instytut badań strukturalnych

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

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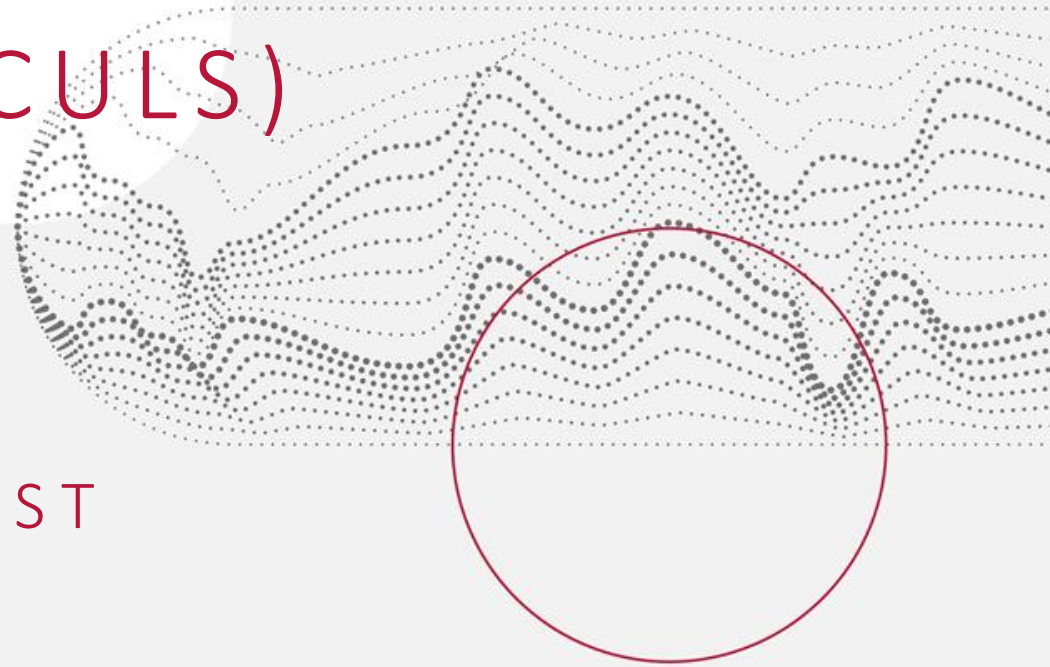
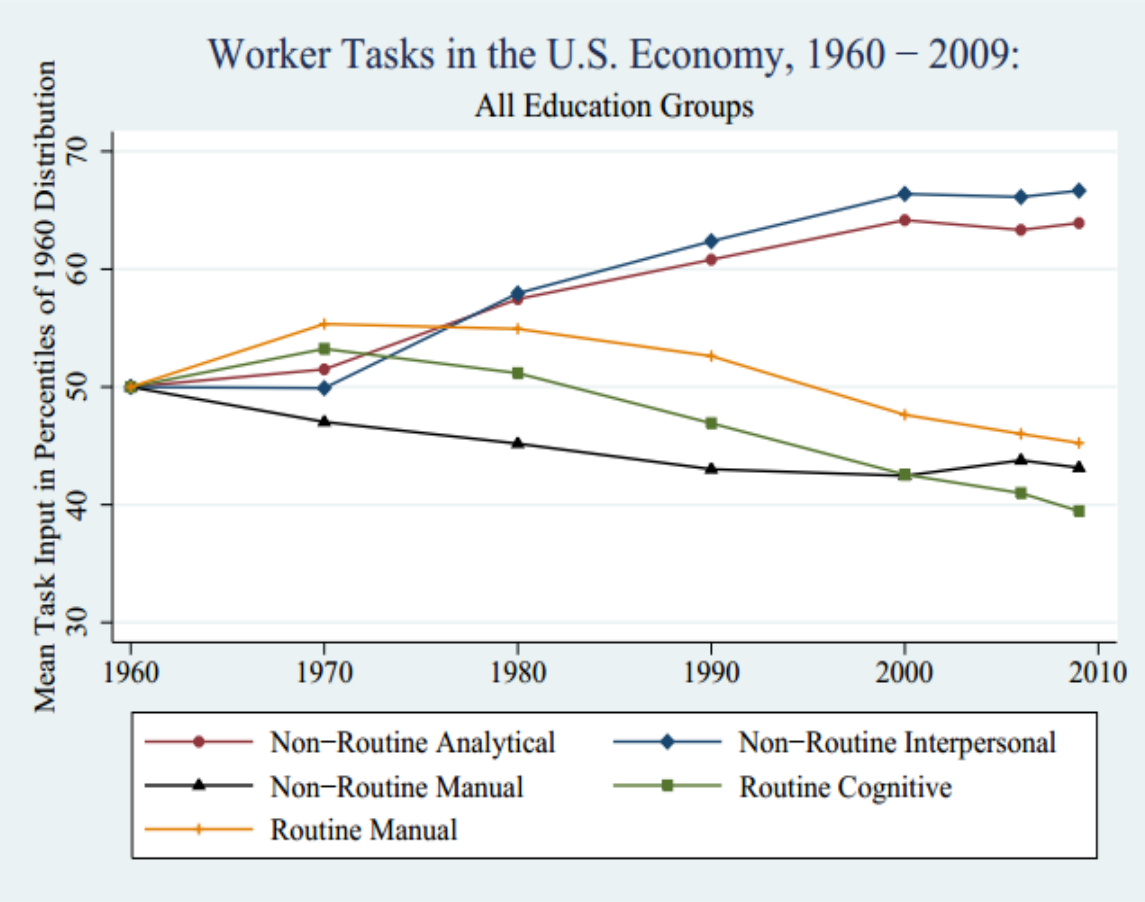
(work in progress with IEMS HKUST & CASS)



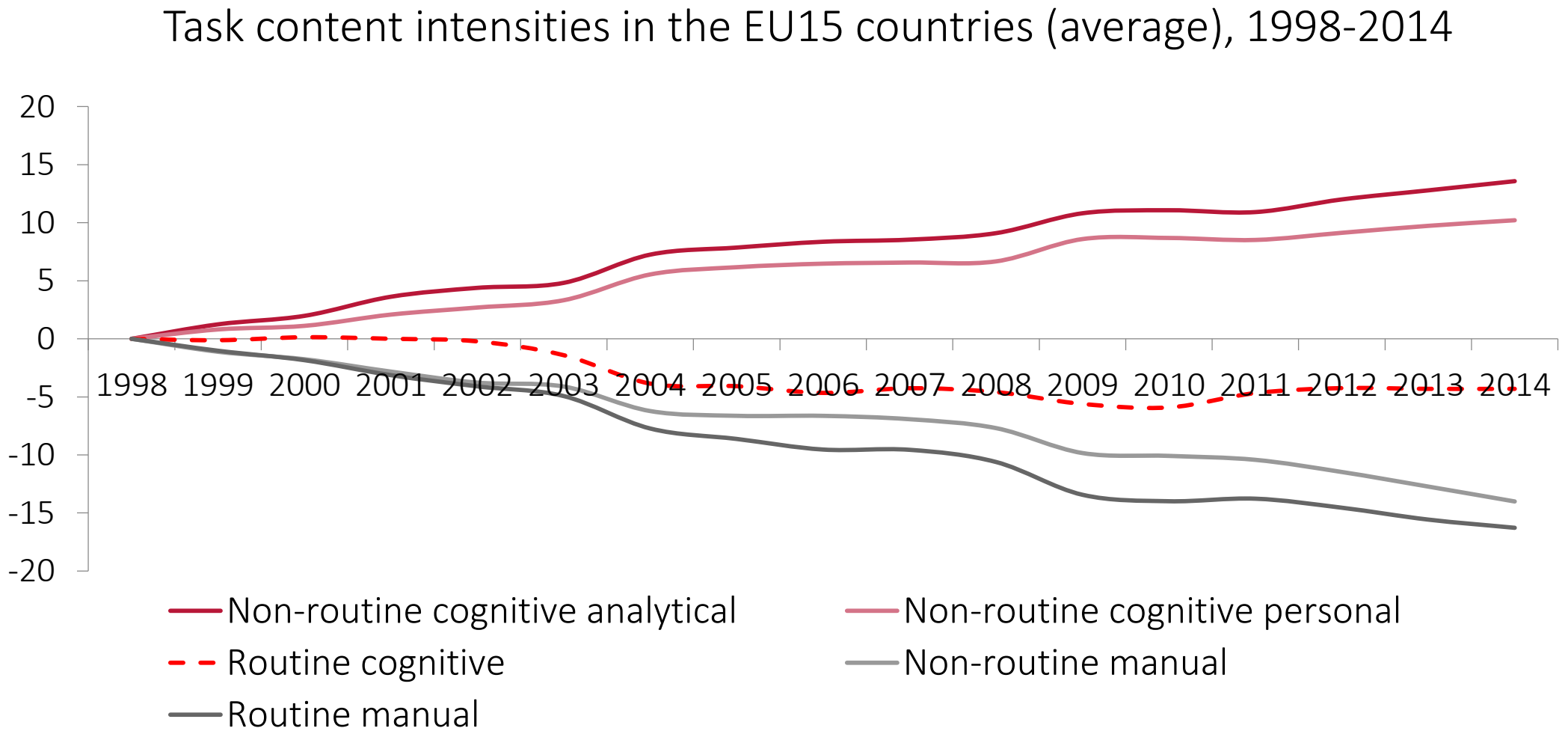
The de-routinisation of jobs in the US has been explained by the routine-biased technical change hypothesis



- Routine cognitive and manual tasks **fell**
- Non-routine cognitive tasks **grew**
- Non-routine manual tasks **decreased,** but started to **grow**

Source: Autor, Price (2013)

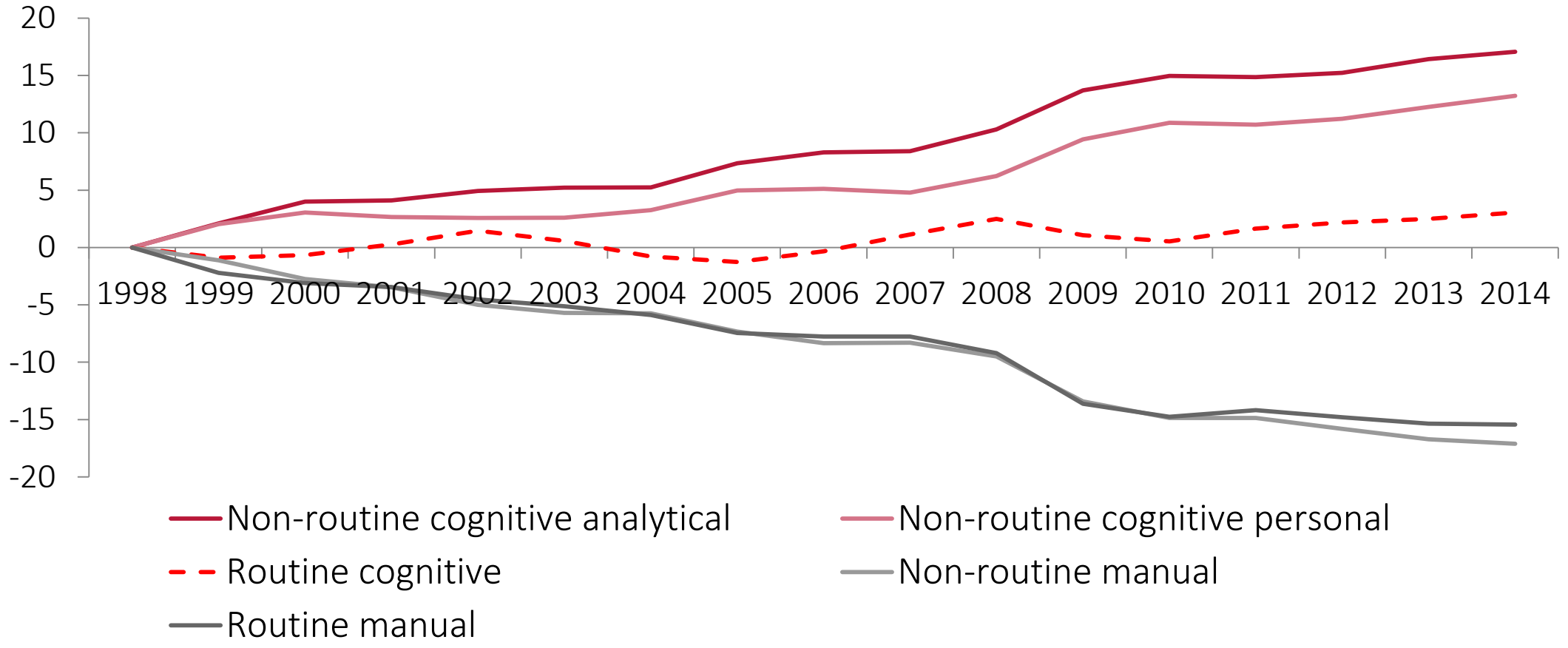
Europe also experiences a secular shift away from manual work towards cognitive work and from routine tasks towards non-routine tasks



Own calculations on LFS and O*NET.

In less developed European countries the routine cognitive content of jobs rises – largely because of a different pattern of structural change

Task content intensities in 10 Central Eastern EU countries (average), 1998-2014



Own calculations on LFS and O*NET.

Task is not a skill – it is a unit of work activity that produces output

Particular occupations involve various amounts of each of five tasks

Non-routine cognitive (analytical and personal)	Routine cognitive	Manual (routine and non-routine)
• Managers • IT specialists • Architects • Engineers	• Bookkeepers • Tellers • Office clerks • Salespersons	• Assemblers • Toolmakers • Drivers • Farmers

Task content are usually calculated with O*NET, a US database on occupations

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

Most of cross-country task studies utilise O*NET under the assumption that it is a good proxy of occupational content also outside of the US

- 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): Autor (2015) typology of high-, middle-, and low-skill occupations done on the US data assigned to developing countries

Recent attempts to create routine/non-routine 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)
- Dicarlo (2016) with STEP (10 developing countries)
- These papers are arbitrary in how they define tasks.

Recent attempts to create routine/non-routine 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)
- Dicarlo (2016) with STEP (10 developing countries)
- These papers are arbitrary in how they define tasks.
- 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 construct worker-level task contents which are comparable to O*NET

PIAAC		STEP	
In your job, how often do you usually - Read bills, invoices, bank statements or other financial statements?	1. Never 2. Less than once a month 3. Less than once a week but at least once a month 4. At least once a week but not every day 5. Every day	As a regular part of this work, do you have to read the following? - Bills or financial statements?	Yes / No

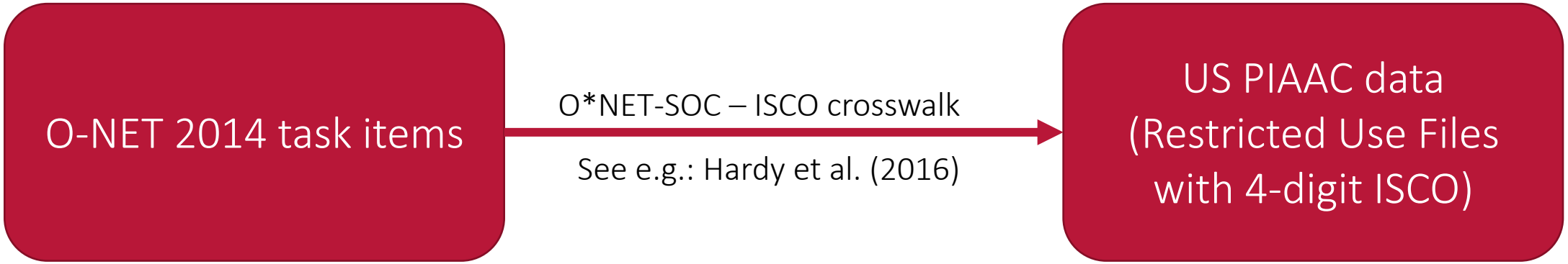
- Step 1. We find task items which exist in both STEP and PIAAC data.

We construct worker-level task contents which are comparable to O*NET

Task content	Non-routine cognitive analytical	Non-routine cognitive personal	Routine cognitive	Manual
Task items	**Reading bills, Reading news**, Reading professional titles, **Advanced math**, **Solving problems, Calculating prices**, Calculating fractions, **Programming**	**Supervising**, Collaborating, **Presenting**	**Changing order of tasks (reversed),** Reading bills, **Filling forms**, Calculating fractions, Physical tasks (reversed), Solving problems (reversed), **Presenting (reversed)**	**Physical tasks**

- Step 1. We find the task items existing both in STEP and PIAAC data.
- Step 2. We group them into four categories (bolded are those ultimately used).

We construct worker-level task contents which are comparable to O*NET



- Step 1. We find the task items existing both in STEP and PIAAC data.
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- Step 3. We calculate O*NET task contents (Autor & Acemoglu, 2011) on the US PIAAC.

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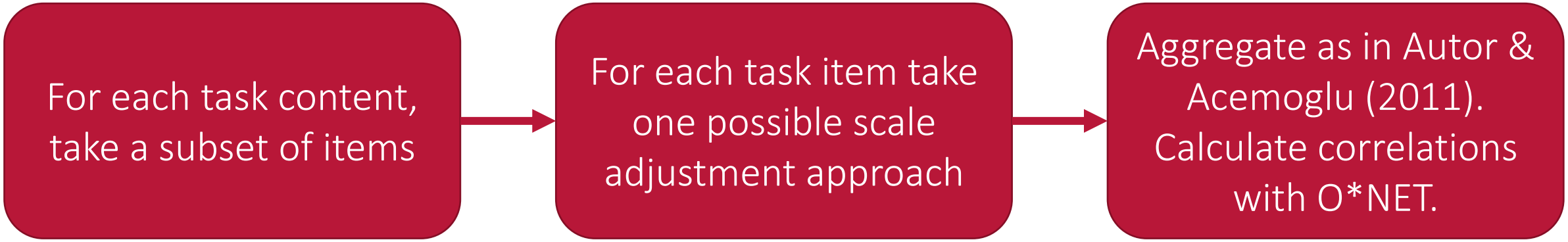

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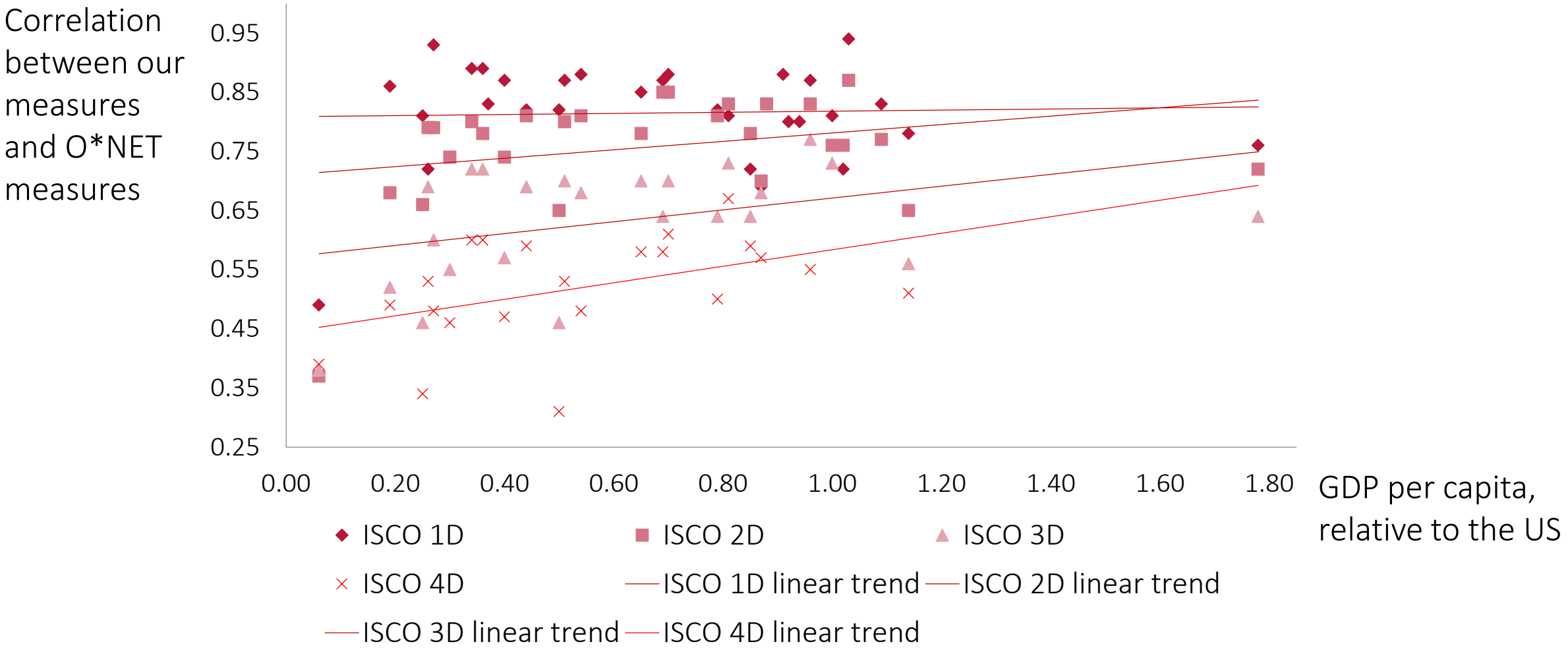
- Step 4. We consider all combinations of PIAAC items and their rescaling. We calculate the correlations of resulting task contents with the O*NET tasks at the occupation level.

We construct worker-level task contents which are comparable to O*NET

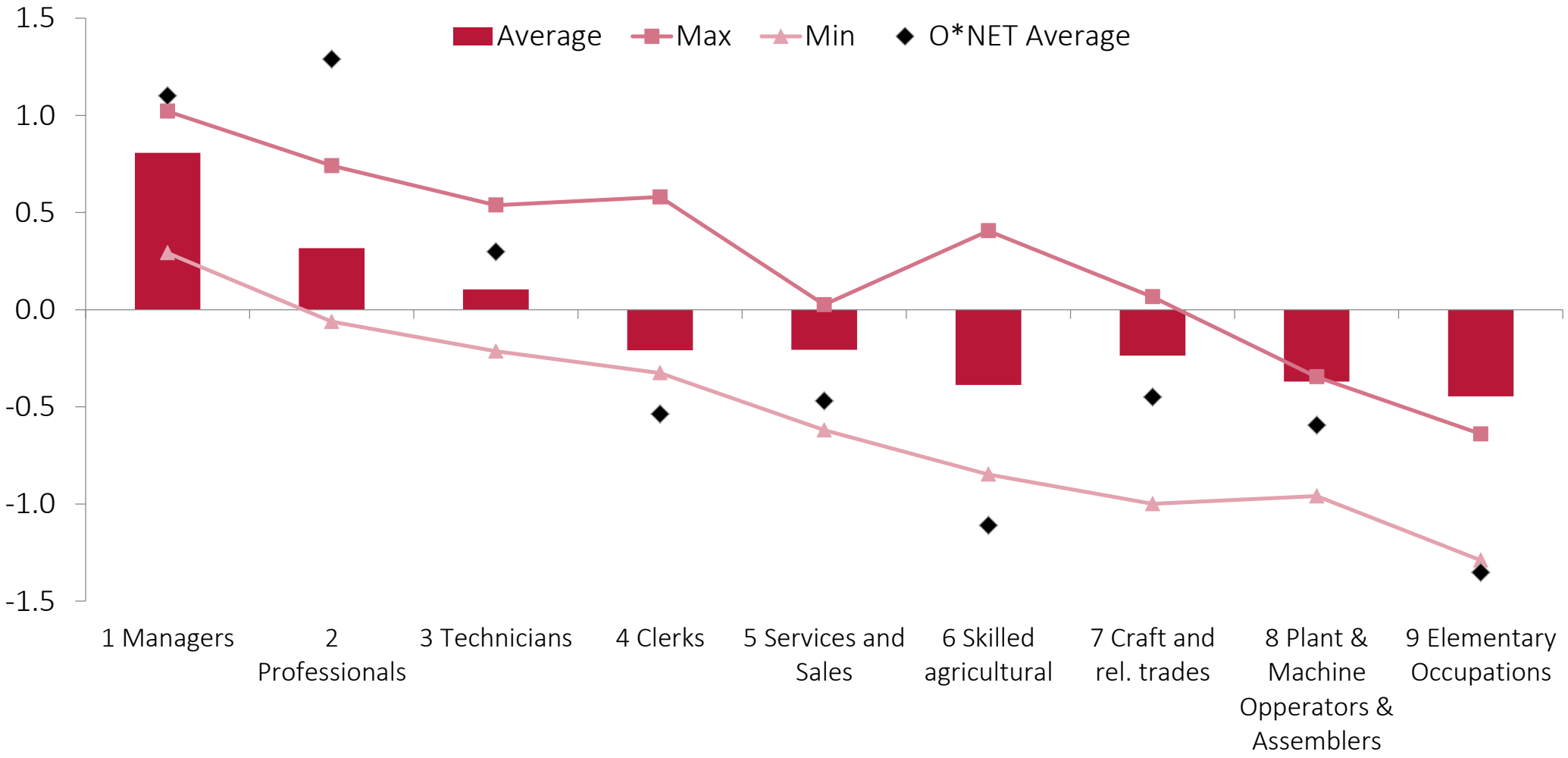
FINAL CHOICE BASED ON:
Correlations at a 3-digit level, Variability (e.g. number of items)

- Step 1. We find the task items existing both in STEP and PIAAC data.
- Step 2. We group them into four categories.
- Step 3. We calculate O*NET task contents (Autor & Acemoglu, 2011) on the US PIAAC.
- Step 4. We consider all combinations of PIAAC items and their rescaling. We calculate the correlations of resulting task contents with the O*NET tasks at the occupation level.
- Step 5. We choose from the top five PIAAC item combinations for each task content.

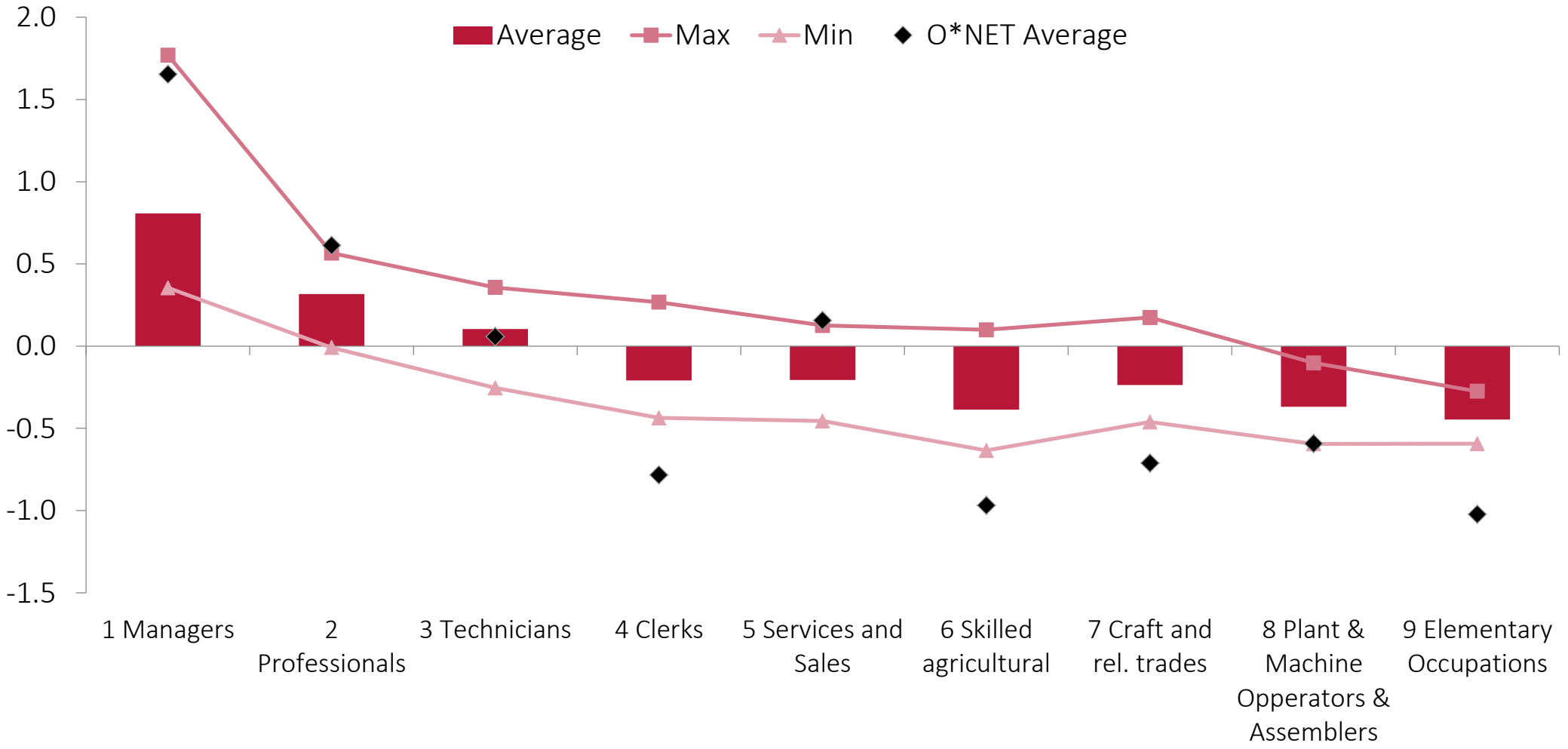
We calculate our tasks contents for all PIAAC and STEP countries. Correlations with O*NET tasks increase with GDP per capita



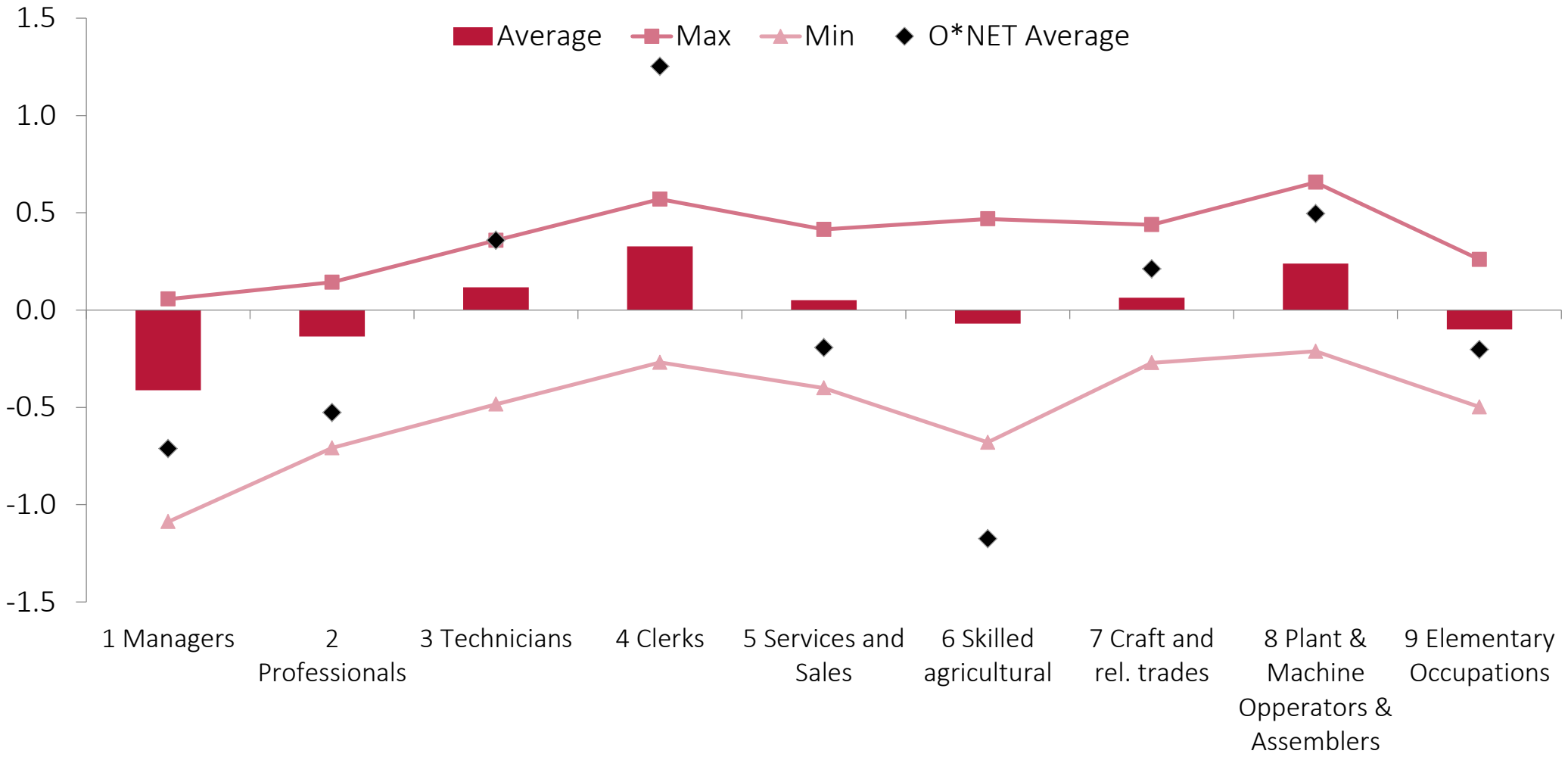
Non-routine cognitive analytical tasks replicate the patterns known from O*NET but have lower variance between major occupation groups



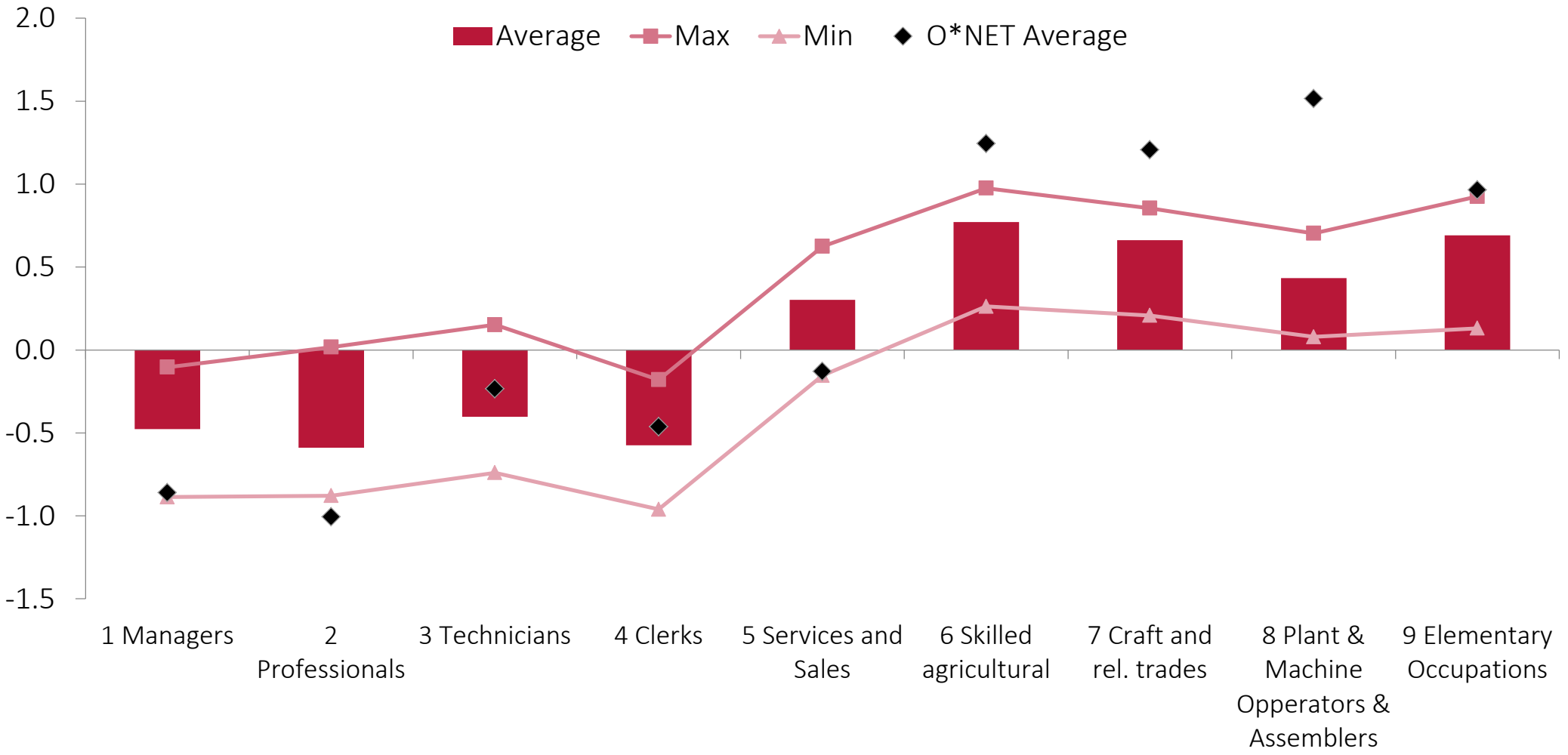
Non-routine cognitive personal tasks also exhibit such pattern



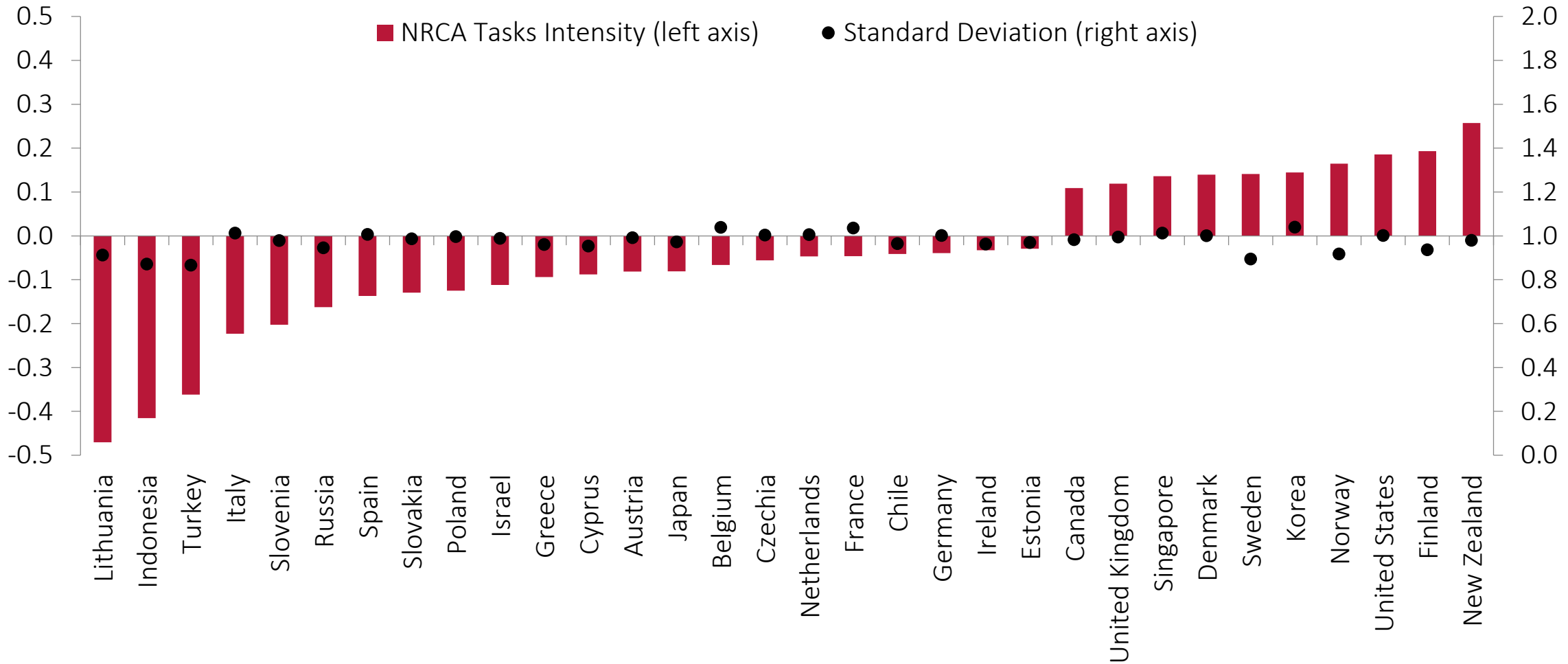
Routine cognitive tasks as well, but services and sales jobs seem more routine than it is implied by O*NET



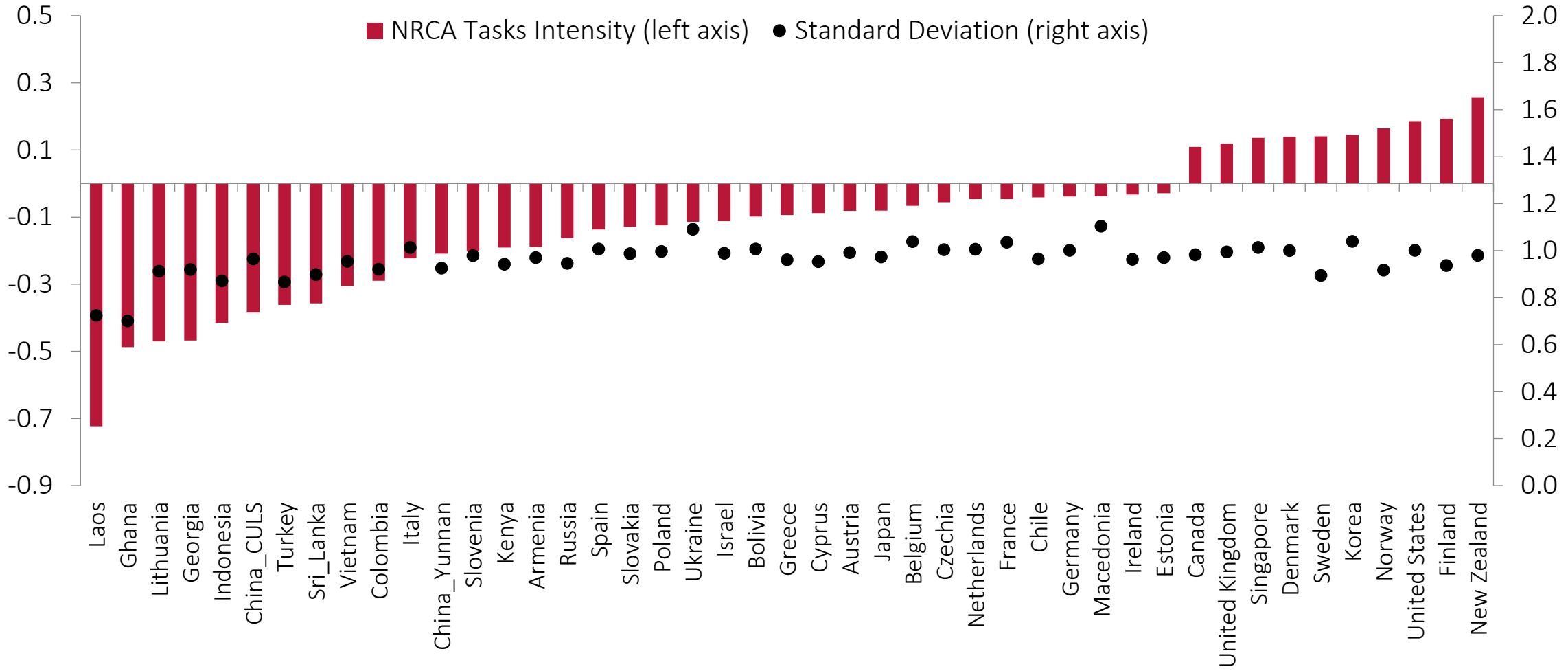
Similarly to O*NET, manual tasks are a domain of occupations 5 to 9



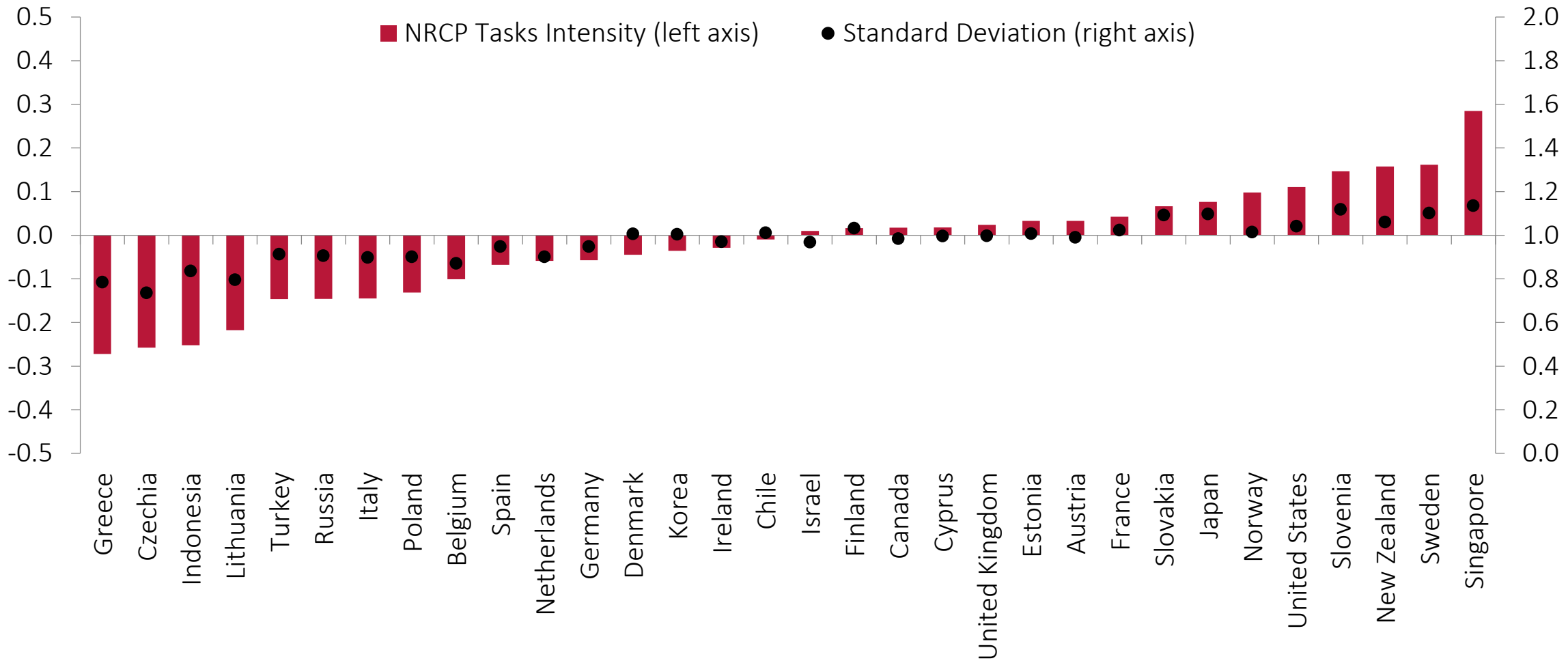
Nordic, Anglosaxon and Asian countries have the highest analytical task contents. Eastern and Southern Europe – the lowest



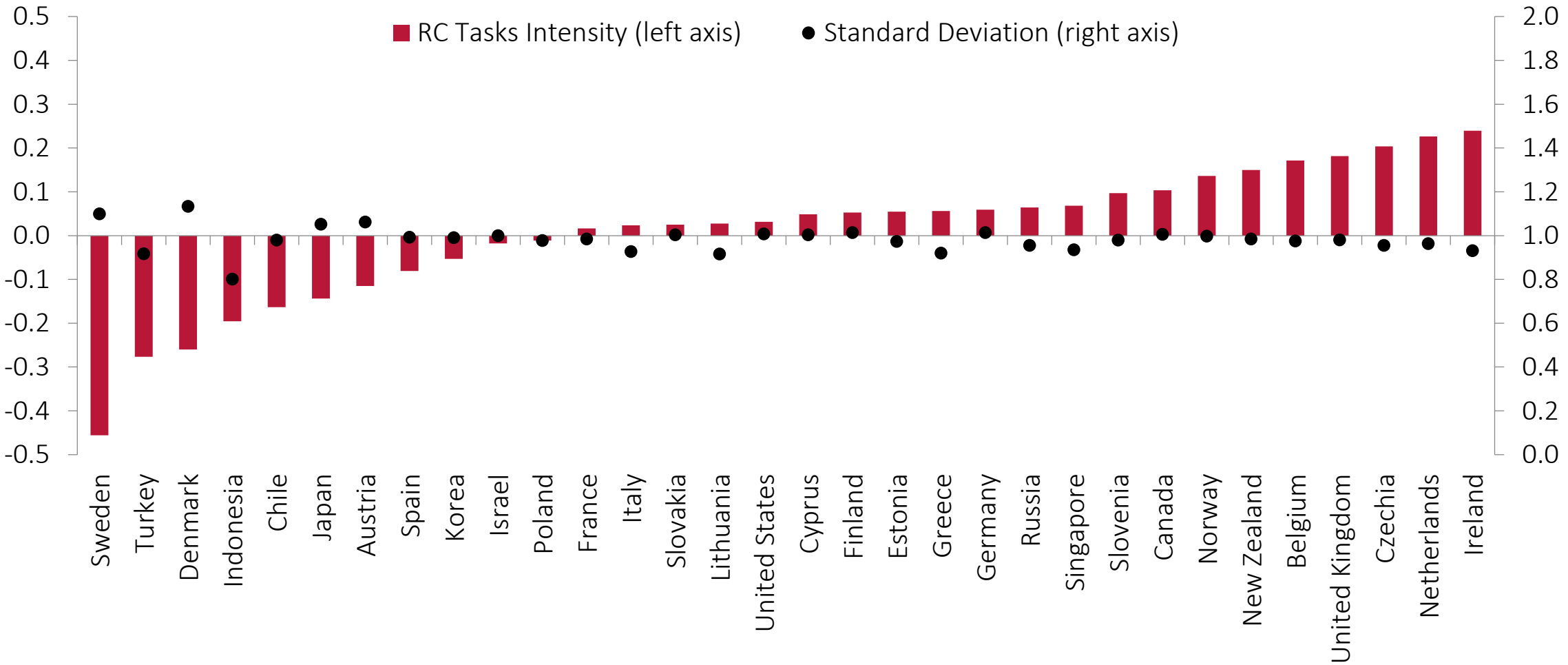
Developing countries (STEP & CULS) exhibit lower NRC analytical task contents than the OECD countries



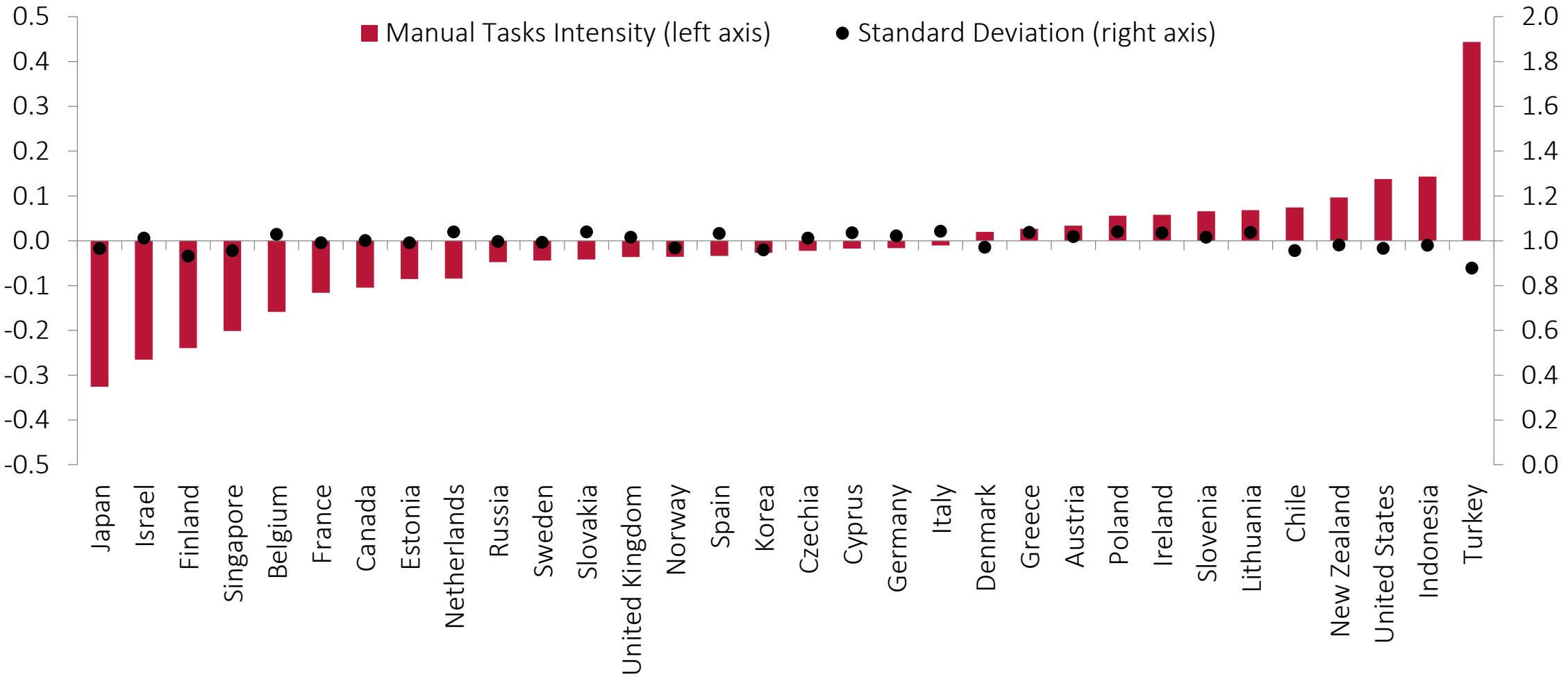
The ranking of NRC personal task contents is similar to the ranking of analytical task contents



Routine cognitive task contents are high in several countries intensive in non-routine cognitive tasks



Manual task contents are higher in the less developed countries, except for the US and NZ



Let's use a shift-share decomposition to decompose the differences of task contents in particular countries wrt the US

- Occupational structure

US task content *i* in occupation *j*, education *k*

$$\forall_{i \in T}\ BO_i = \sum_{j \in O} t^{US}_{i,j,US}\left(h^{c}_{j} - h^{US}_{j}\right),$$

- Educational structure

Employment share in occupation *j*, education *k*

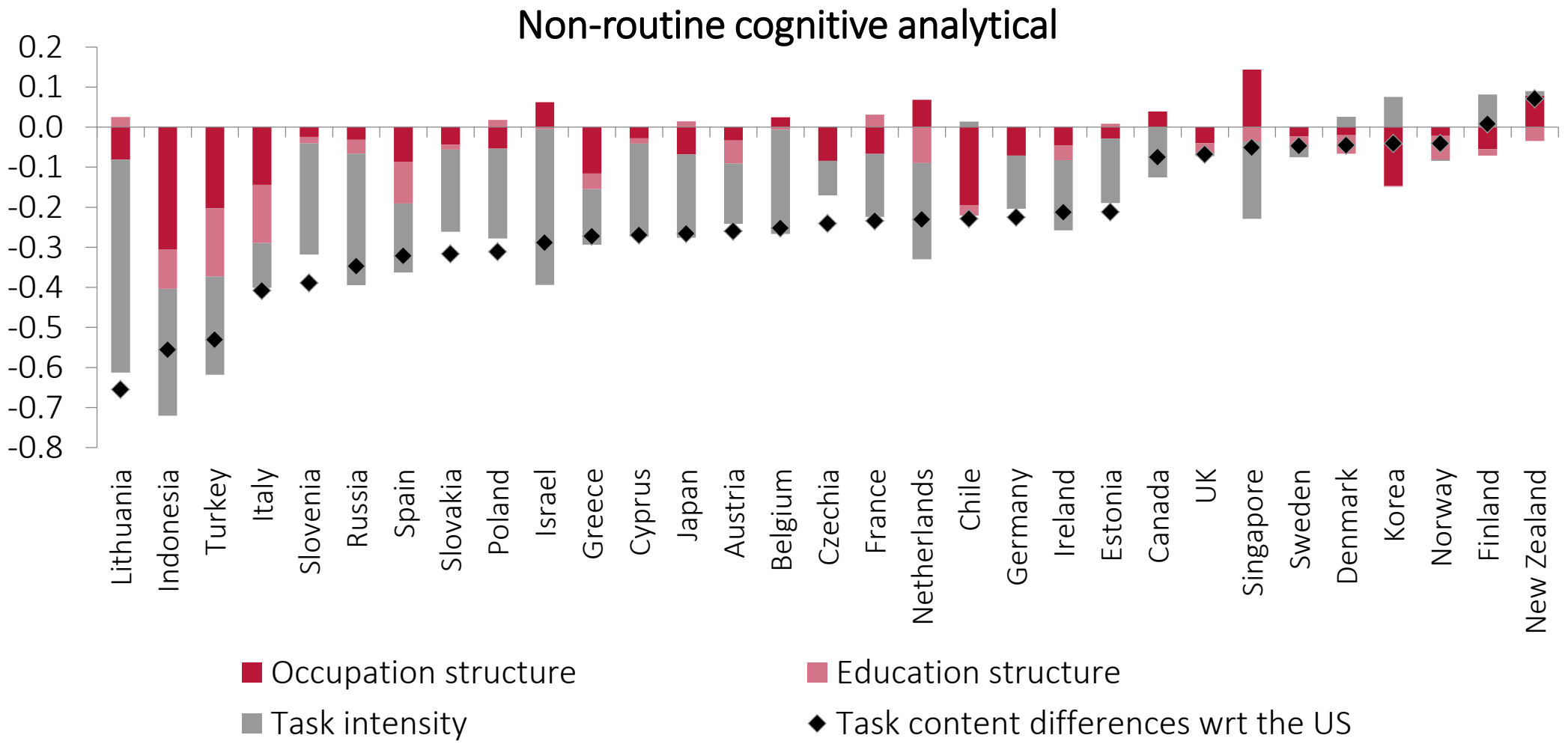
$$\forall_{i \in T}\ BE_i = \sum_{j \in O}\left[\sum_{k \in E} t^{US}_{i,j,k,03}\ \left(\frac{h^{13}_{j,k}}{h^{13}_{j}} - \frac{h^{98}_{j,k}}{h^{98}_{j}}\right)\right] h^{98}_{j},$$

- Task intensities in occupation/education cells

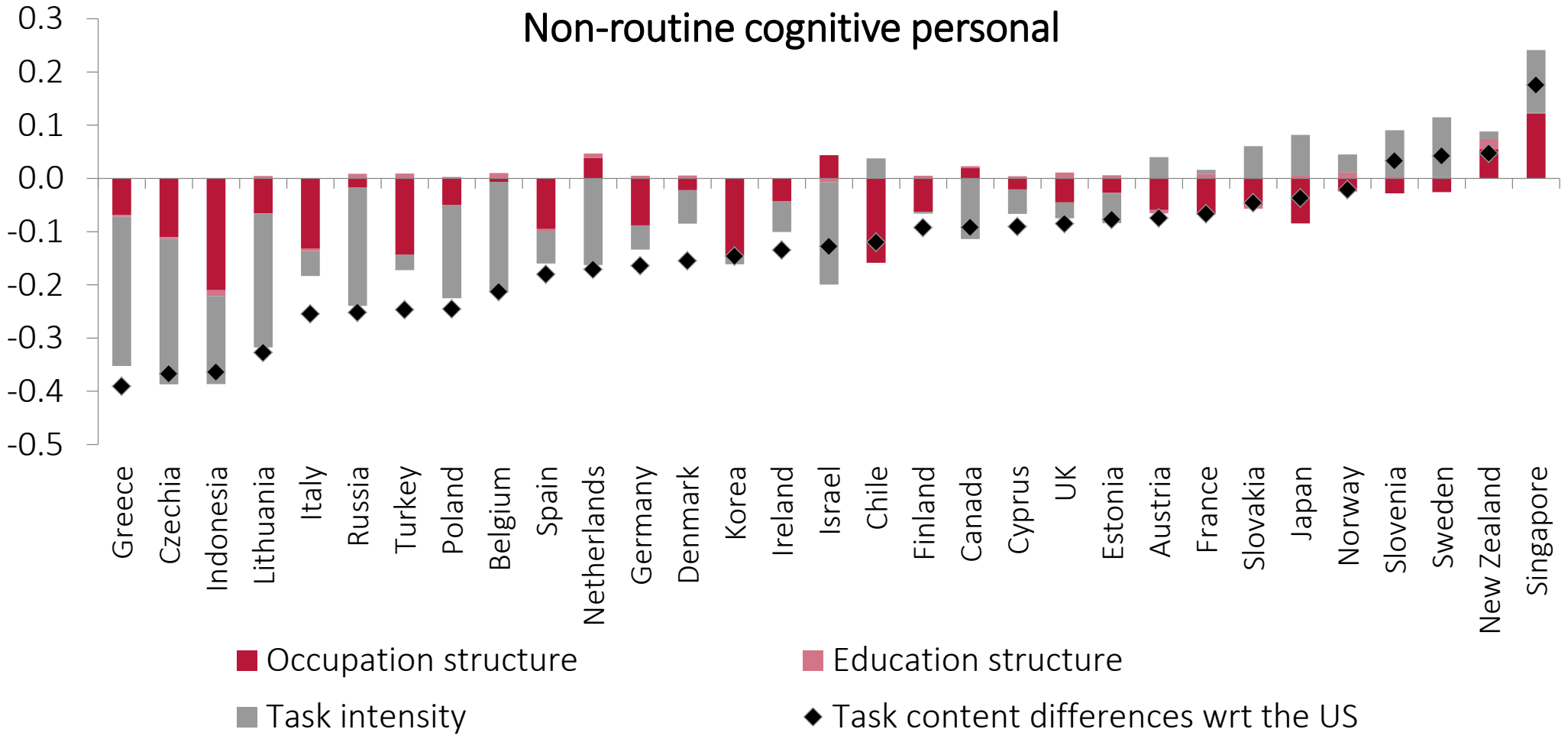
$$\forall_{i \in T}\ TI_i = \sum_{j \in O}\sum_{k \in E}\left(t^{c}_{i,j,k,c} - t^{US}_{i,j,k,US}\right) h^{US}_{j,k}$$

- Interaction (equation in the paper)

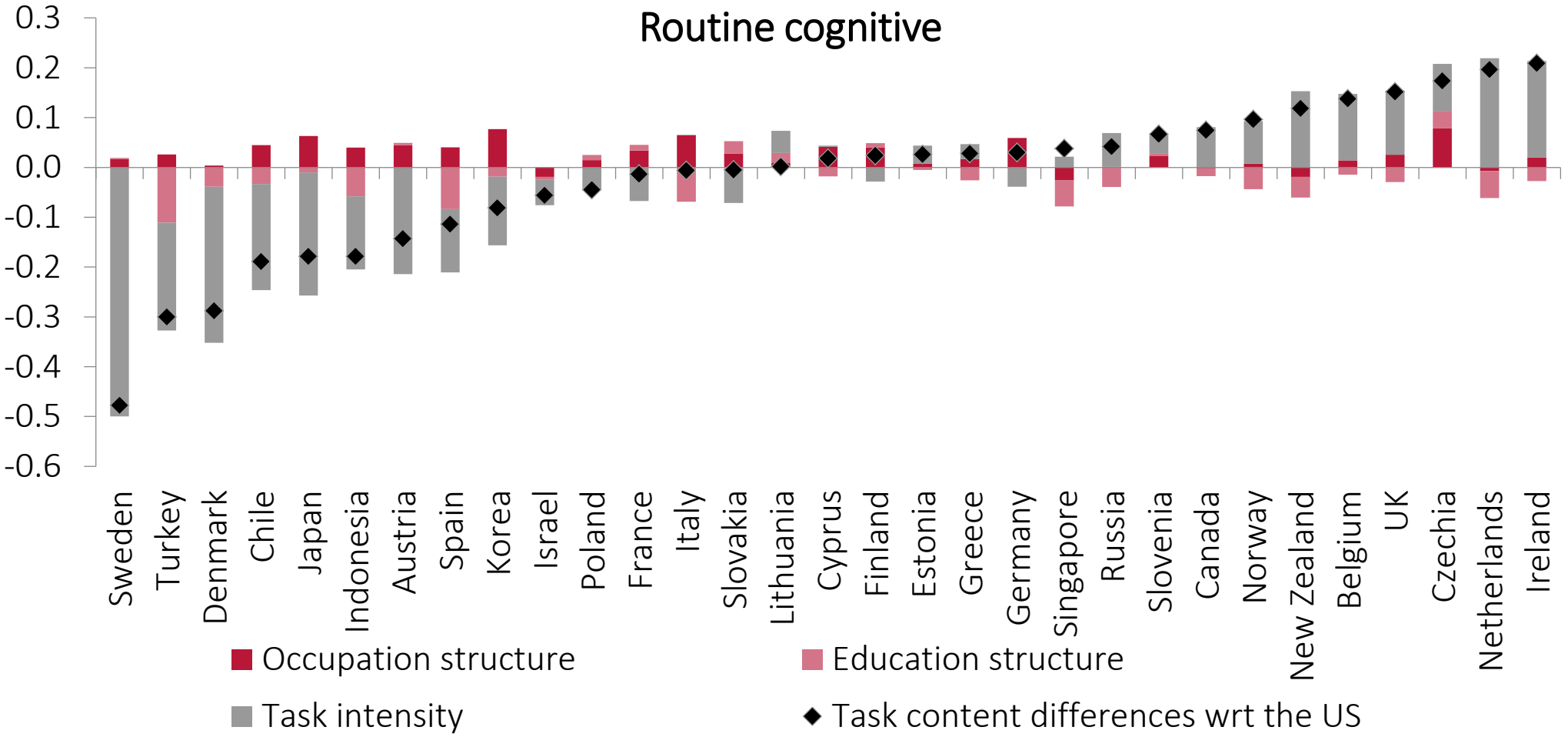
Most of countries have lower NRCA task content than the US because of less NRCA tasks within particular occupation / education cells



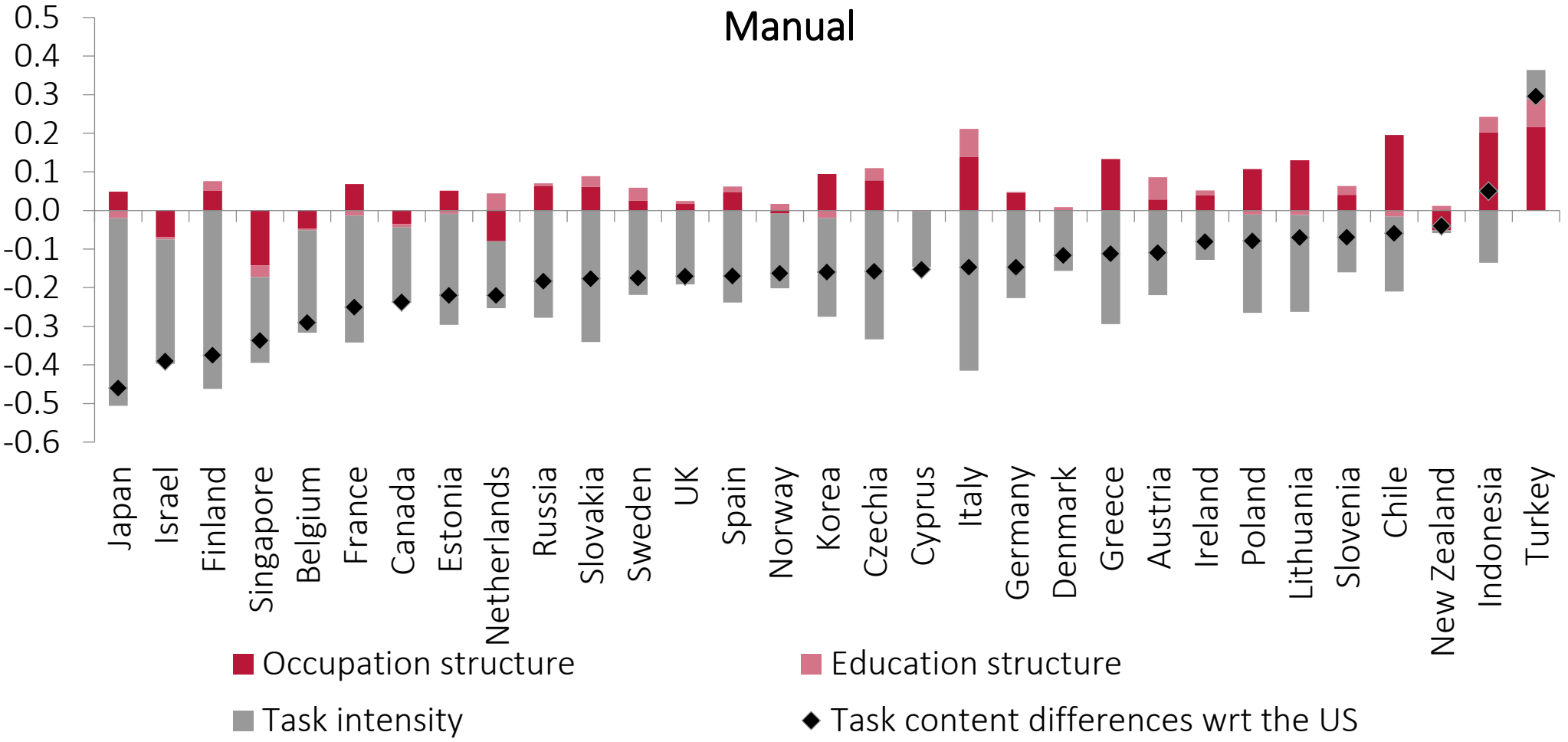
Task intensity and occupation structure contribute most to the differences in NRCP tasks



Differences in education contribute to differences in routine cognitive task intensity, but much less than task intensity patterns



Americans seem to have more physical tasks across all occupations (really? but there is only one question on manual tasks in PIAAC and STEP)



We estimate country-specific worker-level models of routine task intensity (RTI)

- Routine task intensity (RTI) ↗ with the relative importance of routine tasks, ↘ with the relative importance of non-routine tasks

$$\forall_{i \in occupations} RTI_i = \ln(RC + M) - \ln(NRCA + NRCP)$$

We estimate country-specific worker-level models of routine task intensity (RTI)

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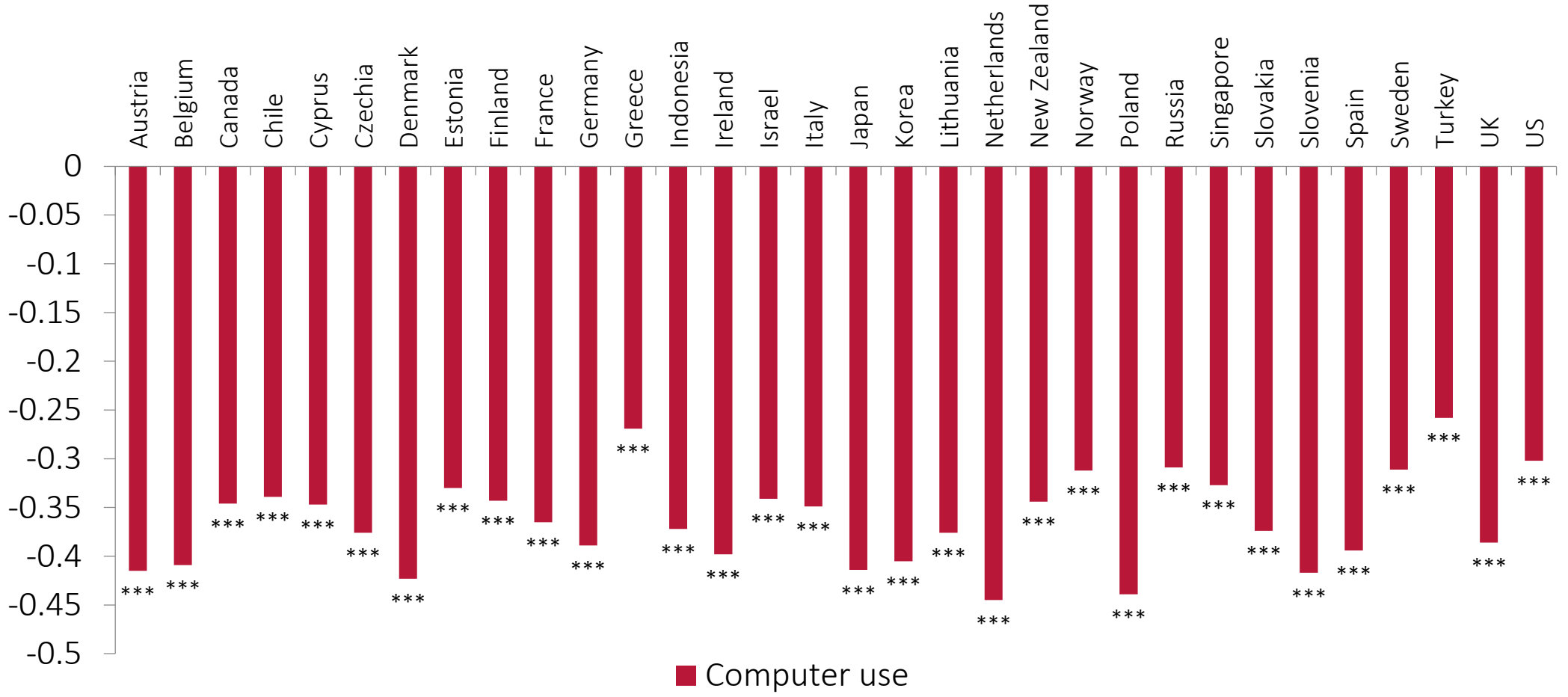
$$\forall_{i \in occupations} RTI_i = \ln(RC + M) - \ln(NRCA + NRCP)$$

- Significantly higher for women in all countries
- Significantly lower for tertiary graduates, rarely for secondard educated workers (ref: primary)
- No significant differences between sectors if personal characteritics and occupations are controlled for

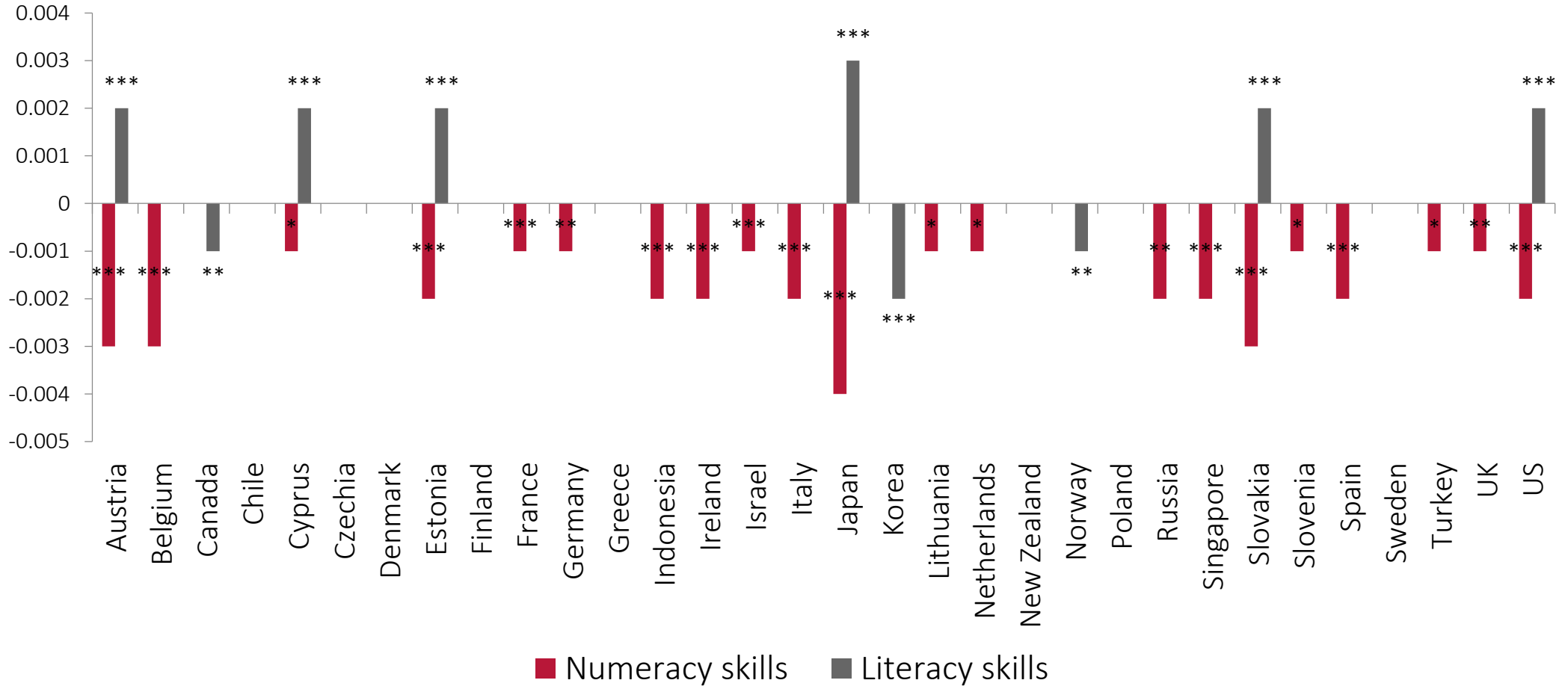
Computer use is significantly correlated with RTI in all countries (no one claims causality here)

The estimated parameters of computer use. Worker level OLS regression on relative routine intensity



But skill levels are not (controlling for education)

The estimated parameters of skill level. Worker level OLS regression on relative routine intensity



What do tasks tell about intergenerational differences in jobs

- We aim at creating task content measures which:
  - are worker-based and country-specific
  - but correspond with established O*NET task content measures
- Differences between our measures and O*NET decline with the GDP pc
- Most of these differences can be attributed to different task intensities within occupation / education cells (skills? technology use?)
- This is a work in progress so all feedback is deeply appreciated

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Thanks for listening

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