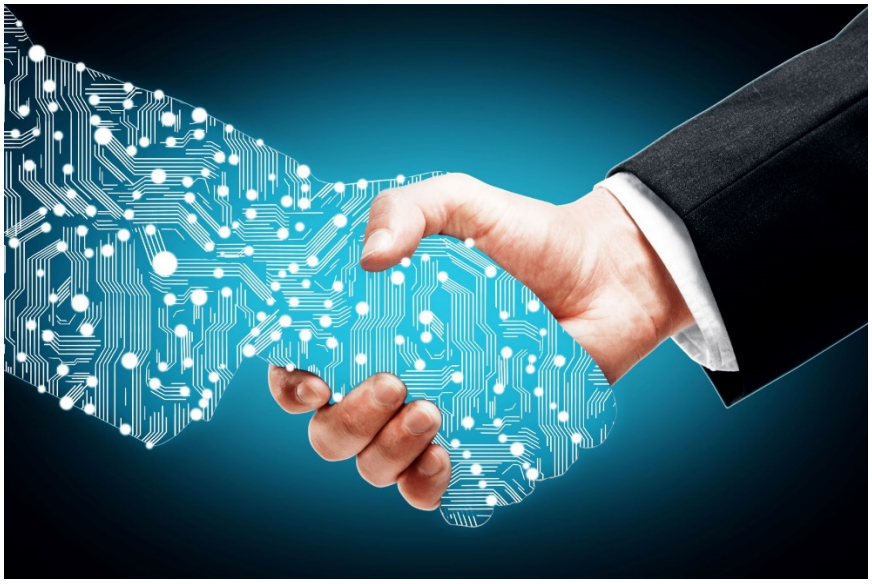
IN-DEPTH ANALYSIS

Requested by the INTA committee

European Parliament

Two briefings and an in-depth analysis on

Data flows, artificial intelligence and international trade: impacts and prospects for the value chains of the future



Policy Department for External Relations
Directorate General for External Policies of the Union
PE 653.617 - November 2020

EN

Table of contents

This paper was requested by the European Parliament's Committee on International Trade.

English-language manuscript was completed on 11 November 2020.

Printed in Belgium.

Authors Briefing 1: Georgios PETROPOULOS, Research Fellow, Bruegel, Belgium, André SAPIR, Senior Fellow, Bruegel, Belgium.

Author Briefing 2: Michele FINK, Senior Research Fellow, Max Planck Institute for Innovation and Competition.

Author In-depth analysis: Niclas Frederic POITIERS, Research Fellow, Bruegel, Belgium; Dennis GÖRLICH, Head of Global Challenges Center, Kiel Institute for the World Economy, Germany.

Officials Responsible: Mario DAMEN, Wolfgang IGLER

Editorial Assistant: Balázs REISS

Feedback of all kind is welcome. Please write to: wolfgang.igler@europarl.europa.eu.

To obtain copies, please send a request to: poldep-expo@europarl.europa.eu

This paper will be published on the European Parliament's online database, 'Think tank'.

ISBN: ISBN: 978-92-846-7437-4 (pdf)
ISBN: 978-92-846-7438-1 (paper)
doi: 10.2861/23699 (pdf)
doi: 10.2861/908579 (paper)
Catalogue number: QA-01-20-704-EN-N (pdf)
Catalogue number: QA-01-20-704-EN-C (paper)

BRIEFING

Requested by the INTA committee

European Parliament

Socio-economic effects of digital trade and artificial intelligence on EU industries including their value chains and EU imports and exports with major trade partners

Policy Department for External Relations
Directorate General for External Policies of the Union
PE 603.516 - November 2020

EN

DIRECTORATE-GENERAL FOR EXTERNAL POLICIES
POLICY DEPARTMENT

European Parliament

BRIEFING

Socio-economic effects of digital trade and artificial intelligence on EU industries including their value chains and EU imports and exports with major trade partners

ABSTRACT

Artificial intelligence and new digital technologies are transforming digital trade. They facilitate the development of new business models of trade and reduce the geographical barriers of economic transactions. Such transformations are quite useful for the small and medium enterprises. Artificial intelligence is being adopted by both digital and non-digital sectors, but its adoption varies a great deal across countries, including within the EU. Data and information flow play a crucial role in digital trade by allowing personalization.

Digital trade is not new, but it is taking new forms that are ushering a new phase of globalisation. So far digital trade mainly affected trade in goods, including through global value chains, though some service activities have already become more tradeable thanks to digital technologies. The new phase of globalisation driven by artificial intelligence and new digital technologies is likely to do for services what the previous phase did for manufacturing: to vastly increase trade between advanced and emerging economies. This prospect raises important issues for domestic policies and trade policy.

EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05
November 2020 - PE 603.516

EN

This paper was requested by the European Parliament's Committee on International Trade.

English-language manuscript was completed on 11 November 2020.

Printed in Belgium.

Authors: Georgios PETROPOULOS, Research Fellow, Bruegel, Belgium, André SAPIR, Senior Fellow, Bruegel, Belgium

Officials Responsible: Mario DAMEN, Wolfgang IGLER

Editorial Assistant: Balázs REISS

Feedback of all kind is welcome. Please write to: wolfgang.igler@europarl.europa.eu.

To obtain copies, please send a request to: poldep-expo@europarl.europa.eu.

This paper will be published on the European Parliament's online database, 'Think tank'.

ISBN: 978-92-846-7433-6 (pdf)

doi: 10.2861/64990 (pdf)

Catalogue number: QA-01-20-703-EN-N

ISBN: 978-92-846-7434-3 (paper)

doi: 10.2861/043049 (paper)

Catalogue number: QA-01-20-703-EN-C (paper)

Table of contents

1 Introduction

Digital trade can broadly be defined as the production, distribution, marketing, sale or delivery of goods and services by electronic means, the sale and/or shipment by traditional means of digital goods (products and services), the transmission or storage of information as a service in its own right, as well as the cross-border transfer of information whether for remuneration or not.

Digital trade has grown rapidly in recent years, both in volume and scope, as a result of technological developments. One such development is artificial intelligence (AI), which has the potential to transform digital trade by greatly reducing geographical barriers. AI refers to the capacity of software programs and machines to develop an intelligent behaviour. It is considered as a general-purpose technology. It is based on artificial neural network structures and the application of machine learning techniques that help machines to improve their performance over time and with the amount and variety of datasets they use.

In this briefing, we assess the socio-economic effects of the introduction of AI technologies in digital trade, including through global value chains (GVCs), the implication of new technologies for the entire range trade in goods and services, and with the entire range of trading partners.

Our briefing is organised as follows. In section 2 we provide evidence of the adoption and diffusion of AI. In section 3 we discuss the central role of data and flow of data in online transactions. Section 4 presents new digital models for trade that have emerged in recent years. We pay attention on how we can define digital trade and we then discuss its socioeconomic implications in relation to GVCs. We also discuss some associated policy issues related to emerging trends in globalisation and the influence of the COVID-19 pandemic shock.

2 Adoption and diffusion of artificial intelligence

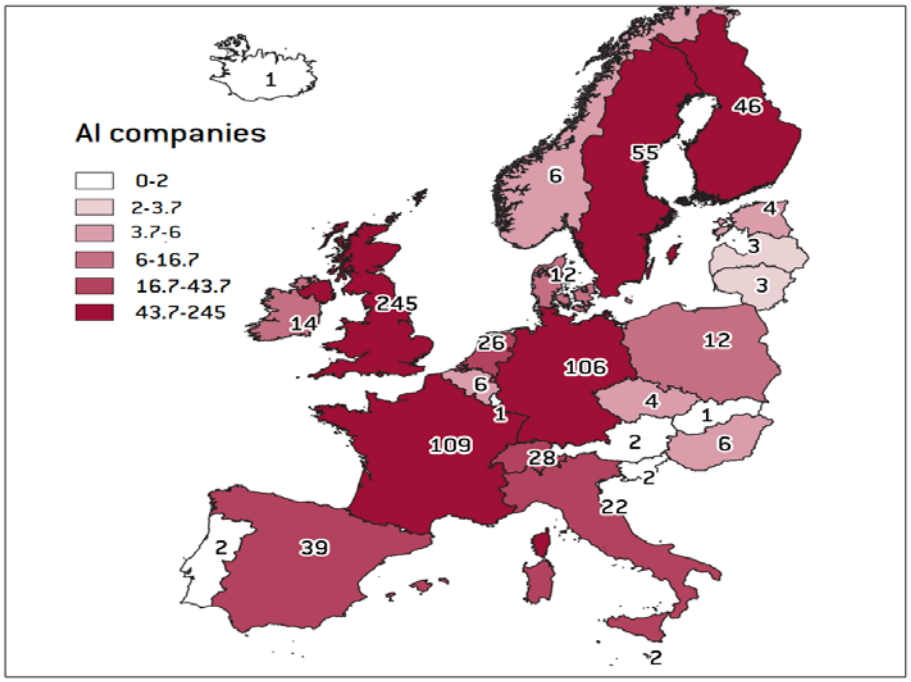
AI and other digital innovations have been made possible by the exponential rise in computing power [1], bandwidth [2] and digital information [3]. Their large-scale diffusion has reshaped the way we carry out transactions and trade through online means. Such technologies were first used in the technology service sector, but applications in nonservice sectors (e.g. manufacturing) followed. In services, the drop in capital costs have significantly reduced barriers to entry for start-ups. At the same time, network effects and the value of collected data often leads to competition for the market instead of competition within the market. In Europe, the United Kingdom has the strongest AI ecosystem. In 2017, EU27 had approximately a total of 490 AI firms which were uneven distributed across member states (see Figure 1). Scandinavian states have the most AI firms per capita (with Finland being the first with more than eight AI firms per 1 million inhabitants), followed Baltic States (with Estonia being the first among Baltic states with approximately three AI firms per 1 million inhabitants) and then followed by central European countries (where France has the most firms per capita). Balkan states and South-East member states, on the other hand, have a very small number of AI firms per capita. Distribution is also uneven within countries. For example, in France, out of the 109 AI firms, the 73 are located in Paris metropolitan area.

[1] Bloom *et al* (2020) illustrated the validity of Moore's law for microprocessor transistors. Such technological advancements led to a fall in the US consumer price index for personal computers by nearly 95 % from 1997 to 2015, while the corresponding index for all items purchased by consumers has risen by nearly 50 percent.

[2] Looking at data from International Telecommunication Union, we see that internet bandwidth in 2015 is 330 times greater than internet bandwidth in 2000.

[3] The ability to collect and store data and turn it into valuable information rapidly increased over the last two decades. According to OECD (2014), the digitisation of nearly all media and the increasing migration of economic and social activities to the internet generate petabytes of data every second.

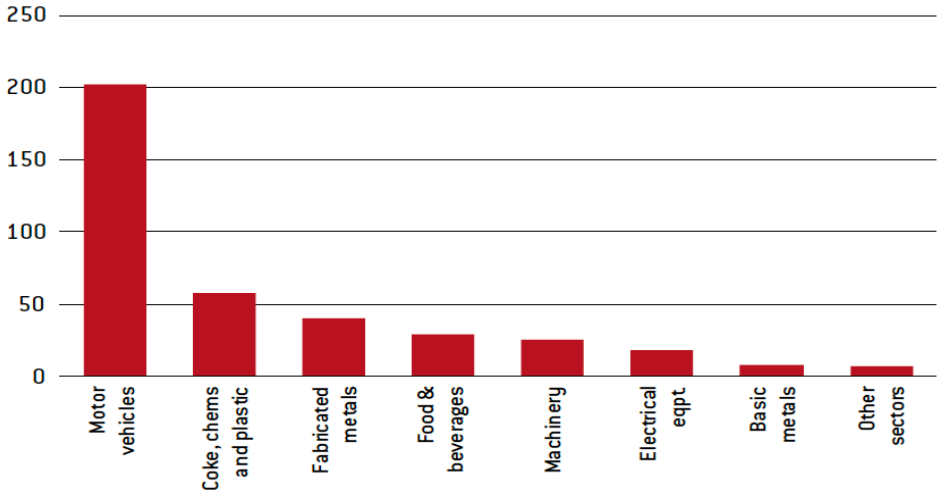
Figure 1: Distribution of AI firms in Europe, 2017



Source: *Asgard (2017).*

But, more traditional sectors have also started to increasingly adopt AI and digital technologies – in car manufacturing, for example. Figure 2 reports the number of industrial robots[4] across 'traditional' sectors (typically used in warehouses for packing and delivery).

Figure 2: Number of industrial robots in thousands in 2015

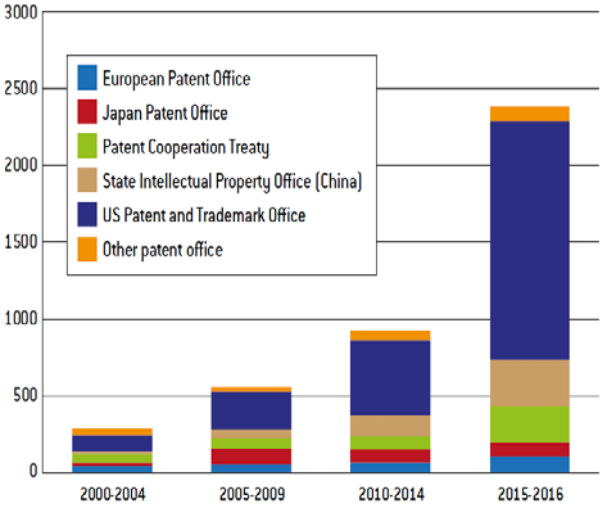


Source: *Petropoulos (2017).*

[4] An industrial robot is defined as *'an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications'* (see Petropoulos et al., 2019, based on International Federation of Robotics).

An indicator of the diffusion of AI is the trend in the number of patent applications. Figure 3 shows the number of patents related to AI technologies granted by major patent offices around the world for different periods.

Figure 3: Number of AI patents granted by country



Source: Petropoulos et al (2019).

However, according to the European Patent Convention, software 'as such' is not patentable, except when specific conditions are met. Hence, we have to rely on an additional measure to capture the full picture on AI adoption. Bughin et al. (2019) collected a set of indicators by country to gauge how they stand on the key AI enablers and aggregated them into an AI Readiness Index per country. They found that the most advanced Northern European countries (Finland and Sweden) and the Anglo-Saxon countries (Ireland) lead in Europe, ahead of China and just behind the United States. But, Southern and Eastern Europe is lagging behind (Poland, Romania, Greece and Cyprus).

3 Importance of data in digital applications and its economic implications

Digital technologies have fundamentally changed the behaviour of consumers. For example, the use of internet-enabled devices, including smartphones, tablets and laptops, is widespread. These devices provide consumers with direct access and real-time information about online markets. Firms have developed digital marketing techniques that increased the transparency over information about products that are available to consumers.

The development of data analytics and machine learning has proved revolutionary in monetising data in digital services. The first fundamental change that this revolution brought about in commerce was the personalisation of services, which in turn increased the efficiency of transactions and consumer welfare and led to online commerce expansion. A survey by Deloitte (2015) finds that more than 50 % of consumers expressed interest in purchasing customized products or services. At the same time, one in four consumers are willing to pay more to receive a personalized product or service, while 22 % of consumers are happy to share some data in return for a more personalized customer product or service.

The free flow of data can increase the benefits from trade, provided that the online ecosystem remains trustworthy and online consumers do not face risks that their data will be used for reasons beyond their knowledge and control. Trust is a fundamental factor for the growth and success of online trade.

In the European Union, the flow of personal data in commercial contexts is governed by the General Data Protection Regulation (GDPR). The GDPR provides the framework within which the free flow of data can be achieved, but at the same time permits the use of only absolutely necessary data in transactions (data minimisation). The GDPR incorporates two data portability rights, one for Business-to-Consumer and one for Business-to-Business with the intermediation of the data subject, or an intermediary that acts on her behalf. As for non-personal data, the Free Flow of Data Regulation dictates direct data portability in business-to-business (B2B) relationships in open standard formats, where data is structured in commonly used and machine-readable formats. The Digital Content Directive provides a respective data portability in business-to-consumer (B2C) relationships.

Transfers of personal data from the EU to other jurisdictions can also bring important benefits in cross-border digital trade relationships. In such a case, legal restrictions may come into play (see Briefing 2) which make data transfers costly. Small and medium enterprises are more affected by such restraints as they may not have the adequate capacity to absorb these costs.

While data has immense value in digital trade, it may also have implications for market concentration, through data-driven economies of scope and the presence of strong network effects. That could lead to over-high entry barriers for small and medium enterprises which do not have access to adequate volumes and variety of data to improve the efficiency of their products and services. The 2019 Report of the UK Digital Competition Expert Panel concluded that concentration is particularly prominent in the following digital markets: i) online search, which is dominated by Google, with some competition from Microsoft Bing; ii) social media, dominated by Facebook and the services its owns, with some competition from Twitter and Snapchat; iii) digital advertising, dominated by Google and Facebook; iv) mobile app downloads, which is a duopoly between Apple and Google; v) commerce through online marketplaces, where Amazon is a dominant platform, with some competition from eBay.

4 The socio-economic effects of digital trade and AI on EU industries

4.1 Digital business models in the economy

The emergence of digital technologies has given rise to platform ecosystems via which goods and services are traded. Platforms have lower costs than previous market forms and achieve scale that can create significant value for the interacting sides of their markets. They are a new way of addressing the fundamental problem of economic organisation: how to coordinate supply and demand in the absence of complete information (Parker *et al*, 2020). To do that, they: i) adopt open digital infrastructures that allow multiple stakeholders to use it for their service and content needs; ii) establish governance rules and invest in governance enforcement mechanisms that seek to balance platform control with the necessary incentives for platform participants to engage with the platform and generate value for one another. The expansion of platform ecosystems at a global scale has created many possibilities for online trade between parties in different parts of the world, an important factor for the scaling up of small and medium enterprises.

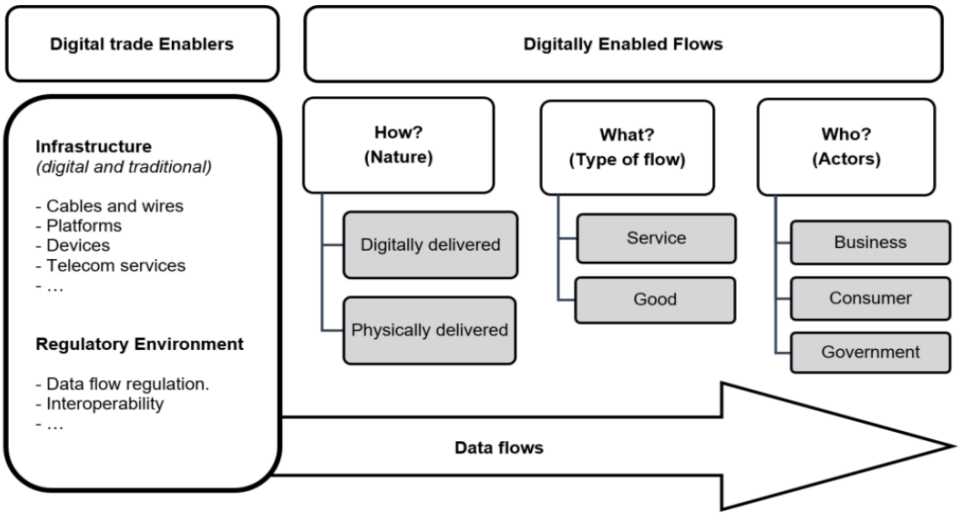
At the same time, the development of blockchain technologies has provided a non-intermediated alternative for secure online transactions. Blockchain is a decentralised and distributed digital record of transactions (distributed ledger). It is made of a continuously growing list of records, which are combined in 'blocks', which are then 'chained' to each other using cryptographic techniques. Once added to a blockchain, information is time-stamped and cannot be modified, so that attempted changes can easily be detected. Transactions are recorded, shared and verified on a peer-to-peer basis. In this way, trust in online transactions increases and intermediaries are less needed for the ecosystem to work properly.

4.2 Digital trade

Digital trade is not new, but it is taking new forms that are adding a new dimension to the process of globalisation, as Baldwin (2016) and López González and Jouanjean (2017) have cogently explained.

There is broad consensus that digital trade encompasses digitally-enabled international transactions in goods and services that can be either digitally or physically delivered (Lopez-Gonzalez and Jouanjean, 2017). Figure 5, borrowed from Lopez-Gonzalez and Jouanjean (2017), has become the standard illustration of what digital trade entails.

Figure 5: Typology of digital trade



Digitally-enabled but physically-delivered trade can involve both B2C transactions in final goods and services, and B2B transactions in intermediate goods and services, including within GVCs. Equally, digitally enabled and delivered trade can involve both goods (through 3D printing) and services, though more often the latter than the former, and final B2B or intermediate B2B transactions.

Goods and services that are physically delivered across borders do not differ according to whether the transaction that enables the trade is digital or not. One can buy the same product in a store or on an online platform. Similarly, one can book the same flight through a travel agent or an online platform. Digitisation in this case can facilitate the transaction. This is even more the case for GVC trade, which would not have been possible without the digital connectivity that has enabled firms to fragment their processes of production across the world and to exploit locational comparative advantages. This has generated a huge increase in trade in intermediate products, which has been the main driver of the growth in international trade in recent decades. Digitisation has therefore increased the physical delivery of final and (mainly) intermediate goods and services, but it has not changed the nature of trade.

The situation is different for digitally-enabled and delivered trade in goods and (mainly) services. Here, digitisation has created entirely new opportunities for international trade, mainly in services that could not be traded previously. Machine-learning AI systems are even starting to enable, as Baldwin (2019) discussed, tele-migration, the kind of trade that happens when workers sitting in one nation telecommute into offices in another, and possibly even communicate with one another in different languages thanks to automatic machine translation.

4.3 Socio-economic effects of digital trade

Unfortunately, there is no reliable estimate of the importance of digital trade from international institutions such as the Organisation for Economic Co-operation and Development or the World Trade Organisation, which have produced reports on digital trade (OECD, 2019; WTO, 2018), or public agencies

in the EU, the US or other major trading nations[5]. It is impossible therefore for the moment to have a sense of the share of global trade in goods and services that is digitally enabled and how fast it is growing[6].

Nonetheless, it should be clear that, so far, the digital transformation has mainly impacted on physically delivered trade, although digitally delivered trade has also been impacted to some extent. Since it is easier to physically deliver goods than services, it follows, that the digital transformation has had a greater impact on trade in manufactured goods (both final products and intermediate goods in global value chains) than on trade in services (mainly in global value chains), though some services have been impacted as well[7].

We share the view of Baldwin and Forslid (2019) that the next stage of the digital transformation, which is already underway and will vastly increase the digital delivery of trade, will affect trade in manufactured goods far less than it will affect trade in services. In fact, robotics and AI may actually reduce trade in manufactured goods, while vastly increasing trade in services.

In manufacturing activities, the main impact of the next stage of the digital transformation will be to reduce employment even further compared to what has already happened in the previous stages of the digital transformation. Some, like Baldwin and Forslid (2019), even predict that manufacturing will become jobless. This would obviously have huge socio-economic implications, but they would be generated through changes in production processes rather than via trade changes.

The impact of a new technology on trade, especially between advanced and developing or emerging economies with vastly different labour costs, depends essentially on two factors. The first is the extent to which the new technology reduces transportation and other transaction costs, thereby increasing the ability of firms to source products from the cheapest location in terms of labour costs. The second factor is the labour-intensity of the production process.

In recent decades, the digital transformation has allowed manufacturing firms based in advanced countries to source labour-intensive products or components from locations with relatively cheap labour. Such GVC trade between advanced and developing or emerging economies was the main driver of the huge increase in globalisation that started in about 1990. If, as Baldwin and Forslid (2019) predict, parts of manufacturing becomes jobless, then by definition the second factor disappears and decisions taken by firms on where to locate production will no longer depend on relative labour costs, but only on other costs. This could mean that some production activities will become localised closer to places of consumption than is currently the case, at least for products where transportation costs are significant. In principle, therefore, one should expect that the new wave of digital transformation will reduce trade in manufactured products (at least in activities for which there is less labour demand), especially if transportation costs remain significant.

If transportation costs also decrease substantially thanks to new digital technologies, then location of production would completely cease to be related to labour costs or transportation costs. Think, for instance, of 3D printing, through which digital technologies enable international trade to be delivered

[5] A report by the US International Trade Commission (USITC, 2017) estimated that global e-commerce amounted to USD 27.7 trillion in 2016, up 44 % from 2012. The report estimated that B2B transactions amounted to USD 23.9 trillion, six times larger than B2C transactions (USD 3.8 trillion). However, these statistics do not break down e-commerce transactions by origin. As a result, domestic and cross-border transactions are not separately identifiable.

[6] UNCTAD publishes annually estimates of the total value of global e-commerce transactions. However, UNCTAD's estimates refer to both domestic and cross-border transactions and do not permit to separate one from the other. See, for instance, UNCTAD (2019).

[7] Trade in primary products has been much less affected by the digital transformation than trade in manufactured products (or trade in services).

digitally. In principle, one would expect that 3D printing will reduce international trade. However, a study by Freund *et al* (2019) of 36 products that are increasingly being 3D printed found a positive effect on trade, but this positive effect of 3D printing on trade decreases with product weight and could even reverse for bulky products. At this stage, however, 3D printing is still very limited, and opinions differ a lot as to how much it can and will replace manufacturing. Moreover, 3D printing requires printer equipment and supplies, which typically involve international transactions.

In services, the main impact of the next stage of the digital transformation, which is already happening (and has accelerated because of the COVID-19 pandemic), is reducing drastically transportation and other transaction costs, rendering tradable many services that have been hitherto non-tradable. It is here that the socio-economic impact of the new digital transformation, which is making more and more services digitally deliverable, will be greatest. Because services tend to be highly labour-intensive and those services that are becoming digitally tradable are typically intensive in medium- to high-skilled labour, AI together with digital technologies, will vastly increase the potential to delocalise production from advanced countries to countries with relatively cheap skilled labour.

Before the COVID-19 crisis, Baldwin and Forslid (2019) already argued that firms in advanced countries were turning more and more to remote workers to perform an increasingly wide range of tasks. Although these remote workers were mainly in the same countries as the firms, meaning these activities did not constitute international trade transactions, Baldwin and Forslid (2019) noted that wage differences between advanced and developing or emerging countries, and talent shortages in advanced countries, were driving more and more firms to turn to foreign-based online service workers, whom they refer to as 'telemigrants'.

All this suggests obviously that competition between advanced and developing or emerging economies, based on lower labour costs in developing countries, is set to increase. So far it was to the East Asian countries (including China) that manufacturing jobs from advanced migrated. Soon it will be to South Asia (mainly India) and other countries with good education systems, that services jobs from advanced economies will migrate, and on a much bigger scale than what has already occurred.

Box 1: Additive manufacturing and global value chains

Additive manufacturing or 3D printing is 'a process of making a three-dimensional solid object of virtually any shape from a digital model' (https://www.sme.org/additive-manufacturing-glossary/). It is used for prototyping and for distributed manufacturing in a wide range of applications, in commercial, industrial and public sectors (e.g. manufacturing of components for cars, trains and planes, manufacturing of printers in schools and public libraries, bioprinting and so on).

3D printing makes customisation much easier and less costly in order to match the desired preferences. This is because in order to change the produced solid project, you only need to change the computer code that defines its characteristics.

Surveys (Sculpteo, 2017; De Bucker and Flaig, 2017) have shown constant high growth rates of the adoption of this technology, its penetration of new markets and its market value. Specifically, the market for additive manufacturing is estimated to reach a value of between USD 5.6 and USD 22 billion dollars in 2020.

As this technology is expected to be adopted widely, it is also going to affect global value chains (Rehnberg and Ponte, 2016; Laplume et al, 2016) in **two main ways**: i.e. by **shortening the development cycles of products** (which are currently produced by traditional manufacturing techniques), ii. by **discouraging offshoring** of manufacturing activities **and** by leading to **localisation** of production **close to the point of consumption**.

4.4 Policy issues

Our discussion suggests that the latest developments in digitisation, although affecting both trade in manufactured goods and trade in services, is having and will have even more in the future its greatest impact on trade in services. Hence, we share the view of Baldwin and Forslid (2019) that globalisation is entering a new phase, driven by digitally-delivered trade in services. We also share the view of van der Marel (2020) that *'globalisation is not in decline, but simply changing'*.

During the previous phase of globalisation, which was and is still largely driven by GVC trade in manufactures, a growing number of industrial activities were outsourced to countries with much lower labour costs than Europe (and within Europe from western to eastern or south-eastern countries), with goods then exported from these countries to various destinations, including Europe. During this phase, industrial employment in Europe and in other advanced economies declined substantially, although the value of industrial production continued to increase. This came about as companies concentrated on high value-added activities, outsourcing lower value-added ones and replacing manual labour by robots or other machines. But overall employment did not decrease. It simply shifted to services but with significant socio-economic consequences, including in terms of the organisation of work, female participation in the labour force and income distribution.

The new phase of globalisation, which is only now starting, will now also transform employment in services, at least in those activities that were hitherto non-tradable (or little tradable), which will now become not only potentially deliverable digitally but actually digitally delivered. This will provide new employment opportunities for some European workers, but for others who have been sheltered from international competition, it could mean that their jobs will be outsourced to other parts of the world where there is an abundant well-educated labour supply. Whether or not total employment opportunities will remain unchanged and only job composition will change is obviously impossible to predict. During earlier phases of technological transformation and globalisation, there was more change in the composition of jobs than in the number of jobs, though there was also a reduction in the number of hours worked per person and a welcome increase in leisure.

What role can and should policy play to accompany such transformation? We see two different areas: domestic policies and trade policy.

The main relevant domestic policies are education, training and retraining, and other social policies aimed at equipping people to master digital technologies and adapt to change. More than ever, societies with flexi-security policies, like the Nordic countries, which combine high quality education and people rather than job security, will be best prepared to manage the digital transformation. But these policies are expensive, so they require states to be able to raise sufficient resources, including by taxing digital activities.

As far as trade policy is concerned, the European Union has an interest in improving its access to markets where the level of restrictiveness on digital services trade is high. According to Ferencz (2019), the OECD digital services trade restrictiveness index (DSTRI) for 2018 was equal to 0.2 or less in all EU countries (except Latvia and Poland) but nearly 0.4 or more in countries like Brazil, China and India[8]. If successful, the on-going WTO plurilateral negotiations on e-commerce – defined by the WTO as *'the production, distribution, marketing, sale or delivery of goods and services by electronic means'* (and therefore similar to

[8] The OECD's DSTRI identifies, catalogues, and quantifies barriers that affect trade in digitally enabled services across 44 countries. It covers many barriers, including those in communication infrastructure, movement of information across networks as well as in electronic transactions and payments. It aggregates the restrictions into an index that ranges between 0 and 1, with 0 being most open and 1 most restrictive.

the notion of digital services used by the OECD and in this briefing) – may produce a reduction in trade barriers. However, we share the viewpoint of Hufbauer and Lu (2019) that multilateral disciplines in digital services will need to be complemented by bilateral and/or regional agreements to deliver significant improvements in market access.

We close by reflecting on the consequences of COVID-19 for the digital transformation and digital trade. Before the crisis, the trends we discussed in this briefing were already clear. What was not clear, however, was the pace at which the transformation would take place. There is no doubt that the crisis has accelerated this pace. Teleworking has become a reality for large segments of the population and is here to stay, although not at the level that it reached at the peak of lock downs. And with teleworking becoming ubiquitous, telemigration, which was still considered not long ago as belonging to the distant future, is sure to soon follow. More generally, we should now expect that the new phase of globalisation driven by digitally-delivered trade in services will unfold more rapidly than we had anticipated. We should be prepared for it.

References

Asgard (2017) 'The European Artificial Intelligence Landscape and largest AI hubs in Europe', Medium, 31 July.

Baldwin, R. (2016). *The Great Convergence*. Cambridge, MA: Harvard University Press.

Baldwin, R. (2019). *The Globotics Upheaval: Globalization, Robotics, and the Future of Work*. Oxford: Oxford University Press.

Baldwin, R., and R. Forslid (2019). 'Globotics and development: When manufacturing is jobless and services are tradable', *WIDER Working Paper 2019/94*, UNU-WIDER, Helsinki.

Bloom, N., Jones, C., Van Reenen, J. and Webb, M. (2017). 'Are Ideas Getting Harder to Find?', *American Economic Review*, Vol. 110, No. 4.

Bughin, J., Seong, J., Manyika, J., Hämäläinen, L., Windhagen, E., and E. Hazan (2019). 'Tackling Europe's gap in digital and AI'. McKinsey Global Institute Discussion Paper.

De Backer, K. and Flaig, D. (2017), 'The future of global value chains', Science, Technology and Industry Working Paper No. 41, Paris: OECD.

Deloitte (2015), The Deloitte Consumer Review: Mass-toorder, the rise of mass personalisation, London: Deloitte.

Deloitte (2016), Consumer Product Trends, Navigating 2020, London: Deloitte.

European Commission (2016). 'Regulation 2016//679 of the European Parliament and of the Council on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (GDPR)', *Official Journal of the European Union* 119: 1–88.

European Commission (2018). Regulation (2018/1807/EU) on a framework for the free flow of non-personal data in the European Union. *Official Journal of the European Union*, *L303/59*, 59-68.

European Commission. (2019a). Directive (2019/770/EU) on certain aspects concerning contracts for the supply of digital content and digital services. *Official Journal of the European Union*, *L136/1*, 1-27.

Ferencz, J. (2019). 'The OECD Digital Services Trade Restrictiveness Index', OECD Trade Policy Paper, No. 221, OECD Publishing, Paris, http://dx.doi.org/10.1787/16ed2d78-en

Freund, C., A. Mulabdic, and M. Ruta (2019). 'Is 3D Printing a Threat to Global Trade? The Trade Effects You Didn't Hear About', Policy Research Working Paper No. 9024, World Bank, Washington, D.C.

Furman, J., Coyle, D., Fletcher, A., McAuley, D., & P. Marsden (2019). '*Unlocking digital competition: Report of the digital competition expert panel*'. Government of the United Kingdom. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/785547/unlocking_digital_competition_furman_review_web.pdf

Hufbauer, G.C., and Z. Lu (2019). 'Global E-Commerce Talks Stumble on Data Issues, Privacy, and More', Policy Brief No. 19-14, Peterson Institute for International Economics, Washington, D.C.

International Federation of Robotics (2016) World Robotics Report 2016.

International Telecommunications Union (ITU) (2016), ICT Facts and Figures, Geneva: ITU.

Laplume A. O., B. Petersen and Joshua M. Pearce (2016). 'Global value chains from a 3D printing perspective'. *Journal of International Business Studies*, 47, 595-609.

Lopez-Gonzalez, J., and M. Jouanjean (2017). 'Digital trade: Developing a framework for analysis', OECD Trade Policy Papers, No. 205, OECD Publishing, Paris, http://dx.doi.org/10.1787/524c8c83-en

OECD (2014). 'Data-Driven Innovation for Growth and Well-Being' Interim Synthesis Report.

OECD (2019). Trade in the Digital Era, OECD, Paris.

Parker, G., G., Petropoulos, G. and M. W. Van Alstyne (forthcoming). *Digital Platforms and Antitrust*. Chapter contribution to the Oxford Handbook of Transnational Economic Governance. Editors: Eric Brousseau and Jean-Michel Glachant.

Petropoulos, G. (2017). The growing presence of robots in EU industries. Bruegel Blogpost: https://www.bruegel.org/2017/12/the-growing-presence-of-robots-in-eu-industries/

Petropoulos, G., J. S. Marcus, N. Moes and E. Bergamini (2019). Digitalisation and the European Welfare States. Bruegel Blueprint: https://www.bruegel.org/wp-content/uploads/2019/07/Bruegel_Blueprint_30_ONLINE.pdf

Rehnberg, M. and S. Ponte, S. (2016). '3D Printing and Global Value Chains: How a New Technology May Restructure Global Production'. GNP Working Paper 2016_010.

Sculpteo (2017), The state of 3D printing, Villejuif, France: Sculpteo.

UNCTAD (2019). Digital Economy Report 2019, New York: United Nations.

USITC (2017). Global Digital Trade 1: Market Opportunities and Key Foreign Trade Restrictions, Washington, D.C.: USITC.

Van der Marel, E. (2020). 'Globalization Isn't in Decline: It's Changing', ECIPE Policy Brief No. 6/2020.

WTO (2018). World Trade Report 2018: The future of world trade: How digital technologies are transforming global commerce, WTO, Geneva.

PE 603.516
EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05

Print ISBN: 978-92-846-7434-3 doi: 10.2861/043049 QA-01-20-703-EN-C
PDF ISBN: 978-92-846-7433-6 doi: 10.2861/64990 QA-01-20-703-EN-N

BRIEFING

Requested by the INTA committee

European Parliament

Legal Analysis of International Trade Law and Digital Trade

Policy Department for External Relations
Directorate General for External Policies of the Union
PE 603.517 - November 2020

EN

DIRECTORATE-GENERAL FOR EXTERNAL POLICIES
POLICY DEPARTMENT

European Parliament

BRIEFING

Legal Analysis of International Trade Law and Digital Trade

ABSTRACT

This brief provides a legal analysis of existing rules in digital trade regarding the various components of artificial intelligence ('AI'), in particular (personal and non-personal) data, computer code in the form of algorithms, and computing power (including cloud computing). To do so, the first part of this analysis will map various international trade rules that affect cross-border flows of data, computer code and computing power to determine their respective advantages and disadvantages. This will form the basis for the second part of the analysis, which will address the desirability and necessity of global rulemaking in this area.

EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05
November 2020 - PE 603.517

EN

This paper was requested by the European Parliament's Committee on International Trade.

English-language manuscript was completed on 11 November 2020.

Printed in Belgium.

Author: Michele FINK, Senior Research Fellow, Max Planck Institute for Innovation and Competition

Officials Responsible: Mario DAMEN, Wolfgang IGLER

Editorial Assistant: Balázs REISS

Feedback of all kind is welcome. Please write to: wolfgang.igler@europarl.europa.eu.

To obtain copies, please send a request to: poldep-expo@europarl.europa.eu.

This paper will be published on the European Parliament's online database, 'Think tank'.

ISBN: 978-92-846-7436-7 (pdf)

doi: 10.2861/50490 (pdf)

Catalogue number: QA-03-20-738-EN-N

ISBN: 978-92-846-7435-0 (paper)

doi: 10.2861/137398 (paper)

Catalogue number: QA-03-20-738-EN-C (paper)

Table of contents

1 International Trade Rules, Data Flows, Computing Resources and Artificial Intelligence

International trade law seeks to remove uncertainty for companies and governments engaging in cross-border trade. These rules were initially conceived for traditional trade in goods, and later on refined to also apply to services. Today, their applicability and need for reform in light of the digital turn, particularly regarding artificial intelligence, has become a topic of economic and political importance. This brief provides an overview of relevant aspects of trade law, in particular European Union ('EU'), World Trade Organisation ('WTO') law and recent Free Trade Agreements ('FTAs'). Each scheme will be surveyed for its applicability to (i) personal and non-personal data; (ii) computer code in the form of algorithms; and (iii) computing power to pinpoint existing restrictions on the trade of artificial intelligence in order to provide a picture of the current state of trade law and its applicability to AI.

Artificial intelligence refers to algorithms that have been trained on (often large) quantities of data. Indeed, improvements in artificial intelligence over the past years are less due to profound breakthroughs in algorithms rather than changes in the swelling availability of data points as well as improvements in computing power. Cross-border trade in digital services that include AI is steadily increasing, which brings such software within the scope of international trade law. On the one hand, services as such are becoming an increasingly prominent component of international trade, whereas, on the other, goods increasingly have a services component[1]. Artificial intelligence can be incorporated into goods or services in a variety of forms, which raises the question of the application of international trade law to artificial intelligence and the therefrom-resulting consequences[2].

2 Barriers to International Trade in Goods and Services that integrate Artificial Intelligence

In recent years, multiple jurisdictions have adopted measures related to the core components of artificial intelligence: data, algorithms, and computing power, which burden or hinder the international circulation of artificial intelligence as well as its various components. These new barriers to digital trade are generally non-tariff barriers, including localisation measures, or national and/or regional regulations, including divergent approaches to data protection and privacy requirements[3] or censorship rules. Beyond, technology standards can be leveraged to favour local companies as 'many applications of AI involve complementary technologies in which standards might not yet exist'[4].

In particular, domestic **data localization requirements** have been the topic of much debate. Data localization measures in essence impose limitations on the free movement of data[5]. These measures encompass requests to use local data centers (which prevents the usage of cloud computing services

[1] Consider, for instance, the example of an electric toothbrush connected to a mobile app, where the app then makes personalized (future processing suggestions) to the user.

[2] Note that digitalization in general has given rise to debates as to whether hybrids such as servitised goods are best qualified as goods or services from a legal perspective: Usman Ahmed, Brian Bieron, and Gary Horlick, Mode 1, Mode 2 or Mode 10: How Should Internet Services be Classified in the General Agreement on Trade and Services?, Current Topics in International Law, Boston University School of Law, 2015. Available at: https://www.bu.edu/ilj/2015/11/24/mode-1-mode-2-or-mode-10-how-should-internet-services-be-classified-in-the-global-agreement-on-trade-in-service/#_ftn18

[3] The fact that data privacy requirements privacy and data protection may sometimes be considered a barrier to trade does of course not mean that these are undesirable. Indeed, privacy and data protection are fundamental rights protected by the EU Charter of Fundamental Rights

[4] Avi Goldfarb et al, AI and International Trade, NBER Working Paper 24254 (2018) https://www.nber.org/papers/w24254.pdf p. 26.

[5] See further Joshua Meltzer, 'A New Digital Trade Agenda' [2015] E15 Initiative 2, 5.

where servers are located outside the relevant jurisdiction) or outright bans to transfer data abroad (for instance in order to ensure law enforcement or for cyber security reasons)[6]. All of these measures impose geographical limitations on data, as they require that data is stored on local servers. These localization measures impact two core components of artificial intelligence: data and computer storage. Some have referred to this trend as 'data nationalism'[7]. Others are sceptical whether such measures can in reality achieve their stated objectives such as shielding citizens from foreign surveillance, privacy and security, economic development, domestic law enforcement and the protection of freedom[8].

Data localization measures across jurisdictions are varied and range from rules regarding content, such as for instance Nigeria's guidelines on content development, online censorship (as rules in place in Turkey), data protection rules as existing in the EU and South Korea, data transfer requirements, transfers of source code in tax-related information (USA), traffic routing requirements, which includes restrictions on foreign ISPs to provide internet access (Vietnam), local data storage and processing requirements such as for instance the Brazilian localization requirements for public procurement contracts including in cloud computing services, requirements that certain data be processed locally (Russia) and the Chinese Great Firewall[9]. A further example of data transfer requirements are India's requirement that payment service providers set up data centres or store their data with cloud providers using Indian data centres[10].

Mandatory transfer of technology requirements may moreover compel companies to reveal elements of a technology, such as the source code (that is to say computer code that can straightforwardly be read by skilled individuals) of the software used in artificial intelligence. Countries can make market access conditional to such disclosures[11]. Furthermore, **local content rules** such as content blocking, content filtering and geo-blocking affect the availability of data to train artificial intelligence on. Beyond, **licensing obligations for cloud services** can hamper the constant data flows between different data centers in various locations and jurisdictions that characterize cloud computing[12].

3 European Union Law

The European Union has exclusive competence to negotiate trade agreements on behalf of its member states[13]. Article 207(3) TFEU provides that negotiated agreements must be in line with the EU's internal policies and rules. Thus, any trade agreement to which the EU would be a signatory ought to comply with EU law, including its various provisions on the respect of fundamental rights should as the right to data protection as set out in Article 16 TFEU and Article 8 of the Charter of Fundamental Rights.

Especially the application of the data protection provisions to international data flows has been a much-discussed issue in recent years. Particularly noteworthy in the context of international data transfers is the European Court of Justice's summer 2020 decision in *Data Protection Commissioner v Facebook Ireland and*

[6] https://ecipe.org/publications/restrictions-to-cross-border-data-flows-a-taxonomy/

[7] Anupam Chander and Uyen P Le, 'Data Nationalism' (2015) 3 Emory Law Journal 64, 677.

[8] Anupam Chander and Uyen Le, Breaking the Web: Data Localisation vs the Global Internet, UC Davis School of Law Working Paper 2014-1 (2014)

[9] Nivedita Sen, 'Understanding the Role of WTO in International Data Flows: Taking the Liberalization or the Regulatory Autonomy Path?' (2018) 21 Journal of International Economic Law https://academic.oup.com/jiel/article/21/2/323/5004397#117982790

[10] See further https://www.pwc.in/consulting/cyber-security/data-privacy/data-localisation-norms.html#:~:text=In%202017%2C%20several%20directives%20and,for%20data%20localisation%20across%20sectors.&text=However%2C%20in%20June%202019%2C%20the,data%20is%20kept%20outside%20India.

[11] Andrea Andrenelli, Julien Gourdon and Evdokia Moïsé, 'International Technology Transfer Policies' (2019) 222 OECD Trade Policy Papers

[12] White and Case, Cloud Services and Export Control: What You Don't Know Can Hurt You, 10 April 2014 https://www.whitecase.com/publications/alert/cloud-services-and-export-control-what-you-dont-know-can-hurt-you.

[13] Articles 3(1)(e) and 207 TFEU.

Maximillian Schrems in which the ECJ annulled the EU-US Privacy Shield and in addition placed significant difficulties on those needing to transfer personal data from the EU to the US using standard contractual clauses under the GDPR[14]. Chander has argued that this ruling is akin to a soft data localisation requirement as it burdens the export of personal data outside the EU to an extent making it prohibitively complicated, particularly for SMEs[15].

It should also be noted that EU law embodies a qualified prohibition on data localisation requirements as they have been adopted in other jurisdictions. The Regulation on the Free Flow of Non-Personal Data provides that data localisation requirements 'shall be prohibited, unless they are justified on grounds of public security in compliance with the principle of proportionality'[16]. In the future, there may be additional rules may impact the international circulation of data and AI, for instance possible transparency requirements[17].

4 The General Agreement on Trade in Services

WTO law covers trade in artificial intelligence (typically trade in digital services or servitised goods with an AI component). Of particular relevance in this respect is the WTO's General Agreement on Trade in Services ('GATS'). Where trade occurs between members of the WTO (such as the European Union and its member states)[18], national measures that restrict trade in artificial intelligence must hence be consistent with the GATS, or, where they are not, be caught by one of its exceptions.

The GATS is the first multilateral treaty on the liberalisation of international trade in services. It seeks to promote trade in services by eliminating trade barriers and applies to all services except for government services. There are, however, limits to its trade liberalisation agenda. Indeed, its preamble recognises that members also have an interest in furthering domestic policy goals through regulation[19]. The GATS applies to any measure 'whether in the form of a law, regulation, rule, procedure, decision, administrative action or any other form' that covers services from their initiation to final delivery[20]. Thus, where a domestic measure affects trade in services, it falls under the GATS[21].

WTO law operates based on distinctions on whether something is a good, a service or intellectual property. This creates challenges regarding categorisations of data at is can bridge all of these categories. Notwithstanding, it is clear that WTO law catches trade in data flows and artificial intelligence. In *US-Gambling*, the WTO dispute settlement mechanism held that the online electronic delivery of a service is within the purview of the GATS and classified it under Mode 1[22]. *China-Audiovisiuals* confirmed that service commitments extend to services delivered online[23].

WTO law classifies services according to existing **service classifications**, which serve to identify a party's commitments. This is done on the basis of a 1994 list in the form of the WTO Services Sectoral

[14] Case C-311/18 Data Protection Commissioner v Facebook Ireland and Maximillian Schrems (2020) EU:C:2020:559.
[15] Anupam Chander, 'Is Data Localisation a Solution for Schrems II, (2020) forthcoming Journal of International Economic Law, https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=275458.
[16] Article 4(1) Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union, OJ L 303, 28.11.2018, 59–68.
[17] European Commission, White Paper on Artificial Intelligence – A European Approach to Excellence and Trust COM (2020) 65 final, 15
[18] Whereas the EU is a WTO member, the various member states are also members in their own right.
[19] See Articles VI(1) and XIV GATS.
[20] Article XXVIII(a) GATS.
[21] Anupam Chander, 'The Internet of Things: Both Goods and Services' (2019) 18 World Trade Review 9-22.
[22] Appellate Body Report, United States – Measures Affecting the Cross-Border Supply of Gambling and Betting Services, 197, 203-04, WTO Doc. WT/DS285/AB/R (Apr. 7, 2005)
[23] WTO Panel Report, China – Publications and Audiovisual Products, WT/DS363/R, para. 7.1641-7.1653.

Classifications List (W/120)[24]. It can be expected that the question of classifications will be the subject of future trade disputes. These general service categories can be difficult to map to contemporary (digital) services[25]. It is likely that artificial intelligence will further exacerbate that difficulty, particularly as it becomes integrated in a large variety of different services (such as healthcare or financial services, to provide just two examples). Where the GATS apply, its general obligations ought to be respected. These are the following:

- The **Most Favoured Nation** ('MFN') treatment mandates that each member shall treat the services and service supplies of other members in a 'no less favourable' manner than 'like' domestic services and services suppliers[26].
- The **National Treatment** requirement compels WTO members to treat services and service suppliers from other WTO members equally to domestic services and service suppliers[27].
- The **Domestic Regulation** rule foresees that each member 'shall ensure that all measures of general application affecting trade in services are administered in a reasonable, objective and impartial manner'[28]. This is essentially a procedural due process and fairness guarantee that ensures that, inter alia, licencing requirements follow objective criteria.
- The **Market Access** rule requires that members bound by commitments in its schedule should not impose the six market access barriers listed n Article XVI:2 (a) to (f)[29].

National measures applicable to artificial intelligence can fall within the scope of the GATS in a variety of forms. Many jurisdictions have in the past years adopted measures concerning data, some of which fall within the purview of the GATS. For example, data **localisation requirements** can create situations where foreign service suppliers are treated less favourably than domestic service suppliers, in breach of the national treatment rule[30]. Depending on the rule, they may also be problematic from a market access perspective. This also has an effect on cloud computing as business are faced with a narrower choice of providers where they cannot rely on services using servers located outside of the jurisdiction.

Data protection norms can raise questions regarding the national treatment provisions, yet can be justified by members' freedom to adopt privacy protections[31]. In particular data localisation measures have been subject to vivid debate regarding their impact on trade and it hence comes as no surprise that the topic is also on the agenda of the WTO as per its Joint Statement Initiative on e-commerce[32].

Member measures related to software that may create issues under the GATS include compulsory **technology transfer requirements** (which may take the form of an obligation to reveal source code)[33]. It was observed above that in some jurisdictions, market access is only granted to firms that make available the source code of the software to local governments. Indeed, governments may demand access to source code for security reasons (such as to reduce fraud or ensure national security).

[24] WTO, Services Sectoral Classification List. Note by the Secretariat, MTN.
GNS/W/120, 10 July 1991.
[25] See further Rolf Weber and Mira Burri, Classification of Services in the Digital Economy (Schulthess 2012).
[26] GATS Article II.
[27] Article XVII.1 GATS.
[28] Article VI GATS.
[29] Article XVI GATS.
[30] Holger Hestermeyer and Laura Nielsen, 'The Legality of Local Content Measures under WTO Law' (2014) 48 Journal of World Trade, 553.
[31] Article XIV of the General Agreement on Trade in Services guarantees that measures that are genuinely intended to protect personal data are fully compatible with GATS.
[32] World Trade Organisation, Joint Statement on Electronic Commerce (WT/L/1056), 25 January 2019.
[33] See further Andrea Andrenello et al, 'International Technology Transfer Policies' (2019) 222 OECD Trade Policy Papers.

Mandatory technology transfer requirements such as the disclosure of source code are caught by GATS market access and domestic regulation disciplines (although intellectual property rights and trade secrets are protected under the WTO TRIPS Agreement)[34]. Below, it will be seen that such rules are now prohibited by recent trade agreements such as the TPP, which prohibits partners from demanding the disclosure of source code, with a few exceptions, such as security reasons[35].

It is worth noting that such measures, which prima facie contravene WTO principles can nonetheless be justified under the GATS where they are caught by one of tits various **justifications**. However, at the same time, such measures may be justifiable by the general exceptions clauses related to **security, public morals, and privacy**[36]. GATS Article V, which deals with economic integration and enables members to become a party to an agreement liberalising trade with other parties; GATS Article XIV bis, which enables members to pursue their security interests, and GATS Article XIV, which engages with general public interest measures. To date, no cases on these questions have been brought before the WTO dispute settlement procedures.

In the past, the **security exemption** has not often been used. However, it has been predicted that in the future, governments may be more extensively relying on such exceptions, which will in turn increase overall trade restrictions[37]. Indeed, this phenomenon has already started. In 2019, a WTO found in *Russia-Measures Concerning Traffic in Transit* that the GATS security exceptions can be reviewed by WTO dispute settlement panels in order to determine whether there are objective security grounds under GATT Article XXI(b) and that members invoking that provision must show that there are good faith essential security interests[38]. Under Article XIV(c), members can pursue important public interests, including the prevention of **deceptive and fraudulent practices** and the **protection of privacy** where these measures meet the provisions material requirements and the chapeau.

Beyond the general GATS scheme, a number of **sector-specific rules** are also of relevance for the trade of goods and services incorporating artificial intelligence under WTO law, such as sector-specific commitments for telecommunications (as foreseen by the Annex on Telecommunications) as well as the Annex on Financial Services. The latter provides that members shall not adopt measures preventing information transfers or prohibitions on the processing of financial information including 'transfers of data by electronic means' except where necessary for data protection reasons[39].

The **Information Technology Agreement** is a plurilateral deal despite having been adopted under the auspices of the WTO (this means that it is only binding upon those parties that have signed it). Many key jurisdictions in the developing and developed world have signed, yet it is merely a tariff cutting mechanism that does not incorporate binding commitments regarding non-tariff barriers. The ITA moreover operates on the bass of a product classification list dating back to 1989, needless to say such classifications cannot easily be applied to current and future technologies[40].

[34] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), Apr. 15, 1994, Annex 1C to the Marrakesh Agreement Establishing the World Trade Organization.

[35] Avi Goldfarb et al, AI and International Trade, NBER Working Paper 24254 (2018) https://www.nber.org/papers/w24254.pdf, p. 26.

[36] Casalini, F. and J. López González (2019-01-23), 'Trade and Cross-Border Data Flows', OECD Trade Policy Papers, No. 220, OECD Publishing, Paris, 26.
http://dx.doi.org/10.1787/b2023a47-en

[37] Joshua Meltzer and Cameron Kerry, 'Cybersecurity and Digital Trade: Getting it Right (18 September 2019), https://www.brookings.edu/research/cybersecurity-and-digital-trade-getting-it-right/

[38] WTO Panel Report, Russia-Measures Concerning Traffic in Transit, WT/DS512/R, para 7.1010.7.102.

[39] Article 8.

[40] It is worth noting that already in 1998 these had been disputes regarding the appropriateness of such classifications: Appellate Body Report, European Communities – Customs Classification of Certain Computer Equipment, WTO Doc. WT/DS62/AB/R,

It must also be underlined that in the future, there may be more detailed WTO rules on e-commerce. In January 2019, 76 WTO members including the European Union, the United States of America and China announced the start of negotiations on new e-commerce rules[41]. Whereas related negotiations are ongoing, the EU has already tabled a proposal on WTO e-commerce rules[42]. Among other points, this proposal suggests that there be:

- A permanent exception from customs duties for electronic transmission and content
- A qualified prohibition of data and technology localisation measures, subject to exceptions for reasons of personal data and privacy
- Protections for source code from members' measures requiring the disclosure thereof.

Below, it will be seen that these measures may foreclose internal rule-making on these matters. The European Commission's 2018 Communication on AI and its 2020 White Paper on AI highlight the importance of algorithmic transparency. A crucial question is what degree of transparency of software is desirable. Adopting contrary trade rules could considerably limit the EU's rule-making capacity in relation to trustworthy and ethical AI

Despite these efforts, it is clear that to date, 'the WTO rules have so far not reacted in a forward-looking manner to the various changes triggered by the Internet. In this sense, data and data flows have not been addressed deliberately'[43]. On the one hand, WTO law, with its broad principles was devised as a technology-neutral framework expected to stand the test of time as technological development unrolls. Yet, research has also shown that adaptation through judicial interpretation cannot be considered satisfactory in the light of the data economy given that (i) the framework is currently 'patchy and fails to contribute to a sufficient level of legal certainty', and that (ii) WTO law has been unable to keep up due to the processes foreseen for its adaptation, as there are fundamental divergences on issues such as human rights, including privacy, and culture[44].

Whereas WTO law has not yet undergone major changes to adopt for socio-economic transformations engendered by the digital turn, recent free trade agreements ('FTA') have exhibited a more proactive approach.

5 Free Trade Agreements

The most recently concluded free trade agreements include specific rules for the digital economy. Data-related provisions are relatively new in international trade law but they are also increasingly located in the dedicated e-commerce chapters of preferential trade agreements, such as bans or limitations of data localisation requirements or rules enabling the cross-border flow of data[45]. Similarly, FTAs increasingly incorporate rules on cross-border data flows in chapters on specific service sectors, such as telecommunications or financial services[46]. Free trade agreements thus in some way fill the vacuum left by a lack of updating WTO rules on e-commerce. This section considers in particular the Canada-European Union Comprehensive Economic and Trade Agreement (CETA) and the Comprehensive and

WT/DS68/AB/R (adopted 5 June 1998). The list was expanded at the Nairobi Ministerial Conference in 2015 to cover 201 additional product lines.

[41] WTO, Joint Statement on Electronic Commerce, 19 January 2019, WT/L/1056.

[42] WTO, EU Proposal for WTO Disciplines and Commitments Relating to Electronic Commerce, 26 April 2019, INF/ECOM/22.

[43] Mira Burri, 'The Governance of Data and Data Flows in Trade Agreements: The Pitfalls of Legal Adaptation' (2017) 51 UC Davis Law Review, 65, 93.

[44] Ibid, 98.

[45] Mira Burri and Rodrigo Polanco, 'Digital Trade Provisions in Preferential Trade Agreements: Introducing a New Dataset' (2020), SSRN Working Paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3482470&download=yes.

[46] Ibid.

Progressive Trans-Pacific Partnership ('CPTPP')'s various provisions that affect international trade in artificial intelligence.

6 The Canada-European Union Comprehensive Economic and Trade Agreement

Chapter Sixteen of CETA deals with electronic commerce and sets out the following legally binding obligations:

- Parties shall not impose **customs duties, frees or charges on deliveries transmitted electronically**[47]. 'Delivery' refers to digitally encoded deliveries, which include computer programs, text, video, image or sound recordings which may all be used in the context of artificial intelligence[48].
- Parties shall adopt measures necessary for the **protection of personal data**[49].

Article 16.6 CETA moreover contains **best endeavours** relevant to digital commerce according to which the European Union and Canada set out to remain in dialogue on matters such as (a) the recognition of electronic signatures and the facilitation of cross-border certification services; (b) the liability of intermediary service providers; (c) spam mail; and (d) the protection of personal information as well as the protection of consumers and businesses from fraudulent and deceptive commercial practices in e-commerce. Whereas no precise agreement was reached on legally binding provisions on these matters these are issues inherent in e-commerce that cannot be satisfactorily addressed by a single jurisdiction, underlining the benefits of transnational cooperation on such matters. To this end, the EU and Canada have agreed to exchange information regarding their respective laws, regulations and other relevant measures and to actively participate in multilateral for a to promote the development of e-commerce[50].

7 The Comprehensive and Progressive Agreement for Trans-Pacific Partnership

The CPTPP probably contains the most ambitious e-commerce chapter in existing regional trade agreements. Its Chapter Fourteen deals with electronic commerce and contains a number of legally binding provisions relevant to artificial intelligence as well as best endeavours[51]. The following provisions are particularly important for artificial intelligence:

- The CPTPP contains best endeavours regarding the **protection of personal information**[52].
- The agreement provides that no party shall make the transfer of, or **access to source code** a precondition for the import, distribution, sale or use of the related software or products containing the software in its territory[53]. Exceptions exist for software used in critical infrastructure[54]. Moreover, the source code provision does not preclude the inclusion or implementation or terms and conditions related to the provision of source code in commercially negotiated contracts, or requirements regarding the modification of source code of software necessary to comply with laws

[47] Article 16.3 CETA. Note that this does not prevent the imposition of internal taxes.
[48] For this definition, see further Article 16.1 CETA.
[49] Article 16.4 CETA.
[50] Article 16.6.
[51] With the exception of government procurement and information held or processed by or on behalf of a party or measures that are related to such information. See further Article 14.2.3 TPP.
[52] Article 14.8 TPP.
[53] Article 14.17.1 TPP.
[54] Article 14.17.2 TPP.

and regulations that are not inconsistent with the agreement[55]. Beyond, the provision should also not be construed to affect disclosure requirements stemming from patent law[56].

- The agreement sets out that **computing facilities localisation** requirements may not be a precondition for the conduct of business in the given jurisdiction[57].
- The agreement prohibits **customs duties on electronic transmissions**, including electronically transmitted content[58].
- The agreement contains a **non-discrimination clause** according to which no less favourable treatment should be accorded to digital products from another party than on internal digital product[59].

Further provisions relate to electronic signatures and electronic authentication[60]. The CPTPP also contains best endeavours relevant to electronic commerce, including commitments recognising the importance of online consumer protection[61] and the protection of personal information[62]. Further best endeavours relate to paperless trading[63] and principles on access to and use of the internet for e-commerce[64] as well as internet interconnect charge sharing[65]. The signatory parties moreover undertook to adopt or maintain measures to combat unsolicited commercial electronic messages ('spam')[66] and to cooperate further on a range of issues including regulatory experience sharing, the promotion of SMEs, the exchange of information regarding consumer access to online goods and services, cooperation in multilateral fora having the objective of developing e-commerce, as well as the development of private sector self-regulation through codes of conduct, model contracts, guidelines and enforcement mechanisms designed to foster e-commerce[67]. The parties also undertook to cooperate on matters of cybersecurity[68].

8 The Trade in Services Agreement

The Trade in Services Agreement (TiSA) is a proposed international treaty that would bind 23 members of the WTO, including the European Union, in order to liberalize the worldwide trade of services. Given that numerous service sectors, such as healthcare or banking, increasingly consider incorporating elements of artificial intelligence in the respective services, TiSA will also have relevance in relation to artificial intelligence. TiSA negotiations are currently **on hold**[69].

[55] Article 14.17.3 TPP.
[56] Article 14.17.4 TPP.
[57] Article 14.13.2 TPP.
[58] Article 14.3 TPP.
[59] Article 14.4.1. TPP.
[60] Article 14.6 TPP.
[61] Article 14.7 TPP.
[62] Article 14.8 TPP.
[63] Article 14.9 TPP.
[64] Article 14.10 TPP.
[65] Article 14.12 TPP.
[66] Article 14.14 TPP.
[67] Article 14.15 TPP.
[68] Article 14.16 TPP.
[69] https://www.europarl.europa.eu/legislative-train/theme-a-balanced-and-progressive-trade-policy-to-harness-globalisation/file-trade-in-services-agreement-(tisa)

9 International Trade in Artificial Intelligence and Developing Countries

In recent years, more attention has been paid to the particularities of developing countries concerning transnational data flows and artificial intelligence[70]. Developing countries typically have less privacy and data protection mechanisms in place, meaning that data originating from these jurisdictions are attractive for companies established in countries with extensive data protection norms. Indeed, there is a temptation to use datasets from such jurisdictions in order to train algorithms, given that they (presumably) contain information that cannot be processed elsewhere due to legal restrictions[71]. As a consequence, developing nations may become '**data exporters**' whereby data, including personal data from its citizens, is acquired by companies abroad in order to do kinds of data analysis that is not legal in their own jurisdiction. As a result, there are concerns that developing countries become suppliers of data – a key AI input – without benefitting from the economic and societal benefits that such artificial intelligence may yield, and putting their own citizens at risk[72]. This phenomenon has been described as 'data colonialism'[73].

The free flow of data may thus not necessarily present benefits for countries that are net exporters of data[74]. As a result, some jurisdictions have initiated policies aimed at stopping (personal) data exports. For example, India has discussed a number of policies that would have had the effect of requiring that certain types of data must be stored in servers that are located on Indian territory[75]. Currently, such rules have been applied to payment data[76]. This reflects growing concerns that participating in international trade may present insufficient benefits for these jurisdictions as to date, '[o]wing to a concentration of digital technologies in developed countries and the skills-based nature of digitalization, the main beneficiaries of the digital economy are currently the most developed countries and a few countries in Asia'[77].

10 The Desirability and Necessity of Global Rulemaking

The above overview of trade provisions applicable to artificial intelligence has highlighted that, on the one hand, **various jurisdictions have in recent times adopted national measures hindering trade in data, algorithms and computing power**, while, on the other, **trade law has also been slow to adapt to the digital turn**. Indeed, it has been suggested that '[t]he brusque pace of technological progress in the digital economy has unfortunately not been matched by policy at the global level that could regulate its development in an effective manner and foreshadow potential negative impacts'[78].

[70] Developing countries are classified self-declare as such in the WTO system.

[71] See further Renata Ávila Pinto, 'Digital Sovereignty or Digital Colonialism?' (2018) 15 Sur International Journal on Human Rights.

72 See further https://twailr.com/digital-colonialism-and-the-world-trade-organization/; https://stanfordpress.typepad.com/blog/2020/07/the-nuances-of-data-colonialism.html.

[73] https://theconversation.com/digital-colonialism-why-some-countries-want-to-take-control-of-their-peoples-data-from-big-tech-123048

[74] Susan Aaronson, 'How AI is prodding governments to rethink trade in data' Center for International Governance Information (2018).

[75] Arindrajit Basu et al, 'The Localisation Gamit. Unpacking Policy Measures for Sovereign Control of Data in India' (2019) The Centre for Internet & Society, https://cis-india.org/internet-governance/resources/the-localisation-gambit.pdf.

[76] See further https://m.rbi.org.in/Scripts/FAQView.aspx?Id=130

[77] United Nations Economic Commission for Africa, Office of the High Commissioner for Human Rights and Friedrich-Ebert-Stiftung 'Digital Trade in Africa. Implications for Inclusion and Human Rights' https://library.fes.de/pdf-files/bueros/genf/15602.pdf, page xv.

[78] Padmashree Gehl Sampath, 'Regulating the Digital Economy: Are We Moving Towards a "Win-Win" or a "Lose-Lose"?' (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3107688, 2.

These developments beg the question of the opportunity of global rulemaking in light of the increasing importance of transnational flows of personal and non-personal data as well as data mining techniques such as AI. Recent free trade agreements such as in particular CETA and the CPTPP are first efforts in this direction as they directly address some national barriers to trade that were erected in the past such as data localisation and source code disclosure requirements. There would be advantages and disadvantages to such a strategy.

Global rule-making efforts regarding international trade in artificial intelligence would present numerous **advantages**:

The EU is the world's biggest exporter of services and it could leverage that position to ensure that new trade rules not only **secure market access for digital goods and services but also ensure that trade rules have real benefits for consumers and ensure respect for fundamental rights**[79]. Indeed, the European Parliament has previously called on the European Commission to ensure that any trade framework secures respect for the EU's data protection and privacy standards[80].

Globally harmonized rules would also **remove frictions from international trade**. Now, much is dealt with through free trade agreements that incorporate numerous WTO-plus commitments and clarify issues that WTO members could not agree on (such as duty exemptions for electronic transmissions) and WTO-extra topics (i.e. issues not covered by WTO law) such as data protection and privacy, consumer protection and safeguards on the free flow of data[81]. Whereas FTAs can enable faster agreement between fewer parties and thus also more flexibility, they also generate 'a patchwork of multiple and overlapping agreements' that exacerbate the world's 'asymmetric wealth distribution and rule fragmentation' and do not contribute to the free flow of data on a global scale[82].

There are, however, also **reasons to be cautious** about global rule-making regarding artificial intelligence at this moment in time, and this for a number of reasons:

International negotiations should be **aligned with EU rule making on artificial intelligence**[83]. Whereas the EU has famously legislated in respect of the protection of personal data, it is still defining its approach to many other elements of the data-driven economy, including artificial intelligence. Given that the Union and its member states 'have not yet exercised their right to regulate responsible artificial intelligence' they should 'guard sufficient space to manoeuvre under international trade law'[84]. As a result, important that EU trade policy 'should not rule out domestic measures that in the public interest mandate source code transparency, accountability and auditability of artificial intelligence systems'[85].

Above, it was observed that the TPP provides that no party shall make the transfer of, or access to source code a precondition for the import, distribution, sale or use of the related software or products containing the software in its territory[86]. The adoption of a similar provision in an agreement that would also be binding upon the EU risks hampering current EU efforts to make regulate artificial intelligence, such as regarding its **transparency**. For example, the EU High Level Expert Group on Artificial Intelligence

[79] Motion for a European Parliament Resolution, 'Towards a Digital Trade Strategy' 2017/2065 (INI) https://www.europarl.europa.eu/doceo/document/A-8-2017-0384_EN.html#title1
[80] Ibid.
[81] See also Mira Burri, Understanding and Shaping Trade Rules for the Digital Era, in Manfred Elsig et al, Future Scenarios for Global Trade Regulation (Cambridge University Press 2019).
[82] Ibid.
[83] Kristina Irion and Josephine Williams, 'Prospective Policy Study on Artificial Intelligence and EU Trade Policy (2019) https://www.ivir.nl/publicaties/download/ivir_artificial-intelligence-and-eu-trade-policy.pdf, 3.
[84] Ibid.
[85] Ibid, 4.
[86] Article 14.17.1 TPP.

also devises transparency as one of the requirements artificial intelligence should meet[87]. Whereas many agree on the need for some degree of transparency in some circumstances, there is still no consensus on the best legal and technical avenues of realising that objective[88]. Iiron has warned that international trade rules should not pre-empt EU law in restricting the Union's mechanisms of achieving responsible AI.

It has furthermore been highlighted that there is still **insufficient empirical evidence** on how trade rules operate in the data economy, both in terms of the rules' content but also their practical impact[89]. Implications of artificial intelligence for trade law remain understudied and explored, and the effect of these rules on artificial intelligence remains equally uncertain.

Others have warned that the **liberalisation of digital trade may exacerbate existing policy problems related to the digital economy**. Irion and Williams has been suggested that the technology-mediated economy 'is imperfect and riddled with information asymmetries, data monopolies, algorithmic intransparencies and the 'winner-takes-all' effects that accompany these changes. These effects are continuously being aggravated by one-sided rules that liberalize digital trade without consideration of the social, developmental and personal (privacy) implications of the digital economy'[90]. It has also been cautioned that free flow of data commitments under trade law would mean that the EU could not prevent the 'the **transfer of entire libraries of public sector and scientific data to third country actors**, unless such measures could be justified under one of the exceptions in trade law'[91]. Indeed, various EU initiatives, such under the PSI Directive, mandate that public sector data, which is produced at public cost, be made available to business, in that case also outside the EU, at no cost[92].

Should the EU initiate international rule-making efforts regarding trade in AI, this approach should be cautious and well-informed. For example, it has been warned that it is critical for new rules to allow to maintain EU standards on **fundamental rights** protection[93]. It must in any event be noted that given the globally diverging approaches to trade in AI (liberalization efforts on the one hand and legal restrictions on the other) it will be **difficult to gather consensus on any suggestion**. A way forward, it has been argued, could be a **data differentiated normative framework** under which 'ensuring market access for some types of data, while retaining greater regulatory autonomy for other types of data', which may be easier to gather consensus around compared to more broad-brush solutions, considering that countries are divided between those favoring and those opposing data localization requirements[94].

Finally, attention should also be paid to the fact that the technological environment around AI is currently subject to continuing technological advances and changes. Crafting a legal framework on the basis of assumptions based on the current status quo runs the **risk of soon being outdated**. To provide but one example, it is currently conventionally assumed that data needs to be moved to an algorithm in

[87] https://ec.europa.eu/futurium/en/ai-alliance-consultation/guidelines#Top

[88] Kristina Irion and Josephine Williams, 'Prospective Policy Study on Artificial Intelligence and EU Trade Policy (2019) https://www.ivir.nl/publicaties/download/ivir_artificial-intelligence-and-eu-trade-policy.pdf, 3.Note also Article 22 GDPR.

[89] Mira Burri, 'The Governance of Data and Data Flows in Trade Agreements: The Pitfalls of Legal Adaptation' (2017) 51 UC Davis Law Review, 65, 131.

[90] Padmashree Gehl Sampath, 'Regulating the Digital Economy: Dilemmas, Trade Offs and Potential Options, South Centre Research Paper 93 (March 2019), 14.

[91] Kristina Irion and Josephine Williams, 'Prospective Policy Study on Artificial Intelligence and EU Trade Policy (2019) https://www.ivir.nl/publicaties/download/ivir_artificial-intelligence-and-eu-trade-policy.pdf, 31.

[92] See further Rosie Collington, 'Digital Public Assets: Rethinking Value and Ownership of Public Sector Data in the Platform Age' (1 November 2019) https://www.common-wealth.co.uk/reports/digital-public-assets-rethinking-value-access-and-control-of-public-sector-data-in-the-platform-age.

[93] Kristina Irion, ' Panta Rhei: A European Perspective on Ensuring a High-Level of Protection of Digital Rights in a World in Which Everything Flows', in Mira Burri (ed.) Big Data and Global Trade Law (Cambridge University Press, forthcoming).

[94] Nivedita Sen, 'Understanding the Role of WTO in International Data Flows: Taking the Liberalization or the Regulatory Autonomy Path?' (2018) 21 Journal of International Economic Law https://academic.oup.com/jiel/article/21/2/323/5004397#117982790.

order to generate innovations in artificial intelligence and its deployment. However, as these discussions are underway, there is on-going innovation on the technical side as a consequence of which data may in fact no longer need to be moved to the algorithm, rather the opposite can also be done such as through federated learning[95].

[95] For an example, see Micah Sheller et al, 'Federated Learning in Medicine: Facilitating Multi-Institutional Collaborations Without Sharing Patient Data' Sci Rep 10, 12598 (2020).

PE 603.517
EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05

Print ISBN: 978-92-846-7435-0 doi: 10.2861/137398 QA-03-20-738-EN-C
PDF ISBN: 978-92-846-7436-7 doi: 10.2861/50490 QA-03-20-738-EN-N

IN-DEPTH ANALYSIS

Requested by the INTA committee

European Parliament

Geopolitical Aspects of Digital Trade

Policy Department for External Relations
Directorate General for External Policies of the Union
PE 653.616 - November 2020

EN

DIRECTORATE-GENERAL FOR EXTERNAL POLICIES
POLICY DEPARTMENT

European Parliament

IN-DEPTH ANALYSIS

Geopolitical Aspects of Digital Trade

ABSTRACT

This in-depth analysis discusses issues in trade in digitally deliverable services and the geopolitics of digital trade policy. Digitally deliverable services are becoming increasingly important for global value chains, both in terms of final products exported to other countries, and in terms of inputs embedded in manufactured goods. To harness the potential of digital trade in services, both the regulation of the digital means by which a service is traded and the regulation of the services themselves have to be accommodative. Digital trade policy is still in its infancy, and many challenges in terms of policy and measurement remain. Looking at regulation of data flows, the EU's focus on privacy policy is incompatible with the *laissez-faire* approach pursued by the US administration and the political control of the internet by the Chinese government, limiting the potential for trade in digitally deliverable services and plurilateral agreements on digital trade. However, a number of other major economies are following similar approaches to the EU, which creates the potential for cooperation and intensifying trade in digital services. The EU should also increase its competitiveness in this strategically important services sector by completing the single market with respect to services and capital, and by strengthening research and development in digital technologies.

EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05
November 2020 - PE 653.616

EN

This paper was requested by the European Parliament's Committee on International Trade.

English-language manuscript was completed on 11 November 2020.

Printed in Belgium.

Authors: Niclas Frederic POITIERS, Research Fellow, Bruegel, Belgium; Dennis GÖRLICH, Head of Global Challenges Center, Kiel Institute for the World Economy, Germany

Officials Responsible: Mario DAMEN, Wolfgang IGLER

Editorial Assistant: Balázs REISS

Feedback of all kind is welcome. Please write to: wolfgang.igler@europarl.europa.eu.

To obtain copies, please send a request to: poldep-expo@europarl.europa.eu

This paper will be published on the European Parliament's online database, 'Think tank'.

ISBN: 978-92-846-7439-8 (pdf)

doi: 10.2861/98661 (pdf)

Catalogue number: QA-02-20-909-EN-N

ISBN: 978-92-846-7440-4 (paper)

doi: 10.2861/318312 (paper)

Catalogue number: QA-02-20-909-EN-C (paper)

Table of contents

1 Introduction[1]

The COVID-19 epidemic has led to a rapid increase in the adoption of digital tools and services. Video calls have replaced physical meetings and conferences, teleworking has replaced commutes to the office. In the services sector in particular, digital technologies have been adopted rapidly to manage pandemic-induced lockdowns and social distancing requirements. Jobs that previously required physical presence in an office are now often performed remotely. This shows the potential for international trade in services through digital delivery. As the physical location of white-collar workers becomes less important, the potential gains from trading services internationally increases. This could allow businesses and consumers to buy services from the best providers in the world at the cheapest price. This has the potential to increase the variety of services available to consumers, and the incorporation of foreign service providers into European value chains could increase their global competitiveness. However, as we explore in this paper, the rules governing digital trade internationally are still in their infancy, and major geopolitical challenges arise, especially from the flow of personal data between different territories and jurisdictions.

Trade in goods has dropped sharply during the pandemic, but indicators point to a relatively quick rebound[2]. While goods are not a disease vector, international travellers are. International travel has collapsed: in August 2020 the number of commercial flights was down by 28.6 % compared to 2019, a recovery from its initial decline of 75 %[3]. Actual numbers of international passengers are likely to be even lower than the total number of flights would indicate, as travel bans are still in place all over the world. Unlike the goods trade, international travel might not rebound until a vaccine is readily available. While travel, tourism, cultural and recreation services have contracted rapidly, digitally delivered services have grown – through videoconferencing and media streaming, for example. This is also the case for digitally-enabled trade (e-commerce), with the retail sector seeing a steep decline during lockdowns and e-commerce and delivery seeing strong increases.

However, for the potential digital trade gains to be realised, the regulation of data flows and the regulation of the services that are traded digitally have to be compatible. As the largest economies have developed different approaches in particular to the treatment of personal data, there is incompatibility and the potential for conflict. This in-depth report discusses the geopolitical implications for the EU of digital trade and digital trade policies. We provide an overview of digital trade in services and digital policies. We focus on digital services as we believe that the role played by data in the services trade is essential for understanding the geopolitics of digital trade. We first provide some key figures on the state of the digital services trade and how it has developed within global value chains, focusing on the EU's main trading partners. Then, we discuss the philosophies and digital strategies of important trading partners, and conclude with a geopolitical assessment of the future of digital trade.

2 What is digital trade?

There is no consensus on the exact definition of digital trade in the literature (see for example Aaronson, 2019), but the key difference compared to traditional trade in goods and services is the prominence of cross-border data flows (Aaronson and LeBlond, 2018). Generally, trade is considered to be digital if parts of the transaction are conducted through digital means. Services and goods can both be traded through

[1] We would like to thank Monika Grzegorczyk, Lionel Jeanrenaud and Raffaella Meninno for their excellent research assistance. We also are grateful for the comments and feedback received by Holger Görg, Jean Pisani-Ferry and Guntram Wolff and for advice from Colin Bradford, J. Scott Marcus and Daniela Stockmann.

[2] According to the World Trade Organisation, we are on path to its *'optimistic'* scenario for 2020 with a decline in trade of 13 %; see WTO press release from 23 June 2020 (PRESS/858): https://www.wto.org/english/news_e/pres20_e/pr858_e.pdf.

[3] Source: flightradar24; https://www.flightradar24.com/blog/commercial-flight-growth-slows-in-august/.

'digital' transactions[4]. Services can be delivered digitally and goods can be ordered online and paid for via digital means[5]. The treatment of 'information' as data or as intellectual property is central to the debate on digital trade. Traditional trade consists of the provision of physical goods against a payment. For services in particular (but also digitally enhanced goods such as internet of things components), data is now an important part of the transaction. On a number of major digital platforms, consumers do not pay directly *in specie*[6]. Service providers rely instead on consumers surrendering private data that is used to sell targeted advertisements to other businesses. Data and data analytics are also behind many new and transformed services. The internet of things has led to the embedment of software in an increasing range of products, which are often sold with a service component attached to them, of which the ongoing exchange of data with the producer is a major part[7].

Data is a very peculiar economic input. It is similar to a public good in the sense that it is not consumed when being used (in economic parlance 'non-rival in consumption'), while it is similar to a resource in that one can control access to it (it is 'excludable'). The economic value of data for a company depends on the company's ability to control access to the data. The disembodied nature of data and digital services also implies that they can be easily copied and moved across borders. This frictionless mobility is the source of the great economic potential of trade in digital services, but also poses challenges for its regulation. Regulatory and tax arbitrage are a concern when companies can easily move their operations between jurisdictions. Easy movement of data also poses challenges in enforcing consumer rights. As a result, a number of laws with extraterritorial scope have been passed, such as the European Union's General Data Protection Regulation (GDPR) and the US CLOUD Act.

We discuss in this in depth analysis the regulatory and geopolitical challenges to EU trade policy from cross-border data flows. These challenges (and opportunities) are much less important for goods ordered by digital means (e-commerce) than for services that are themselves delivered digitally. Therefore, we focus in our analysis on digitally deliverable services. Services trade is regulated by the General Agreement on Trade in Services (GATS), which distinguishes between four modes of services trade:

- Mode 1: services supplied from one country to another (e.g. video conferences);
- Mode 2: consumers or firms making use of a service in another country (e.g. tourism);
- Mode 3: a foreign company setting up a subsidiary or branch to supply a service in another country (e.g. a bank with a foreign branch);
- Mode 4: individuals travelling from their own country to supply services in another country (e.g. consultants working with clients abroad).

Not all services can be traded digitally. For our economic analysis on digital trade in services, we employ the classification of UNCTAD (2015) to determine the services that *potentially* can be delivered digitally[8]. The classification covers:

- Insurance and pension services;
- Financial services;

[4] According to Lopez Gonzalez and Jouanjean (2017), the common understanding emerges that digital trade 'encompasses digitally-enabled transactions in trade in goods and services which can be either digitally or physically delivered and which involve consumers, firms and governments' (p. 4).
[5] It is still debated if digital goods such as digital media should be treated as goods or services.
[6] This also complicates the measurement of digital trade; see Lopez Gonzalez and Jouanjean (2017).
[7] Developments around the internet of things also raise a number of regulatory and security issues that must be addressed at international level (see Twomey, 2018).
8 See website accompanying the database for international trade in digitally-deliverable services: https://unctadstat.unctad.org/wds/TableViewer/summary.aspx?ReportId=158358

- Charges for the use of intellectual property;
- Telecommunications, computer and information services;
- Other business services; and
- Audio-visual and related services.

These service types are disaggregated in the Extended Balance of Payments Services classification (EBOPS) adopted by the UN Statistical Commission in 2010. We use this classification of digitally deliverable services throughout this report and we also make use of an approximation of *sectors* that produce digitally-deliverable services, based on Wettstein *et al* (2019).

We consider digital trade to describe the *mode of delivery* of a service (see also Lopez Gonzalez and Jouanjean, 2017). For example, consulting services can be delivered physically or digitally. Therefore, they are *potentially* digitally deliverable. Note that the service as such (consulting) does not change, but the mode of delivery is different (GATS mode 4 vs. mode 1). In one mode, data crosses borders but does not necessarily in the other. Digitalisation has also enabled the creation of new services based directly on data and the movement of data across borders, such as social media platforms or cloud services.

The potential created by new technologies in terms of trading services digitally is constrained by regulation. Digital technologies have created the technical ability to trade such services directly across borders (mode 1) without the need to create a physical presence (mode 3), or for the service provider to travel the country where the service is provided (mode 4). However, this potential is limited by regulatory hurdles in terms of both the digital delivery of the services and restrictions on the trade in services itself. For example, a professional who wants to market their services in a foreign country might be prevented from doing so by laws requiring them to store the data of his customers in the customers' country of residence. He might also be prevented from doing so by laws requiring him to be resident in the country his customers live in, or by country-specific certifications and licenses. This example highlights the need for both the regulation of data flows and the regulation of services itself to be compatible, if the potential of trade in digital services is to be fulfilled.

The problem of how to regulate digital trade in goods and services could be resolved via multilateral or plurilateral agreements. The World Trade Organisation agenda on digital trade dates back to 1998, when the *Work programme on electronic commerce* was adopted. However, *'policymakers are just beginning to figure out how and where to regulate cross-border data flows'* (Aaronson and LeBlond, 2018, p.250). Fundamental questions on the nature of 'electronic transmission' are still unresolved. Are digital 'items' such as software, digital movies or e-books, to be treated as goods (subject to GATT and potentially to tariffs) or services (and thus subject to GATS and service regulation)? In this debate, the United States' position is that electronic transmissions are to be treated as intangible goods, while the EU wants them to be treated as services[9]. A moratorium on tariffs on 'electronic transmissions' was introduced in 1998. However, this moratorium is under pressure from countries that lose out on tariff revenues[10].

3 Digital services in global value chains

When thinking about trade and global value chains, container ships, cranes, assembly factories and warehouses come to mind. However, the face of trade has changed fundamentally over the last few decades. Trade in services is growing more strongly than trade in goods, digitally-deliverable services are on the rise, and, as services are also embodied in manufactures, digital services are also crossing borders

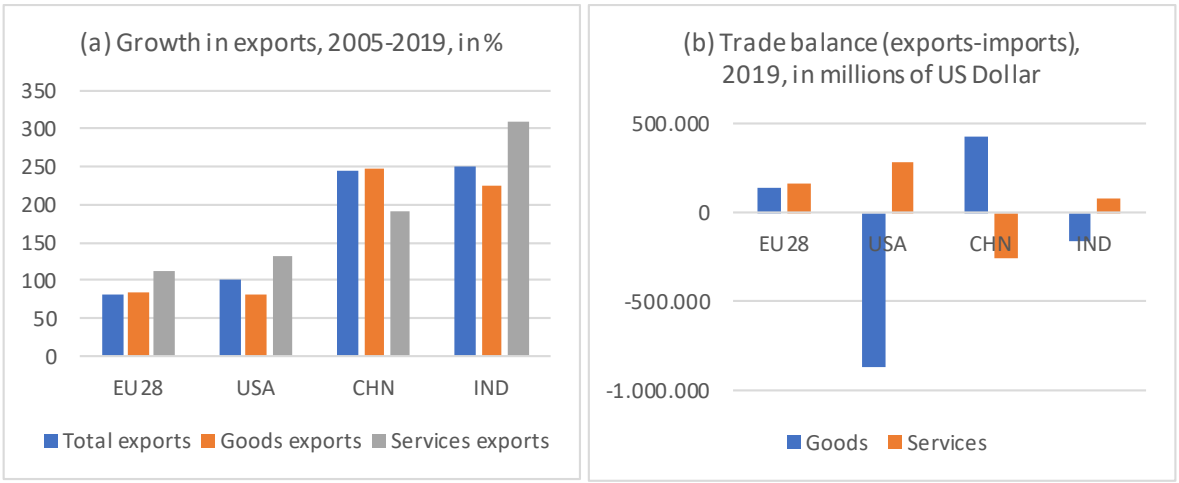
[9] See WTO documents WT/GC/W/497 & WT/GC/W/556. For a discussion, see Banga (2019, page 25-27).
[10] This moratorium has been extended biannually. However last time it was extended only until the WTO ministerial in June 2020 (MC12), which was postponed due to the coronavirus pandemic. See WTO document WT/L/1079.

as part of the regular goods trade. This section focuses on the EU, and on the United States, China and India, as the EU's major trading partners and countries of strategic interest. Generally, international trade has increased strongly during recent decades, even though growth has levelled off in the last few years. Much of this growth in trade has been generated by the proliferation of global value chains (GVCs). As they pass along these, goods and services cross borders several times before the final product is consumed or exported. Digital trade has played a role in the proliferation of GVCs by enabling and simplifying exchanges, payments and controls between partners in a value chain.

The measurement of digital trade poses considerable challenges. Since digitally delivered services never pass by a customs agent, and since crucial intangible capital (intellectual property) is easily transferred between jurisdictions, it is difficult to gauge the 'real' local value added embedded in trade in digital services. Tax optimisation schemes that channel profits through jurisdictions like Ireland distort the real flow of trade in services to some extent (Setser, 2020; Lane, 2020).

Figure 1 (a) shows that between 2005 and 2019, the value of services exports from the EU-28, the US and India grew faster than goods exports. Note that as our data cover the pre-Brexit time, the data on EU include the UK. In China, services exports grew somewhat less than goods exports, but still at a high rate. In 2019, services exports accounted for approximately 33 % of the value of all exports from the EU-28 and the US (up from 29 % in 2005). In China, services accounted for 8 % of exports, and in India they accounted for almost 40 % of exports. The trade balance position of the four economies is shown in Figure 1 (b). The United States and India are net importers of goods, but net exporters of services. The opposite is true for China, which is a net exporter of goods and a net importer of services. Only the European Union is a net exporter of both goods and services.

Figure 1: OECD Statistics on International Trade in Services



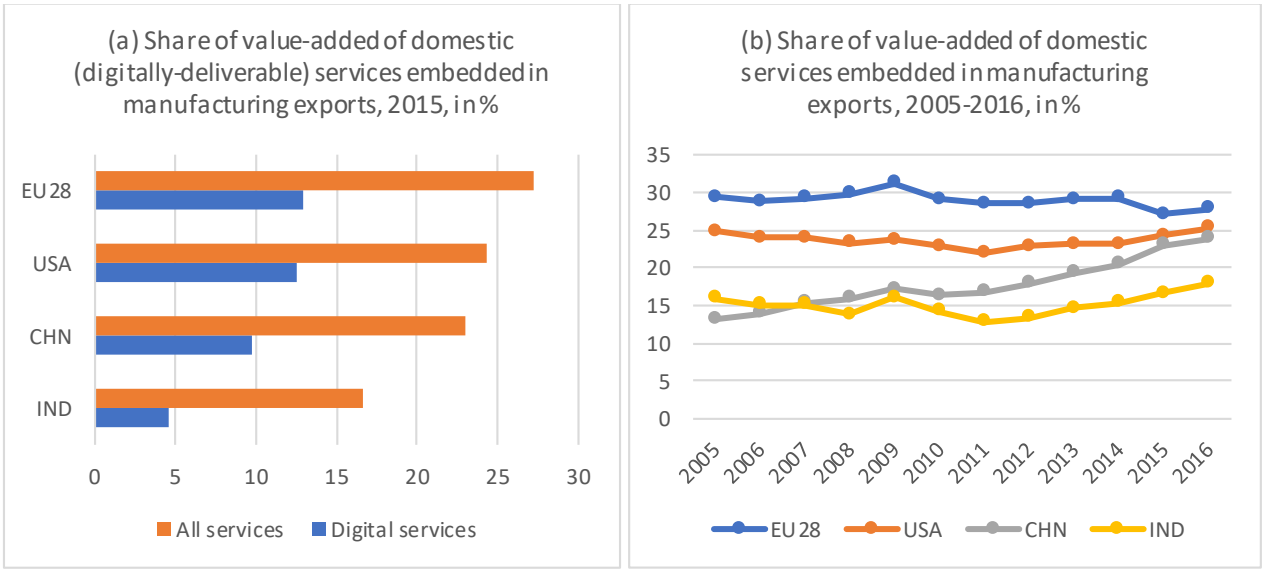
Source: OECD, Balance of Payments.

Despite the faster growth of the services trade, manufacturing trade is still much larger in terms of scale. Yet services are also an essential element in manufactured goods GVCs, starting with R&D, consulting and market analyses in the upstream sections of GVCs, and ending with customer service and repair services in the downstream sections. For many manufactured goods the embodied services are central to product differentiation. Cernat and Sousa (2015) estimated that manufacturing is responsible for around 60 % of all EU jobs that are linked to exports. However, 40 % of the jobs that are supported by manufacturing exports are in fact service-sector jobs.

Figure 2 (a) compares the value added of domestic services embedded in manufacturing exports in the EU-28 and its partners. The EU's domestic value-added share of services is larger than in all other the economies, amounting to roughly 27 %, and about half of the embedded services can be characterised as

digitally-deliverable services. Figure 2 (b) shows that, in Europe, the share has been roughly constant, while it has increased significantly in China. This indicates substantial value-chain upgrading in China in the past decade.

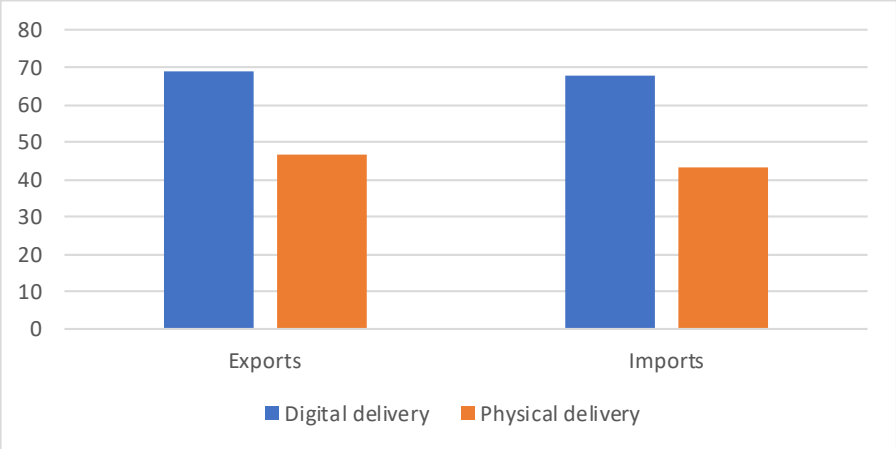
Figure 2: Value added of services embedded in manufacturing exports



Source: OECD (2020) – Trade in Value Added, Principal indicators & origin of value added in gross exports; own calculations; classification of digitally-deliverable services based on UNCTAD (2015) and Wettstein et al. (2019).

However, pure service GVCs are also increasingly spreading across countries. Examples include outsourcing to foreign countries by consulting agencies, or social media platforms or cloud services launched in many countries around the world. These developments are reflected in services trade growth rates. In Figure 3, we compare the growth rates of exports of potentially digitally deliverable services and physically deliverable services in the pre-Brexit EU. In the EU, trade in digitally-deliverable services increased more rapidly between 2010 and 2018 than trade in services that can only be delivered physically. This indicates a structural shift in the services industry. In terms of the GATS modes of services, we suspect that we observe a relative increase in mode 1 trade (which is the major mode of delivery of digital services) relative to the other modes, even though this interpretation cannot be validated with the available data[11].

Figure 3: Growth in services trade by delivery type in the EU28, 2010-2018, in %

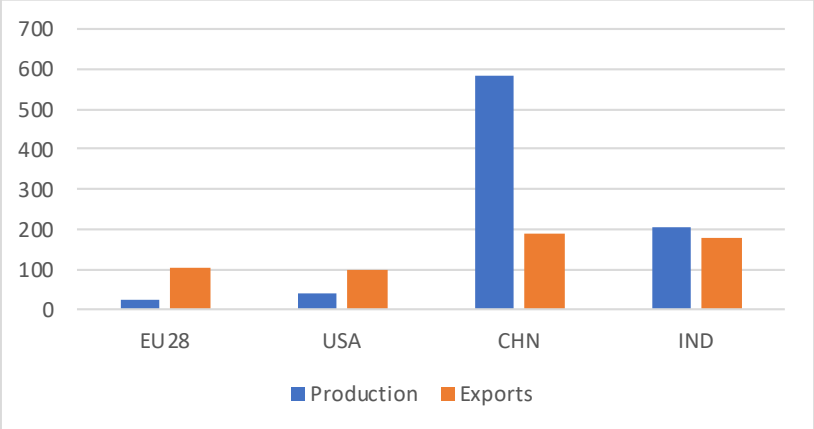


[11] For some statistics on trade in service by mode and a discussion on the difficulties in data availability see Cernat *et al* (2016).

Source: OECD (2019b) - Trade in services - EBOPS 2010, trade in services by partner economy; classification of digitally-deliverable services based on UNCTAD (2015).

Taking a closer look at digitally deliverable services in our four economies of analysis, Figure 4 shows the growth in production and exports of digitally-deliverable services between 2005 and 2015. It becomes clear that production increased most in China, but those services were mostly used domestically. Chinese exports of these services grew at a much slower rate. However, exports of digital services from the US and the European Union increased at a much faster rate than production.

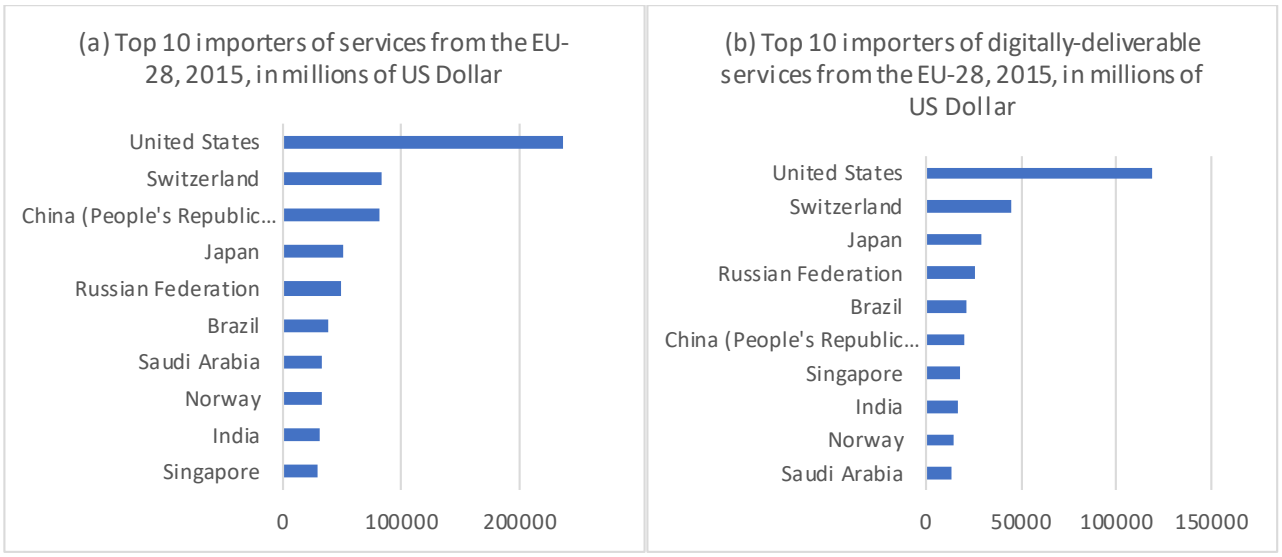
Figure 4: Growth in production and exports of digitally-deliverable services, 2005-2015, in %



Source: OECD (2020) – Trade in Value Added, principal indicators; classification of digitally-deliverable services based on UNCTAD (2015).

Most of the services exports from the EU-28 go to the United States, followed by Switzerland and China (see Figure 5 (a), which lists the top 10 importers of European services). The same holds for exports of digitally deliverable services (Figure 5 (b)), except that China is much less important as a destination for European digital services than it is for European services in general. This gives a first hint at market access restrictions in China, which will be discussed in more detail below. Overall, the world market share of services from the EU was 24 % in 2015. The United States had a market share of 21 %, China had 4.6 %, and India had 3.8 %.

Figure 5: Top importers of service from the EU-28

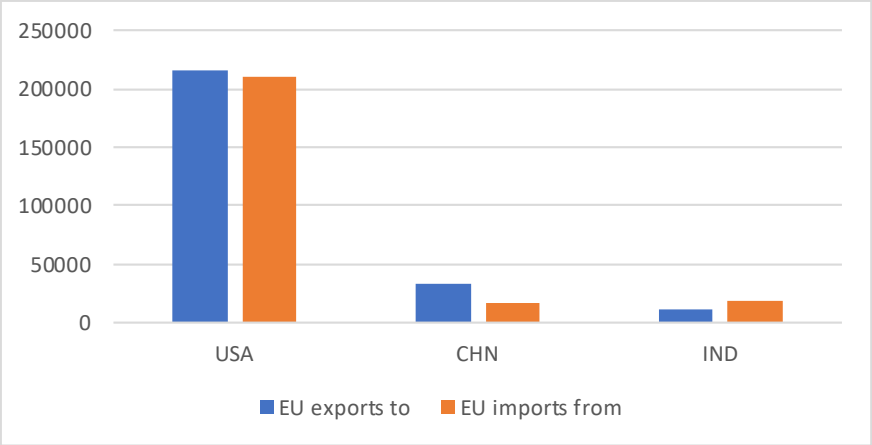


Source: OECD (2020) – Trade in Value Added, Origin of value added in gross imports

Figure 6 shows bilateral trade in digital services between the EU-28 with its partners. The Figure shows exports from the European Union to partners, as well as imports from partners. It is striking that bilateral

trade with the US in digital services is almost balanced: the EU exports as many digitally-deliverable services to the US as it imports [12]. Moreover, the EU is a net importer of digital services from India.

Figure 6: Bilateral trade with digitally-deliverable services of the EU-28 with major trading partners, 2018, in millions of US Dollars



Source: OECD (2019b) - Trade in services - EBOPS 2010, trade in services by partner economy; classification of digitally-deliverable services based on UNCTAD (2015).

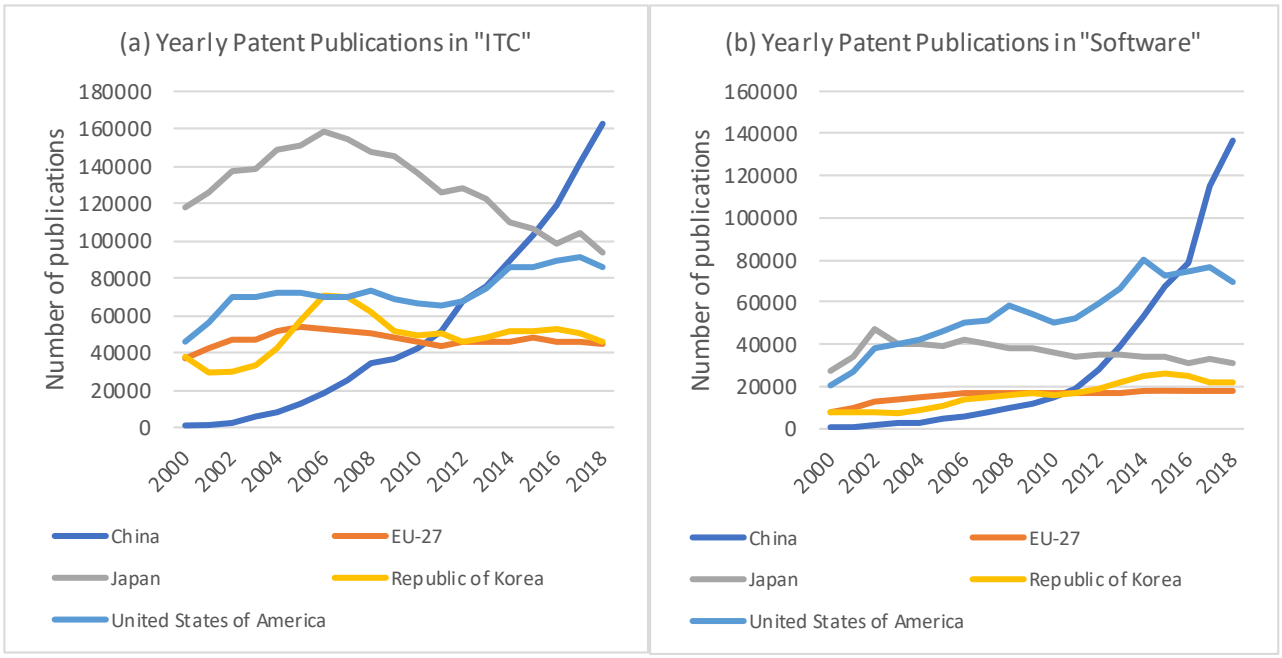
The digital realm is often seen as being dominated by the United States: The digital giants (like the GAFA – Google, Apple, Facebook and Amazon) are predominately American. Of the 10 largest public companies by market capitalisation, seven are 'digital' companies based in the US or China [13]. Judging from patent counts in information and communication technologies and software (Figure 7), it is apparent that Europe lags the US and East Asian economies. While in 2018, 155 211 patents in these two categories were filed in the US, and 299 310 were filed in China, in the EU is was a mere 62 473 [14].

[12] It should be noted that the output of large digital platforms such as Google may not appear in this statistic. Notably, tax optimisation schemes that channel profits through tax havens such as Ireland distort the real flow of trade in services. See Setser (2020) and Lane (2020).

[13] Source: *Forbes*, 'The World's Largest Public Companies'. Digital companies are Microsoft, Apple, Amazon, Alphabet (Google), Alibaba and Tencent Holdings. The only company in the top 10 that is not from the US or China is Saudi Aramco. Ranking retrieved on 12 September 2020. See https://www.forbes.com/global2000/list/#header:marketValue_sortreverse:true.

[14] However, these are just patent counts regardless of quality. In the section 5.4 on artificial intelligence, we see that in terms of high quality patents, the US is far ahead, while in terms of high quality publications in scientific journals, the EU is on par with China.

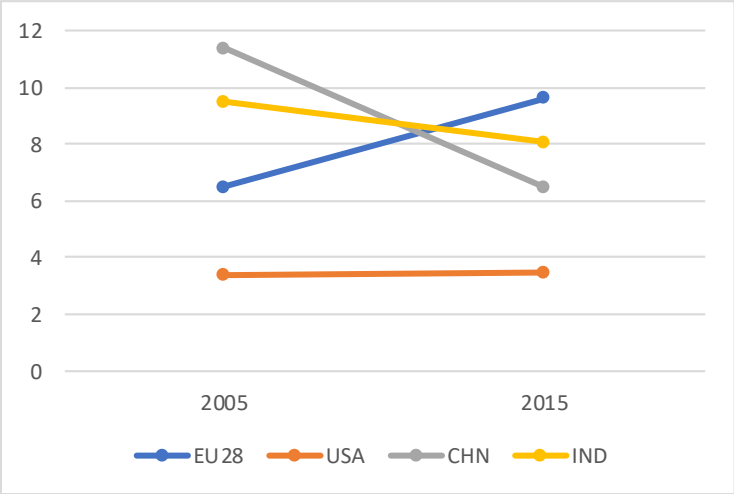
Figure 7: Yearly patent publications in ITC goods and software



Source: World Intellectual Property Organisation. 'ITC' includes the patent categories 'Audio-visual technology' 'Telecommunications', 'Digital communication', 'Basic communication processes', 'Semiconductors' and 'Optics'. 'Software' is comprised of the patent categories 'IT methods for management' and 'Computer Technology'.

The share of foreign value added in exports of digitally-deliverable services increased only in the European Union, whereas it stayed constant in the US and decreased in China and India (see Figure 8). In other words, European exports of digital services contain an increasing amount of foreign input. Europe thus relies more than other economies on digital services sourced from abroad. This is a positive development in that it could signal better integration of Europe into GVCs, with benefits from specialisation. As Rückert *et al* (2019) showed, compared to the US, European companies are indeed not lagging behind in adoption of (foreign) digital technologies.

Figure 8: Share of foreign value added in exports of digitally-deliverable services, 2005 and 2015, in %



Source: OECD (2020) – Trade in Value Added, Principal indicators; own calculations; classification of digitally-deliverable services based on UNCTAD (2015) and Wettstein et al. (2019).

However, because many digital services are characterised as winner-takes-all markets, there is a risk of Europe losing out in this sector. Digital services can be created at almost zero marginal cost and their production can deliver large returns to scale. Together with network effects (a social network is only valuable to a consumer if it is widely used), the large returns to scale present in digital services can lead to

monopolistic power. As a service can easily be scaled up, it is cheap to trade these services across borders if regulation allows. These winner-takes-all tendencies make lack of technological prowess a crucial problem. If a service is only produced by a few companies, every country that has a slight technological disadvantage will lose the entire market.

4 Philosophies and objectives

Before discussing trade policies, we attempt a generalisation of the philosophy and objectives that major economies have with regard to the digital economy. While this generalisation will certainly not reflect the diversity of opinions in the political debate in each economy, we believe it is informative as a model for our discussion. We focus on the US, the EU and China, which are not only the three largest economies but are also representative of three distinct points on the spectrum of digital policy[15]. When we discuss particular trade policy fields in section 5, we expand this discussion to other major EU trading partners.

At one end of the spectrum is the US, which has followed a *laissez-faire* approach and which has objectives in the digital area that are in particular concerned with supporting economic growth and maintaining technological leadership[16]. This implies that policies tend to be more accommodative of the interests of the highly competitive digital sector in the US. Privacy rules written into the e-commerce sections of US trade agreements are lax compared to European standards (we discuss this further in section 5.1). The high value assigned to freedom of speech in the US also informs its stance against regulating online platforms. US law gives social media platforms considerable freedom and legal protection in managing content on their platforms, an approach that has also entered into US trade agreements[17] [18]. The free flow of data and market access for US companies are key objectives of US digital trade policy. Protection of private data is secondary, and the US calls for privacy-related restrictions to be *'proportionate to the risks presented'*[19]. Artificial intelligence is seen as key technology, and therefore investment and research in this area are of strategic importance. The primacy of US technology in digital services is unquestionable. For example, all of the most used operating systems (Android, iOS, Linux, Windows, MacOS) are of American origin.

The EU, while generally supporting the US vision of a free internet with freedom of expression and free flow of data, has prioritised protection of personal rights to a much greater extent. The protection of personal data has the status of a fundamental right[20]. The GDPR has established a gold standard for privacy regulation, establishing data subject rights over their private data. It follows from this position that privacy is excluded from trade negotiations and is dealt with in unilateral adequacy decisions. Freedom of speech is not as absolute a value in the EU as in the US, and personal rights and concerns about hate speech are high on the policy agenda[21]. Similar to privacy protection, there is now a plan to

[15] For a comparison of EU, US, and Chinese digital trade policy see also Hufbauer and Lu (2019).
[16] According to OECD (2017, p. 34), the US is the only country without a national digital strategy and which takes a *'decentralised, market-driven approach to its digital strategy'*.
[17] The platform providers are protected by the First Amendment in 'editorial' decisions over content, while being protected from liability in relation to non-free-speech-related content decisions by Section 230 of the Communications Decency Act, 47 U.S.C. § 230. On side of the users, the First Amendment provides protection against state action restrictions on free speech, but not corporate action. See Brannon (2018).
[18] Both the USMCA (Article 19.17 of the Agreement between the United States of America, the United Mexican States, and Canada) and the 2019 US Japan Trade Agreement (Article 18 of the Agreement between the United States and Japan concerning Digital Trade) contain sections on *'Interactive Computer Services'*, mimicking language from Section 230 of the Communications Decency Act, 47 U.S.C. § 230.
[19] From the proposal by the United States for a WTO Agreement on Digital Trade (April 2019).
[20] Charter of Fundamental Rights of the European Union, Art. 8.
[21] See the French international digital strategy (Le ministère de l'Europe et des Affaires étrangères, 2017).

develop regulation for algorithms ('human centric AI'[22]) and to regulate digital services platforms. While the EU is not very competitive in digital services, digital technologies are seen as a way to maintain competitiveness in particular in manufacturing, and as a way to support SMEs (BMWi, 2020). Industry 4.0, or the usage of digital technologies to improve manufacturing productivity, is seen as an area in which US primacy is not yet established and where Europe can use its manufacturing prowess to develop digital platforms.

Access to information has often been reported as concern when it comes to digital policy in China. The Chinese internet has been separated from the global internet since its inception in 1994, and for Chinese users many Western webpages and digital services are blocked or censored. This is often referred to as the Great Firewall[23]. The Chinese government exerts political control over the information available to its citizens and requires social media companies to censor messaging services and online platforms. Self-censorship by users is enforced through the threat of draconian penalties, including long prison sentences (Freedom House, 2019). However, some political discussions at the local level or in small private groups are tolerated, as long as they are not perceived to be a political threat to the Chinese Communist Party (Stockmann, 2014, chapter 6). The State Security Law of 1993 gives the government access to data collected by private enterprises. However, there are attempts to limit companies' use of private data. Chinese companies have benefited from a large market closed to international competition and have developed a range of services. While initially copying their international siblings, these companies have developed into innovative digital giants in their own right. However, while the closed nature of the Chinese digital services market has effectively protected the industry in its infancy, now in adulthood it is an impediment to international expansion (Ferracane and Lee-Makiyama, 2017).

5 Digital trade policy

In this section, we discuss the policies and strategies that affect digital services and the free flow of data, employed by the different major economies. We first focus on privacy and measures of market openness to digital services, and then briefly on artificial intelligence and digital tariffs and taxation. While this is certainly not comprehensive coverage of digital trade policy topics, we believe that our focus on these particular topics is warranted by their importance for the geopolitical discussion on data flows and digital trade.

5.1 Privacy

As noted in section 4, the three largest economies have very different approaches when it comes to control over data. The EU has declared the protection of privacy a fundamental right and as such it is not negotiable in trade agreements. It does not trade-off privacy against commercial and economic interests. In particular the GDPR, the EU's headline privacy regulation, gives individuals wide-ranging rights over how their private data is gathered, stored and processed. Data portability, consent and the right to erasure are key parts of the legislation. Companies collecting and processing private data must ensure that contracting partners also comply with the same standard. For countries that have similar privacy protections, the European Commission issues adequacy decisions, which allow transfers of data as within the EU. For countries without adequacy decisions, transfers of personal data must be governed by Standard Contractual Clauses, which are contingent on the non-EU contract partner's ability to provide an equivalent level of privacy protection, or a limited number of other mechanisms (Marcus, 2020).

[22] See 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Building Trust in Human Centric Artificial Intelligence'; COM(2019)168.
[23] Strictly speaking the Great Firewall refers to the blocking of foreign webpages, whereas the censorship of Chinese social media is a different matter.

So far, the US has no comparable privacy law at federal level. Internationally, the US has tried to push an alternative arrangement, Cross-Border Privacy Rules (CBPR) system, developed under the umbrella of the Asian-Pacific Economic Cooperation (APEC). This is included as a basis for data transfer in the US-Mexico-Canada (USMCA) agreement and the 2019 US-Japan trade agreement. The CBPR is only a set of principles and as such provides much weaker legal protection than GDPR (Gribakov, 2019a). It is a minimum standard and allows signatory jurisdictions to implement stricter laws. Thus, CBPR compliance does not mean that a company can freely transfer data between CBPR member economies, as stricter laws might still apply. So far, the CBPR has largely failed to live up to its ambitions. Of the 21 APEC members, only eight have signed the CBPR, and just 35 companies have certified at time of writing[24].

However, recently there has been a shift in some US states, with California in particular passing the California Consumer Privacy Act in 2018, which is partly based on the GDPR. While this law is generally weaker than its European equivalent, for the first time there are signification restrictions on companies' usage of data in US[25]. However, the California law could be overruled or replaced by federal legislation. Because of the importance of trade in services between the EU and the US, the European Commission and the US government have twice tried to establish a framework that would allow companies to transfer data to the US under a regime similar to an EU adequacy decision. Under the EU-US Safe Harbor, from 2000, and the Privacy Shield from 2016, US companies could self-certify as compliant and be treated by European companies as safe data controllers and processors. However, both agreements have been invalidated by the EU Court of Justice because of the lack of legal protection for EU citizens' data against US government surveillance[26] [27].

When discussing privacy of personal data in China, it is important to distinguish between consumer privacy in relation to companies and privacy protection against the government. The Chinese government has introduced laws to protect consumer rights against private companies (Sacks, 2018a). However, the Chinese government has access to all data gathered by companies operating in China. It also requires companies that operate within China to store this data locally. The development of social credit scores that combine traditional credit scores with punishments for fraud (and increasingly infractions like traffic violations) has led to fears that this system could be extended to include online behaviour and evolve into a tool for totalitarian control[28].

Other authoritarian governments are trying to replicate the Chinese approach[29]. Russia and Turkey require personal data to be stored locally and limit the usage of encryption[30]. In 2019, Russia passed the Sovereign Internet Law that aims to increase Russian control over the internet and that could be a first step towards a separation of the Russian digital sphere (Epifanova, 2020).

Other emerging markets are closer to the European model. The Indian Supreme Court declared privacy a fundamental right in 2017 (though the implications of this in particular for digital platforms are yet unclear)[31]. In 2019, India introduced privacy legislation inspired by the GDPR and, according to media

[24] See http://cbprs.org/compliance-directory/cbpr-system/.
[25] See Gribakov (2019b) for a discussion on the Californian law and its relationship to the GDPR.
[26] See the judgment in Case C-362/14, Maximillian Schrems v Data Protection Commissioner, and the judgment in Case C-311/18, Data Protection Commissioner v Facebook Ireland and Maximillian Schrems (also referred to as Schrems I and Schrems II).
[27] For a discussion see Marcus (2020).
[28] As of yet this is not the case; see Horsley (2018).
[29] See for instance Meserole and Polyakove (2019).
[30] See USTR (2020, p. 428-429 & p. 488-489).
[31] See https://www.cfr.org/blog/implications-indias-right-privacy-decision.

reports, India is seeking an EU adequacy decision[32]. As a reaction to a military confrontation with China, India has banned 59 Chinese apps, with privacy of Indian citizens as the justification[33].

The GDPR is an example of the 'Brussels effect', i.e. the EU's ability as the largest market in the world to set international standards through precedent. A number of countries have adopted similar laws. The EU has taken adequacy decisions for eight countries: Andorra, Argentina, Canada, Israel, Japan, New Zealand, Switzerland and Uruguay. The European Commission is currently evaluating adequacy decision for South Korea and the UK. The California Consumer Privacy Act, while much weaker than the GDPR, has clearly followed the path forged by the European law. Even China, notorious for government censorship and surveillance, has a privacy standard for the protection of citizens' data against misuse by private companies partly based on the GDPR[34]. The GDPR is applying to EU citizens globally, an example of the extraterritoriality that is sometimes applied to regulate digital services effectively. However, as we will discuss, to protect data, it is not enough to provide protection against privacy infractions by private companies.

5.2 Market openness to digital services

Trade in digital services is restricted by two types of regulation: regulation that impedes digital trade in itself, such as localisation requirements, and regulation that restricts trade in services at sectoral level, such as professional licensing. We look at both using service trade restriction indices from the OECD and the World Bank. We focus on the G20 countries because the EU's most important trading partners for digital services outside of the European Single Market are, with the exception of Singapore, all G20 members (Figure 5)[35].

The OECD aggregates the restrictions that countries impose on digital trade in services in its *Digital Service Trade Restrictiveness Index* (Digital STRI). Based on the laws in different jurisdictions, it assigns each country an index between 0 and 1, with 0 being most open and 1 most restrictive. Figure 9 shows the 2019 values for the Digital STRI for G20 countries.[36] The most significant restriction on digital services trade is 'Infrastructure and connectivity', a category that includes localisation requirements. While the most important trade restrictions are from this category, restrictions on electronic transactions and payment systems are also common.

According to this index, the EU is among the economies most open to digital services trade, with an average value of 0.14. The US, with an index of 0.08, is even more open.

[32] Reported by *The Economic Times* on 30 June 2019; see https://economictimes.indiatimes.com/tech/internet/govt-to-ping-eu-to-align-its-data-law-with-gdpr/articleshow/70442538.cms.

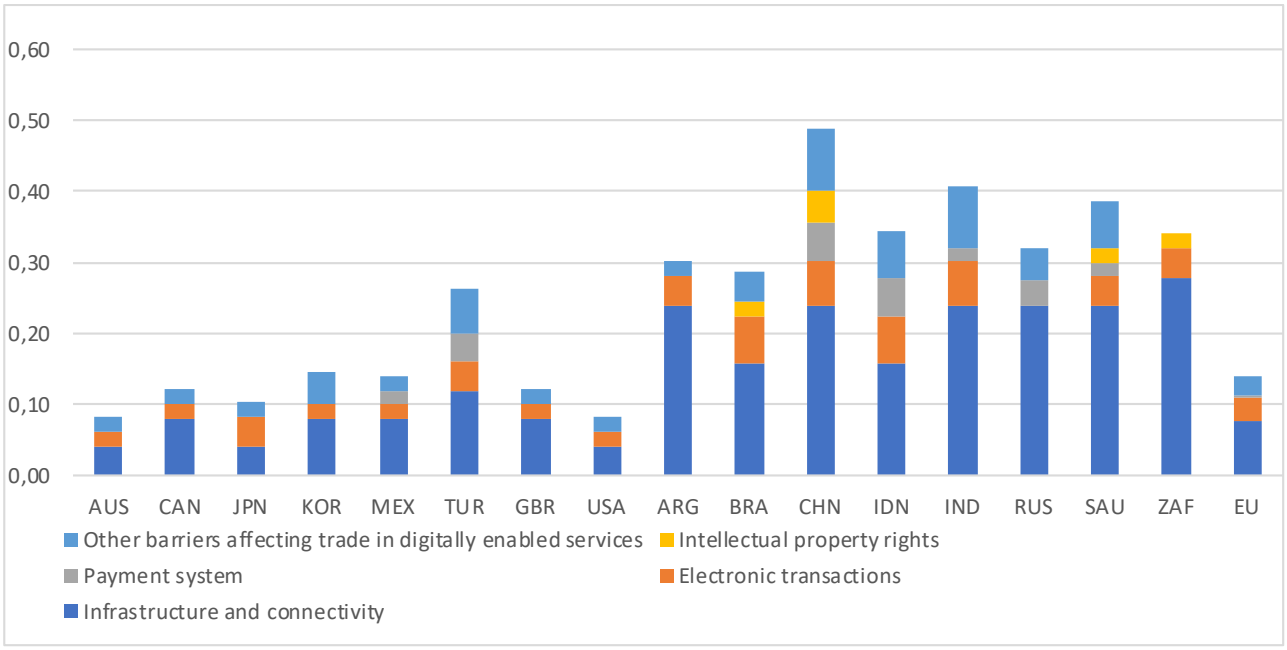
[33] See Ministry of Electronics & IT press release from 29 June 2020 (Release ID: 1635206); https://pib.gov.in/PressReleasePage.aspx?PRID=1635206.

[34] Sacks (2018b) goes as far as to argue that 'China and the European Union are moving forward with establishing data regimes that have more in common with each other than with that of the United States'.

[35] The European single market consists of the EU, Switzerland and the non-EU members of the European Economic Area (Iceland, Liechtenstein and Norway). The UK is for the duration of the Brexit transition period also member of the European single market.

[36] The EU value reflects the simple cross-country average of the 22 EU countries covered in this database.

Figure 9: Digital Services Trade Restriction Index



Source: OECD. Infrastructure and connectivity include most types of data localisation requirements.

China is the most restrictive country, with major barriers in all categories. When comparing the index values from 2019 to when it was first constructed in 2014, Turkey stands out for having become much more restrictive. Russia, Saudi Arabia, Brazil and South Korea have also become significantly more restrictive (though South Korea started from a low level). Mexico stands out for having liberalised the most in this period (see also Ferencz, 2019).

The OECD also provides estimates of the relative similarity of digital services regulation through the Digital STRI Heterogeneity Index. This provides an assessment of bilateral compatibility of regulatory regimes covering digital trade. Table 1 shows the heterogeneity index values for G20 countries relative to the EU, the US and China, with lower values signifying greater correspondence of digital service regulation [37]. While the US is generally more open to services trade, the EU is more compatible with most G20 members on a country-by-country basis. In particular, the EU has lower scores than the US in relation to countries with high levels of privacy protection, including South Korea and Japan. China has generally very high scores (indicating non-similarity) relative to all G20 countries except Saudi Arabia and Indonesia.

Table 1: OECD Service Trade Restrictiveness Heterogeneity Index 2019

	EU	*US*	*China*	*Argentina*	*Australia*	*Brazil*	*Canada*	*India*	*Indonesia*	*Japan*	*Mexico*	*Russia*	*Saudi Arabia*	*South Africa*	*South Korea*	*Turkey*	*UK*
EU		0.25	0.5	0.24	0.06	0.28	0.14	0.3	0.34	0.07	0.14	0.27	0.35	0.2	0.16	0.21	0.07
US	0.25		0.55	0.18	0.20	0.32	0.12	0.42	0.38	0.22	0.22	0.36	0.39	0.3	0.26	0.42	0.24
China	0.50	0.55		0.73	0.51	0.34	0.51	0.37	0.21	0.49	0.41	0.39	0.20	0.52	0.45	0.45	0.55

[37] The EU value reflects the simple cross-country average of the 22 EU countries covered in this database.

COVID-19 has made it necessary where possible to trade services without parties being physically presence. It has also shown the potential of digital technologies for direct trade across borders without commercial presence or indeed the presence of a person (mode 1 of trade in services). However, to harness this potential, the regulatory environment has to be conducive. Table 2 shows the World Bank *Services Trade Restrictions Index* for mode 1 and a number of services industries that have the potential for digital trade. The table displays the values for the EU and G20 countries for 2016[38]. The index evaluates restrictions on trade in services and generates a value between 0 and 100, a higher value indicating more restrictions. Except for reinsurance, financial services are quite closed for mode 1 trade in services in all G20 countries. Retail and professional services have fewer impediments to direct cross-country trade. The EU is generally much more open than China, and also more open than India. The US and Japan are by far the most open economies for these services sectors, with no restrictions on direct trade in professional services. The US also has no restrictions on retail services. South Africa is also very open, while Indonesia is almost completely closed to direct cross-country trade in services. It is important to note here that many of these services are regulated in the EU at the national level, which is also a significant challenge for intra-EU (digital) trade in services.

[38] The EU value reflects the simple cross-country average of the 22 EU countries covered in this database.

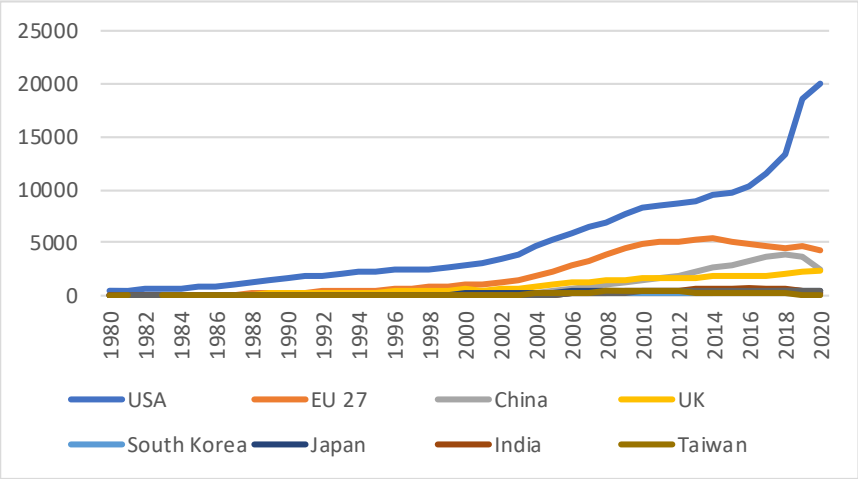
Table 2: World Bank Services Trade Restrictions Index (STRI) 2016 for Mode 1 trade in services

	EU	US	China	Argentina	Australia	Brazil	Canada	India	Indonesia	Japan	South Korea	Mexico	Russian	South Africa	UK
Professional Services															
Legal Services	42	0	26	32	26	100	25	100	100	0	25	26	26	13	32
Accounting Services	36	0	76	100	26	100	25	32	100	0	100	26	26	13	32
Auditing Services	51	0	76	100	26	100	25	32	100	0	100	26	26	13	32
Distribution Services															
Wholesale Trade Services	35	0	100	32	26	0	25	77	100	0	25	26	26	13	32
Retailing Services	35	0	100	32	26	0	25	100	100	25	25	26	26	13	32
Financial Services															
Life Insurance	70	100	100	100	100	100	100	100	76	100	25	100	100	100	77
Non-Life Insurance	68	76	76	37	76	75	76	78	76	76	77	100	76	100	77
Reinsurance	46	26	27	78	26	0	25	77	26	26	25	76	26	75	77
Commercial Banking	59	52	77	37	52	76	76	77	77	76	76	76	76	75	77

5.3 Artificial intelligence

A special area of digital regulation is the evolving field of artificial intelligence (AI). The term artificial intelligence is used to describe a wide range of different algorithmic methodologies. Because of advancements in computational power and in machine-learning methods in particular, such algorithms have proved very effective in a wide range of applications that were infeasible for computers just a few years ago. Some of these applications have implication for the political discourse and civil rights. Facial recognition is used for government surveillance, while deep fakes could appear in disinformation campaigns and the application of poorly understood algorithms for decision-making in sensitive areas can lead to discriminatory outcomes.

Figure 10: Top 10 % Scientific Journal Publications on 'AI' by country



Source: OECD.AI (2020).

Because of their versatility, algorithmic methods have also the potential to disrupt a large number of industries. A particular concern is that artificial intelligence methods could replace white-collar administrative jobs, similarly to the way automatisation has made many manufacturing jobs obsolete. In manufacturing, AI will mostly likely become increasingly important for maintaining a competitive edge. AI also has implications for competition policy. The dynamics that led to the monopolistic tendencies of digital platforms could be exacerbated in particular by data-intensive machine learning (Anderson, 2020a, 2020b). Finally, due to its military applications, AI is seen as strategic capability in the debate over the emergence of a *'technological cold war'* between the US and China (US Department of Defense, 2019; Segal, 2020).

The European Commission seeks to regulate automated decision-making based on the principle of 'human-centric AI'. This is based on seven key principles: human agency and oversight; technical robustness and safety; privacy and data governance; transparency; diversity, non-discrimination and fairness; societal and environmental well-being; and accountability[39]. The GDPR already includes a right not to be subjected to automated decision-making *'which produces legal effects concerning him or her or similarly significantly affects him or her'*[40]. However, there are concerns over a lack of expertise in this key technology. National AI strategies, such as those in France and Germany, emphasise (besides the need for ethical rules for AI) the necessity of strengthening relevant research in the EU (Bundesregierung, 2018; Villani, 2018). As Anderson *et al* (2020) have found, the EU is currently lagging behind in the training of new data and computer scientists working on AI-related topics. However, the picture is more encouraging when looking at high quality research output. Figure 10 shows in the production of high-quality scientific publications (top 10 % of scientific journal publications on AI as defined by OECD.AI, 2020), the US leads, while the EU is in second place, roughly on par with China. However, the US is the clear industry leader in terms of research output and US dominance is even more pronounced when looking at AI patents, with the top 10 % of AI patents almost exclusively originating in the US (OECD.AI, 2020)[41].

[39] See 'Building Trust in Human-Centric Artificial Intelligence', COM(2019)168, April 2019. See also https://ec.europa.eu/futurium/en/ai-alliance-consultation/guidelines#Top

[40] Article 22, GDPR, Regulation (EU) 2016/679.

[41] Eligibility of software for patents differs significantly between the US and the EU, distorting these numbers to some extent.

5.4 Digital tariffs and taxation

Other highly-disputed aspects of digital trade are taxes and tariffs. With the inception of the World Trade Organisation work programme on e-commerce, a moratorium on tariffs on electronic transmissions has been introduced. This moratorium faces increasing resistance from India and South Africa in particular. Developing countries are losing out on revenues from tariffs on digital services such as movie streaming, which if delivered as physical goods would have faced tariffs. Banga (2019) estimated that these lost tariff revenues for developing countries amounted to USD 5.1 billion annually, however other estimates are significantly lower and it overall unclear if such tariff would be economically beneficial (Andrenelli and López González, 2019). At the same time, the practice of moving intangible capital to tax havens for tax avoidance is rampant in digital services. Following the financial crisis, the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting (BEPS) was set up to find a solution to the problem of corporate profit shifting. Attempts were made by France and other EU countries to resolve the issue unilaterally by introducing digital services taxes. These attempts were met with threats of trade sanctions by the US administration[42]. It should be noted, that EU countries are among the main destinations of tax avoidance schemes[43]. Tørsløv *et al* (2019) estimated that in 2017, EUR 126 billion in profits was shifted to Ireland, EUR 79 billion to the Netherlands and EUR 66 billion to Luxembourg, making Ireland in particular the world's primary location used for corporate tax avoidance. Ireland gains 67 % of its corporate tax revenues from profit shifted to Ireland, 9 % of global corporate tax revenue is lost through these schemes[44].

6 Geopolitical aspects of digital trade

The European Union is at the forefront of developing regulation that reconciles digital technologies with citizens' rights and consumer interests. The EU constitutes the largest market in the world, and this allows it to shape digital regulation. The EU also has the world's largest market share of services trade, and is a major global exporter of machinery and equipment, which increasingly relies on complementary services. However, the evidence assembled in this report also shows the significant difference between the EU's approach compared to its two largest trading partners. The US has followed a *laissez-faire* approach to digital services and its digital trade policy is aimed at protecting the interests of its highly competitive digital services sector. China, while developing privacy standards for corporations, exerts tight control over the content on its digital platforms and the government has access to all private data. This control over the digital realm is seen by the Chinese Communist Party as vital for China's economic and political future. As the regulatory regimes governing the flow of data and the scope of algorithmic decision-making mature, the differences between jurisdictions will become more apparent. As a result, there is the risk the internet will fracture into national spheres. Authoritarian regimes require data localisation for political control, while privacy-focused democratic governments require localisation to protect citizens' rights. Some ITC manufacturers already struggle in their attempts to manoeuvre between the US and China. The rules on privacy and surveillance in the EU and the US are diverging and this carries the potential for conflict over digital services between the world's two biggest economies.

The trend of 'nationalisation' and the fracturing of the global information network undermine the economic potential that is inherent in digital technologies. The potential of digital trade lies in the frictionless flow of data, information and thus services. However, to fulfil this potential, regulation and trade governance would have to be compatible. This applies not only to regulation of data flows and the

[42] See 'Notice of Determination and Request for Comments Concerning Action Pursuant to Section 301: France's Digital Services Tax', (Docket No. USTR–2019–0009), Federal Register/Vol. 84, No. 235/Friday, December 6, 2019/Notices, p. 66956-66959.
[43] For a discussion on Ireland's role in the tax avoidance schemes of digital companies, see Setser (2020).
[44] See https://missingprofits.world.

digital mode of delivery, but also to the regulations that govern specific service sectors that are traded through digital means. Given the current state of multilateralism and the very different visions of digital governance in the EU, the US and China, a wide-ranging agreement in the WTO e-commerce talks may seem unlikely in the short run. While progress on basic concepts and definitions and less controversial topics would certainly be welcome, and would have positive economic effects, it would not solve the problem of market fragmentation caused by incompatibility, in particular of privacy regimes. Because of the large divergences in the interests of the largest economies, the most critical aspects of digital trade – privacy, platform economies, and localisation requirements – are unlikely to be resolved multilaterally or even plurilaterally.

Given the risk posed by surveillance and by violations of privacy by hostile (and allied) foreign governments, open economies must weigh the benefits of the free flow of data against the costs in terms of civil liberties. We think that the EU, with its strong principled stance on privacy, has made a clear statement in favour of prioritising the latter (affirmed most recently by the EU Court of Justice Schrems II ruling). Given this stance, the EU must develop a trade policy that harnesses the opportunities of digital trade where possible without compromising citizens' rights. We make two sets of recommendations: how Europe can strengthen its comparative advantage in global markets for digital services, and how to proceed in terms of digital trade policy.

6.1 Strengthen the European digital economy

In contrast to the Chinese market for digital services, the European digital services sector has not been protected from US competition. While in China and the US, domestic companies are dominating the digital service market, in the EU large American multinational companies are the most important digital players. As we have seen from the example of artificial intelligence, while the EU is doing some world class research in digital technologies, it does not result in patents or in competitive digital companies. Figure 8 also suggested that Europe should integrate more foreign value added in its digital services exports. Specialisation in international trade is by no means new, and as Philippon (2019, chapter 13) has shown, the digital giants roaming Silicon Valley have an exceptionally small footprint in terms of employment. However, the lack of a genuine European digital sector is problematic given its strategic geopolitical and economic value, and also its increasing relevance for (high-end) manufacturing goods[45].

Silicon Valley, the epicentre of American digital technology, is a result of Cold War military investments into computer chips. Many of the companies that dominate digital services were born out the interaction between this industry cluster and the excellent research centres that are present in the area and across the US. These companies had the opportunity to grow quickly in the large American market (supported by venture capital) before expanding to the EU. In each of the factors that contributed to US success, the European digital sector is at a disadvantage. While there have been significant attempts to unify the European Digital Single Market, many of the services that could be traded digitally are still regulated at national level (Marcus *et al*, 2019). This limits the ability of European companies to grow to a scale that would allow them to compete internationally. Furthermore, Europe's capital markets are underdeveloped compared to the US, limiting the ability of venture capital to support start-ups (Bhatia *et al*, 2019). Finally, as discussed in Sections 3.1 and 5.4, European research in computer science lags far behind the US.

A number of policy recommendations for strengthening the digital sector in the EU follow directly from this. Completing the single market for digitally traded services would allow digital services companies to reach a larger market. This is especially important giving the large returns to scale and monopolistic

[45] For a discussion see Leonhard *et al* (2019).

tendencies in many digital services. Second, venture capital plays an important role in financing risky new digital technologies. Completing the capital markets union would help create a vital European venture capital scene. Finally, investment into digital technologies R&D is essential. The development of technologies that are important for the European digital agenda but are not prioritised by the US, such as human-centric AI, should be prioritised by European research funds. Each of these policies is worth pursing in its own right, but is also crucial for Europe to catch up with the US in this strategic industry.

6.2 Trade policy and geopolitical challenges

The digital sphere is increasingly becoming a stage for geopolitical conflicts, with disinformation campaigns targeting US and European elections, export and import restrictions on information and communication technologies, digital technologies used as a tool in the US-China trade war and cyber-attacks threatening financial and political institutions (Demertzis and Wolff, 2019). The reduced importance of physical distance as a factor in cyber security means that remoteness between strategic rivals is no longer a guarantee against conflict.

As a response to the territorial mobility of data, a number of potentially conflicting regulations with extraterritorial scope have emerged. The examples of the US CLOUD Act and the GDPR show the potential for incompatibilities in such laws. The US CLOUD Act obliges US companies to hand over data stored outside the US to US law enforcement agencies, an action that could violate the GDPR[46]. While the large fines for violations of the GDPR might protect against data misuse by private companies, they do not protect the privacy of European citizens against surveillance by foreign governments. To do that effectively, regulation has to be accompanied by strong cybersecurity policy and should be complemented with encryption where possible.

Given these difficulties, the free flow of private data will only be limited to likeminded countries with equivalent privacy regulation, reducing the scope for trade in digital services. However, there are already several large and diverse economies with strong privacy protection, including Japan, South Korea, and recently India, which could form a 'privacy-focused' digital sphere. After Schrems II, an operational data transfer regime with the EU's most important trading partner depends on US policy to provide guarantees against government surveillance. The free flow of private data between China and the EU seems out of the question given Chinese government surveillance and Chinese efforts to protect their market and control the information available for citizens.

Greater potential for free flow of data lies in the area of industry 4.0. As a strong and open manufacturing economy, the EU is well positioned to gain from digital technologies in managing supply chains. The main challenge in this area is intellectual property protection. Forced technology transfers and industrial espionage are impediments to the free flow of industrial data between the EU and China in particular. The EU should work towards resolving these issues with China.

At the same time, the threat of premature deindustrialisation is a significant challenge for developing economies (Rodrik, 2016). Digital technologies could boost trade in services and could help countries develop at a time when the opportunities for development through export-oriented manufacturing are becoming more limited. Similar to the way in which trade in goods allowed for the locating of low-skilled manufacturing to developing economies, digital trade could enable the outsourcing of low-skilled services. This presents a tremendous opportunity for countries that are well positioned in digital trade.

[46] See annex to the 'EDPB-EDPS Joint Response to the LIBE Committee on the impact of the US Cloud Act on the European legal framework for personal data protection', from July 2019: https://edpb.europa.eu/our-work-tools/our-documents/letters/edpb-edps-joint-response-libe-committee-impact-us-cloud-act_en.

Integrating developing economies into their digital value chains could also increase the competitiveness of European companies.

The EU should offer an alternative to the Chinese Belt and Road Initiative. The threat posed by digital services and the use of infrastructure a geopolitical tool is much greater for developing countries that lack security expertise and economic clout, than it is for the EU. A further deepening of trade in services could also open up new markets for European digital companies. Commercial interests are here aligned with support for free exchange of information and support for democratic institutions. The immense efforts by the Chinese Communist Party to control the Chinese internet are evidence of the power of free access to information. The EU should support initiatives that bring internet access to developing countries and support civil society organisations that fight for freedom of information.

COVID-19 and the upcoming American elections both introduce uncertainty about the future strategy of American trade and digital policy. California's new privacy laws mark a significant departure at the state level from the current *laissez-faire* philosophy with regard to personal privacy. Whether this push for more privacy will be overruled by a federal law or has the chance of being adopted at federal level remains to be seen. The same is true of US willingness to concede legal guarantees against government surveillance of European citizens. If re-elected, President Trump would likely proceed with a US-China decoupling strategy and an agenda of managed trade. In that case we would not expect a solution to the problem of the EU-US flow of private data. Secondary sanctions could make digital trade with China even more difficult for European companies. A President Biden would likely be much more accommodative to European interests, even though he has also expressed a hawkish attitude towards China (Biden, 2020).

7 Conclusions

While the EU is currently not at the forefront of developing new digital technologies (see Figure 7), European companies are taking advantage of the opportunities of the services provided by foreign technologies. The EU has developed a privacy framework that is based on fundamental principles. The GDPR is the gold standard in terms of privacy regulation. A number of similar regulations around the world have emerged. Now the EU is trying to replicate this 'Brussels effect' with the regulation of algorithms and the Digital Services Act. However, given the economic and geopolitical importance of digital technologies, the EU should aim to also strengthen its digital sector.

There are three fundamental questions the EU must answer for its future digital trade policy: the extent to which the EU itself wants to be a producer of digital services, how to promote European values and interests in the global digital economy, and how to interact with other economies with conflicting approaches to digital policy. The road to competitiveness in digital products is strongly interlinked with completing the single market with respect to capital and services, and requires investment in research and development. Promoting European values and interests in the digital economy will need cooperation with likeminded allies, and support for an open internet and free access to information in developing countries. The internet is a tool for authoritarian regimes and democratic movements alike, and digital trade will be essential for economic development in the age of premature deindustrialisation. Finally, while there might be some potential for a shift in the US position on privacy regulation, we should not expect full convergence with European standards or respect for the civil rights of European citizens by US security agencies. The case is even clearer with regard to countries like China and Russia. Safeguarding citizens' rights will therefore require limiting the free flow of private data. Harnessing the potential of digital trade and building a European digital services sector around these constraints is the big challenge for European digital trade policy.

References

Aaronson, S. A., 2019, "What Are We Talking about When We Talk about Digital Protectionism?", *World Trade Review (18)*4, 541–577, doi:10.1017/S1474745618000198.

Aaronson, S.A. and P. LeBlond, 2018, "Another Digital Divide: The Rise of Data Realms and its Implications for the WTO", *Journal of International Economic Law (21)*, 245–272, doi: 10.1093/jiel/jgy019.

Anderson, J., 2020a, "Do AI markets create competition policy concerns?", *Bruegel Blogpost,* January 2020, https://www.bruegel.org/2020/01/do-ai-markets-create-competition-policy-concerns/

Anderson, J., 2020b, "The dynamics of data accumulation", *Bruegel Blogpost,* February 2020, https://www.bruegel.org/2020/02/the-dynamics-of-data-accumulation/

Anderson, J., P. Viry and G. Wolff, 2020, "Europe has an artificial-intelligence skills shortage", *Bruegel Blogpost,* August 2020 https://www.bruegel.org/2020/08/europe-has-an-artificial-intelligence-skills-shortage/

Andrenelli, A. and J. López González, 2019, "Electronic transmissions and international trade - shedding new light on the moratorium debate", *OECD Trade Policy Papers*, No. 233, OECD Publishing, Paris, http://dx.doi.org/10.1787/57b50a4b-en

Banga, R., 2019 "Growing Trade in Electronic Transmissions: Implications for the South", *UNCTAD Research Paper*, no. 29, UNCTAD/SER.RP/2019/1/Rev.1, February 2019

Biden, J., 2020, "Why America Must Lead Again", *Foreign Affairs,* March/April 2020, https://www.foreignaffairs.com/articles/united-states/2020-01-23/why-america-must-lead-again

Bhatia, A.V., Mitra, S., Weber, A., Aiyar, S., de Almeida, L.A., Cuervo, C., Santos, A.O., Gudmundsson, T., Bergthaler, W. and Garrido, J., 2019., "A Capital Market Union for Europe.", *IMF Staff Discussion Notes*, 19/07, September 2019

Brannon, V. C., 2019, "Free Speech and the Regulation of Social Media Content", *CRS Report*, no R45650, Congressional Research Service, March 2019

Bundesministerium für Wirtschaft und Energie (BMWi), 2019, „Industriestrategie 2030 Leitlinien für eine deutsche und europäische Industriepolitik"

Bundesregierung, 2019, "Artificial Intelligence Strategy", November 2018

Cernat, L., R. Kerner, J. M. Rueda-Cantuche and V. Ritola, 2016, "Trade in Services by GATS Modes of Supply: Statistical Concepts and First EU Estimates", *Chief Economist Note,* European Commission DG Trade, Issue 3, November 2016

Cernat, L. and N. Sousa, 2016, "The Trade and Jobs Nexus in Europe: How Important Are Mode 5 Services Exports?", *CESifo Forum*, ifo Institute - Leibniz Institute for Economic Research at the University of Munich, vol. 16(04), pages 65-67, January.

Demertzis, M. & G. Wolff, 2019, "Hybrid and cybersecurity threats and the European Union's financial system", *Bruegel Policy Contribution*, no. 10, September 2019.

Epifanova, A., 2020, "Deciphering Russia's 'Sovereign Internet Law'", *DGAP Analysis,* No. 2, German Council on Foreign Relations, January 2020

Ferencz, J., 2019, "The OECD Digital Services Trade Restrictiveness Index", *OECD Trade Policy Papers*, No. 221, OECD Publishing, Paris, http://dx.doi.org/10.1787/16ed2d78-en

Ferracane, M. F., and H. Lee-Makiyama, 2017, "China's technology protectionism and its non-negotiable rationales", *ECIPE Trade Working Paper*

Freedom House, 2019, "Freedom of the Net China 2019 China Country Report", *Freedom of the Net*, https://freedomhouse.org/country/china/freedom-net/2019

Gribakov, A., 2019b, "Road to Adequacy: Can California Apply Under the GDPR?", *Lawfare,* April 2019, https://www.lawfareblog.com/road-adequacy-can-california-apply-under-gdpr

Gribakov, A., 2019a, "Cross-Border Privacy Rules in Asia: An Overview", *Lawfare,* January 2019, https://www.lawfareblog.com/cross-border-privacy-rules-asia-overview

Horsley, J. P., (2018) "China's Orwellian Social Credit Score Isn't Real", *Foreign Policy,* November 2018, https://foreignpolicy.com/2018/11/16/chinas-orwellian-social-credit-score-isnt-real/

Hufbauer, G. C. and Z. Lu, 2019, „Global E-Commerce Talks Stumble on Data Issues, Privacy, and More", *PIIE Policy Brief,* no. 19-14, October 2019

Lane, P. R., (2020), "The analytical contribution of external statistics: addressing the challenges", *Speech at the Joint European Central Bank, Irving Fisher Committee and Banco de Portugal conference on "Bridging measurement challenges and analytical needs of external statistics: evolution or revolution?",* February 2020, https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200217~1123672b04.en.html

Le ministère de l'Europe et des Affaires étrangères, 2017, "Stratégie internationale de la France pour le numérique"

Leonard, M., J. Pisani-Ferry, E. Ribakova, J. Shapiro and G. Wolff, (2019) "Redefining Europe's economic sovereignty", *Bruegel Policy Contribution,* Issue no 9, 2019.

López González, J. and M. Jouanjean (2017). *Digital Trade: Developing a Framework for Analysis*, OECD Trade Policy Papers, No. 205, Paris: OECD. http://dx.doi.org/10.1787/524c8c83-en

Marcus, J. S., G. Petropoulos and T. Yeung, 2019, "Contribution to growth: The European Digital Single Market.", *Study for the Committee on the Internal Market and Consumer Protection*, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2018

Marcus, J. S., 2020, "New challenges to transfers of personal data from the EU to the United States", *Bruegel Blog Post,* July 2020, https://www.bruegel.org/2020/07/new-challenges-to-transfers-of-personal-data-from-the-eu-to-the-united-states/

Meserole, C., and A. Polyakova, 2019, "Exporting digital authoritarianism: The Russian and Chinese models", *Brookings Policy Brief*, August 2019

OECD, 2017, "OECD Digital Economy Outlook 2017", *OECD Publishing*, Paris. http://dx.doi.org/10.1787/9789264276284-en

OECD, 2019a, "Balance of payments BPM6 (Edition 2018)", *Main Economic Indicators* (database), https://doi.org/10.1787/82c58d96-en (accessed on 11 September 2020).

OECD, 2019b, "Trade in services - EBOPS 2010 (Edition 2018)", *OECD Statistics on International Trade in Services* (database), https://doi.org/10.1787/f336b9af-en (accessed on 11 September 2020).

OECD, 2020, "Trade in value added", *OECD Statistics on Trade in Value Added* (database), https://doi.org/10.1787/data-00648-en (accessed on 11 September 2020).

OECD.AI, 2020, powered by EC/OECD (2020), STIP Compass database, accessed on 29/09/2020, https://oecd.ai.

Philippon, T., 2019, "The Great Reversal: How America Gave up on Free Markets.",*The Belknap Press of Harvard University Press*, 2019

Rodrik, D., 2016, "Premature deindustrialization", *Journal of economic growth*, 21(1), pp.1-33.

Rückert, D., R. Veugelers, and C. Weiss, 2019, "Bridging the divide: new evidence about firms and digitalisation", *Bruegel Policy Contribution*, Issue no17, December 2019

Sacks, S., 2018, "New China Data Privacy Standard Looks More Far-Reaching than GDPR", *CSIS Critical Questions*, January 2018 https://www.csis.org/analysis/new-china-data-privacy-standard-looks-more-far-reaching-gdpr

Segal, A., 2020, "The Coming Tech Cold War With China", *Foreign Affairs,* September 2020, https://www.foreignaffairs.com/articles/north-america/2020-09-09/coming-tech-cold-war-china

Setser, B. W., 2020, "Ireland Really Shouldn't be Driving the Details of the Euro Area's GDP Data", *Follow the Money, Council on Foreign Relations,* April 2020, https://www.cfr.org/blog/ireland-really-shouldnt-be-driving-details-euro-areas-gdp-data

Stockmann, D., 2014, "Media Commercialization and Authoritarian Rule in China", *Cambridge University Press,* 2014

Tørsløv, T., L. Wier, and G. Zucman, 2019 „The Missing Profits of Nations: 2017 Figures", September 2019

Twomey, P., 2018, "Addressing Market Failures to improve the health of the Digital Infrastructure" *T20 Policy Brief*, https://www.g20-insights.org/policy_briefs/addressing-market-failures-improve-health-digital-infrastructure/.

UNCTAD, 2015, "International Trade in ICT Services and ICT-enabled Services. Proposed Indicators from the Partnership on Measuring ICT for Development." *Technical Note,* No.3, October 2015.

United States Department of Defense, 2019, "Summary of the 2018 Department of Defense Artificial Intelligence Strategy"

United States Trade Representative (USTR), 2020, "2020 National Trade Estimate Report on Foreign Trade Barriers"

Villani, C., 2018, „For a Meaningful Artificial Intelligence – Towards a French and European Strategy"

Wettstein, S., A. Liberatore, J. Magdeleine, and A. Maurer, 2019, "A Global Trade in Services Data Set by Sector and by Mode of Supply (TISMOS).", *WTO Methodological Note*, https://www.wto.org/english/res_e/statis_e/daily_update_e/Tismos_methodology.pdf

PE 653.616
EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05

Print ISBN: 978-92-846-7440-4 doi: 10.2861/318312 QA-02-20-909-EN-C
PDF ISBN: 978-92-846-7439-8 doi: 10.2861/98661 QA-02-20-909-EN-N

PE 653.617
EP/EXPO/INTA/FWC/2019-01/LOT5/1/C/05

Print ISBN: 978-92-846-7438-1 doi: 10.2861/908579 QA-01-20-704-EN-C
PDF ISBN: 978-92-846-7437-4 doi: 10.2861/23699 QA-01-20-704-EN-N