Returns to Skills and Tasks: Evidence from 22 Selected Countries

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Overview

Programme for the International Assessment of Adult Competencies (PIAAC)

- **Purpose:** Comparable data for cognitive skills and job tasks
- **Number of Countries**: 33 in total
- **Target Population:** Individuals aged 16–65 years
  1. Cover at least 95% of the target population
  2. Achieve overall response rates of 70% or greater
- **2 Rounds** of Data Collection
  - *Round 1*: August 2011–March 2012
  - *Round 2*: April 2014–March 2015
- **22 out of 33** countries in my analysis
  - Due to legal restrictions and non-reported variables

Countries in my Empirical Analysis

1) Belgium (BEL)	2) Chile (CHL)	3) Cyprus (CYP)
4) Czech Republic (CZE)	5) Denmark (DNK)	6) Estonia (EST)
7) Finland (FIN)	8) France (FRA)	9) Greece (GRC)
10) Ireland (IRL)	11) Israel (ISR)	12) Italy (ITA)
13) Japan (JPN)	14) Korea (KOR)	15) Lithuania (LTU)
16) Netherlands (NLD)	17) Norway (NOR)	18) Poland (POL)
19) Slovak Republic (SVK)	20) Slovenia (SVN)	
21) Spain (ESP)	22) United Kingdom (UK)	

- Belgium $\rightarrow$ Flanders region only
- United Kingdom $\rightarrow$ England & Northern Ireland only
- Country acronyms in parentheses

Assessed Cognitive Skill Domains in PIAAC Survey

Prior to skill assessment $\rightarrow$ A **background questionnaire** was filled

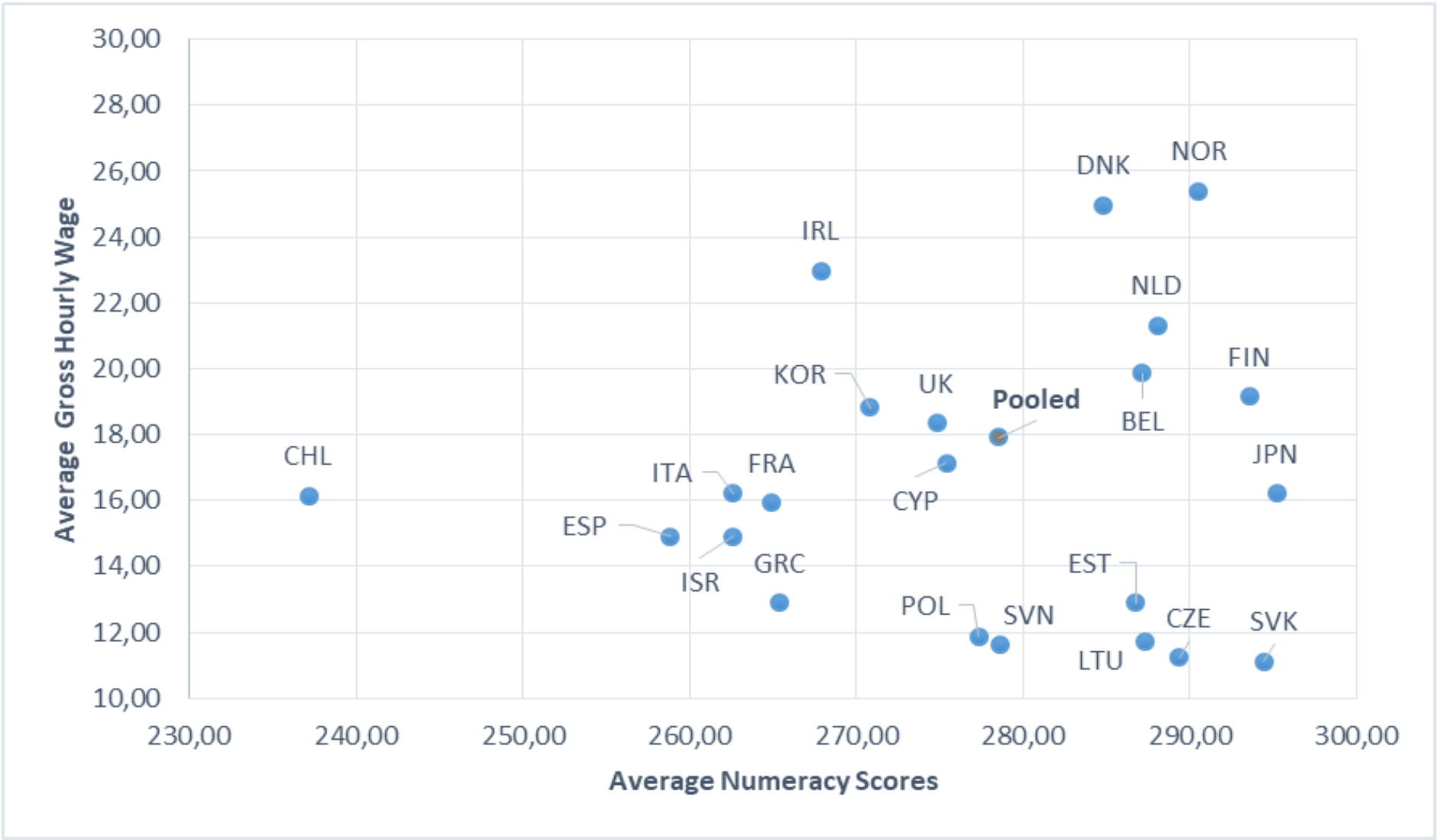
Skill assessed in PIAAC:

1. *Literacy*
2. *Numeracy*
3. *Problem solving in technology-rich environments*

- Assessed on a **500-point** scale
- **Assistance** during cognitive skills assessment **was forbidden**

I focus on **numeracy scores** $\rightarrow$ Most comparable across countries

Numeracy Scores & Gross Hourly Wage by Country



Note: Gross hourly wage (in PPP U.S. dollars). *Source*: PIAAC

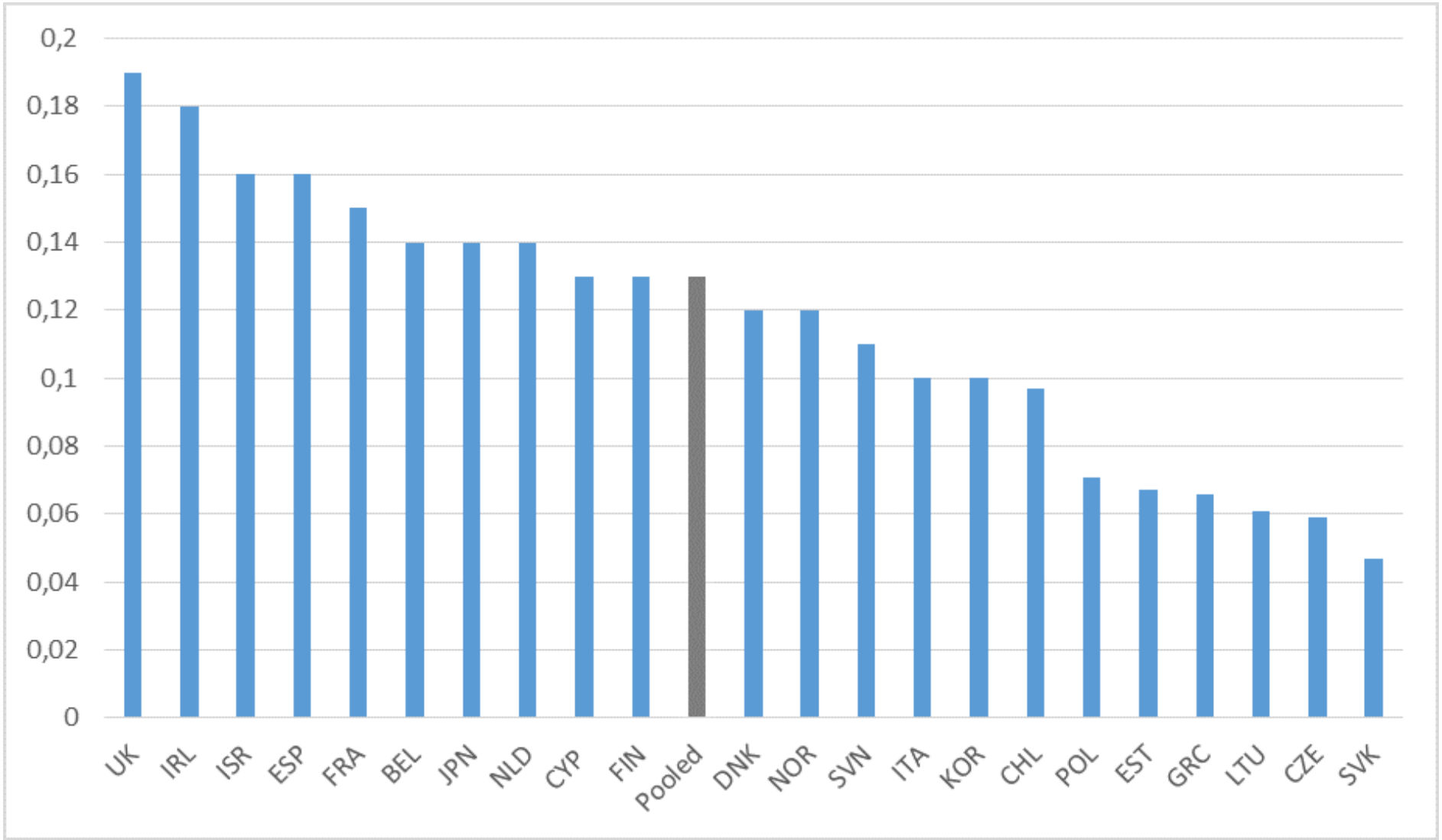
Baseline Empirical Approach

$$\log y_{ic} = \eta_c + \alpha_0 + \alpha_1 C_{ic} + \alpha_2 PE_{ic} + \alpha_3 PE_{ic}^2 + \alpha_4 G_{ic} + \epsilon_{ic} \qquad (1)$$

- $y_i \rightarrow$ gross hourly earnings (in PPP U.S. dollars) of individual i
- $C \rightarrow$ numeracy scores standardised to (0,1) within country
- $PE \rightarrow$ years of potential experience (age – years of schooling – 6)
- $PE^2 \rightarrow$ squared years of potential experience divided by 100
- $G \rightarrow$ binary gender indicator (1 = female; 0 = male)
- $\epsilon \rightarrow$ stochastic term
- $c \rightarrow$ country indicator
- $\eta_c \rightarrow$ country-fixed effects

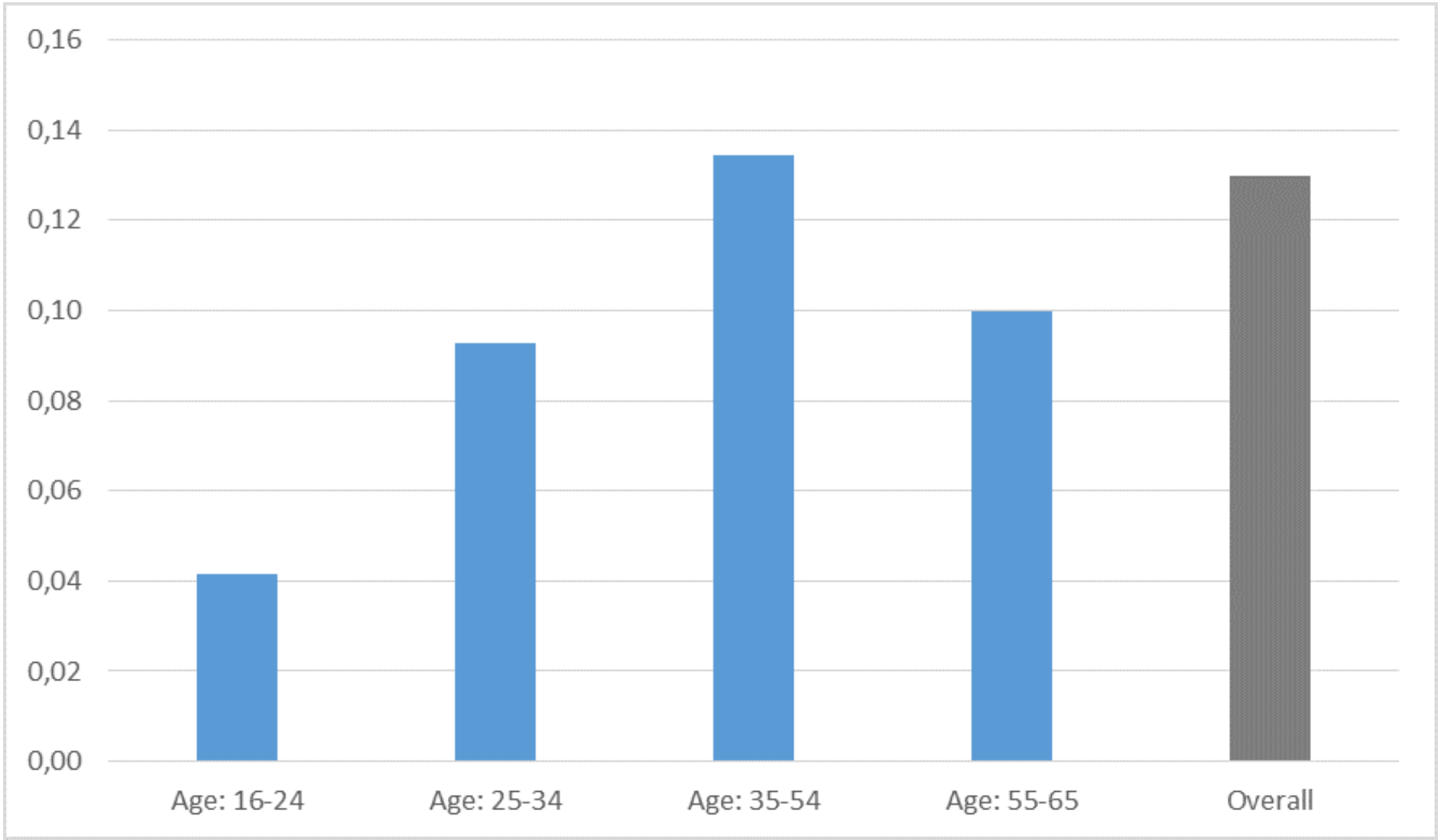
Sample: Workers aged 16-65 excluding self-employed & unemployed

Returns to Numeracy Across Countries



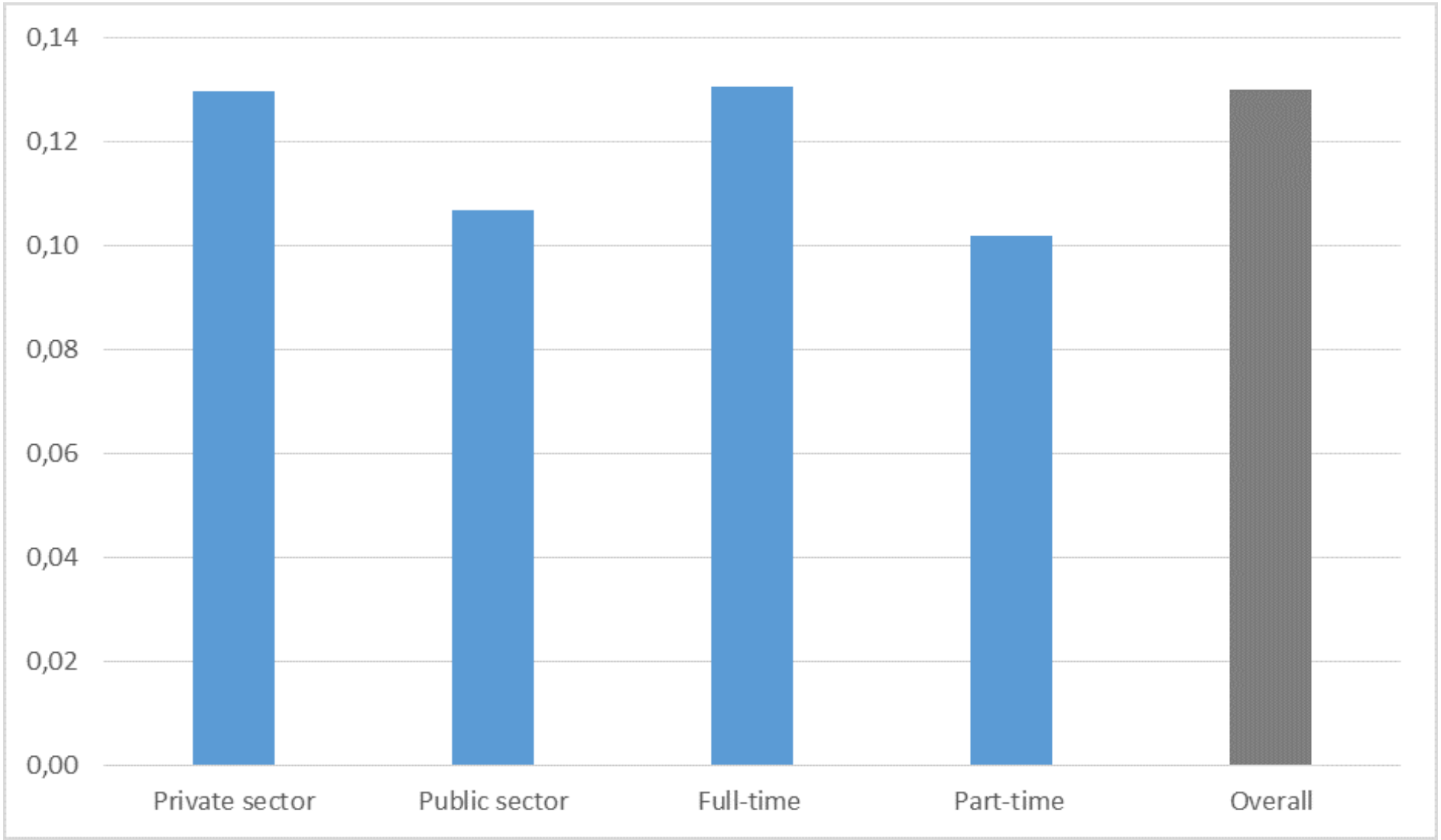
Source: Author's calculations & PIAAC

Age Varying Heterogeneity of Returns



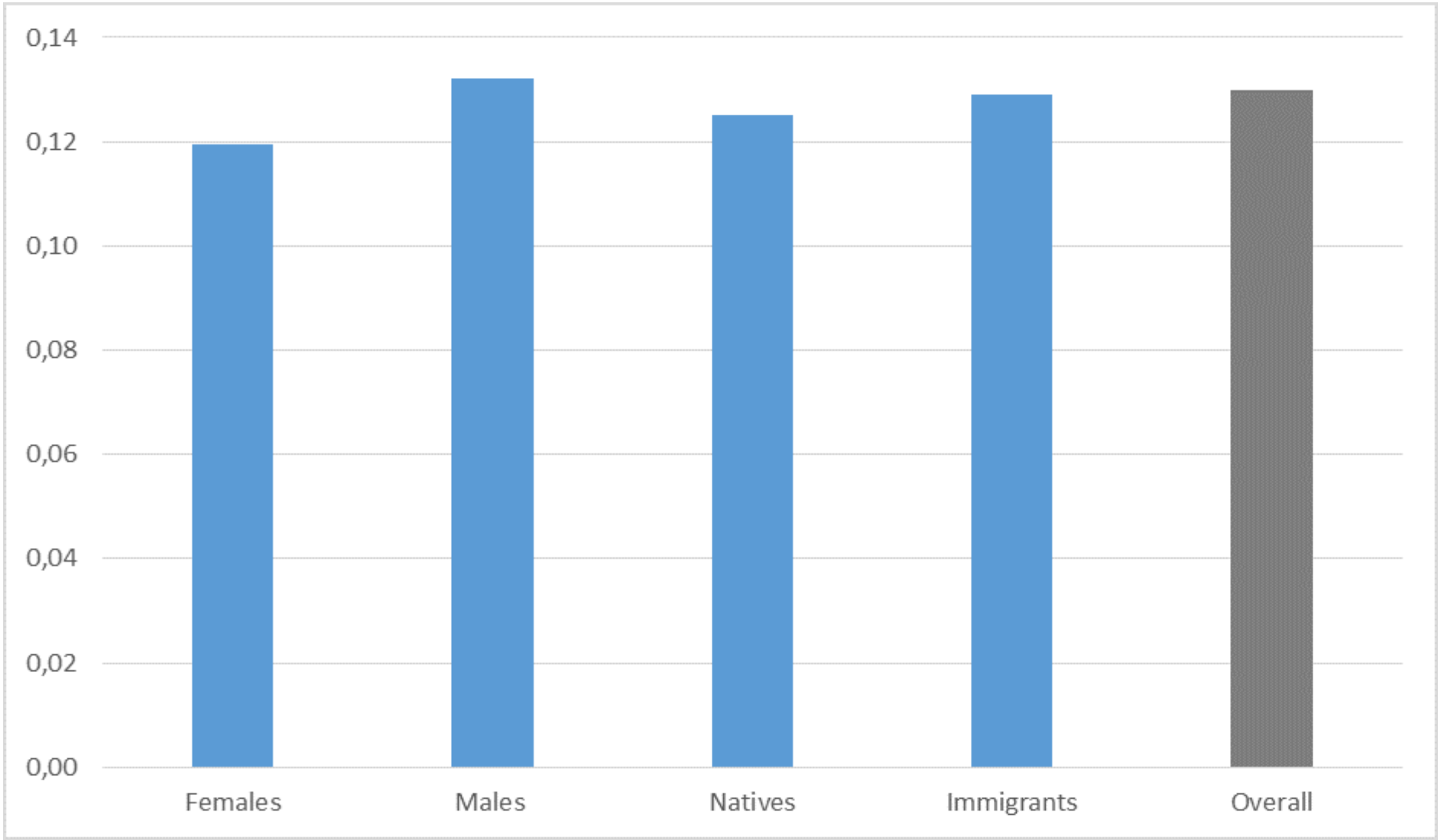
Source: Author's calculations & PIAAC

Heterogeneous Returns in Different Job Sub-groups



Source: Author's calculations & PIAAC

Heterogeneous Returns in Different Societal Sub-groups



Source: Author's calculations & PIAAC

Task-based Empirical Approach

$$\log y_{ic} = \eta_c + \alpha_0 + \alpha_1 C_{ic} + \alpha_2 PE_{ic} + \alpha_3 PE_{ic}^2 + \alpha_4 G_{ic} + \alpha_5 ICT_{ic} + \alpha_6 INFL_{ic} + \alpha_7 PHYS_{ic} + \alpha_8 DISC_{ic} + \epsilon_{ic} \quad (2)$$

OECD selected tasks indices interpretation:

1. *ICT* $\rightarrow$ cognitive or analytical tasks frequency
2. INFL $\rightarrow$ influence or interpersonal tasks frequency
3. *PHYS* $\rightarrow$ physical or manual tasks frequency
4. *DISC* $\rightarrow$ tasks discretion or intensity

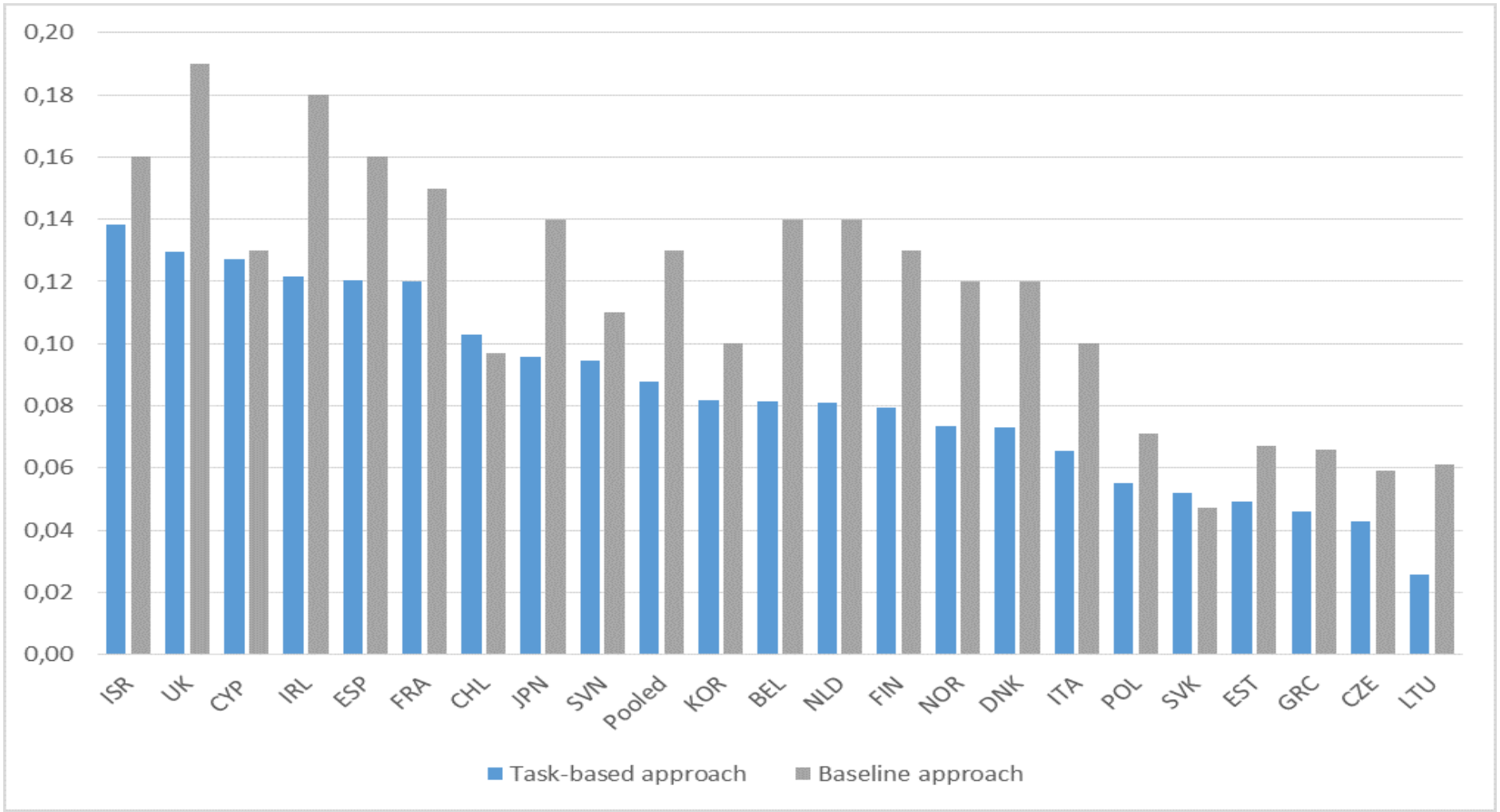
- Continuous variables from 0 to 4 **except** *PHYS* $\rightarrow$ ordinal [0,4]
- Pre-standardised to (2,1) within country by OECD

Why Job Tasks Add Value to the Empirical Analysis?

Variables	(1)	(2)	(3)	(4)	(5)
Numeracy	0.094***	0.094***	0.089***	0.088***	0.056***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Experience	0.025***	0.024***	0.024***	0.024***	0.021***
	[0.001]	[0.001]	[0.001]	[0.0007]	[0.001]
$Experience^2$	-0.037***	-0.035***	-0.035***	-0.035***	-0.031***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Female	-0.103***	-0.095***	-0.094***	-0.091***	-0.095***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
ICT	0.081***	0.069***	0.063***	0.056***	0.034***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Influence		0.053***	0.054***	0.051***	0.029***
		[0.002]	[0.002]	[0.002]	[0.002]
Physical			-0.040***	-0.039***	-0.027***
			[0.002]	[0.002]	[0.002]
Discretion				0.029***	0.028***
				[0.002]	[0.002]
Country fixed effects	X	X	X	X	X
Industry fixed effects					X
Occupation fixed effects					X
R^2	0.42	0.43	0.44	0.44	0.50
Observations	35,226	34,221	34,196	33,776	33,037

* $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$

Comparison of Returns to Numeracy in Baseline and Task-based Approach



Source: Author's calculations & PIAAC

Selection of Sample for Robustness Check

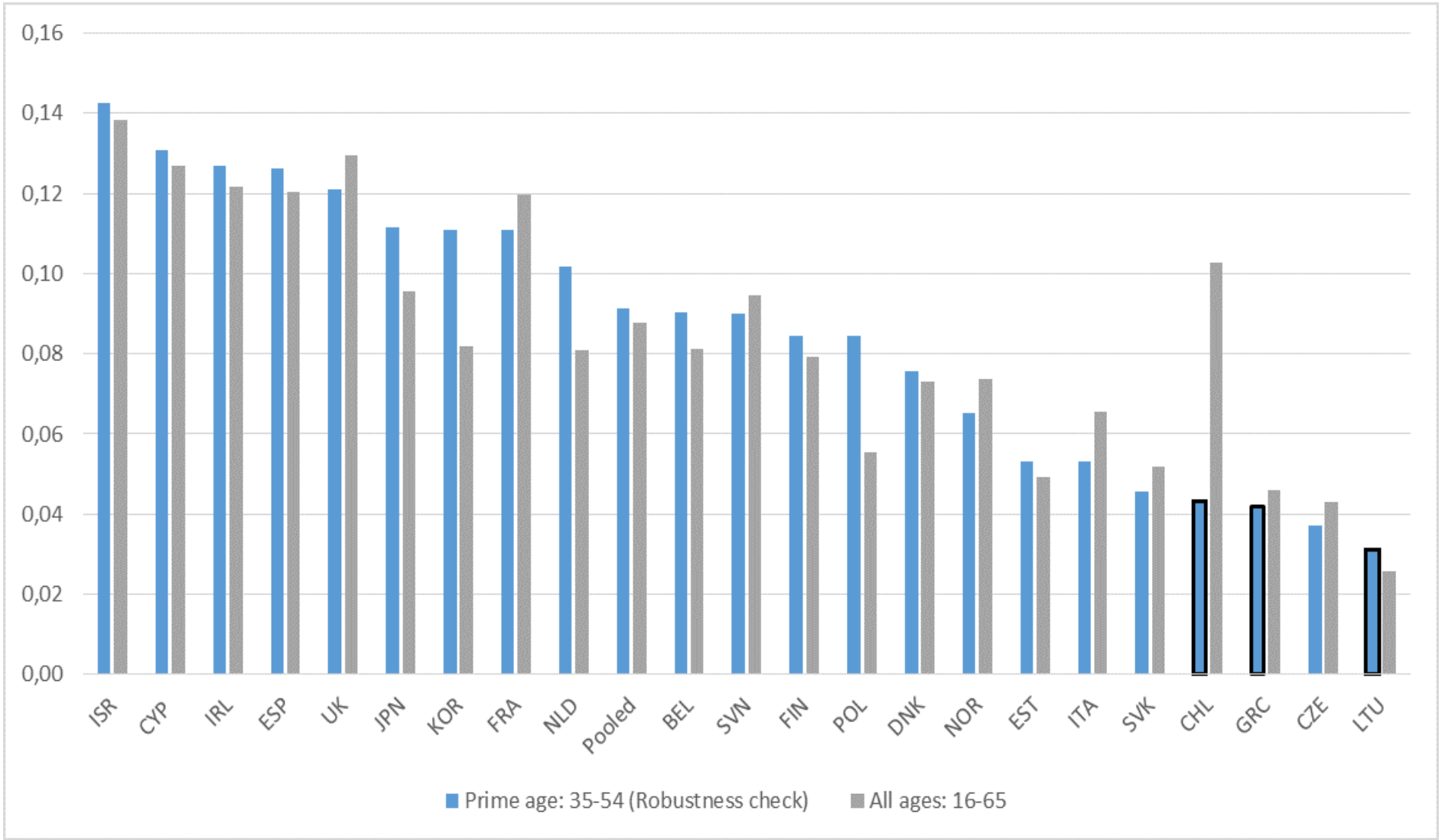
Full-time employees aged 35-54 (i.e. prime-age)

Why I am using the specific sub-sample?

- Approximate better the lifetime earnings **[Haider and Solon, 2006]**

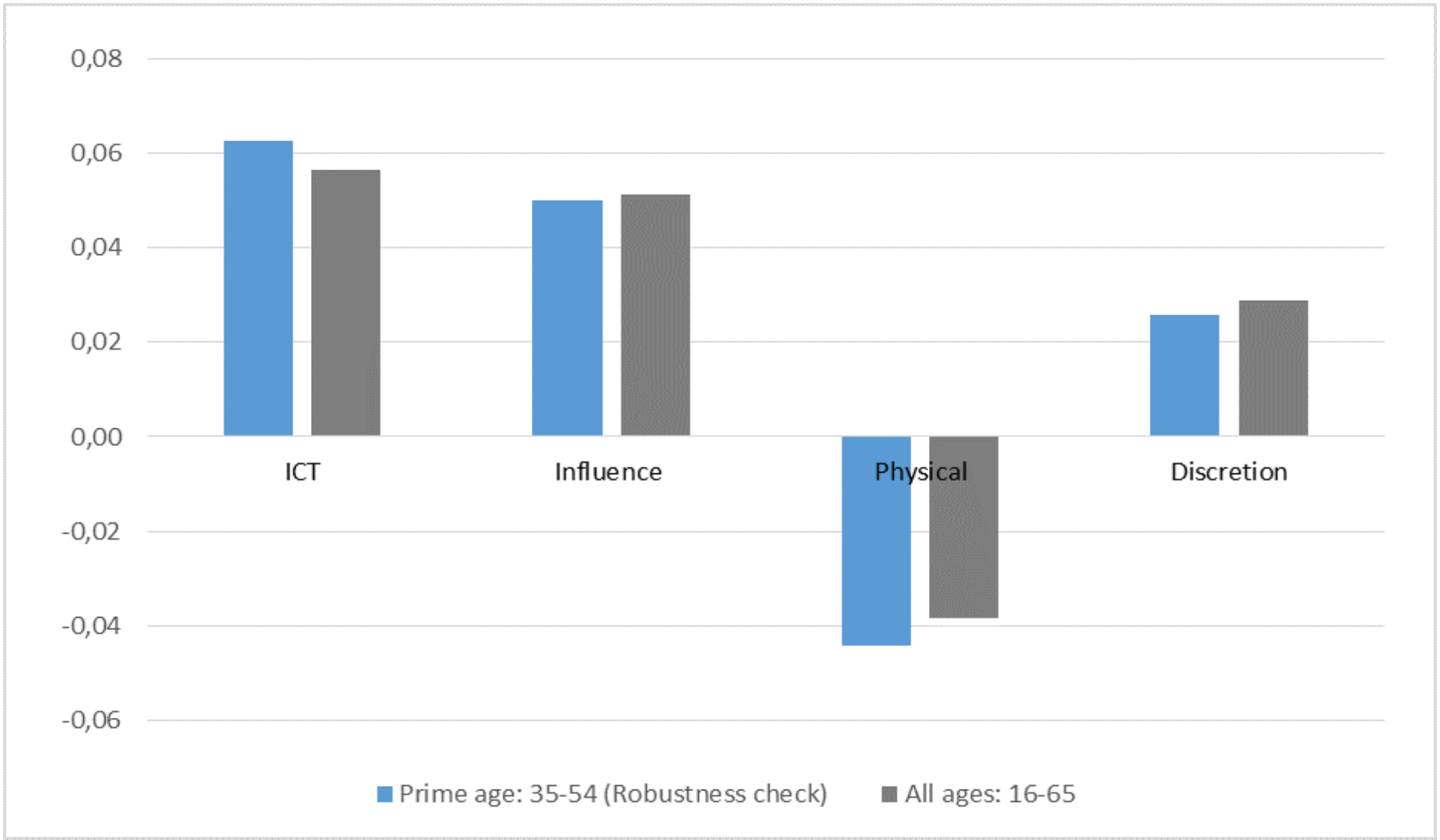
  According to **[Hanushek et al., 2013]:**
- Isolates the direct labour market effects due to limited influences from:
  1. Family
  2. Health condition
  3. Changes in preferences
- Strong commitment to their job $\rightarrow$ Climax of their careers

Returns to Numeracy Before and After Robustness Check



Source: Author's calculations & PIAAC

Returns to Job Tasks Before and After Robustness Check



Source: Author's calculations & PIAAC

Empirical Methodology for Cross-Country Differences

The final algebraic form is the following:

$$\log y_{ic} = \eta_c + \alpha_0 + \alpha_1 C_{ic} + \beta_1 (C_{ic} \times \Lambda_c) + \alpha_2 PE_{ic} + \alpha_3 PE_{ic}^2 + \alpha_4 G_{ic} + \epsilon_{ic} \quad (3)$$

- Job tasks were not included due to self-selection concerns
- $c \rightarrow 1, \ldots, 22$ countries
- $\eta_c \rightarrow$ Country fixed effects
- $\Lambda_c \rightarrow$ Country-specific measures
- η_c absorbs the major effects from Λ_c
- Standard errors clustered at the country level
- All Λ_c are de-meaned

Sample: Full-time employees aged 35-54 (i.e. prime-age)

What Country Characteristics Affect Returns to Numeracy?

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Numeracy	0.133***	0.135***	0.132***	0.135***	0.135***	0.144***	0.135***	0.147***	0.077***
	[0.008]	[0.010]	[0.009]	[0.009]	[0.005]	[0.01]	[0.009]	[0.009]	[0.006]
× *EPL*	-0.045***							-0.039**	-0.035**
	[0.013]							[0.02]	[0.014]
× *Unionism*		0.0002							
		[0.0003]							
× *GDP per capita Growth*			-0.003						
			[0.006]						
× *Productivity Growth*				-0.008					
				[0.013]					
× *Minimum Wage*					-0.004				
					[0.0013]				
× *Public Sector*						-0.034***		-0.036***	-0.021***
						[0.008]		[0.009]	[0.006]
× *R&D Investements*							0.016**	0.013*	0.010
							[0.007]	[0.007]	[0.006]
Country fixed effects	X	X	X	X	X	X	X	X	X
Industry fixed effects (22)									X
Occupation fixed effects (10)									X
R^2	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.51
Number of Countries	21	20	22	20	22	22	22	21	21
Observations	20,299	19,761	21,217	19,761	21,217	21,217	21,217	20,299	20,299

$$^{*}\ p \leq 0.10,\ ^{**}\ p \leq 0.05,\ ^{***}\ p \leq 0.01$$

Country Measures Explanation

- Employment Protection Legislation (*EPL*) index: Strictness of employment protection for individual and collective dismissals
- *Unionism*: Share of workers who are trade union members
- Percentage *GDP per capita Growth* (2007-2012)
- *Productivity*: Change in real productivity (2007-2012)
- *Minimum Wage*: Binary variable if a statutory minimum wage exists
- *Public Sector*: Share of workers employed in the public sector $\rightarrow$ Calculated from PIAAC
- *R&D Investments*: Gross domestic expenditure on R&D (2007-2012)

Policy Implications

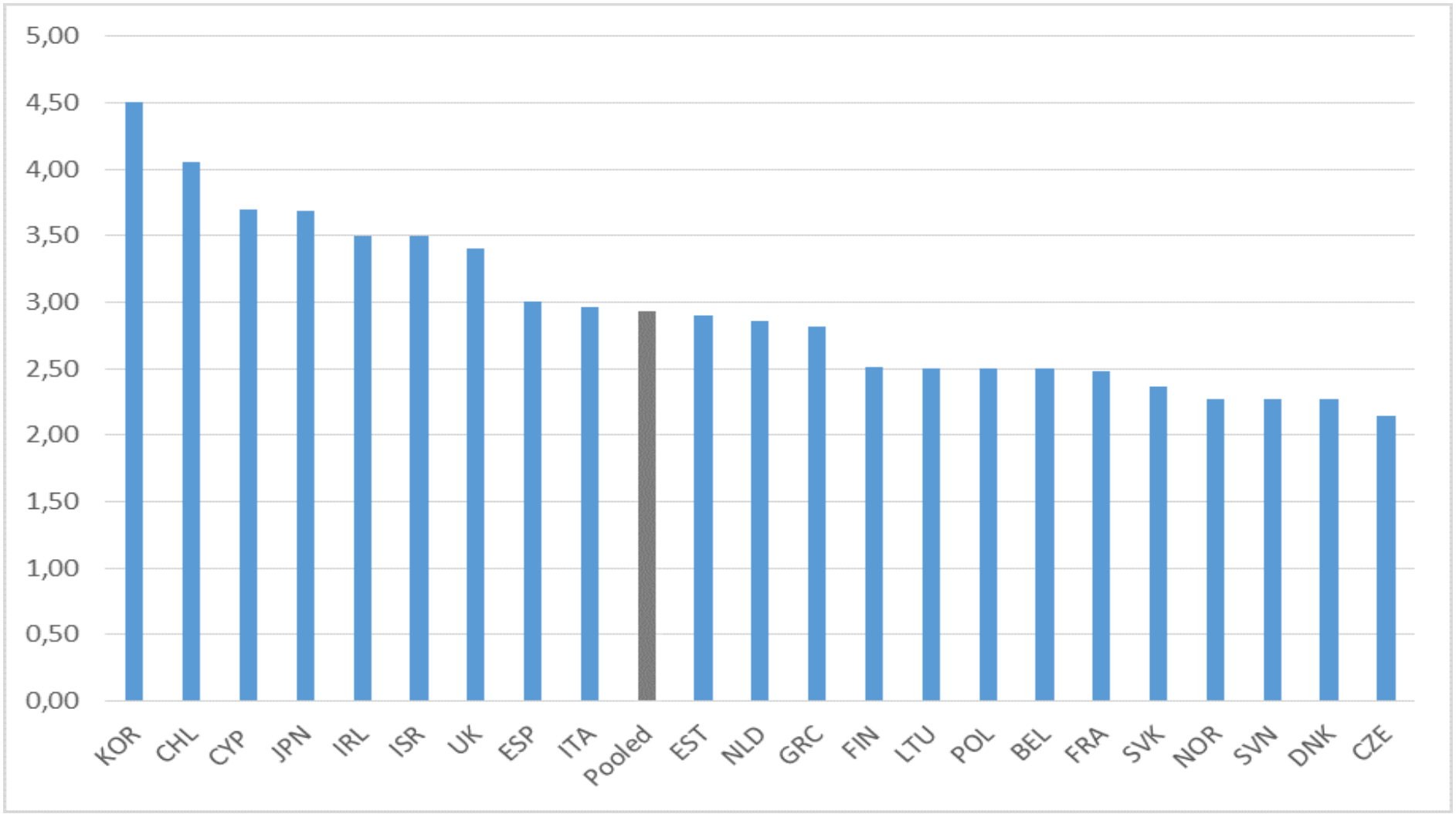
Policies to augment well-being and mitigate inequality:

1. Excellent preschool through high school education
2. Broad access to post-secondary education
3. Good public health

Those policies could reduce wage inequality:

- Enabling more adults to attain high productivity and well-paid jobs
- Raising skills supply reduces the wage premium of skilled workers

Wage Inequality by Country



Note: Wage inequality defined as gross hourly wage ratio between 90th and 10th percentile of wage distribution. *Source*: PIAAC

Shortcomings of My Analysis

Endogeneity Issues

- Omitted variable bias $\rightarrow$ Other skills scores are missing
- Reverse causality $\rightarrow$ Better skills related to challenging jobs
- Schooling extension $\rightarrow$ Related partly to higher cognitive skills
- Standard ability bias $\rightarrow$ Innate ability merely measurable
- Self-selection into occupations and job tasks (i.e. non-random assignment)

Recomendations for Future Research

- Combine school achievements and direct skills measurements
- Use comparable panel data $\rightarrow$ changes across countries and over time
- *Roy's model* to randomly assign workers into occupations and job tasks **[Autor and Handel, 2013]**

References

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The End

Thank you for your attention!