

The global distribution of routine and non-routine work. Findings from PIAAC, STEP & CULS

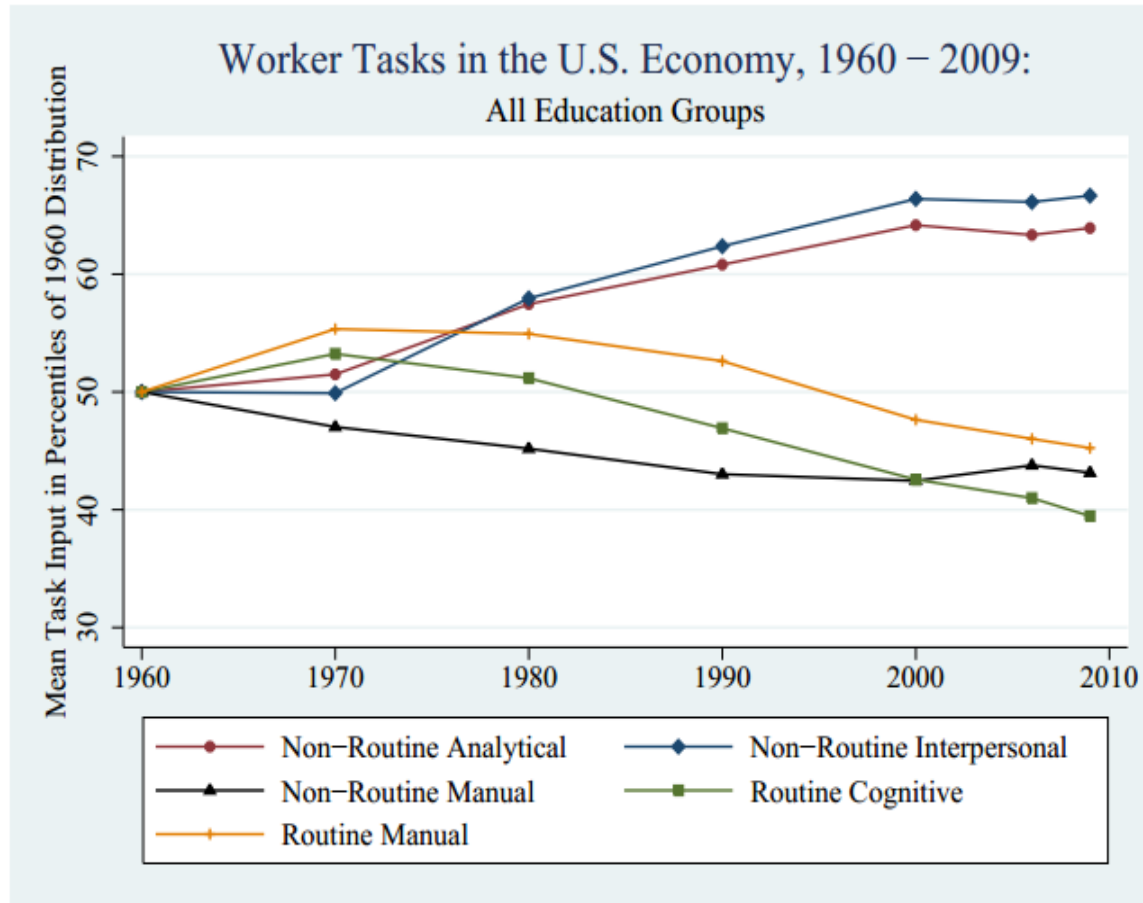
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The de-routinisation of jobs in the US and Western Europe has been attributed to the routine-biased technological progress



- Routine cognitive and manual tasks are substituted by technology and decline
- Non-routine cognitive tasks complement technology and grow
- Non-routine manual tasks rebounded but are typical for lousy jobs

Source: Autor, Price (2013)

Task contents are usually calculated with O*NET, a US database on occupational demands (Autor et al. 2003, Acemoglu & Autor 2011)



Task content measure	Task items used
Non-routine cognitive analytical	Analysing data / information Thinking creatively Interpreting information for others
Non-routine cognitive interpersonal	Establishing and maintaining personal relationships Guiding, directing and motivating subordinates Coaching/developing others
Routine cognitive	The importance of repeating the same tasks The importance of being exact or accurate Structured vs. unstructured work
Routine manual	Pace determined by the speed of equipment Controlling machines and processes Spending time making repetitive motions
Non-routine manual physical	Operating vehicles, mechanized devices, or equipment Spending time using hands to handle, control or feel objects, tools or controls Manual dexterity Spatial orientation

Cross-country studies utilise O*NET assumming that it is a good proxy for occupational content outside of the US (occupations are identical)



- Handel (2012): high correlations between O*NET measures and results from country-specific skill surveys in some OECD countries
- Goos et al. (2014), Arias et al. (2014), Lewandowski et al. (2016, 2017): applications of O*NET to LFS data in the OECD and/or EU countries
- WDR (2016): the Autor (2015) typology of high-, middle-, and low-skill occupations in the US is assigned to developing countries

The aim of this paper



- Construct task content measures which:
 - Are measured at the worker level
 - Are country-specific
 - Are consistent with the established measures based on O*NET (US dataset)
 - Can be applied to PIAAC and STEP datasets
- Quantify differences in the task content of jobs around the world
- Identify factors which contribute to these differences

Recent attempts to create routine/non-routine task measures using skill surveys with individual level data on job content



- De la Rica & Gortazar (2016), Marcolin et al. (2016) with PIAAC (OECD and partners)
- Dicarolo (2016) with STEP (10 developing countries)
- These papers are quite arbitrary in how they define tasks.

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- Differences wrt O*NET tasks can result from different definitions (☹️) or different country-specific work patterns (😊).

- We want to minimise the former and highlight the latter

- We use PIAAC (32 countries), STEP (9 countries) and CULS (China)

We use three surveys which include comparable data on the skill use at work, literacy and labour market status



PIAAC (OECD)

- 32 countries surveyed between 2011 and 2015
- sample sizes: from 4000 (Russia) to 26000 (Canada)

STEP (World Bank)

- 9 countries surveyed between 2011 and 2015
- sample sizes: from 2400 (Ukraine) to 4000 (Macedonia) urban residents
- representative for survey areas
- skill use at work and literacy test comparable to PIAAC

CULS (Chinese Academy of Social Science)

- 6 cities (Guangzhou, Shanghai, Fuzhou, Shenyang, Xian, Wuhan) in 2016
- sample size 15500
- representative for the survey area
- skill use at work questionnaire as in STEP

Representativeness of the data is limited in some countries.
Bear that in mind when looking at the results



PIAAC

- Belgium – Flanders
- Russia – without Moscow municipal area
- UK – England and Northern Ireland
- Indonesia – Jakarta
- Singapore – only permanent residents (approx. 75% of population)

STEP – urban survey with additional limitations in some countries

- Bolivia – four main cities – La Paz, El Alto, Cochabamba and Santa Cruz de la Sierra (approx. 80% of urban population)
- Colombia – 13 main metropolitan areas
- Georgia – without Abkhazia and South Ossetia
- Lao PDR – both urban and rural, but we drop rural for consistency
- China (CULS) – 6 cities

We use the US PIAAC to construct task measures which are consistent with O*NET but are calculated at a worker level and are country-specific

Identify task items which are included in both PIAAC and STEP

Group them into four categories (non-routine cognitive analytical and personal, routine cognitive, manual)

Calculate O*NET task contents (Autor & Acemoglu, 2011) on the US PIAAC

Find combinations of items which are highly correlated with O*NET tasks at the occupation level in the US PIAAC

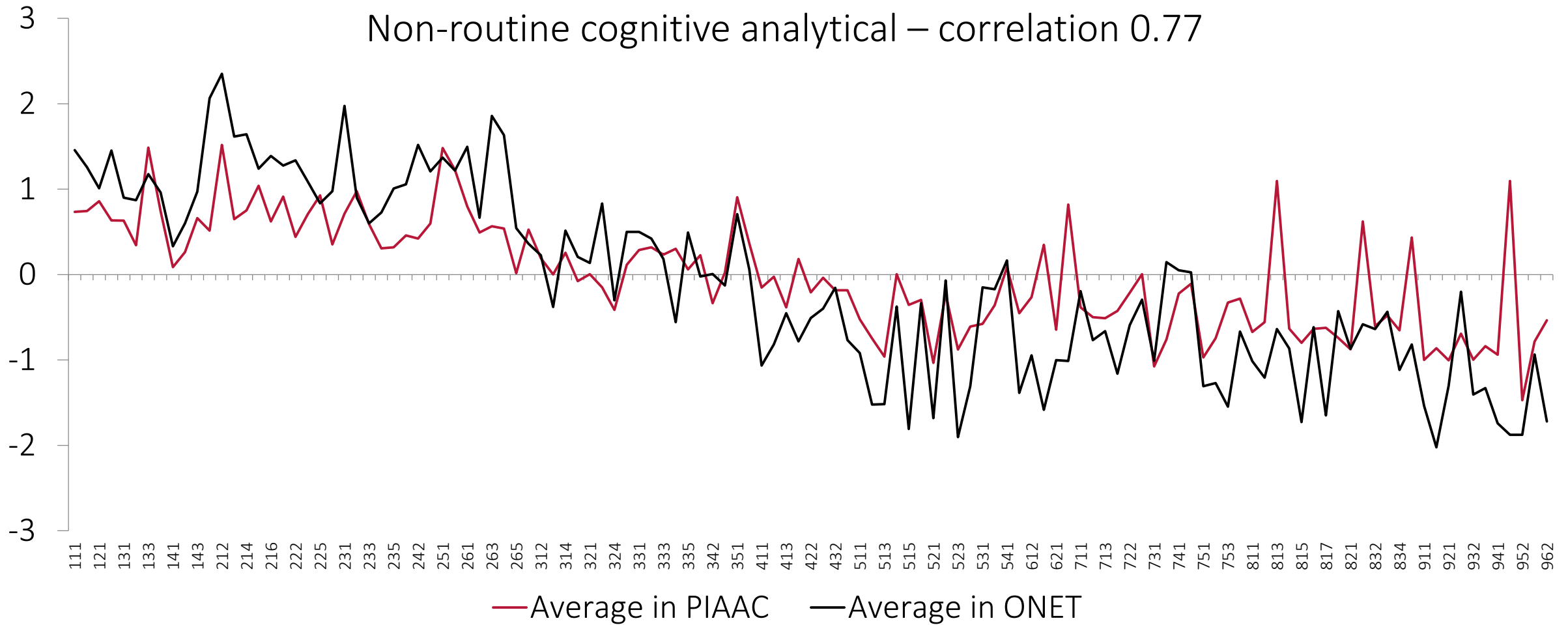
Choose the best combinations for every task measure and apply them to all countries

We select the PIAAC / STEP items below and follow Autor & Acemoglu (2011) to calculate the values of tasks



Task content measure	PIAAC / STEP task items used
Non-routine cognitive analytical	Reading news Reading professional titles Solving problems Programming
Non-routine cognitive interpersonal	Supervising Presenting
Routine cognitive	Changing order of tasks (reversed) Filling forms Presenting (reversed)
Manual	Physical tasks

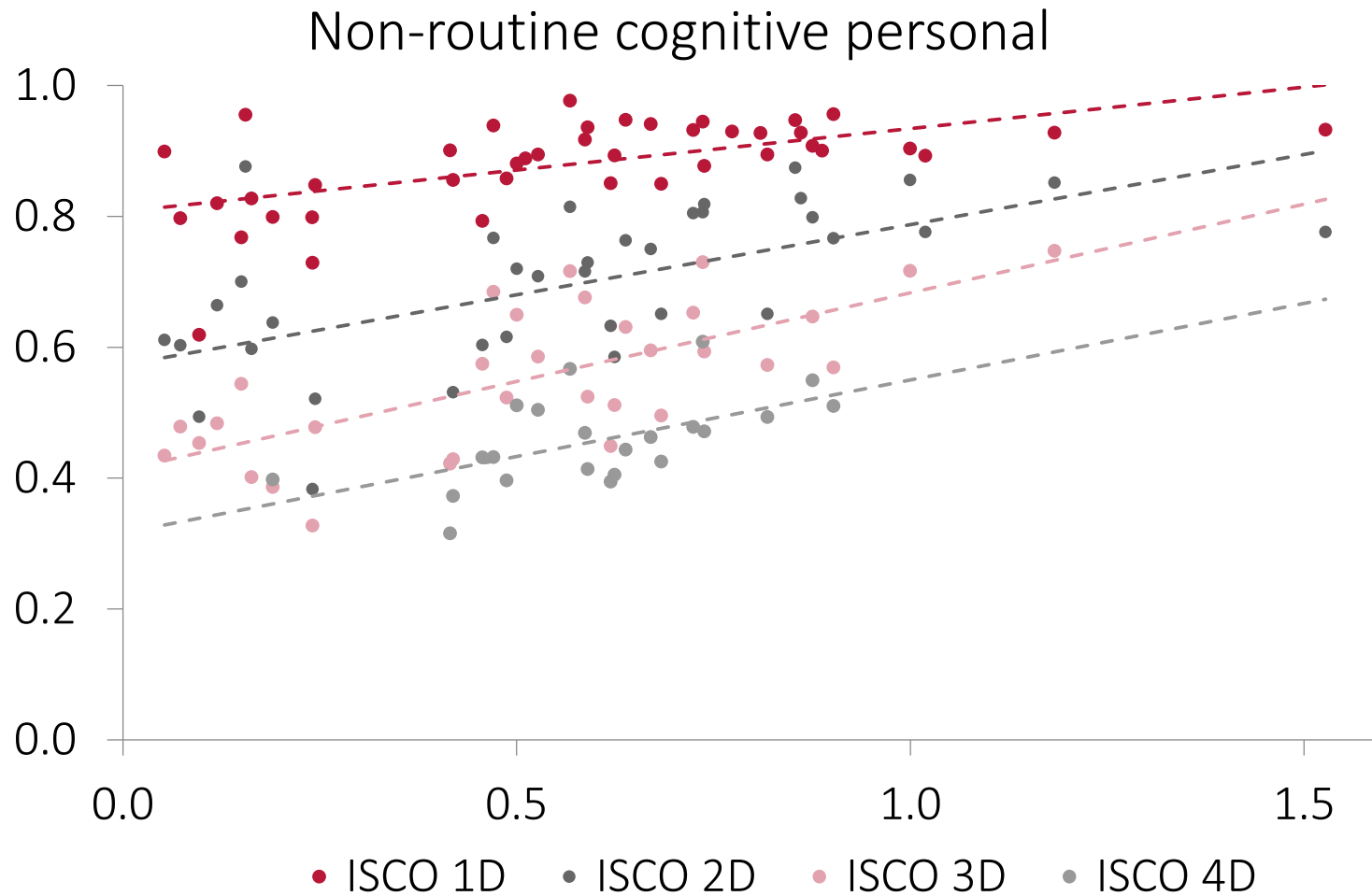
At the 3-digit occupation level in the US, the correlations between our measures and O*NET measures range from 0.55 to 0.77



The higher is the GDP per capita, the higher are the correlations between our tasks and the O*NET tasks at the occupation level



Correlation between our measures and O*NET measures



GDP per capita, relative to the US

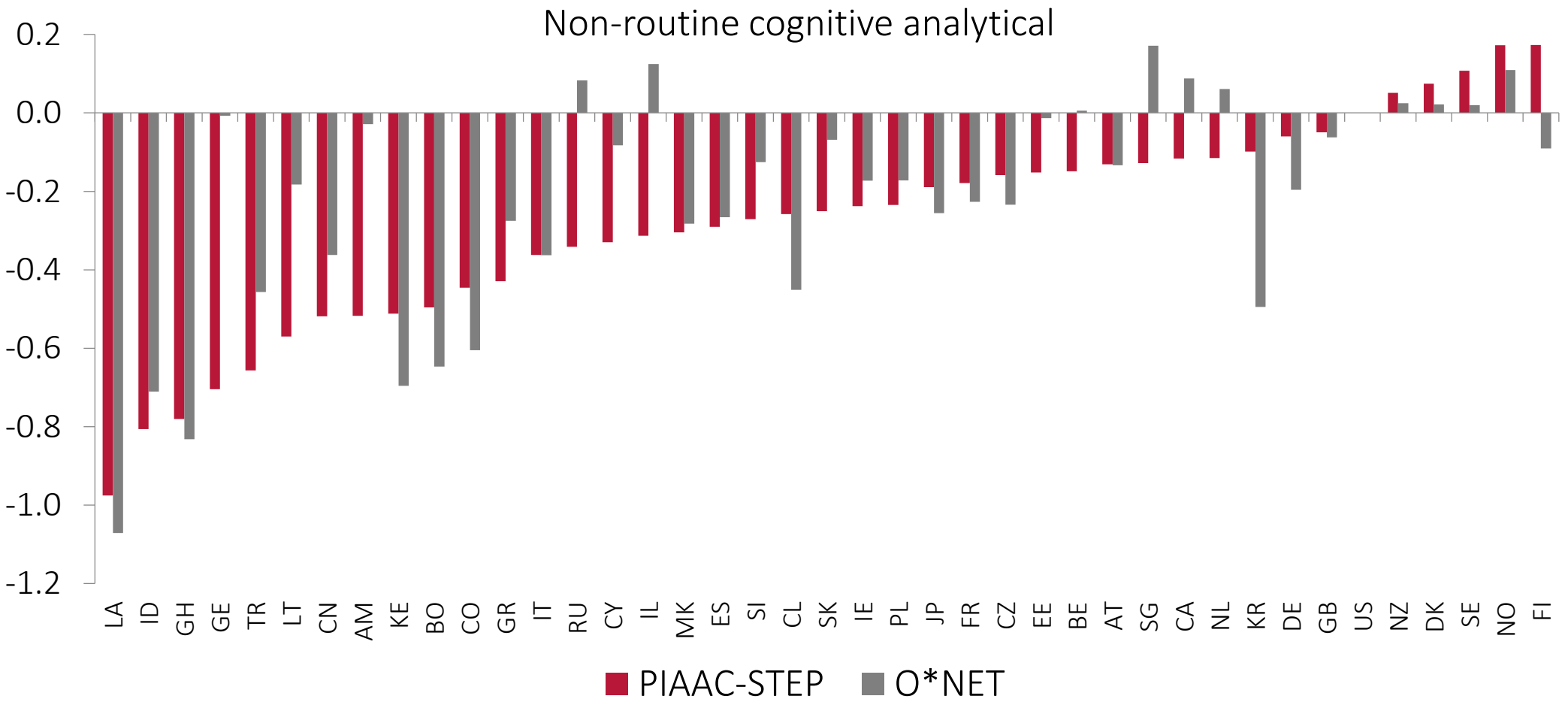
Once we control for GDP and literacy scores, the difference between PIAAC and STEP datasets becomes small and insignificant



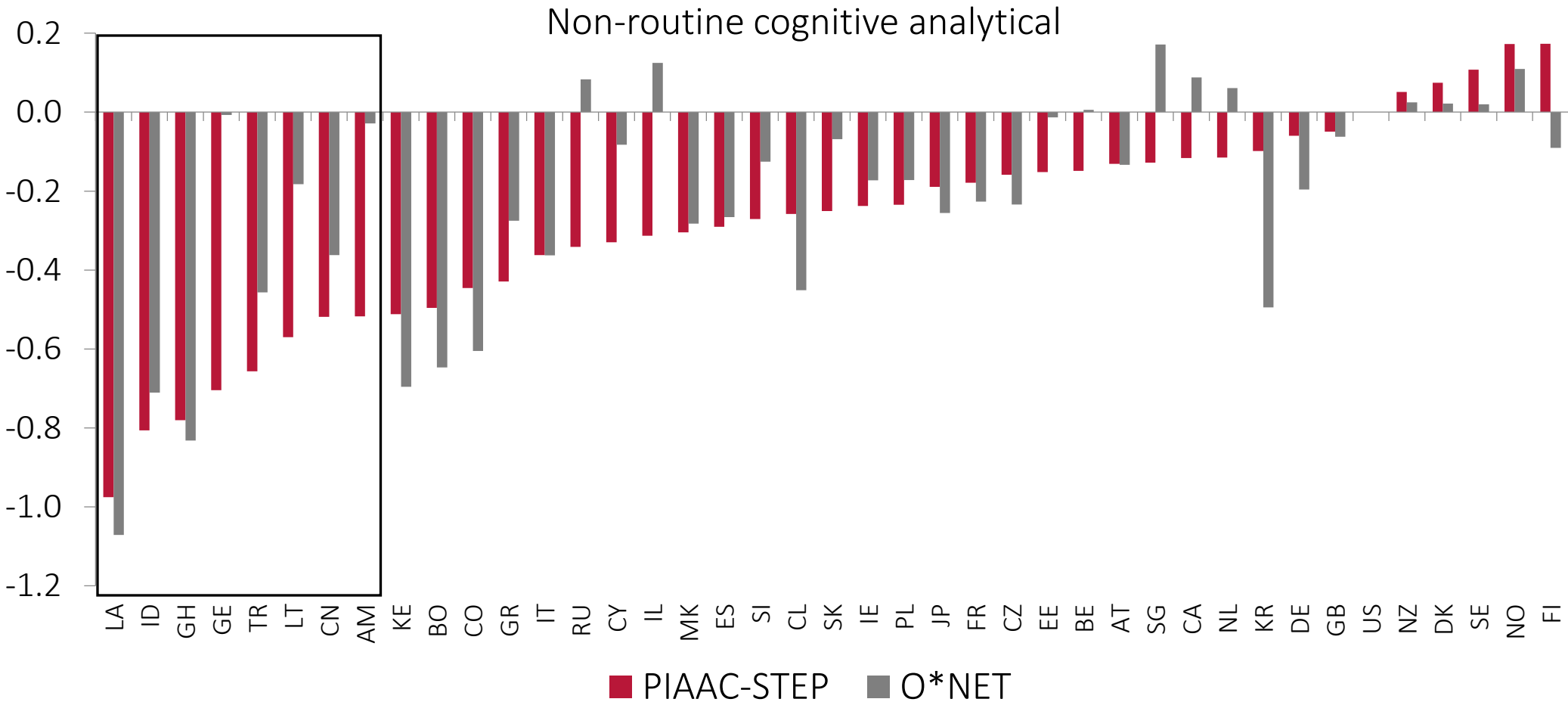
	Non-routine cognitive analytical	Non-routine cognitive personal	Routine cognitive	Manual
Base model (I)	-0.22***	-0.03	-0.05	-0.38***
I+ literacy skills (II)	-0.10	-0.04	-0.20	-0.44***
II + GDP	-0.00	0.06	-0.07	-0.18***

The reported coefficients are for a STEP dummy in a whole sample models. The base regressions include dummies for gender, 10-year age groups, education, 1-digit occupations and sectors. The standard errors are clustered at a country level. The regressions with literacy scores exclude China (CULS), Laos and Macedonia due to lack of literacy skills assessment in these countries.

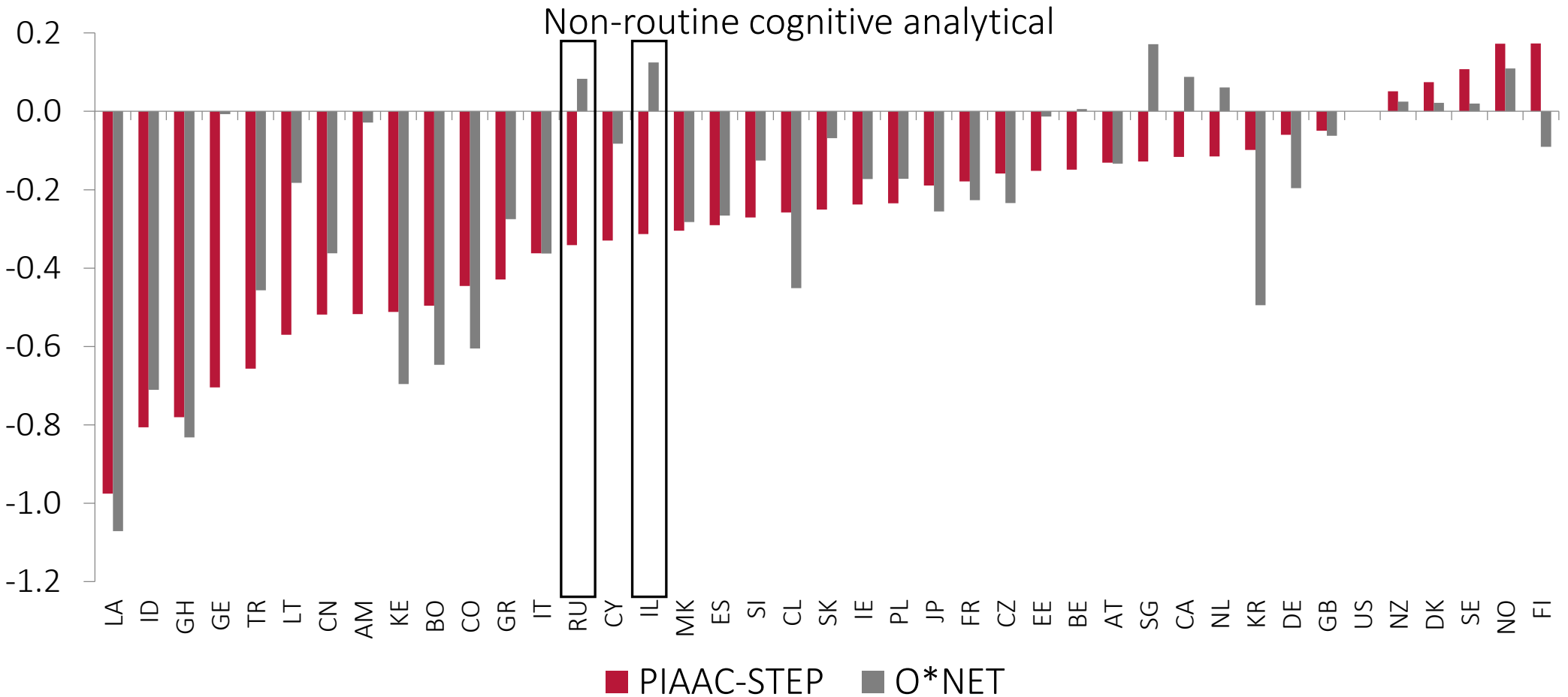
In the less developed countries our measures show less non-routine task content than O*NET, the opposite is true in highly advanced countries



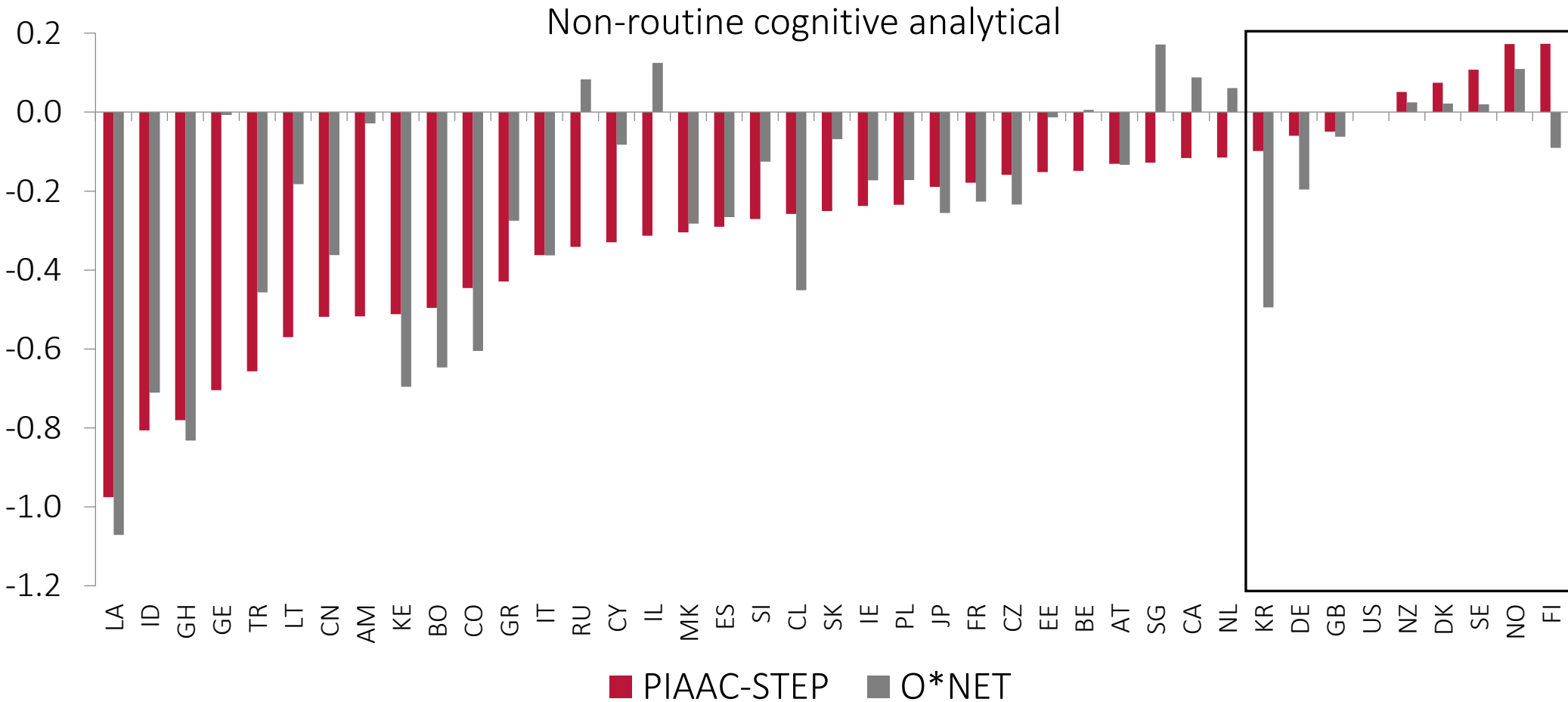
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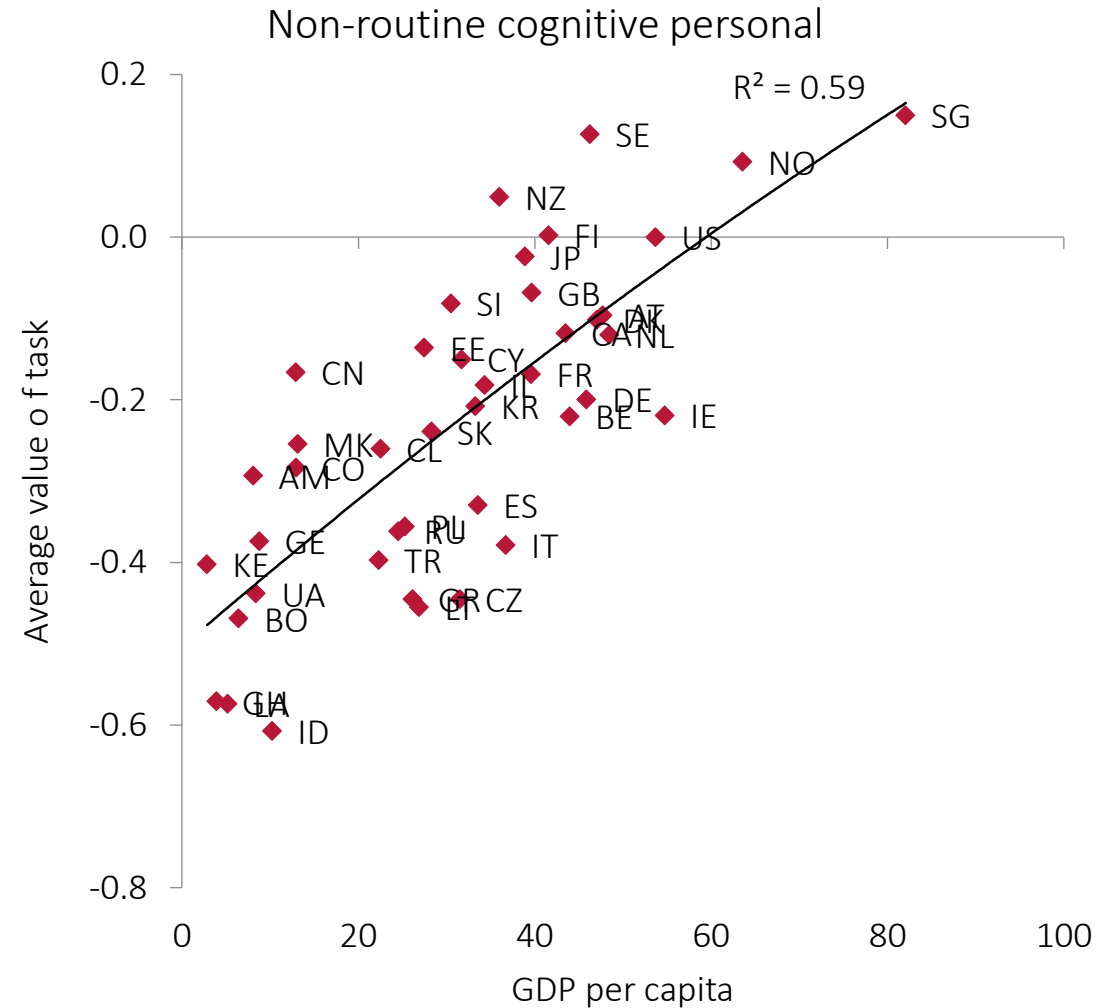
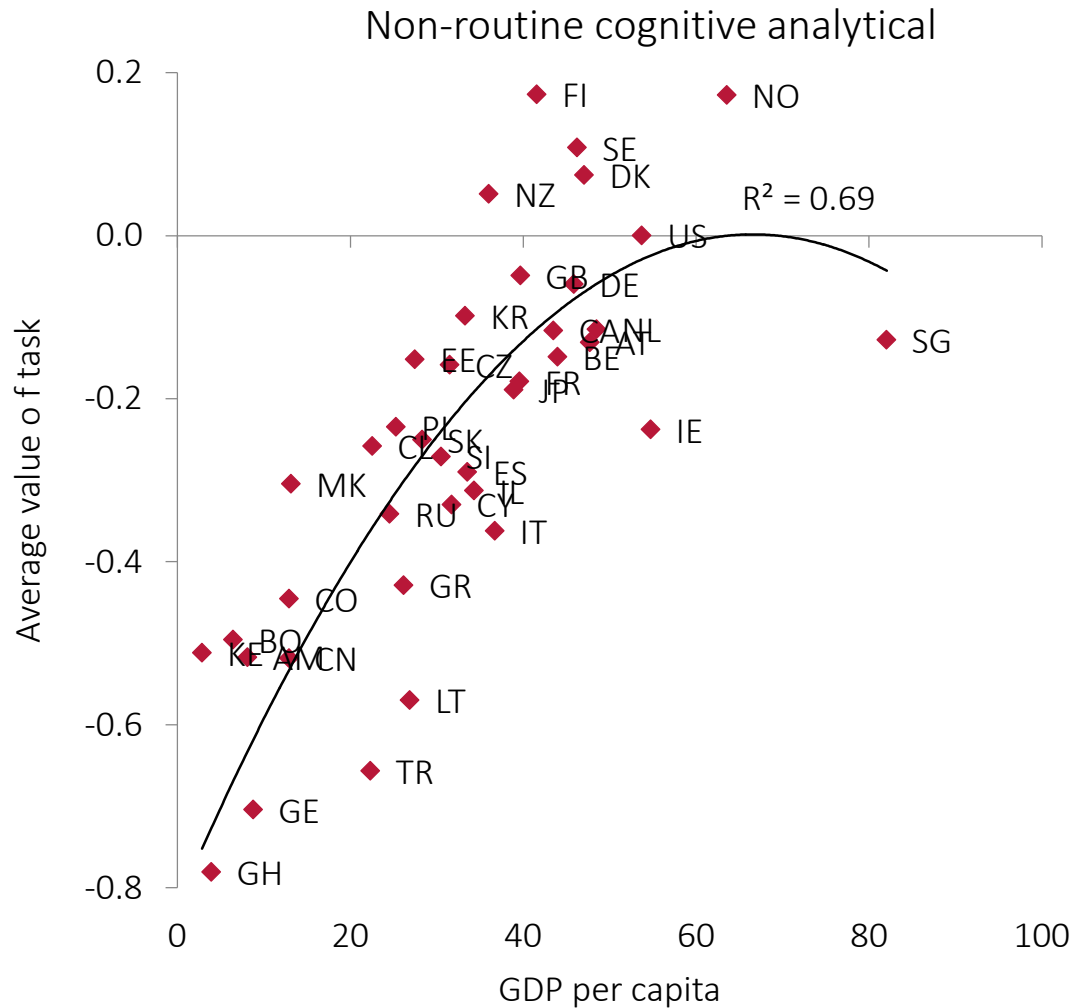
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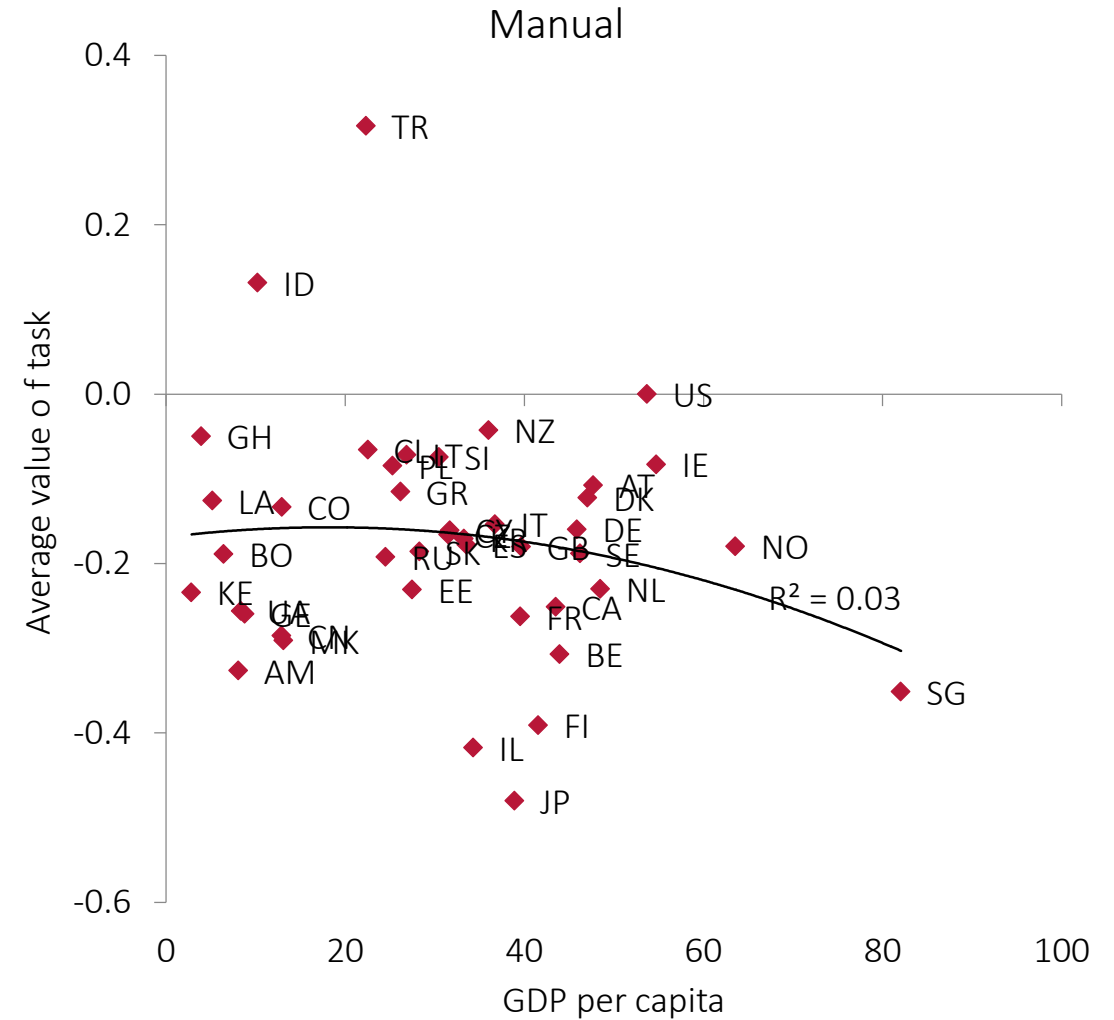
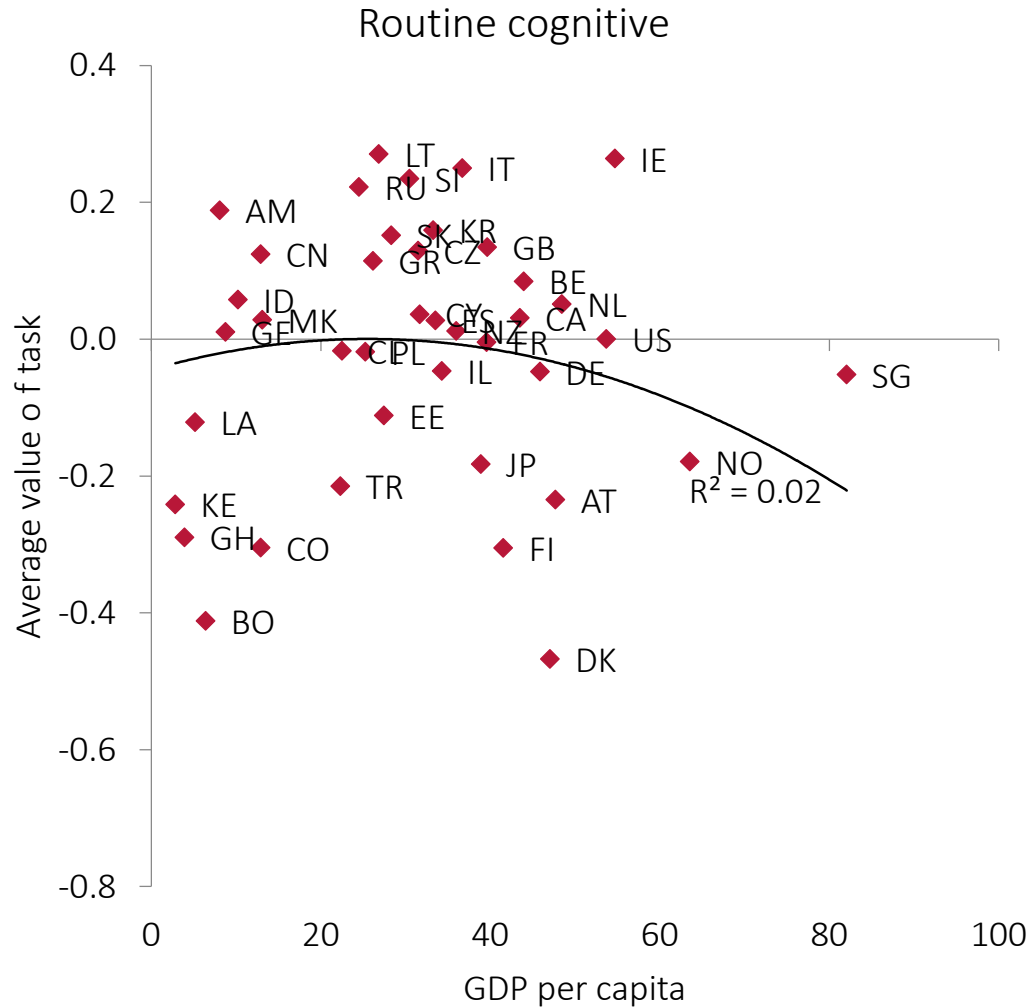
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The more developed countries exhibit higher average values of non-routine tasks than the less developed countries



The relationship of routine cognitive and manual tasks with GDP per capita is inverse U-shaped but not significant



To quantify the distribution of routine and non-routine workers we define the relative routine task intensity (RTI)

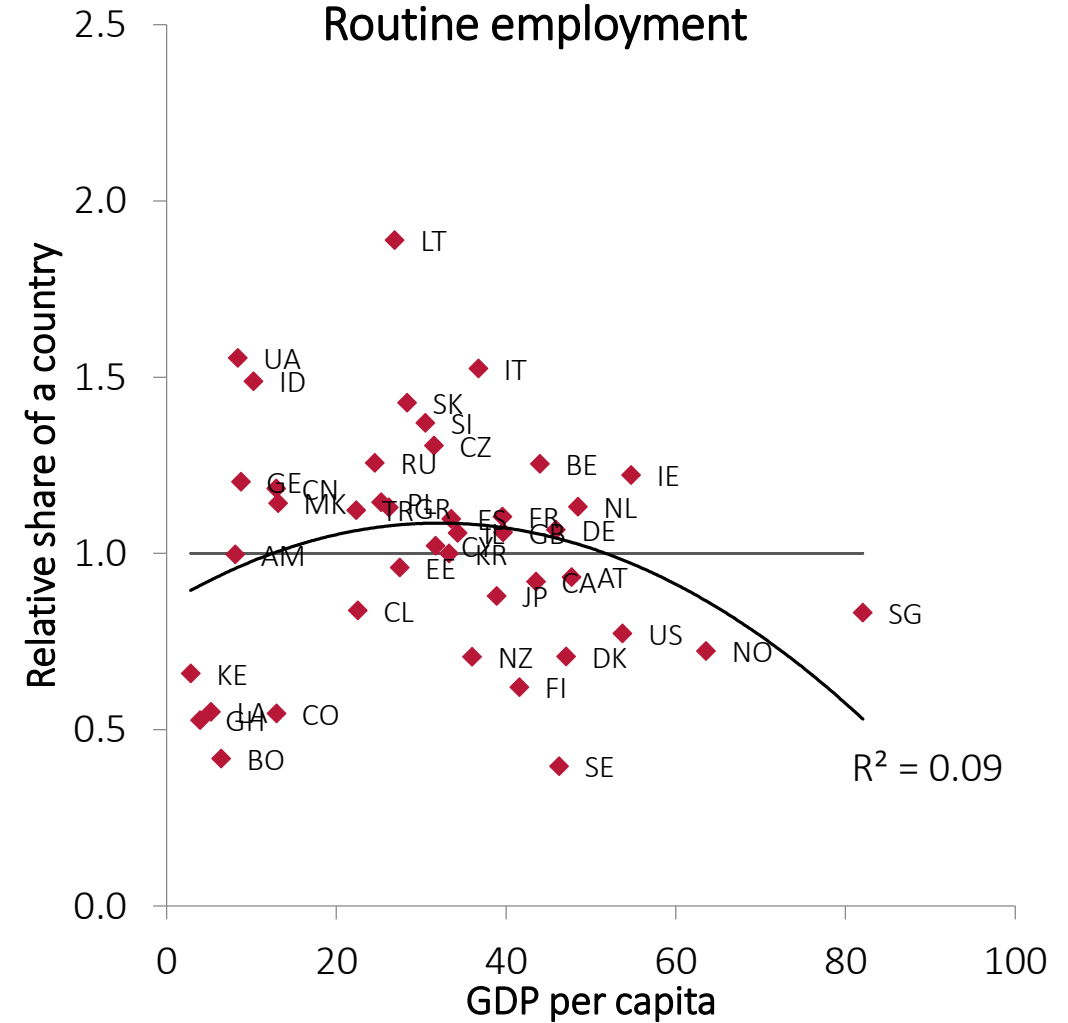
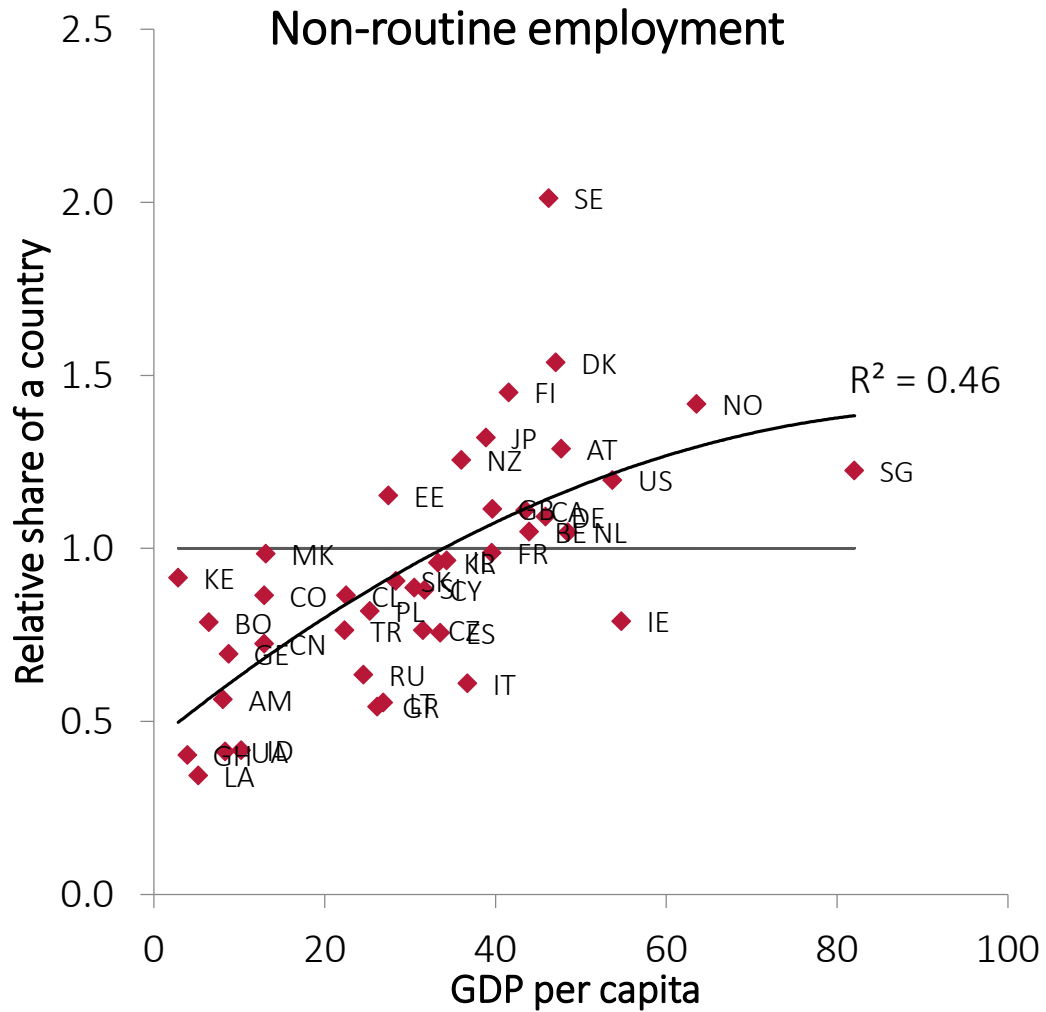


- Routine task intensity (RTI) \nearrow with the relative importance of routine tasks, \searrow with the relative importance of non-routine tasks

$$RTI = \ln(r_{cog}) - \ln\left(\frac{nr_{analytical} + nr_{personal}}{2}\right)$$

- The pooled distribution of relative routine intensity provides:
 - Non-routine workers – 20% of individuals with the lowest RTI
 - Routine workers – 20% of individuals with the highest RTI

The more advanced countries exhibit abundance of non-routine workers.
The middle to high income countries exhibit abundance of routine workers

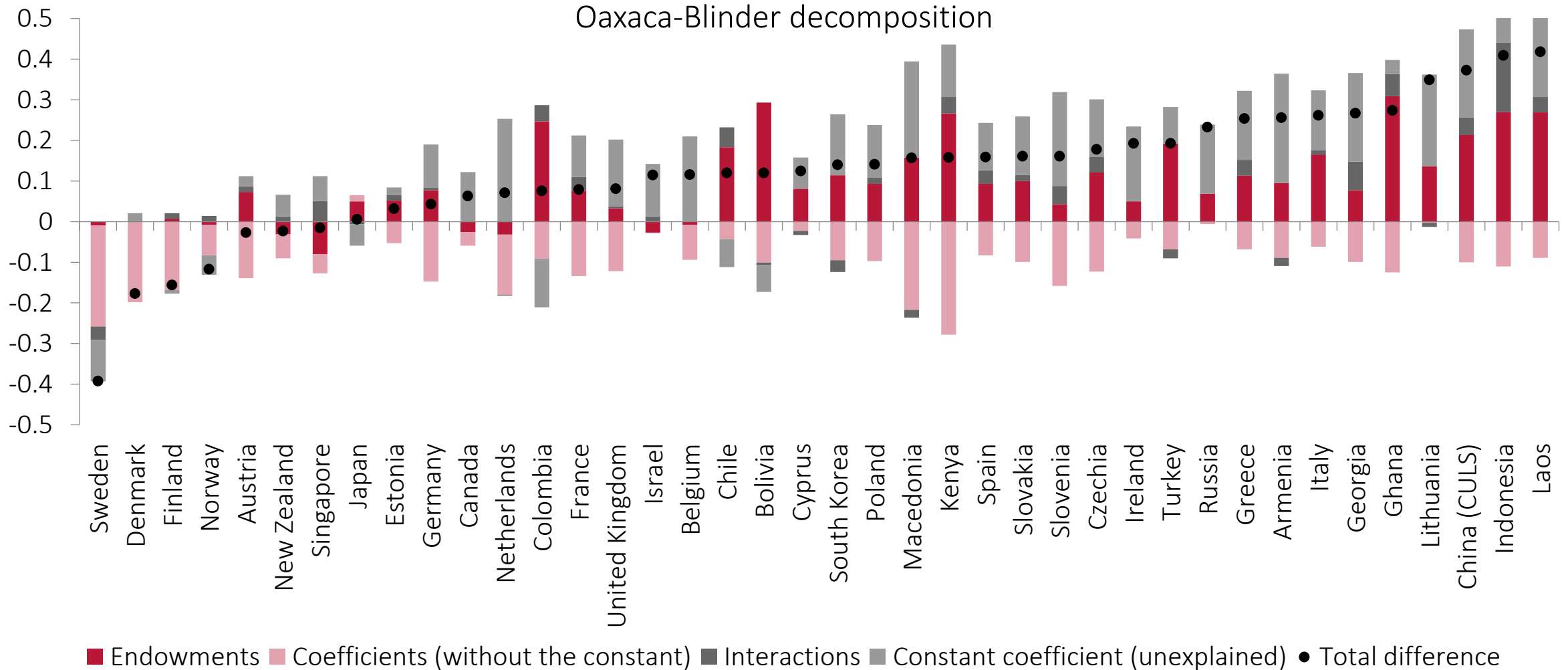


We estimate worker-level models of routine task intensity (RTI).
Routine intensity is significantly higher for workers who are

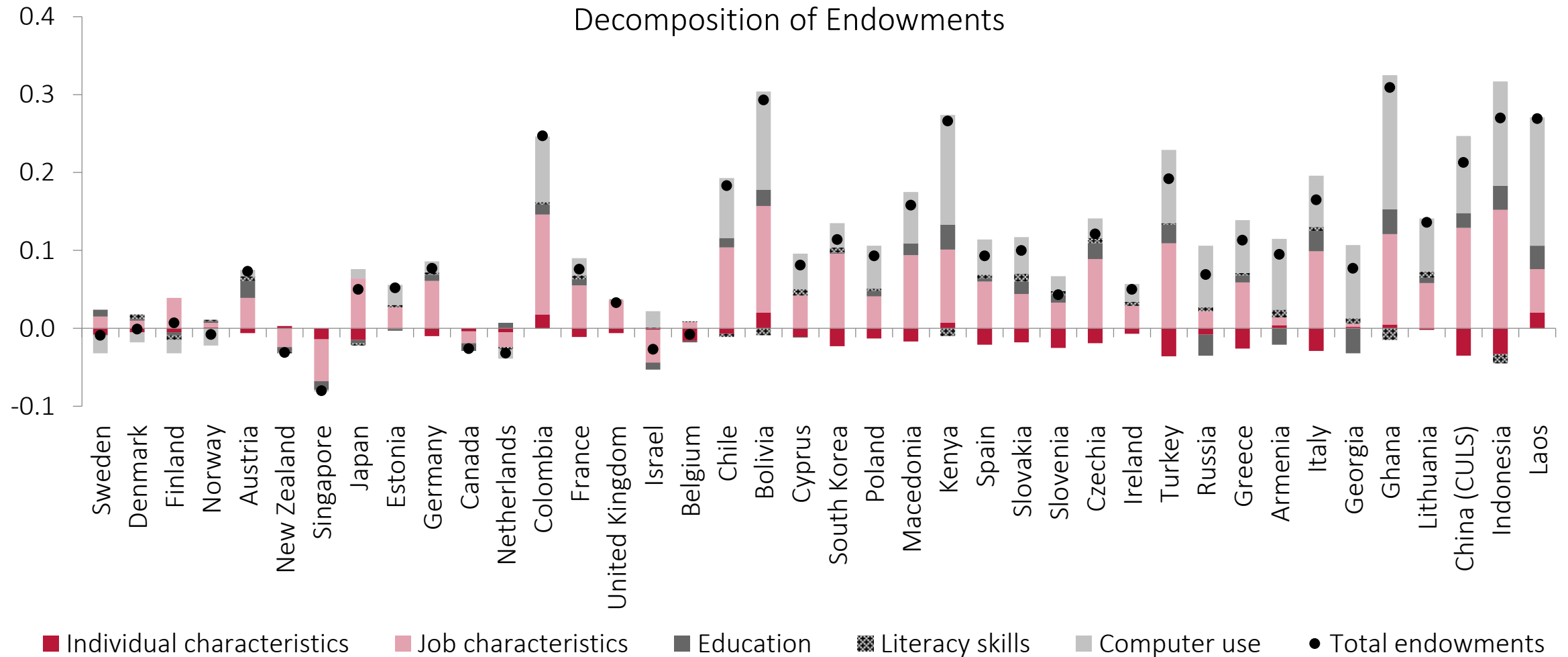


- Women
- Young
- Without college or without secondary education
- In the low-skilled occupations (the craft and related trades workers, plant and machine operators and assemblers or elementary occupations)
- In wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage or accommodation and food service activities
- Who don't use computer at work
- Who have low literacy skills

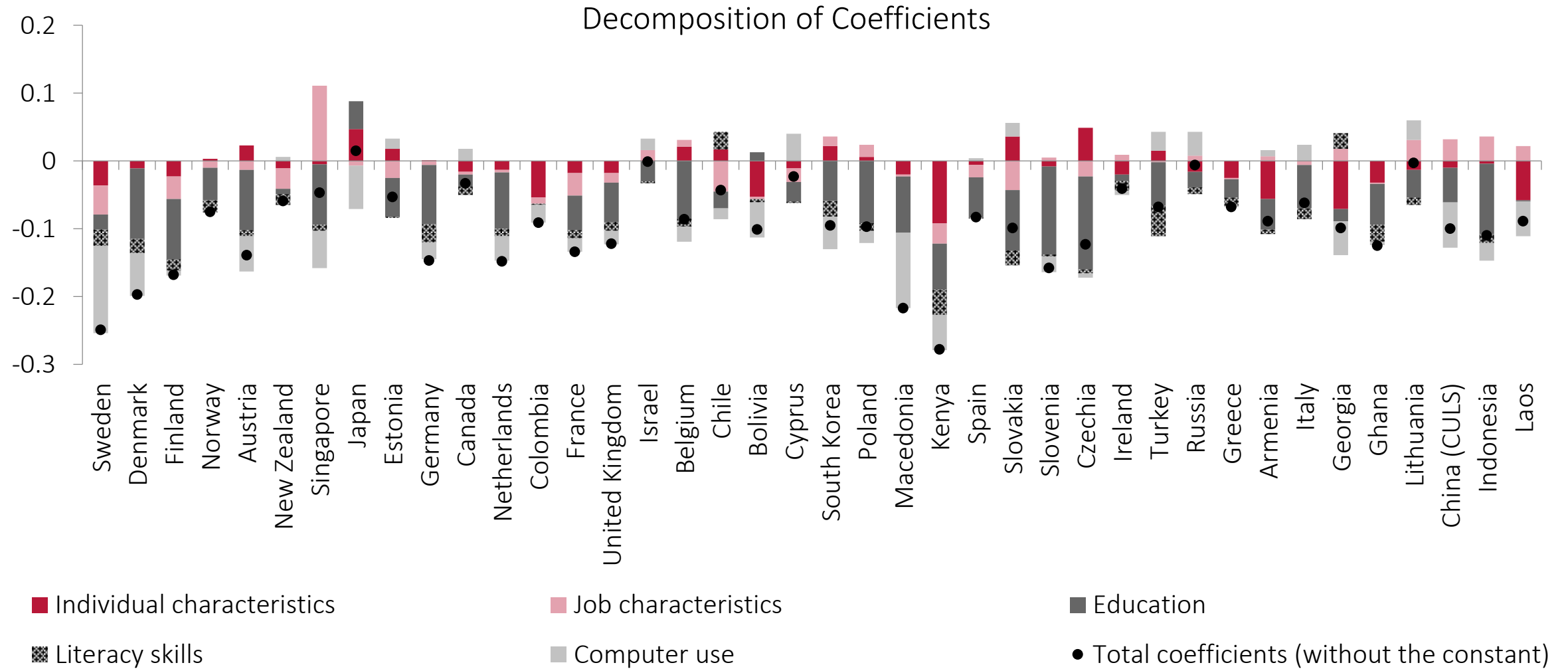
In most countries, workforce and workplace characteristics contribute to higher routine intensity of jobs than in the US



In most countries, the structure of job characteristics (occupations and sectors) and computer use at work raise routine intensity above the US



But more education, better skills, and computer use reduce the routine intensity to a higher extent than in the US



What tasks tell us about the global division of work



- We create task content measures which:
 - are worker-based and country-specific
 - but correspond with the established O*NET task content measures
- Occupations are indeed different around the world
- Non-routine work is more common in the most advanced countries
- Routine cognitive work has an inverse-U shape relationship with GDP per capita
- About a half of cross-country differences in routine intensity of jobs can be explained by differences in education, skills and employment structures

Thanks for listening

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