Session 3
Which inclusive and sustainable growth engines?

Globalization and Development Challenges

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« Facing Heightened Risks: stabilization and Reforms in MENA: A Regional Commission»
June 20 session

Overall Appreciation

- From a globalization perspective, MENA defies geography
- MENA has lagged on servicification with low GVC upstream participation
- Optimistic scenario. Absence of services export growth outside GCC suggests strong potential and opportunities to leverage digitalization because of young computer-savy workforce….provided that governments get their act together on policy front.
- If digitalization signifies ultimate death of distance (properly measured for services trade via data), then how can MENA that missed the digitization boat jump on GVC train (presumably here to stay notwithstanding current some offshoring)?
- Pessimistic scenario. The weight of history (Kuran sees Islamic law as brake on modernization) reflected in low values for indicators of network readiness
- Huge climate change challenge for adaptation (large CC migratory pressures)

Outline

- MENA defies geography
- Persistently high Trade Costs with mostly forward GVC participation
- Low servification (services trade concentrated in transport and tourism)
- High Mobile usage in MENA, but low network readiness (see also annex 1)
- Two Challenges of digitalisation
- The weight of history
- The Climate Change Challenge
- Annex 1 Extracts from ERF-UNDP report
- Annex 2: Sustainability vignettes

MENA defies geography

- High GVC participation associated with higher future growth (WB 2020)
- Geography is an important correlate of trade costs at least for goods, less so for services.
- MENA countries are not landlocked so SMC connection necessary for GVC participation are good and good connectivity (see below)

- Why hasn't MENA region which is at arm's length of EU participated more in globalization as one would have expected the GVC data to tell us (i.e. locate at the star in the figure with higher GVC participation and growth from 1990 to 2915)?
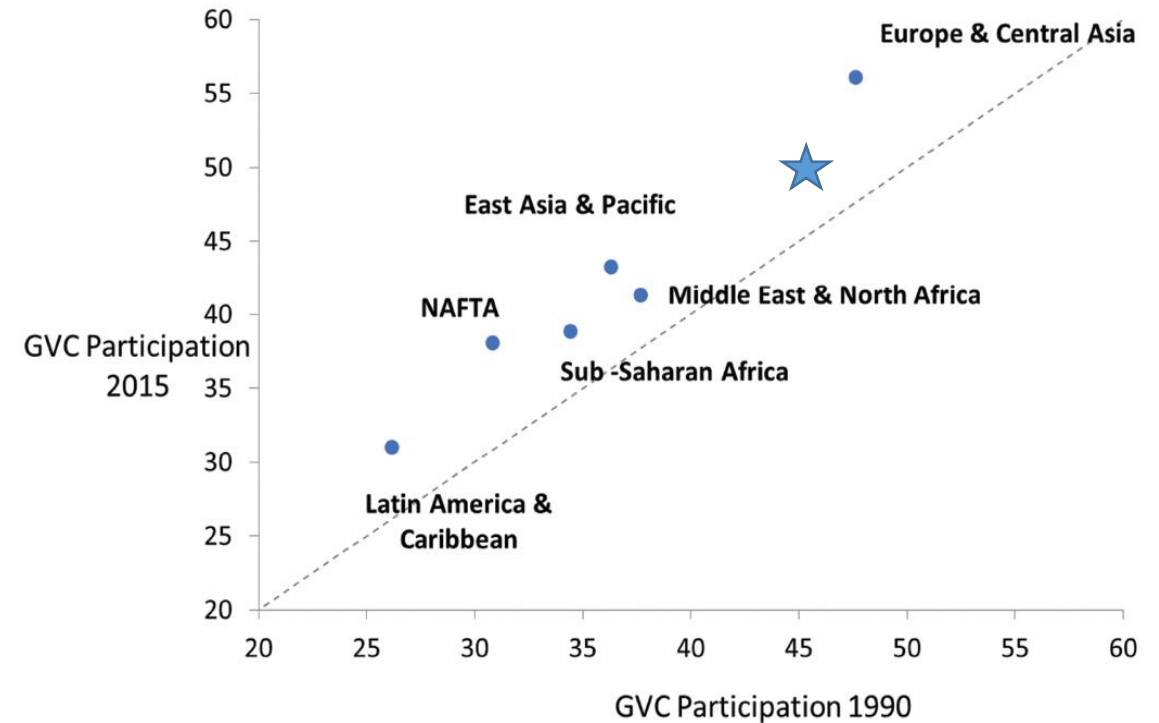

Figure 2 | Global Value Chain (GVC) participation by major geographic regions. *Source*: Authors calculation using GVC database from Borin and Mancini (2015, 2019). *Note*: See Annex A for full countries in regional groups. Points above 45° indicate an increase in GVC participation.
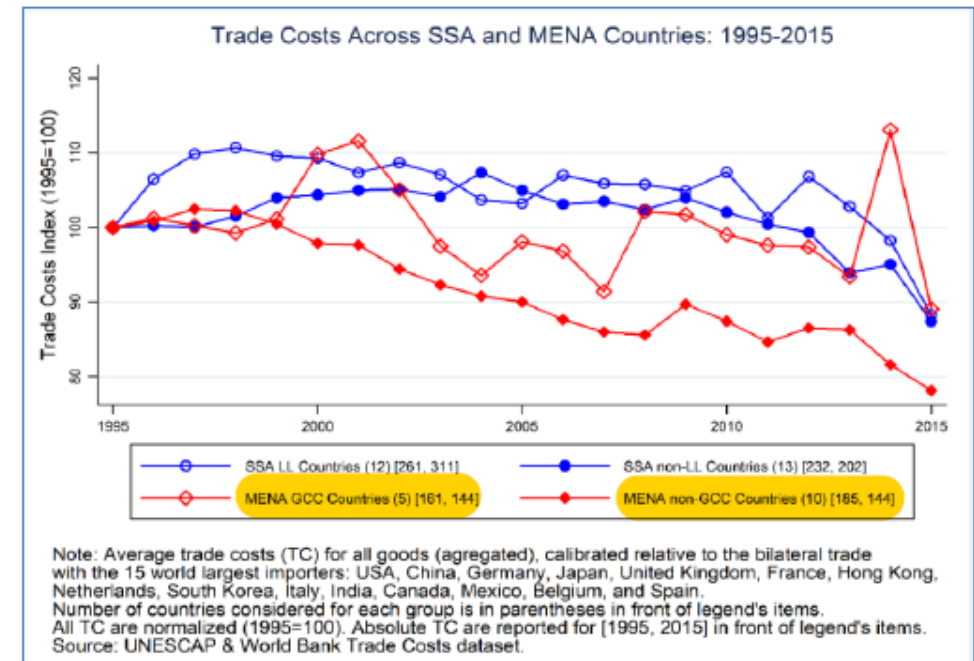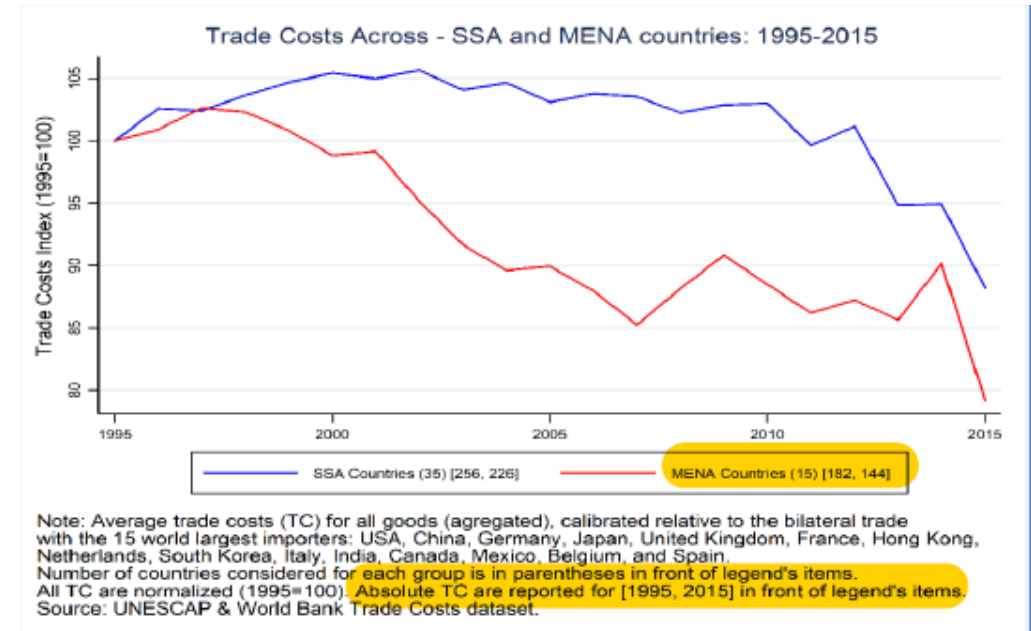
Source: Melo and Twum (2021)

Bilateral trade costs high in MENA

Gravity-calibrated Trade Costs

- Bilateral trade costs of MENA (15 countries) relative to bilateral trade costs of top 15 world traders (182% → 144%)

- Non-GCC group started a little further to top than GCC (and especially from SSA) with slight catching up to GCC.

- ...but, controlling for geography factors, trade costs still stubbornly high.

- ... Reflected in low backward GVC participation.

Source: Melo/Solleder (2022a)

Trade Costs Across - SSA and MENA countries: 1995-2015

Note: Average trade costs (TC) for all goods (agregated), calibrated relative to the bilateral trade with the 15 world largest importers: USA, China, Germany, Japan, United Kingdom, France, Hong Kong, Netherlands, South Korea, Italy, India, Canada, Mexico, Belgium, and Spain.
Number of countries considered for each group is in parentheses in front of legend's items.
All TC are normalized (1995=100). Absolute TC are reported for [1995, 2015] in front of legend's items.
Source: UNESCAP & World Bank Trade Costs dataset.

Legend: SSA Countries (35) [256, 226] — MENA Countries (15) [182, 144]

Trade Costs Across SSA and MENA Countries: 1995-2015

Note: Average trade costs (TC) for all goods (agregated), calibrated relative to the bilateral trade with the 15 world largest importers: USA, China, Germany, Japan, United Kingdom, France, Hong Kong, Netherlands, South Korea, Italy, India, Canada, Mexico, Belgium, and Spain.
Number of countries considered for each group is in parentheses in front of legend's items.
All TC are normalized (1995=100). Absolute TC are reported for [1995, 2015] in front of legend's items.
Source: UNESCAP & World Bank Trade Costs dataset.

Legend: SSA LL Countries (12) [261, 311] — SSA non-LL Countries (13) [232, 202] — MENA GCC Countries (5) [161, 144] — MENA non-GCC Countries (10) [185, 144]

MENA: So far mostly forward GVC participation

Table 3: Trends in GVC participation by region

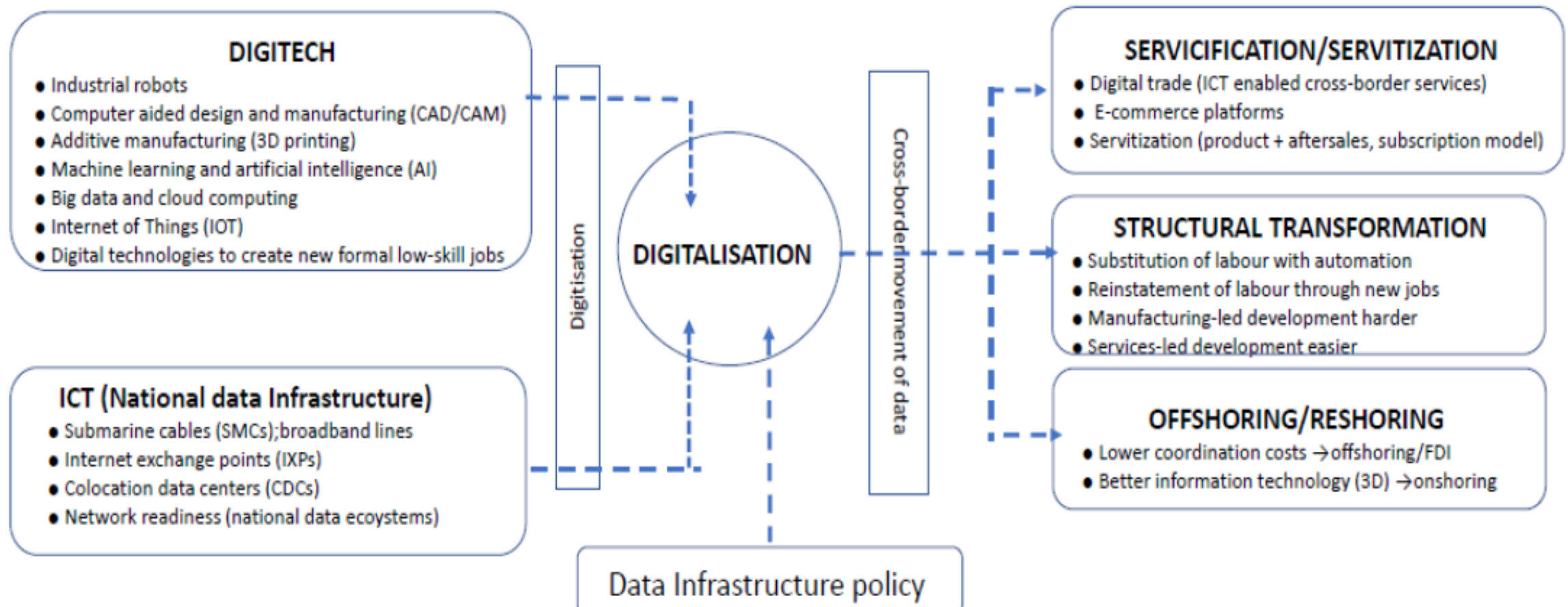|	Backward (GVCbs)			Forward (GVCfs)			Total (GVCs)			Trend
	1995	2005	2015	1995	2005	2015	1995	2005	2015	
By region										
World	0.25	0.29	0.28	0.19	0.20	0.20	0.44	0.49	0.48	⌒
East Asia & Pacific	0.22	0.25	0.25	0.17	0.19	0.19	0.39	0.44	0.43	⌒
Europe & Central Asia	0.31	0.35	0.35	0.20	0.21	0.21	0.51	0.56	0.56	⌒
Latin America & Caribbean	0.19	0.20	0.19	0.13	0.13	0.15	0.33	0.33	0.33	—
Middle East & North Africa	0.18	0.15	0.14	0.22	0.26	0.27	0.39	0.41	0.41	⌒
North America	0.16	0.18	0.16	0.20	0.21	0.21	0.35	0.39	0.37	⌒
South Asia	0.11	0.14	0.15	0.18	0.20	0.19	0.29	0.34	0.35	⌒
Sub-Saharan Africa	0.15	0.14	0.13	0.22	0.25	0.25	0.37	0.39	0.39	⌒
By Country										
Egypt	0.11	0.14	0.11	0.23	0.25	0.26	0.35	0.38	0.37	⌒
Kenya	0.15	0.17	0.17	0.18	0.20	0.19	0.33	0.37	0.36	⌒
Morocco	0.11	0.12	0.16	0.21	0.27	0.26	0.33	0.40	0.42	⌒
Nigeria	0.11	0.08	0.06	0.25	0.26	0.29	0.36	0.34	0.35	⌣
Rwanda	0.16	0.12	0.18	0.25	0.32	0.25	0.41	0.44	0.43	⌒
Saudi Arabia	0.21	0.16	0.13	0.20	0.24	0.28	0.41	0.40	0.41	⌣
South Africa	0.16	0.17	0.17	0.22	0.25	0.25	0.37	0.41	0.42	⌒

Notes: Estimates from the sample of 148 countries listed in table A2. Simple average at the region level. (GVCbs) is the share of imports in gross exports and (GVCfs) is the share of gross exports that enters into exports of destination country. (GVCs) = (GVCbs)+(GVCfs)

Source: Melo and Solleder (2021, table 1).

● Large import content of exports (high backward GVC) , an indicator of TFPG, key ingredient for successful transformation lacking for MENA (virtually lowest in world at 14% in 2015)

# Digitalisation : ICT (high); DIGITECH (low)→Servification(low)

Figure 1: Inputs and outcomes of the digital economy

DIGITECH
- Industrial robots
- Computer aided design and manufacturing (CAD/CAM)
- Additive manufacturing (3D printing)
- Machine learning and artificial intelligence (AI)
- Big data and cloud computing
- Internet of Things (IOT)
- Digital technologies to create new formal low-skill jobs

ICT (National data Infrastructure)
- Submarine cables (SMCs);broadband lines
- Internet exchange points (IXPs)
- Colocation data centers (CDCs)
- Network readiness (national data ecosystems)

Digitisation

DIGITALISATION

Cross-border/movement of data

SERVICIFICATION/SERVITIZATION
- Digital trade (ICT enabled cross-border services)
- E-commerce platforms
- Servitization (product + aftersales, subscription model)

STRUCTURAL TRANSFORMATION
- Substitution of labour with automation
- Reinstatement of labour through new jobs
- Manufacturing-led development harder
- Services-led development easier

OFFSHORING/RESHORING
- Lower coordination costs →offshoring/FDI
- Better information technology (3D) →onshoring

Data Infrastructure policy

●MENA has done well on ICT (see next slide) but not on DIGITECH (arguably because of low backward GVC participation?). ● Outcome: low servification (services share of GDP low for MICs)

Hoped-for gains from digitization

FIGURE 5.2 The Upside of Digital: Cumulative Gains in GDP per Capita in the Middle East and North Africa and in Sub-Saharan Africa, 2017–45

Legend:
- – – Middle East and North Africa
- ····· Middle East and North Africa excluding high-income countries
- —— Sub-Saharan Africa
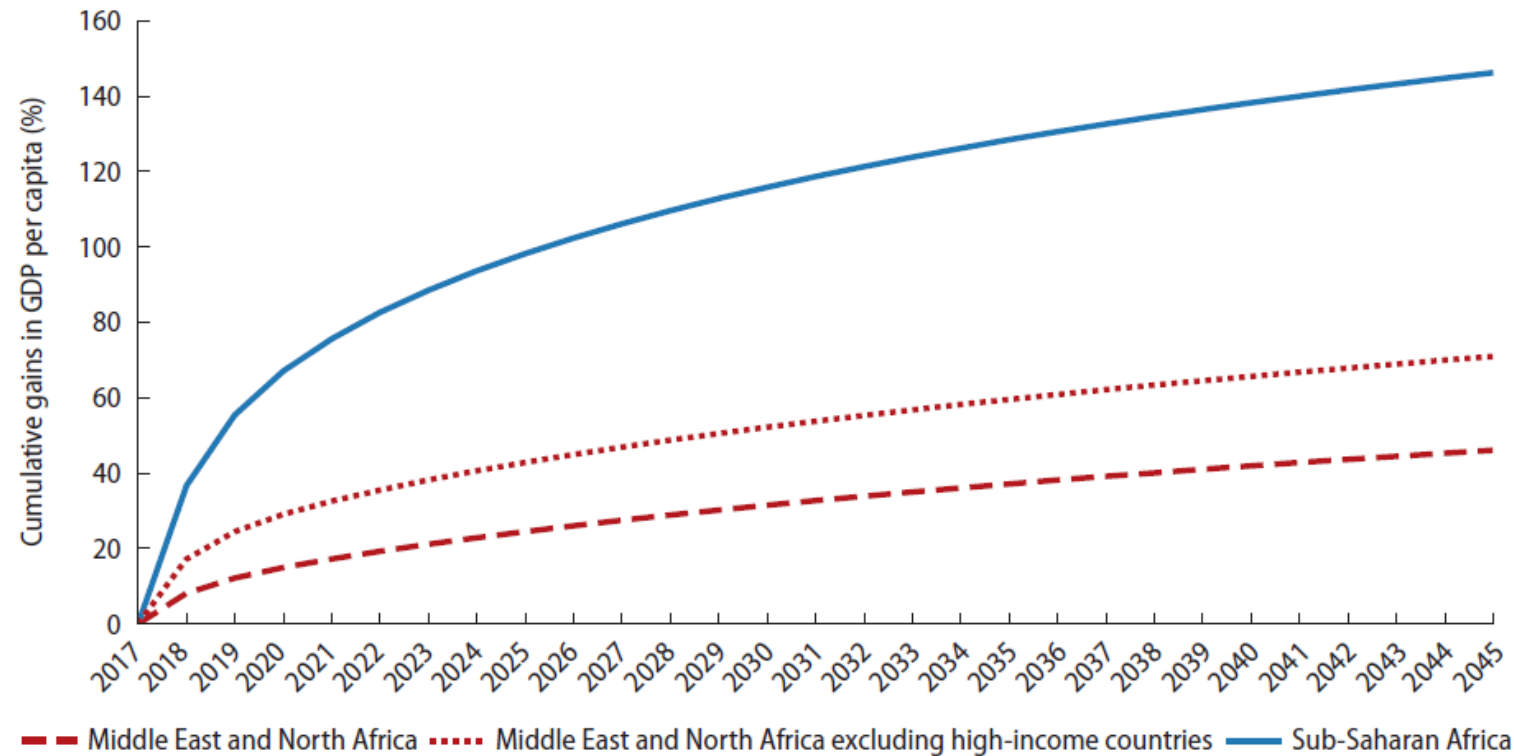
Source: Calculations based on estimates of the marginal effects of digital infrastructure on the level of GDP per capita presented in Calderon et al. 2019.
Note: The estimates of the marginal effects of expanding digital infrastructure services (internet use, mobile subscriptions, and broadband subscriptions) control for the preexisting level of GDP per capita and other indicators used in the various regression analyses. All countries are assigned the same marginal effect. The assumed adoption schedule follows the concave function discussed in the text. The data for each curve have been normalized to obtain start values of "0" in 2017.

Source: Cusolito et al. (2022)

...low digitalization reflected in low regional servicification in MENA (as captured in low Services share of exports)

- Digitization: converting analog representations of tangible objects or attributes into a digital format
- Digitalization: applying digital technologies to existing business processes
- Digital transformation: changing or developing new business processes and products using digitalization technologies
- <mark>Servicification: process of increasing intensity of the share of services in GDP</mark> (value added), or, at the firm level, a shift towards services in revenues
  - Average rate of increase in servicification of Arab countries below that observed in middle-income countries: 7.5 vs. 15 percentage point increase since 1990
  - **Services % GDP Arab states =<mark>49.7% vs, 54.7% in MICs</mark>**

(structure of services exports in next 3 slides)
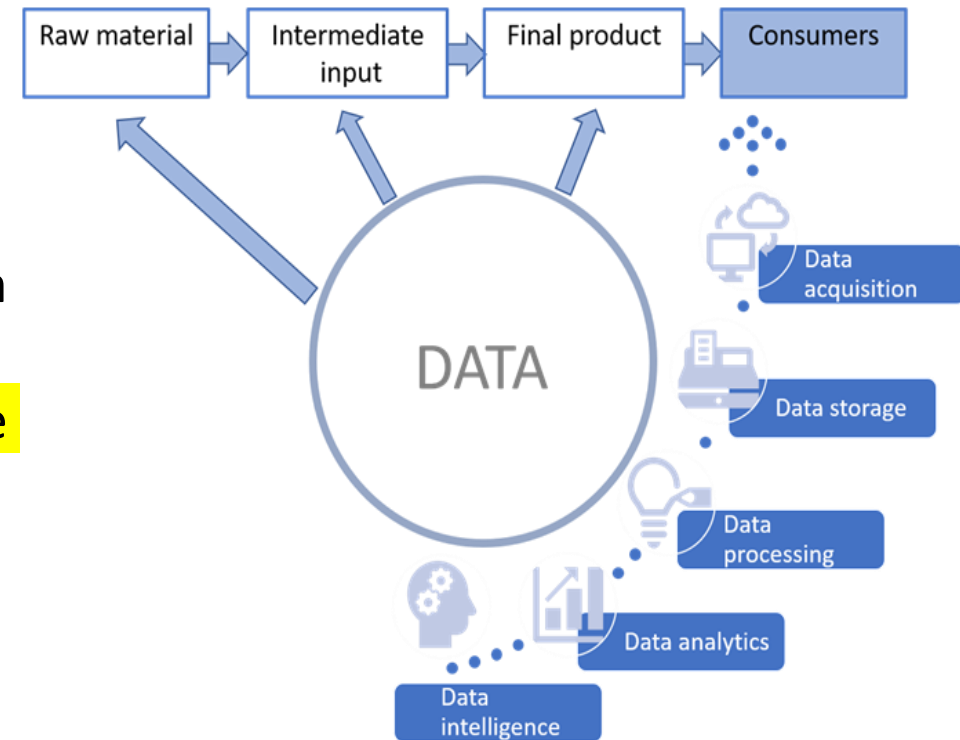
Source: Hoekman (2021)

Arab countries specialized more in transport and travel services

Composition of world commercial services exports, 2019

3.9
17.0
23.8
55.4

- Goods-related services
- Transport
- Travel
- Other commercial services
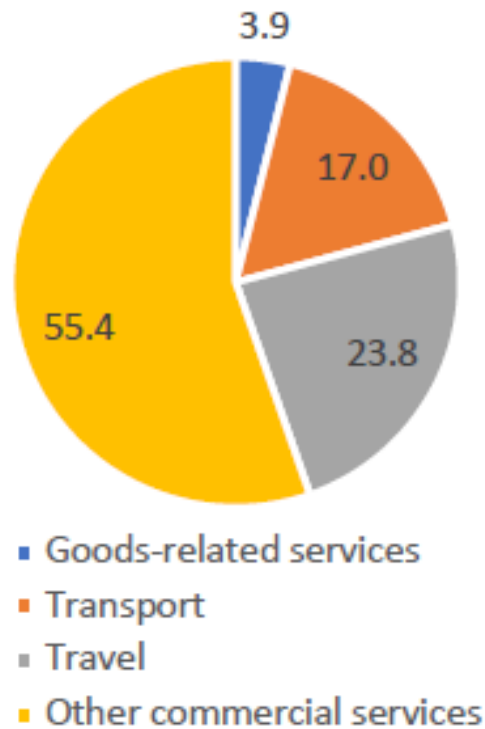
Composition of commercial services exports, Arab countries, 2019

0.7
25.0
40.0
34.3

- Goods-related services
- Transport
- Travel
- Other commercial services

Source: WTO.
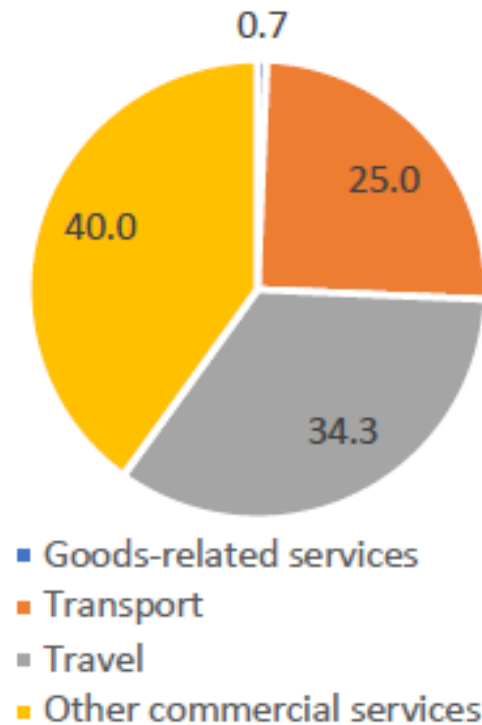
Source: Hoekman (2021)

Services exports been a positive factor for most Arab countries...

5-year average annual growth rate (%), 2013-18 or 2014-19)

■ Total goods & Services exports   ■ Total services exports
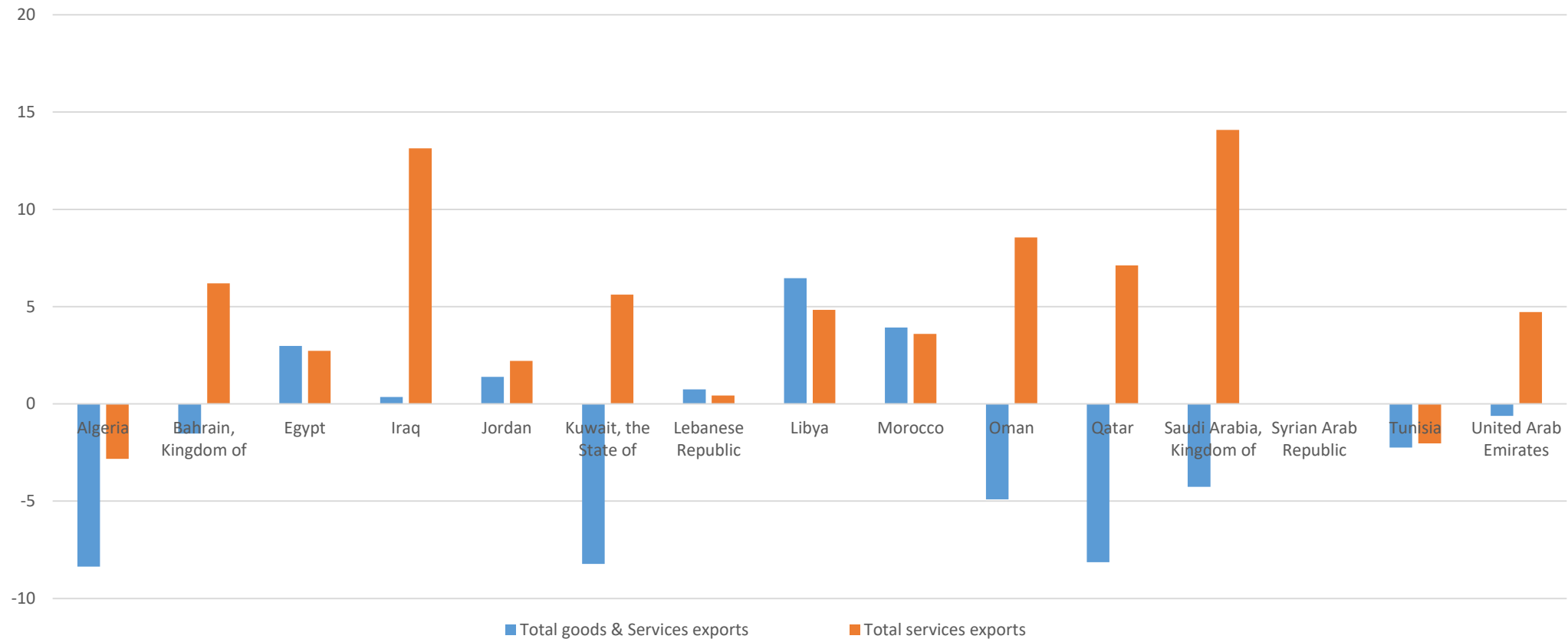
Source: Hoekman (2021)

...but weak performance in non-tourism services

Panel A. 5-year average annual growth rate (%), 2013-18 or 2014-19)
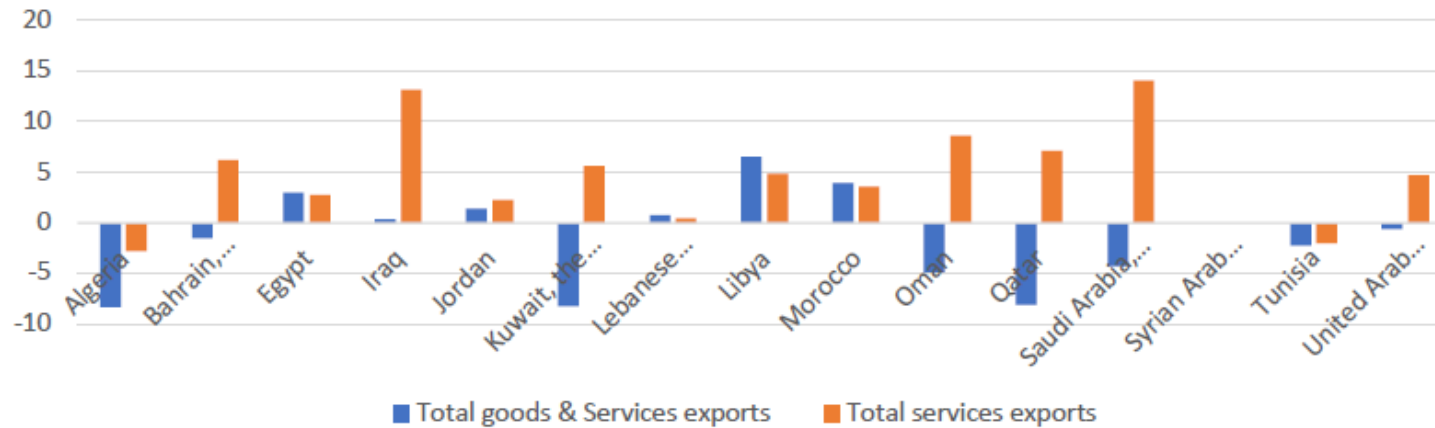
● Weak services exports reflect transport/tourism prevalence,

● but several Arab countries have experienced *negative* growth in exports of 'other commercial services'

Panel B. Commercial services exports, 5 year growth rate (latest available years)
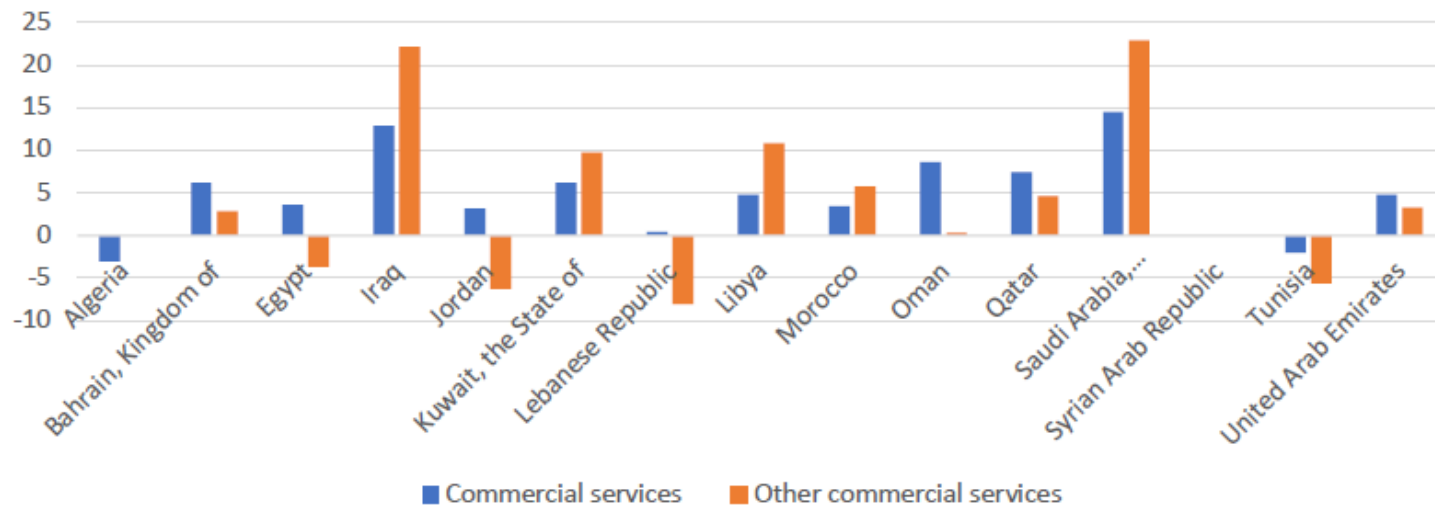
Panel C. 5 year export growth rate, selected services
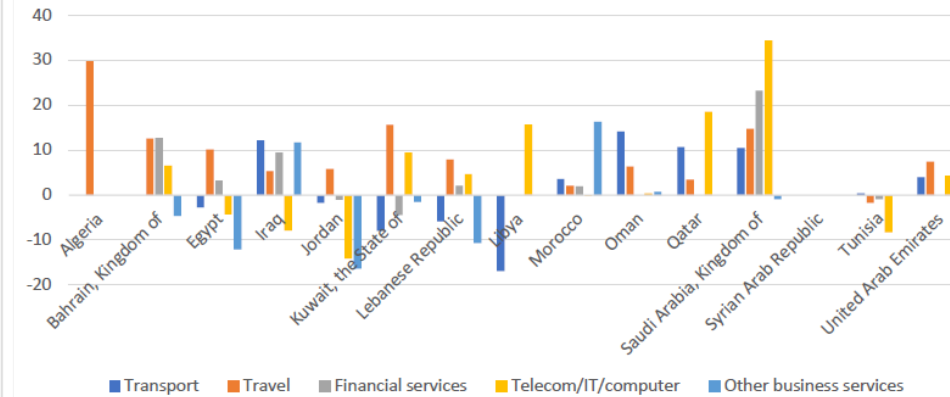
Source: WTO

Source: Hoekman (2021)

Two Challenges of digitalisation

DIGITECH should favor MENA countries that have missed the manufacturing-led stage of structural transformation, especially since well connected to the worldwide web (see high mobile usage)

Figure 2: Two Challenges of Digitalization: (a) Globotics and (b) Disappearance of jobs
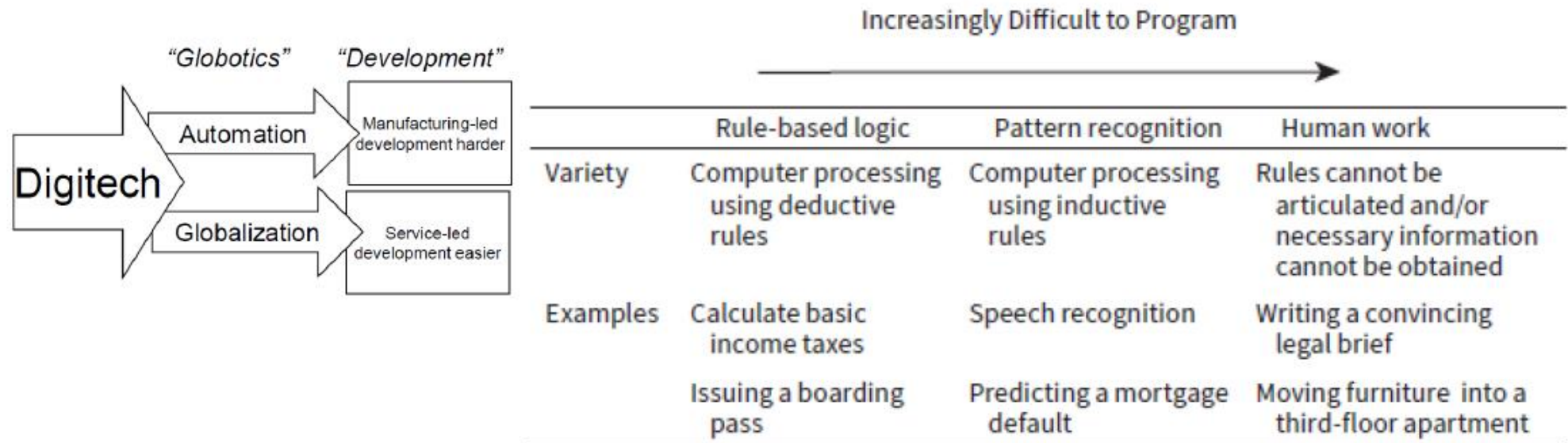
Source: (a) Baldwin and Forslid (2020); (b) Tirole (2017, table 15.1)

High Mobile usage in MENA…

b. By region
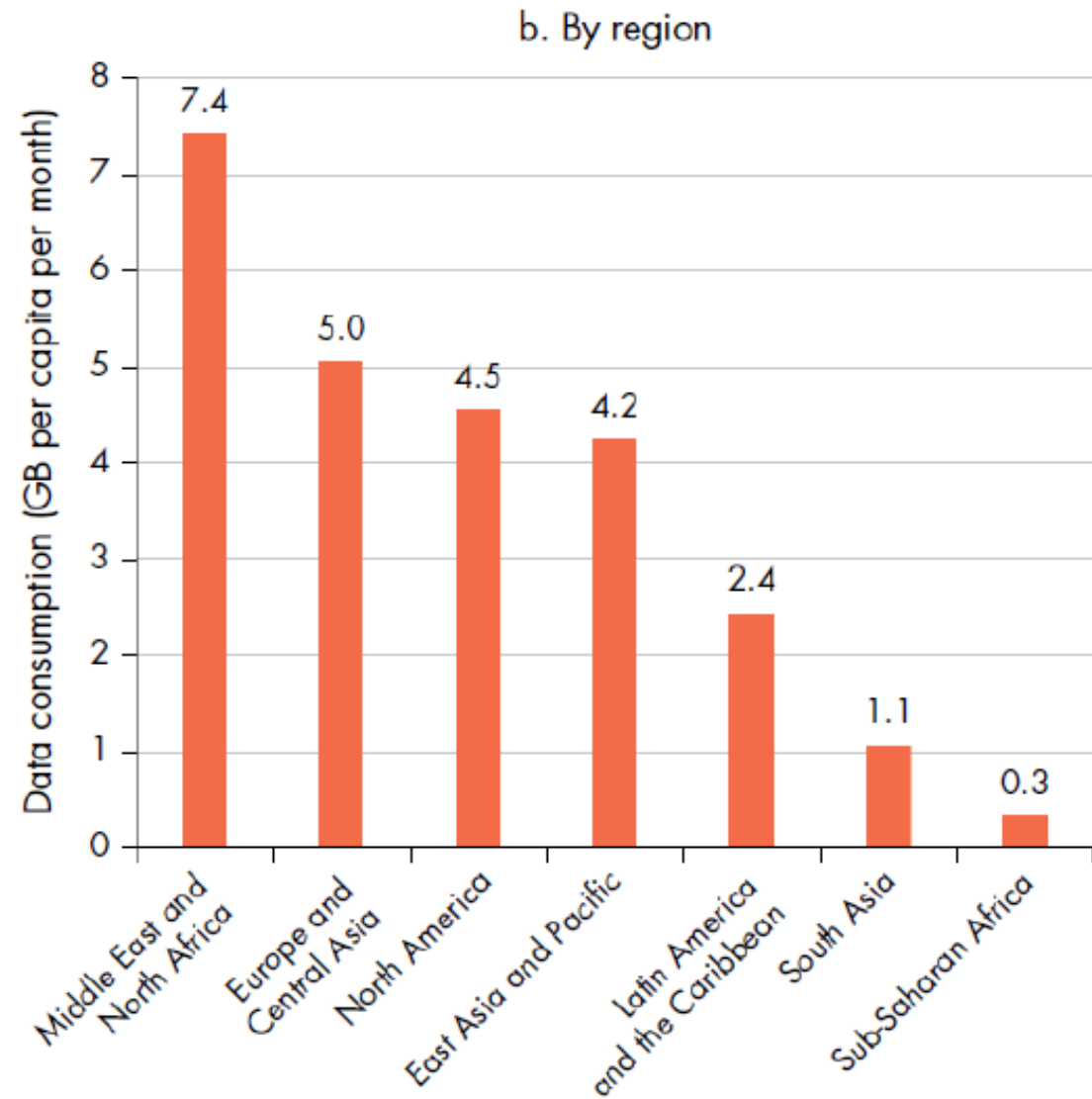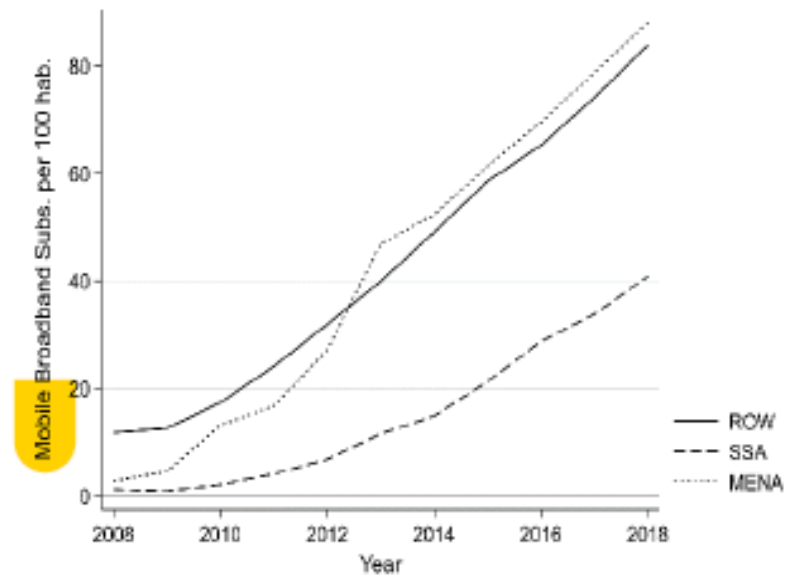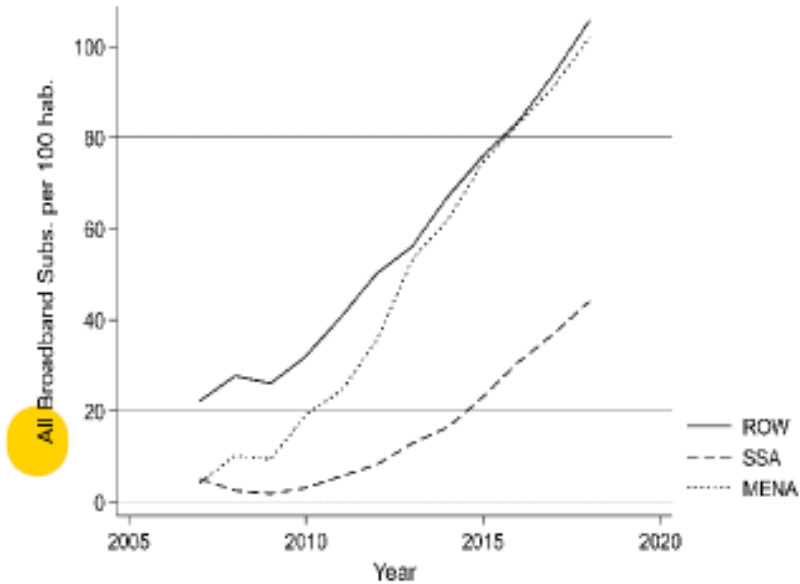
Source: ITU 2020

Source World Bank 2021, chp. 5, figure 10

… But low Network Readiness Score for MENA…

Figure 4: Network Readiness Index (NRI) scores in MENA and SSA
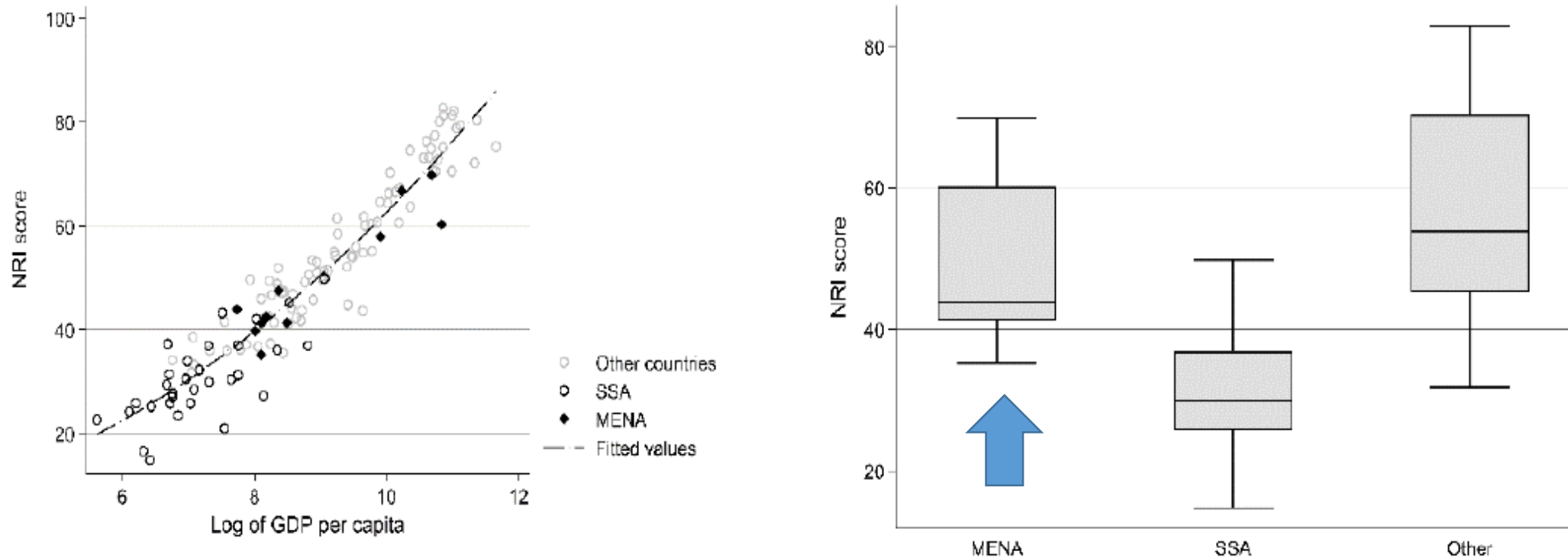
Notes: Scores based on a simple average of scores (number of indices per pillar in parenthesis) over four pillars: Technology (16), people (16), Governance (14), Impact (14). Except for technology, SSA and MENA, figure in the bottom of the regional rankings

Source: Authors' from NRI (2021) data for 132 countries (31 SSA and 14 MENA).

Source: Melo/Solleder (2022a)

…with low digital Trade Potential scores for MENA (1)

Table 1: Digital trade potential scores and ranking, selected Arab countries, 2016-2017 (N=111)

| | Digital infrastructure | | Digital trade potential | | Weighted overall |
	Score	Rank	Score	Rank	rank
UAE	1.014	22	0.045	26	24
Bahrain	0.816	31	-0.592	108	33
Kuwait	0.182	44	-0.406	92	47
Saudi Arabia	-0.176	56	0.192	16	50
Egypt	-0.638	82	0.015	28	70
Jordan	-0.621	77	-0.115	42	74
Lebanon	-0.75	85	-0.113	40	84
Tunisia	-0.623	80	-0.396	89	87
Algeria	-1.158	101	0.035	27	96
Memo items:					
Switzerland	1.894	1	-0.022	30	7
USA	-0.22	58	7.96	1	1
China	-0.788	87	5.054	2	5

Note: Scores derived from a factor analysis of indicators sourced from ITU, World Bank, WEF and UNCTAD: mobile telephone and fixed broadband subscribers per 100 inhabitants, credit card ownership (%), % of credit card owners making at least one digital payment in the past year, quality of logistics services and trade/transport infrastructure (5 point ordinal scale), use of ICT for B2B and B2C transactions (7 point scale), legal framework for consumer protection for online purchases and data protection (yes, no, draft), and GDP, total trade, and final consumption (USD bn).
Source: Ma, Guo and Zhang (2019).

Table 2: EGDI global ranking, 2020

Country	Rank
United Arab Emirates	21
Bahrain	38
Saudi Arabia	43
Kuwait	46
Oman	50
Qatar	66
Tunisia	91
Morocco	106
Egypt	111
Jordan	117
Algeria	120
Lebanon	127
Syrian Arab Republic	131
Iraq	143
Libya	162
Sudan	170
Yemen	173

Source: UN (2020).

EGDI: UN E-government digital index

Source: Hoekman table 1

… low ICT Skills and education outcomes (2)

Table 4: Penetration of population with Basic, Standard, and Advanced Skills, 2020 or latest available year (%)

Country	Basic Skills/1	Standard Skills/2	Advanced Skills/3
Arab countries			
Algeria	18	12	7
Bahrain	63	48	17
Djibouti	17	13	5
Egypt	55	43	11
Iraq	30	1	5
Kuwait		44	15
Morocco	40	28	10
Oman		37	8
Qatar	47	30	5
Saudi Arabia	61	64	21
Sudan	3	2	2
Tunisia	21	17	16
UAE	79	69	17
West Bank and Gaza	13	6	3
Advanced countries			
Finland	74		9
Germany	65		5
Ireland	58	41	7
Japan		49	4
South Korea	72	51	7
Sweden			11
Switzerland			10
United Kingdom	68		7

Source: ITU database, 2021

1/ Basic skills are defined as copying or moving a file or folder, using copy and paste tools, sending emails and attached files, and transferring files between a computer and other devices.

2/ Standard skills include using basic arithmetic formula in a spreadsheet; connecting and installing new devices; creating electronic presentations; and finding, downloading, and configuring software.

3/ Advanced skills would allow writing computer programmes using specialized programming language.

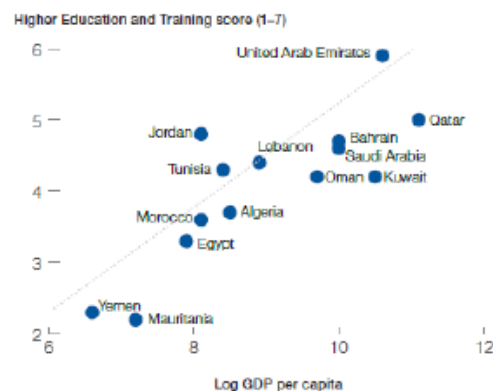Figure 2: Sectoral shares in value-added, Arab world, 1995–2015
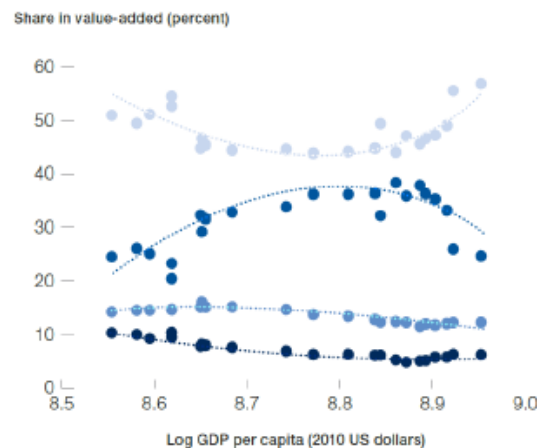
Figure 4: Economic complexity and per capita GDP, 2016

Figure 18: Higher education and training vs income level in the Arab world, 2015

Figure 20: TIMSS score vs income level in the Arab world, 2015
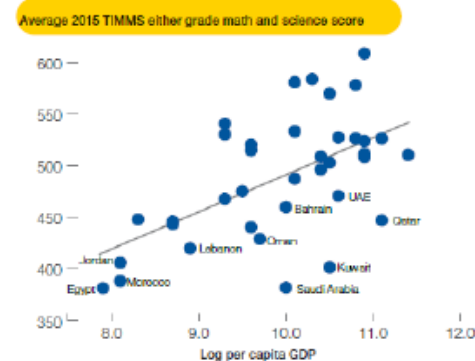
The weight of history

- The low share of 'other services trade' is arresting given closeness to the large, relatively dynamic, EU zone Slow of adoption of ICT by SMEs.
- See comparative trends from Lukonga reproduced here and also deployment of 5G across cities in figure 3.2 of « Artificial Intelligence in emerging markets report » (WB(2020)).
- Can shortcomings of education system (learning by rote), legacy of history and of associated regulatory environment be overcome ?
- **Kuran (2010) pessimistic.** Argues that introduction of islamic law around 1000 BC coincided with the fall of the region as the technological leader in the world (Comin et al. 2010). Powerful brake against modernization that facilitated rise of dictatorships.
- **Hoekman (2021) cautiously optimistic**. The pool of young educated could overcome the weight of crony capitalism, weak links (to disappear with digitalization?) + all the manifestations of the curse-via-politics?
- Ishac to weigh in with his experience…

Late adopters
While internet penetration has improved…
(percent of population)
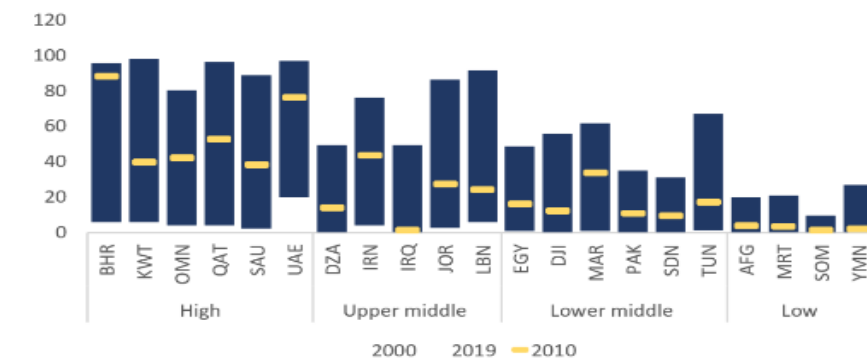
Source: ITU.

…businesses trail individuals and government in embracing digital technology in some Middle East countries.
(index 0-7)
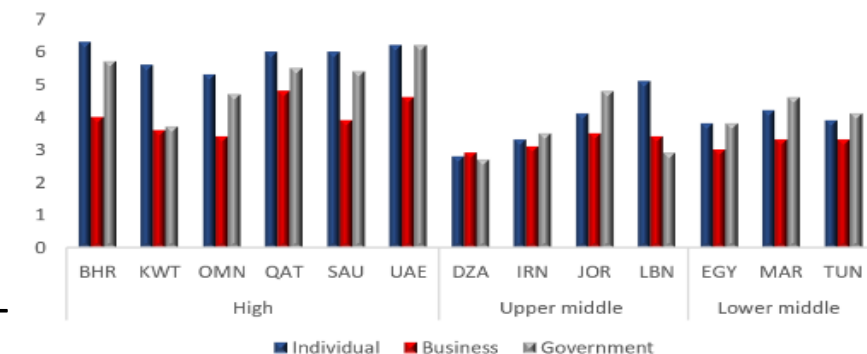
Source: WEF Networked Readiness Index.
Note: BHR = Bahrain; KWT = Kuwait; OMN = Oman; QAT = Qatar; SAU = Saudi Arabia; UAE = United Arab Emirates; DZA = Algeria; IRN = Iran; JOR = Jordan; LBN = Lebanon; EGY = Egypt; MAR = Morocco; TUN = Tunisia.

The climate change challenge

- Hardest-hit region (with SSA) so far (and in future…) by climate change
- Challenges on 2 fronts: adaptation (but also mitigation)
- CO_2 emissions: Vey few MENA countries have started decoupling over 1995-2015 (See annex 2)
- Climate-change (fast and slow onset events) expected to result in :
    - Large productivity losses
    - Increased poverty
    - Exacerbate migratory pressures
- Results at high granularity (5kmx5km level) in annex 2

→Accelerate transition towards solar energy

Final Thoughts

- Regional-level trends suggest MENA specificities have contributed in region having missed the industrialization cum manufactured exports structural transformation of the past observed in Asia.
- Good ICT infrastructure but low DIGITECH combine to present a challenge towards successful digitalisation, at least so far.
- Weight of distant history still a brake on a successful digitalization?
- Recommendations for policy-makers in summary UNDP-ERF report (Fardoust and Nabli (2022)—see list of 8 bottlenecks in annex 1
- Recommendations in EIB report from 5800 firm surveys (Betz et al. (2022))
- Huge climate change challenge ahead (See annex 2)

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Annex 1
Extracts from UNDP-ERF summary report
(Fardoust-Nabli)

Coverage by type of mobile network

Figure 1. Population coverage by type of mobile network, 2021

Population coverage by type of mobile network, 2021*

World	4G (88%) · 3G (7%)
Africa	4G (49%) · 3G (33%) · 2G (7%)
Arab States	4G (70%) · 3G (25%)
Asia & Pacific	4G (96%)
CIS	4G (91%)
Europe	4G (99%)
The Americas	4G (92%)
Developed	4G (99%)
Developing	4G (85%) · 3G (9%)
LDCs	4G (53%) · 3G (30%) · 2G (7%)
LLDCs	4G (53%) · 3G (31%) · 2G (10%)
SIDS	4G (71%) · 3G (19%)
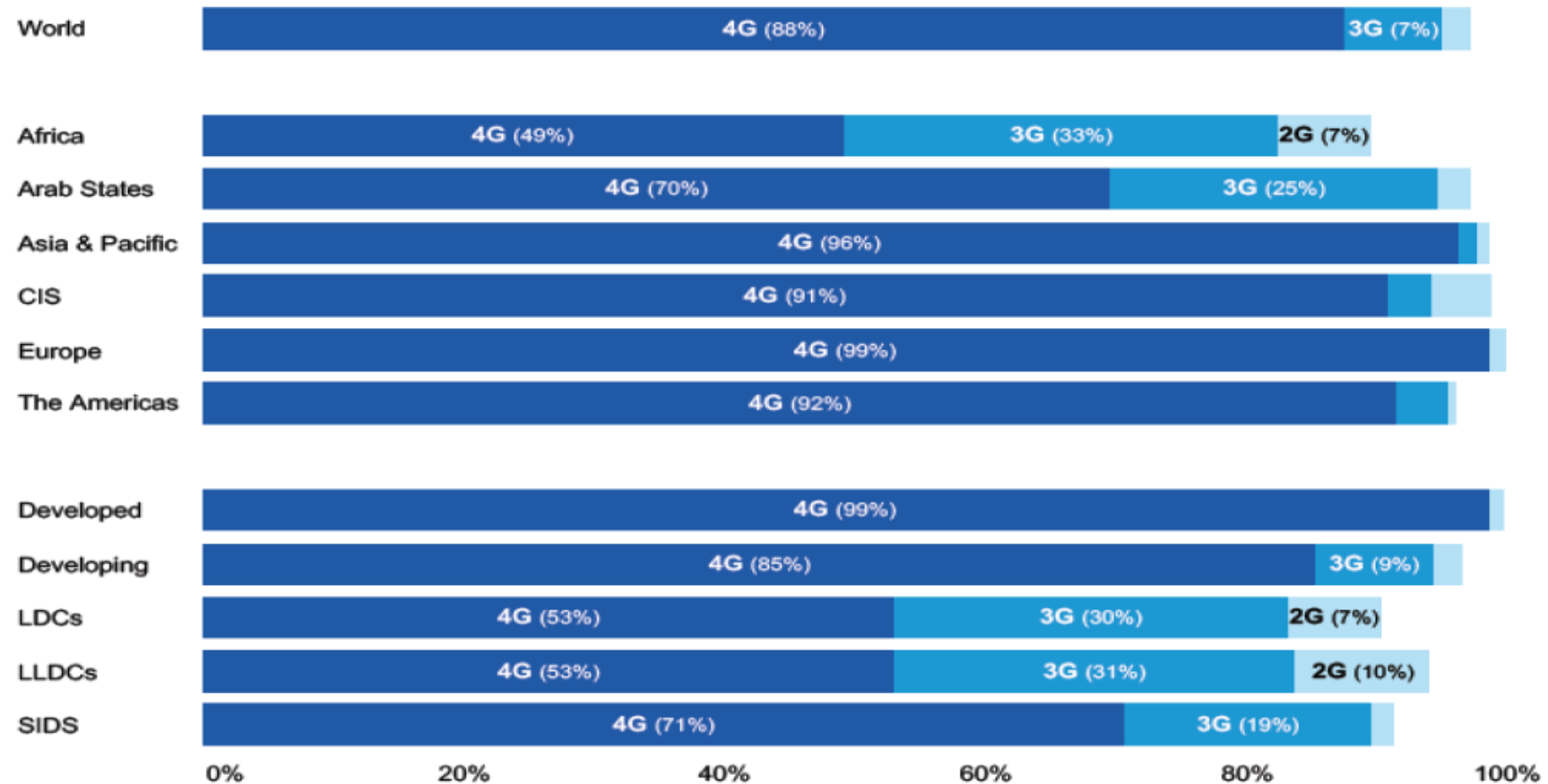
The Gender usage gap by region highest in MENA

The Internet user gender parity score (%), 2013 and 2019*

Gender Parity (0.98-1.02)

World: 2013 0.89 / 2019 0.87
Africa: 0.79 / 0.54
Arab States: 0.81 / 0.77
Asia & Pacific: 0.83 / 0.86
CIS: 0.92 / 0.97
Europe: 0.91 / 0.94
The Americas: 1.00 / 1.01

* ITU estimate. - Source: ITU
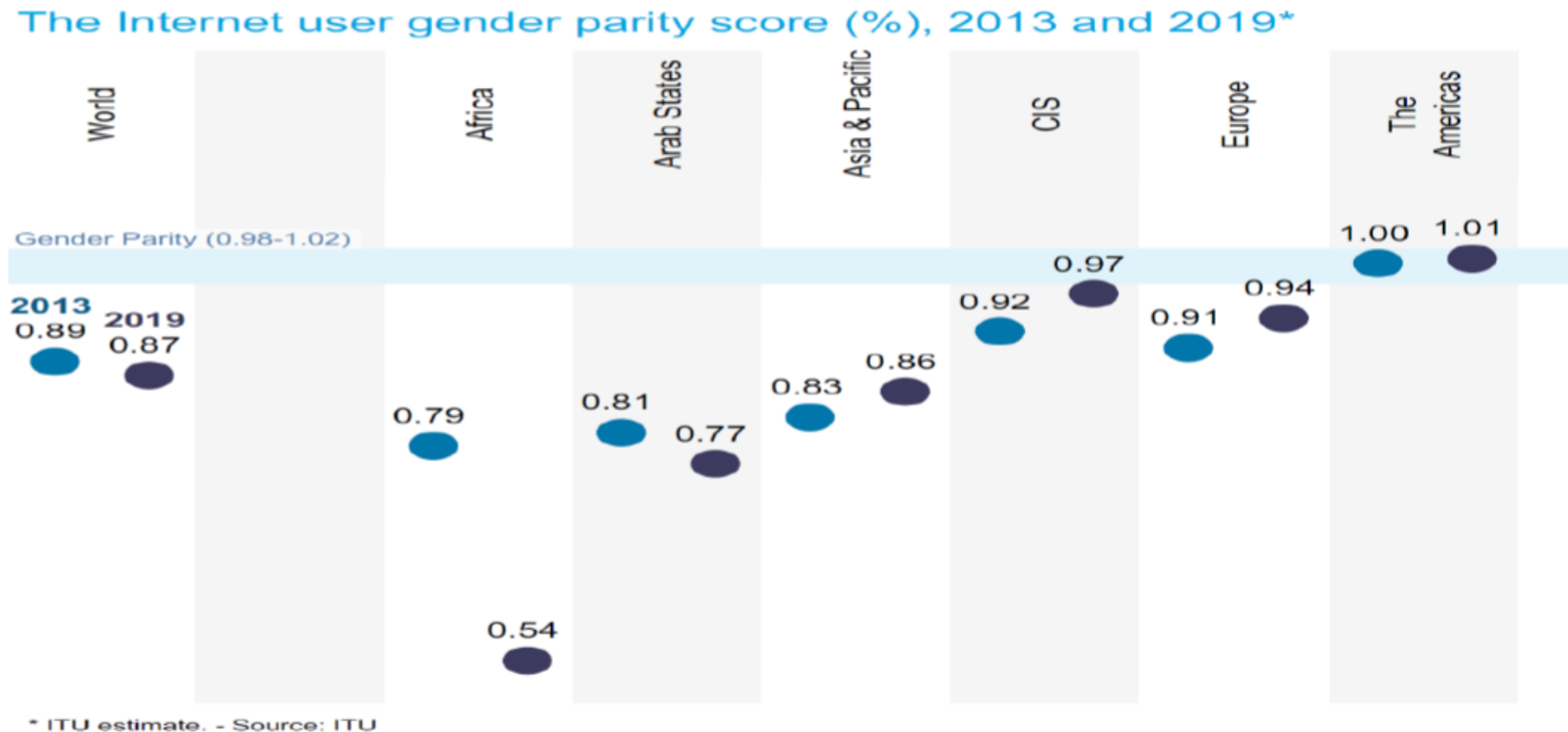
Source: International Telecommunications Union, *Measuring Digital Development: Facts and Figures 2020* (Geneva), https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2020.pdf.

Note: The gender parity score is calculated as the proportion of women who use the Internet divided by the proportion of men using the Internet. A value smaller than 1.0 indicates that men are more likely to use the Internet than women.

Internet usage challenges

8 major bottlenecks on usage
UNDP-ERF summary

(Fardoust-Nabli)

Table 2: Digitalization and individuals (latest data as of January 2021)

Country	Internet connections % of population	Active social media users % of population	Mobile connections % of population
Sweden	98.0	82.1	141.6
USA	90.0	72.3	106.6
S Korea	97.0	89.3	118.3
Ireland	91.0	76.4	94.6
Malaysia	84.2	86.0	122.8
China	65.2	64.6	118.8
Chile	82.3	83.5	132.1
Turkey	77.7	70.8	90.8
Brazil	75.0	70.3	96.3
Vietnam	70.3	73.7	157.9
Kenya	40.0	20.2	108.9
India	45.0	32.3	79.0
Rwanda	31.4	6.5	73.9
UAE	99.0	99.0	171.5
Qatar	99.0	98.8	160.6
Saudi Arabia	95.7	79.3	112.7
Bahrain	99.0	87.0	128.9
Oman	95.2	80.2	110.7
Kuwait	99.0	98.8	161.4
Jordan	66.8	61.5	78.2
Egypt	57.3	47.4	92.7
Lebanon	78.2	64.3	67.3
Tunisia	66.7	69.0	150.0
Morocco	74.4	59.3	117.1
Algeria	59.6	56.5	105.8
Yemen	26.7	10.6	60.4
Iraq	75.0	61.4	98.3
Syria	47.0		79.6
Source: DataReportal 2021 January			

1. Human capital, skills, and labour markets
2. Digital divides differences in access
3. The challenge of e-government
4. Digital technology adoption by businesses and innovation
5. Regional and global regulatory challenges
6. Taxation and regulation of digital transactions
7. Competition and regulations
8. Cybersecurity, privacy, and data protection
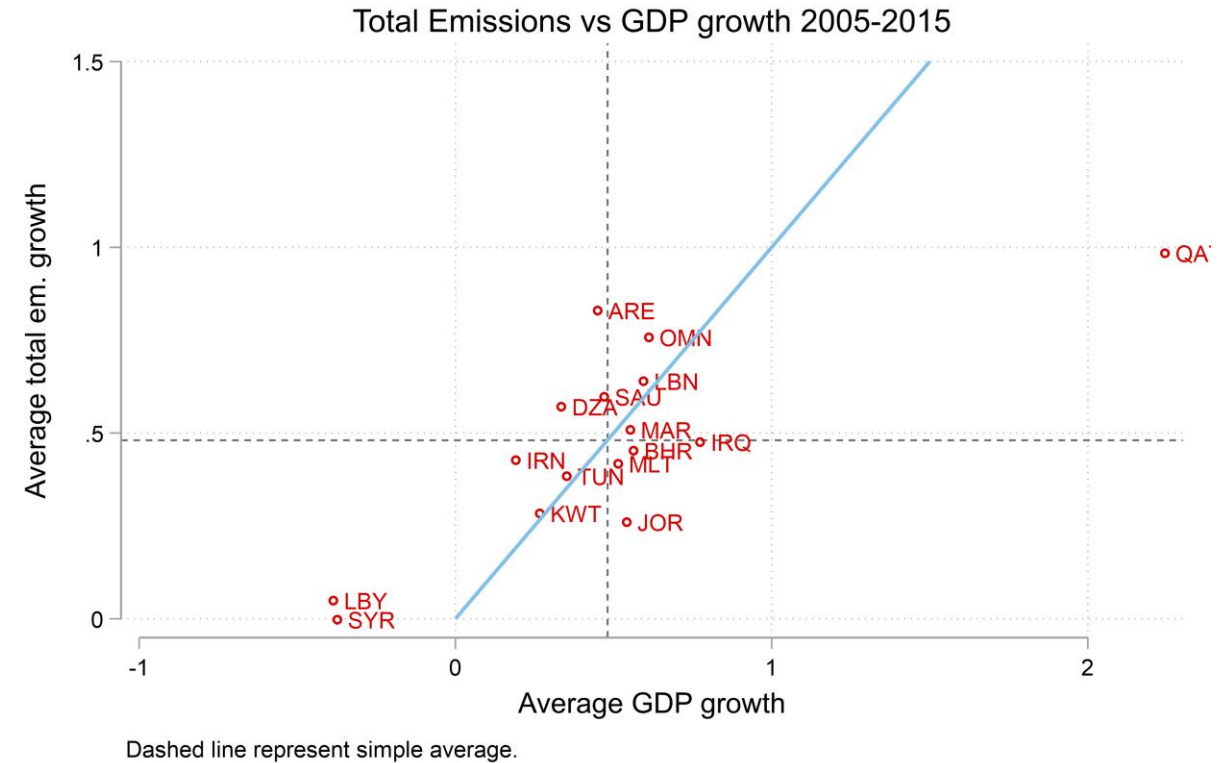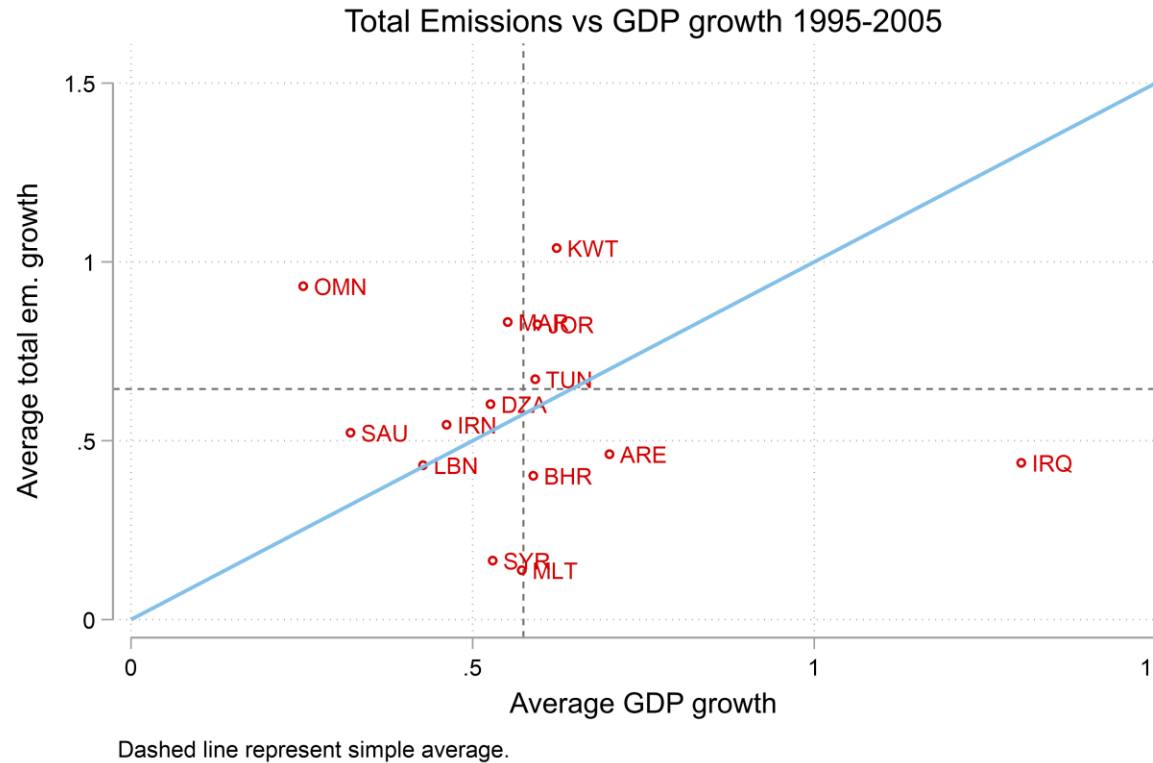
Table 3: Labour productivity growth (%), 1992–2019.

Country	Labor productivity growth (%) 1992-2000	2001-2010	2011-2019
Sweden	3.22	1.61	0.75
USA	1.98	1.66	0.8
S Korea	5.1	3.47	1.54
Ireland	3.13	1.97	4.45
Malaysia	3.56	2.01	2.18
China	8.78	9.62	6.98
Chile	4.4	1.45	0.97
Turkey	2.98	2.77	2.67
Brazil	0.4	1.44	-0.15
Vietnam	5.16	4.27	4.97
Kenya	-1.42	1.22	1.53
India	3.68	4.96	5.47
Rwanda	-1.09	5.2	4.12
UAE	-1.42	-8.81	2.66
Qatar		-1.84	-0.57
Saudi Arabia	-1.37	-0.99	-0.91
Bahrain	1.29	-3.25	-0.28
Oman	1.66	-2.82	-4.34
Kuwait		-0.2	-2.67
Jordan	-0.53	2.15	-0.77
Egypt	2.2	1.58	2.78
Lebanon	1.73	2.04	-3.56
Tunisia	2.26	2.24	1.15
Morocco	-0.12	2.53	2.83
Algeria	0.44	-0.91	1.22
Iraq	11.69	0.55	1.65
Libya		1.39	-4.85

Annex 2
Sustainability vignettes
(extracts from Melo/Solleder (2022b) and Burzynski et al. 2022)

Limited CO2 Decoupling across MENA over 1995-2015

Total Emissions vs GDP growth 1995-2005

Total Emissions vs GDP growth 2005-2015

Dashed line represent simple average.

- Vertical lines show average GDP growth
- Horizontal lines show average CO2 emission growth
- **Countries below 45 deg are decarbonizing**
- Intersection of average growth lines below (above) 45 deg. Line indicate region is decoupling (coupling)

Source: Melo and Solleder (2022b)

CO2 emissions growth decomposition across MENA1995-2015

Countries ranked by descending order of scale.
- Scale represents 100 times output in 2015 divided by output in 1995.
- Scale + composition modifies the scale value to keep technique (emission rate) constant for each (country*sector), i.e. as it was in 1995.
- Scale +composition + technique represents 100 times emissions in 2015 divided by emissions in 1995.

→Vertical line at "change in emissions" = 100 (not shown) represents the value of no change in emissions between 1995 and 2015.

☐ Even excluding IRQ, very large increases in CO2 emissions across all countries in MENA (also among the highest across all regions)

☐ Mitigation,an urgency (see Kelley et al. 2015 on drought). Solar an obvious part of solutiontowards resustainable growth
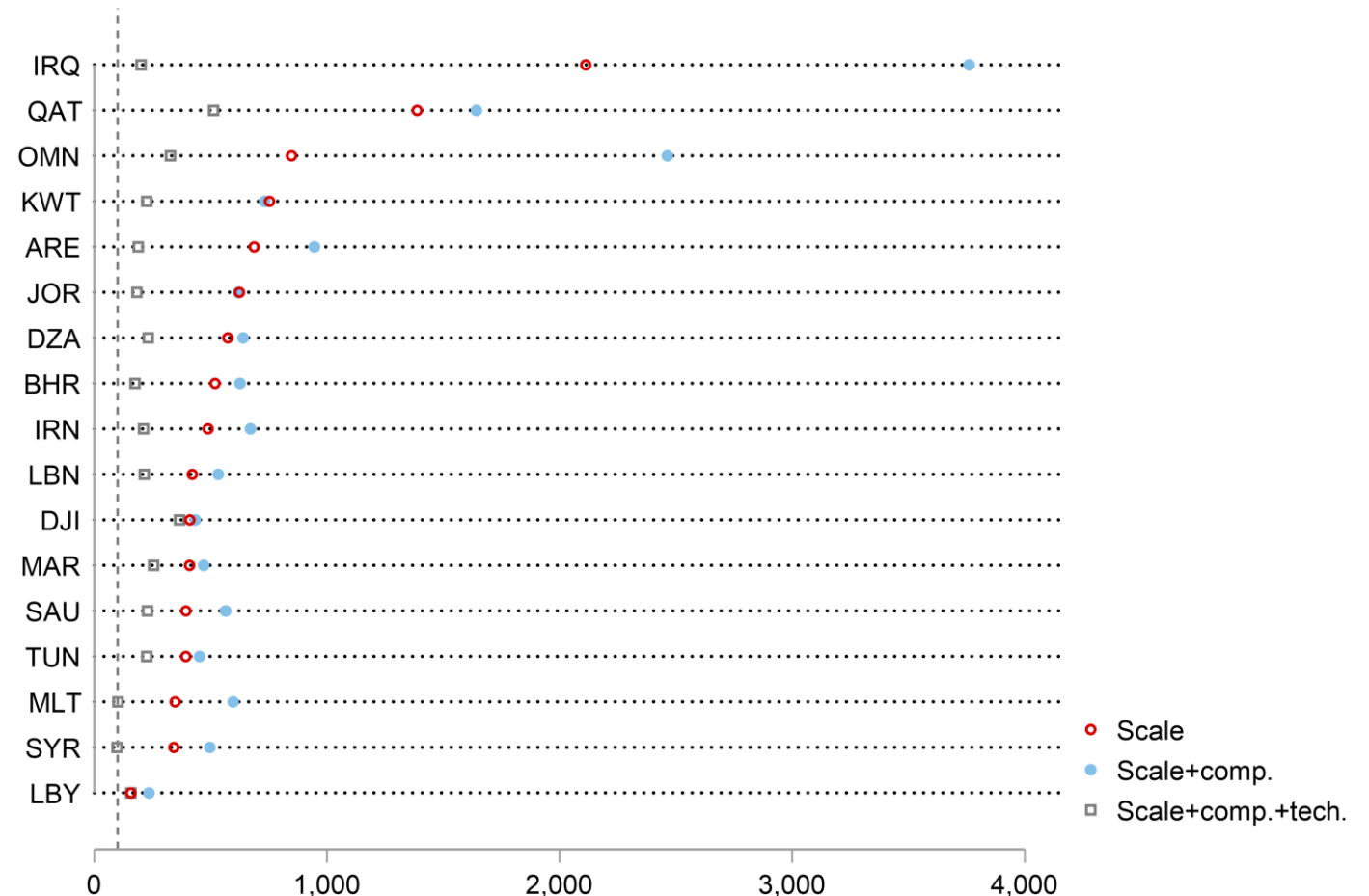
Source: Melo and Solleder (2022b)

Climate-change-migration-poverty (1)

Abstract

This paper investigates the long-term implications of climate change on global migration and inequality. Accounting for the effects of changing temperatures, sea levels, and the frequency and intensity of natural disasters, we model the impact of climate change on productivity and utility in a dynamic general equilibrium framework. By endogenizing people's migration decisions across millions of 5 × 5 km spatial cells, our approach sheds light on the magnitude and dyadic, education-specific structure of human migration induced by global warming. We find that climate change strongly intensifies global inequality and poverty, reinforces urbanization, and boosts migration from low- to high-latitude areas. Median projections suggest that climate change will induce a voluntary and a forced permanent relocation of 62 million working-age individuals over the course of the 21st century. Overall, under current international migration laws and policies, only a small fraction of people suffering from the negative effects of climate change manages to move beyond their homelands. We conclude that it is unlikely that climate shocks will induce massive international flows

- RCP (2021) scenarios in 2-sectors (rural-Urban), 2 class (HS-LS) workers live 2 periods.
- OLG model projected over 4 periods (2010,2040,2070,2100)
- Shocks: Slow Onset (SO) (temperature) + Sea Level Rise (SLR) and Fast onset (FO) (i.e. Natural disasters, heat waves, FO- induced conflict)
- 3 types of migration: (i) forced from SLR; (ii) regional;(iii) international (to OECD countries)

Source: Burzinski et al. (2022)

Climate-change-migration-poverty (2)

TABLE 3. Aggregate effects of SO, SLR, and FO shocks on the world economy (percentage changes).

Continent/		GDP			Population			HS share			Urbanization			Emigration shares		
Scenario		'40	'70	'00	'40	'70	'00	'40	'70	'00	'40	'70	'00	'40	'70	'00
AFR	RCP4.5	−14.5	−25.7	−27.8	−0.3	−0.6	−0.9	−0.9	−1.0	−1.1	0.3	1.9	1.4	7.0	6.0	7.0
	RCP7.0	−14.9	−30.9	−40.1	−0.3	−0.7	−1.2	−1.0	−1.1	−1.0	0.4	2.6	2.4	7.5	9.3	14.9
	RCP8.5	−18.2	−39.2	−51.8	−0.4	−0.9	−1.7	−1.2	−1.5	−1.5	0.5	3.2	2.9	8.7	14.2	22.8
ASI	RCP4.5	−7.9	−15.7	−19.2	−0.2	−0.6	−1.2	−0.3	−3.1	−4.2	−0.4	−0.3	0.4	6.2	5.9	6.9
	RCP7.0	−7.8	−18.3	−25.8	−0.2	−0.7	−1.6	−0.3	−3.2	−4.5	−0.4	−0.1	1.2	6.2	7.9	15.2
	RCP8.5	−10.1	−23.8	−33.4	−0.3	−1.1	−2.4	−0.5	−3.7	−5.1	−0.3	0.4	2.5	8.5	15.7	30.8

- MENA is a mix of Africa and Asia.
- Changes are from a simulated growth path with no climate change
- Paper based on extensive—and most recent—projections of geography of temperature rise (SO), productivity effects on agriculture and on FO events
- Robust result. MENA countries are all located in the 2 regions with the largest expected climate-change-induced shocks over the century.

Climate-change-migration-poverty (3)

Policy scenarios (with SO+SLR+FO)
Changes relative to a no-CC scenario over 2010-2100

- Closing all borders: No international migration
→ Internal migration up by factor of 10

- More open borders: Reduct by half international migration costs
→ International migration up by 50%

- Conflict: 10-20% GDP loss in 20 most vulnerable countries with food price ↑↑ (see Kelley et al. 2015 for motivational evidence)
→ All migration up by 33%