Bulgaria 4.0

Catching the Digital Wave

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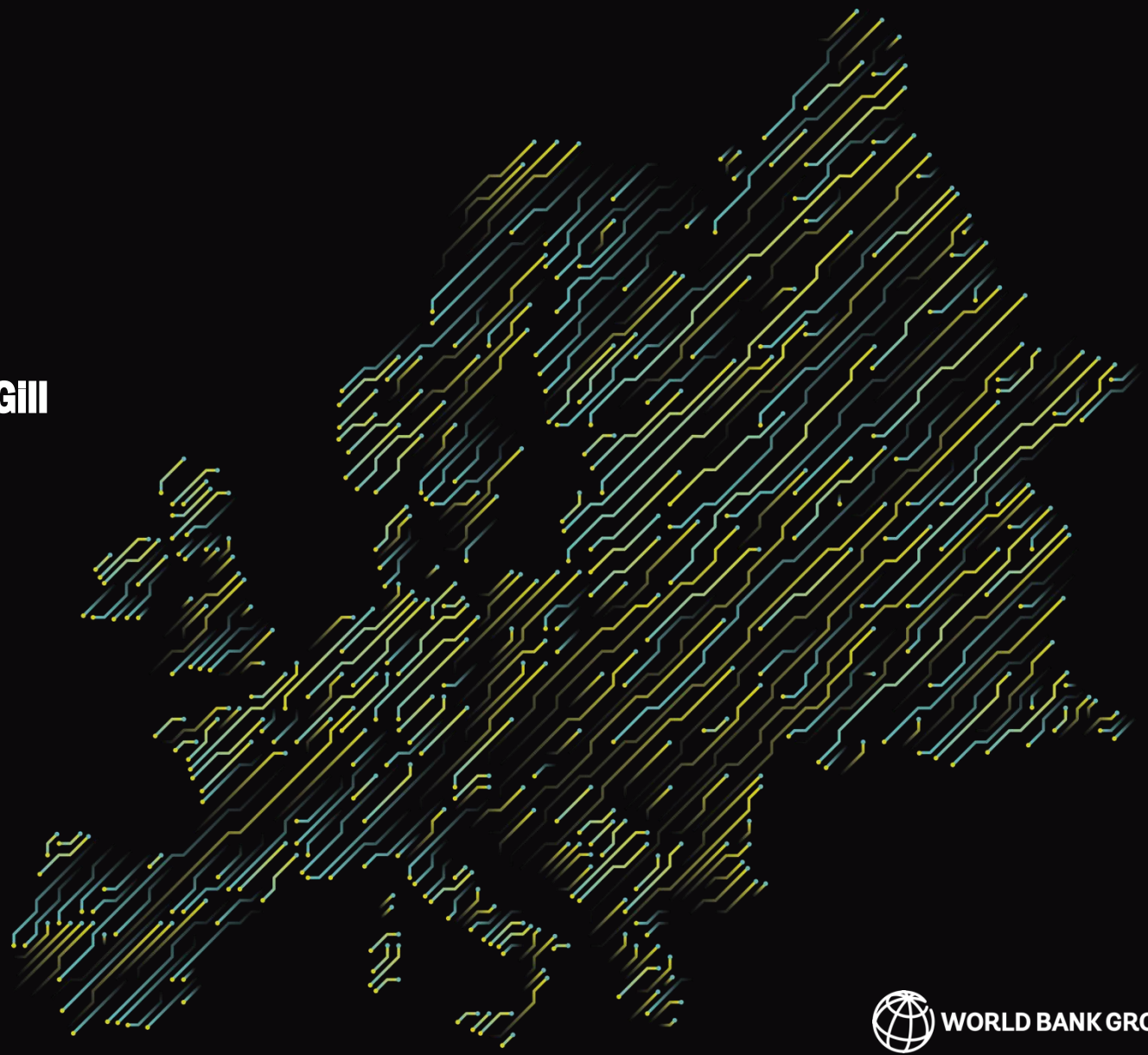
Jan 14, 2021



EUROPE 4.0

Addressing
the Digital Dilemma

Link to the report here

WORLD BANK GROUP

Europe 4.0 — Addressing the Digital Dilemma

EUROPE'S DIGITAL DILEMMA

New technologies can help Europe be more competitive. BUT some create new challenges for market inclusion and the "convergence machine"

- *Smart robotics* and *3D printing* are technologies where Europe is globally competitive **BUT** they also widen divides between firms and regions.
- *Digital platforms* and *cloud computing* have the greatest potential for market inclusion and convergence **BUT** this is where Europe's global competitiveness remains weak.

EUROPE 4.0 IS ATTAINABLE.

New digital technologies can help Europe achieve its *triple objective of competitiveness, market inclusion and geographic convergence* by:

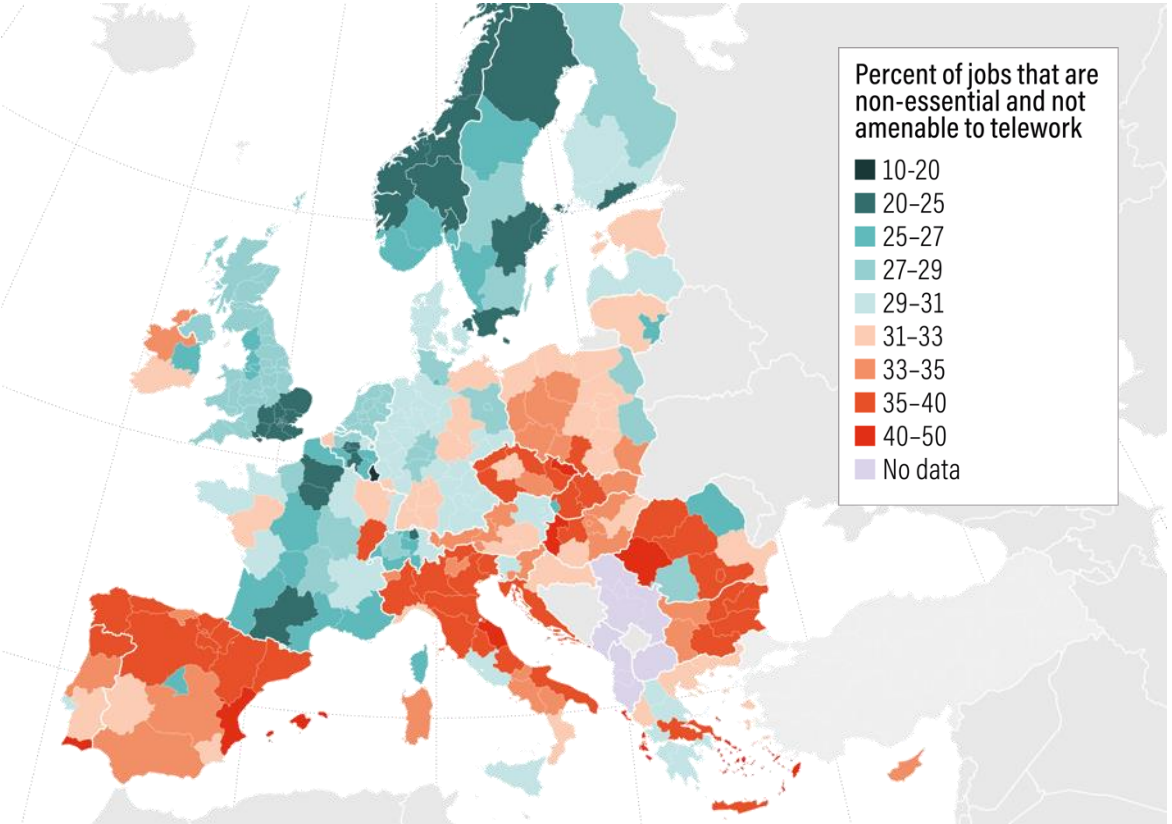
- *Scaling markets* — Complete the digital market; close gaps in 'analog complements' such as skills, logistics
- *Shaping the commercial use of data* — Address challenges posed by AI and new types of market dominance
- *Smoothing technology adoption* — Balance investments in frontier innovation with digital catch-up by MSMEs and in lagging regions

COVID-19 raises urgency of digital agenda

Crisis threatens Europe's 3 objectives

Digital *can* expand solutions - but not yet everywhere and not for all firms

Jobs made vulnerable by COVID-19

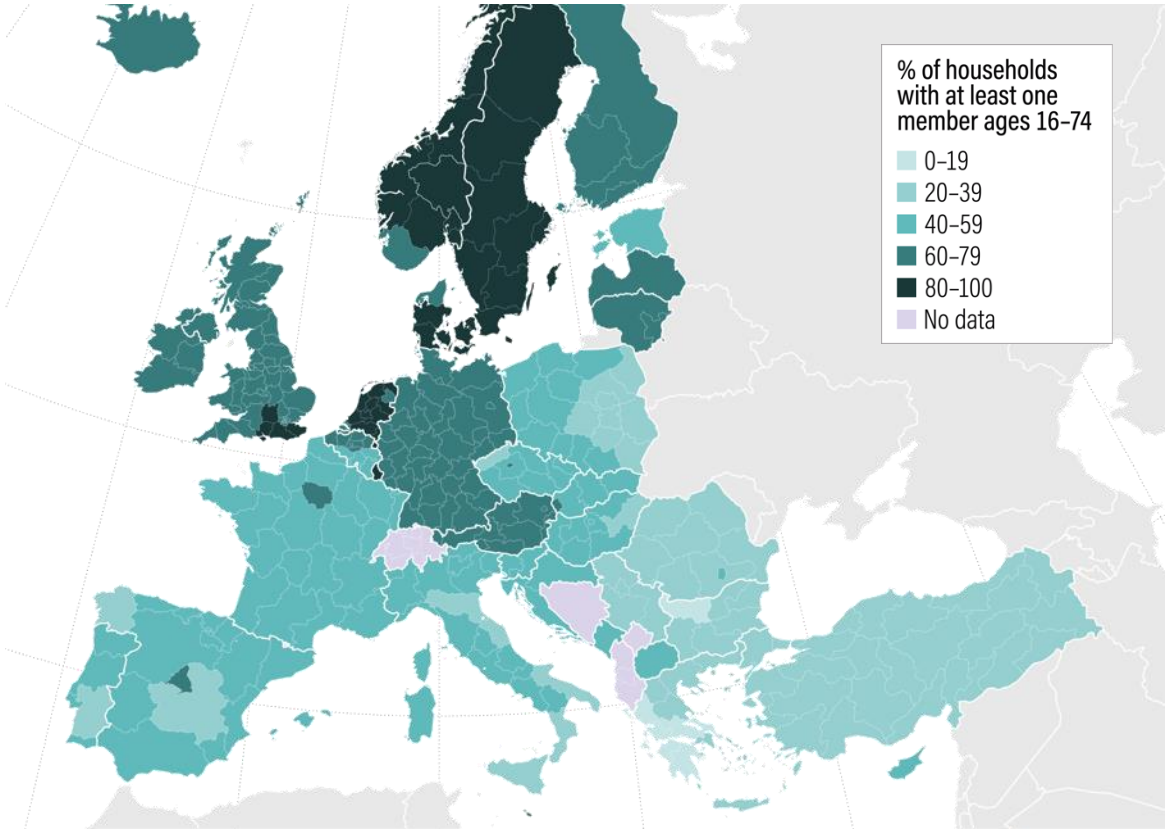


Source: Daniel Garrote Sanchez, Nicolas Gomez Parra, Caglar Ozden, and Bob Rijkers. "Which Jobs Are Most Vulnerable to COVID-19? What an Analysis of the European Union Reveals" May 2020

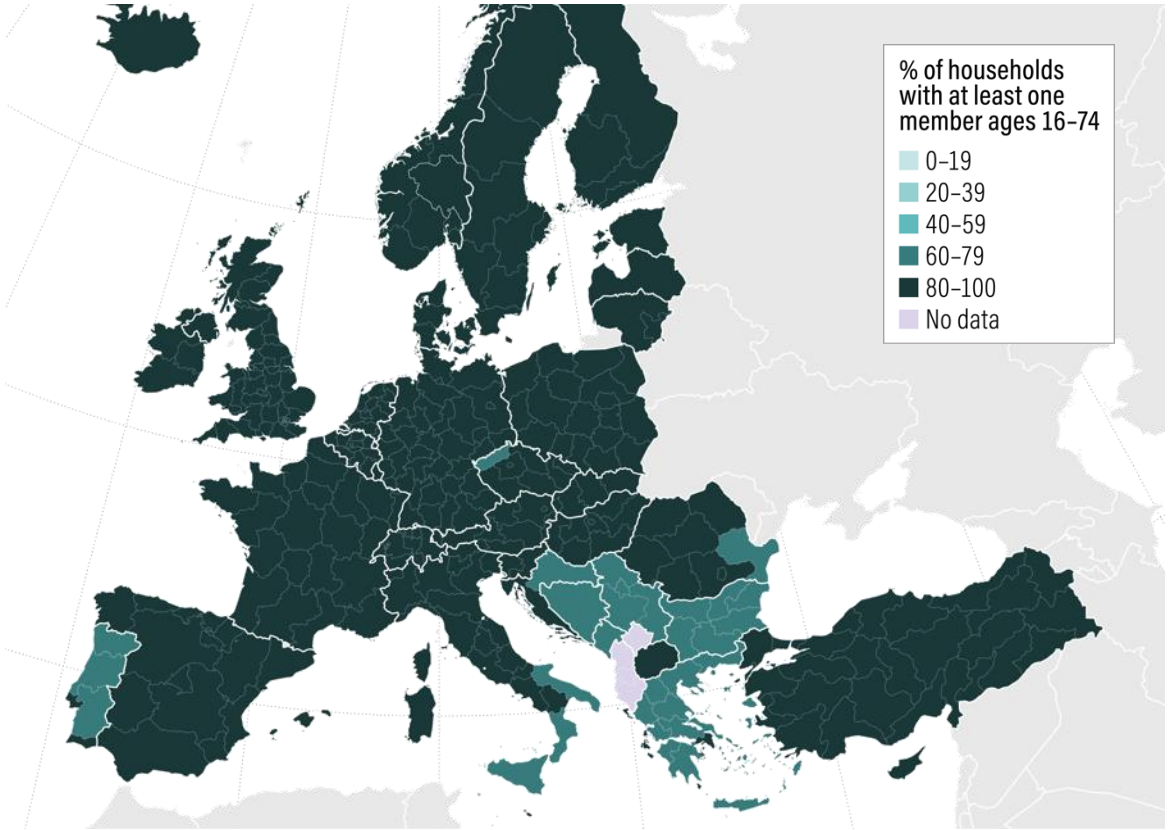
Europe has converged in digital infrastructure...

Households with broadband access

2008



2019

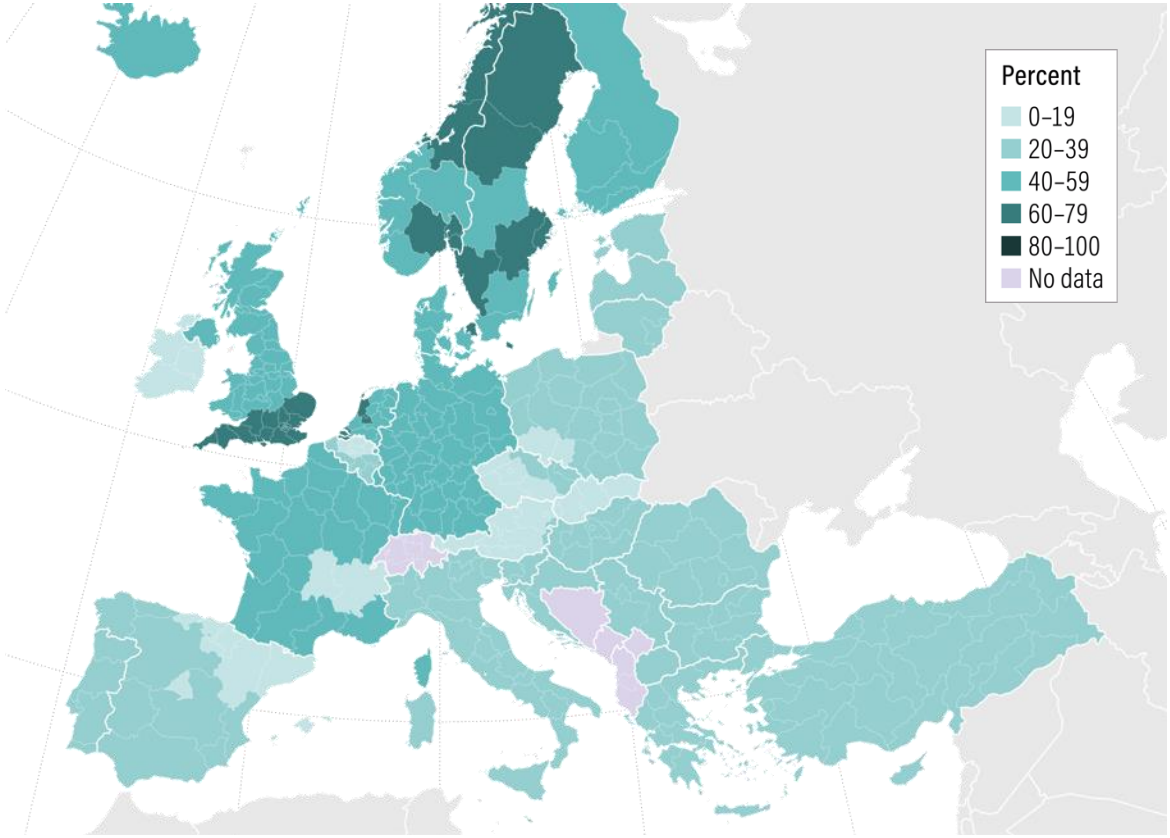


Source: Authors' calculations based on Eurostat.
Notes: The maps reflect NUTS 2 level data. Due to lack of data, Poland, Germany, the United Kingdom, Turkey, and Greece reflect NUTS 1 level data. In addition, France reflects NUTS 1 level data in 2019 and national data in 2008 (except for Île-de-France and Auvergne - Rhône-Alpes in 2008).

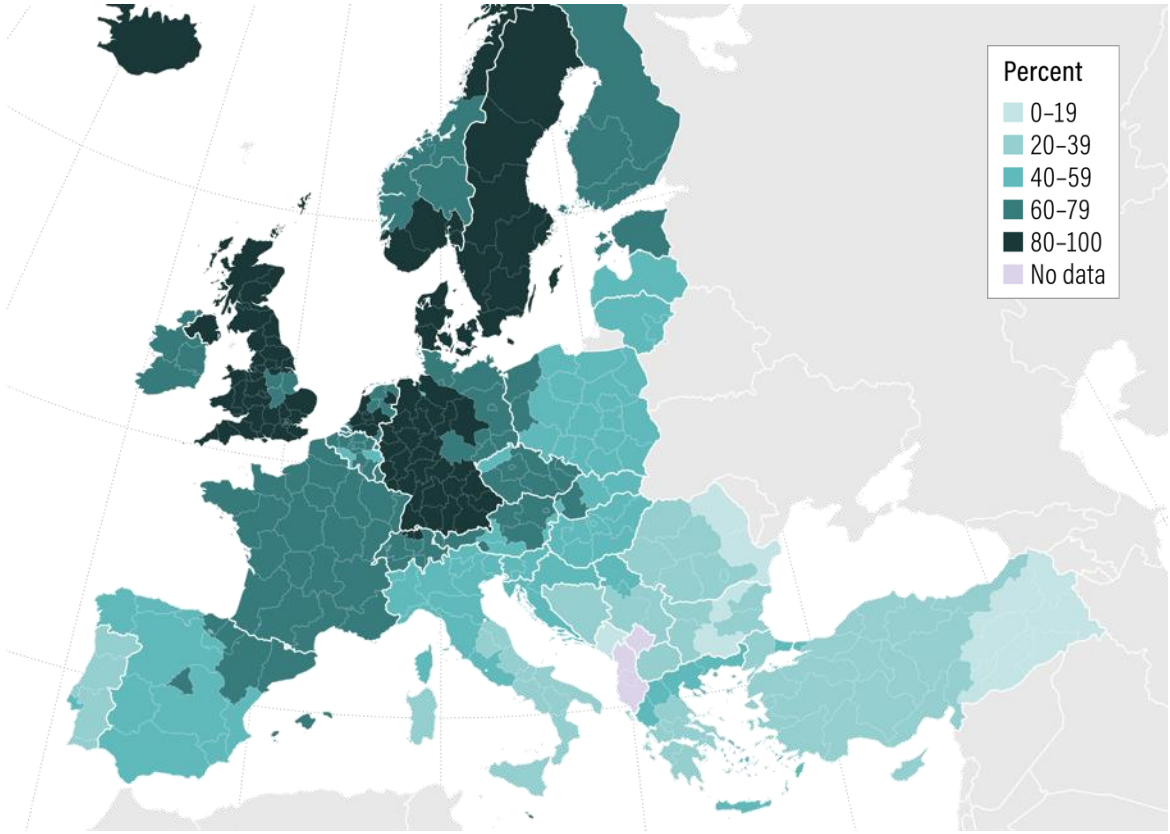
...but more needs to be done to accelerate commercial use

Individuals aged 16-74 who ordered goods or services online for private use in the last year

2008

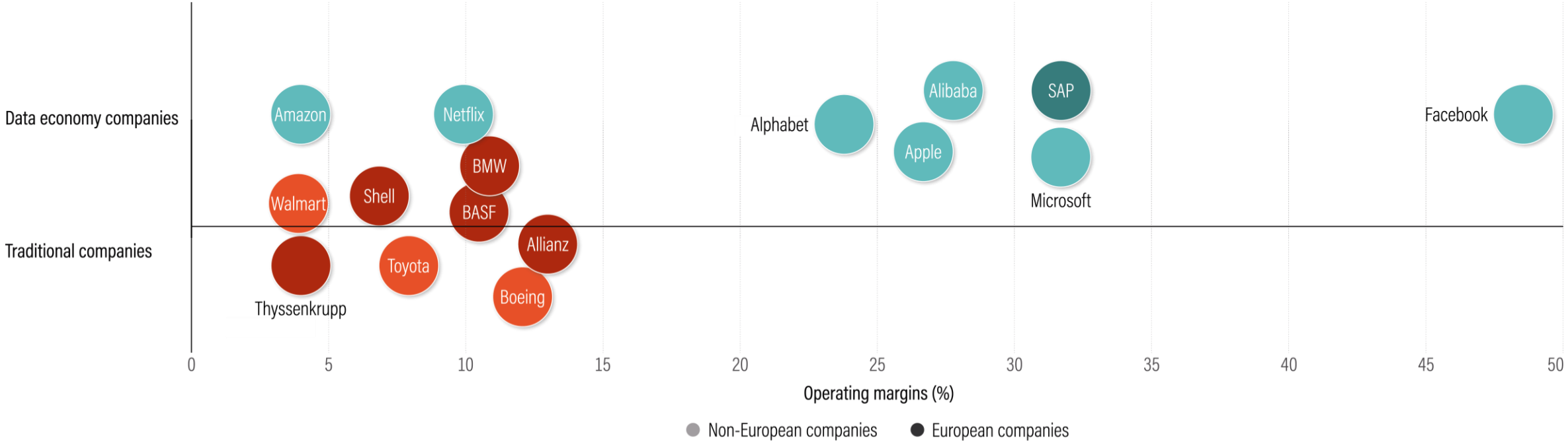


2019



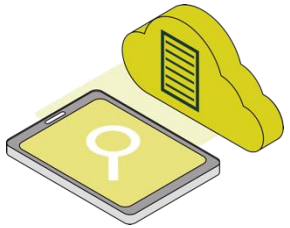
Source: Authors' calculations based on Eurostat.
Notes: The maps reflect NUTS 2 level data. Due to lack of data, Poland, Germany, the United Kingdom, Turkey, and Greece reflect NUTS 1 level data. In addition, France reflects NUTS 1 level data in 2019 and national data in 2008 (except for Île-de-France and Auvergne - Rhône-Alpes in 2008).

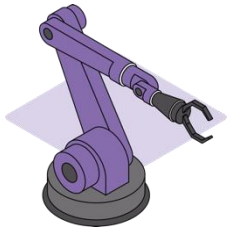
Europe's traditional leaders are strong — but data companies are significantly more profitable



Source: Authors' calculations based on Bloomberg, December 2019.

Digital technology is not monolithic…





Technology category	TRANSACTIONAL	INFORMATIONAL	OPERATIONAL
Source of efficiency gains	Matching supply and demand	Computing and storage	Replace labor
Types of technologies	Platforms Blockchain	Cloud computing Big data analytics Machine learning	Smart robots 3D printing Drones
Examples of companies	Amazon Marketplace, Alibaba, Uber, Spotify	Google, Facebook, Tencent, SAP	Yaskawa, Fanuc, ABB, Siemens, Rockwell

Source: Europe 4.0 Team

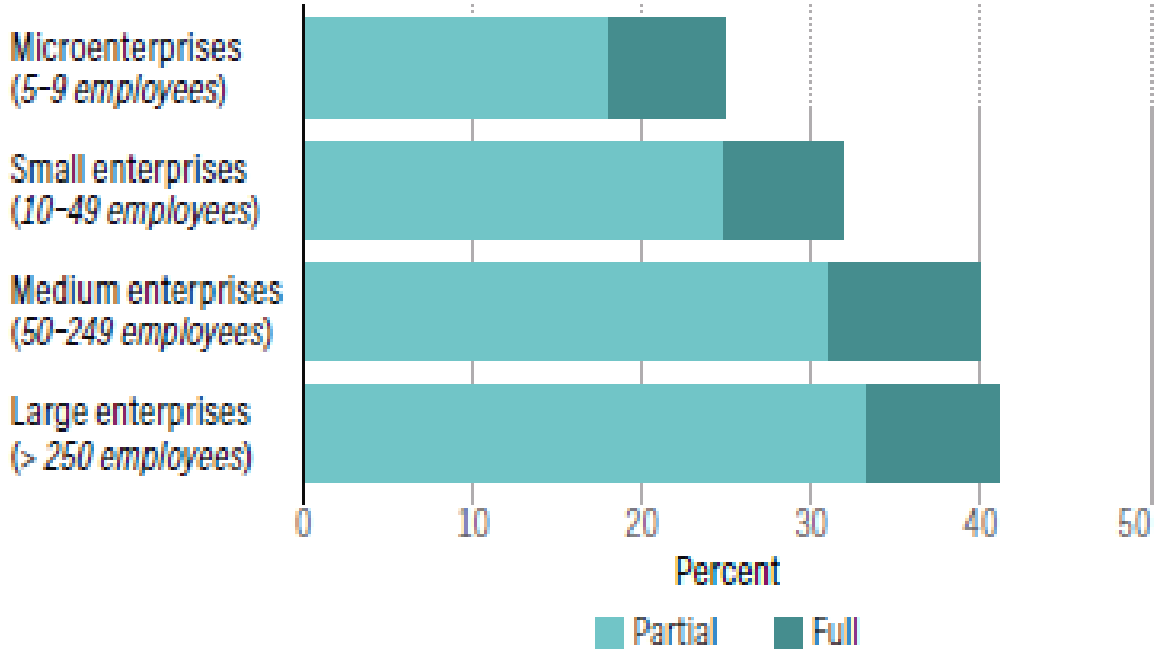
Europe faces a Digital Dilemma between its objectives and its performance

	TRANSACTIONAL TECHNOLOGIES	INFORMATIONAL TECHNOLOGIES	OPERATIONAL TECHNOLOGIES
	a. Digital technologies vary in their contributions to Europe's Triple Objective		
Competitiveness	+	+	+
Market inclusion	+	+	−
Geographic convergence	+	−	−
	b. Europe's performance across technologies also varies		
Creation	−	−	+
Adoption	−	−	+

Source: Europe 4.0 Team

Transactional technologies boost market inclusion

The share of SMEs using digital platforms is not very different from large firms, 2018



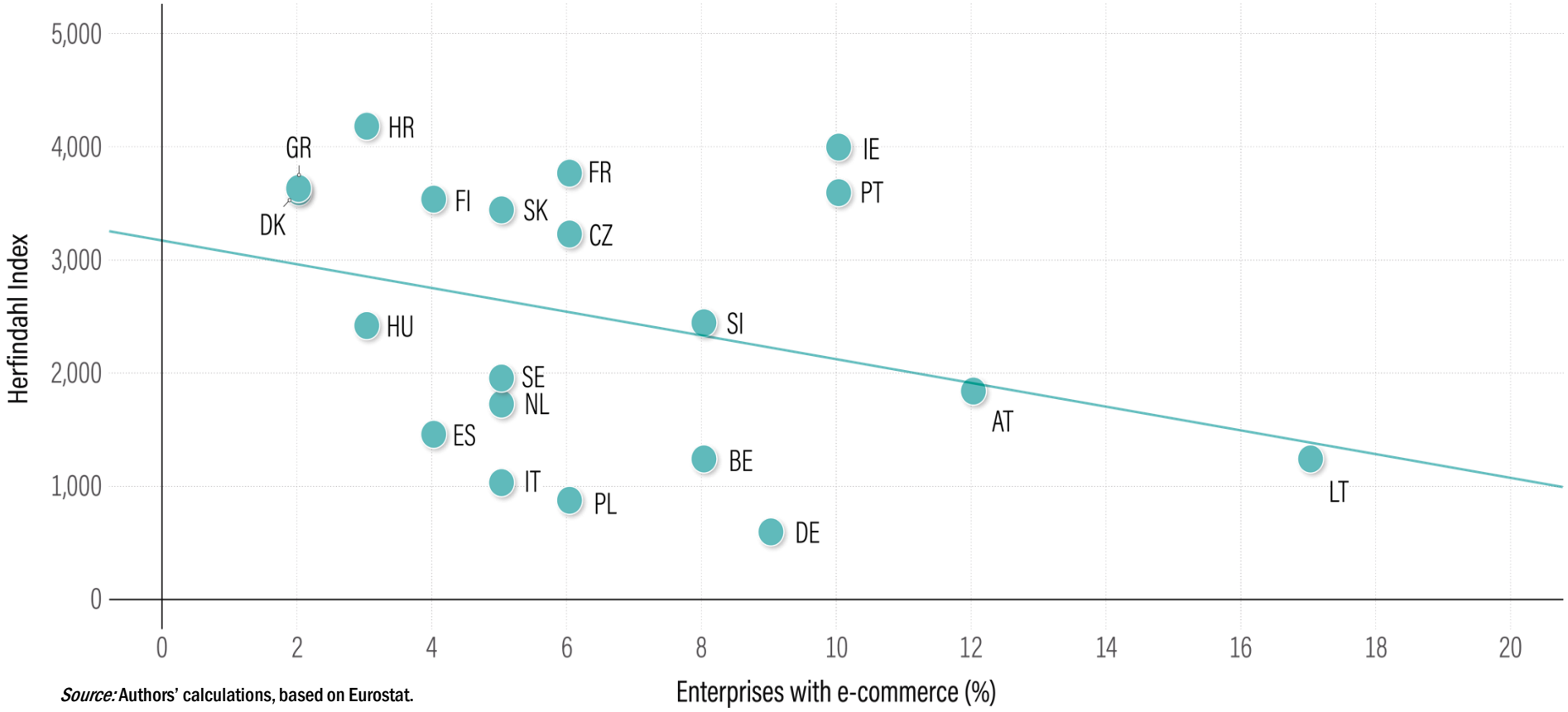
Source: EIB-WBG background paper by Cathles, Nayyar and Rückert (2020).

Higher use of on-line sales is associated with smaller productivity gaps between large and small firms in sectors using online sales intensively

Source: EIB-WBG background paper by Cathles, Nayyar and Rückert (2020).

Transactional technologies enable convergence

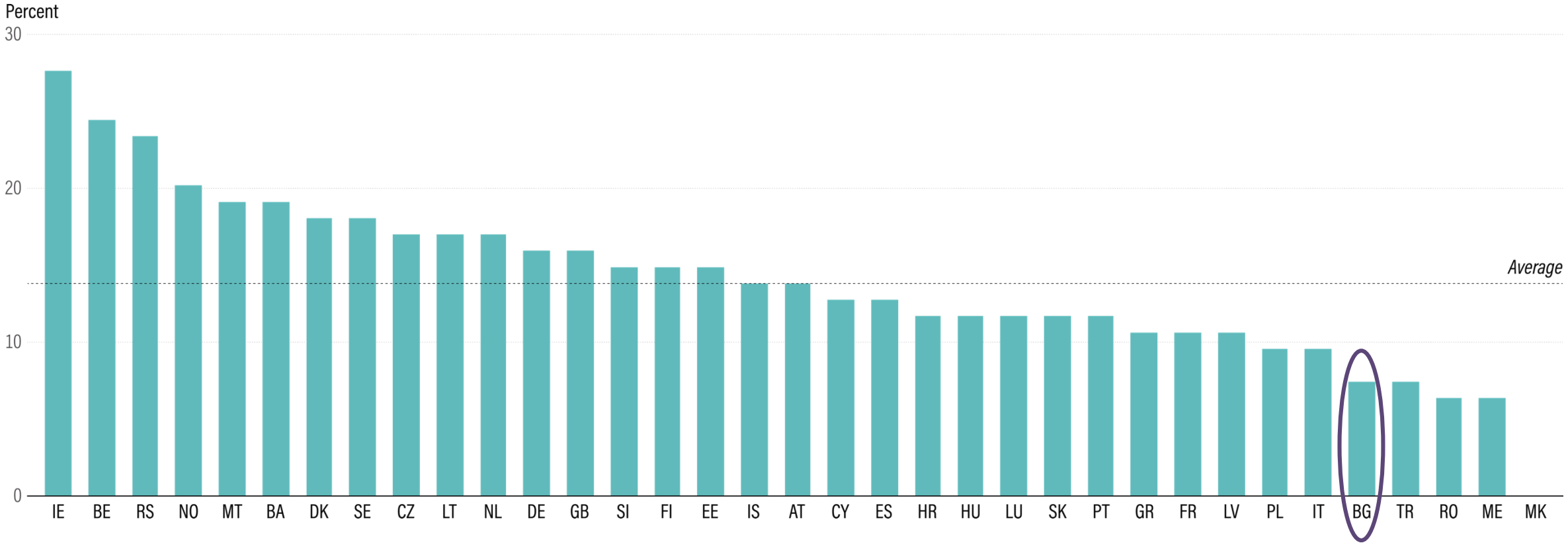
Higher use of e-commerce platforms is associated with lower spatial concentration in ICT services, 2018



Source: Authors' calculations, based on Eurostat.

Transactional technologies also improve Europe's competitiveness - but there is vast unrealized potential

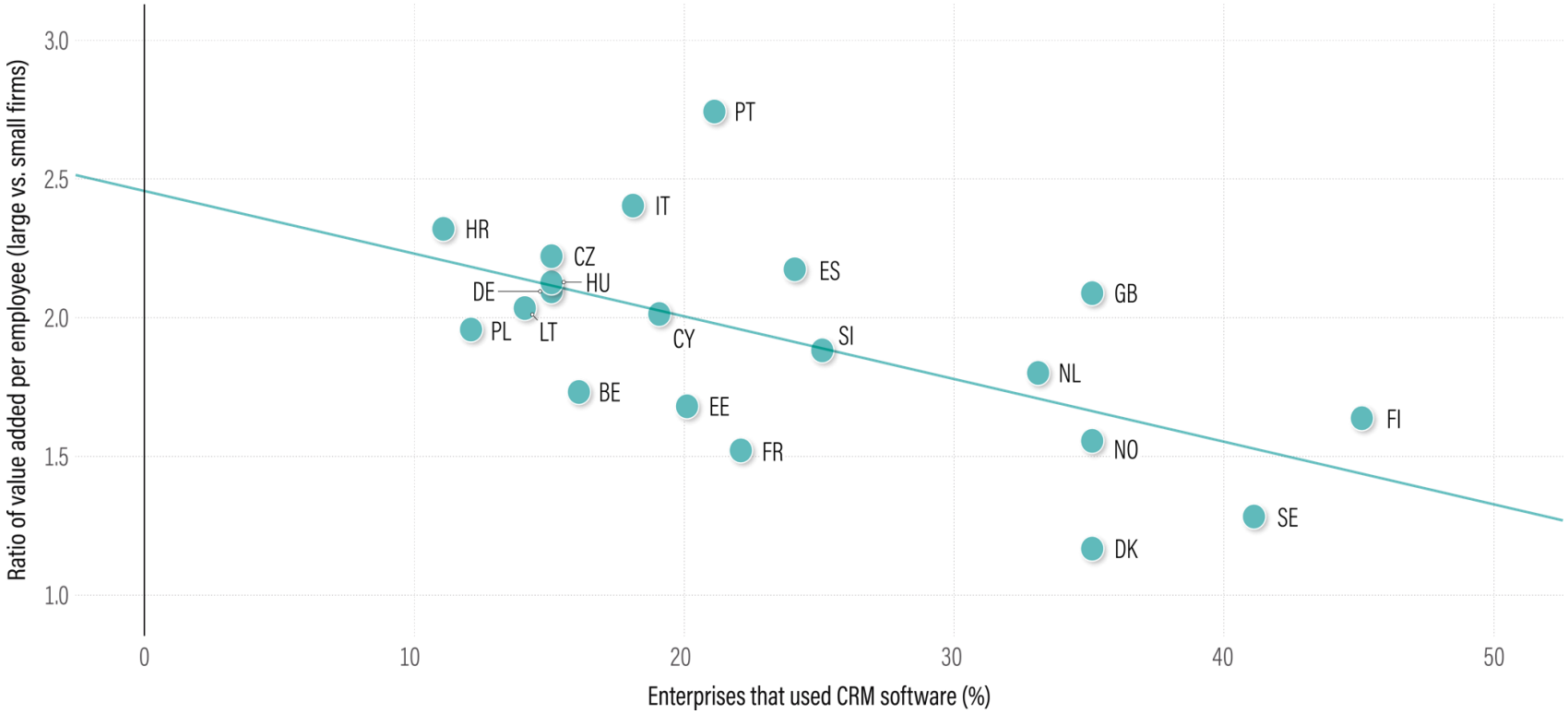
The share of firms that meet even a minimum threshold of selling online (at least 1% of their turnover) is far from universal, 2016



Source: Authors' calculations, based on Eurostat.

Older informational technologies boost market inclusion

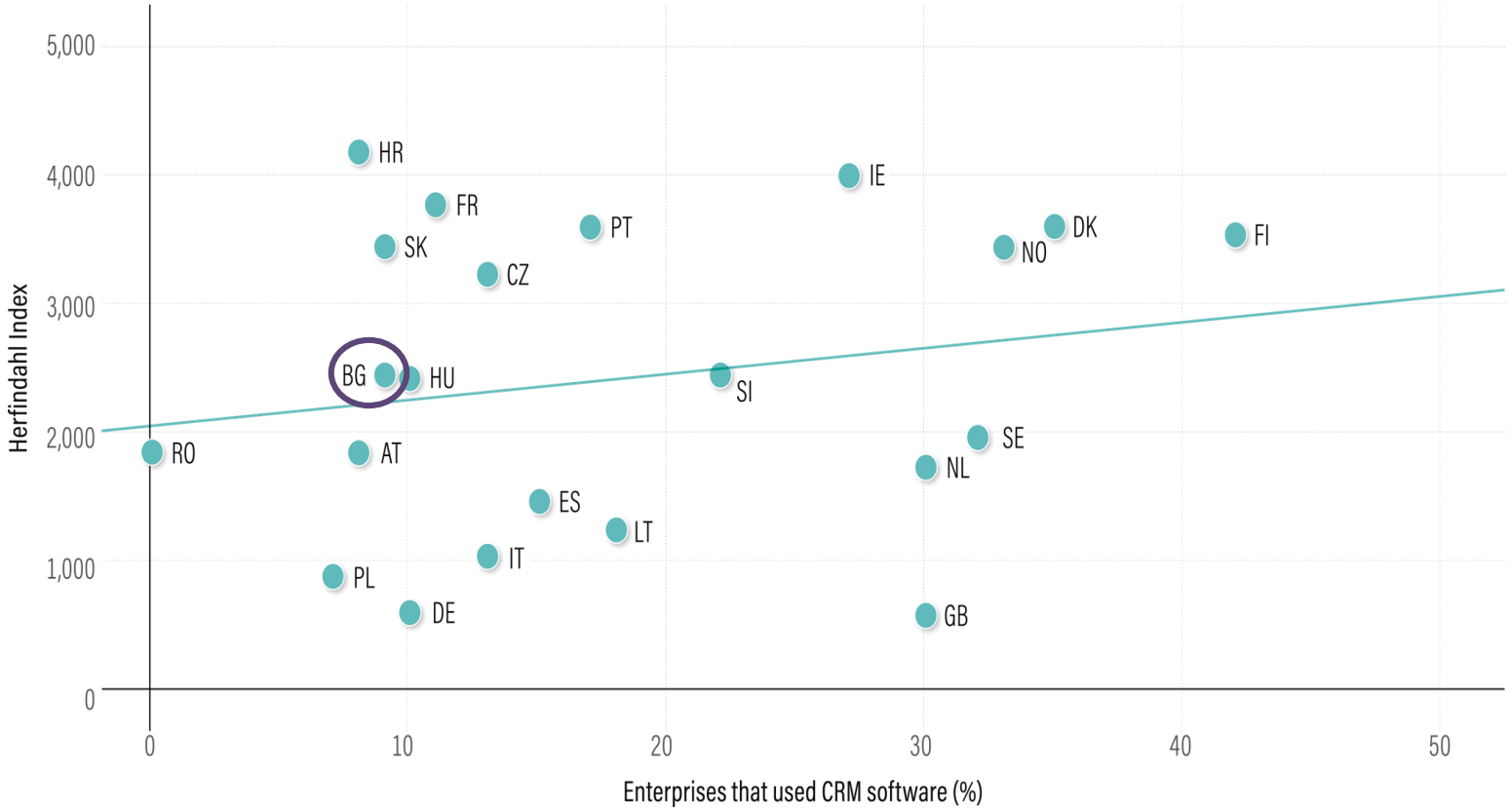
Higher use of customer relationship management (CRM) software is associated with smaller productivity gaps between large and small firms in information and communication services, 2016



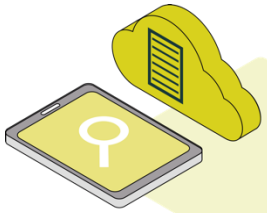
Source: Authors' calculations, based on Eurostat.

… but they have not enabled greater convergence

The use of CRM software has not reduced the spatial concentration of economic activity in information and communication services, 2016

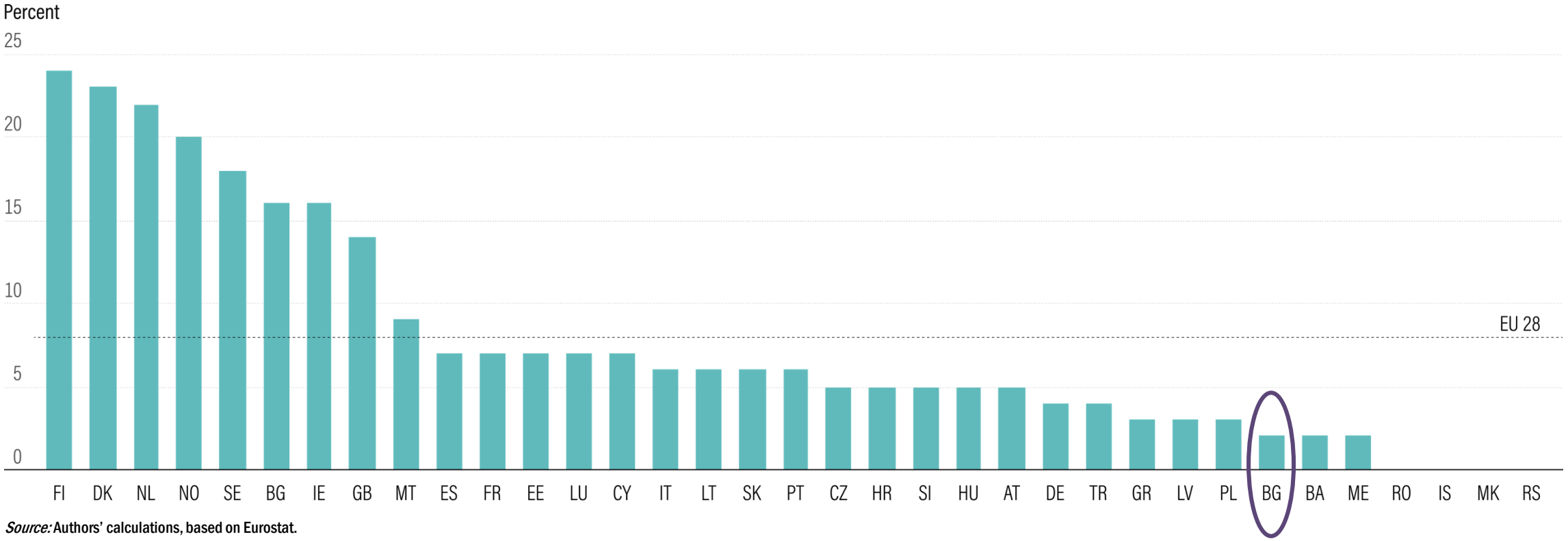


Source: Authors' calculations, based on Eurostat.



Older informational technologies improve Europe's competitiveness but there is vast unrealized potential

The share of firms using CRM software is far from universal, 2018



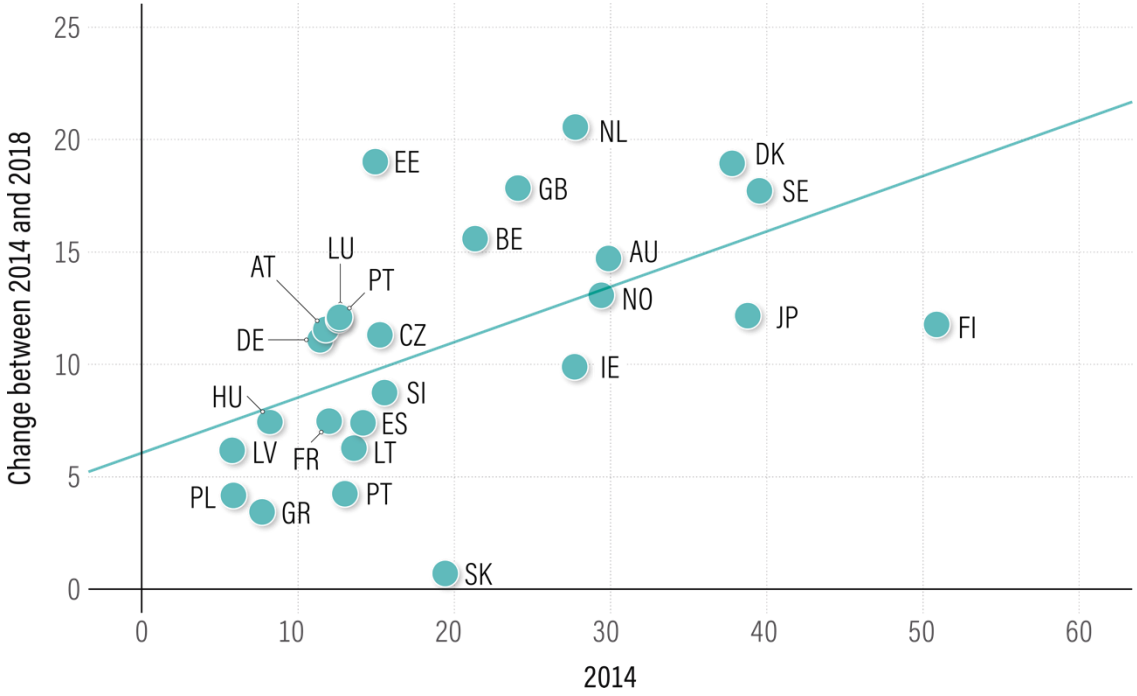
Source: Authors' calculations, based on Eurostat.

However, newer informational technologies are reinforcing larger firms and leading regions

A notably higher share of large firms, relative to SMEs, used big data analytics and AI in the EU

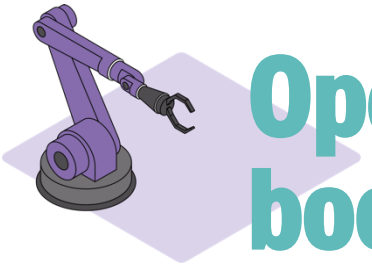
And there is growing divergence across countries in the use of cloud computing

Share of firms (%) that purchased cloud computing, level in 2014 vs change between 2014 and 2018



Source: EIB-WBG background paper by Cathles, Nayyar and Rückert (2020)

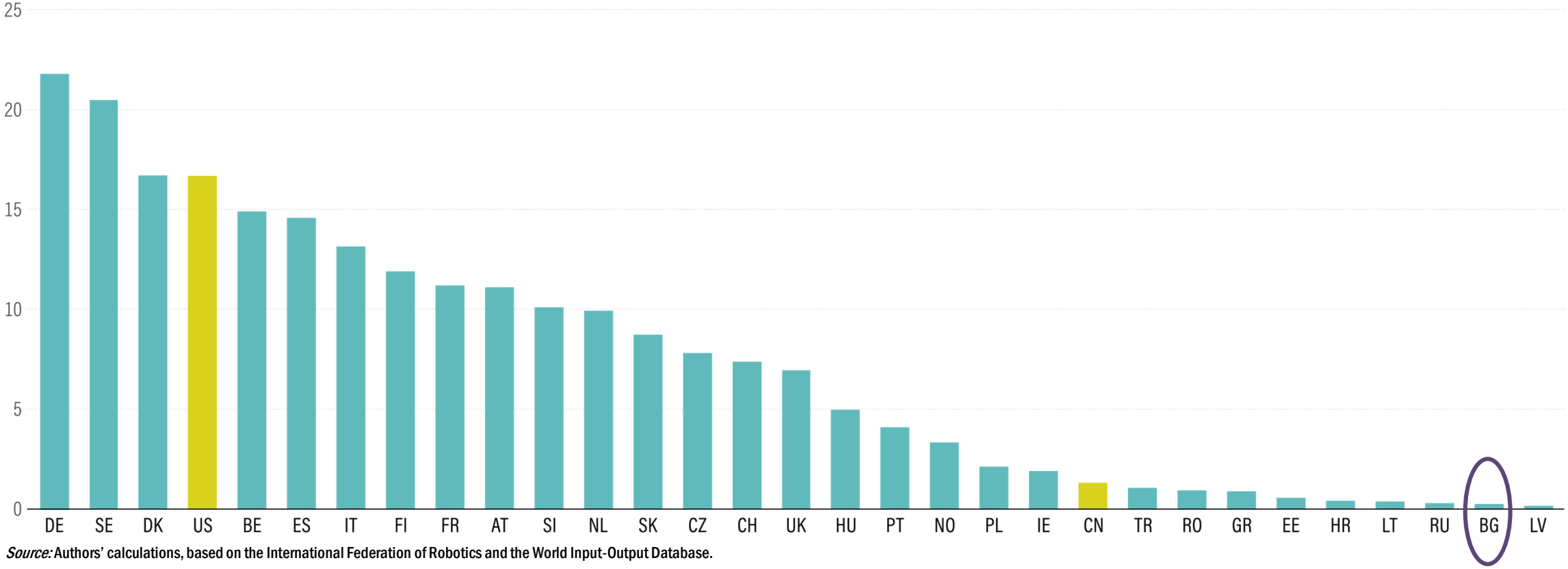
Source: Authors' calculations, based on Eurostat.



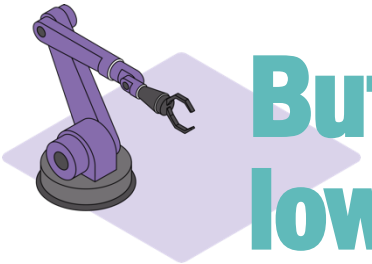
Operational technologies have large potential to boost Europe's competitiveness

EU14 countries and the United States have the highest intensity of robot use (robots per 1,000 workers), 2016

Number of robots per 1,000 employees, 2016

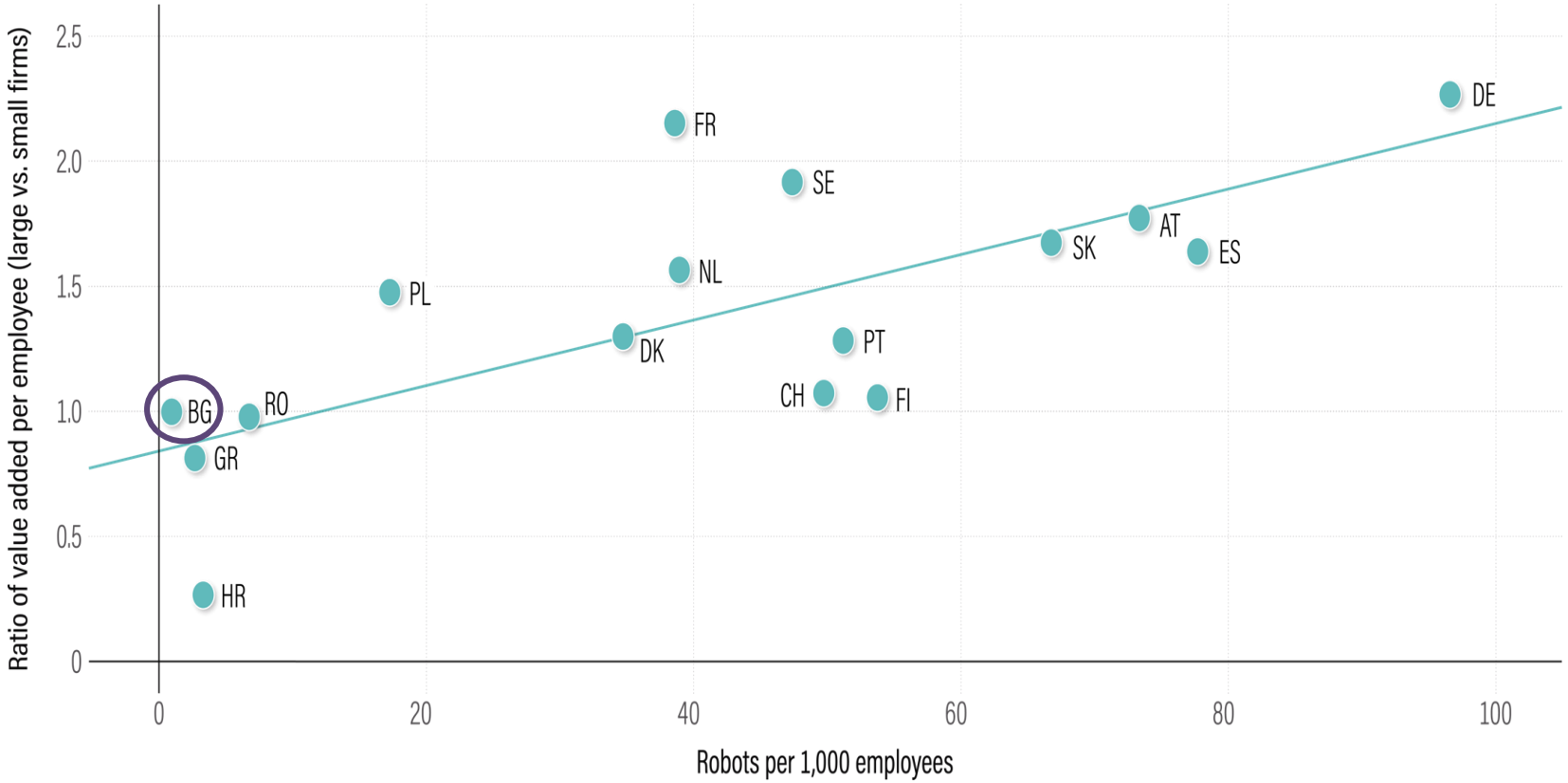


Source: Authors' calculations, based on the International Federation of Robotics and the World Input-Output Database.

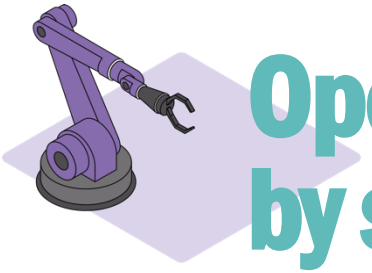


But operational technologies lower market inclusion

Robots per 1,000 workers are associated with a productivity gap between large and small firms in sectors that are highly automated, e.g. the transportation equipment sector, 2016

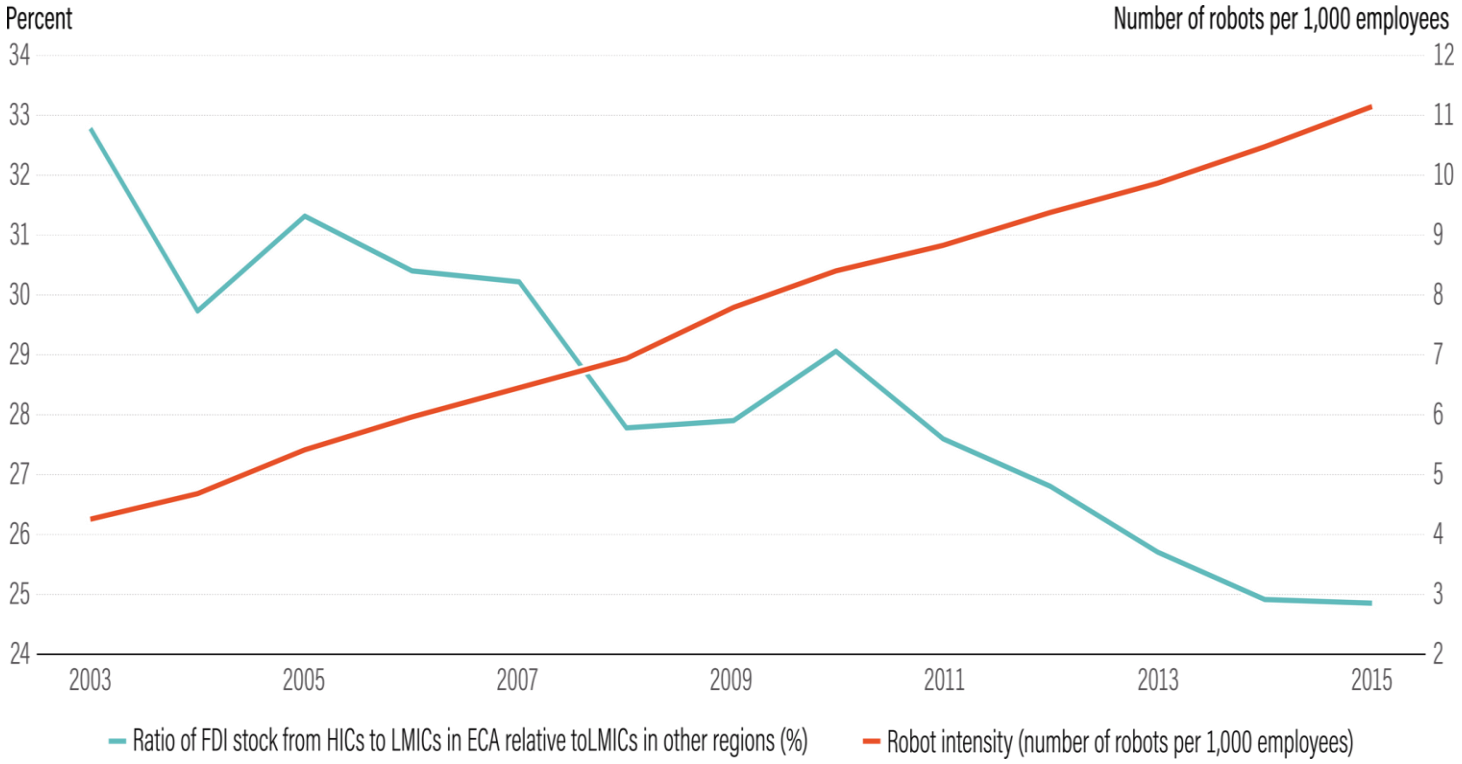


Source: Authors' calculations, based on Eurostat and International Federation of Robots data.



Operational technologies also inhibit convergence by slowing down offshoring to LMICs in Europe

Robotization in Europe's HICs is negatively associated with the share of FDI going from HICs to LMICs in the Europe and Central Asia region, 2004-2015



Source: Hallward-Driemeier and Nayyar, 2019.

Addressing the Digital Dilemma

	 **TRANSACTIONAL TECHNOLOGIES**	 **INFORMATIONAL TECHNOLOGIES**	 **OPERATIONAL TECHNOLOGIES**
Digital dilemmas	Contributes to all three goals, but limited competitiveness means that potential is only partially realized	European firms show more promise, but new opportunities are more concentrated	European firms are among global leaders, but technologies favor large firms and increasingly concentrate production
Policy directions	Scaling markets	Shaping commercial use of data	Smoothing adoption in MSMEs and lagging regions

Source: Europe 4.0 Team

TRANSACTIONAL TECHNOLOGIES

Scale to realize potential for inclusion and convergence

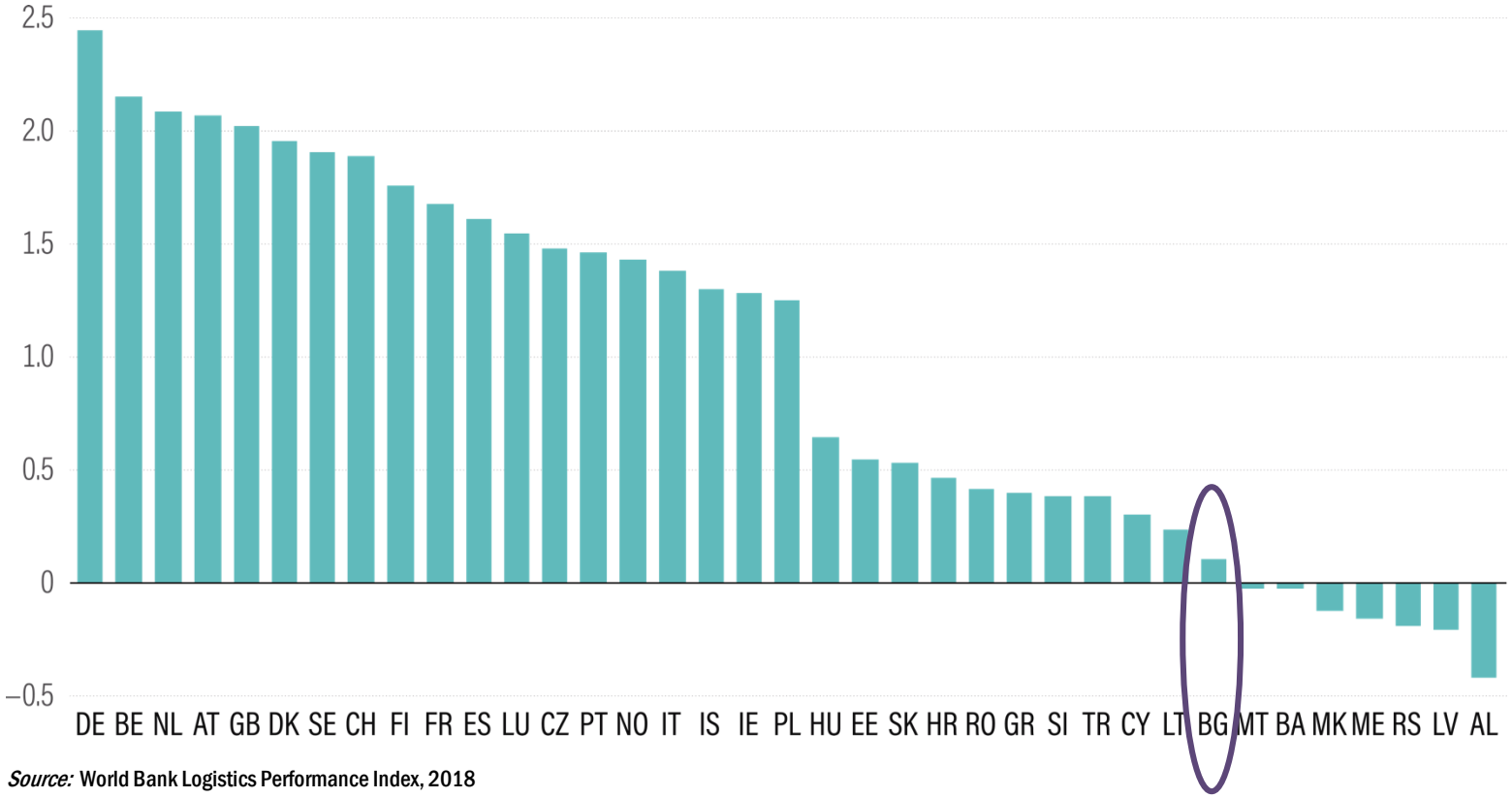
WHAT IS AT STAKE?

- Scale of markets matter for users and creators
- Access to ICT is not sufficient to *use* ICT enabled technologies

The cost of sending packages across the EU is 3.71 times the cost, on average, of sending the same package domestically

Even by 2030, less than 50% of households are projected to use e-commerce in Romania, Bulgaria, Italy and Portugal

Normalized LPI scores (global average=0; standard deviation=1)



Source: World Bank Logistics Performance Index, 2018

TRANSACTIONAL TECHNOLOGIES

Scale to realize potential for inclusion and convergence

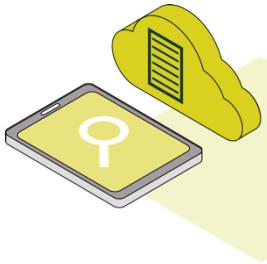
HOW TO MOVE FORWARD?

1. EU:
Complete single market

- Address fragmentation of digital single market (geoblocking; copyright portability)
- Constraints on trade in services
  - In key supporting sectors, e.g. postal services and logistics
  - But also ability to provide digital services remotely, especially professional services

2. COUNTRIES:
Focus on equalizing opportunities — which is not just about technology policies.

- Use of ecommerce is still projected to be under 50% of households by 2030 in Romania, Bulgaria, Greece and Portugal — even with access to ICT
- To access and use new technologies, need the necessary 'analog complements' of skills, infrastructure, finance and regulatory enforcement, especially in lagging regions.



INFORMATIONAL TECHNOLOGIES

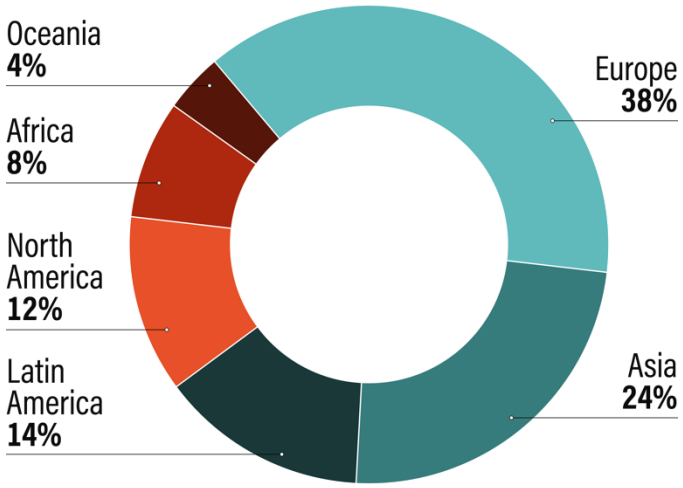
Shape new opportunities to expand access for SMEs

WHAT IS AT STAKE?

Network effects and benefits of access to large amounts of data raise new trade-offs between large incumbents and inclusion

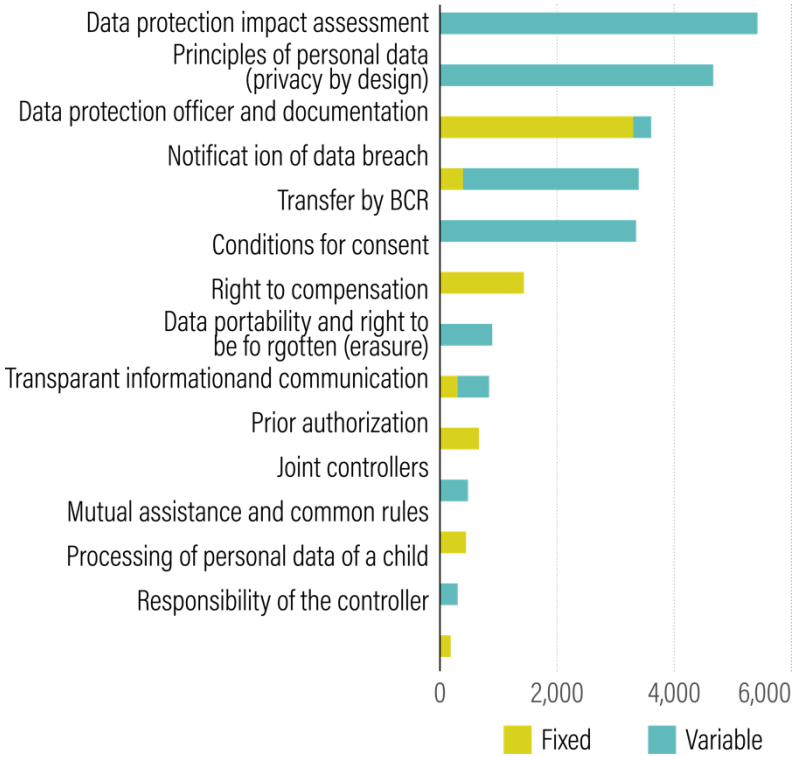
- Need to update regulations to address new forms of potential market dominance
- Data privacy as a constraint to innovation or source of advantage?

European competition authorities lead among regions in launching investigations

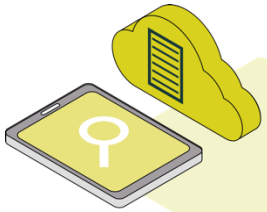


Source: World Bank Competition Policy Project.

Average expected direct costs of complying with GDPR (€)



Source: Background paper, van der Marle 2019



INFORMATIONAL TECHNOLOGIES

Shape opportunities to expand access for SMEs and entrants

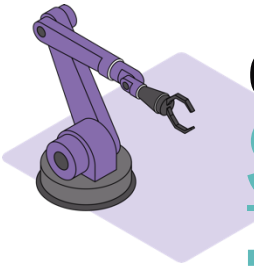
HOW TO MOVE FORWARD?

1. EU:
Shape regulations to address new challenges digital technologies bring:

- Continue to adapt competition policy for the digital age and new forms of market domination – avoid self-preferencing; thresholds & criteria for M&A; speed of enforcement; relevant remedies; who bears burden of proof; review of algorithms
- Sharing of commercial or B2B data could be new source of innovation, if compliant with competition rules, e.g. to avoid collusion or price setting
- Address costs of compliance to GDPR for smaller firms – make data portability and interoperability standardized and transparent
- Data privacy could limit some innovation – or 'privacy by design' become a new source of comparative advantage

2. COUNTRIES:
Strengthen start-up ecosystem for entrants to thrive

- Strengthen venture capital – including transferability of stock options
- Reform restrictions and administrative burdens on IPOs



OPERATIONAL TECHNOLOGIES

Smooth access to opportunities for greater convergence

WHAT IS AT STAKE?

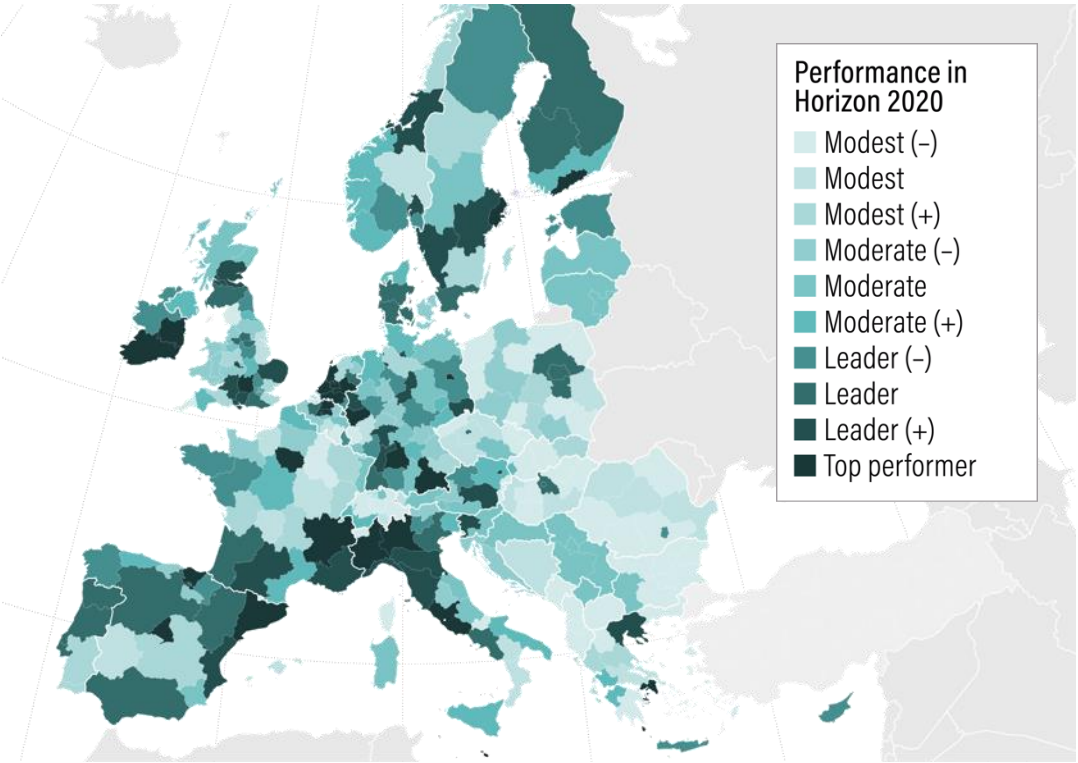
- Is it possible to leapfrog to Industry 4.0?
- Intersection of digital and green: harness AI to improve efficiency — of energy and material inputs used

Frontier innovation is highly clustered – but opportunities to diffuse technology are widespread

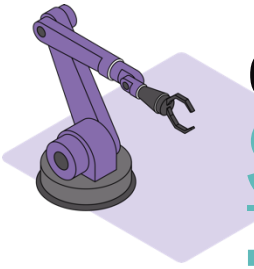
Two areas in Poland and one in Czech are among 20 top innovation hubs in Europe

Locations can specialize and become centers of excellence in some areas; only a handful master multiple types of technologies

Allocation of Horizon 2020 funds, 2018



Source: Background paper, Ballard and Bosch 2019



OPERATIONAL TECHNOLOGIES

Smooth access to opportunities for greater convergence

HOW TO MOVE FORWARD?

1. EU and COUNTRIES:

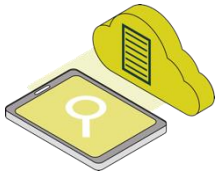
Applied R&D to assist with technology diffusion

- Private sector's share in R&D in Europe is relatively low compared to other leaders
- Allocate resources where build on related strengths and links to market opportunities; attempts to leapfrog are rarely successful
- Support firm capabilities (management practices, skills) to adapt and adopt technologies

Expand industrial IoT and B2B platforms to help more SMEs participate in industrial value chains.

Use redistribution tools to help workers during transitions

Policy Agenda for Europe 4.0

		 TRANSACTIONAL TECHNOLOGIES	 INFORMATIONAL TECHNOLOGIES	 OPERATIONAL TECHNOLOGIES
Policy directions		**Scaling** markets	**Shaping** commercial use of data	**Smoothing** adoption in MSMEs and lagging regions
Policy priorities	EU	Complete digital single market and support trade in services	Making competition and data privacy regulations fit for purpose in digital economy	Allocation of R&D and regional funds to build capabilities and links to markets
	National governments	Implementation of the single market Support complements in logistics (e.g., postal systems)	Start-up ecosystems Venture capital markets Digital skills	Support applied R&D, research-firm links
	Subnational governments	"Last-mile" infrastructure, enforcement	Innovation hubs Expand links with local firms and markets	Strengthen firms and governments capabilities to support adoption

Source: Europe 4.0 Team

Addressing the digital challenge facing Bulgaria

	 TRANSACTIONAL TECHNOLOGIES	 INFORMATIONAL TECHNOLOGIES	 OPERATIONAL TECHNOLOGIES
Performance	Among the lowest share of firms selling online in EU	Low uptake of cloud, analytics, big data, and earlier tech, such as CRM	Growing employment in technology-intensive industries, but low rates of robot intensity
Policy priorities	Improving consumer trust in digital transactions Overcoming last mile and cross-border delivery challenges	E-gov and open public data unfinished Competition policy for dynamic digital markets Maturation of the startup ecosystem, diversification	Improving support for R&D, tech transfer and research collaboration Support for tech upgrading, particularly among small firms Improving supply of both basic and advanced digital skills

Source: Europe 4.0 Team

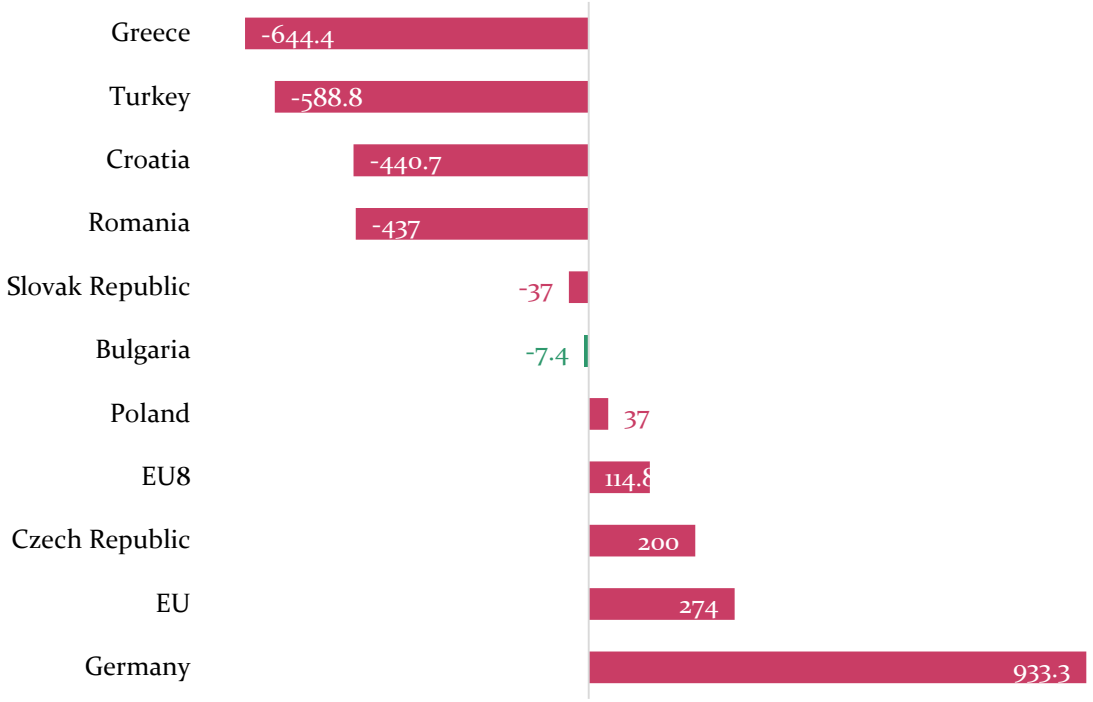
Key policy challenge: Digital & I4.0 Skills

- Compared with regional peers, BG workforce lacks a clear advantage in Industry 4.0 skills (frontier digital skills).

- **Cloud computing** and **human-computer interaction** skills are areas of strength, but Romania and other peers are strong as well. In AI, Bulgaria lags behind peers.

- Bulgaria reports a **net loss of skills to emigration**, although the observed emigration is not as large as in some peer countries
  - Data science and human-computer interaction do not show out migration

Net Change in LinkedIn Members with Frontier Skills (out of 10,000 members) 2015-18



Source: World Bank Group & LinkedIn Corporation

Spotlight: Growing Bulgarian Digital Startups Scene

TRANSACTIONAL TECHNOLOGIES

INFORMATIONAL TECHNOLOGIES

OPERATIONAL TECHNOLOGIES

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QuarkXR

Gtmhub

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cintelly

prosfit®

payhawk

TVS

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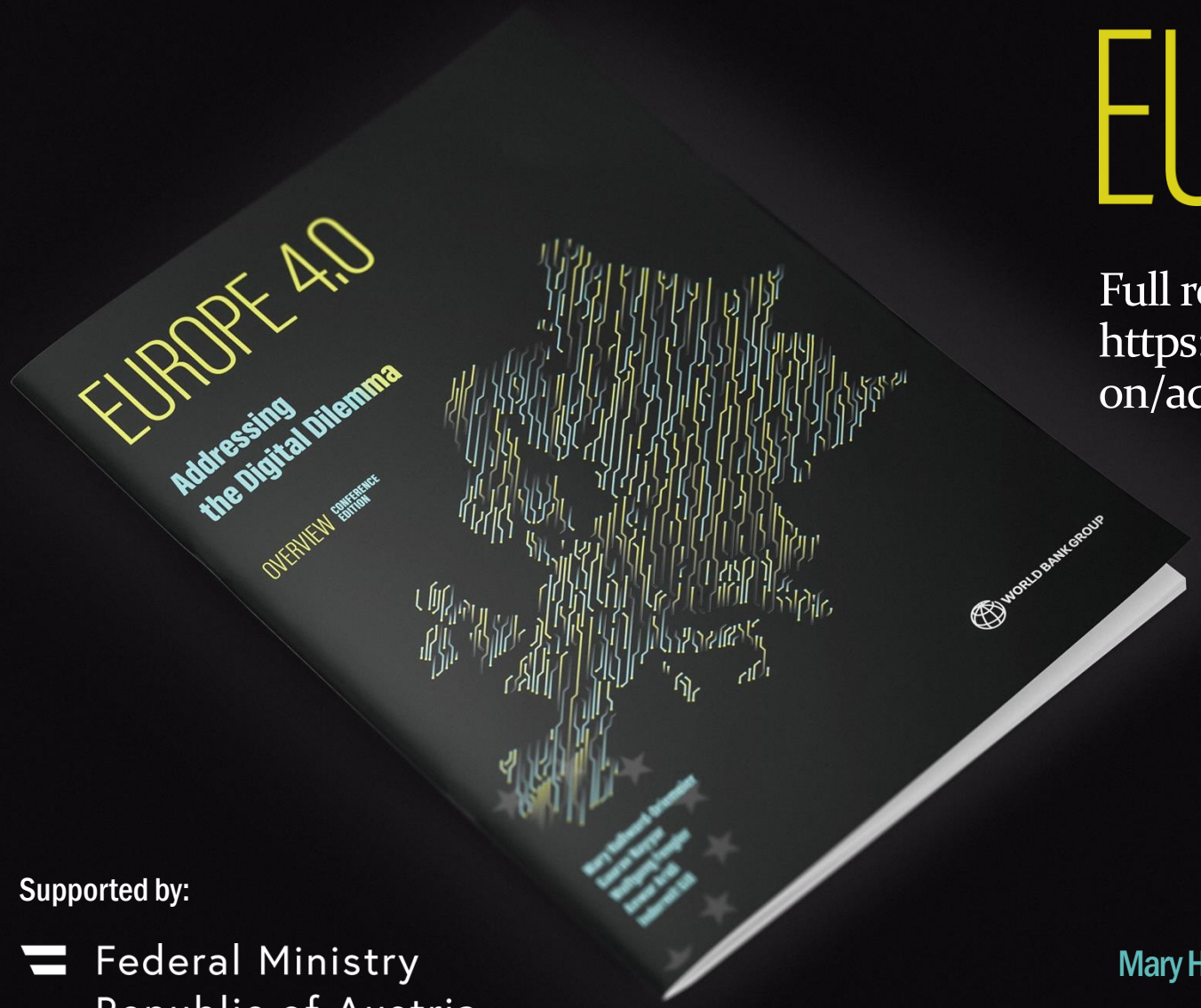

EUROPE 4.0

Full report available here:
https://www.worldbank.org/en/region/eca/publication/addressing-europes-digital-dilemma

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Feedback or questions :

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Anwar Aridi (Sofia) aaridi@worldbank.org