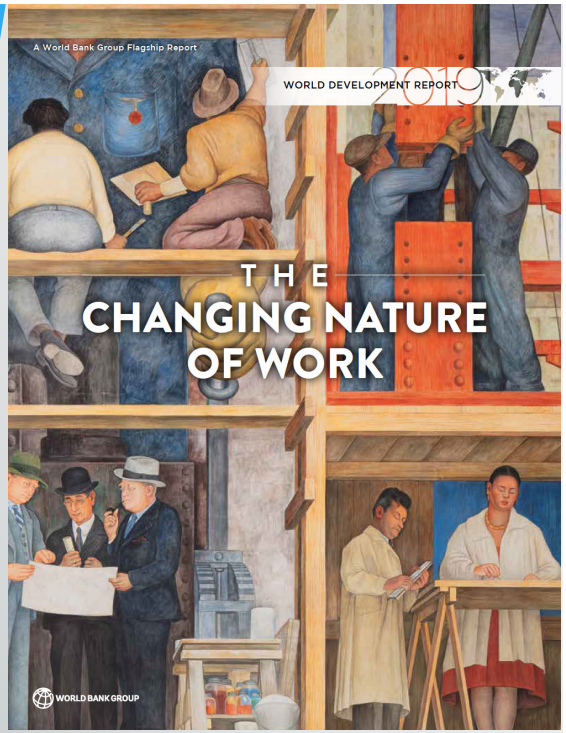
Technology, Globalization, Skills, and the Task Content of Jobs in China

Albert Park, HKUST

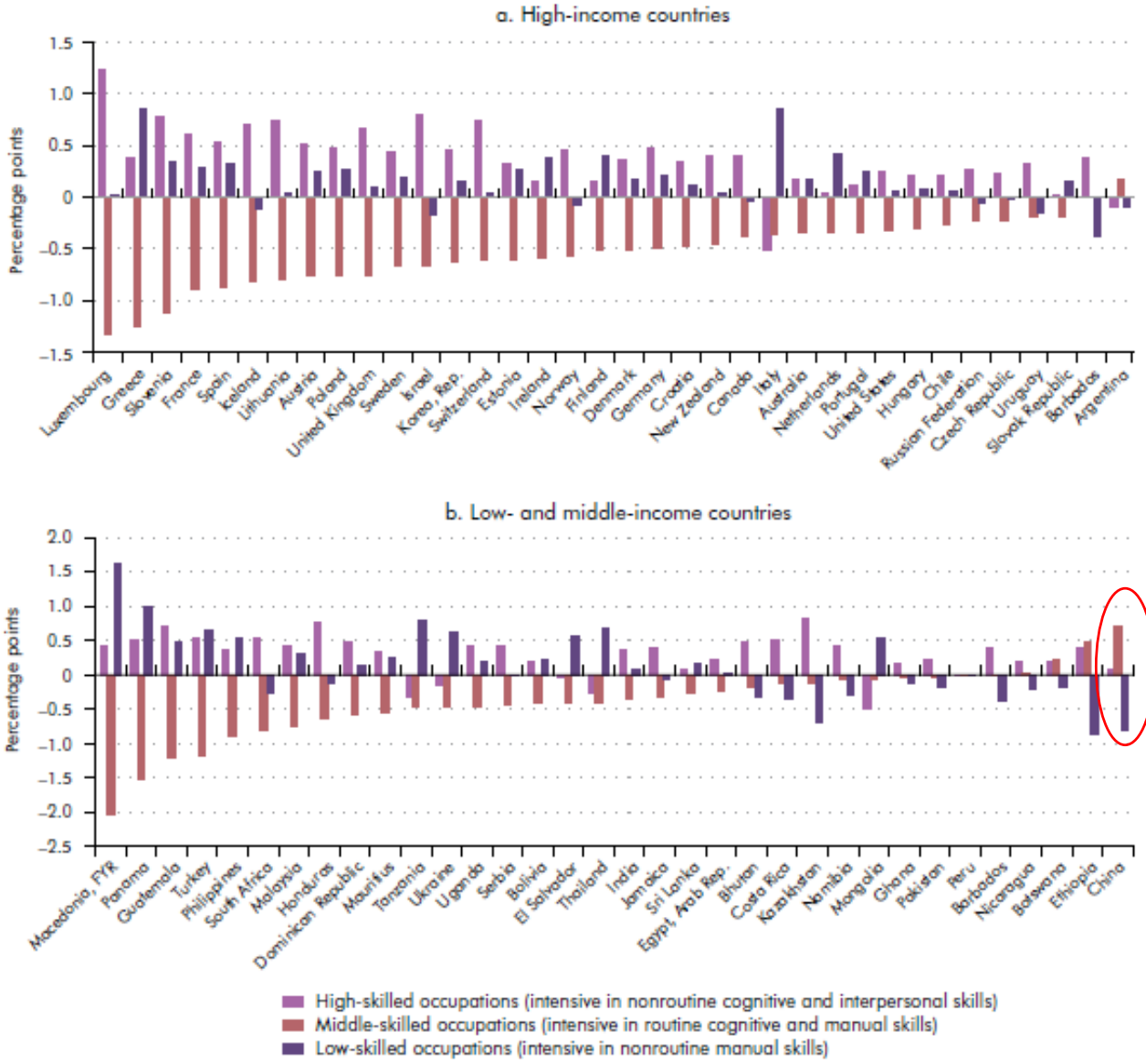
Informal Workshop on Digital Technologies: Limits and Opportunities for Economic Development

International Economic Association

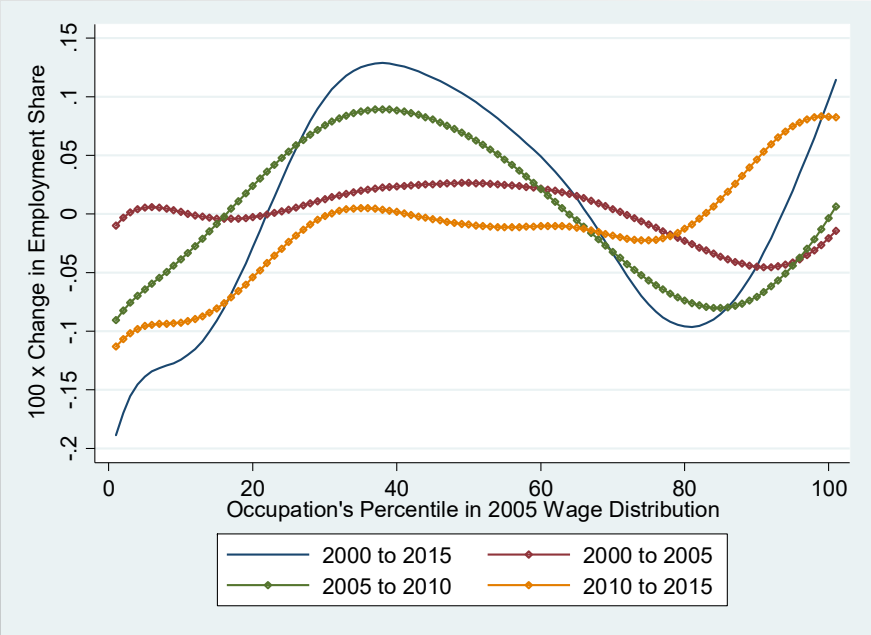
12 October 2021



Is China Exceptional in Increasing Middle-Skill Jobs?



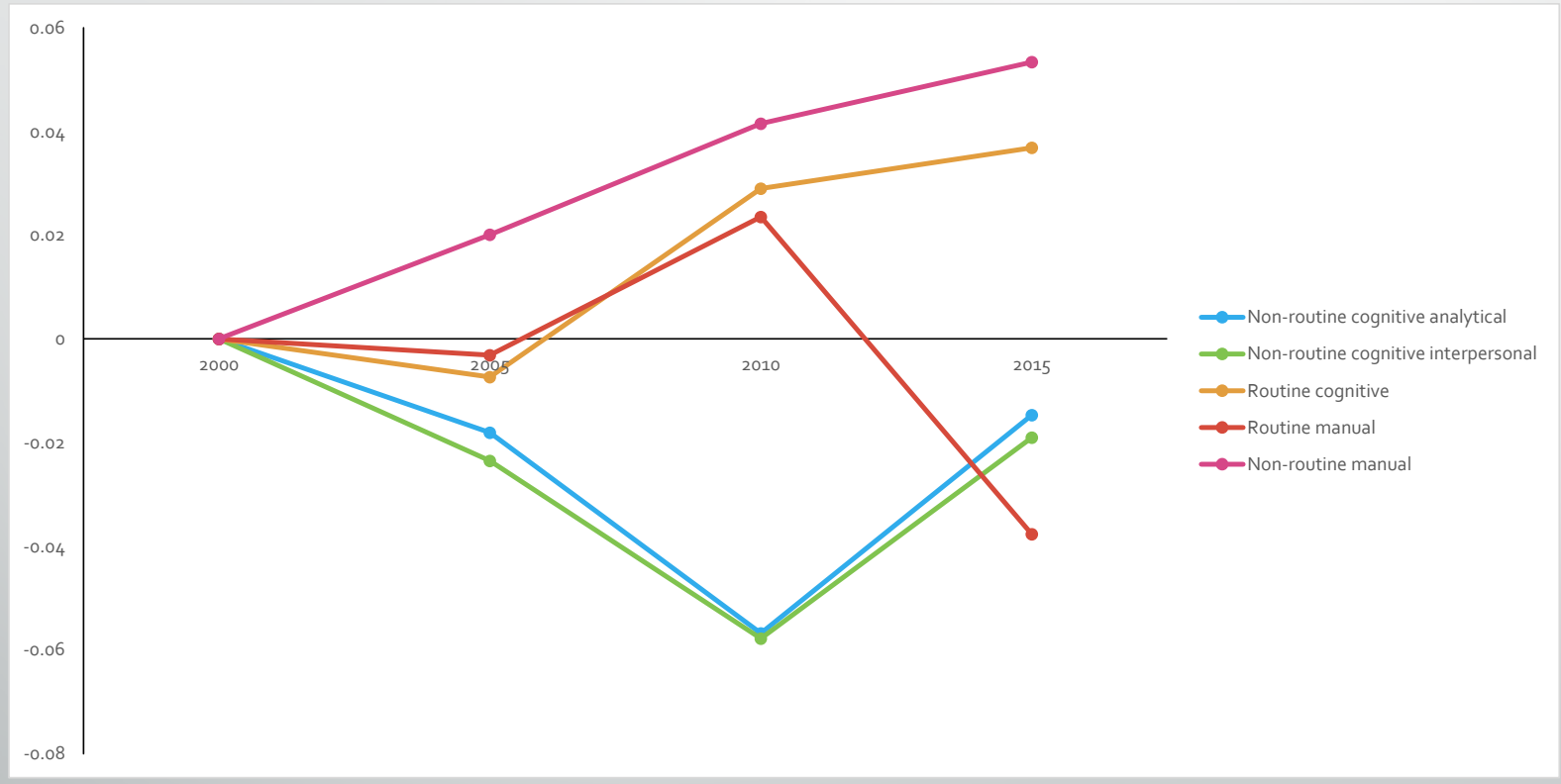
China: Change in Occupational Employment Shares by Wage Percentile



- Confirms faster growth in middle-wage jobs
- Changing pattern since 2010

Source: China census data, in Du and Park (2019)

CHINA: Trends in Job Tasks, 2000 to 2015



- Nonroutine cognitive tasks have fallen and routine tasks have increased
- Changing trend since 2010

Concern: task analysis in different countries often are based on US occupational task data (O*NET)

Innovation: measure tasks using survey data from different countries with comparable data on occupations, nature of work, skills (education, literacy tests), computer use

PIAAC (OECD)	• 37 countries surveyed between 2011 and 2018 • sample sizes: from 4000 (Russia) to 26000 (Canada)
STEP (World Bank)	• 8 countries surveyed between 2011 and 2015 • sample sizes: from 2400 (Ukraine) to 4000 (Macedonia) urban residents
CULS (Chinese Academy of Social Science)	• 6 cities (Guangzhou, Shanghai, Fuzhou, Shenyang, Xian, Wuhan) in 2016 • sample size 15500

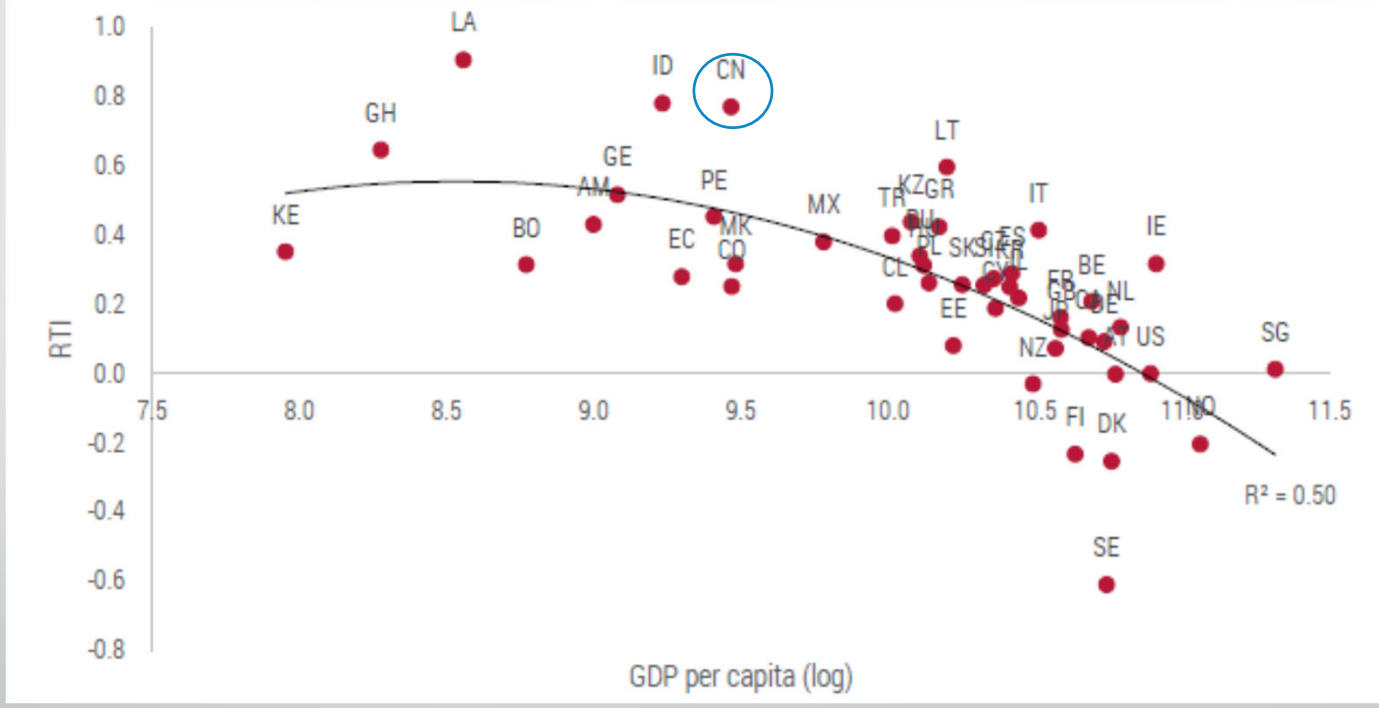
Source: Lewandowski, Park, Hardy, Wu, and Du (forthcoming). "Technology, Skills, and Globalisation: Explaining International Differences in Routine and Nonroutine Work Using Survey Data", *World Bank Economic Review*.

Defining Routine Task Intensity (RTI)

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

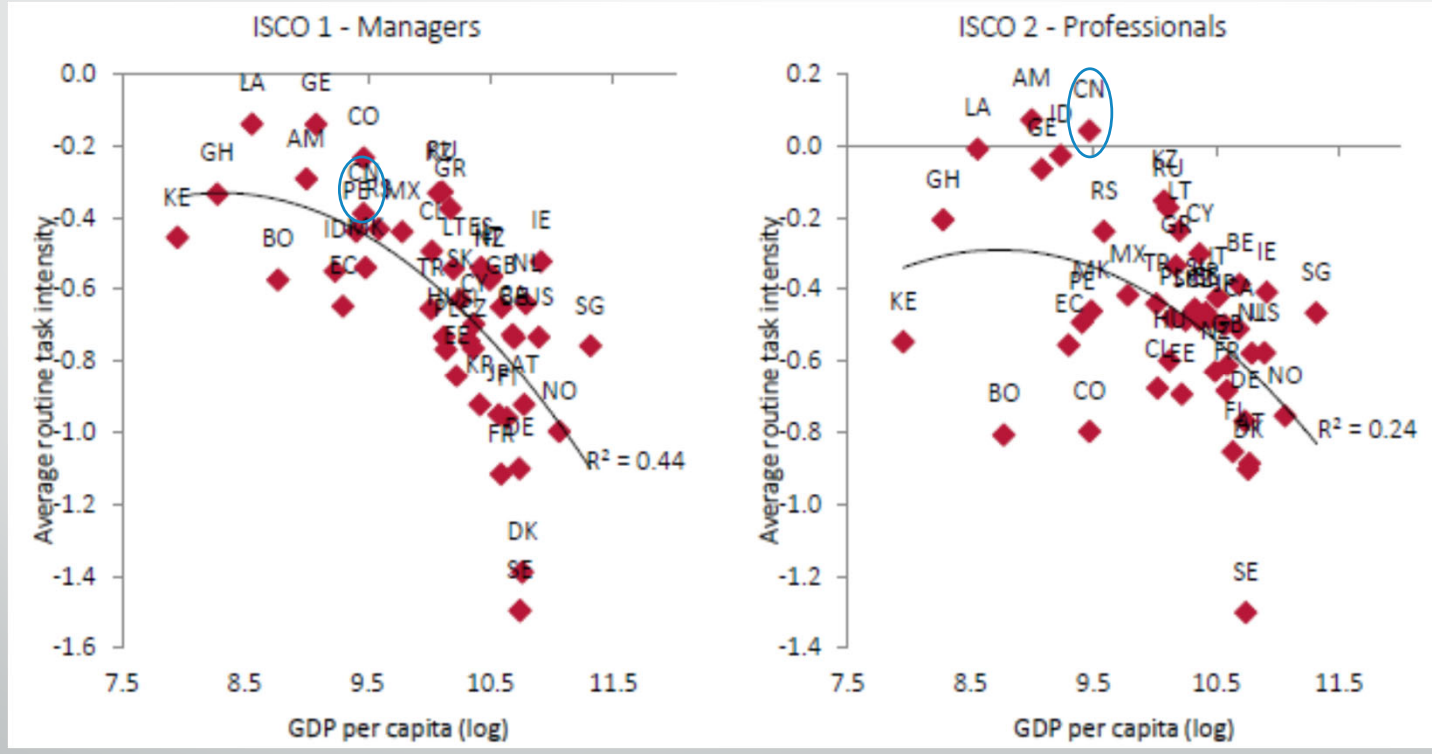
Routine task intensity (RTI) increases with the relative importance of routine cognitive tasks and decreases with the relative importance of non-routine cognitive tasks

Routine Task Intensity (RTI) and GDP Per Capita (based on survey data)



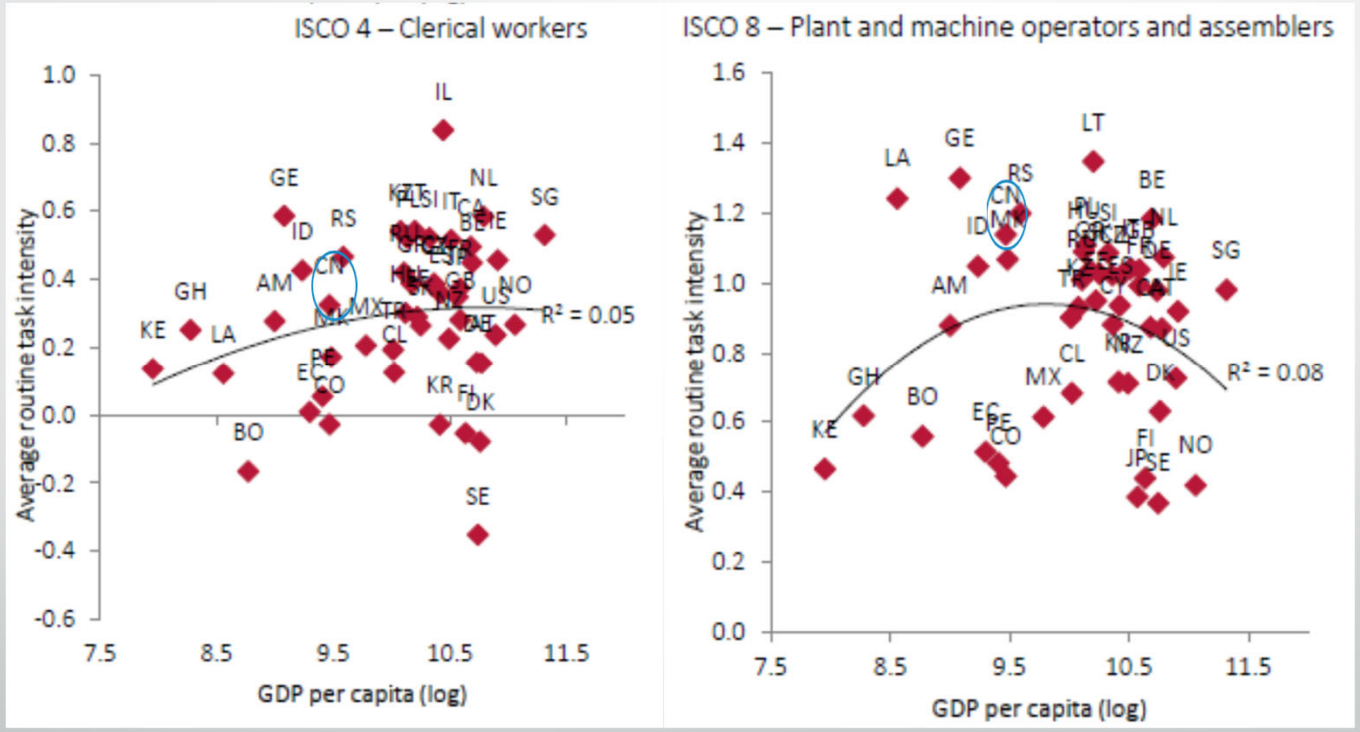
Source: Lewandowski, Park, Hardy, Wu, and Du (forthcoming). "Technology, Skills, and Globalisation: Explaining International Differences in Routine and Nonroutine Work Using Survey Data", *World Bank Economic Review*.

Routine Task Intensity and GDP per capita: High-skill Occupations



Source: Lewandowski et al (forthcoming)

Routine Task Intensity and GDP per capita: Middle- and Low-skill Occupations



Source: Lewandowski et al (forthcoming)

Measuring Determinants of Task Demand

- Technology: country-sector computer use (also tried sector robot use and national ICT peneteration)
- Globalization: country sector foreign value-added share (FVA) and national FDI/GDP, plus interactions with ln(GDP per capita)
- Structural change: GDPpc, 19 sector dummies plus interactions with GDPpc
- Supply of skills: worker education, literacy, age, gender

	All workers
Computer use	1.698***
	(0.356)
Computer use ^2	-2.224***
	(0.298)
Foreign Value Added (FVA) share	0.213**
	(0.107)
FVA share * [Ln(GDP pc) –mean(Ln(GDP pc))]	-0.227*
	(0.116)
FDI / GDP	0.016
	(0.013)
FDI / GDP * [Ln(GDP pc) –mean(Ln(GDP pc))]	0.002
	(0.005)
Ln(GDP per capita) – mean(Ln(GDP per capita))	0.033
	(0.043)

Decomposition of Cross-Country Variation in Routine Task Intensity (RTI)

	Technology	Globalization	Structural Change	Supply of skills	Total
All workers	39.0	8.1	-10.3	28.5	65.2
High-skilled occupations (ISCO 1-3)	38.7	6.1	-0.9	10.1	53.8
Middle-skilled occupations (ISCO 4-5)	25.7	9.0	-8.9	4.4	30.2
Low-skilled occupations (ISCO 7-9)	24.6	8.5	0.7	0.6	34.4

Note: the contributions of particular factors to RTI variance, σ_k, calculated in line with equation (4) using the model presented in Table 3.

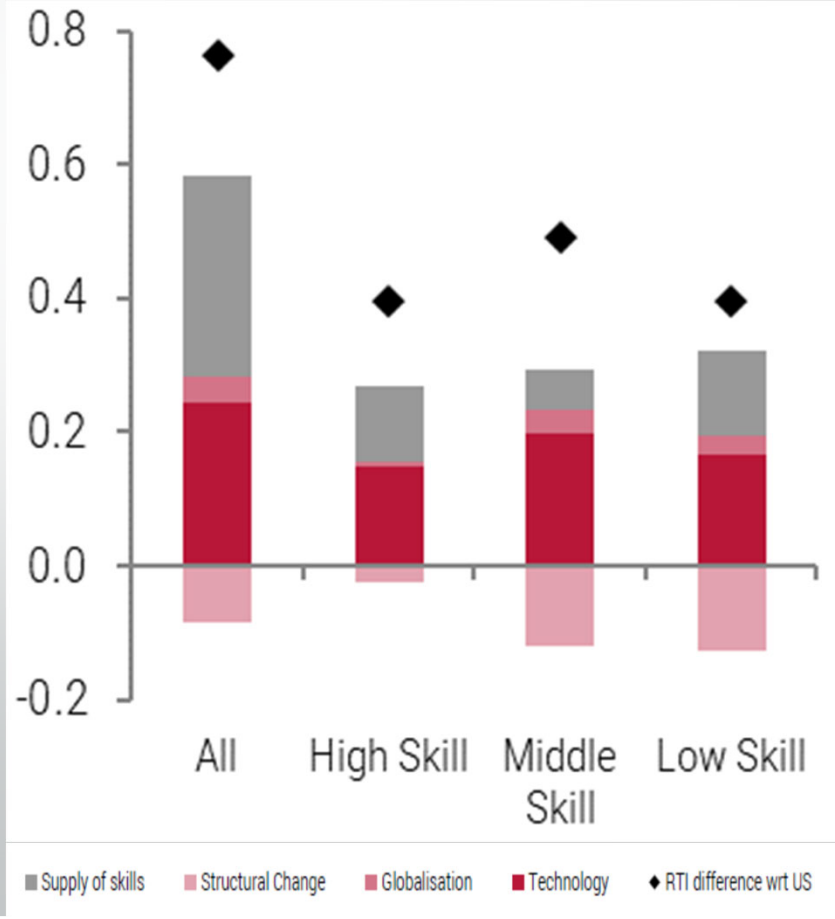
Source: authors' estimations based on PIAAC, STEP, CULS, World Bank and UIBE GVC Indicators data.

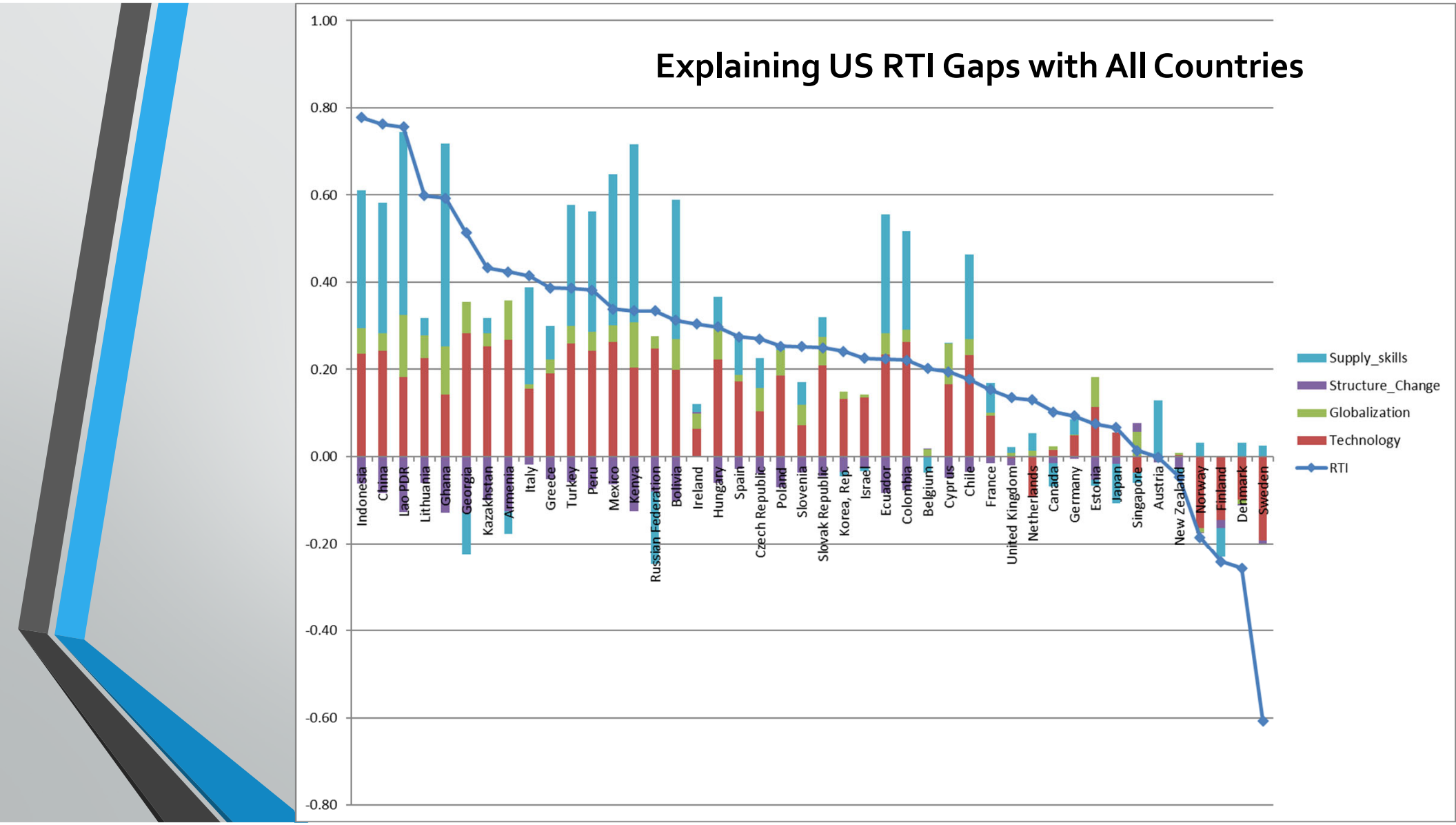
- Technology is the most important factor in predicting differences in RTI across countries, followed by skills and then globalization.
- Technology and skills are particularly important in explaining differences in tasks of those in high-skill occupations.

Explaining the US-China Gap in RTI

Summary Statistics (means)	US	China
RTI	0.00	0.76
Female	0.49	0.38
Age: 16-24	0.15	0.05
Age: 35-44	0.22	0.33
Age: 45-54	0.23	0.28
Age: 55-65	0.18	0.06
Education: middle school and below	0.10	0.54
Education: college and above	0.42	0.23
Computer use	0.75	0.52
Log of GDP per capita (demeaned)	1.29	-0.67
FDI stock/GDP (country)	0.35	0.12
Foreign Value Added (FVA) Share	0.08	0.11

Both technology and skills explain large shares of the RTI gap between China and the US




Explaining US RTI Gaps with All Countries
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
Indonesia
China
Lao PDR
Lithuania
Ghana
Georgia
Kazakhstan
Armenia
Italy
Greece
Turkey
Peru
Mexico
Kenya
Russian Federation
Bolivia
Ireland
Hungary
Spain
Czech Republic
Poland
Slovenia
Slovak Republic
Korea, Rep.
Israel
Ecuador
Colombia
Belgium
Cyprus
Chile
France
United Kingdom
Netherlands
Canada
Germany
Estonia
Japan
Singapore
Austria
New Zealand
Norway
Finland
Denmark
Sweden
Supply_skills
Structure_Change
Globalization
Technology
RTI

What factors have contributed to changing demand for tasks and skills in China?

- Structural change: employment share of tertiary sector increased from 27.5% in 2000 to 40.6% in 2014
- Globalization: rapid growth in exports since 2000, 7.5% of urban workers in FDI firms
- Technology: 58% of urban workers use computers (as of 2015), 40% of manufacturing workers in firms with automation equipment and 11% work in firms with robots (as of 2018)
- Education expansion: college share of nonag workers increased from 12.8% in 2000 to 22.1% in 2015

Only structural change and globalization could lead to increasing RTI over time

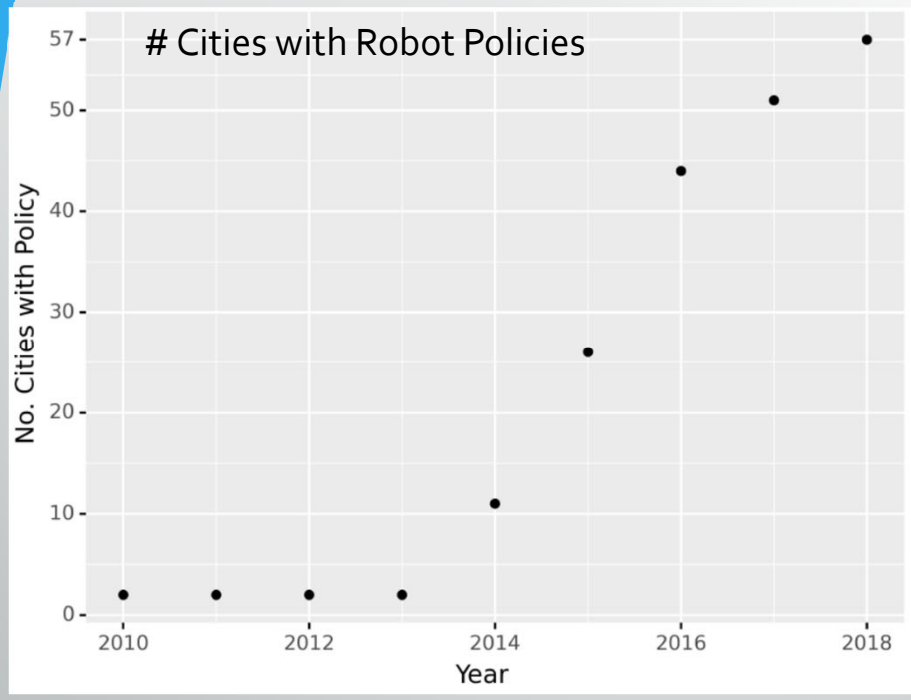
- Corroborating evidence that China has had difficulty expanding employment in high-skill occupations (retail service jobs grew fastest, and college graduates increasingly enter middle-skill occupations); and that FDI and exporting firms demand more routine tasks

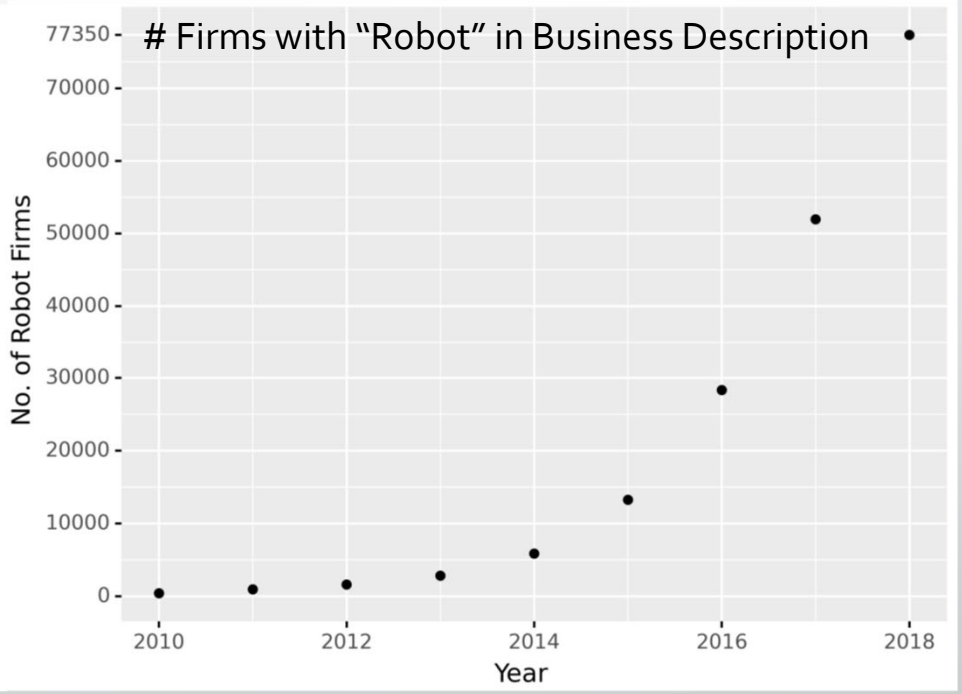
What will the future of jobs look like in China

- Many forces point toward rapid de-routinization:
  - Rapid technological change, including leadership in robotics and AI
  - New labor force entrants much better educated (quantity and quality) than retirees
  - Chinese manufacturing firms are capturing larger shares of global value chains and are becoming less export-oriented, more capital-intensive, and more productive, all of which will increase the demand for noncognitive tasks
- On the other hand:
  - Anti-competitive, state-led industrial policies may reduce innovation and inhibit the growth of high-skill occupations

Growth of Robot Policies and Robot-related Firms:

(recent evidence from policy documents and firm registration data)





- 21.5% of Chinese cities have adopted robot policies (of which 8.5% include subsidies)
- Nearly 80,000 robot-related firms have been established in China, nearly all in the past 5 years