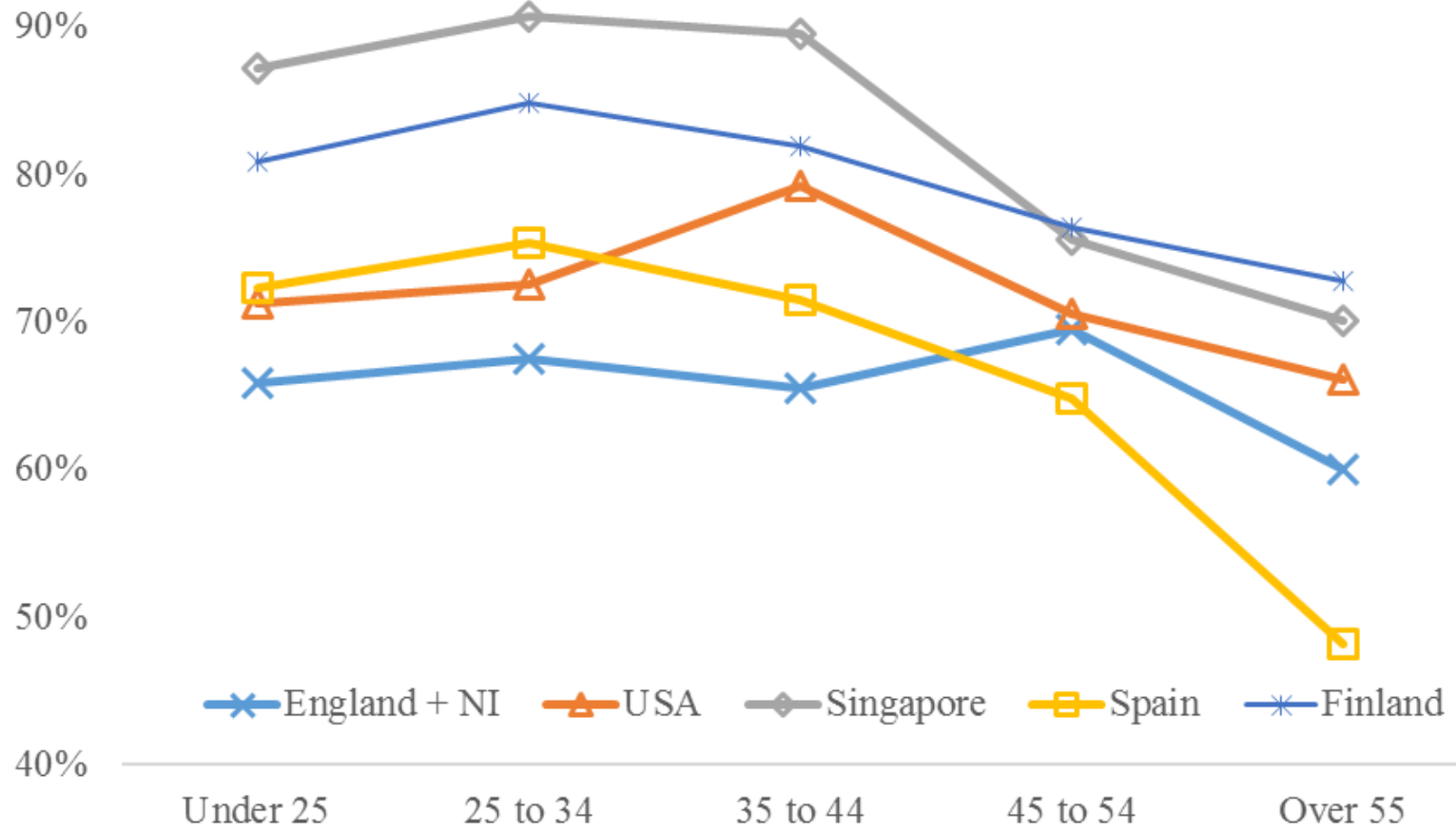
## PPT Gender gap in responses – positive favours women

	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 *
<b>Average</b>	<b>1</b>	<b>-3</b>	<b>-7</b>	<b>-7</b>

# Relationship with age – cross country averages



## Relationship with age varies by country (Item A)



Relationship between adult computational skills and interpretive skills, by country

