Measuring the Digital Economy and its role in Trade and Global Value Chains

9 December 2021

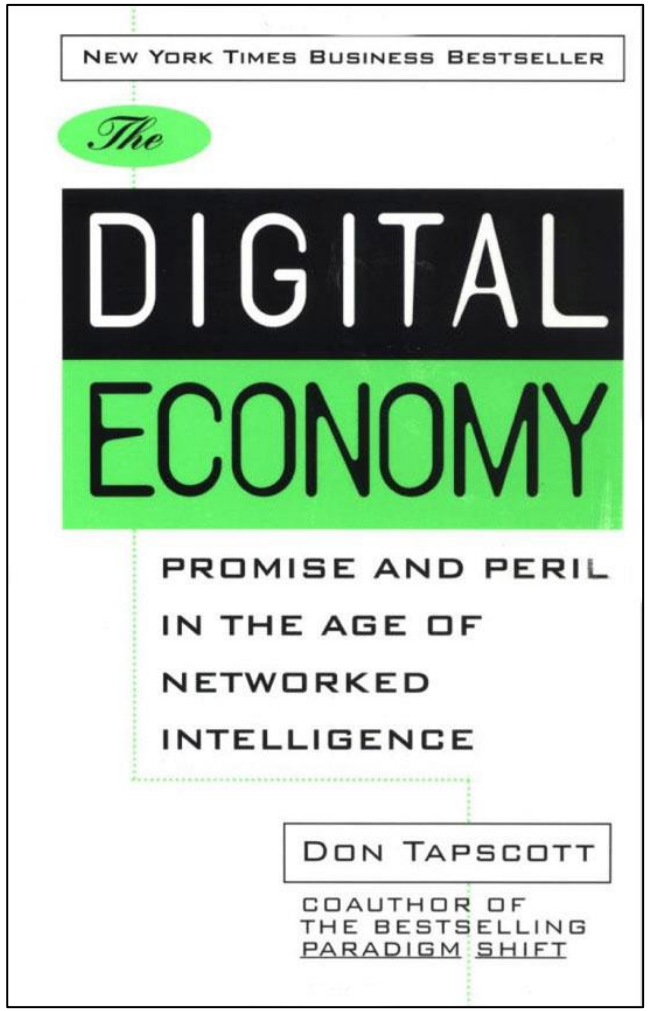
Asian Development Bank

Outline of Discussion

- Defining Digital Economy
- Digital Economy Measurement Framework
- Framework Estimates
- Digital Economy and GVCs
- Digital Economy during COVID-19
- Conclusion

Defining Digital Economy

The Digital Economy

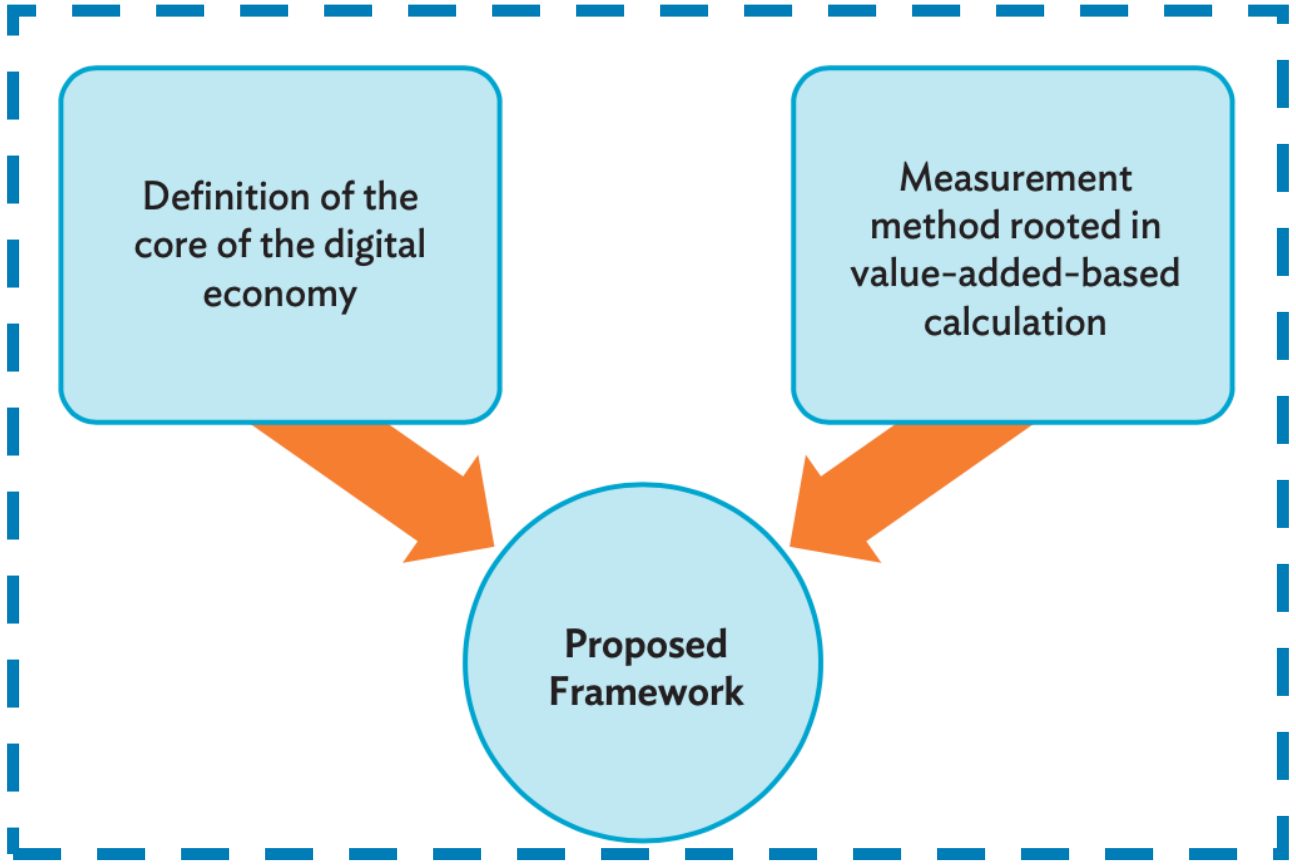


Source: https://dontapscott.com/books/the-digital-economy/

- The term "digital economy" is believed to have been coined by Don Tapscott in his 1996 publication.

- Since then, proposed definitions of the digital economy have evolved and grown in number, and these have varied in concreteness and differed in classification systems (Bukht and Heeks 2017).

Proposed Framework



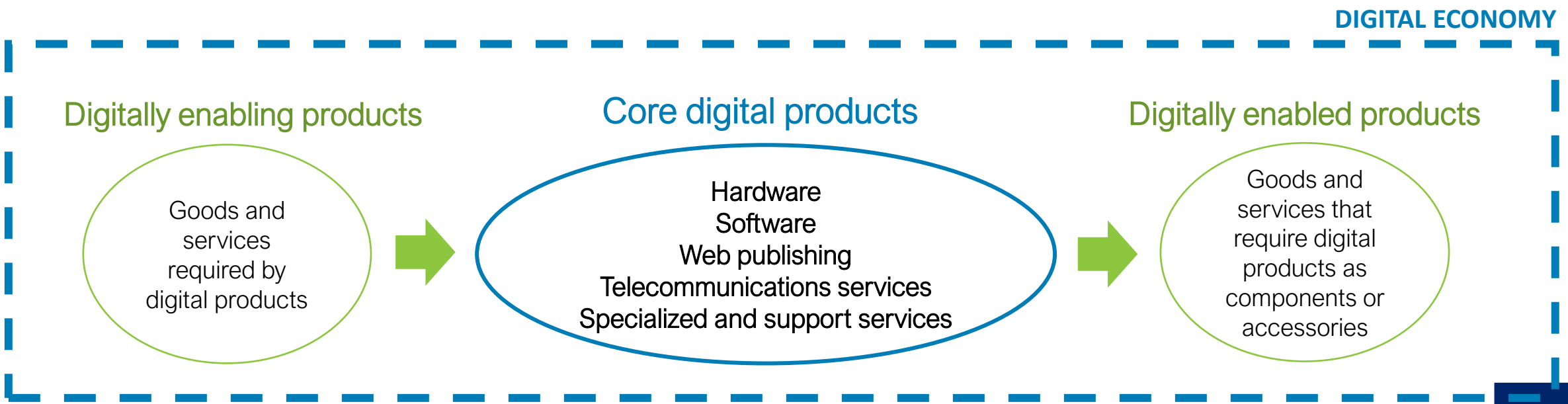
UNIFORM, HARMONIZED, AND COMPARABLE DATA

Source: Graphics generated by the Digital Economy Measurement Framework study team.

Contribution to the GDP of any exchange or flow of economic value involving digital products and/or industries

The Digital Economy

- The centerpiece to the definition of the digital economy is the identification of specific digital products and industries.
- Core digital products / industries are those products / industries with the main function of generating, processing and/or storing digitized data.



Main Digital Product Groups, Central Product Classification Version 2

Main Activity Group	Code	Product
Hardware	452	Computing machinery and parts and accessories thereof
	475	Disks, tapes, solid-state nonvolatile storage devices, and other media, not recorded
Software publishing	38582	Software cartridges for video game consoles
	478	Packaged software
	83143	Software originals
	8434	Software downloads
	84391	Online games
	84392	Online software
Web publishing	83633	Sale of internet advertising space (except on commission)
	843	Online content[a]
Telecommunications services	841	Telephony and other telecommunications services
	842	Internet telecommunications services
Specialized and support services	8313	IT consulting and support services
	83141	IT design and development services for applications
	83142	IT design and development services for networks and systems
	8315	Hosting and IT infrastructure provisioning services
	8316	IT infrastructure and network management services

IT = information technology.

[a] Excluding items under Central Product Classification Version 2, 843 already counted under Software Publishing – 8434, 84391, 84392.

Source: Methodology of the Digital Economy Measurement Framework study team, using United Nations' Central Product Classification: Version 2 (2008).

Measuring Digital Economy

Selecting Data Sources

Principal Data Sources

- National supply and use tables (SUTs)
- National input-output tables (NIOTs)
- World Input-Output Database (WIOD)
  - 44 economies, 56 sectors, years 2000 to 2014
- Asian Development Bank Multiregional Input-Output Tables (ADB MRIOTs)
  - 63 economies, 35 sectors, years 2000 and 2007 to 2019

Challenges for National Estimates

- For national estimates, the uniformity across national tables is a challenge.
  - Correspondence in classification systems
  - Harmonization in table presentation format
  - Comparability in price and valuation

Disaggregating Products and Industries

- For tables with less than the desired level of detail, isolation of the exact digital activities identified in our framework is crucial.
- Finding the most credible source of data for disaggregating sectors is a data integration challenge.

Data Sources for Disaggregating Sectors

Source of Data	Merits	Drawbacks and/or Caveats
National statistics office	Highly reliable data consistent with the construction of SUT	Dependent on public availability of data or the NSO's responsiveness to queries
Relevant journals and published reports	Alternative of sourcing out if primary data are not available	Finding consistent and reliable data may be time-consuming, if even available
Supply table	Readily available in the SUT	Applies only if the desired degree of disaggregation among sectors is present
Operating revenue data from credible data resources	Readily available given permissions to access certain databases	May be limited by the amount of data collected by the resource
Data from donor economy	Based on an actual economy's industry disaggregation	Requires some degree of similarity in terms of structure between the two economies
Number of establishments from credible data resources	Readily available given permissions to access certain databases	Bias from an assumption of homogeneity

NSO = national statistics office, SUT = supply and use table.
Source: R. Consing III, M. Barsabal, J. Alvarez, and M. Mariasingham. 2020. The Wellness Economy, A Comprehensive System of National Accounts Approach. *Asian Development Bank Economics Working Paper* Series. No. 631. Manila: Asian Development Bank.

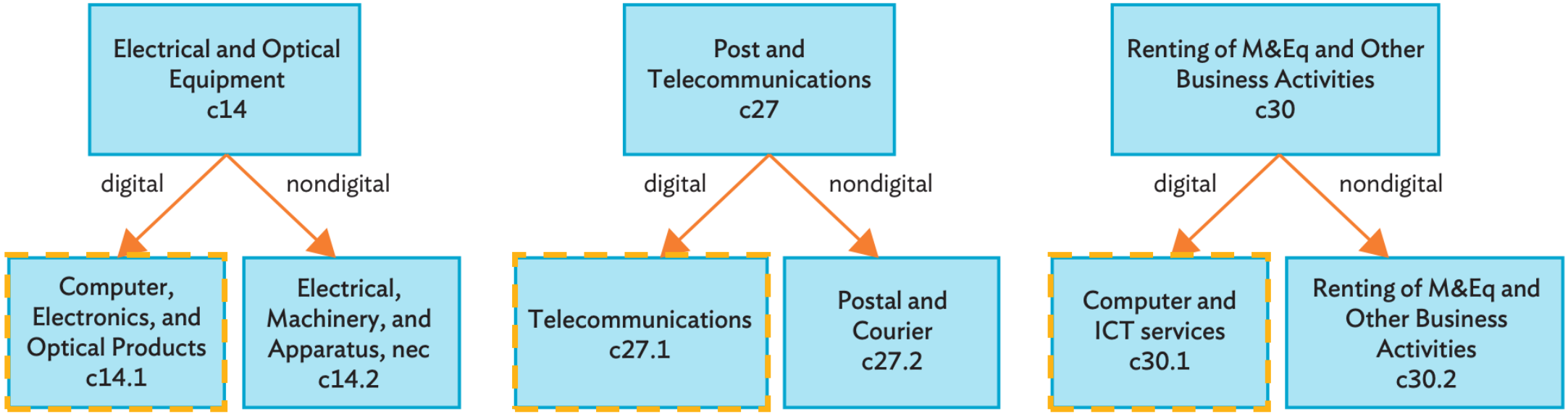
Data Used for Digital Economy Estimations per Economy

Economy	Year(s) Used for Estimation	Source(s) of IOT, SUT and/ or Related Data	Disaggregation Data Source(s)	No. of Industries	No. of Digital Industries Identified (Total or disaggregated from total)
Australia	2010, 2018	Australian Bureau of Statistics	Orbis, OECD	114	4
Canada	2012, 2016	Statistics Canada	Statistics Canada	236 (2012), 240 (2016)	7
Denmark	2010, 2016	Statistics Denmark	Orbis, Statistics Denmark	117	5
Fiji	2011	Fiji Bureau of Statistics	Orbis, Fiji Bureau of Statistics	50	4
Germany	2010, 2016	Federal Statistical Office of Germany	Orbis	72	4
India	2010, 2014	World Input-Output Database	Orbis, Ministry of Statistics & Programme Implementation (Government of India)	56	4
Indonesia	2010, 2014	World Input-Output Database	Orbis, Thailand data, SUT	56	4
Japan	2000, 2005, 2011, 2015	e-Stat - Statistics Bureau, Ministry of Internal Affairs and Communications	None	104 (2000), 108 (2005 and 2011), 107 (2015)	4 (2000), 5 (2005-2015)
Kazakhstan	2001, 2010, 2018	Committee on Statistics of the Republic of Kazakhstan	Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan	72	3
Malaysia	2010, 2015	Department of Statistics Malaysia	SUT, Thailand data	86 (2010) , 124 (2015)	5 (2010), 5 (2015)
People's Republic of China	2012	National Bureau of Statistics of China	Orbis, National Bureau of Statistics of China	64	5
Republic of Korea	2010, 2018	Economics Statistics System - Bank of Korea	Statistics Korea	161 (2010), 165 (2018)	5 (2010), 5 (2018)
Singapore	2000, 2016	Singapore Department of Statistics	Orbis, SUT	152 (2000), 105 (2016)	3 (2000), 5 (2016)
Taipei,China	2016	Directorate-General of Budget Accounting and Statistics	None	164	4
Thailand	2010, 2015	National Statistics Office of Thailand	Orbis	180	5
United States	2010, 2019	U.S. Bureau of Economic Analysis	U.S. Bureau of Economic Analysis, Canada IOTs	71	5

IOT = input-output table, OECD = Organisation for Economic Co-operation and Development, SUT = supply and use table, US = United States
Source: Construction of the Digital Economy Measurement Framework study team.

ADB

Disaggregating MRIOTs



ICT = information and communication technology, M&Eq = machinery and equipment, nec = not elsewhere classified.
Source: Methodology of the Digital Economy Measurement Framework study team.

Measuring Digital Economy

Measurement Framework

ADB

Measurement Framework

- Rooted in input-output analysis, using the $\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}$ matrix:
  - $\mathbf{v}$ – direct value-added coefficient vector
  - $\mathbf{B}$ – Leontief inverse matrix $(\mathbf{I}-\mathbf{A})^{-1}$
  - $\mathbf{y}$ – final demand vector

- Digital GDP equation:

$$\mathrm{GDP}_{\mathrm{digital}} = \underbrace{\mathbf{i}^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\boldsymbol{\varepsilon}_1}_{1} + \underbrace{\mathbf{i}^{\mathrm{T}}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{2} - \underbrace{[\mathrm{diag}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})]^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{3} + \underbrace{(\mathbf{i}-\boldsymbol{\varepsilon}_1)^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}}\boldsymbol{\varepsilon}_2}_{4}$$

Theoretical Framework

- Assume that industry 1 is the digital sector.
- Term 1: $\mathbf{i}^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\boldsymbol{\varepsilon}_1$ represents the backward linkage of the digital sector

$$\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}} = \begin{bmatrix} v_1 b_{11} y_1 & v_1 b_{12} y_2 & \cdots & v_1 b_{1n} y_n \\ v_2 b_{21} y_1 & v_2 b_{22} y_2 & \cdots & v_2 b_{2n} y_n \\ \vdots & \vdots & \ddots & \vdots \\ v_n b_{n1} y_1 & v_n b_{n2} y_2 & \cdots & v_n b_{nn} y_n \end{bmatrix}$$

$$\mathrm{GDP}_{\mathrm{digital}} = \underbrace{\mathbf{i}^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\boldsymbol{\varepsilon}_1}_{1} + \underbrace{\mathbf{i}^{\mathrm{T}}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{2} - \underbrace{[\mathrm{diag}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})]^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{3} + \underbrace{(\mathbf{i} - \boldsymbol{\varepsilon}_1)^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}}\boldsymbol{\varepsilon}_2}_{4}$$

Theoretical Framework

- Assume that industry 1 is the digital sector.
- Term 2: $\mathbf{i}^{\mathrm{T}}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})^{\mathrm{T}}\boldsymbol{\varepsilon}_1$ represents the forward linkage of the digital sector

$$\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}} = \begin{bmatrix} v_1 b_{11} y_1 & v_1 b_{12} y_2 & \cdots & v_1 b_{1n} y_n \\ v_2 b_{21} y_1 & v_2 b_{22} y_2 & \cdots & v_2 b_{2n} y_n \\ \vdots & \vdots & \ddots & \vdots \\ v_n b_{n1} y_1 & v_n b_{n2} y_2 & \cdots & v_n b_{nn} y_n \end{bmatrix}$$

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Theoretical Framework

- Assume that industry 1 is the digital sector.
- Term 3: $-[\mathrm{diag}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})]^{\mathrm{T}}\boldsymbol{\varepsilon}_1$ represents the double-counted term

$$\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}} = \begin{bmatrix} v_1 b_{11} y_1 & v_1 b_{12} y_2 & \cdots & v_1 b_{1n} y_n \\ v_2 b_{21} y_1 & v_2 b_{22} y_2 & \cdots & v_2 b_{2n} y_n \\ \vdots & \vdots & \ddots & \vdots \\ v_n b_{n1} y_1 & v_n b_{n2} y_2 & \cdots & v_n b_{nn} y_n \end{bmatrix}$$

$$\mathrm{GDP}_{\mathrm{digital}} = \underbrace{\mathbf{i}^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\boldsymbol{\varepsilon}_1}_{1} + \underbrace{\mathbf{i}^{\mathrm{T}}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{2} - \underbrace{[\mathrm{diag}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})]^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{3} + \underbrace{(\mathbf{i}-\boldsymbol{\varepsilon}_1)^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}}\boldsymbol{\varepsilon}_2}_{4}$$

Theoretical Framework

- Assume that industry 1 is the digital sector.
- Term 4: $(\mathbf{i} - \boldsymbol{\varepsilon}_1)^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}}\boldsymbol{\varepsilon}_2$ represents fixed capital investments by the digital sector in goods produced by non-digital industries

$$\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}} = \begin{bmatrix} v_1 b_{11} y_1 r_1 & v_1 b_{12} y_2 r_2 & \cdots & v_1 b_{1n} y_n r_n \\ v_2 b_{21} y_1 r_1 & v_2 b_{22} y_2 r_2 & \cdots & v_2 b_{2n} y_n r_n \\ \vdots & \vdots & \ddots & \vdots \\ v_n b_{n1} y_1 r_1 & v_n b_{n2} y_2 r_2 & \cdots & v_n b_{nn} y_n r_n \end{bmatrix}$$

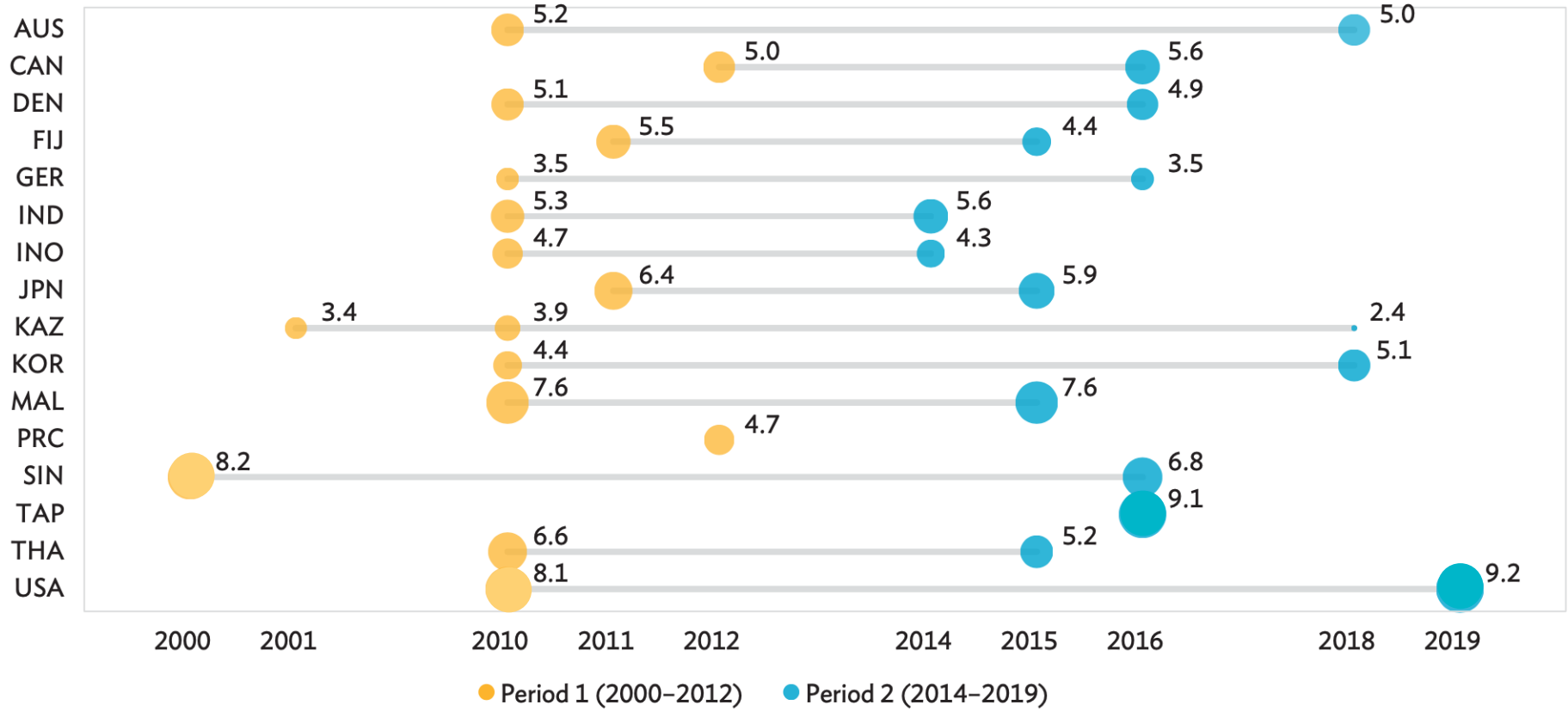
$\hat{\mathbf{r}}$ – diagonalized vector of ratios of gross fixed capital formation (GFCF) used by the digital industry to the corresponding final demand

$$\mathrm{GDP}_{\mathrm{digital}} = \underbrace{\mathbf{i}^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\boldsymbol{\varepsilon}_1}_{1} + \underbrace{\mathbf{i}^{\mathrm{T}}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{2} - \underbrace{[\mathrm{diag}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})]^{\mathrm{T}}\boldsymbol{\varepsilon}_1}_{3} + \underbrace{(\mathbf{i} - \boldsymbol{\varepsilon}_1)^{\mathrm{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}}\boldsymbol{\varepsilon}_2}_{4}$$

Framework Estimates

Digital GDP

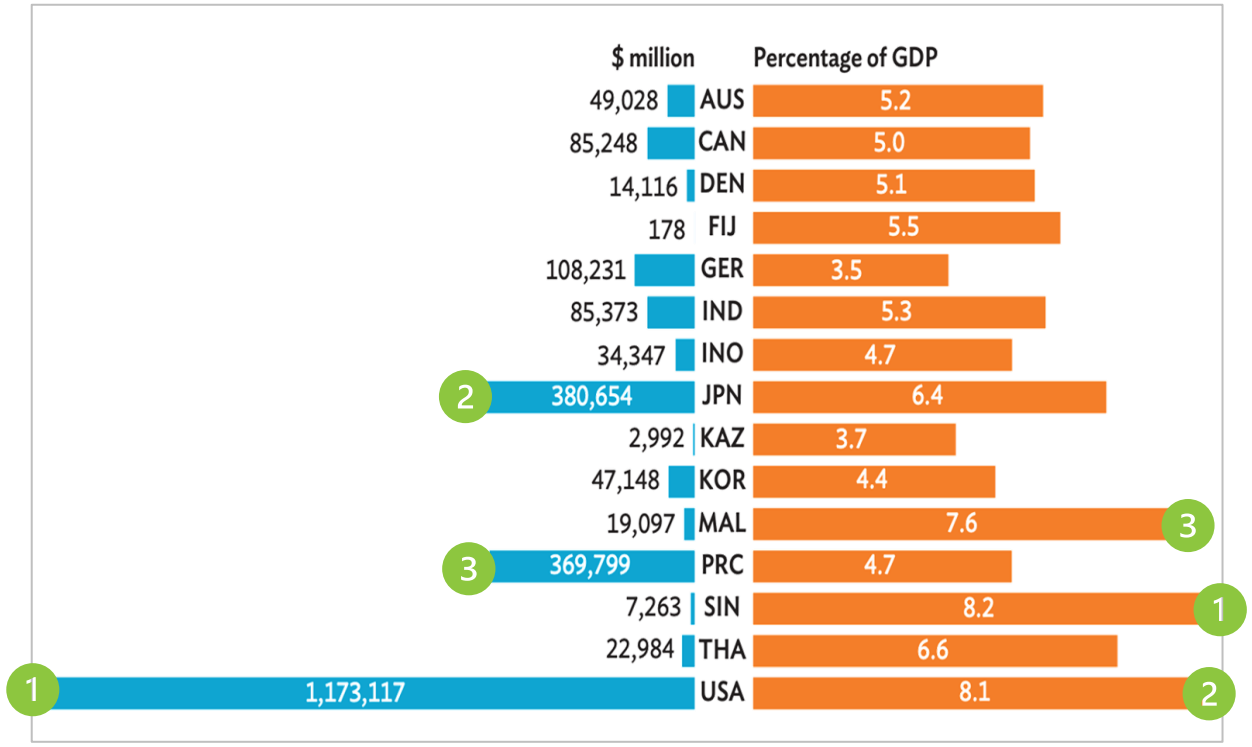
Digital Economy as a Proportion of Total Economy
(% of gross domestic product)



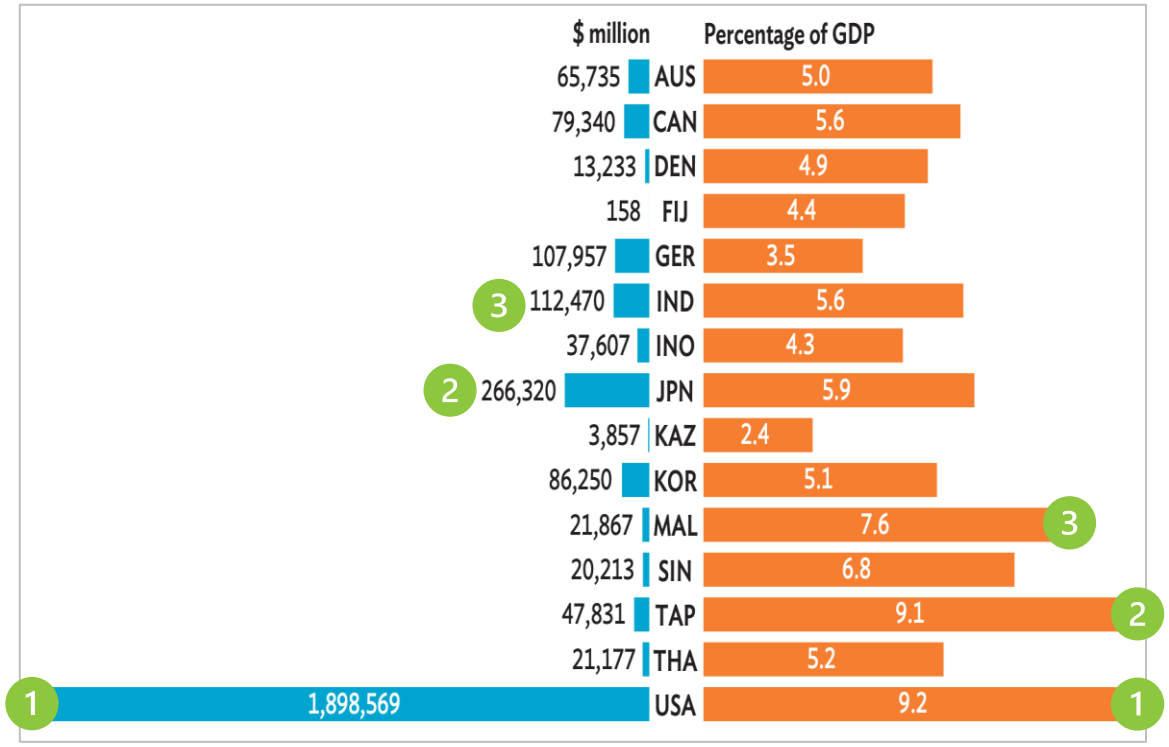
AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.
Note: Point size reflects size of the digital economy.
Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Size of the digital economy

Period 1 (2000 to 2012)

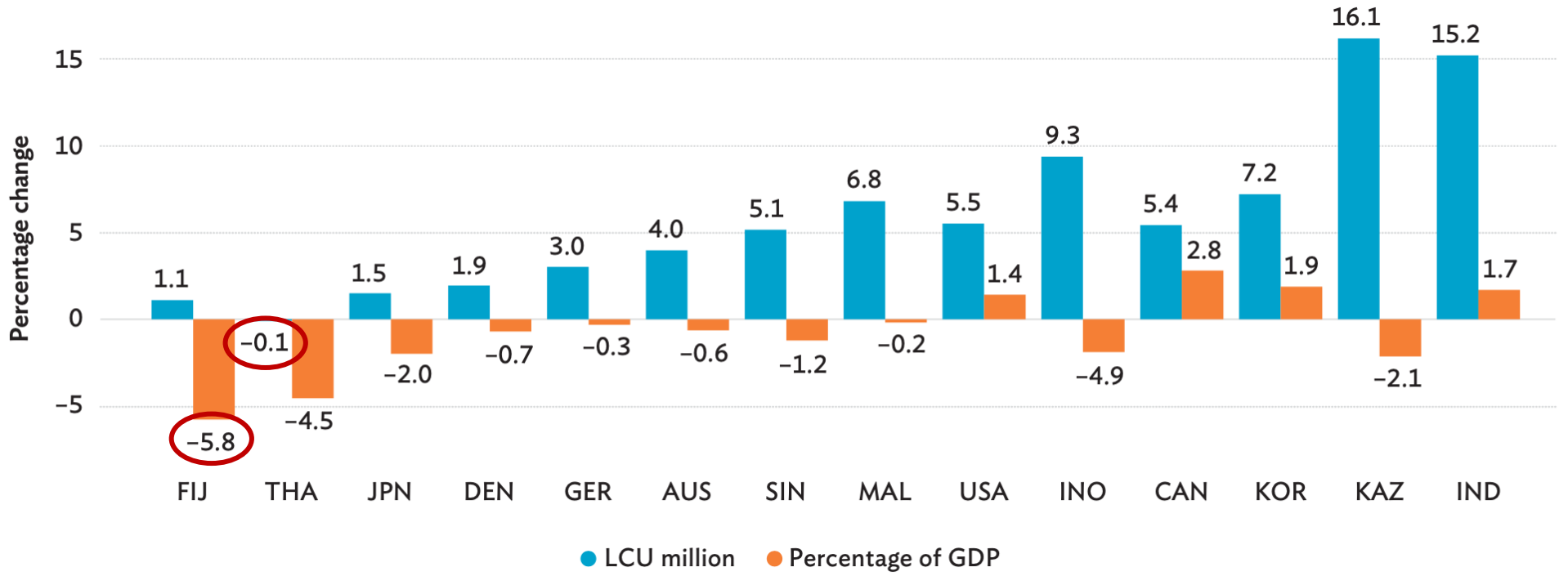


Period 2 (2014 to 2019)



$ = United States dollars; AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GDP = gross domestic product; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.
Notes: Period 1 = 2007 to 2012. Period 1 for AUS, 2010; CAN, 2012; DEN, 2010; FIJ, 2011; GER, 2010; IND, 2010; INO, 2010; JPN, 2011; KAZ, 2001, 2010; KOR, 2010; MAL, 2010; PRC, 2012; SIN, 2000, THA, 2010; and USA, 2010. Period 2 = 2014 to 2019. Period 2 for AUS, 2018; CAN, 2016; DEN, 2016; FIJ, 2015; GER, 2016; IND, 2014; INO, 2014; JPN, 2018; KAZ, 2018; KOR, 2018; MAL, 2015; SIN, 2015; TAP, 2016; THA, 2015; and USA, 2019. The average is presented in economies for which calculations include multiple years.
Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Compound Annual Growth Rates of the Digital Economy

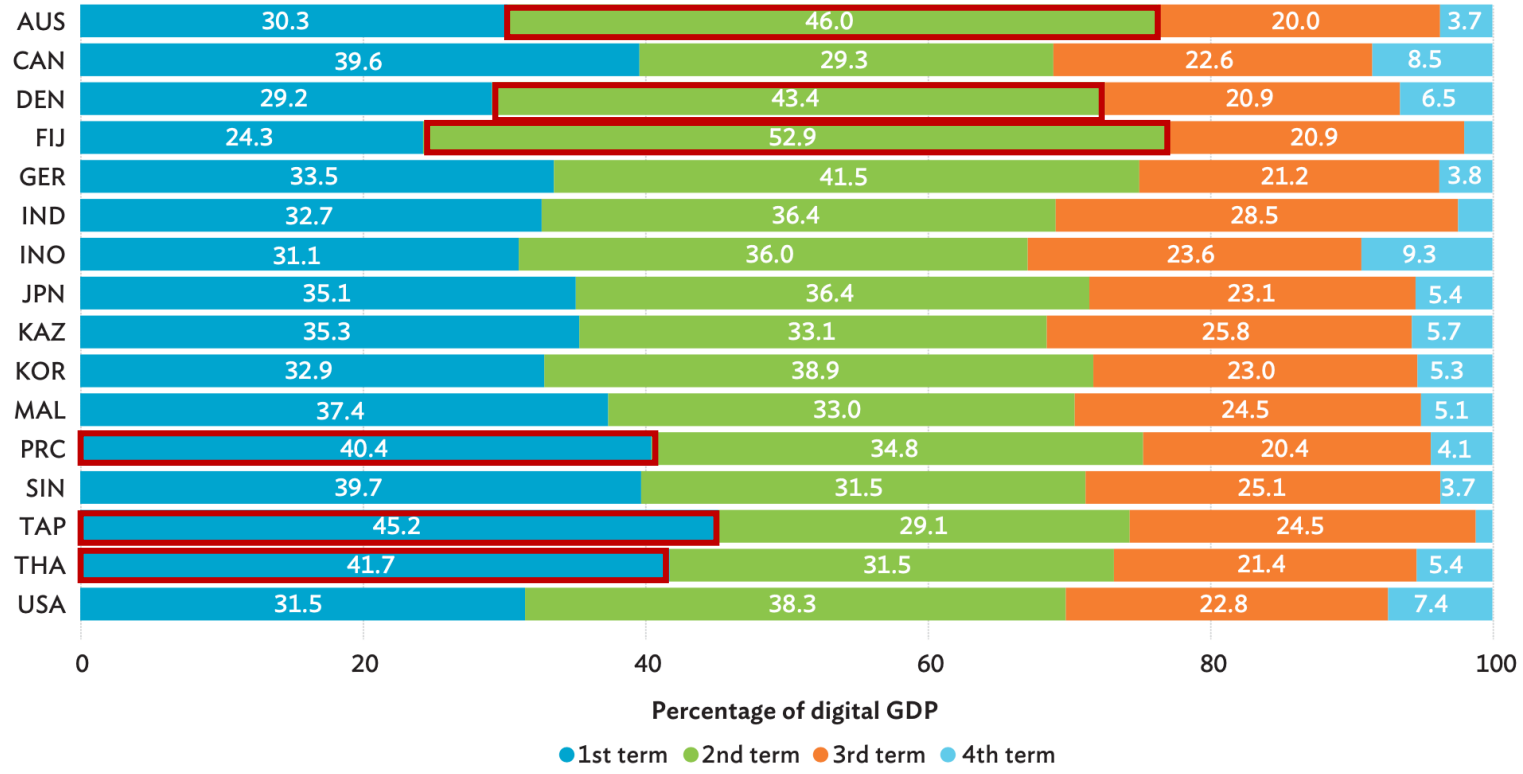


AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GDP = gross domestic product; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; LCU = local currency unit; MAL = Malaysia; SIN = Singapore; THA = Thailand; USA = United States.

Note: The first and latest years used to calculate the compound annual growth rate are: AUS, 2010, 2018; CAN, 2012, 2016; DEN, 2010, 2016; FIJ, 2011, 2015; GER, 2010, 2016; IND, 2010, 2014; INO, 2010, 2014; JPN, 2011, 2015; KAZ, 2001, 2018; KOR, 2010, 2018; MAL, 2010, 2015; SIN, 2000, 2016; THA, 2010, 2015; USA, 2010, 2019.

Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Disaggregation of the Digital Economy by Terms of the Digital GDP Equation



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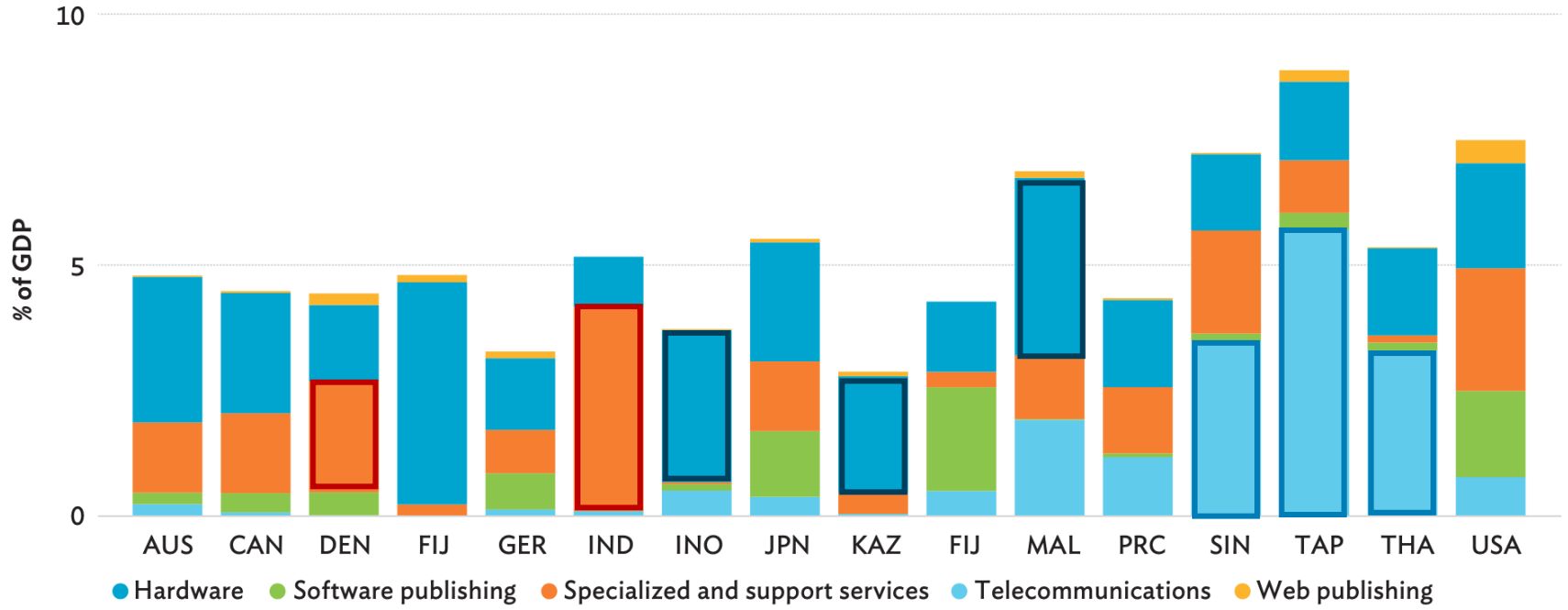
TAP = Taipei,China; THA = Thailand; USA = United States.

Notes: Years included are AUS 2010, 2018; CAN, 2012, 2016; DEN, 2010, 2016; FIJ, 2011, 2015; GER, 2010, 2016; IND, 2010, 2014;
INO, 2010, 2014; JPN, 2011, 2015; KAZ, 2010, 2018; KOR, 2010, 2018; MAL, 2010, 2015; PRC, 2012; SIN, 2016; TAP, 2016; THA, 2010, 2015; USA, 2010, 2019.
$\text{GDP}_{\text{digital}} = \mathbf{i}^{\text{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\boldsymbol{\varepsilon}_1 + \mathbf{i}^{\text{T}}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})^{\text{T}}\boldsymbol{\varepsilon}_1 - [\text{diag}(\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}})]^{\text{T}}\boldsymbol{\varepsilon}_1 + (\mathbf{i} - \boldsymbol{\varepsilon}_1)^{\text{T}}\hat{\mathbf{v}}\mathbf{B}\hat{\mathbf{y}}\hat{\mathbf{r}}\boldsymbol{\varepsilon}_2$. 1st term = backward linkage of the digital sector, 2nd term = forward linkage of the digital sector, 3rd term = double-counted term or the digital sector's value-added contribution to its own final goods, 4th term = the nondigital products capitalized by the digital sector. When the 2nd term is greater than the 1st term, the digital economy takes a supply-side role. When the 1st term is greater than 2nd term, the digital economy takes a demand-side role.
The average is presented in economies for which calculations include multiple years.

Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Disaggregation of the Digital Economy by Digital Subsector



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Notes: Years included are AUS, 2010, 2018; CAN, 2012, 2016; DEN, 2010, 2016; FIJ, 2011, 2015; GER, 2010, 2016; IND, 2010, 2014; INO, 2010, 2014; JPN, 2011, 2015; KAZ, 2001, 2010, 2018; KOR, 2010, 2018; MAL, 2010, 2015; PRC, 2012; SIN, 2000, 2016; TAP, 2016; THA, 2010, 2015; USA, 2010, 2019. The average is presented in economies for which calculations include multiple years.

Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Framework Estimates

Role of Digital Industries (Digital Dependence)

Top Domestic Digitally Enabled Sectors Based on Forward Linkages (normalized %)

Industry	AUS	CAN	DEN	FIJ	GER	IND	INO	JPN	KAZ	KOR	MAL	PRC	SIN	TAP	THA	USA
Agriculture, hunting, forestry, and fishing				5.5												5.7
Air transport				8.4			2.1						1.3			
Architectural and engineering activities			3.2			0.9			3.0		0.5	2.6				
Construction	6.5	3.7	2.5	8.1		2.5	11.9	1.7	1.0	2.2	0.9	12.3	0.7	0.6		
Education	4.4		3.1	4.8			4.7		2.8	3.9	1.6	2.1	0.7	0.7	1.9	
Electronic, electrical, and optical equipment						3.2	1.9			4.6	9.0	15.3	1.6	0.6	19.4	1.6
Financial intermediation	19.2	9.1	3.2	7.9	3.8		1.8	4.9		5.0	4.4		2.1		1.6	
Food, beverages, and tobacco				10.0		2.1	3.6	1.3			1.8					
Furniture						1.6										
Health and social work	5.9	1.9	5.5		3.7			4.1		1.9		2.0		0.8		2.4
Hotels and restaurants				18.0	3.5			2.6		2.2	0.5			1.4	1.8	
Information services					4.9											
Inland transport						2.2			1.7							
Leather, leather products, and footwear															1.4	
Machinery, nec					4.1	1.7		1.2				5.1		0.7		
Manufacturing, nec; recycling															0.7	
Mining and quarrying									3.6							
Other community, social, and personal services									0.8		1.8					2.6
Other supporting and auxiliary transport activities; activities of travel agencies				11.4												
Pharmaceuticals			3.7													
Post and telecommunications										2.9						
Public administration and defense; compulsory social security	15.5	12.3	11.3	9.6	5.8		3.5	5.5	7.2	4.6	4.6	5.8	3.5	1.9		6.0
Real estate activities	5.2	2.1	4.9					1.5	0.7							
Renting of M&Eq and other business activities	3.8										1.1		1.1		3.8	
Research and development					3.4			4.2		3.1						
Textiles and textile products						2.3	1.7									
Transport equipment					5.0	1.6				2.4		2.6				6.4
Water transport													0.6			
Wholesale and retail trade	17.5		15.8	30.9	9.3		3.4	11.7	4.7	11.2	3.2		4.9	2.1	2.4	2.5
Wood and products of wood and cork																2.9

AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; nec = not elsewhere classified; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.

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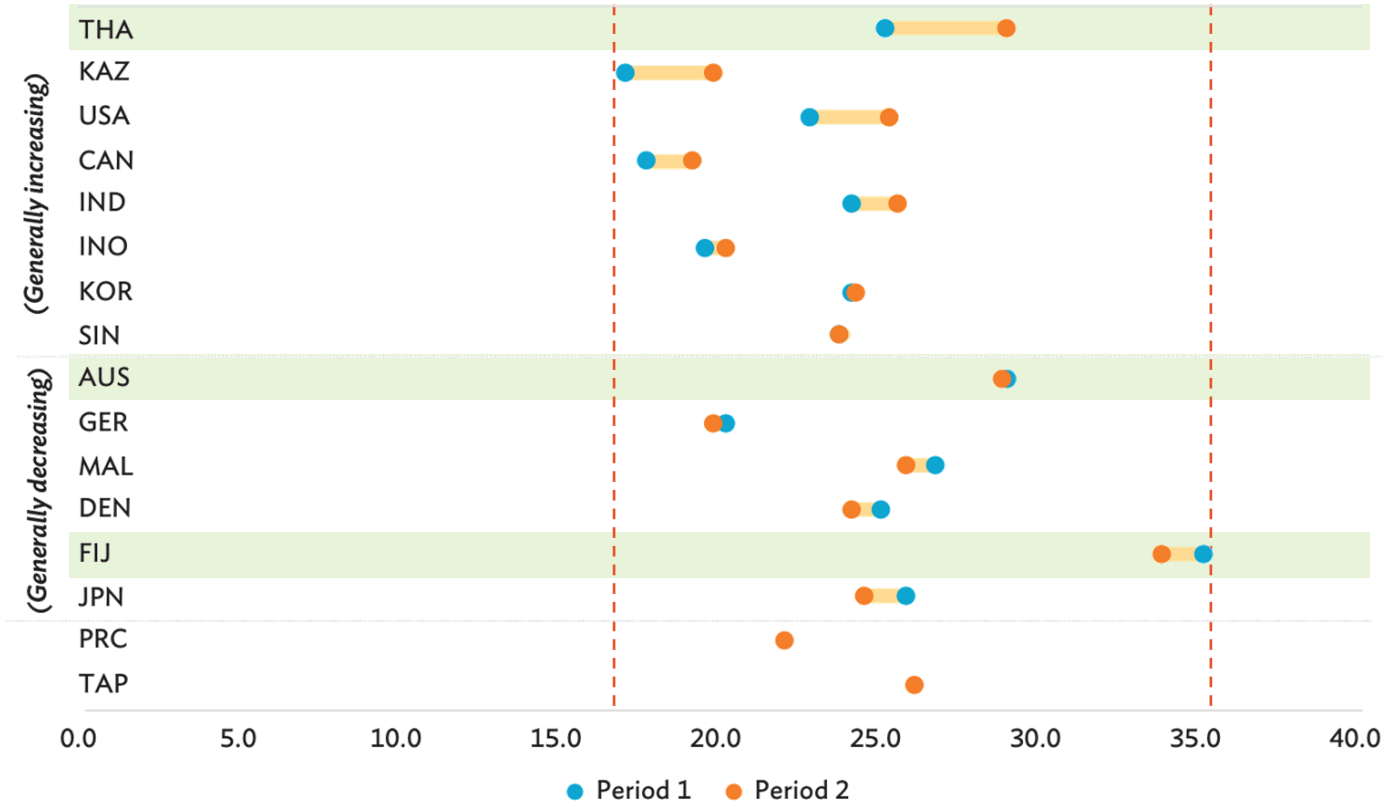
Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Most Digitally Disrupted Sectors, Classification of Products by Activity

Code	Description
49	Land transport services and transport services via pipelines
55	Accommodation services
56	Food and Beverage serving services
58	Publishing services
59	Motion picture, video and television programme production services, sound recording and music publishing
K	Financial and insurance services
73	Advertising and market research services
79	Travel agency, tour operator and other reservation services
P	Education services
92	Gambling and betting services

Source: Advisory Expert Group on National Accounts (2019).

Degree of Digital Dependence by Economy
(% of gross domestic product)

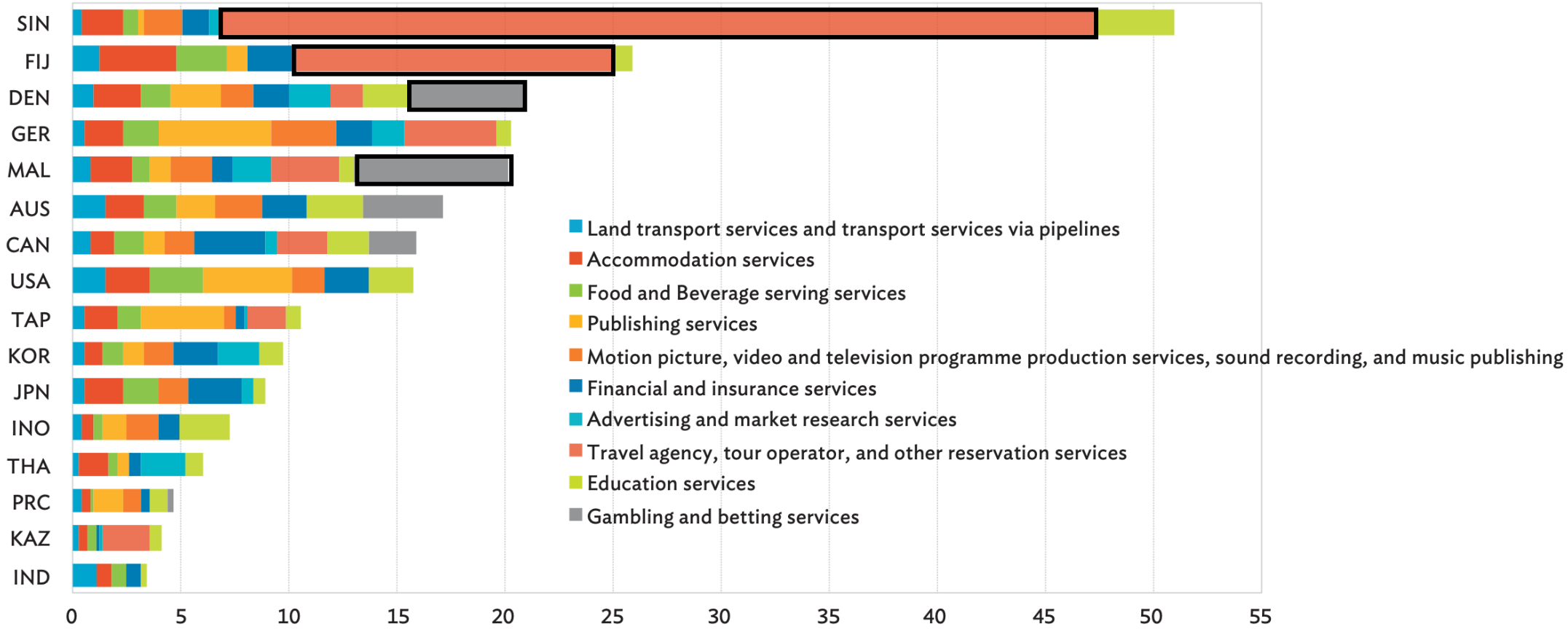


AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.

Notes: Period 1 is AUS, 2010; CAN, 2012; DEN, 2010; FIJ, 2011; GER, 2010; IND, 2010; INO, 2010; JPN, 2011; KAZ, 2001; KOR, 2010; MAL, 2010; SIN, 2000; THA, 2010; USA, 2010. Period 2 is AUS, 2018; CAN, 2016; DEN, 2016; FIJ, 2015; GER, 2016; IND, 2014; INO, 2014; JPN, 2015; KAZ, 2018; KOR, 2018; MAL, 2015; PRC, 2012; SIN, 2016; TAP, 2016; THA, 2015; USA, 2019.

Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Digitally Disrupted Sectors by Size of Digital Forward Contribution
(averaged % of respective sector size)

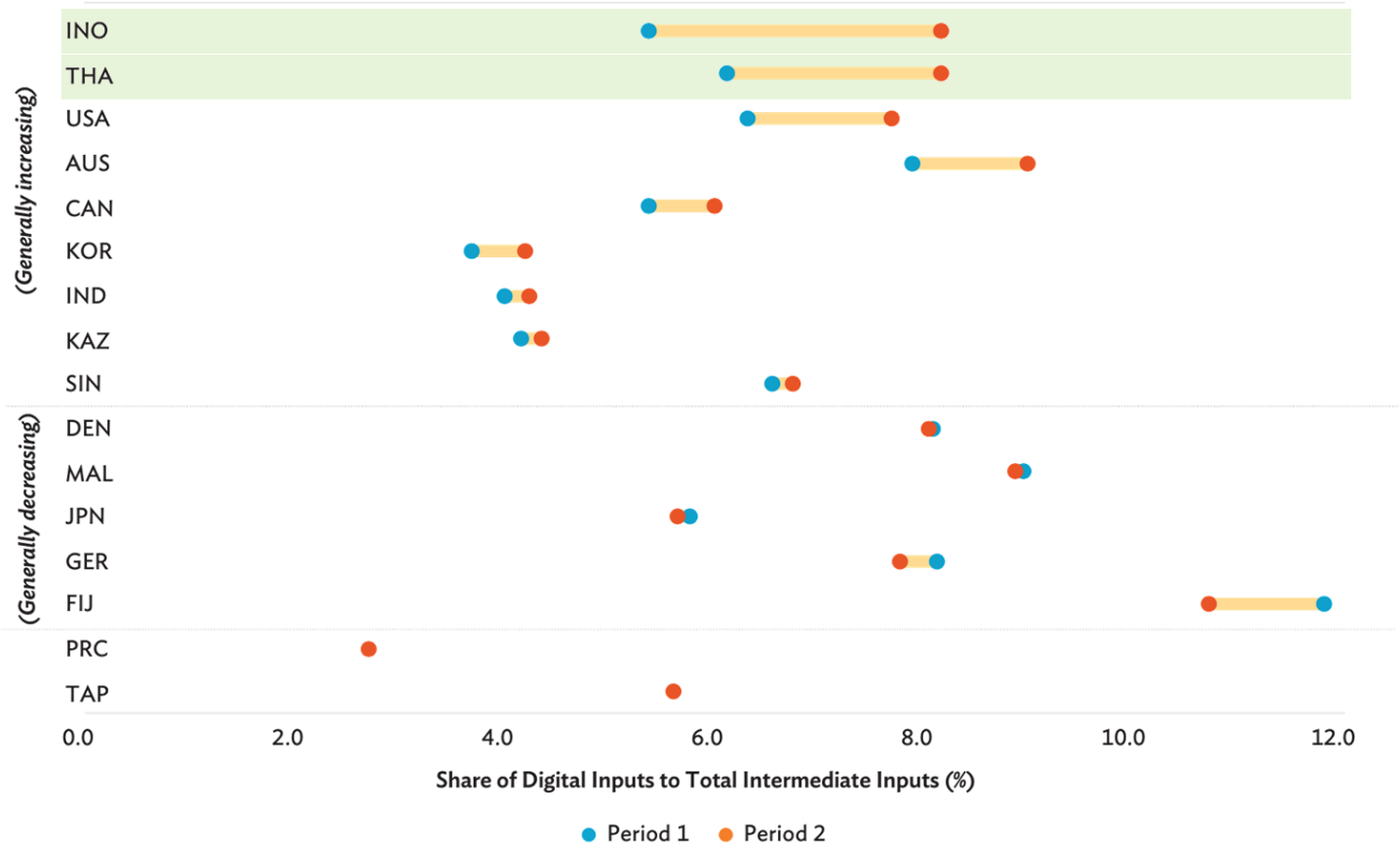


AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.

Note: Years included are AUS, 2010, 2018; CAN, 2012, 2016; DEN, 2010, 2016; FIJ, 2011, 2015; GER, 2010, 2016; IND, 2010, 2014; INO, 2010, 2014; JPN, 2011, 2015; KAZ, 2010, 2018; KOR, 2010, 2018; MAL, 2010, 2015; PRC, 2012; SIN, 2000, 2016; TAP, 2016; THA, 2010, 2015; USA, 2010, 2019.

Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Average Share of Digital Inputs to Total Intermediate Inputs for Digitally Dependent Sectors

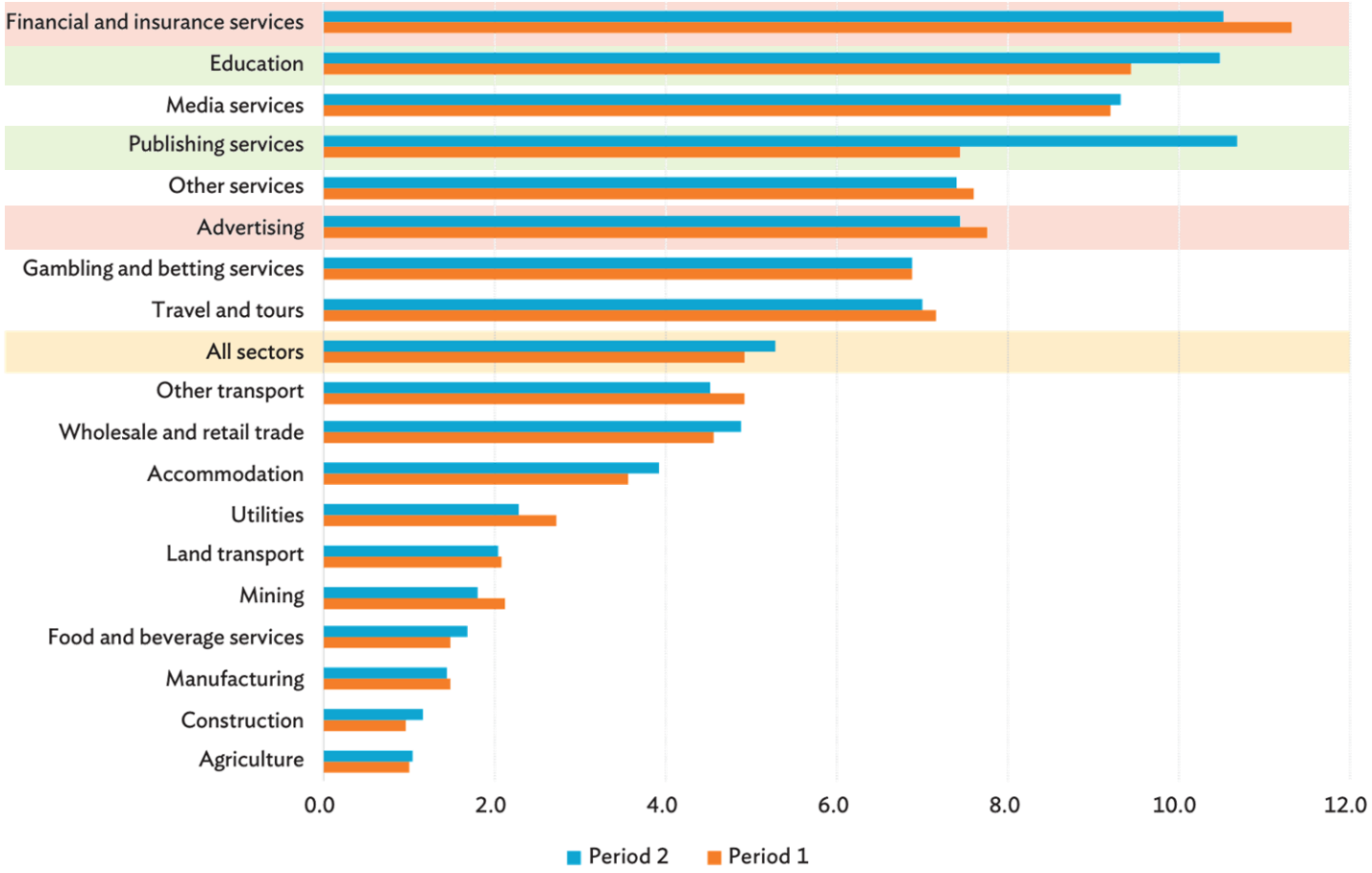


AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.

Notes: Period 1 is AUS, 2010; CAN, 2012; DEN, 2010; FIJ, 2011; GER, 2010; IND, 2010; INO, 2010; JPN, 2011; KAZ, 2001; KOR, 2010; MAL, 2010; SIN, 2000; THA, 2010; USA, 2010. Period 2 is AUS, 2018; CAN, 2016; DEN, 2016; FIJ, 2015; GER, 2016; IND, 2014; INO, 2014; JPN, 2015; KAZ, 2018; KOR, 2018; MAL, 2015; PRC, 2012; SIN, 2016; TAP, 2016; THA, 2015; USA, 2019.

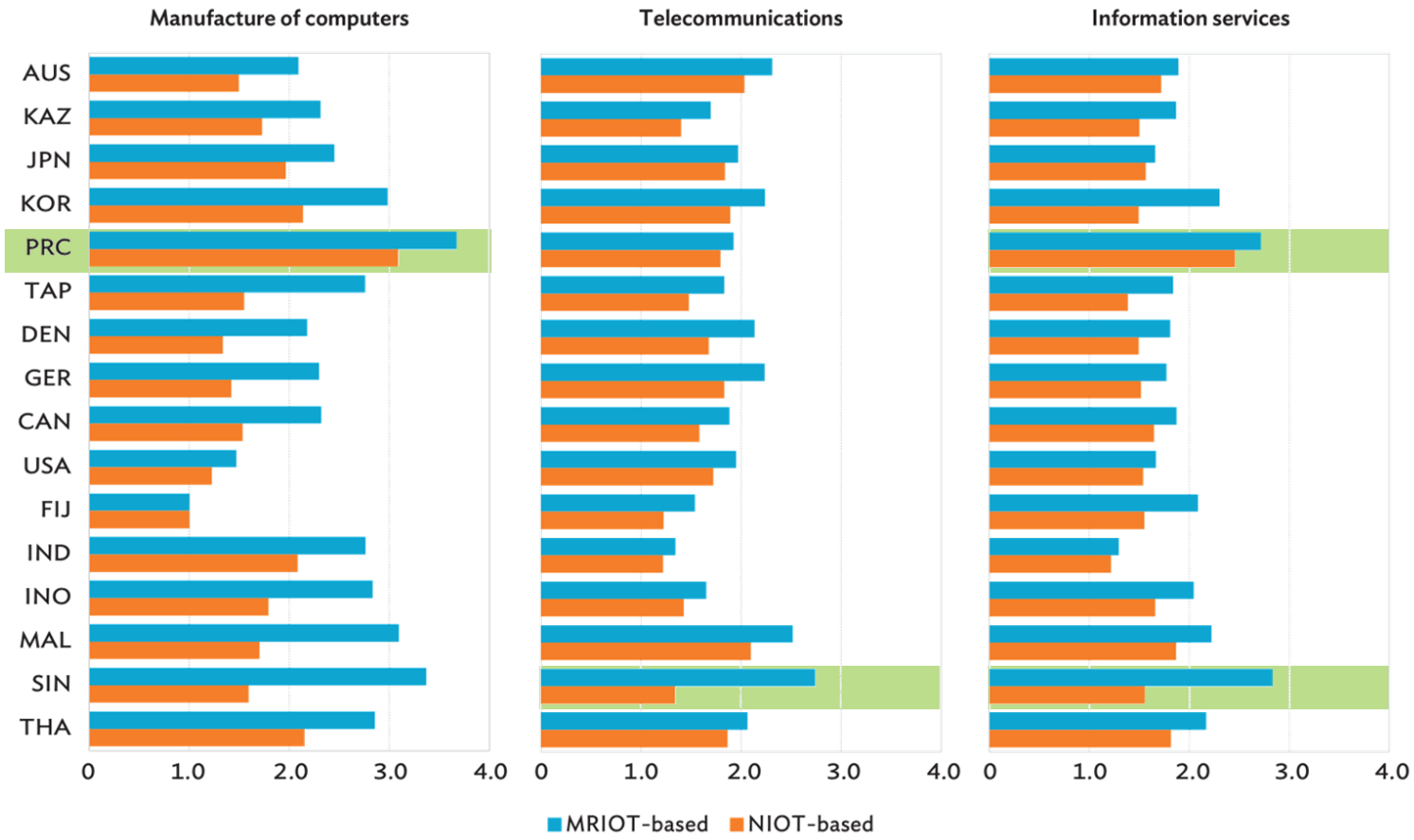
Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Average Shares of Digital Inputs to Total Intermediate Inputs by Sector (%)



Notes: Economies covered and their years for Period 1 and Period 2 are Australia (2010, 2018); Canada (2012, 2016); Denmark (2010, 2016); Fiji (2011, 2015); Germany (2010, 2016); India (2010, 2014); Indonesia (2010, 2014); Japan (2011, 2015); Kazakhstan (2001, 2018); Republic of Korea (2010, 2018); Malaysia (2010, 2015); People's Republic of China (2012); Singapore (2000, 2016); Taipei,China (2016); Thailand (2010, 2015); and the United States (2010, 2019). Sectors' digital input shares are averaged across sectors for Period 1 and Period 2.
Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases.

Digital Sector Output Multipliers Based on Multiregional and National Input-Output Tables, 2019

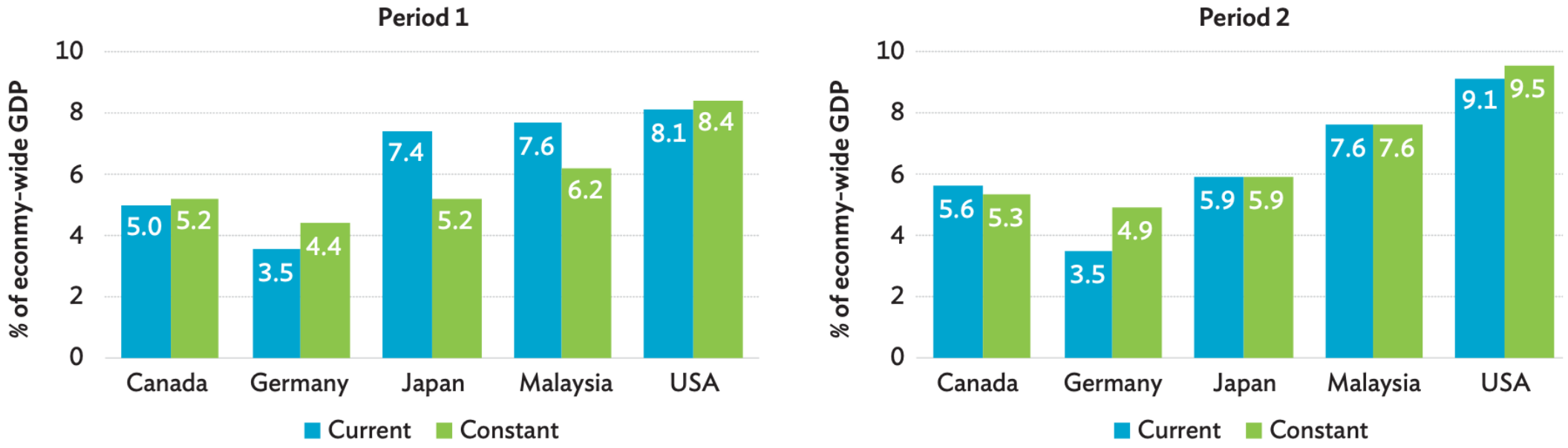


AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; MRIOT = multiregional input-output table; NIOT = national input-output table; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.

Note: NIOT-based multipliers were calculated using the NIOT extracted from the 38-sector MRIOTs for 2019, for sector and temporal comparability to MRIOT-based multipliers.

Source: Calculations of the Digital Economy Measurement Framework study team, using the 38-sector Asian Development Bank MRIOT for 2019.

The Digital Economy as a Percentage of Economy-Wide Gross Domestic Product
(current prices versus constant prices)



GDP = gross domestic product; USA = United States.

Note: Period 1 and Period 2 are represented by the following years: Canada, 2010, 2016; Germany, 2010, 2016; Japan, 2000, 2015; Malaysia, 2010, 2015; US, 2010, 2016. Base year of constant price estimates is 2015.

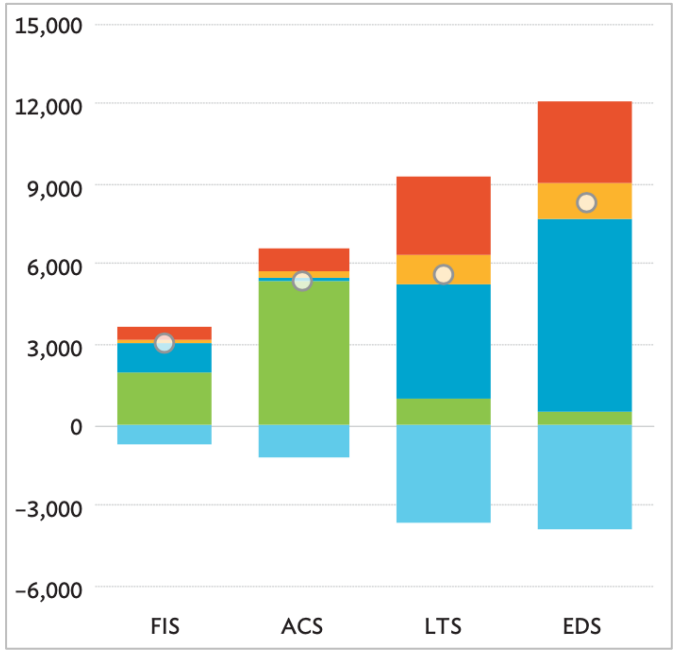
Source: Calculations of the Digital Economy Measurement Framework study team, using input-output and related data from various national statistics offices and international databases. Published input-output related data from national statistics offices were stated in constant prices using the double deflation methodology.

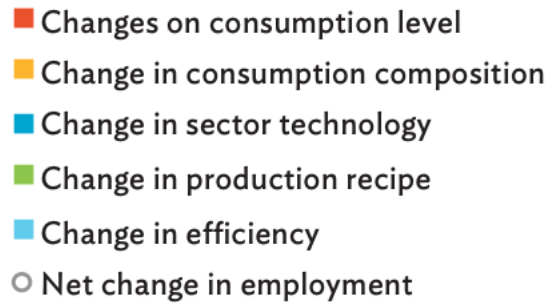
Change in Employment in India, 2010 and 2014

Core digital sectors

CCP = computer consultancy and related activities; information service activities. MCP = manufacture of computers and peripheral equipment; TCM = telecommunications.
Source: Calculations of the Digital Economy Measurement Framework study team, using data from the Ministry of Statistics and Programme Implementation, CEIC database, and Organisation for Economic Co-operation and Development Multifactor Productivity.

Digitally-enabled sectors

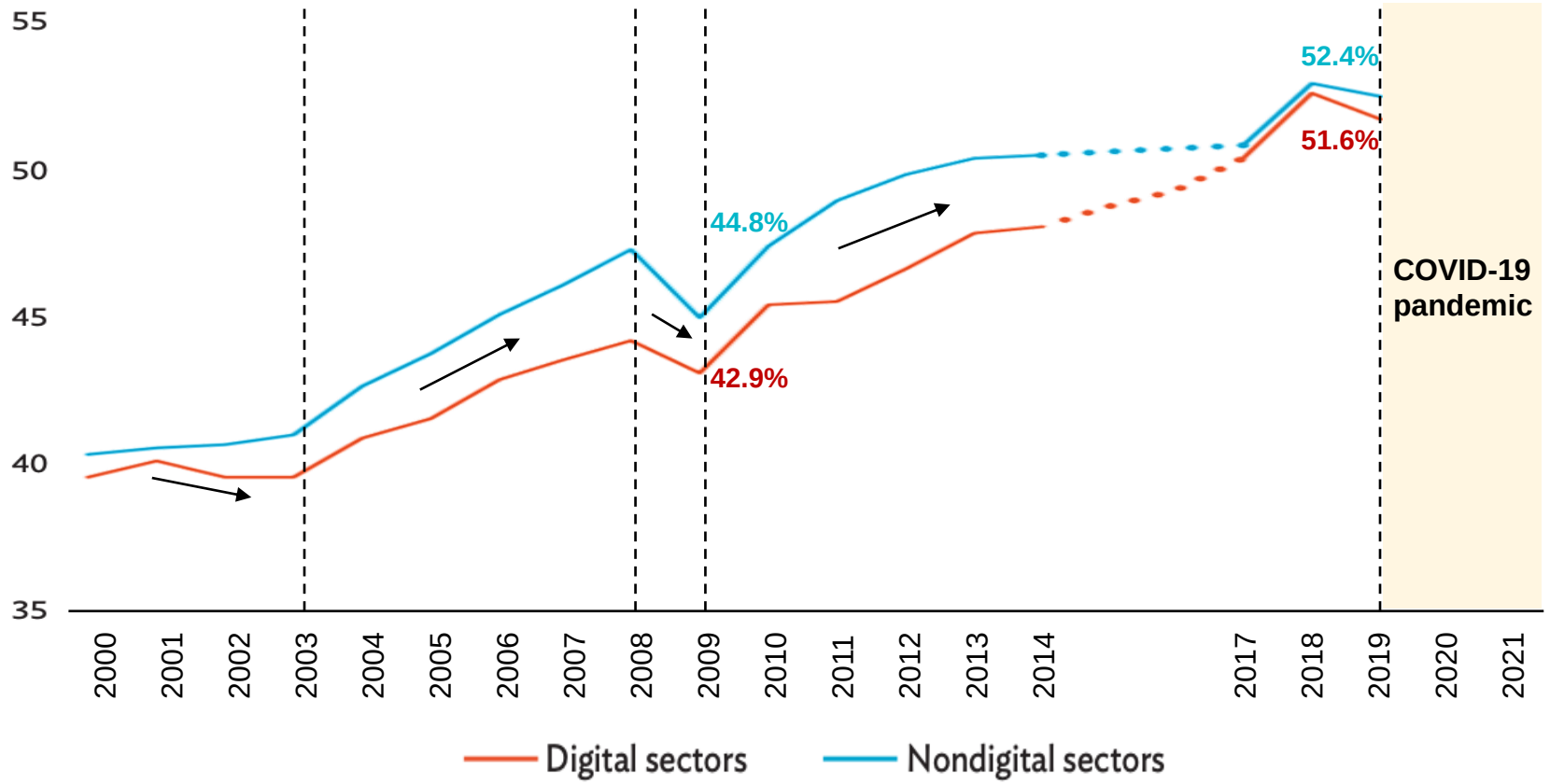




ACS = accommodation services; EDS = education services; FIS = financial and insurance services; LTS = land transport services and transport services via pipelines.
Source: Calculations of the Digital Economy Measurement Framework study team, using data from the Ministry of Statistics and Programme Implementation, CEIC database, and Organisation for Economic Co-operation and Development Multifactor Productivity.

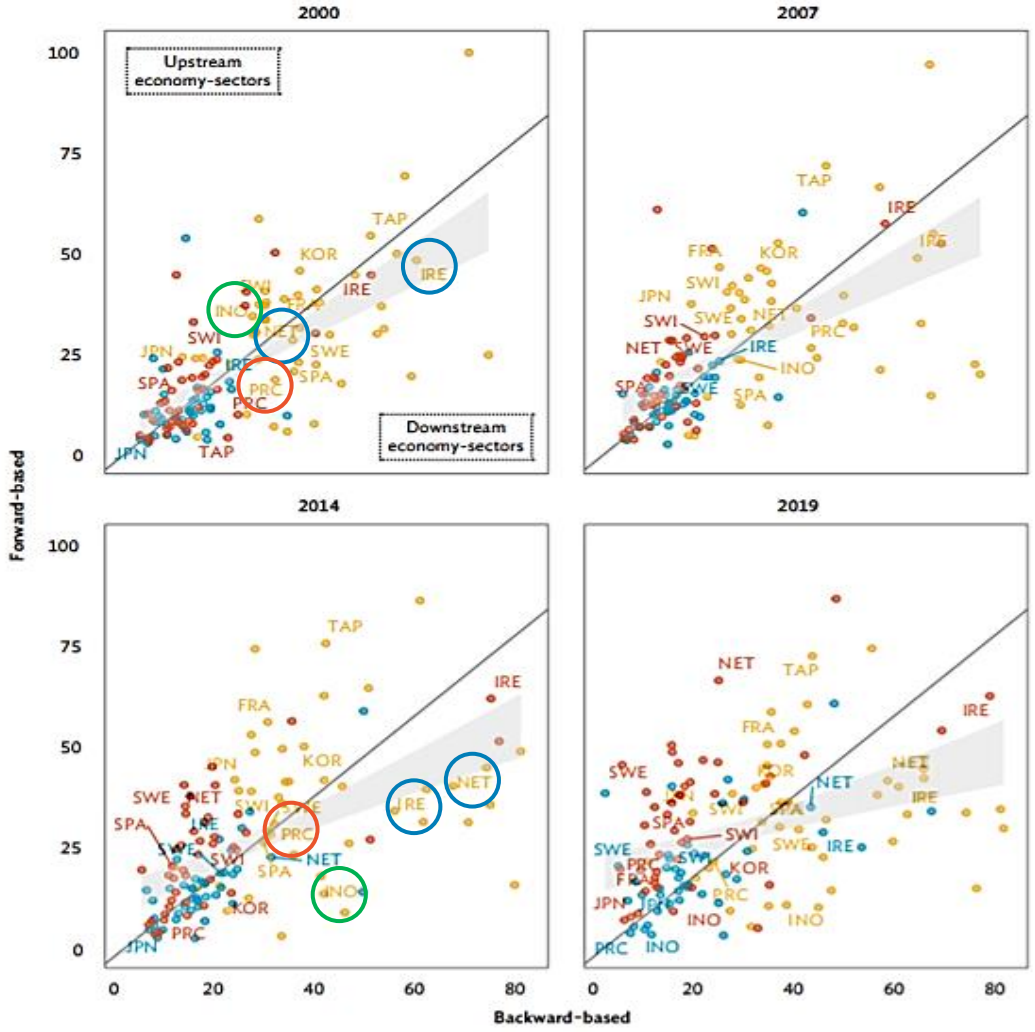
Digital Economy and Global Value Chains

Total Global Value Chain Participation Rates of Digital and Nondigital Sectors



Notes: Digital sector = manufacture of computer, electronic and optical products; telecommunications; and computer programming, consultancy, and related activities, and information service activities. Asian Development Bank estimates are based on the methodology of Wang, Wei, Yu, and Zhu (2017). The world average of total global value chain (GVC) participation is calculated by taking the sum of the world average of forward GVC participation and backward GVC participation. Certain economy-sectors were excluded in calculating for the world average because of mathematical inconsistencies.
Sources: World Input–Output Database Tables, 2000–2014; and the Asian Development Bank's 38-sector Multiregional Input-Output Table 2017–2019.

Global Value Chain Participation Rates of Digital Sectors (2000, 2007, 2014, 2019)



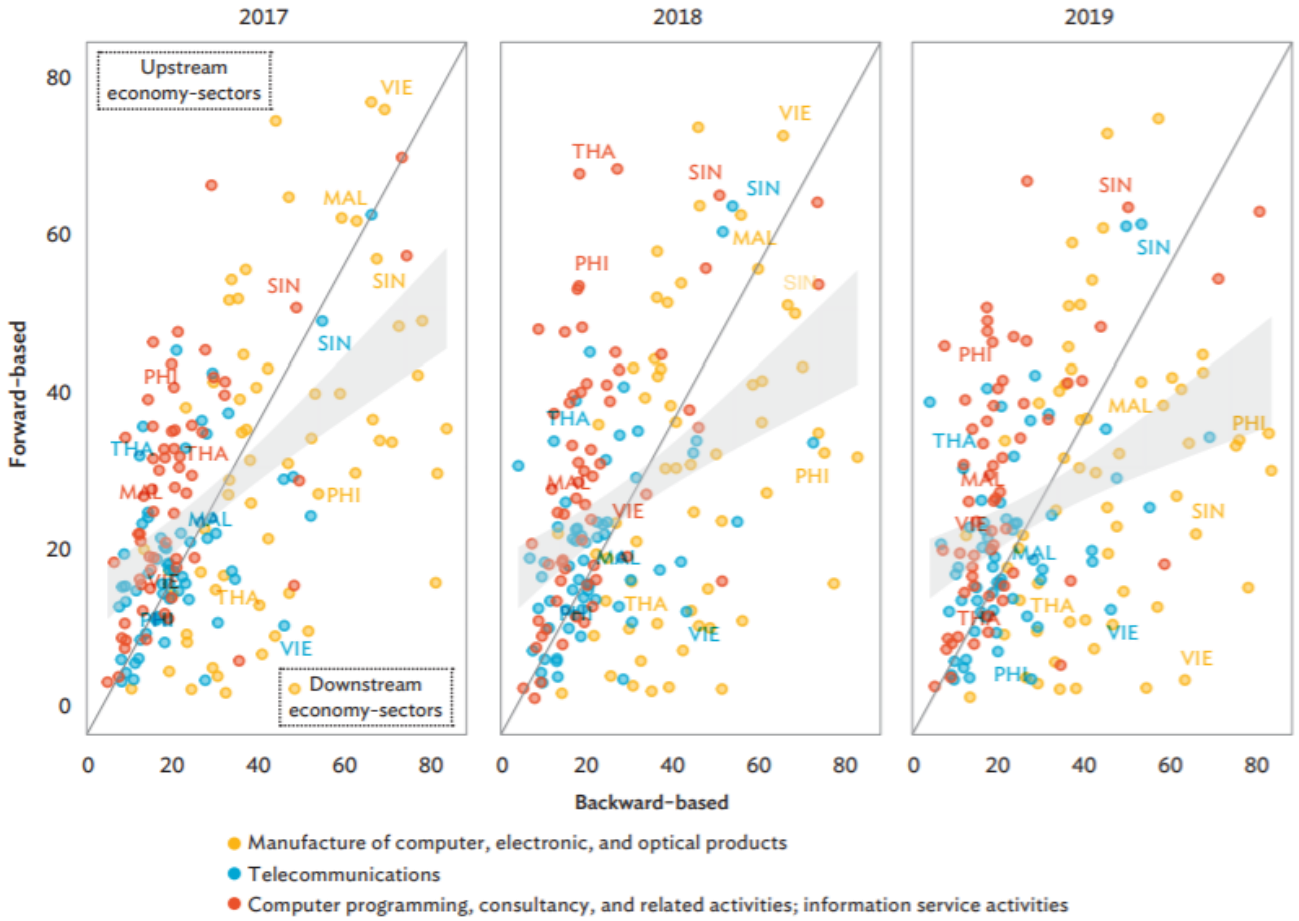
- Manufacture of computer, electronic, and optical products
- Telecommunications
- Computer programming, consultancy, and related activities; information service activities

FRA = France; INO = Indonesia; IRE = Ireland; JPN = Japan; KOR = Republic of Korea; NET = Netherlands; PRC = People's Republic of China; SPA = Spain; SWE = Sweden; SWI = Switzerland.

Notes: Digital sector = manufacture of computer, electronic, and optical products; telecommunications; and computer programming, consultancy, and related activities, and information service activities. The scatterplot shows 44 economies, including "the Rest of the World." Asian Development Bank estimates are based on the methodology of Wang, Wei, Yu, and Zhu (2017).

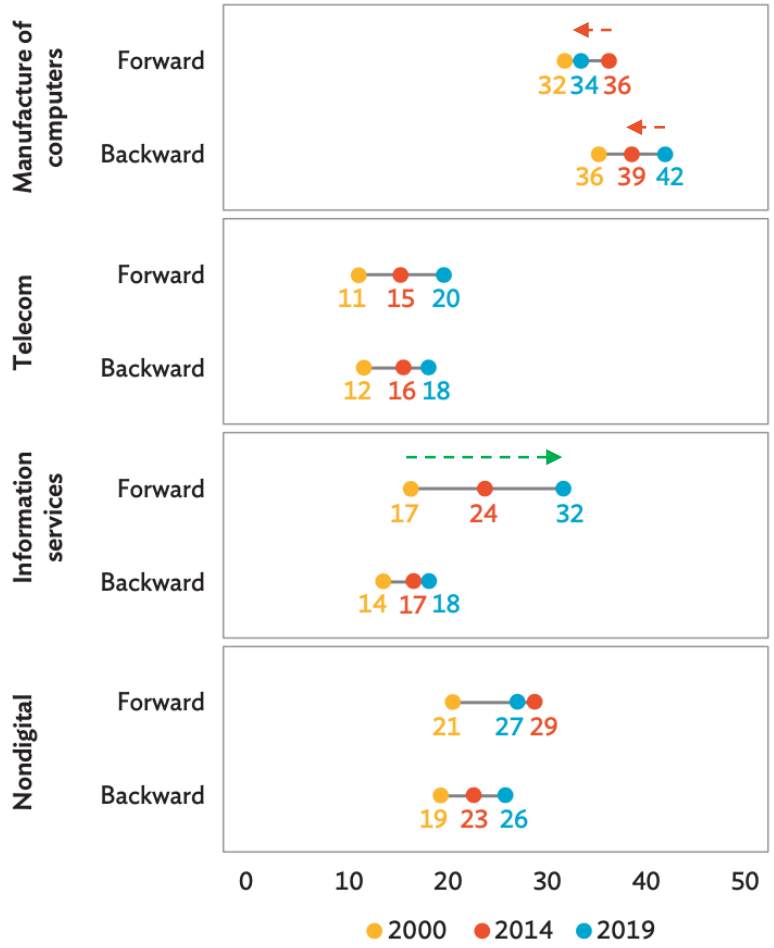
Sources: World Input–Output Database Tables, 2000, 2007, and 2014; and the Asian Development Bank's 38-sector Multiregional Input-Output Table 2019.

Global Value Chain Participation Rates of Digital Sectors (2017-2019)



ADB = Asian Development Bank; MAL = Malaysia; PHI = Philippines; SIN = Singapore; THA = Thailand; VIE = Viet Nam.
Notes: Digital sector = manufacture of computer, electronic, and optical products; telecommunications; and computer programming, consultancy, and related activities, and information service activities. The scatterplot shows the 62 ADB member economies and the "rest of the world" economy included in the Multiregional Input-Output Table 2017–2019. ADB estimates are based on the methodology of Wang, Wei, Yu, and Zhu (2017).
Source: Asian Development Bank Multiregional Input-Output Table 2017–2019

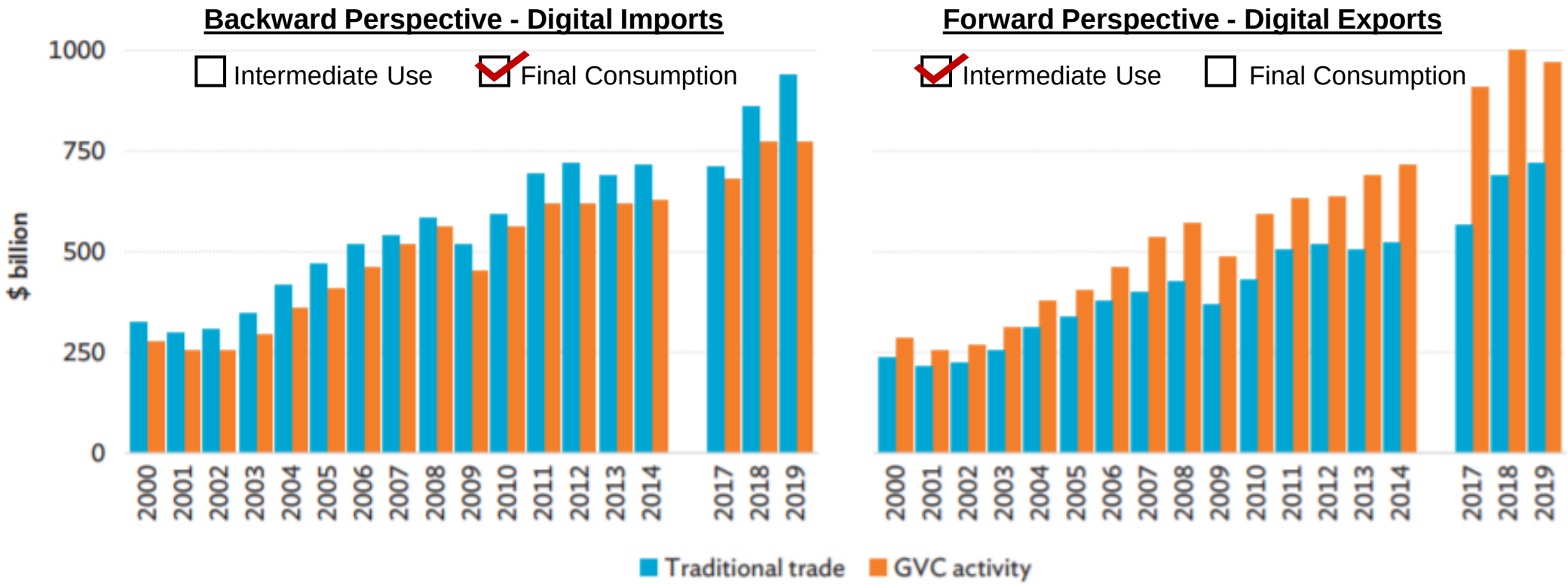
Global Value Chain Participation Rates by Broad Sector (world average)



Notes: "Information services" = computer programming, consultancy, and related activities, and information service activities; "Manufacture of computers" = manufacture of computer, electronic, and optical products; "Telecom" = telecommunications sector. Digital sector = manufacture of computer, electronic, and optical products; telecommunications; and computer programming, consultancy, and related activities, and information service activities. Nondigital sector = all other sectors in the Asian Development Bank (ADB)'s Multiregional Input-Output Table 2019 that are not part of the digital sector. ADB estimates are based on the methodology of Wang, Wei, Yu, and Zhu (2017).

Sources: World Input–Output Database Tables, 2000 and 2014; and ADB's 38-sector Multiregional Input-Output Table 2019.

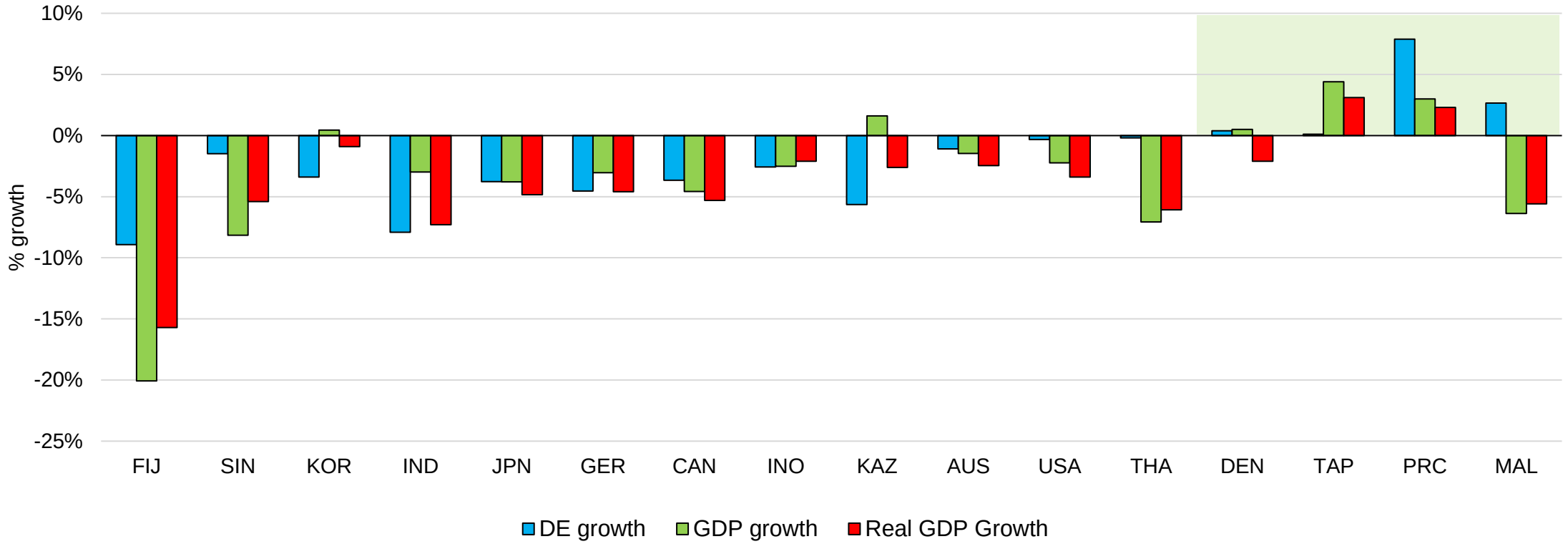
Trade in Value-Added (TiVA) via Traditional Trade and Global Value Chains



$ = United States dollars, GVC = global value chain.
Notes: Digital sector = manufacture of computer, electronic, and optical products; telecommunications; and computer programming, consultancy, and related activities, and information service activities. Asian Development Bank estimates are based on the methodology of Wang, Wei, Yu, and Zhu (2017). Bars refer to the sum of trade in value-added of all digital economy-sectors via traditional channels (i.e., export or import of finished products) and via GVCs (i.e., export or import of intermediates).
Sources: World Input–Output Database Tables, 2000–2014; and the Asian Development Bank's 38-sector Multiregional Input-Output Table 2017–2019.

Digital Economy during COVID-19

Growth (%) in economy-wide GDP and Digital Economy from 2019-2020



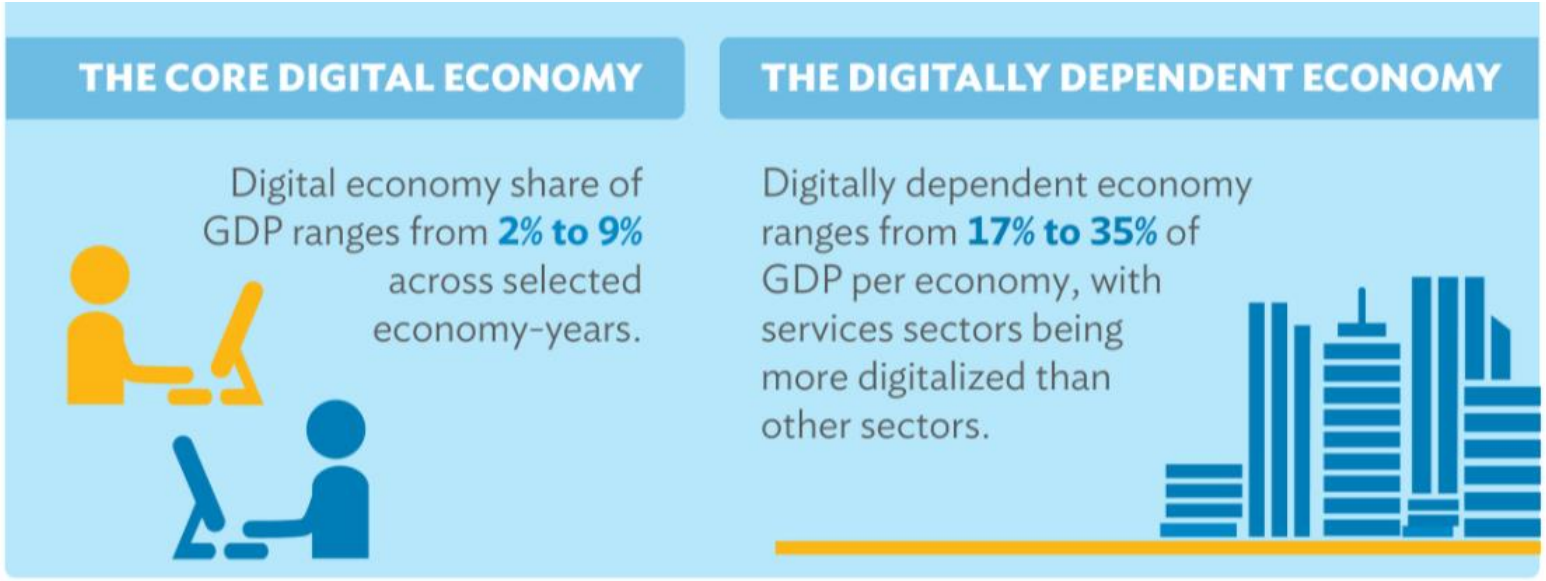
AUS = Australia; CAN = Canada; DEN = Denmark; FIJ = Fiji; GER = Germany; IND = India; INO = Indonesia; IT = information technology; JPN = Japan; KAZ = Kazakhstan; KOR = Republic of Korea; MAL = Malaysia; PRC = People's Republic of China; SIN = Singapore; TAP = Taipei,China; THA = Thailand; USA = United States.

Source: Calculations of the Digital Economy Measurement Framework study team, based on the Asian Development Bank's 38-sector Multiregional Input-Output Table 2019, national accounts, and various sources of digitally ordered business-to-consumer shares to total sales; real GDP growth rates are based on national statistics offices and World Development Indicators.

Conclusion

Conclusion

- Data requirements and framework application are relatively simple and proves to be feasible for any domestic or multiregional IOT
- We applied the methodology to several economies which provided insightful results and allowed for various statistical analyses to support evidence-based decision making.
- Various additional economic and regional applications and analyses will still be conducted in the future.



Source: https://www.adb.org/news/infographics/capturing-digital-economy/

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Asian Development Bank

Thank you!

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