Centre for International
Governance Innovation

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Regulating the International Digital Economy, with Trade and Innovation in Mind

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About the Author

Douglas (Doug) Lippoldt is a CIGI senior fellow and an international trade economist based in Claremont, California. He served as chief trade economist at HSBC Global Research from 2014 to 2020. Previously, he served in various roles as a senior economist at the Organisation for Economic Co-operation and Development in Paris during a tenure of 22 years. Doug's early career included seven years as an international economist with the US Department of Labor.

He has published extensively on trade topics as well as on related aspects of economic development, labour market adjustment, innovation and intellectual property. Doug holds a Ph.D. in economics from the Institut d'études politiques de Paris (Sciences Po), an M.A. in international studies from the University of Denver and a B.A. in international studies from Washington College in Maryland. He was a Fulbright Scholar at the University of Cologne, Germany, and a Peace Corps volunteer in Burkina Faso. During 2015–2019, he represented HSBC as the deputy delegate on the Business 20 Trade and Investment Taskforce. He is currently a contributing author on a Think20 trade task force team.

Acronyms and Abbreviations

AI	artificial intelligence
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
AUS-SGP DEA	Australia-Singapore Digital Economy Agreement
B2B	business-to-business
B2C	business-to-consumer
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CUSMA	Canada-United States-Mexico Agreement
DEA	Digital Economy Agreement
DEPA	Digital Economy Partnership Agreement
DMA	Digital Markets Act
DSA	Digital Services Act
DSTRI	Digital Services Trade Restrictiveness Index
EPA	European Union-Japan Economic Partnership Agreement
G20	Group of Twenty
GATS	General Agreement on Trade in Services
GDPR	General Data Protection Regulation
ICT	information and communications technology
IMF	International Monetary Fund
IoT	Internet of Things
IP	intellectual property
ISPs	internet service providers
ITA	Information Technology Agreement
JSI	Joint Statement Initiative
M&A	mergers and acquisitions
MFN	most-favoured nation
NACE	*nomenclature statistique des activités économiques dans la Communauté européenne*
OECD	Organisation for Economic Co-operation and Development
OLS	ordinary least squares
PPP	purchasing power parity
R&D	research and development
RCEP	Regional Comprehensive Economic Partnership
RTAs	regional trade agreements
TRIPS	Trade-Related Aspects of Intellectual Property Rights
UNCITRAL	United Nations Commission on International Trade Law
UNCTAD	United Nations Conference on Trade and Development
WEF	World Economic Forum
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Executive Summary

This paper highlights the scale of the international digital economy; describes the current, incomplete governance framework for the international digital economy; illustrates the importance of governance in relation to private-sector innovation; and recommends incremental, doable next steps to enhance governance, close gaps and promote further innovation. The analysis finds indications that digital services market openness and framework conditions matter for the digital economy and, in particular, for innovative firms that operate with high digital intensity. Better definition and international alignment of the framework for governance of digital trade and data could lead to benefits for the regulatory objectives of privacy, trust and security. This approach could also promote development of the digital economy via reduced friction in the conduct of business and increased international openness within the bounds of appropriate regulatory guardrails.

Introduction

In an examination of the challenge of data governance, Michael Chertoff (2018, 77–78), former US Secretary of Homeland Security, pointed to Angry Birds[1] to illustrate his point. For most folks, this enormously popular digital game simply concerns a struggle as birds defend their eggs from roving green pigs that would like to eat them. However, as Chertoff notes, for commercial stakeholders, the interesting bit is that the application collected data from millions of users, including items such as their unique cellphone ID number, gender and location. This information could then be sold to advertising partners. While this aspect was disclosed in the application's terms and conditions, many users remained unaware. And so it often is with the digital economy, whose integration into the mainstream is advancing rapidly, sometimes in ways that market participants may not even recognize.

In the digital economy, open markets matter. As will be explained later in the paper, private-sector innovation is concentrated in just a limited number of economies. The rules-based multilateral trading system affords a degree of market openness and thereby supports diffusion of this innovation and provides opportunities for participation of others in this activity. Moreover, with digital technologies, there are often substantial upfront research and development (R&D) costs and low marginal costs for production of many resultant products at scale. Open markets facilitate the ability of consumers to benefit from this innovation while enabling firms to reap the commercial rewards of their R&D efforts. However, the rapid growth of the international digital economy has outpaced the development of a corresponding international system of governance, and there are gaps such as the ones highlighted by Chertoff.

This review considers the international digital economy in terms of its current scale and its admittedly incomplete governance framework. The importance of governance in the international digital economy is then illustrated using two statistical analyses: one on firm-level R&D expenditure and another on successful start-up firms. The conclusion recommends incremental, doable next steps to enhance governance. The recommendations are motivated by indications that digital market openness and framework conditions matter for the digital economy and, in particular, for innovative firms that operate with high digital intensity. Governance of digital trade and data management could be strengthened through better definition and international alignment in regulation, including with respect to the objectives of privacy, trust and security. A well-conceived framework could facilitate the conduct of business and support international market openness while providing appropriate regulatory guardrails.

1 For more about the Angry Birds game franchise, see the Wikipedia entry (https://en.wikipedia.org/wiki/Angry_Birds).

Digital Trade and Its Governance

Scale of the International Digital Economy

According to the Organisation for Economic Co-operation and Development (OECD),[2] digital trade might be viewed as encompassing "digitally-enabled transactions of trade in goods and services that can either be digitally or physically delivered, and that involve consumers, firms, and governments."[3] Such transactions entail cross-border movement of data in the conduct of the actual transactions. Data systems are often employed in the delivery of the actual product as data can be integral to the content and products sold (for example, software or streamed entertainment). The OECD notes that digitized information plays a key role in facilitating tangible goods trade via the operation of global value chains and related customs processes. Moreover, data drives modern service supply models in areas such as cloud computing, the Internet of Things (IoT) and additive manufacturing.

Statistically, digital trade is challenging to track. Not all cross-border flows are recorded and identified separately. Businesses may transfer ownership of intellectual assets and associated revenues to low-tax jurisdictions one step removed from the geographic location of the actual trade. Firms may invest in markets to establish local affiliates to service a domestic market, international clients or both, drawing on content, software and methods from across their own international operations and those of partner firms.

What is known is that the constellation of activities concerning the digital economy is huge. E-commerce is a central feature, consisting of business-to-consumer (B2C) and business-to-business (B2B) transactions. The United Nations Conference on Trade and Development (UNCTAD) estimated global B2C commerce to amount to some US$4.9 trillion as of 2019.[4] Most of this commerce is domestic, but a rising share is cross-border. Of the 1.48 billion online shoppers in that year, nearly one in four had engaged in international e-commerce (see Figure 1). But this is just a fraction of the online activity.

B2B sales far outpace those that are B2C. The strength of B2B e-commerce can be seen in Table 1. At the global level, recent B2B sales amounted to more than four times those via B2C activities. Among the top 10 economies for e-commerce, only in China is B2C activity greater than B2B. Major market-oriented economies are heavily represented in the e-commerce sector, and China is the only emerging market among the top 10 e-commerce nations. In Japan and South Korea, the value of e-commerce sales corresponds to more than 50 percent of GDP. E-commerce in the United States is also rising to approach this milestone.

The top 10 economies for e-commerce account for about three-quarters of global e-commerce value. This concentration of activity has implications beyond the actual sales transactions. Data accumulated during a firm's operations may be sold (for example, a mailing list of potential customers) or may be employed internally to provide a competitive advantage for a firm (for example, for use in artificial intelligence [AI] applications or internal operational analytics). Thus, the advantages of an early sustained leading position may compound for a firm.

Leadership advantage may also be manifested via trade in the tools for the digital economy. Exports of information and communications technology (ICT) products have exhibited robust growth since 2005, nearly doubling by 2020.[5] This expansion was anchored by exports from Asia, which accounted for 77 percent of the global total in 2020. Shares for Europe and North America at 14 percent and six percent, respectively, lagged in comparison. The challenge of trade inclusiveness is highlighted by the small shares for other regions. Latin America accounted for less than three percent, and Oceania and Africa for just 0.1 percent each.

Recent growth in the ICT sector was facilitated not only by innovation and improved technological

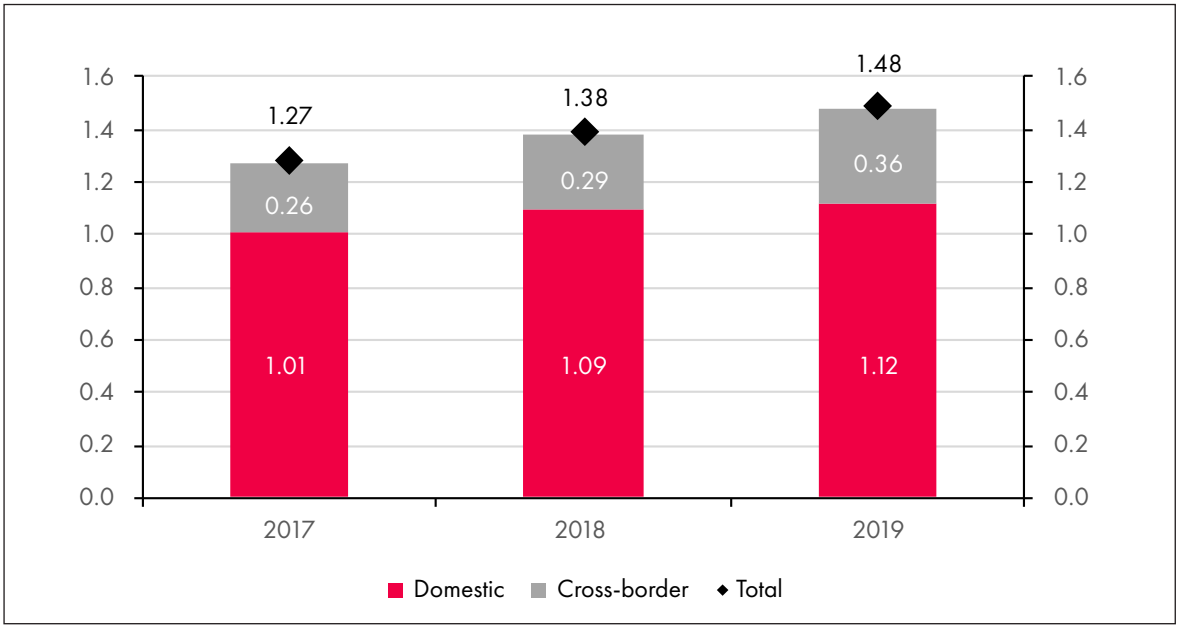
2 The OECD is an intergovernmental, policy-focused institution representing 38 (mostly) advanced economies globally. See www.oecd.org/about/.

3 See OECD (www.oecd.org/trade/topics/digital-trade/).

4 See UNCTAD (https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx, digital economy folder).

5 Ibid.

Figure 1: Worldwide Online Retail Shoppers, in Billions (2017–2019)



Sources: UNCTAD (2021a); author's presentation of the data.
Notes: Based on national data and UNCTAD estimates. "Cross-border shoppers" refers to those who purchase from websites located abroad for delivery from abroad.

capacity, but also by improvements in the trade regime via an update to the World Trade Organization's (WTO's) Information Technology Agreement (ITA). The original ITA entered into force in 1997, providing duty-free treatment to products and markets representing most of the global electronics trade. With further technological development and the emergence of new products, there was a need to expand the original scope.[6] This was accomplished in 2015 (followed by entry into force in 2016), with an agreement to cover an additional 201 electronic products with a total export value of some US$1.3 trillion. As of December 2021, 82 WTO members were members of the ITA, accounting for 97 percent of global trade in information technology products (WTO 2021).

Trade in digitally delivered services products (see Figure 2) has exhibited even stronger growth. By 2020, trade in these services reached a level that was more than 2.5 times that of 2005. As ICT capacities improved, businesses capitalized on this opportunity to increase offerings in areas such as software-as-a-service and real-time financial services. Digital delivery offers timely relay of products and updates and can provide greater reliability and security in some circumstances than traditional, locally maintained equipment. In another manifestation, the IoT offers the potential for service providers to engage in a timely manner in areas such as tracking of performance, quality control and maintenance needs, potentially boosting efficiency and resilience of operations.

The data in Table 1 underscores the concentration in market shares of the leading nations in the global digital economy. The scale of the US e-commerce market was estimated to be US$9.6 trillion in 2019, amounting to 36 percent of the global total. The US value was 2.8 times that of the next largest e-commerce country, Japan. Despite America's famous early entrepreneurs in online retail such as Amazon and eBay, in fact, about 86 percent of the US turnover in e-commerce in 2019 came from B2B activity. The four EU countries among the major e-commerce players (France, Germany, Italy and Spain) together accounted for about eight percent of global online sales.

Figure 3 offers a firm-level perspective covering leading e-commerce retailers globally in 2020. Among these 13 firms, seven had headquarters in the United States, four in China, one in Canada and one in Japan. Thus, here again, one sees a

6 For more on the ITA negotiations, see Adeyemi (2021, 68–78).

Table 1: E-commerce Sales in Top 10 Countries and Rest of World (2019)

Rank	Economy	Total e-commerce sales (US$ billions)	E-commerce sales as share of GDP (%)	B2B e-commerce sales (US$ billions)	B2C e-commerce sales (US$ billions)
1	United States	9,580*	45	8,319	1,261
2	Japan	3,416	67	3,238	178
3	China	2,604	18	1,065	1,539
4	South Korea	1,302*	79	1,187	115
5	United Kingdom	885	31	633	251
6	France	785*	29	669	116
7	Germany	524	14	413	111
8	Italy	431*	22	396	35
9	Australia	347*	25	325	21
10	Spain	344	25	280	64
Subtotal		**20,218**	**36**	**16,526**	**3,691**
Rest of world		6,455	18	5,277	1,179
World total		**26,673**	**30**	**21,803**	**4,870**

Sources: UNCTAD (2021a); author's tabulations.

Note: This data draws on national sources and UNCTAD estimates. * indicates UNCTAD estimates.

significant geographic concentration. Further reviews by the International Monetary Fund (IMF) and Statista in 2020[7] found four additional firms of similar magnitude: two Chinese, one American and one Singaporean. Such geographic concentration, along with the lack of an integrated, independent global governance framework, may be fuelling unease among competition authorities in some other regions such as Europe, which lacks a top-tier global player in this space.

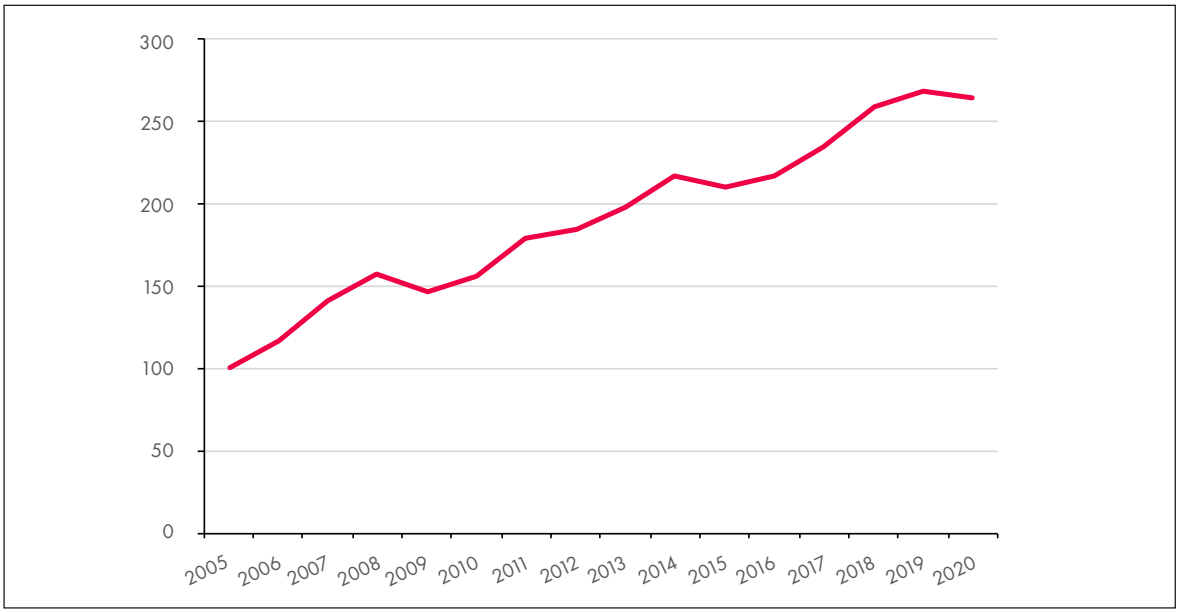
The European Union is seeking to remedy this situation, in part, via proposals for a Digital Services Act (DSA) and a Digital Markets Act (DMA). These aim to correct perceived imbalances in the rights of users of digital platforms and to address local business demands for a level playing field.[8] The DSA would establish harmonized EU rules and measures governing online platforms and intermediaries that handle user data (European Commission 2020a). The DMA aims to establish rules that govern systemically important platforms, where private entities are serving as gatekeepers (European Commission 2020b). Key policy objectives include regulation of illegal goods, services and content online; disciplines to address manipulative algorithmic services that are used for the spread of disinformation and other harmful purposes; and measures to ensure that platform gatekeepers meet obligations that support and protect consumer choice and fair competition conditions for businesses.

Given that US firms occupy a substantial share of the online digital services market in Europe, it is perhaps not surprising that US trade officials and business representatives are on guard against potential discriminatory effects that might arise out of such measures and related tax matters (see Box 1). One bilateral channel for resolution of such differences between the United States and the European Union is the jointly chaired US-EU Trade and Technology Council, which held its first meeting in September 2021. The digital economy

7 See Statista (www.statista.com/statistics/664814/global-e-commerce-market-share/); Dabla-Norris et al. (2021).

8 See European Commission (https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package). The DSA was adopted by the European Parliament on January 20, 2022, and is now under negotiation with the council (European Parliament 2022). The parties reached a provisional agreement on the DSA on April 23, 2022 (European Council 2022).

Figure 2: Worldwide Digitally Deliverable Services Trade (Imports and Exports)



Source: See UNCTAD (https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx, digital economy folder). The current data set is available at https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=158358 (digital economy folder).

Notes: Underlying data is in US dollars. Digitally deliverable services include insurance and pensions, financial services, charges for use of intellectual property (IP), telecommunications, computer and information services, audiovisual services and other business services.

was reportedly on the agenda.[9] Other broader channels might include talks at international institutions such as the OECD, the Group of Twenty (G20) and the WTO. Digital economy matters have been on the agenda for all three institutions and are discussed in more detail in the next section.

How Is Digital Trade Currently Governed?

Governance of the international digital economy remains a fragmented work in progress. Multiple supraregional organizations are engaged in monitoring various dimensions of the digital economy, developing guidance and policy recommendations, and promulgating relevant international accords, standards and other legal instruments. Regional and bilateral groupings fill out the picture, in many instances going beyond the current multilateral framework to include binding commitments related to market openness, level playing field issues (non-discrimination) and digital trade facilitation. At the global, regional and bilateral levels, consultation and dispute resolution mechanisms are included in some cases for specific types of commitments.

Multilateral and International Institutions

At the global level, the WTO plays a key role as a forum for discussion of digital trade matters, negotiation of rules-based trade liberalization in specific areas, Trade Policy Reviews of members, trade statistics and dispute resolution with respect to WTO commitments. Examples of concrete instruments include the ITA (cited earlier) and the General Agreement on Trade in Services (GATS) (for example, supporting access in some markets for ICT services). Such accords

9 See Office of the United States Trade Representative (2021); The White House (2021); Table A1, which presents the key points from the EU digital trade strategy and WTO e-commerce talks.

Box 1: Digital Services and Global Taxation

Stakeholder concerns have emerged in response to various national and regional tax initiatives aiming to better capture a share of business gains made through the digital economy. In some cases, these gains are made by firms providing services in markets where they do not have a physical presence. Countries such as France and the United Kingdom prepared legislation for unilateral taxation measures on such cross-border digital services. US firms would be disproportionately affected. In response, the United States launched a series of investigations under section 301 of the US Trade Act of 1974, potentially leading to punitive unilateral trade measures to counter the alleged unfair trade practices.[10]

Thankfully, a solution is in the works to reduce tensions and clarify these tax matters. On October 8, 2021, representatives of 136 economies reached an accord via the OECD "to address the tax challenges arising from the digitalization of the economy" (OECD and G20 2021a). The deal fleshes out the terms and implementation plan building on an agreement in principle reached in July 2021, whereby 130 countries and jurisdictions had signed on to pursue a two-pillar approach (OECD and G20 2021b).

Under the terms of pillar one, the deal would apportion taxation rights with respect to cross-border digital services trade of large, profitable multinational enterprises that meet certain minimum size and profitability criteria. This approach would take into account where the profits were made, while also preventing double taxation. A share of roughly 25 percent of the covered profits (after various exclusions) would be subject to taxation at rates determined by the authorities in the destination market where a firm operates remotely. Under pillar two, a minimum corporate income tax rate of 15 percent would be established, including a right for home countries to collect any shortfalls in the tax if the partner jurisdiction fails to impose a minimum tax rate of 15 percent. Talks on remaining matters and codification of the terms in a multilateral convention will continue, aiming for an early conclusion and entry into force in 2023.

The agreement would cover most of the global economy. It comes following prolonged negotiations under way at the OECD in Paris over the past decade (OECD 2021). The terms would harmonize some aspects of taxing digital services. This is intended to reduce the risk of unilateral and potentially inconsistent digital services tax measures, to provide greater certainty for stakeholders, to discipline would-be tax havens and to ensure appropriate revenue streams for governments.

have facilitated the build-out of the internet.[11] In relation to data transmissions, many WTO members have worked to prevent imposition of duties thanks to a temporary moratorium that has been in place since 1998 and renewed biennially since (due to be reviewed at the upcoming delayed WTO Ministerial Conference).[12] The WTO Trade Facilitation Agreement is also supporting digitization of some customs and clearance processes, as well as improving transparency and streamlining some red tape at borders (WTO 2017).

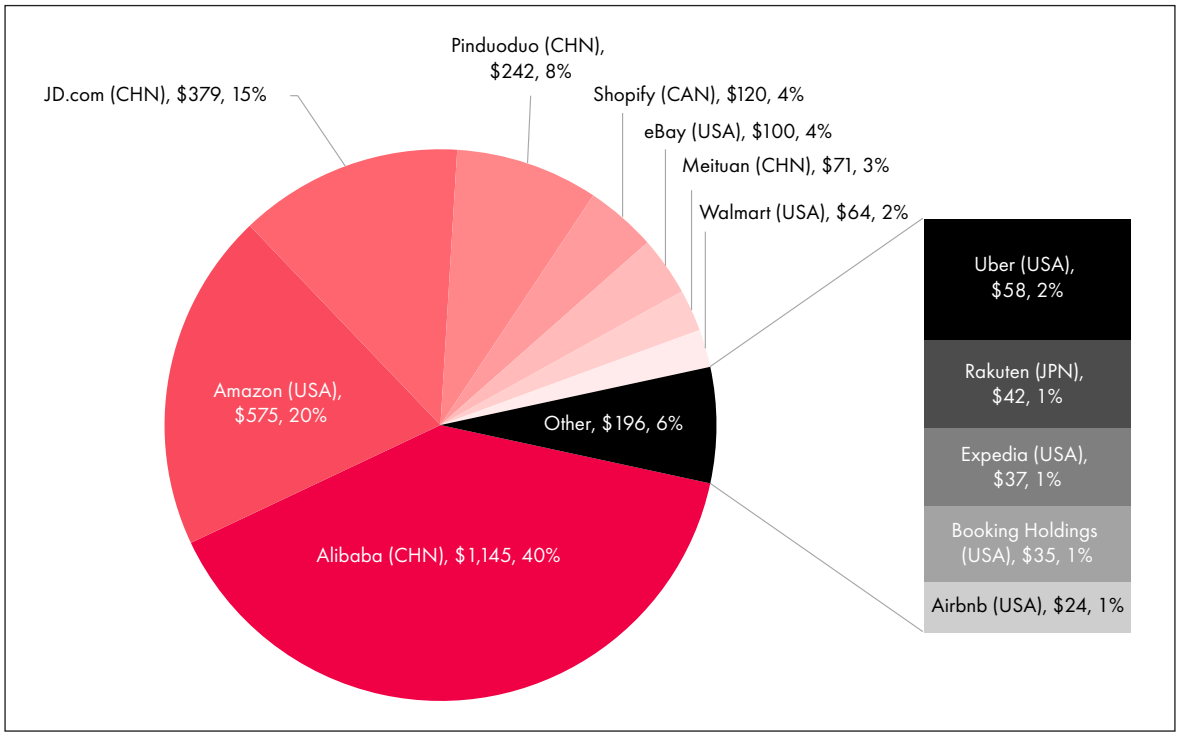
The UN system has played a complementary role with measures to facilitate digital trade, monitor policy and produce relevant trade statistics. In particular, the United Nations Commission on International Trade Law (UNCITRAL) has provided tools such as the Model Law on

10 See Office of the United States Trade Representative (https://ustr.gov/issue-areas/enforcement/section-301-investigations/section-301-digital-services-taxes).

11 GATS entered into force with the launch of the WTO in 1995.

12 See WTO (www.wto.org/english/news_e/news19_e/gc_10dec19_e.htm). India and South Africa have expressed reservations about this approach, noting that it constrains their ability to tax a large and growing segment of international trade. The WTO Ministerial Conference is currently scheduled for the week of June 13, 2022 (see www.wto.org/english/thewto_e/minist_e/mc12_e/mc12_e.htm).

Figure 3: Leading E-commerce Retailers, Shares of Gross Merchandise and Bookings Value, in US$ Billions (2020)



Sources: UNCTAD (2021a); author's tabulations.

Notes: The underlying UNCTAD data is based on company reports. In the figure, countries in which headquarters are located are noted next to company names, using standard three-character indicators. Alibaba includes sites it owns, such as Taobao.com and Tmall.com. The UNCTAD tabulation omits some significant players in this market space, such as Suning.com (CHN), Apple (USA), VIP.com (CHN) and Shopee (owned by Sea Group [SGN]).

Electronic Commerce (1996),[13] the Model Law on Electronic Signatures (2001) and the Model Law on Electronic Transferable Records (2017).[14] UNCTAD has contributed an important monitoring function with periodic reports on issues such as e-commerce preparedness (defined to include availability of personal financial accounts, online experience, access to secure internet and postal service reliability); recommendations on policy dimensions; and international statistics on some aspects of digital trade (for example, on digital products and ICT equipment).[15]

The G20, notably, is providing a forum for policy development and coordination among the governments of large economies. Key stakeholder groups jostle to consolidate views from among their members into coherent, prioritized analytical and advocacy inputs on a wide range of issues, including the digital economy. These satellite engagement groupings represent labour, business and think tanks, among others. With its light and agile structure and its de facto convening power, the G20 is likely to remain at the leading edge of substantial policy developments in the digital economy.

13 The UNCITRAL model law conceptualized non-discrimination, technological neutrality and functional equivalence. It established rules for contracts concluded by electronic means; attribution of data messages; acknowledgment of receipt; and determination of the time and place of dispatch and receipt of data messages. See *UNCITRAL Model Law on Electronic Commerce (1996) with additional article 5 bis as adopted in 1998*, 12 June 1996, online: <https://uncitral.un.org/en/texts/ecommerce/modellaw/electronic_commerce>. Also, the Electronic Communications Convention (2005) established functional equivalence between electronic communications and paper documents.

14 See UNCITRAL (https://uncitral.un.org/en/texts/ecommerce).

15 See, for example, UNCTAD (2021b); UNCTAD (2021c); UNCTAD (https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx, digital economy folder).

The OECD has a mandate to support sustainable growth, improved welfare, employment, financial stability, science and technology, and international trade and investment, all of which are relevant to the digital economy.[16] Working via development of soft law and policy recommendations, policy monitoring and analysis, peer review, statistical tracking of the economy and outreach, the OECD represents an important component of the international governance architecture. For example, OECD members have promulgated formal recommendations for governments in recent decades on broadband development (2004), electronic authentication (2007), digital government strategies (2014), consumer protection in e-commerce (2016), digital security of critical activities (2019), and enhancing access to and sharing of data (2021), among others.[17]

An OECD team recently completed an inventory of legal instruments relevant for the WTO's current e-commerce negotiations. The OECD found 52 different instruments administered in 24 different international fora (Nemoto and López González 2021). In terms of quantity of instruments, the most active rulemaking international institutions included the WTO, the OECD, the International Standards Organization/ International Electrotechnical Commission, the UN Economic Commission for Europe/ UN Centre for Trade Facilitation and Electronic Business, and UNCITRAL. Other international organizations active on these issues included the World Customs Organization, other UN regional commissions (for example, the United Nations Economic and Social Commission for Asia and the Pacific), the World Bank, the IMF and the International Telecommunication Union (a UN agency). They are making contributions ranging from policy-relevant indicators, empirical assessments and technological upgrade projects to trade facilitation and recommendations.

Next Steps via International Institutions

Further advances may be on the horizon. For example, the WTO's Joint Statement Initiative (JSI) on e-commerce may deliver an accord for improved transparency and various trade-facilitating steps (for example, e-signatures) for a large subset of the WTO membership (currently 86 members).[18] Progress could be made at the pending WTO Ministerial Conference (June 12–15, 2022). And the OECD digital tax initiative, discussed earlier, is on track for entry into force in 2023.

Regional Accords and Digital Trade

In the absence of a comprehensive global framework, trade partners have been able to make further advances in digital trade governance at the regional and bilateral level. Regional trade agreements (RTAs) can permit smaller groups of countries — often with greater alignment in their objectives than the full WTO membership — to tackle pressing challenges related to digital trade development. Of course, RTAs do not advance in isolation. The parties to an RTA are also members of the regional and global organizations, and regional organizations contribute analysis and infrastructure in this regard. For example, regional bodies such as the Asia-Pacific Economic Cooperation (APEC) and the Council of Europe are contributing digital trade-facilitating measures and guidance on issues such as personal data protection.[19] In another example, the Association of Southeast Asian Nations (ASEAN) is developing an economic community that is promoting economic integration going well beyond traditional RTAs, with alignment and facilitation in goods and services trade that will support development of regional digital trade. Experience at the regional level can also help to inform next steps to resolve blockages at the multilateral level (Akman et al. 2021).

The author has taken a closer look at regional developments based on a case study approach, selecting a pool of seven recent regional trade deals that include a significant focus on digital

16 See *Convention on the Organisation for Economic Co-operation and Development,* 14 December 1960, art 2 (entered into force 30 September 1961), online: <www.oecd.org/general/conventionontheorganisationforeconomicco-operationanddevelopment.htm>.

17 A full list of OECD legal instruments, including those cited here, can be found at https://legalinstruments.oecd.org/en/instruments?mode=normal&statusIds=1&dateType=adoption.

18 See, for example, International Institute for Sustainable Development (2021). For a review of China's positions in the WTO JSI, see Gao (2021).

19 See Cross Border Privacy Rules System (http://cbprs.org); Council of Europe, *Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data,* 28 January 1981, ETS No 108 (entered into force 1 October 1985), online: <https://rm.coe.int/1680078b37>.

Table 2: Illustrative List of Areas of Convergence across Various Current Digital Trade-Related Agreements

Accord (Year of Entry Into Force)	CPTPP (2018)	AUS-SGP DEA (2020)	DEPA (2021)	EU-Japan EPA/GDPR (2019/2018)	RCEP (2022)	US-Japan Digital Trade Agreement (2020)	CUSMA (2020)
Duty-free electronic data transmission	✓	✓	✓	✓	✓	✓	✓
Liberal cross-border data transfer rules	✓	✓	✓	(Parties to review need by 2022)	✓ (With significant national security exceptions)	✓	✓
Non-discrimination in treatment of digital products (with toleration of national regulation for legitimate policy objectives, exceptions)	✓	✓	✓	✓	✓	✓	✓
Legal protection of personal information	✓	✓	✓	✓	✓	✓	✓
Protection of source code (may have toleration of exceptions, for example, for regulatory or judicial processes)	✓	✓	✓	✓	(A matter for further dialogue among members)	✓	✓
Consumer protection (for example, from spam, fraud, harm and misinformation)	✓	✓	✓	✓	✓	✓	✓
Cooperation on cybersecurity (for example, incident response)	✓	✓	✓	✓	✓	✓	✓
Restriction on use of data localization	✓	✓	✓	✓	✓ (With significant national security exceptions)	✓	✓
Digital economy facilitation (for example, UNCITRAL model law, paperless trade, e-payments, e-authorization and interoperability)	✓	✓	✓	✓	✓	✓	✓
Exclusion of government procurement	✓	✓	✓		✓	✓	✓

Sources: Official texts of the accords; Leblond (2020); Morita-Jaeger (2021).

Notes: Details of membership are provided in Table A2. CPTPP = Comprehensive and Progressive Agreement for Trans-Pacific Partnership; AUS-SGP DEA = Australia-Singapore Digital Economy Agreement (also known as SADEA); DEPA = Digital Economy Partnership Agreement; EU-Japan EPA = European Union-Japan Economic Partnership Agreement; RCEP = Regional Comprehensive Economic Partnership; CUSMA = Canada-United States-Mexico Agreement.

trade or e-commerce. The author has also covered the European Union's General Data Protection Regulation (GDPR), as this is closely bound up with the European Union's strategy for trade agreements that cover e-commerce. An illustrative review of the seven regional trade accords reveals some interesting findings. For at least 10 issues covered by the RTAs, there appears to be some convergence among the largest digital trading nations in the world in their general approach to liberalizing multiple dimensions of digital trade. This observation is summarized in Table 2, and a detailed illustrative comparison is provided in the Annex (Table A2).

This is not to say that there is sufficient alignment for a broad global accord just yet. Across the various regional and bilateral accords, important differences persist in areas such as rights for consumers in the management of their data, privacy, data localization, protection of source code and national security exceptions (for example, related to freedom of the press).

Approaches to digital economy trade accords have tended to be differentiated depending on whether a leadership role was played by China, the European Union or the United States.[20] For example, while all three have pursued liberal market access, they have differed in their approach to privacy and cybersecurity, emphasizing, respectively: commercial openness within an environment of state-defined privacy protection, and subject to subordination to national security interests (China); commercial openness within a regulated environment, including user-led control of privacy aspects operating on the basis of fundamental rights and values (European Union); and commercial openness supported by regulated, business-led control of data, with firm-level responsibility for protecting some aspects of privacy and cybersecurity (United States).

Nonetheless, the fact that these accords are in effect and operational points to substantial steps already taken toward liberalization and standardization of some aspects of digital trade. In the next section, the author will examine the effects of these recent developments, using an indicator for openness to digital services trade that covers 50 countries. In addition, the author will take a preliminary look at how the degree of openness correlates with some important indicators of firm-level responsiveness.

Tracking Digital Market Openness

An OECD publication once famously stated that "Open Markets Matter" (OECD 1998). And the historical record confirms that economies that have established liberal market access for trade and investment in the period since the Second World War have tended to grow more rapidly than those that remained relatively closed (Lippoldt 2012, chapter 1). Although market openness may not be a sufficient condition for developing countries to catch up with the advanced economies, no country has caught up in recent decades without providing adequate openness.

Integration in the rules-based multilateral trading system affords a degree of market access and protections against some policy excesses and other impediments to trade, including digital trade.[21] But, in practice, this approach can still leave important gaps. For example, an incomplete framework may leave in place continued regulatory biases in favour of domestic communications service providers or discriminatory subsidies for local incumbents, among other unfair practices. To reduce such distortions, further steps are required. Improved sectoral coverage and international regulatory alignment on matters related to the digital economy can sometimes be found through regional and bilateral trade and economic agreements, as well as via unilateral trade reforms (for example, moving policy settings toward international standards). Implementation of appropriate complementary domestic policies, such as competition policies that prevent exclusion of start-ups from dominant platforms and policies that support human capital development, can further stimulate growth and innovation in the digital economy.

Innovation can be a critical factor driving firm-level success in the digital economy. Firms that develop scalable innovations in areas such as new product or process features, new approaches to marketing and distribution, or improved efficiency of

20 In addition to the tables in this paper, see also the discussion in UNCTAD (2021c). India may be seen as pursuing a fourth model, a hybrid drawing on elements from each of these approaches, while also promoting digital public goods, a point noted at a November 2021 CIGI/King's College event by reviewer Akshay Mathur, director of the Observer Research Foundation. See Holla (2021).

21 For example, regional and bilateral trade preferences can lead to trade diversion from optimal patterns. (See Viner [1950]). An inclusive multilateral framework can help to reduce such discrimination and promote a level playing field.

operations, among others, may get traction in the competitive landscape. And, here again, some of the factors that drive innovation processes are supported through appropriate policy settings in areas such as market openness, regulation, availability of human capital, IP rights and remedies for unfair practices. And, in a globally connected world, inward market openness can matter as much as destination market openness. Inward openness, for example, may be conducive to in-bound technology transfer via trade and investment and to availability of other critical inputs such as software, machine tools and product components.

The OECD Digital Services Trade Restrictiveness Index

The OECD Digital Services Trade Restrictiveness Index (DSTRI) is an indicator based on an established peer-reviewed methodology for characterizing regulations and their cumulative effect, taking into account five specific dimensions of digital market openness (Ferencz 2019). The dimensions are:

- infrastructure and connectivity;
- electronic transactions;
- payment systems;
- IP rights (copyright, trademark and enforcement provisions); and
- other barriers affecting trade in digitally enabled services (for example, performance requirements affecting digital trade).

See Table A3 for a full listing of the components under each dimension.

The indicator is calibrated so that scores fall between 0 (completely open) and 1 (completely closed). As a rough guideline, scores above 0.1 indicate the presence of meaningful impediments to trade (OECD 2014, 5).

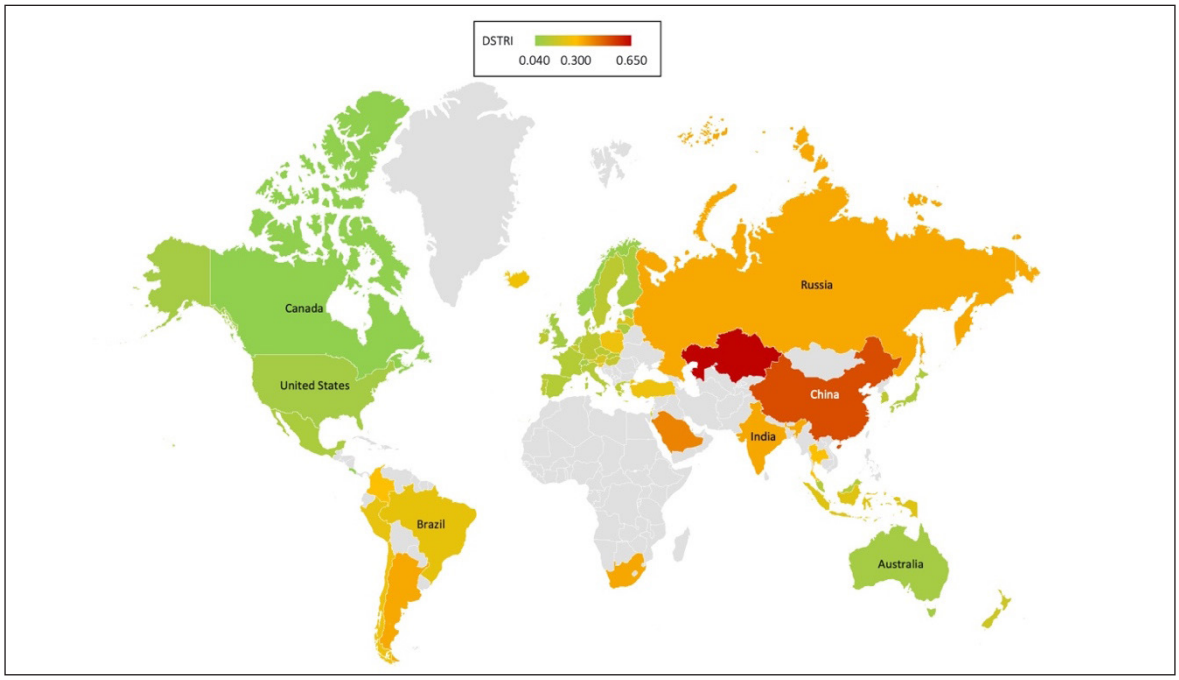
A low DSTRI does not necessarily imply deregulation, but rather low trade restrictiveness in the various measures in place. Relevant regulations are tracked in an empirical manner and scored based on a consistent system developed by OECD economists working in consultation with a large panel of industry experts. The cumulative scoring for each economy uses a weighting scheme, taking into account the relative effect of each area of regulation on the ability to trade. This weighting scheme was developed based on the experts' assessments. As a result, the *infrastructure and connectivity* dimension is overweighted relative to the four other dimensions.

As of September 2021, the DSTRI covered 50 countries including the 38 OECD members and Argentina, Brazil, China, India, Indonesia, Kazakhstan, Malaysia, Peru, Russia, Saudi Arabia, South Africa and Thailand (Figure 4). The advanced economies have tended to exhibit greater openness than developing economies. But there are outliers. For example, Iceland is marked down due in part to a recent deterioration in its score for *infrastructure and connectivity*. And Malaysia scores in an upper tranche despite its status as an emerging market. On average, the global dynamics have not been good for the period since 2014, the year the DSTRI time series begins (Table A4). There have been improvements in seven countries, but deterioration in the scores for 15 countries. The average score for the entire sample has deteriorated by 0.024 points. Kazakhstan led the way, falling by 0.419 points to a score of 0.647. On the positive side of the ledger, Mexico significantly improved its results by –0.199, with a 2020 score of 0.101. (As noted above, lower scores indicate more openness for digital services trade.)

Cross-Referencing RTA Issues in the DSTRI

A number of the inputs taken into account for the DSTRI indicator score (Table A3) are also among the priority digital economy issues covered in regional and bilateral trade accords and noted in the author's illustrative review of such accords (Table A2). For example, matters related to discrimination, cross-border transfer of personal data, data localization, privacy and cybersecurity are referenced. In assessing these elements, the DSTRI provides a partial indication of the potential effectiveness of the various trade agreements in practice with respect to the international digital economy. The DSTRI should not be considered a full and direct reflection of the performance of these trade deals. But a low DSTRI score, reflecting a high degree of market openness, cannot be achieved without taking steps to address the types of digital economy issues covered in the regional and bilateral trade agreements. In this sense, they are related.

Figure 4: The DSTRI (2020)



Sources: See https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL; author's tabulations; Microsoft Bing mapping.

IP Rights

IP rights are an important policy element in establishing effective market openness. Without IP rights protection, rights holders may not be able to enter a market without undue risks. Modern forms of IP rights protection began to take shape in the 1880s when the first treaties for protection of patents, trademarks and copyright were agreed.[22] The current basic global norms for IP rights protection in the trade context were laid down primarily in the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS, entered into force in 1995). In many cases, RTAs and national laws provide measures going beyond the minimum requirements of TRIPS.

The TRIPS Agreement explicitly discusses the protections to be afforded for each type of IP: copyright and related rights, trademarks (including service marks), geographical indications, industrial designs, patents, layout designs (topographies) of integrated circuits and undisclosed information including trade secrets.[23] TRIPS also includes some enforcement obligations, which WTO members are to apply in a fair and equitable manner (Lippoldt 2011). Within limitations specified in the agreement (for example, patent terms, copyright duration), an appropriate degree of effective protection can provide rightsholders with a measure of market exclusivity and an opportunity to reap a return on their IP. This can encourage further innovation as well as market-mediated diffusion of existing innovation (Park and Lippoldt 2014).

RTAs and unilateral domestic legal provisions are important complements to the TRIPS Agreement and may offer additional protection (for example, extended duration of copyright protection); facilitation of legitimate trade (for example, protecting against infringements, expediting customs clearance); and measures to close gaps (for example, the TRIPS Agreement provides for trade secrets protection but leaves unspecified the manner of enforcement). High-standards international legal instruments such as CUSMA, the CPTPP, the EU internal market regulation and the EU-Japan EPA deliver meaningful

22 World Intellectual Property Organization (WIPO), *Paris Convention for the Protection of Industrial Property,* 20 March 1883 (entered into force 7 July 1884) (patents, industrial designs and trademarks); WIPO, *Berne Convention for the Protection of Literary and Artistic Works,* 9 September 1886 (entered into force 5 December 1887) (copyright and related rights).

23 The TRIPS Agreement requires protection be available for trade secrets but does not spell out the terms of implementation and enforcement. See Lippoldt and Schultz (2014).

supplementary IP rights protection for the digital economy. However, weaknesses and gaps persist, as evidenced by the persistence of illicit trade that entails breaches of IP rights protection.[24]

This is not to say that increased stringency in IP rights legal provisions is always appropriate.[25] In some cases, shortfalls in protection are associated with failures to apply existing laws on the books. For example, a pattern of copyright infringement may not be rectified by extending the term of copyright protection by an additional 10 years. Rather, greater resources may have to be devoted to catching and prosecuting the infringers. And overly stringent IP rights systems can have costs for society. For example, a poorly specified national law or regulation could, in theory, undermine healthy competition, promote excess litigation, unduly constrain the ability of stakeholders to collaborate, limit economically and socially desirable labour mobility, or stifle follow-on innovation, among other possibilities.[26] Thus, a balanced approach is needed to ensure appropriate specification and enforcement of IP rights for rights holders, while considering the interests of the other stakeholders that are active in the digital economy.

One element of the DSTRI indicator discussed in the previous section considers the de jure legal framework for copyrights, patents and enforcement. To get a handle on business perceptions of the operation of the IP rights protection in practice, the author turns to the World Economic Forum (WEF) executive survey indicator of IP protection.[27] WEF asks executives, "In your country, how strong is the protection of intellectual property, including anti-counterfeiting measures?"[28] Results are scored from 1 (extremely weak) to 7 (extremely strong). Scores for the advanced economies tend to be higher than those for the emerging markets (Figure 5). These perceptions matter as some studies have found that inadequacy in effective IP rights protection may undermine innovation incentives.[29]

Firm-Level Economic Performance

Innovation Is Important

Innovation is a key driver of economic progress, enabling improvements in products and processes. It changes the relationship between inputs and outputs, generally boosting productivity. Sectors concentrating in digital trade tend to be relatively technology-intensive and sensitive to innovation. Conditions that affect the ability to conduct digital trade may be expected to influence the intensity of innovation activity of firms in these sectors.

Effective improvements in market access in a given economy may elicit a competitive international supply response and expansion in the range of product varieties available. Incumbent suppliers in the market may respond by exploiting more intensively their existing stock of technological assets. But if they do only this, they may face increased margin pressures. The incumbent firms may encounter a sort of innovator's dilemma in the post-liberalization environment (Christensen 1997). Where competitive foreign firms enter the market, management at domestic incumbents may be able to utilize their initial advantages (for example, consumer brand loyalty, network effects and technological path dependency of customers) to maintain a portion of their revenue streams. But, over time, the new competitive pressures may result in shrinking resources available to incumbents for subsequent innovation, thereby locking in future declines in their competitivity.

On the other hand, a successful R&D response may enable the incumbent to differentiate its products and potentially defend or expand its market position.[30] Also, the innovation may open new opportunities for a firm's products in international markets.

24 A current OECD project has documented significant volumes of counterfeit products flowing along some trade corridors, sometimes using e-commerce channels. See OECD (www.oecd.org/gov/illicit-trade/).

25 See discussion in Lippoldt (2011).

26 For example, see Galasso and Schankerman (2014).

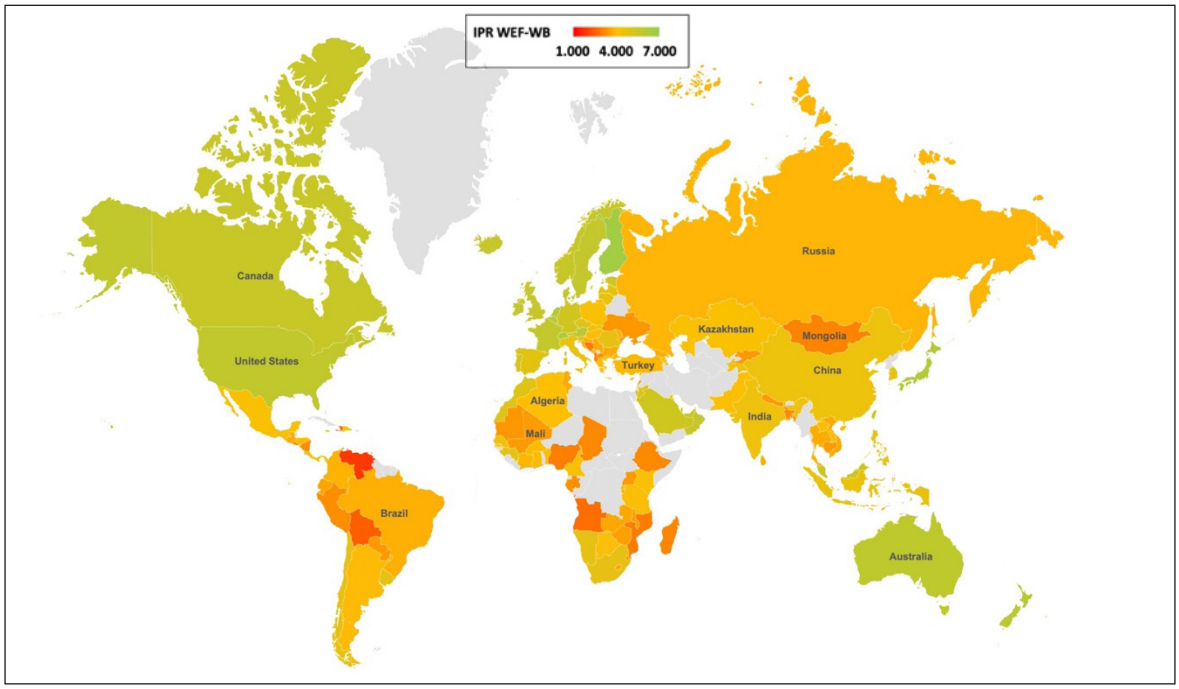
27 See World Bank (https://govdata360.worldbank.org/indicators/h0d12f8de?country=BRA&indicator=41019&viz=choropleth&years=2019).

28 Ibid.

29 For example, for analysis and references, see Lippoldt (2011); Lippoldt and Schultz (2014). Although the WEF executive survey data is subjective, and the observations are drawn from a sample of respondents that varies by country, the resulting scores are relatively consistent in comparison with some more precise empirical indicators such as the US Chamber of Commerce International IP Index. In 2019, for example, the correlation coefficient between these two series was 0.83 (based on scores for mutually covered countries). Both monitoring approaches have merits, depending on the type of analysis to be undertaken. For the purposes of the present study, the WEF survey was employed in some analyses as it offered a longer, consistent time series.

30 For example, see Melitz and Trefler (2012); also see Lippoldt (2018).

Figure 5: WEF Executive Survey on IP Rights Protection (2019)



Sources: See World Bank (https://govdata360.worldbank.org/indicators/h0d12f8de?); author's tabulations; Microsoft Bing mapping.

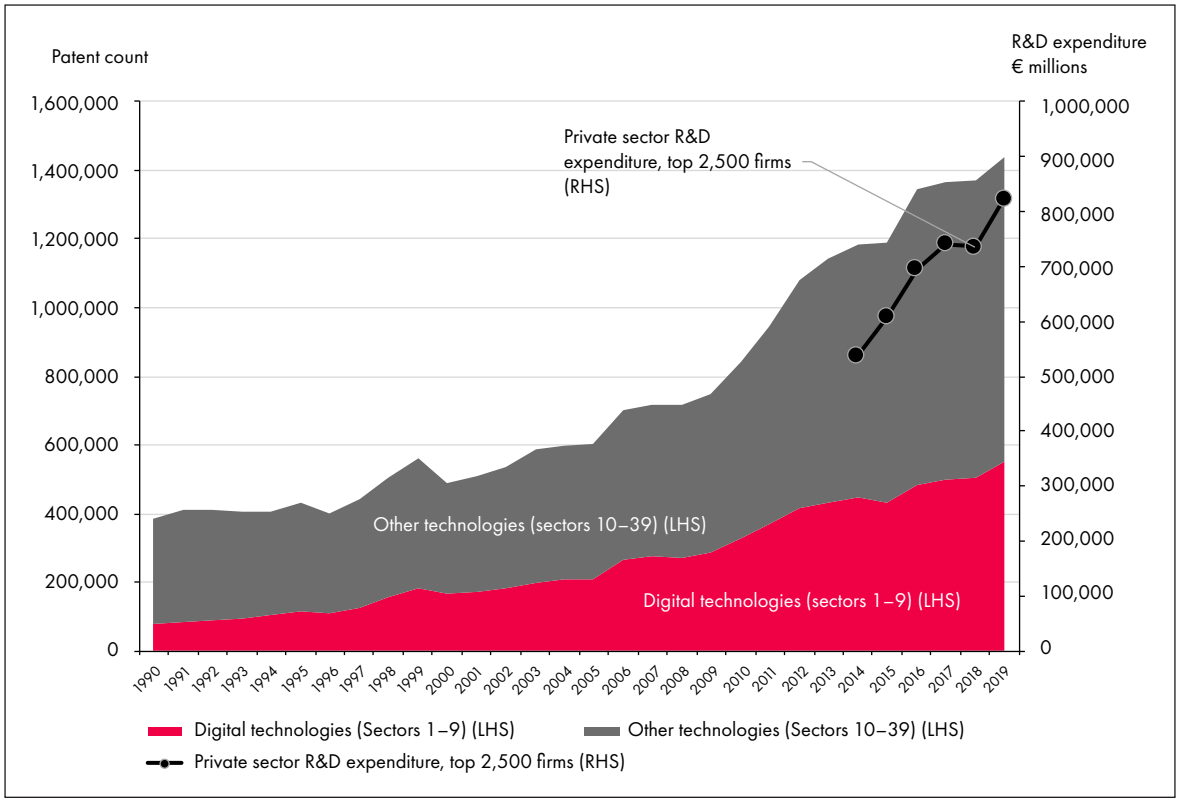
Notes: Higher scores indicate business leader perceptions of stronger, more effective protection. The WEF IP rights indicator provides information on business perceptions of the application and enforcement of IP rights in practice. In contrast, the IP rights elements in the DSTRI are focused primarily on the de jure elements of IP rights protection.

National-level policies maintaining or imposing new protectionist restrictions on trade in a market may disincentivize such investment, as firms may strive to rely on exploitation of their existing strengths to maximize returns while keeping costs down. Moreover, innovation processes and their resulting products may rely to some degree on imported inputs — both tangible and intangible — as well as on access to external markets for products (for example, to achieve scale economies), including with respect to products that are digitally traded. Protectionist policies and a lack of digital trade facilitation may therefore constrain or disincentivize new firm-level investment in innovation.

Firm-level expenditure on R&D appears to matter materially for innovation outcomes. One indication of a positive outcome can be the awarding of a patent (Lippoldt 2011). Patents are treated in section 5 of the TRIPS Agreement. Article 27 notes that, subject to certain conditions, "patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step [i.e., they are non-obvious] and are capable of industrial application [i.e., useful]." In other words, the granting of a patent is associated with a technological advance. A benefit for innovators awarded a patent is a period of market exclusivity, typically 20 years, for the specific innovation. For example, an innovator can exploit this advantage as part of the firm's own activity or can assign it or license it to others in exchange for some type of compensation.

Figure 6 highlights data from WIPO on the awarding of new patent grants globally since 1990. The volume of patent grants has increased dramatically during the subsequent period, reflecting in part an increase in the pace of some

Figure 6: New Patent Grants by Field of Technology and Private Sector R&D Expenditure of Top 2,500 Firms



Sources: Patent grant counts are drawn from www3.wipo.int/ipstats/; R&D expenditure data is drawn from Grassano et al. (2020) (and previous years) and the author's tabulations.
Notes: LHS = left-hand-side axis; RHS = right-hand-side axis.

aspects of innovation.[31] Fields of technology directly related to the digital economy have increased their share in the total, rising from 20 percent in 1990 to 38 percent in 2019.[32] The number of patents granted for the digital economy fields has increased by more than 600 percent over this period. There is a statistical correlation between annual patent grants and firm-level expenditure on R&D for the period 2014–2019 (correlation coefficient of 0.96 for the series shown in Figure 6). While simple statistical correlation does not confirm causality or even a materially important relationship, it may prove relevant. This possibility helps motivate exploration of the relationship of digital trade governance to business expenditure on R&D in the next section.

31 Concerns have arisen about the quality of some patents, including with respect to some areas of the digital economy such as software. A weakness in the examination of inventive steps could result in the awarding of patents that may not merit the recognition (OECD 2004). In response, a number of patent offices have taken steps to improve the rigour of examinations and the quality of patents granted. For example, the US Patent and Trademark Office has set this as an objective (see www.uspto.gov/patents/patent-quality). There is also some debate in the literature about the global pace of innovation and challenges in technology research. By some measures (for example, labour inputs), advances at the technological frontier in areas such as electronics are growing more costly in view of rising complexity and limits in existing knowledge in areas such as materials science (for example, see Bloom et al. [2017]). In addition, there are measurement challenges and changes in innovation. For example, there are developments that may not be adequately captured in the area of non-technological innovation (for example, institutional reform) or hybrid, organizational-technological innovation (for example, digitally enabled organizational change in retail sales). For a discussion, see Cowen and Southwood (2019).

32 The digital economy is defined here to cover nine WIPO patent categories: electrical machinery, apparatus, energy; audiovisual technology; telecommunications; digital communication; basic communication processes; computer technology; IT methods for management; semiconductors; and optics.

The Analytical Approach

In this section, the author considers the relationship of digital trade restrictiveness at the firm level to two aspects of innovation. To accomplish this, the author employs regression analysis.

In the first step of the analysis, the author considers a data set focused on the evolving list of the top 2,500 public firms in the world in terms of annual expenditure on R&D during the period from 2014 to 2019. To what extent are changes in digital services market openness and business perceptions of IP rights protection associated with change in this R&D expenditure, controlling for other factors (i.e., change in domestic market size, firm-level fixed effects)?

In the second step of the analysis, the author examines a global data set presenting a sample of successful start-up firms during the period from 2007 to 2021. The data covers so-called unicorns, that is, early-stage firms that have not yet gone public but are already valued at more than US$1 billion (i.e., they are successful by that measure). The goal is to determine whether there is an association between the number of such start-ups by country and market openness in digital services trade, after controlling for domestic market size as measured by GDP.

These statistical analyses are relatively simple in structure and are meant to explore the possible existence of an association among the variables of interest. The methodology and data sets are not adequate for demonstrating any causal relationships between the variables. Rather, where significant association is found, this may motivate, and provide a starting point for, further assessments of the relationships.

R&D and Openness to Digital Services Trade: Statistical Analysis

Inputs for the Consideration of Firm-Level R&D Expenditure

The analysis here draws on data from the European Union's *Industrial R&D Investment Scoreboard*, which is produced annually under the auspices of the European Commission. This publication highlights the top 2,500 firms globally for R&D expenditure and presents related performance indicators (see Box 2 for details) (Grassano et al. 2020). The firms represent collectively about 90 percent of the global business expenditure on R&D, and approximately half of the total global innovation expenditure from all sectors, including business, government, academia and non-profit institutions.[33]

For the period from 2014 to 2019, the author developed a panel data set of firms that figured among the top 2,500 firms for R&D expenditure in any of these six years. Because firm-level expenditure on R&D can vary by year, and firms are only covered if they disclose their R&D expenditure in the year concerned, the composition of the top 2,500 firms changes somewhat each year (i.e., this is not a balanced panel). Altogether, 3,918 firms are represented among the pooled observations over the six years covered by the author's sample, of which 1,525 firms met the criteria for top 2,500 selection in all six years (other firms met the criteria only for some years). Each observation includes a firm's R&D expenditure, net sales revenue, the year of observation and the home market of registry. In the author's applied analysis, a number of firms drop out due to data omissions (see Tables 4 and 5, below, for sample sizes).

The author supplements this data set with relevant information on the home country policy settings for digital services trade restrictiveness (i.e., the DSTRI) and IP rights protection (i.e., WEF IP rights), as described above. (It is helpful to keep in mind that lower DSTRI scores point to greater market openness and higher WEF IP rights scores indicate the perception of more effective IP rights protection.) The author also includes the size of the home market as measured by the aggregate GDP in the firm's country of registry.[34]

In R&D expenditure analyses, the author first considers the overall sample and then reruns the analysis just for those firms that are digitally intensive in their products or operations. For this, the author draws on the scoring from a recent OECD sectoral taxonomy of digital intensity (Calvino et al. 2018). To develop the taxonomy, the OECD team considered each sector of the International Standard Industrial Classification (Revision 4) using five indicators over a three-year period (2013–2015).

33 See Lippoldt (2020a); an online synopsis is available (see Lippoldt 2020b).

34 Current GDP level is drawn from the IMF data website and converted to euros using the market exchange rates employed in the EU *Industrial R&D Investment Scoreboard* (Grassano et al. 2020). This serves as an indicator of home market size.

Box 2: Key Features of the European Union's *Industrial R&D Investment Scoreboard* Data

The European Union's *Industrial R&D Investment Scoreboard* provides a core input for the firm-level quantitative analysis presented in this section: data on net sales, investment in R&D and country of registry. The European Commission engaged Bureau van Dijk (a Moody's company) to collect the data drawing on company annual reports and accounts, and other public domain documents. The information reflects audited financial statements rather than government survey results and administrative statistics.

The data set compiled for this analysis is an unbalanced panel drawn from the top 2,500 firms for R&D investment in each year from 2014 to 2019. It covers 15,000 observations, although some drop out in the present analysis due to gaps in data.

Despite substantial continuity in the firms listed from year to year, the exact composition of the list varies annually due to changes at the firm level. The status of a firm may evolve over time due to changes in its R&D expenditure; changes in reporting practices (for example, new accounting standards); mergers and acquisitions (M&A); demergers; bankruptcies or other factors. And there may be successful new entrants. Across the six years covered, 3,918 firms are represented.

R&D investment is defined as the cash investment self-funded by the companies themselves, including externally contracted R&D paid for by a covered company and destined for its own internal use. It excludes R&D that a covered firm may conduct based on a contract for a third party.

In the database, "home country" designations are assigned based on place of registration. This may not be the location where a firm's R&D is conducted or where most of that firm's net sales are made.

Net sales exclude sales taxes and shares of sales accruing to others (for example, joint ventures and associates). For banks, sales are defined as "total operating income" plus any insurance income. For insurance companies, sales are defined as "gross premiums written" plus any banking income.

Where there are subsidiaries, the consolidated group accounts of the ultimate parent company are used. In the case of M&A, pro forma data is employed where feasible for the year of the merger and prior year comparables. In the case of demergers, the history of continuing entity is retained and the separating entity is only shown from the time of demerger to avoid double counting.

The data is subject to various limitations and caveats. Among the main limitations cited by the EU report authors:

- Data for non-euro countries is affected by exchange rate variation. The data set is compiled using nominal data and the euro as the base currency.
- The fiscal years of individual firms may vary. In 2020, about 70 percent of the covered firms had fiscal years ending in December. Reporting for other firms does not coincide with the calendar year.

There is variation in certain other accounting practices. For example:

- The listing of the top 2,500 firms may not reflect the full population of candidate firms due to a failure by firms to disclose R&D information. This may happen in economies where there is not a legal requirement to disclose. For example, the EU team reports that firms in Southern European countries or new EU member states may be underrepresented for this reason.
- Another accounting issue concerns engineering costs. The EU team notes that US firms generally include in R&D investment data the costs for engineering related to product improvements; EU firms tend to exclude these costs. Where data permits, the EU team adjusts for this to align with EU practice.

Box 2 (continued)

Sample Statistics

- Mean R&D expenditure: €300.6 million
- Minimum R&D expenditure: €17.9 million (two firms: Odelo, 2015, and Intralot, 2015)
- Maximum R&D expenditure: €23,160.1 million (firm: Alphabet, 2019)
- Standard deviation (R&D expenditure): 996.0
- Number of firm-level, annual observations: 15,000 (2,500 per year, 2014–2019).
- Firms in the sample: 3,918 firms, of which 1,525 are present in all six time periods (others only met the top 2,500 criteria in some years).

Sources: Grassano et al. (2020) and previous editions. For further details, see "Methodological Notes" (ibid., 103–5).
Notes: As the DSTRI is a key independent variable in the firm-level statistical analysis (below), the reader may wish to note the sample statistics for the DSTRI as represented in the pool of firm-level observations in this paper for 2014–2019: mean score = 0.17; max score = 0.51; min score = 0.04; standard deviation = 0.16. Among the 15,000 firms in the author's data set, 14,325 include a corresponding DSTRI score for their home country.

The OECD digital intensity indicators are:

- the share of ICT tangible and intangible (for example, software and databases, respectively) investment as a percentage of non-residential gross fixed capital formation, by sector;
- the share of purchases of intermediate ICT goods and services (for example, production inputs) as a percentage of output, by sector;
- the stock of robots per hundred employees (as an indicator of automation);
- the share of ICT specialists in total employment; and
- the share of turnover from online sales.

Ranking sectors using these indicators, the OECD team defined the top quartile of sectors as being of high digital intensity. For this paper, the team reclassified the resulting taxonomy to create a final list of high digital intensity sectors based on the *nomenclature statistique des activités économiques dans la Communauté européenne* (NACE) classification employed in the database used in the following analysis. The list of high digital intensity sectors for the analysis is presented in Table 3. On this basis, some 814 firms are identified as falling into this category of sectors out of the 3,918 firms covered in the R&D expenditure database.

A review of the firm-level R&D expenditure data set by economy is provided in Table 4, covering the years from 2014 to 2019. Among this pool of 15,000 observations, the top six economies represent more than three-quarters of the observations (76.8 percent). The result highlights a significant geographic concentration of private sector R&D activity and the important potential role of improved market openness for the diffusion of the resulting innovation.

Graphical Sketch: R&D Expenditure and Digital Services Market Openness

To get a first impression of the dynamics in the data and for illustrative purposes, the team charted the relationship between digital services market openness and firm-level R&D expenditure. The team chose a sample of four countries with substantial changes in market openness as measured by the DSTRI and having multiple firms in the top 2,500 for R&D expenditure during the period from 2014 to 2019. The team then plotted, for each year, the average expenditure on R&D for each country's firms from the top 2,500 list against each country's national DSTRI score for each year. In order to present a view on trends prior to the study period, they included data for 2013. The team considered two country cases of increased openness and two cases of decreased openness.

As may be seen in Figure 7, in three of the four cases, a change in the DSTRI score is followed by an echo in average R&D expenditure. The echo may come with a lag and may manifest as a peak, trough or alteration of a trend. Austria is the outlier, exhibiting the least evident response. It is still notable in that Austria's average R&D expenditure

Table 3: Sectors of High Digital Intensity Represented among the Top 2,500 Firms for R&D (2014–2019)

High Digital Intensity Sectors	NACE Code
Aerospace and defence	1
Automobiles and parts	3
Banks	4
Equity investment instruments	10
Financial services	11
Fixed-line telecommunications	12
Life insurance	25
Mobile telecommunications	28
Non-equity investment instruments	29
Non-life insurance	30
Software and computer services	36
Support services	37

Sources: Calvino et al. (2018); author's tabulations.

level is much lower than those in its developed-country competitors Canada and Denmark. And, despite an increase, Austria's R&D trend may be lower than it otherwise would have been with less of a decline in its DSTRI score. With respect to the other three cases, R&D expenditure may be more evident, with a stronger pattern where digital services market access improves and a weaker pattern where access deteriorates. Clearly, there is not a one-to-one relationship between R&D expenditure and DSTRI. A more detailed assessment is needed to begin to untangle the relationships.

Regression Results: Exercises 1 and 2

In order to provide a more nuanced assessment of the R&D expenditure and DSTRI relationship, the author turns to a statistical analysis based on ordinary least squares (OLS) panel regression techniques. Exercises 1 and 2 use a first-differences approach based on annual data for an unbalanced panel of firms for the period from 2014 to 2019. Due to turnover in firms among the top 2,500, use of a balanced panel would have resulted in significant loss of information, including with respect to developing-country firms. By employing a first-differences approach, the author hopes to obtain a sense of the dynamics among the variables. Also, statistically, this approach yields stronger results. OLS regression techniques were chosen because examination of the data revealed a roughly linear relationship among the variables, at least for the short time frame covered here.

The author regresses firm-level R&D expenditure on DSTRI, controlling for business perceptions of IP rights protection (WEF IP rights), home economy aggregate GDP and firm-level fixed effects. GDP serves as a proxy for market scale and institutional development in an economy. Firm-level fixed effects (dummy variables) are employed to take account of firm-specific matters. The exercise was run once for the full sample and once for the subset of firms in sectors most engaged in the digital economy, as identified using the OECD taxonomy (see Table 5).

Discussion

As can be seen in Table 5, for both the full sample and the digital sector sample of firms and after taking account of the control variables, a weak, statistically significant relationship is still found between DSTRI and firm-level R&D expenditure (with a 90 percent confidence interval for the coefficients). Home country GDP is highly significant. The WEF IP rights variable has the expected sign in both cases but is not statistically significant. One reason for this may be that some firms may use trade secrets protection during

Table 4: Firm-Level Sample, Home Economy of Registry (2014–2019)

Economies Represented					
A–M	Counts	%	M–Z	Counts	%
Argentina	4	0.03	Malta	5	0.03
Australia	82	0.55	Mexico	8	0.05
Austria	94	0.63	Netherlands	236	1.57
Belgium	87	0.58	New Zealand	17	0.11
Brazil	45	0.30	Norway	63	0.42
Canada	172	1.15	Poland	3	0.02
China	2,485	16.57	Portugal	18	0.12
Colombia	2	0.01	Russia	13	0.09
Czech Republic	3	0.02	Saudi Arabia	13	0.09
Denmark	172	1.15	Singapore	40	0.27
Finland	111	0.74	Slovenia	7	0.05
France	451	3.01	South Africa	10	0.07
Germany	791	5.27	South Korea	424	2.83
Greece	14	0.09	Spain	93	0.62
Hungary	6	0.04	Sweden	219	1.46
Iceland	6	0.04	Switzerland	340	2.27
India	168	1.12	Taiwan	606	4.04
Iraq	6	0.04	Thailand	4	0.03
Ireland	143	0.95	Turkey	37	0.25
Israel	134	0.89	Ukraine	1	0.01
Italy	159	1.06	United Arab Emirates	3	0.02
Japan	2,047	13.65	United Kingdom	785	5.23
Liechtenstein	6	0.04	United States	4,810	32.07
Luxembourg	38	0.25	Venezuela	4	0.03
Malaysia	15	0.10			
Subtotals (%)		**48.27**			**51.73**
Subtotals (counts)	**7,241**			**7,759**	
Grand total counts and %	**15,000**	**100%**			

Sources: Grassano et al. (2020) and various earlier editions.

Notes: A "count" is a firm-level observation for one year that lists a specific economy as the place of registry. The place of registration may not be a firm's main location for R&D activity. Companies registered in Bermuda, the Cayman Islands and Hong Kong but with principal operations elsewhere have been allocated to the home country for operations.

Figure 7: Illustrative Plots of Average Firm-Level R&D Expenditure among Top 2,500 Firms and DSTRI, by country (2013–2019)

Sources: See Grassano et al. (2020) and various earlier editions; OECD (https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL); author's tabulations.

Notes: The number of top 2,500 R&D firms per county varies over time: Austria (between 14 and 17), Canada (between 25 and 32), Denmark (between 25 and 32), Turkey (between 4 and 9). LHS = left-hand side axis; RHS = right-hand side axis; avg = average. Changes over time in the underlying infrastructure and connectivity scores account for much of the movement in the DSTRI scores for these four countries during this period. OECD country notes on overall services trade restrictiveness (see www.oecd.org/trade/topics/services-trade/) highlight some of the broadly relevant policy developments in each country for recent years. Lower DSTRI scores indicate greater market openness. Trend lines are labelled as "linear" in the figure.

the early R&D innovation phase, rather than the better-known copyright, patent and trademark protections that may spring to mind in the WEF IP rights survey context (Lippoldt and Schultz 2014).

The regression equation accounts for less than half of the variation in R&D expenditure but nonetheless does appear to explain a substantial portion. (This degree of explanatory power appears largely due to the use of firm-level fixed effects.) The result is stronger for the high-digital-intensity firms than for the overall sample. Thus, while other factors clearly affect changes in R&D expenditure, the DSTRI does appear to be positively associated *at the margin*. In other words, the governance factors represented by the DSTRI variable may tend to be associated with firm-level innovation processes, at least with respect to firms with comparatively large investments in R&D in the 2014–2019 time frame (i.e., the firms in the sample).[35]

The team tested the robustness of this finding by running a number of variations. They experimented by lagging variables and using alternative formulations such as dropping or adding control variables. They also tested the model by running iterations with just those firms present in the top 2,500 for each year (a balanced panel in that

35 There are some outliers in the DSTRI data set. Kazakhstan and Saudi Arabia stand out for their substantial increases in digital services market restrictiveness. However, their effects tend to drop out from the R&D expenditure analysis as their firms generally fail to meet the top 2,500 criteria. Kazakhstan has zero qualifying firm-level observations and Saudi Arabia only 13, out of 15,000 observations in the entire data set.

Table 5: Firm-Level R&D Expenditure and Market Openness for Digital Services Trade (2014–2019)

	Regression 1 (First Differences)	Regression 2 (First Differences)
Period covered	2014–2019	2014–2019
Firm sample	All sectors, top 2,500 firms for R&D expenditure each year	Digital sectors only, among top 2,500 firms for R&D expenditure each year
Dependent variable	ΔFirm-level R&D expenditure (euros)	ΔFirm-level R&D expenditure (euros)
Method	Unbalanced panel, least squares, ordinary	Unbalanced panel, least squares, ordinary
ΔDSTRI	−193.5818*	−438.6174*
ΔHome economy GDP level (current prices, euros)	0.0153***	0.0259***
ΔWEF IP rights (survey of executive perceptions)	6.3482	12.2778
Firm-level fixed effects	✓	✓
Number of observations (unbalanced panel)	12,614	3,039
Number of firms	3,216	801
Adjusted R^2	0.4064	0.4816

Sources: See Grassano et al. (2020); World Bank (https://databank.worldbank.org/source/world-development-indicators); Calvino et al. (2018); OECD (https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL); World Bank (https://govdata360.worldbank.org/indicators/h0d12f8de?); author's calculations.

Notes: While the full sample included 15,000 observations for these years, some were excluded due to missing data. This concerned firms located outside of the DSTRI's coverage. The DSTRI covered 50 countries: the 38 OECD countries and Argentina, Brazil, China, India, Indonesia, Kazakhstan, Malaysia, Peru, Russia, Saudi Arabia, South Africa and Thailand. Statistical significance is indicated as follows: * = 90%; ** = 95%; *** = 99%. Use of first differences is indicated by the delta symbol = Δ. Adjusted R^2 is a standard statistical indicator of the extent of the variance in the dependent variable that is accounted for by a statistical model, adjusted for the number of independent variables included.

sense).[36] Several alternative specifications offered significant results or nearly significant results (just under the 90 percent threshold for P values), although with wide variation in explanatory power. The exercises presented here offered the best combination of significance and explanatory power.

It is important to keep in mind the limitations of this exercise, which examines correlation, not causality, and a specific time frame and a specific sample of high-performing R&D firms. Yet, given the potential impact of innovation on economic performance, these results certainly merit further consideration in more comprehensive future analysis covering the broader economy. Consistent implementation of a policy framework offering digital services market openness may potentially be found to be conducive to a positive and substantial firm-level innovation response.

36 An edition of the model, not shown here, with a nearly balanced panel (some firms still dropped out due to gaps in the control variable data set) was nearly significant (with a P value just under 0.90 for the DSTRI coefficient). However, many developing countries dropped out of the analysis as they had quite a few leading firms that emerged during the period or fluctuated at the threshold for selection depending on the year.

Unicorn Firms and Openness to Digital Trade

A significant volume of new start-up activity takes place in sectors that are medium to high in their digital intensity. The author hypothesized that there would be sensitivity of such firms to digital services market openness. This is relevant for inbound market access for globally competitive inputs including services related to digital technology, tools and equipment, and components, as well as for outbound access to destination markets. In this exercise, the author takes a closer look at the population of unicorns using a database compiled from public information by CBInsights, an investment advisory service.[37] These are early-stage firms that are not yet public but have proven successful as evidenced by their individual valuations of US$1 billion or greater.

Tables 6 and 7 provide information on the profiles of unicorn enterprises identified in the CBInsights unicorn database. For the author's analysis, tracking coverage starts in 2014 and runs through July 2021. Firms graduate from tracking once they are publicly listed or acquired, or if they fail. The author assessed data for the roster of unicorns as of September 8, 2021, the date the author sampled the data. A breakdown of these firms by jurisdiction of registry finds significant geographic concentration: the sample of 776 unicorns represents just 35 economies. Moreover, seven out of 10 unicorns are located in just two economies: the United States (51 percent) and China (20 percent). Two other geographic areas of notable activity include India at nearly five percent and the United Kingdom at four percent. The other unicorns are spread thinly around the remaining 31 economies.

As for types of unicorn activity, a closer examination confirms a particular concentration in the digital economy. The database identifies just 15 sectors as representing the entire sample. However, the database defines the sectors at a fairly disaggregated level, meaning that a standard two-digit industrial classification would reveal an even more pronounced concentration. Linking the unicorn sectoral distribution back to the OECD taxonomy of digital intensity employed in the previous exercise, the author finds that the unicorns are exclusively engaged in medium-to-high digitally intensive activity. There are no low-digital-intensity firms in this population.

Among the leading sectors for unicorns, AI is of particular interest. It may well be that AI is an emerging "general-purpose technology" (Dernis et al. 2019, 47). Such technologies have the potential for application across the economy in a manner that transforms business operations. The impact might be similar to the scale of the effects associated with the arrival of the internet. AI is an innovative growth sector in its own right,[38] but its advance is also enabling advances in other industries, especially data- and knowledge-intensive industries.[39] Among the unicorns considered in the present analysis, more than eight percent are in the AI sector, ranking that sector fourth among the unicorn sectors (Table 7).

Figure 8 highlights the population of unicorns by the year in which each firm was first categorized as a unicorn and also provides the recent valuation of each firm as of September 8, 2021 (i.e., the date the data was downloaded). The figure thins out in the earlier years, as there were fewer unicorns to start with and presumably some have already been listed, acquired and integrated with an existing public firm, or perhaps delisted (possibly due to declines in valuation or commercial failure). Information on exits from the unicorn tracker is not reported in the public edition of the database. Valuation is included in the chart to give an idea of the range of the firms covered, by size. A number of these firms could be future candidates for going public or acquisition. The chart covers the study period (2014–July 2021), plus three years of historical data for perspective (2011–2013).

In the present analysis, the author takes a closer look at unicorns to see the effect that digital services trade restrictiveness might have on an economy's ability to generate such unicorns. Using a pooled data sample, the author regresses the total number of unicorns identified in each country during the period from 2014 to July 2021

37 The current database is available at www.cbinsights.com/research-unicorn-companies/.

38 A glance at the AI patent distribution provides an indication of the span of AI activity. According to an OECD study, the filers of AI-related patents are concentrated, with computers and electronics firms accounting for almost 50 percent of AI patents filed. But, of course, *computers and electronics* products are employed economy-wide and provide a channel for broad AI diffusion. Service sector firms (including health services) also account for a notable share of AI patents, followed by transportation and machinery. See Dernis et al. (2019, 5).

39 At the same time, this transformational power of AI is not without risks. A recent paper highlights the potential for harms to emerge from AI development in the absence of an appropriate regulatory framework. For example, AI may embed control of information in a manner that manipulates consumers, limits access to information or otherwise discriminates. See Acemoglu (2021).

Table 6: Geography of Unicorns, by Country of Registry (2014–July 2021)

Country	Unicorns (Count)	Country Share of All Unicorns (%)
Argentina	1	0.1
Australia	6	0.8
Austria	2	0.3
Belgium	2	0.3
Brazil	13	1.7
Canada	16	2.1
Chile	1	0.1
China	158	20.4
Colombia	2	0.3
Czech Republic	1	0.1
Denmark	2	0.3
Estonia	1	0.1
Finland	1	0.1
France	16	2.1
Germany	19	2.4
India	38	4.9
Indonesia	3	0.4
Ireland	3	0.4
Israel	18	2.3
Japan	5	0.6
Lithuania	1	0.1
Luxembourg	1	0.1
Malaysia	1	0.1
Mexico	3	0.4
Netherlands	4	0.5
Norway	2	0.3
South Africa	2	0.3
South Korea	11	1.4
Spain	2	0.3
Sweden	3	0.4
Switzerland	5	0.6
Thailand	1	0.1
Turkey	2	0.3
United Kingdom	31	4.0
United States	399	51.4
Total	**776**	**100**

Sources: See CBInsights (www.cbinsights.com/research/unicorn-startup-market-map/); the author's tabulations.
Notes: The unicorns tracked included a further 23 firms dropped for the author's study due to missing data. Their registry: Bermuda (1), Croatia (1), Hong Kong (7), Nigeria (1), the Philippines (1), Senegal (1), Singapore (8) and the United Arab Emirates (3).

(inclusive) on the average DSTRI score for each country for the period covered, while controlling for average market size for each country (using GDP in US dollars at purchasing power parity [PPP] exchange rates as a proxy). For each country, the average DSTRI score and the average GDP PPP are calculated as the average of the annual levels for the period from 2014 to 2020. This simple assessment aims to consider — for this country sample and time period — whether there is a statistical association between digital services market openness and the number of unicorns recorded.[40]

Results and Discussion: Regression Exercise 3 (Unicorns)

The results of the unicorn exercise are presented in Table 8. With respect to the propensity of an economy to generate unicorns over the time frame considered here (Regression 3), the author finds highly statistically significant (99 percent) results in terms of a correlation between unicorn incidence and digital market openness (DSTRI). The control for market size (GDP) was also highly significant (99 percent). This simple model highlights a probable association between the variables.

As in the previous exercise, the limitations of this exercise must be duly acknowledged. The model considers statistical association between the variables of interest. But it does not

40 The sample statistics for the unicorn country counts are as follows: mean = 22.2 per country; max = 399; min = 1; standard deviation = 69.9.

Table 7: Successful Unicorns, by Sector (2014–July 2021)

Sector	Nature of Technology Activity	Firm Count	Share (%)
AI	Digital tech supplier	65	8.4
Auto and transportation	Data-intensive digital user	31	4.0
Consumer and retail	Other	20	2.6
Cybersecurity	Digital tech supplier	29	3.7
Data management and analytics	Data supplier	26	3.4
E-commerce and direct-to-consumer	Data-intensive digital user	81	10.4
Educational technology	Data-intensive digital user	27	3.5
Financial technology	Data-intensive digital user	149	19.2
Hardware	Digital tech supplier	28	3.6
Health	Data-intensive digital user	55	7.1
Internet software and services	Digital tech supplier	132	17.0
Mobile and telecommunications	Data-intensive digital user	34	4.4
Other	Other	45	5.8
Supply chain, logistics and delivery	Data-intensive digital user	42	5.4
Travel	Data-intensive digital user	12	1.5
Total		**776**	**100**

Sources: See CBInsights (www.cbinsights.com/research/unicorn-startup-market-map/); the author's tabulations.
Notes: "Other" includes areas such as aerospace, business support, media and nanotechnology, among others. Successful unicorns are defined as early-stage firms that are not yet public but have proven successful as evidenced by their individual valuations of US$1 billion or greater.

address causality nor the possibility of reverse causality (for example, a situation where larger numbers of unicorns were to be a factor driving development of greater market openness as measured by the DSTRI). Also, the model only covers a specific timeline and sample of firms, so it may not be representative of relationships in other instances. Yet it provides a lead for future analysis and confirmation using a more comprehensive modelling exercise.

Conclusion and Policy Recommendations

The author's review of policy developments in the international digital economy in the opening section on "Digital Trade and Its Governance" pointed to progress on some aspects of governance. For example, the achievement of the OECD-facilitated agreement for taxation of cross-border digital economic activity marked an important milestone. Recent advances at the WTO toward an eventual e-commerce agreement may also bode well for measures in support of transparency and digital trade facilitation. There is action at the regional level, for example, with the entry into force of the RCEP trade agreement (2022[41]) and the DEPA (2020). In the longer term, promising steps are under way toward the potential expansion of the CPTPP agreement and potential conclusion of high-standards bilateral EU-Australia and EU-New Zealand trade agreements, among many other initiatives.

With respect to the international digital economy at firm level, the author's preliminary analysis in the section on "Firm-Level Economic Performance" has revealed positive indications of a relationship between a measure of digital services market openness and certain aspects of firm-level innovation.[42] The relationship appears to be more pronounced among firms in digitally intensive sectors than for the overall populations of firms considered in the analysis.

Thus, in view of advances at the institutional level, convergence on policy settings on some issues, and the potential to reinforce innovation processes at firm level, it may prove timely for advocates of improved governance for the international digital economy to advance in a careful stepwise manner. In the face of a challenging geopolitical environment, an incremental approach may prove most efficient and inclusive, while also providing an opportunity for evaluation at each step. Here are three potential areas for action:

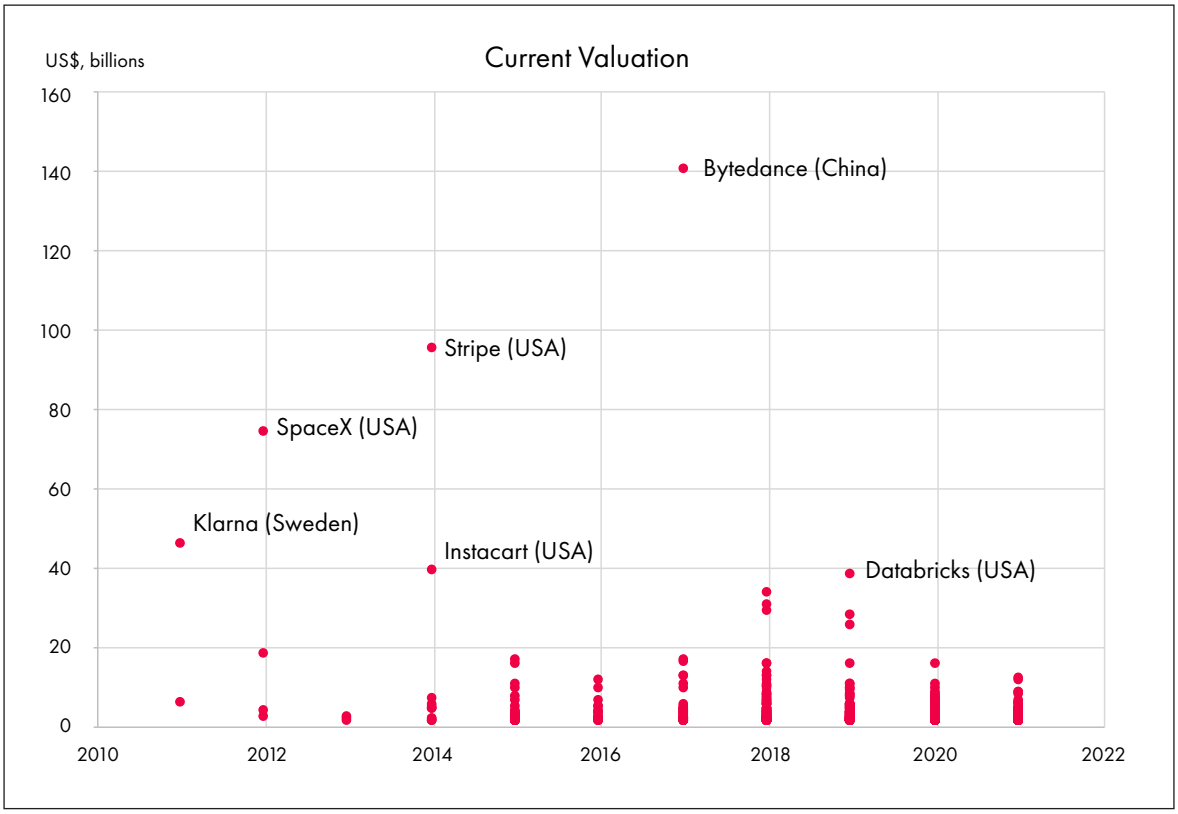
- **The proposed WTO JSI e-commerce initiative should be concluded as a priority, even if compromises and omissions are necessary.** Areas of convergence will likely include transparency provisions, consumer protection and e-trade facilitation. But despite some resistance, there may be some support for further elements such as permanent duty-free treatment of electronic transmission and provisions for free flow of data (albeit with exceptions of varying degrees for national regulatory objectives). The public policy symbolism of a new WTO accord would argue for an early conclusion of a deal, even if more ambitious objectives must be set aside for now. Demonstration of even stepwise progress through a plurilateral e-commerce accord at the multilateral level would be beneficial in light of current trade tensions.
- **With respect to digital trade, the ongoing regional and bilateral movement toward establishment of liberal, lean, regulatory facts on the ground should proceed apace.** This means that existing regional and bilateral deals should be expanded and new ones concluded, as appropriate and feasible.[43] The goal would be to build experience with increased market openness in the digital economy. This is particularly true in areas such as free flow of data, non-discrimination for digital products, informed-consumer-consent models for privacy protection and source code protection. There is substantial buy-in already in some existing accords. As experience grows with these types of provisions, nations will be better

41 Note that RCEP was diplomatically launched through ASEAN, but economically China is by far the leading stakeholder.

42 The reference here concerns national-level consideration of the OECD's DSTRI indicator seen in relation to firm-level expenditure on R&D and, separately, the number of successful start-ups achieving valuations of US$1 billion or more (i.e., unicorns). The results refer to specific time periods and samples.

43 This reference includes DEPA-style accords focused explicitly on the digital economy and engaging nations that may not be located in geographic proximity to one another.

Figure 8: Year Unicorn First Identified and Current Value of Each Unicorn as of September 8, 2021



Sources: See CBInsights (www.cbinsights.com/research/unicorn-startup-market-map); author's charting.
Notes: This figure covers the author's sample of 776 unicorns from 2014 to July 2021, plus three prior years of unicorn listings for reference (2011–2013). Valuations for all the firms were current as of September 8, 2021. Unicorns are defined here as early-stage, non-public firms valued at US$1 billion or more. Years indicate when each firm was first recorded as a unicorn. Once a unicorn is publicly listed, merged, acquired or fails, it is removed from the tracker.

able to confirm benefits and, as necessary, identify aspects where further refinement of provisions might address remaining concerns. The result may be improved prospects for eventual multilateralization of some elements. In principle, multilateralism has the potential to deliver a broad, inclusive reduction in trade discrimination for the digital economy. In the meantime, regional and bilateral accords should be structured with provision for openness to new members and with due consideration of managing possible discriminatory effects (for example, by including provisions with most-favoured-nation [MFN] application).

→ **A more regular, comprehensive and coherent monitoring of developments in the digital economy should be put in place, covering digital trade and domestic digital economy activity, as well as tracking of relevant policy, regulations and standards.** Perhaps coordinated by an existing international organization such as the OECD or UNCTAD, the various stakeholders could be engaged to promote better systemwide integration and coverage. This approach would provide an improved basis for future policy formation, and it would be a useful complement to the proposals for a lean global governance structure such as the Digital Stability Board proposed by a team from CIGI (Fay and Medhora 2021).

Table 8: Correlation of Digital Services Market Openness to Unicorn Performance

	Regression 3
Period covered	From 2014 to July 2021
Dependent variable	Total number of unicorns by country for the entire period
Year	Pooled (full period)
DSTRI (average score for period, for each country)	–118.2691***
Home economy GDP level (PPP, US$)	0.000015***
Number of observations	35 countries (total population of 776 unicorns)
Adjusted R^2	0.7908

Sources: See CBInsights (www.cbinsights.com/research/unicorn-startup-market-map/); GDP data is from the World Bank (see https://databank.worldbank.org/source/world-development-indicators); OECD (see https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL); author's calculations.

Notes: A unicorn is defined as a high-growth, early-stage private firm valued at US$1 billion or more. Statistical significance is indicated as follows: * = 90%; ** = 95%, *** = 99%. Unicorn country count sample statistics are as follows: mean = 22.2 per country; max = 399; min = 1; standard deviation = 69.9.

Final Remarks

The leading edge of the digital economy is concentrated geographically and sectorally, even though there are economy-wide applications of the technology globally. The United States, Japan and China account for a large share of e-commerce and related digital services (Table 1). Not surprisingly, data-intensive sectors such as ICT, finance and transportation equipment tend to be among the most engaged in digital economy activity, often with some geographic concentration as well. Digital trade offers a channel for conducting transactions across an expanded range of buyers and sellers; potential for international diffusion of digital products; and opportunities for development of data resources for future commercial activity (for example, improved operational efficiency and resilience, marketing, administration and management). Trade can provide a means for market-mediated diffusion of goods and services, including digital technology and other related innovation (Park and Lippoldt 2014).

Appropriate governance in this case may aim for a healthy and dynamic international digital economy within a framework offering improved market openness as well as regulatory protections and guardrails. It is notable that top-ranked innovative firms including those in the digital economy already tend to be located in relatively open markets, with adequate IP rights, advances in regulation and significant market scale. Openness within a more complete, rules-based framework for the digital economy has the potential to address key stakeholder concerns and promote further technology transfer, entrance of new market participants from a broader range of economies, access to cost-competitive inputs for producers and access to new varieties of products for consumers. Especially in the digital space where the marginal cost of production can be very low, openness permits producers to gain scale and maximize the return on investment, thereby incentivizing further innovation. And that would appear to be a very good trajectory to advance upon, indeed.

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Works Cited

Acemoglu, Daron. 2021. "Harms of AI." NBER Working Paper 29247, September. www.nber.org/papers/w29247.

Adeyemi, Temitope O. 2021. "A 'Critical Mass' Approach to Negotiations in the WTO: A Case Study Analysis." Master's thesis, Western University. https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=10662&context=etd.

Akman, Mehmet Sait, Bozkurt Aran, Leonardo Borlini, Carlos A. Primo Braga, Uri Dadush, Fernando De Mateo, Alejandro Jara, Douglas Lippoldt and Giorgio Sacerdoti. 2021. "Confronting 'Deglobalization' in the Multilateral Trading System." T20 Italy 2021, Task Force 3, Policy Brief 2, September. www.t20italy.org/wp-content/uploads/2021/09/TF3_PB02_LM04.pdf.

Bloom, Nicholas, Charles I. Jones, John Van Reenen and Michael Webb. 2017. "Are Ideas Getting Harder to Find?" NBER Working Paper 23782. www.nber.org/system/files/working_papers/w23782/w23782.pdf.

Calvino, Flavio, Chiara Criscuolo, Luca Marcolin and Mariagrazia Squicciarini. 2018. "A taxonomy of digital intensive sectors." OECD Science, Technology and Industry Working Papers 2018/14. www.oecd-ilibrary.org/industry-and-services/a-taxonomy-of-digital-intensive-sectors_f404736a-en.

Chertoff, Michael. 2018. *Exploding Data: Reclaiming Our Cyber Security in the Digital Age*. New York, NY: Atlantic Monthly Press.

Christensen, Clayton M. 1997. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston, MA: Harvard Business School Press.

Cowen, Tyler and Ben Southwood. 2019. "Is the Rate of Scientific Progress Slowing Down?" George Mason University Working Paper No. 21-13.

Dabla-Norris, Era, Ruud De Mooij, Andrew Hodge and Dinar Prihardini. 2021. "How to Tax in Asia's Digital Age." *IMFBlog*, September 14. https://blogs.imf.org/2021/09/14/how-to-tax-in-asias-digital-age/.

Dernis, Hélène, Petros Gkotsis, Nicola Grassano, Shohei Nakazato, Mariagrazia Squicciarini, Brigitte van Beuzekom and Antonio Vezzani. 2019. *World Corporate Top R&D Investors: Shaping the Future of Technologies and of AI*. Luxembourg: Publications Office of the European Union.

European Commission. 2020a. "Impact assessment of the Digital Services Act." European Commission, December 15. https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-services-act.

———. 2020b. "Impact assessment of the Digital Markets Act." European Commission, December 16. https://digital-strategy.ec.europa.eu/en/library/impact-assessment-digital-markets-act.

European Council. 2022. "Digital Services Act: Council and European Parliament provisional agreement for making the internet a safer space for European citizens." Press release, April 23. www.consilium.europa.eu/en/press/press-releases/2022/04/23/digital-services-act-council-and-european-parliament-reach-deal-on-a-safer-online-space/.

European Parliament. 2022. "Digital Services Act: regulating platforms for a safer online space for users." Press release, January 20. www.europarl.europa.eu/news/en/press-room/20220114IPR21017/digital-services-act-regulating-platforms-for-a-safer-online-space-for-users.

Fay, Robert and Rohinton Medhora. 2021. "A Global Governance Framework for Digital Technologies." T20 Italy 2021, Task Force 4, Policy Brief 5. www.t20italy.org/wp-content/uploads/2021/09/TF4-PB5-Fay-1.pdf.

Ferencz, Janos. 2019. "The OECD Digital Services Trade Restrictiveness Index." OECD Trade Policy Papers No. 221. www.oecd-ilibrary.org/trade/the-oecd-digital-services-trade-restrictiveness-index_16ed2d78-en.

Galasso, Alberto and Mark Schankerman. 2014. "Patents and cumulative innovation: causal evidence from the courts." *Quarterly Journal of Economics* 130 (1): 317–69.

Gao, Henry. 2021. "Across the Great Wall: E-commerce Joint Statement Initiative Negotiation and China." In *Artificial Intelligence and International Economic Law: Disruption, Regulation, and Reconfiguration*, edited by Shin-yi Peng, Ching-Fu Lin and Thomas Streinz, 295–318. Cambridge, UK: Cambridge University Press.

Grassano, Nicola, Héctor Hernández, Alexander Tübke and Sara Amoroso. 2020. *The 2020 EU Industrial R&D Investment Scoreboard*. Luxembourg: Publications Office of the European Union. https://iri.jrc.ec.europa.eu/scoreboard/2020-eu-industrial-rd-investment-scoreboard.

Holla, Nisha. 2021. "Democratising Technology for the Next Six Billion: India's 'Digital Public Goods' Innovation." Observer Research Foundation Issue Brief No. 506, November. www.orfonline.org/wp-content/uploads/2021/11/ORF_IssueBrief_506_DemocratisingTech.pdf.

International Institute for Sustainable Development. 2021. "WTO Members Participating in E-commerce Talks Arrive at 'Clean Text' on E-signatures, Authentication." International Institute for Sustainable Development, May 10. https://sdg.iisd.org/news/wto-members-participating-in-e-commerce-talks-arrive-at-clean-text-on-e-signatures-authentication/.

Leblond, Patrick. 2020. "Digital Trade: Is RCEP the WTO's Future?" Opinion, Centre for International Governance Innovation, November 23. www.cigionline.org/articles/digital-trade-rcep-wtos-future/.

Lippoldt, Douglas. 2011. "Patent Rights, Developing Countries and the Economic Influence of the Multilateral Trading System." Doctoral thesis, Sciences Po-Paris. https://core.ac.uk/download/pdf/45367215.pdf.

———, ed. 2012. *Policy Priorities for International Trade and Jobs*. Paris, France: OECD Publishing. www.oecd-ilibrary.org/trade/policy-priorities-for-international-trade-and-jobs_9789264180178-en.

———. 2018. "The Trans-Pacific Partnership Agreement: Promoting Waves of Innovation." In *Megaregionalism 2.0: Trade and Innovation within Global Networks*, edited by Dieter Ernst and Michael G. Plummer, 23–52. Hackensack, NJ: World Scientific.

———. 2020a. "R&D, trade and COVID-19: A health-innovation situation." HSBC Global Research, April. www.research.hsbc.com/R/24/TjqQrGCGWndb.

———. 2020b. "Trade barriers hamper COVID fight." HSBC, May 28. www.hsbc.com/insight/topics/trade-barriers-hamper-covid-fight.

Lippoldt, Douglas and Mark F. Schultz. 2014. "Uncovering Trade Secrets: An Empirical Assessment of Economic Implications of Protection for Undisclosed Data." OECD Trade Policy Papers No. 167. doi:10.1787/5jxzl5w3j3s6-en.

Melitz, Marc J. and Daniel Trefler. 2012. "Gains from Trade when Firms Matter." *Journal of Economic Perspectives* 26 (2): 91–118.

Morita-Jaeger, Minako. 2021. "Accessing CPTPP without a National Digital Regulatory Strategy? Hard Policy Challenges for the UK." UK Trade Policy Observatory Briefing Paper 61, July. https://blogs.sussex.ac.uk/uktpo/files/2021/07/Briefing-paper-61.pdf.

Nemoto, Taku and Javier López González. 2021. "Digital Trade Inventory: Rules, Standards and Principles." OECD Trade Policy Paper No. 251. www.oecd-ilibrary.org/docserver/9a9821e0-en.pdf.

OECD. 1998. *Open Markets Matter: The Benefits of Trade and Investment Liberalisation*. Paris, France: OECD Publishing.

———. 2004. *Patents and Innovation: Trends and Policy Challenges*. Paris, France: OECD Publishing. www.oecd.org/science/inno/24508541.pdf.

———. 2014. "OECD Services Trade Restrictiveness Index (STRI)." Policy Brief, May. www.oecd.org/mcm/MCM-2014-STRI-Policy-Brief.pdf.

———. 2021. "130 countries and jurisdictions join bold new framework for international tax reform." Press release, July 1. www.oecd.org/newsroom/130-countries-and-jurisdictions-join-bold-new-framework-for-international-tax-reform.htm.

OECD and G20. 2021a. "Statement on a Two-Pillar Solution to Address the Tax Challenges Arising from the Digitalisation of the Economy." OECD and G20, October 8. www.oecd.org/tax/beps/statement-on-a-two-pillar-solution-to-address-the-tax-challenges-arising-from-the-digitalisation-of-the-economy-october-2021.pdf.

———. 2021b. "Statement on a Two-Pillar Solution to Address the Tax Challenges Arising from the Digitalisation of the Economy." OECD and G20, July 1. www.oecd.org/tax/beps/statement-on-a-two-pillar-solution-to-address-the-tax-challenges-arising-from-the-digitalisation-of-the-economy-october-2021.pdf.

Office of the United States Trade Representative. 2021. "Remarks As Prepared for Delivery of Ambassador Katherine Tai Outlining the Biden-Harris Administration's 'New Approach to the U.S.-China Trade Relationship.'" October. https://ustr.gov/about-us/policy-offices/press-office/speeches-and-remarks/2021/october/remarks-prepared-delivery-ambassador-katherine-tai-outlining-biden-harris-administrations-new.

Park, Walter G. and Douglas Lippoldt. 2014. "Channels of technology transfer and intellectual property rights in developing countries." In *Intellectual Property for Economic Development*, edited by Sanghoon Ahn, Bronwyn H. Hall and Keun Lee, 33–89. Cheltenham, UK: Edward Elgar.

The White House. 2021. "U.S.-EU Trade and Technology Council Inaugural Joint Statement." Statements and releases, September 29. www.whitehouse.gov/briefing-room/statements-releases/2021/09/29/u-s-eu-trade-and-technology-council-inaugural-joint-statement/.

UNCTAD. 2021a. "Estimates of Global E-commerce 2019 and Preliminary Assessment of COVID-19 Impact on Online Retail 2020." UNCTAD Technical Notes on ICT for Development No. 18. https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf.

———. 2021b. "The UNCTAD B2C E-commerce Index 2020: Spotlight on Latin America and the Caribbean." UNCTAD Technical Notes on ICT for Development No. 17. https://unctad.org/system/files/official-document/tn_unctad_ict4d17_en.pdf.

———. 2021c. *Digital Economy Report 2021: Cross-border data flows and development: For whom the data flow.* Geneva, Switzerland: United Nations. https://unctad.org/system/files/official-document/der2021_overview_en_0.pdf.

Viner, Jacob. 1950. *The Customs Union Issue.* New York, NY: Carnegie Endowment for International Peace.

WTO. 2017. "WTO's Trade Facilitation Agreement enters into force." News item, February 22. www.wto.org/english/news_e/news17_e/fac_31jan17_e.htm.

———. 2021. "Lao PDR joins information technology agreements." News item, December 2. www.wto.org/english/news_e/news21_e/ita_02dec21_e.htm.

Annex

Table A1: The European Union's Digital Trade Strategy

In its digital trade strategy, the European Union aims to standardize the following elements:
→ customs duties on electronic transmissions; → electronic contracts, electronic authentication methods and electronic trust services (for example, e-signatures, e-seals and time stamps), as necessary for the validation of online transactions; → online consumer protection, including protection against spam; → unjustified government access to software source code; → unjustified barriers to data flows, including data localization requirements and protecting privacy; and → regulatory cooperation.[44]
Within the WTO e-commerce negotiations, the European Union seeks to:
→ facilitate electronic transactions (for example, e-contracts, e-signatures, e-payments); → enhance consumer and business trust; → address barriers related to cross-border data flows and data localization requirements; → protect computer source code; → facilitate online trade in goods (for example, paperless trade); → improve the regulatory conditions for telecommunications services by updating the WTO Telecommunications Reference Paper; and → enhance market access in services sectors and goods that are key for e-commerce.[45]

44 See European Commission (https://policy.trade.ec.europa.eu/help-exporters-and-importers/accessing-markets/goods-and-services/digital-trade_en).

45 Ibid.

Table A2: Illustrative Overview of Selected Digital Economy Provisions from Current Regional and Bilateral Trade Accords

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
CPTPP, chapter 14[46] Entry into force: December 2018	Duty-free electronic transmission of data Generally restricts limitations on data transfers for conduct of business National regulatory requirements are acceptable for legitimate public policy objectives	No party shall accord less favourable treatment to digital products from a member than to domestic or third parties Exceptions for subsidies, grants and broadcasting	Members must provide legal protection of personal information	Prohibits requirements for transfer or availability of source code for mass market products, with some exceptions such as for critical infrastructure and patent applications	Consumer protection measures to prevent spam Members must provide legal protection from e-commerce fraud and harm Cooperation on cybersecurity matters	General prohibition, with allowance for legitimate, non-discriminatory public policy objectives	Consultation in development of regulations Covers some facilitation matters (for example, authentication) Consultations available, but lacks dispute settlement in some areas Exclusions: government procurement, financial services

46 See *Comprehensive and Progressive Agreement for Trans-Pacific Partnership*, 8 March 2018, c 14 (entered into force 30 December 2018), online: <www.dfat.gov.au/sites/default/files/14-electronic-commerce.pdf>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
Australia-Singapore DEA[47] Entry into force: December 2020	Duty-free electronic transmission of data No party shall prohibit or restrict the cross-border e-transfer of information necessary for the conduct of business National regulatory requirements are acceptable for legitimate public policy objectives	No party shall accord less favourable treatment to digital products from a member than to domestic or third parties Exceptions for subsidies, grants and broadcasting	Members must provide legal protection of personal information, taking account of international guidelines (APEC, OECD)	Prohibits requirements for transfer or availability of source code for products or key elements of encryption software, with some exceptions such as for some regulatory or judicial processes	Provisions to support internet access and consumer choice in services, prevent spam Consumer protection from e-commerce fraud and harm including deceptive commercial practices Cooperation on incident response, skills development and certification User protection from harmful materials (for example, terrorism, extremist content)	General prohibition, with allowance for legitimate, non-discriminatory public policy objectives Also applies to financial services provided, regulators retain immediate direct access to data stored	Aims: promote digital economy cooperation, benchmarks for effective regulation of the digital economy, facilitate B2B and research links Facilitation of authentication, e-payments, paperless trading, cross-border e-invoicing, expedited small parcel customs clearance, conformity assessment, standards and interoperability Cooperation in areas such as fintech and AI regulation, ICT infrastructure Exclusions: government procurement

47 See *Australia-Singapore Digital Economy Agreement,* 6 August 2020 (entered into force 8 December 2020), online: <www.dfat.gov.au/trade/services-and-digital-trade/australia-and-singapore-digital-economy-agreement>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
DEPA[48] Entry into force: January 2021	Duty-free treatment of electronic transmissions Members shall allow cross-border e-transfer of information necessary for the conduct of business National regulatory requirements are acceptable for legitimate public policy objectives	No party shall accord less favourable treatment to digital products from a member than to domestic or third parties Exceptions for subsidies, grants and broadcasting	Members shall adopt or maintain a legal framework that provides for the protection of the personal information of the users of e-commerce and digital trade	Prohibits requirements for transfer or availability of source code for products or key elements of encryption software, with some exceptions such as for some regulatory or judicial processes	Provisions to support internet access and consumer choice in services Consumer protection measures to prevent spam Members are to legally provide for security safeguards to protect personal information, provide a safe and secure online environment, and protect against deceptive practices Cybersecurity cooperation	General prohibition, with allowance for legitimate, non-discriminatory public policy objectives	Supports digital trade and existing commitments Facilitates paperless trade, transparency, e-payments, e-invoicing and digital identities; supports small and medium-sized enterprises; streamlines customs; supports interoperability Cooperation on fintech, AI, competition policy, data sharing and digitization Dispute settlement exclusions: some non-discrimination, cryptography and data localization Exclusions: some financial services, some government procurement

48 See *Digital Economy Partnership Agreement,* 12 June 2020 (entered into force 7 January 2021), online: <www.mfat.govt.nz/assets/Trade-agreements/DEPA/DEPA-Signing-Text-11-June-2020-GMT.pdf>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
GDPR[49] Entry into force: May 2016 (applied May 2018) The GDPR operates in conjunction with the European Union's bilateral and multilateral trade accords	Rules restrict commercial processing and transfer of personal data of EU subjects Transfer of data may be authorized within the European Union or recognized third country (based on adequacy decisions). Parties may restrict due to national security, public security and so forth.	The GDPR does not directly tackle trade-related non-discrimination as a separate issue. It does provide a means for third-party adequacy determinations to facilitate transfers of personal data subject to certain conditions.	Protects personal data rights and freedoms Holding data is limited; data must be current, accurate, for legitimate purposes, kept no longer than necessary; needs subject's consent Subject has rights to review and rectify data and be forgotten	Protection of source code is beyond the scope of the GDPR	Data controllers must ensure appropriate security of personal data; protect against unauthorized or unlawful processing and accidental loss, destruction or damage, using appropriate technical or organizational measures such as integrity and confidentiality International cooperation on legal protections for personal data	Provides conditions for data transfer among EU nations, European Economic Area partners and third countries deemed to have adequate protections	Procedures for certification of GDPR compliance are provided Cooperation for the protection of personal data is provided for in the regulation For personal data matters governed by the GDPR, the regulation has broad coverage including individuals and firms in EU and non-EU entities with relations to EU subjects

49 See *General Data Protection Regulation*, [2016] OJ, L 119, online: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02016R0679-20160504&from=EN>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
EU-Japan EPA, chapter 8,[50] section F Entry into force: February 2019 Operates in conjunction with the GDPR	Duty-free treatment of electronic transmissions The need for provisions on the free flow of data will be reassessed within three years from the entry into force of the EPA	Each party shall accord to entrepreneurs of the other party and to covered enterprises treatment no less favourable than that it accords, in like situations, to its own entrepreneurs and to their enterprises, with respect to operation in its territory; likewise with reference to third-country parties (i.e., MFNs) Exceptions for subsidies, grants and broadcasting	Covered separately via the European Union's GDPR adequacy determination for Japan	A party may not require the transfer of, or access to, source code of software owned by a person of the other party, subject to some limitations such as due to judicial requirements	Provided via the GDPR in areas such as the need for consumer protection to be recognized, including protection of personal data Parties are to provide means to stop unwanted spam (consumer consent required) Cybersecurity cooperation, for example, the protection of personal data and authentication	Covered separately in effect via the European Union's GDPR adequacy determination for Japan	Facilitation: best endeavours not to impose prior authorization requirements; recognition of e-authentication and e-signatures Cooperation on regulatory matters related to e-commerce Restrictions allowed, for example, to protect public morals, privacy of personal data and safety. Existing non-conforming measures may be maintained. Exclusions: gambling, broadcasting, audiovisual, notaries and legal representation

50 See *Agreement between the European Union and Japan for an Economic Partnership,* 12 December 2018, c 8 (entered into force 1 February 2019), online: <https://eur-lex.europa.eu/resource.html?uri=cellar:cf1c4c42-4321-11e8-a9f4-01aa75ed71a1.0001.02/DOC_2&format=PDF#page=186>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
RCEP, chapter 12[51] Entry into force: January 2022	Duty-free electronic transmission of data In principle, free data transfer for business, but substantial exceptions for (self-defined) national security risks National regulatory requirements allowed	Limits on measures that would constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on trade	Each party to adopt legal protection for personal information	A matter for further dialogue among RCEP members	Consumer protection measures to prevent spam Members to build incident response capacity and to cooperate on cybersecurity	Each party has own security and confidentiality requirements; no localization, except for public policy and national security needs as defined by each member	Aim: promote e-commerce, trust and cooperation Covers some facilitation matters (for example, authentication) and references the UNCITRAL model law Consultations available, but no access to dispute settlement Excluded: government procurement

51 See *Regional Comprehensive Economic Partnership*, 15 November 2020, c 12 (entered into force 1 January 2022), online: <https://rcepsec.org/wp-content/uploads/2020/11/Chapter-12.pdf>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
US-Japan Digital Trade Agreement[52] Entry into force: January 2020	Duty-free electronic transmission of data Neither party shall prohibit or restrict cross-border transfer of information, including personal information, as needed for the conduct of business National regulatory requirements are acceptable for legitimate public policy objectives	No party shall accord less favourable treatment to digital products of a member than to domestic or third parties Exceptions for subsidies, grants and broadcasting	Each party shall adopt or maintain a legal framework that provides for the protection of the personal information of the users of digital trade channels	No member shall require transfer or access to source code of software or to an algorithm in that code, as a condition for the import, distribution, sale or use of the software and related products Parties may require code availability for regulatory and judicial needs	Provisions for internet access and consumer choice in services, measures to prevent spam Members must provide legal protection from deceptive practices, e-commerce fraud and harm Best endeavours to support incident response and identify intrusions	Neither party shall require use or location of computing facilities in a party's territory as a condition for conducting business in that territory Also applies to financial services, provided regulators retain immediate direct access to data stored	Facilitation via principles of UNCITRAL model law for electronic transactions, recognition of e-authentication and e-signatures Measures may be applied for essential security interests Internet service providers (ISPs) are sheltered from some liability for hosted content Excluded: government procurement, most tax matters

52 See *Agreement between the United States of America and Japan Concerning Digital Trade*, 7 October 2019 (entered into force 1 February 2019), online: <https://ustr.gov/sites/default/files/files/agreements/japan/Agreement_between_the_United_States_and_Japan_concerning_Digital_Trade.pdf>.

Accord	Free Flow of Data	Non-discrimination in Treatment of Digital Products	Privacy and Data Ownership	Source Code	Consumer Protection and Cybersecurity	Data Localization	Observations, Digital Trade Facilitation and Exclusions
CUSMA, chapter 19[53] Entry into force: July 2020	Duty-free electronic transmission of data No party shall prohibit or restrict the cross-border transfer of information necessary for the conduct of business National regulatory requirements are acceptable for legitimate public policy objectives	No party shall accord less favourable treatment to digital products of a member than to domestic or third parties Exceptions for subsidies or grants Non-discriminatory and least trade restrictive practices required on a best endeavour basis	Members provide legal protection of personal information, based on international norms (APEC, OECD) Cross-border flows of personal information allowed where commercially necessary and proportionate to the risks	No member shall require transfer or access to source code of software or to an algorithm as a condition for the import, distribution, sale or use of the software or related products Availability may be required for regulatory and judicial purposes.	Provisions to support internet access and consumer choice in services Consumer protection measures to prevent spam Members must provide legal protection from e-commerce fraud and harm Cooperation and risk-based approach on cybersecurity matters	No party shall require a covered person to use or locate computing facilities in that party's territory as a condition for conducting business in that territory	Covers facilitation matters (for example, authentication, paperless trading), references principles of UNCITRAL for e-transactions Broad cooperation, policy information exchange ISPs are sheltered from some liability for hosted content Excluded: government procurement

Sources: Official texts of the accords; Leblond (2020); Morita-Jaeger (2021).

Notes: RCEP members include the 10 ASEAN nations, Australia, China, Japan, New Zealand and South Korea; as of January 2022, Indonesia, Myanmar and the Philippines have not yet ratified. CPTPP members include Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam; Brunei, Chile, Malaysia and Peru have not yet ratified. The GDPR covers EU members, Iceland, Liechtenstein and Norway. The European Commission recognized[54] GDPR equivalence for Andorra, Argentina, Canada (commercial organizations), Faroe Islands, Guernsey, Israel, Isle of Man, Japan, Jersey, New Zealand, Switzerland and Uruguay. DEPA members include Chile, New Zealand and Singapore.

53 See *Canada-United States-Mexico Agreement*, 30 November 2018, c 19 (entered into force 1 July 2020), online: <https://ustr.gov/sites/default/files/files/agreements/FTA/USMCA/Text/19-Digital-Trade.pdf>.

54 See European Commission (https://ec.europa.eu/info/law/law-topic/data-protection/international-dimension-data-protection/adequacy-decisions_en).

Table A3: Measures Tracked via OECD DSTRI

Infrastructure and Connectivity
→ Interconnection is mandated.
→ Interconnection prices and conditions are regulated.
→ Interconnection reference offers are made public.
→ Vertical separation is required.
→ Memo: non-discriminatory internet traffic management is mandated.*
→ Memo: there is at least one dominant firm in the market segment considered.**
→ Restrictions are applied to the use of communication services.
→ Memo: free cross-border transfer of personal data or application of the accountability principle.*
→ Cross-border transfer of personal data is possible when certain private sector safeguards are in place.
→ Cross-border data flows: cross-border transfer of personal data is possible to countries with substantially similar privacy protection laws.
→ Cross-border data flows: cross-border transfer is subject to approval on a case-by-case basis.
→ Cross-border data flows: certain data must be stored locally.
→ Cross-border data flows: transfer of data is prohibited.
Electronic Transactions
→ Discriminatory conditions applied for licences to engage in e-commerce.
→ Memo: licence or authorization is required to engage in e-commerce.**
→ Online tax registration and declaration is available to non-resident foreign providers.
→ National contract rule for cross-border transaction deviates from internationally standardized rules.
→ Laws or regulations explicitly protect confidential information.
→ Laws or regulations provide e-signature with the equivalent legal validity of hand-written signature.
→ Dispute settlement mechanism exists to resolve disputes arising from cross-border digital trade.
Payment Systems
→ Discriminatory access to payment settlement methods.
→ National payment security standards deviate from international standards.
→ Restrictions are applied on internet banking or insurance.

IP Rights***
→ Foreign firms are discriminated against on trademark protection.
→ Discriminatory treatment applied to foreigners for the protection of copyrights and related rights.
→ Memo: exceptions to copyright protection are limited in accord with international rules.*
→ Enforcement of IP rights: judicial or administrative enforcement measures and remedies are available.
→ Enforcement of IP rights: provisional measures are available.
→ Enforcement of IP rights: criminal enforcement proceedings and penalties are available.
Other Barriers Affecting Trade in Digitally Enabled Services
→ Performance requirements affect cross-border digital trade.
→ Limitations on downloading and streaming affect cross-border digital trade.
→ Restrictions applied to online advertising.
→ Commercial presence is required in order to provide cross-border services.
→ Local presence is required in order to provide cross-border services.
→ Firms have redress when business practices restrict competition in a given market.
→ Other restrictions applied to digitally enabled services.

Source: Ferencz (2019).
Notes: DSTRI statistics for the sample of firm-level observations, 2014–2019: mean score = 0.17; max score = 0.51; min score = 0.04; standard deviation = 0.16. *For these items, data is only collected for information purposes. These items are not scored for the index. **These items are not scored directly but indirectly influence other items that are scored. ***The DSTRI considers IP rights application and enforcement based on laws on the books. As a complement to the DSTRI, this paper also employs the WEF executive survey indicator for IP protection, which provides information on business perceptions of the operation of the IP rights system in practice in each economy.

Table A4: The OECD DSTRI and Components (2020)

Country	Infrastructure and Connectivity	Electronic Transactions	Payment Systems	IP Rights	Other Barriers Affecting Trade in Digital Services	Total 2020	Total 2014	Change from 2014 to 2020	OECD Member Economy?
Argentina	0.278	0.021	0.018	0.000	0.022	0.340	0.361	**-0.021**	No
Australia	0.040	0.021	0.000	0.000	0.022	0.083	0.083	0.000	Yes
Austria	0.159	0.021	0.000	0.000	0.022	0.202	0.083	0.119	Yes
Belgium	0.119	0.021	0.000	0.000	0.022	0.162	0.162	0.000	Yes
Brazil	0.159	0.043	0.000	0.022	0.022	0.245	0.227	0.018	No
Canada	0.000	0.021	0.000	0.000	0.022	0.043	0.162	**-0.119**	Yes
Chile	0.298	0.043	0.000	0.022	0.000	0.263	0.263	0.000	Yes
China	0.238	0.064	0.055	0.043	0.109	0.510	0.488	0.022	No
Colombia	0.278	0.021	0.000	0.000	0.000	0.299	0.299	0.000	Yes (joined 04/2020)
Costa Rica	0.000	0.043	0.000	0.000	0.000	0.043	0.043	0.000	Yes (joined 05/2021)
Czech Republic	0.079	0.021	0.018	0.000	0.022	0.141	0.141	0.000	Yes
Denmark	0.040	0.043	0.000	0.000	0.022	0.104	0.144	**-0.040**	Yes
Estonia	0.040	0.021	0.000	0.000	0.022	0.083	0.083	0.000	Yes
Finland	0.040	0.021	0.018	0.000	0.022	0.101	0.101	0.000	Yes
France	0.040	0.021	0.018	0.000	0.044	0.123	0.123	0.000	Yes
Germany	0.079	0.043	0.000	0.000	0.022	0.144	0.144	0.000	Yes
Greece	0.079	0.021	0.000	0.000	0.044	0.144	0.144	0.000	Yes
Hungary	0.079	0.043	0.000	0.000	0.044	0.166	0.166	0.000	Yes
Iceland	0.159	0.021	0.000	0.043	0.044	0.267	0.148	0.119	Yes
India	0.159	0.064	0.055	0.000	0.066	0.343	0.239	0.104	No
Indonesia	0.079	0.064	0.018	0.000	0.066	0.227	0.307	**-0.080**	No
Ireland	0.079	0.043	0.000	0.000	0.022	0.144	0.144	0.000	Yes
Israel	0.159	0.021	0.000	0.000	0.000	0.180	0.180	0.000	Yes
Italy	0.040	0.043	0.000	0.000	0.044	0.126	0.126	0.000	Yes
Japan	0.040	0.043	0.000	0.000	0.022	0.104	0.064	0.040	Yes
Kazakhstan	0.476	0.043	0.018	0.000	0.109	0.647	0.228	0.419	No

Country	Infrastructure and Connectivity	Electronic Transactions	Payment Systems	IP Rights	Other Barriers Affecting Trade in Digital Services	Total 2020	Total 2014	Change from 2014 to 2020	OECD Member Economy?
Latvia	0.159	0.043	0.000	0.000	0.022	0.223	0.104	0.119	Yes (joined 07/2016)
Lithuania	0.040	0.043	0.000	0.000	0.022	0.104	0.104	0.000	Yes (joined 07/2018)
Luxembourg	0.040	0.021	0.000	0.000	0.022	0.083	0.083	0.000	Yes
Malaysia	0.040	0.021	0.000	0.022	0.044	0.126	0.126	0.000	No
Mexico	0.040	0.021	0.018	0.000	0.022	0.101	0.300	**–0.199**	Yes
Netherlands	0.040	0.043	0.000	0.000	0.022	0.104	0.104	0.000	Yes
New Zealand	0.159	0.021	0.000	0.000	0.000	0.180	0.180	0.000	Yes
Norway	0.040	0.021	0.000	0.000	0.000	0.061	0.083	**–0.022**	Yes
Peru	0.198	0.021	0.000	0.000	0.022	0.242	0.242	0.000	No
Poland	0.198	0.021	0.000	0.000	0.044	0.263	0.184	0.079	Yes
Portugal	0.040	0.043	0.018	0.000	0.044	0.145	0.184	**–0.039**	Yes
Russia	0.238	0.000	0.037	0.000	0.066	0.341	0.241	0.100	No
Saudi Arabia	0.278	0.021	0.018	0.022	0.066	0.405	0.206	0.199	No
Slovak Republic	0.079	0.021	0.018	0.000	0.022	0.141	0.101	0.040	Yes
Slovenia	0.198	0.021	0.000	0.000	0.022	0.242	0.104	0.138	Yes
South Africa	0.278	0.043	0.000	0.022	0.000	0.342	0.342	0.000	No
South Korea	0.079	0.021	0.000	0.000	0.044	0.145	0.141	0.004	Yes
Spain	0.079	0.021	0.000	0.000	0.022	0.123	0.123	0.000	Yes
Sweden	0.079	0.043	0.000	0.000	0.022	0.144	0.144	0.000	Yes
Switzerland	0.040	0.021	0.000	0.000	0.022	0.083	0.083	0.000	Yes
Thailand	0.238	0.021	0.018	0.000	0.022	0.300	0.300	0.000	No
Turkey	0.119	0.043	0.037	0.000	0.066	0.264	0.083	0.181	Yes
United Kingdom	0.040	0.021	0.000	0.000	0.022	0.083	0.083	0.000	Yes
United States	0.040	0.021	0.000	0.000	0.022	0.083	0.083	0.000	Yes
Average	**0.118**	**0.031**	**0.008**	**0.004**	**0.031**	**0.191**	**0.168**	**0.024**	

Sources: See OECD (https://stats.oecd.org/Index.aspx?DataSetCode=STRI_DIGITAL); author's tabulations. The components are weighted based on a survey of a broad panel of industry experts. Compared to an equal weighting scheme, the expert panel assigned a higher weight to the *infrastructure and connectivity* segment and lower weights to each of the other component segments. Lower scores indicate greater market openness. For methodological details, see Ferencz (2019).

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