ECIPE OCCASIONAL PAPER ▪ 03/2022

After the DMA, the DSA and the New AI regulation:

Mapping the Economic Consequences of and Responses to New Digital Regulations in Europe

By **Fredrik Erixon, Oscar Guinea, Erik van der Marel, and Elena Sisto**[1]

[1] Fredrik Erixon is a Director of ECIPE. Erik van der Marel is a Senior Economists at ECIPE and professor at ULB. Oscar Guinea is a Senior Economist at ECIPE. Elena Sisto is a Research Assistant at ECIPE.

ECIPE | EUROPEAN CENTRE FOR INTERNATIONAL POLITICAL ECONOMY

EXECUTIVE SUMMARY

The European Union (EU) has pursued an ambitious agenda for regulating the digital economy, and it is now planning to establish a new package of regulations, including the Digital Markets Act (DMA), the Digital Services Act (DSA), and a new regulation of Artificial Intelligence (AI). These regulations build on an already established structure of digital and business regulations in Europe that is comparatively restrictive but that varies substantially between EU member states. In this study, we take stock of the new incoming regulations and review their effect on EU member states' economies. More precisely, the paper considers how different countries in Europe will be affected by the regulations and how they should balance these effects with policies that help the economy to prosper.

The European Commission's economic analyses and impact assessments of the new regulations are thin. In fact, they are grossly inadequate for the purpose at hand: to better understand how the economy will change because of these regulations. The Commission identifies some benefits – for instance, positive competition outcomes from reduced network effects and more trust in AI-based goods and services. There are good reasons to think that these benefits are real. However, these regulations will also lead to new costs and have broader consequences for firms and resource allocation in the economy. Remarkably, the only costs identified in the impact assessments are direct compliance and administrative costs. Obviously, for far-reaching regulations such as the DMA, the DSA and the AI regulation, the main costs will not be the direct compliance burden, but the dynamic and downstream economic effects spurred by their implementation. This is because these regulations will prompt firms and markets to change their current and future behaviour: these changes are likely to define the most important costs.

Furthermore, it is important to get a better idea of the distribution of these costs. It is highly unlikely that all sectors and countries will be affected equally. Some sectors will be more affected than others just as some countries will experience economic consequences that are bigger than in other countries. The question is: what factors will lead to the expected variation in the costs and consequences of the three new regulations?

In this paper, we argue that two factors are important for grasping the distributive patterns of costs from digital regulations. First, the industry structure of a country is key. In the economy, countries have different endowment structures, and the modern European economy is defined by factor endowments such as data and digital competences. These factor endowments are exploited in the economy by firms and organisations that use them to create different comparative advantages. In turn, these advantages influence how a firm and a country market, sell and trade. Second, the existing structure of a country's business and digital regulations will influence how an economy will respond to new and additional

digital regulations. In fact, the restrictiveness of regulations that we know to impact on the digital economy vary substantially in the European Union – both between countries and between sectors. This variation will have consequences for the distribution of the costs of the three new regulations that are going to be implemented.

This paper maps countries and country groups in the digital economy: their endowments, advantages, and flows. Especially, it evaluates the digital performance of countries in a number of key indicators and data points, and anchors the analysis in the academic literature. The paper points to some specific consequences of the DMA, the DSA and the AI regulation, and how different regulations will affect endowments structures and advantages. One key finding is that the distributive effects of the regulations will depend on size advantages and disadvantages. In short, small economies and small firms will likely carry a disproportionate part of the cost of new digital regulations. Furthermore, countries that have used their endowments to specialise in the digital economy will be more affected than others. On this score, there is a vast difference between EU countries. For instance, countries in Europe's North – generally small, competitive, and open economies – will be most affected by these new regulatory burdens. Countries in Central and Eastern Europe will also be negatively affected, especially through risks of market exclusion effects for small firms.

It is important for European policymakers to now consider how they can avoid that these new digital regulations continuously reinforce size advantages for big economies and big firms. There are some policy strategies that should be considered. First, regulations can be changed to better fit the overwhelming evidence that young, dynamic, and innovative firms drive a substantial part of productivity growth in the economy. Second, EU and national policymakers can pursue policies that make the transition into a more size-balanced economy easier, for instance by taxing and regulating small firms differently. Smaller economies can also be helped by having corporate taxes that are lower than in big economies. Third, EU and national policymakers can reform other digital and business regulations and make them less burdensome. Fourth, the EU can help to support the build-up of digital advantages in smaller economies.

1. INTRODUCTION[2]

In the past decade, the European Union has taken significant steps to regulate its digital economy. Now there is another wave of regulations coming, and these regulations include different aspects of the digital economy – ranging from new conditions for intermediary liability and restrictions on "gatekeeper" platforms to policies for the development and use of artificial intelligence (AI). Many of the proposed regulations are novel: they take an

[2] ECIPE's work on Europe's digital economy receives funding from several firms with an interest in digital regulations, including Amazon, Bertelsmann, Ericsson, Google, Meta, Microsoft, Rakuten, SAP, and Siemens.

approach to regulations that has not been tried-and-tested in the past. Nor do they imitate regulations in other parts of the world. The European Commission is rather presenting itself as a trailblazer: these regulations, it says, will likely be followed by similar regulations in other key digital markets in the world.

There are some reasons behind this view. For instance, Europe's data privacy regulation, the General Data Protection Regulation (GDPR), was largely copied by several other countries in the world.[3] Other EU regulations on data and data processing have also been "internationalised" – at least to an extent.[4] And aren't other countries already drawing up plans to regulate the market power of large platforms? Just like the EU has agreed on a Digital Markets Act (DMA) to regulate the market behaviour of gatekeeper platforms, other countries are designing policies to promote competition in platform markets where companies like Amazon, Apple, Facebook, and Google are big players. No country with significant development of AI is thinking that it should be free of regulations.

However, the argument shouldn't be taken too far. Most other countries haven't copied the GDPR or EU data-processing regulations, and those who followed the European example were typically countries with a strong economic orientation towards the EU. And this time, there is not a first-mover advantage. Many other countries are already in the process of designing their platform regulations and they seem to be taking different approaches. In the case of the DMA, countries like the United Kingdom and the United States are discussing different models of regulation[5], and some of these governments have already been critical about specific aspects of the DMA, like its potential consequences on cyber security and intellectual property.[6] The same pattern holds for the proposed AI regulation in Europe: while other countries are moving ahead too, few are doing it in the same way as the EU.[7] Another signature regulation, the Digital Services Act (DSA), also covers areas that other countries are regulating (rules on content takedown and third-party transactions on a platform, for example). But other countries are choosing different methods and often do not go as far as the DSA in regulating, for example, procedures for managing "systemic risks" on platforms and "know-your-customers"-type of rules for all transactions enabled by a digital platform.

---

[3] See the discussion about "the Brussels Effect" in Bradford (2020).

[4] See for instance Van der Marel (2021).

[5] Bauer et al (2022) provides a comparative analysis of DMA-like proposals in the United Kingdom and the United States.

[6] See Chee (2021) and Stolton (2022).

[7] See for instance Federal Trade Commission (2021); Burt (2021); and Minevich (2021).

BOX 1: SHORT SUMMARY OF EU'S DIGITAL REGULATIONS

The **DMA** (Digital Markets Act) sets out rules for in particular very large online platforms (which are here called "gatekeepers"). With these rules, the EU aims to establish a greater level of competition by making it easier for new and smaller online platforms to respectively enter and operate in the market.

The **DSA** (Digital Services Act) aims at a higher level of accountability for online platforms and intermediaries. The DSA establishes a greater level of transparency and user safety through, for instance, rules relating to transparency obligations, due diligence requirements, and liability rule of third-party content.

Finally, the **AI** (Artificial Intelligence) regulation proposes harmonized rules for the safety of AI system that are placed on the EU market. It puts requirements on operators of so-called high-risk systems and obligations for producers and users of these high-risk AI systems.

Moreover, many observers are struggling to understand the actual economic consequences of these regulations. The impact assessments of the DMA and DSA were thin on economic analysis – a point that the Regulatory Scrutiny Board has underscored in both instances.[8] There are general economic motivations – including the reduction of network effects in the case of the DMA and the combat against counterfeit products in the case of the DSA – that are reasonable and connect with established knowledge and research about how the digital economy works. However, it is far less clear how the application of these regulations will work out in practice and how they will affect different exchanges and flows of digital services.

Unfortunately, the Commission has not presented analyses of how different new business restrictions will impact on current or future platform business activities – let alone the effect they will have on economic factors like innovation, technology diffusion, and the accessibility of digital services. All these factors are crucial for spurring productivity and growth in the 21st century and deserve more attention. The same verdict applies to the impact of the AI regulation: there are reasonable general motivations for the proposal – for instance, the use of AI will be more widespread if there is higher general trust in AI – but they don't inform much about how the economic consequences will emerge and what the costs will be. Notably, the potential economic costs that get covered in impact assessments

[8] European Commission (2020a) and (2020b).

are direct compliance costs, but they are usually only a small part in the larger economic analysis of the consequences of new regulations.

Equally important, current analyses of the economic consequences of the proposed digital regulations – the DMA, the DSA and the AI regulation – don't cover the *distributional* economic effects, the effects across countries and sectors in the EU. In its impact assessments, the Commission suggests net economic gains will result from the DMA. But who will pocket these gains – and in what countries and sectors will they emerge? Surely, there will also be costs – and what countries and sectors would be burdened by them?

The underlying assumption seems to be that Europe's economies will respond alike to the introduction of these three regulations. However, this is highly unlikely. In fact, it is reasonable to expect that the consequences of these regulation will vary substantially between countries because there are substantial differences between the European economies in their "digital economy endowments", how intensively they use digital services, and the extent to which they are home to AI development and deployment. After all, the lesson learned from many other digital regulations is that they affect countries in very different ways.

Our thesis is that EU countries will be differently affected by these new regulations because of two factors.9 First, the effect on individual countries will be dependent on the economic structure of a country. For example, a regulation restricting the development and use of AI will be mostly affected by countries that are home to AI development and countries that consume AI applications. In other words, countries that are positioned at the technological frontier in AI-intensive sectors (e.g. healthcare and transport) and R&D-intensive industries are probably going to be more affected by the AI regulation than other countries.

Similarly, platform regulations that affect the growth and behaviour of platforms will be felt more in countries where digital services are widely used and produced, compared to countries that use and produce digital services to a lesser extent. For instance, in countries where platform-intensive sectors (e.g. business consultancy, finance and telecom) have a high share of output, the effect of platform restrictions will likely be different than in countries where these sectors are smaller. Since there are substantial differences within the EU on all these accounts, the expectation should be that the consequences of the proposed regulations will be unevenly distributed.

Second, there are significant differences in the policy environments around the EU, and the effects of new regulations will partly depend on how other regulations support or deter digital economic activity – for instance, the degree to which they support competition,

[9] Obviously, there are more than two factors that will determine the variation in effects in different economies from regulations, but we will cover only two central factors in this paper.

market contestability, entrepreneurship, and firm growth. In short, countries have different degrees of business and market restrictiveness in sectors that affect the digital economy, and therefore it is likely that the effects of the new regulations will be felt differently across the EU because of the composition of these existing business regulations.

Hence, this paper will closely examine the relative economic change that will emerge as a consequence of new digital regulations, and the factors driving these changes. The central argument of this paper is that it is crucial for European policymakers to get a much better understanding of the distributional economic consequences of the new digital regulations, and that they respond with measures that will help countries to grow their digital capabilities. These policymakers include national governments that should consider how they need to design their other digital policies and business regulations after the introduction of the DMA, the DSA, and the AI regulation. These regulations will bring cost to businesses and most likely have the effect of deterring technological entrepreneurship and diffusion. While there are individual EU countries that are already top global performers in digitalisation, the EU is increasingly distant from the global digital and technological frontier. It is urgent that both Brussels and national capitals take measures that will spur new digital growth, entrepreneurship, and diffusion.

In the next chapter, we will present an analysis of the importance of the economic structure and the policy environment for understanding the consequences of regulation in the digital economy. In chapter 3, we will compare EU countries and consider different country groups that are relevant for the analysis of digital-economy regulations. It also presents a taxonomy for how to map different economic effects that follow from the regulations. In that chapter, we will also draw some general conclusions. In chapter 4, we present short summaries of the expected economic consequences of new digital regulations for individual EU countries, and how they should respond.

2. UNITED IN DIGITAL DIVERSITY

Let us start with an obvious point about Europe's digital economy: European countries do not share similar comparative advantages in the digital economy, and the way they are affected by digitalization is not identical. Nor have all countries applied similar policies affecting the activities of "digital firms" – the companies that are producing or using digital services in an extensive way. EU member states differ on these two points, and these differences go a long way to explain their digital firm performance.

Take the issue of economic size. Some smaller European countries are economically more oriented toward services given that, structurally, they have always been disadvantaged by their lack of scale in developing competitive industrial sectors. For the same reason, they have now developed their own niches in the digital services economy. Similarly, larger European markets are better positioned to use their manufacturing sector for advancing digital technologies such as the Internet of Things (IoT), robotics, and AI. Moreover, the ability to exploit business opportunities in each country will depend on the set of policies that are already in place: these policies help or frustrate businesses to benefit from existing different comparative advantages in the digital economy.

2.1 United in Diverse Industry Structures

European countries differ markedly in their industry structures and the factor endowments that power the digital economy.

Figure 2.1 illustrates this point by selecting some of the most important economic factors behind the shape of digital output in various countries. The first panel depicts to what extent countries are oriented towards producing high and medium R&D manufacturing compared to digital services. Constructed as a ratio of the gross production of the two industries, a darker shade indicates a higher gross production in R&D manufacturing. It shows that Germany and Italy – together with some Eastern European countries such as the Czech Republic, Slovakia, and Hungary – score high in R&D manufacturing and low in digital services. In other words, the relative sizes of these two sectors suggest that these countries have fewer production-oriented interests in digital services. Other countries – such as the Nordics, France, Ireland, and Portugal – have an industry structure that is much more catered towards digital information services. Interestingly, a large country as France has an industry structure which is much more aligned with the Nordics. The differences between countries are stark – and not just between the outliers. Slovakia, for instance, has a ratio twice that of Poland, while Slovenia has one that is almost twice as big as the Netherlands.

Similarly, firm characteristics differ substantially between countries. Many young high-growth firms are active in the digital economy and new regulations would therefore especially affect them. The second panel in Figure 2.1 shows that the economies of Sweden, the Baltics, Ireland, and the Netherlands – together with countries in Central and Eastern Europe (CEE) – have a higher share of firms that are fast growing (based on their employment expansion in recent years). Sweden, for example, tops the ranking as it has 5.2 high-growth firms per 100.000 inhabitants, while for Slovenia and Belgium this number is 2.71 and 1.25, respectively. This metric illustrates how firm dynamics play an important role for the overall growth in these economies.

Often, fast-growing firms are relatively young, and as they successfully mature, they often become a major determinant for a country's overall productivity growth. This is a crucial part of the digital economy. As said above, many digital or digital-intensive firms are still fairly young, and as a consequence, they tend to be small. Firm growth, not firm size, then becomes an important part of the analysis: a significant part of the producers in the digital economy are new and small enterprises, not big and incumbent firms. Supporting the growth of these types of firms in the digital economy is therefore key in these countries.

There is a "user-side" aspect as well. Small firms are more reliant on the external supply of digital solutions for their operations – often also for their sales. They lack the in-house capacity to serve the operation with self-owned digital solutions. Moreover, many of the smaller CEE countries are also large outsource destinations of freelance services work in digital sectors. These freelance services are exported through online platforms.[10] Countries such as Poland, Hungary, and Romania have developed a strong position in outsourced micro activities as they receive relatively high levels of dollar values of production and exports through digital labour platforms such as Freelancer and Upwork. The growth prospects are sizable for these firms: one study finds that these markets have expanded by about 25 percent globally a year.[11]

BOX 2: ENDOWMENTS AND ECONOMIC PERFORMANCE

A useful way to study the economic performance of a country is to focus on its endowments. Historically, economists studied especially three endowments: land, labour, and capital. Countries with relative abundance in land, for instance, tended to specialise in agriculture and other forms of output that was land intensive. By contrast, countries with relatively little land but an abundance of labour specialised in more labour-intensive output, like manufacturing. As the economy has modernised some endowments (like land) have become less important while new endowments have merged. Data is one of those new endowments. The relative abundance of data in a country helps to explain how the economy of that country specialises and why data-intensive activities become more important.[12] Moreover, other intangible assets play a significant role for determining output and specialisation in the digital economy – organisation competencies, digital-business know-how, and data-based intellectual property rights.[13]

Strong differences within Europe also appear in analyses of data endowments. Panel 3 in Figure 2.1 shows the difference between countries in the EU – and, again, there is a clear

[10] Graham et al (2017).

[11] Kässi and Lehdonvirta (2016).

[12] Van der Marel (2016).

[13] Haskel and Westlake (2018).

geographic pattern. The strong producers of data-related services and technologies, or "data suppliers", are Denmark, Sweden, Finland, and Ireland. They have 57 to 90 data suppliers per 100,000 inhabitants. France, on the other hand, ranks low with only 20 data suppliers per 100,000 inhabitants. The fact that these "Nordic" countries are also big users of data-related technologies is well-known. The share of firms using big data, customer relationship management, and cloud computing has also shown to be high for the Nordics and in the Netherlands.[14] Their relative position is particularly important for the future development of digital services and AI technologies – areas with substantial growth prospects for both services and industries.[15]

The R&D levels used in digital services, as shown in the final panel of Figure 2.1, directly relate to future growth prospects. The panel shows how much the digital service sector spends on R&D as a share of value added. Again, Nordic countries top the rankings. The difference between countries is also significant. Sweden's digital services sector, for instance, spends 3.6 percent on R&D as a share of value-added while that number is less than half for Germany and Italy – 1.2 percent and 1.3 percent, respectively. These Nordic countries have also developed strong positions in other related intangible assets such as economic competences, organizational capital, and innovative property – key factors of production for the digital economy. The combination of strong data provision and big R&D-related intangible assets in these countries helps to explain their competitive position relative to other EU countries – for instance in niche markets like app development[16]. Moreover, Sweden is also an attractive location for data centres, which is further strengthening its competitive edge in data innovations and cloud.[17]

Even if European countries differ substantially on these digital indicators, some patterns emerge with groups of countries sharing similar characteristics. For instance, the Nordics, together with the Netherlands and Ireland, are strong producers of data-related technologies and have companies with strong growth dynamics. However, all these countries offer no real scale advantage as they are small, which explains their services development in the first place. On the other hand, scale advantages have served a country like Germany well. An industrial powerhouse, Germany has developed a strong position in R&D-related manufacturing activities. These R&D industries also profit countries in the CEE region that are part of Germany's industrial value chain. Meanwhile, several of these CEE countries have high levels of self-employed services work – output which often is exported through online labour platforms. Many of these exports are found in (digital) business services.

[14] Hallward-Driemeier et al. (2020); van der Marel et al. (2019); Cathles et al. (2020).

[15] Aghion et al. (2020).

[16] Szczepanski (2018); Mandel and Long (2017).

[17] OECD, (2018); Business Sweden (2017).

A somewhat surprising finding is that France, also a big market, has relatively low levels of R&D activity in manufacturing (relative to digital services activity) compared to Germany, as shown in the first panel of Figure 2.1. Yet, when restricting our definition of R&D to *high-level innovation* activities in the digital services sectors only, France outperforms many of its European peers. Still, together with Germany, Spain, and (to a lesser extent) Italy, the country shows a higher level of high-level R&D in the economy compared to their digital services activities. France and Germany are home to some of the world's biggest cloud vendors with headquarters in Europe such as Cegid (France) and SAP and T-Systems (Germany).[18] Generally, cloud investments need high upfront fixed costs and scale is an important factor to make these investments profitable, which often only large markets can pay for.[19]

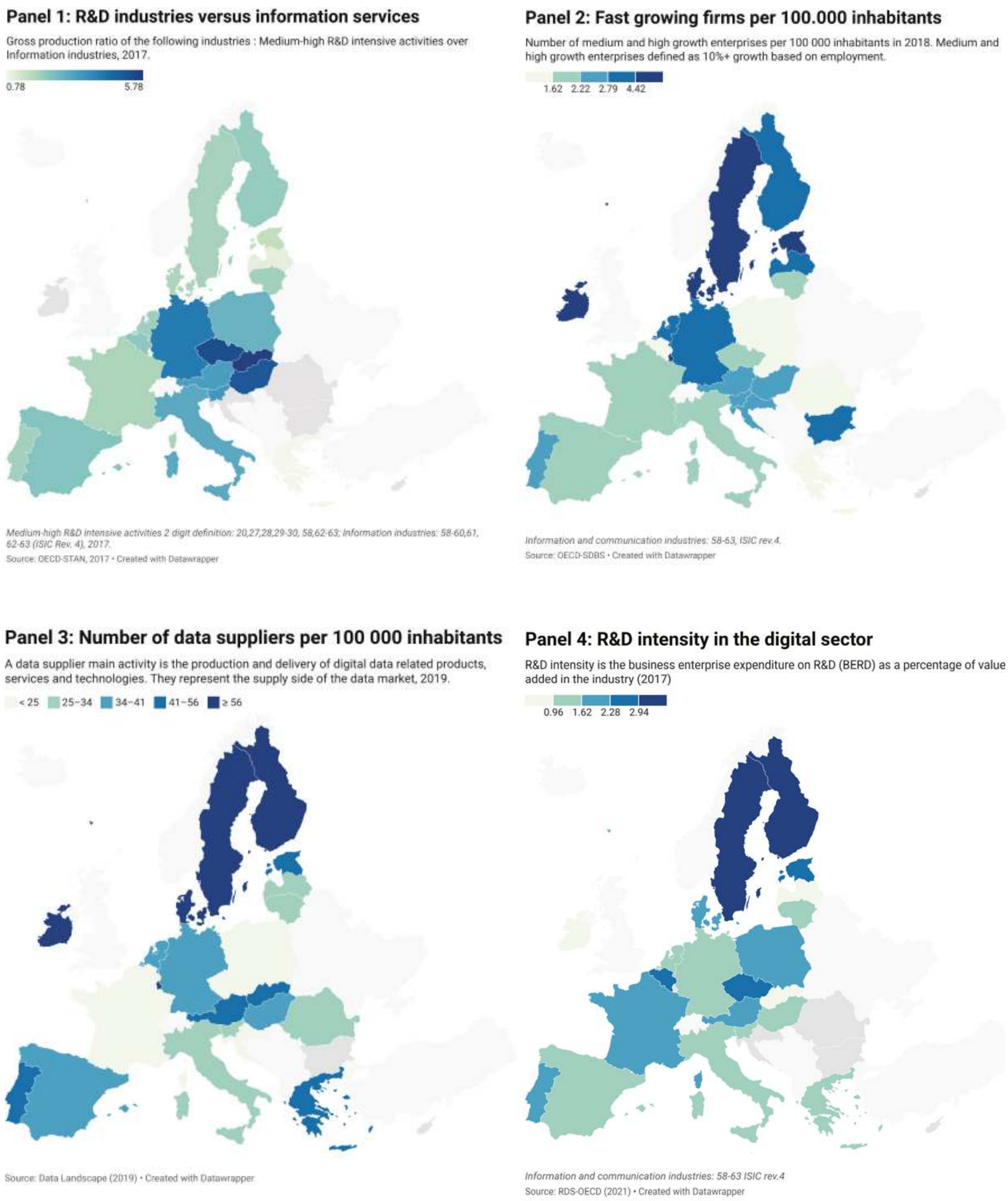
A final point to make is about Germany's industrial structure. Thanks to its strong manufacturing base, Germany is likely to see a huge potential in industrial platform development. A worldwide survey by The Centre for Global Enterprise found that Germany is the only European country with a company which appears in the top 10 publicly traded platforms (SAP). As Germany's industrial sector digitalizes, other industrial platforms too have started capitalizing on the prospects for IoT developments in the sector. Examples include ThyssenKrupp with its MAX platform, Lufthansa Technik with Aviatar, and Siemens with MindSphere. For all these activities, the ability to exploit data with AI will define their success and performance. Moreover, Germany also has some of the largest industrial robot producers, with Italy and France also performing well in that space.[20]

[18] Nayyar (2021); Atkinson (2018).

[19] The Netherlands also holds one of the top 5 cloud vendors with headquarters in Europe, namely Unit4.

[20] Leigh and Kraft (2018).

FIGURE 2.1: EUROPEAN COUNTRIES DIFFER IN INDUSTRY STRUCTURES AND ENDOWMENTS



2.2 United in Diverse Digital Policies

Let us now turn to the composition of relevant business and digital policies – and their differences across Europe. These differences matter for the analysis of the distribution of gains from digitalisation.

For instance, it has been clearly shown that data-related regulatory policies have first and foremost an effect on firms active in industries that are heavily reliant on software technologies.[21] For example, restricting the extent to which data can flow across borders is associated with lower productivity for firms reliant on advanced software technologies. Moreover, this finding is particularly strong for smaller firms. In this case, countries that are more dependent on smaller firms and industries that intensively use advanced software technologies are more affected by these restrictions than other countries.

More generally, the ability of firms to adopt digital technologies is affected by both trade and technology restrictions in digital sectors.[22] This explains why some European countries are performing well in terms of their exports and productivity in digital services – and why others are trailing. For instance, some Eastern European countries have a lower adoption of digital technologies in services sectors. At the same time, these countries also have some high restrictions on digital trade and technologies. That combination ultimately influences their capability to improve productivity through new digital technologies in these sectors.

Equally important is that digital services, and other business services heavily reliant on digital technologies, typically show high shares of value-added that are (indirectly) exported. These activities are also specialised and – to some extent – offshored. They have a greater share of R&D, which promotes specialisaiton, and higher levels of sales to other downstream sectors, leading many to offshore activties.[23] All this is crucial for the contribution that these services make to productivity and growth in a country. Indeed, the market structures in digital markets matter crucially for reaping these productivity gains, as we showed in the previous section.[24] And on top of the differences in market structures in Europe's digital economy comes the regulatory profile of a country: digital regulations affect the competitiveness and the ability of countries to exploit comparative advantages through investments in and the use of digital technologies.

[21] Ferracane and van der Marel (2020).

[22] van der Marel et al. (2020).

[23] Nayyar et al. (2021).

[24] van der Marel et al. (2020).

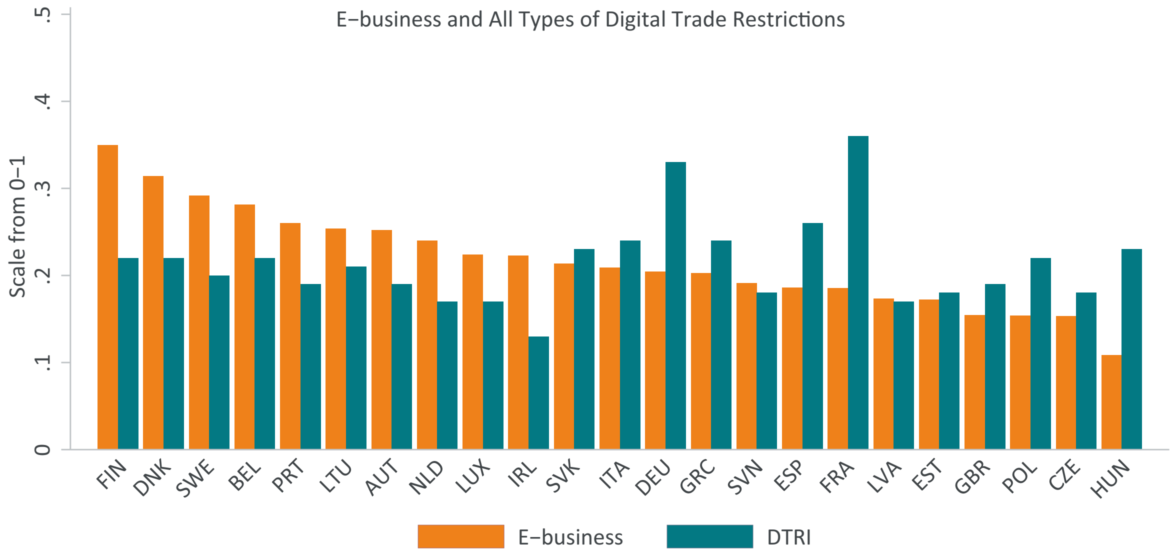
Regulations are therefore one of the major drivers for the competitiveness of a country in digital technologies and services. Recent research shows that across a wide set of countries (both developed and developing), a large proportion of the observed differences in productivity between services firms cannot be explained by standard economic explanations.[25] Even though firm characteristics such as size and capital-intensity, and general industry characteristics, explain almost half of this variation between countries, it is remarkable that an equally high proportion cannot be allocated to a specific characteristic of a firm or an industry. Most likely, cross-cutting factors affecting both firms and industries simultaneously – such as technology and regulatory quality – are likely additional strong factors that explain these differences.

That takes us to the differences in regulatory policies that influence the development and the use of digital technologies. Even if regulatory policies have similarities across countries and sectors, they may affect the quality of services for countries in different ways because countries have different market structures. A previous study by ECIPE showed that higher regulatory restrictions on digital trade and technologies more broadly affects the extent to which firms can adopt digital technologies.

These digital adoption rates differ starkly across countries, and the differences in digital and technology restrictions between countries appear to be highly correlated with the variation in adoption. Digital technologies include Customer Relationship Management (CRM) software, AI, and cloud computing – which are all component parts in the e-business indicator in Figure 2.2. As can be seen in this figure, digital adoption rates vary substantially between countries. It is equally notable in the figure that EU countries differ in how much they are still restricted in digital trade and technologies, captured by ECIPE's Digital Trade Restrictiveness Index (DTRI), is also substantial.

[25] Nayyar et al., (2021).

FIGURE 2.2: DIGITAL TECHNOLOGY ABSORPTION BY FIRMS (E-BUSINESS) AND THE DIGITAL TRADE RESTRICTIVENESS INDEX (DTRI)



Source: Eurostat, OECD, ECIPE; authors' own calculations. Note: See Annex C in van der Marel et al. (2020) for further details. E-business denotes the percentage usage of digital technologies by firms in each services sector. For the e-business indicator, the sector of business services is chosen.

Similarly, for online platforms such as search engines and e-commerce, it has been demonstrated that differences in digital regulations between countries are negatively correlated with a country's ability to create intangible capital (e.g. organizational capital, data, and innovative property).[26] In other words, the higher the restrictiveness of regulation on these digital platforms, the lower the intangible capital. More specifically, that study also demonstrated that this relation has implications for how digital capital services contribute to overall productivity. Much of the intangible capital that economies develop aims to increase the quality of goods and services, thereby raising productivity. Regulations therefore affect productivity.

Data from the OECD also shows great differences in the level of restrictive regulations in digital services between EU countries (Figure 2.3). The OECD's Digital Services Trade Restrictiveness (DSTRI) paints an overall picture where there are some clear country groups. For instance, several CEE countries like Poland and Slovenia, together with Germany, have a policy environment which is more restrictive than the OECD average. On the other spectrum of this chart, some Nordic countries, together with the Netherlands and Estonia, show much lower levels of digital services restrictiveness. Even though the overall level of these restrictions may be low, as in the DTRI in Figure 2.2, differences are nonetheless significant. Poland's level of restrictiveness is twice as high as

[26] Ferracane and van der Marel (2020).

in France and Spain, for instance. The result is similar for Austria when the country is compared to Denmark. These differences influence business decisions about adopting and investing in new technology.

FIGURE 2.3: OECD DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020)

Source: OECD; authors' own calculations.

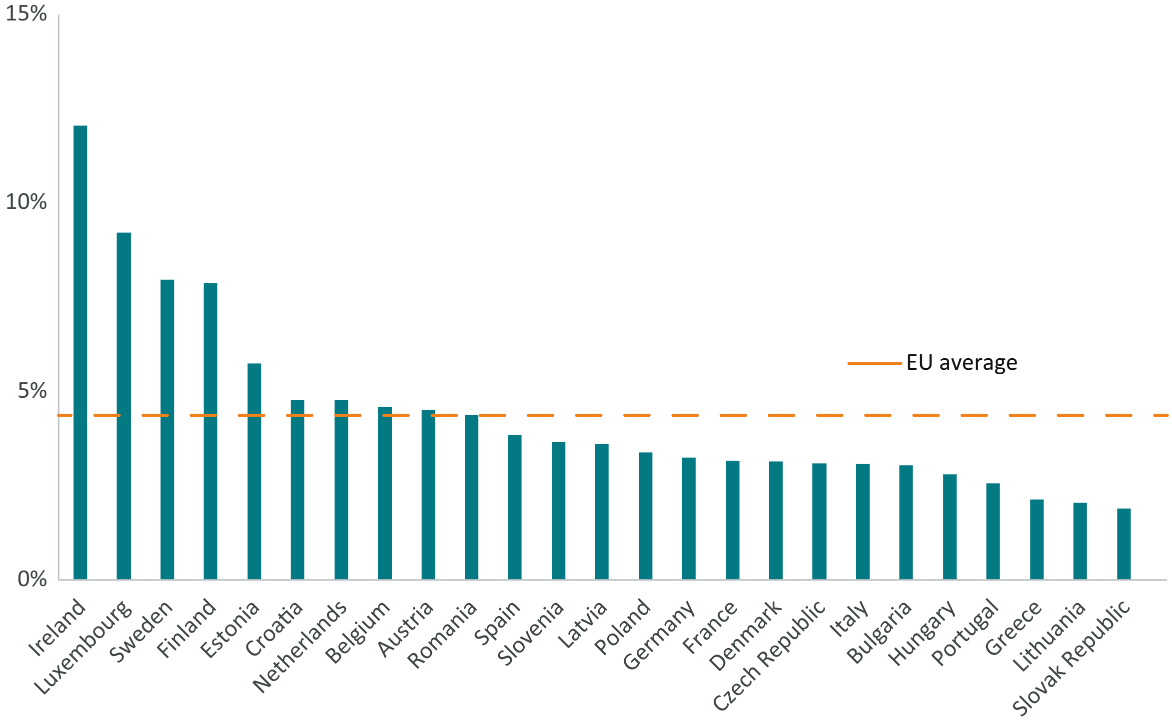
Moreover, some of these countries are not just restricted in digital services. Taking traditional product market regulations (PMR) ratings, an index of market openness also developed by the OECD, it becomes clear that several Eastern countries such as Romania, Bulgaria, and Poland have higher restrictions than the five best performing OECD members (see Figure 2.4). Similarly, France, Austria, and Belgium also have higher restrictions in notable product markets, which is in part due to their greater state involvement. Many of these countries, plus the Czech Republic and Estonia, still have relatively higher restrictions in place for start-ups too. Interestingly, the restrictions related to start-ups can be found in Ireland and the Netherlands as well. With economy-wide technologies such as AI affecting many traditional product markets, differences in regulatory policies are likely to affect countries' ability to tap into digital market with new technologies.

FIGURE 2.4: OECD PRODUCT MARKET REGULATION INDICATOR (2018)

Source: OECD; authors' own calculations.

Finally, it is not surprising that these different types of policy restrictions have an impact on how much each country trade in digital services. Figure 2.5 shows the share of digital trade in total trade, and points to some substantial differences between EU countries in their trade profile. Countries that are relatively more open and less restrictive in their policy attitude to the digital sector also have a higher share of digital-services trade in their overall trade performance. On the other hand, countries that are more restrictive also have a lower share of trade in digital services.

FIGURE 2.5: TRADE IN DIGITAL SERVICES (PERCENTAGE OF DIGITAL SERVICES TRADE OVER TOTAL TRADE, 2018)



Source: OECD; authors' own calculations.

3. MAPPING COUNTRY GROUPS AND THE EFFECTS OF DIGITAL REGULATION

Based on these differences in industry structure and regulatory policy related, we can categorize EU member states in different groupings. By doing so, it gets easier to understand how the DMA, the DSA, and the AI proposal are likely to affect EU member states with different conditions for their digital-economy performance. In this chapter, we will work with three country groups, namely "the North", Central and Eastern European (CEE), and six continental EU countries (EU6).

3.1 Three Country Groups and their Digital Profiles

The three country groups are set out in Figure 3.1. We are calling the first country group "the North" because the members of that group – Denmark, Finland, Sweden, Ireland, and the Netherlands – are all geographically positioned in the northern part of Europe. They are small and open economies, often at the "frontier" of digital technology – meaning that their digital endowments and performance are on par with the best-ranked innovation economies in the world. Their digital human capital is high, as we could see in Figure 2.1, and they often rank at the top in global comparisons of network readiness and innovation capability.[27] That is also why they are sometimes referred to as "digital frontrunners". Their digital economies are often highly dynamic, and their firms are intense users of new digital services and online platforms. They are also important producers of new technologies with high digital intensities in old and big companies, and with a strong performance in new firm growth. While these northern economies have their comparative advantages in somewhat different sub-sectors in the digital economy, they all trade more than other country groups in digital-intense sectors.

The second group are CEE countries – Croatia, the Czech Republic, Lithuania, Poland, Romania, Slovakia, and Slovenia. They are also comparatively small and open economies, and they rely on economic integration with other economies for the supply of data and digital services. They are not significant producers of new digital technologies, but they are increasingly offering digital ancillary services to companies in other EU countries. These economies have gone through a period of substantial structural economic change – in the decades that followed on their independence and the collapse of communism – and therefore have a firm profile that is uncommon. Due to high levels of firm exits in their transition phase, they have comparatively few old and incumbent firms and a comparatively high share of new firms. Some also feature unicorns. These firms are also growing faster compared to firm growth in continental Europe. However, firm growth is not on par with the North.

[27] Erixon and Lamprecht (2018).

Finally, the third category is called the EU6 and is made up of continental economies – Belgium, France, Germany, Italy, Portugal, and Spain. Except for Belgium and Portugal, these are comparatively large economies by European standards. Hence, they have stronger scale advantages than the other two groups. Their industry structure is based considerably more on manufacturing than digital services. Their digital intensities are higher than in the CEE but significantly lower than in the North. Furthermore, their firm growth is also weaker than in the North. While France and Germany have an absolute advantage in data because of their size, their data supply per capita trails the North. Moreover, even if France and Germany have more unicorns than other EU countries, their unicorn intensity (unicorns per capita) is much lower compared to countries in the other two groups.

FIGURE 3.1: COUNTRY GROUPS FOR THE EU'S DIGITAL ECONOMY

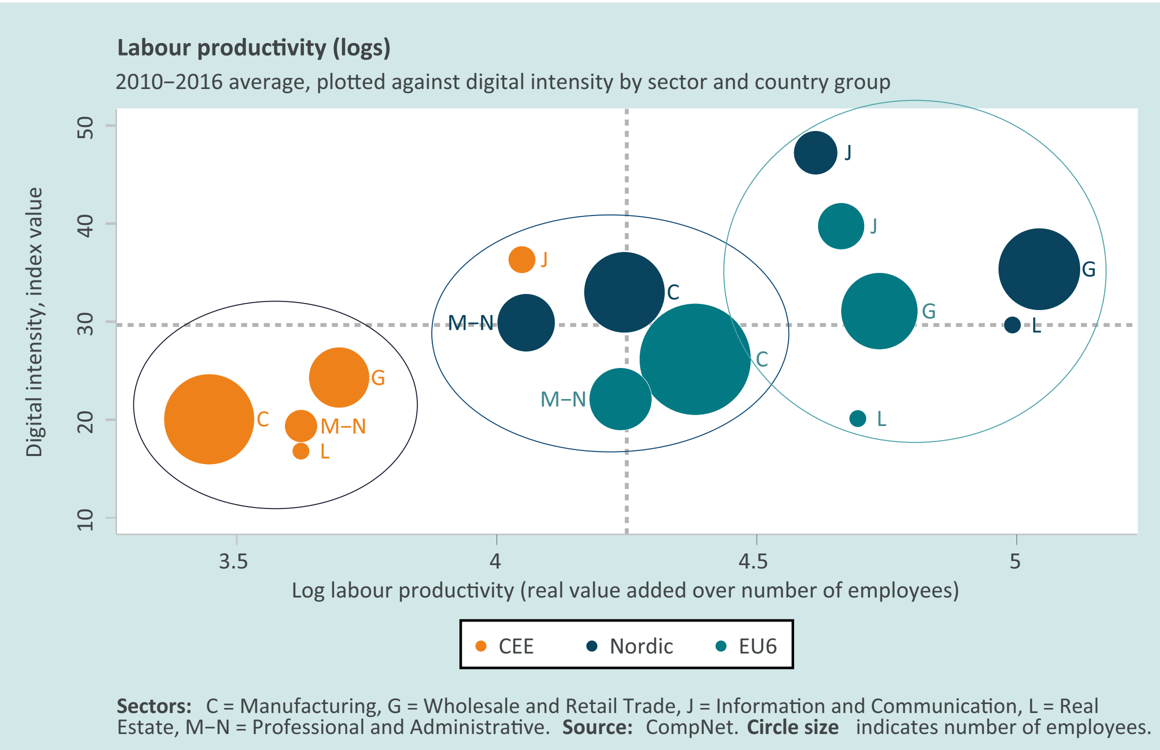
The North	The CEE	The EU6
- Small and open economies, dependent on cross-border exchange in digital technology and services; - Low digital restrictiveness overall. - At the digital "frontier" – with high levels of networks readiness and digital human capital; - High levels of new digital entrepreneurship: young and fast-growing firms and platforms; - High unicorn and app-intensity on the production side; - Relative strength in data supply and R&D value-added in digital sectors. - Includes: Sweden, Finland, Denmark, Ireland, and the Netherlands.	- Small and open economies, dependent on cross-border exchange in digital technology and services; - Higher digital restrictiveness than in the North and the EU6; - Distant from the digital "frontier"; - Few incumbent companies and many small firms – but not small-firm growth comparable to the North; - Digital users rather than digital producers, with companies offering digital ancillary services to other firms in the EU. - Includes: Croatia, the Czech Republic, Lithuania, Poland, Romania, Slovakia, and Slovenia.	- Typically larger economies with stronger scale advantages; - Comparatively strong in manufacturing and R&D-intensive manufacturing; weaker in digital services sectors; - More restrictive digital policy environment than in the North; - Incumbency advantages for old firms and weak firm growth, with comparatively few start-ups and unicorns; - Lower comparative levels of value added in digital sectors than in the North – more equal to the CEE; - Include: France, Germany, Italy, Portugal, Spain, and Belgium.

The three groupings also emerge distinctly if we look closer at productivity performance. Figure 3.2 illustrates the relationship between *firm-use* of digital technology and *firm-level* productivity. It shows that there is a tight connection between the two variables: the usage of digital technologies by firms is positively associated with productivity.[28] Digital

[28] Numerous papers have shown the strong positive relationship between digital technology usage and industry and firm-level productivity which by now has been robustly established in the academic literature. Examples include Bertelsmann (2019); Graetz and Michaels (2018); Cathles et al., (2020); Gal et al., (2019). Our Figure 3.2 merely points out to where the three country groupings with their sectors are positioned on the digital-technology-and-productivity map.

technologies are defined by the e-business indicator, the same indicator as in Figure 2.2.[29] This indicator covers technologies such as CRM software, cloud computing, big data, and online platforms. We have used the ECB CompNet database for computing the variable for aggregate firm-level productivity for each sector available. While the CEE group is obviously a group that is different from the other two groups, Figure 3.2 also shows that the North has consistently higher digital intensities than the other groups, and that the North and EU6 top the productivity ranking in an equal number of sectors.

FIGURE 3.2: LABOUR PRODUCTIVITY AND FIRMS' USE OF DIGITAL TECHNOLOGIES



Source: ECIPE, CompNet, and Eurostat. Labour productivity is defined as real value added over the number of employees. Following the specifications in CompNet, we only consider those companies with at least 20 employees. Digital intensity was produced using the ECIPE e-business indicator developed by Ferracane and van der Marel (2020).

In addition to this upward pattern – the higher the digital intensity, the higher the firm-level productivity – some other conclusions can be drawn from Figure 3.2.

For starters, in most digital-enabled sectors in the CEE group, productivity is lagging – and this low productivity level is paired with a low use of digital technologies by firms in the region. Even though many of these countries have firms with high growth potential (see Figure 2.1, third panel, in Chapter 2), productivity is still low in the digital economy. Any

[29] This e-business indicator is similar to the one developed in van der Marel et al. (2020) and is computed with Eurostat data.

regulatory policy in the (digital) economy that inhibits the start-up and continued growth of firms will therefore limit further positive productivity developments in the region. That's an important factor to consider given that the empirical literature finds that young firms with high growth potential often turn out to be big drivers of a country's aggregate productivity after they mature.[30]

Second, both manufacturing and digital-enabled services in the North and the EU6 show higher levels of productivity with greater digital technology usage by firms. They show medium measures of digital-technology penetration with somewhat higher-than-average levels of productivity. Firms in these sectors are therefore not outperforming the rest of the economy, but nor are they laggards. The CEE's information services sector also belongs to this group. Digital services in the region therefore seem to have outpaced all other sectors in the CEE group. It should be noted that both manufacturing and business services are relatively big sectors that employ many workers which can be read by the size of their bubbles.

Finally, the third cluster are the sectoral leaders (e.g. wholesale and retail, and information and communication). These sectors are in the North and the EU6 groups – more in the latter than the former – and are placed in the upper right corner of Figure 3.2. They are the information and communication sector, and the retail and distribution sector – and in the North, the real estate sector also qualifies into this high-performing group. Interestingly, retail and distribution are also a relatively big sector with many employees. In fact, in all three country groups, this sector is the second largest employer. The retail and distribution sector shows high productivity levels in especially the North.

However, the focus should not just be on the users of digital technologies. These technologies also improve the performance of producers – and the market itself. Take online platforms. Online retail platforms match the supply and demand of goods and services, thereby helping sellers and buyers to find each other and reduce information costs. Again, the North outpaces the two other groups. Besides having Spotify as Europe's leading online platform, the North also has the highest number of app-related jobs.[31]

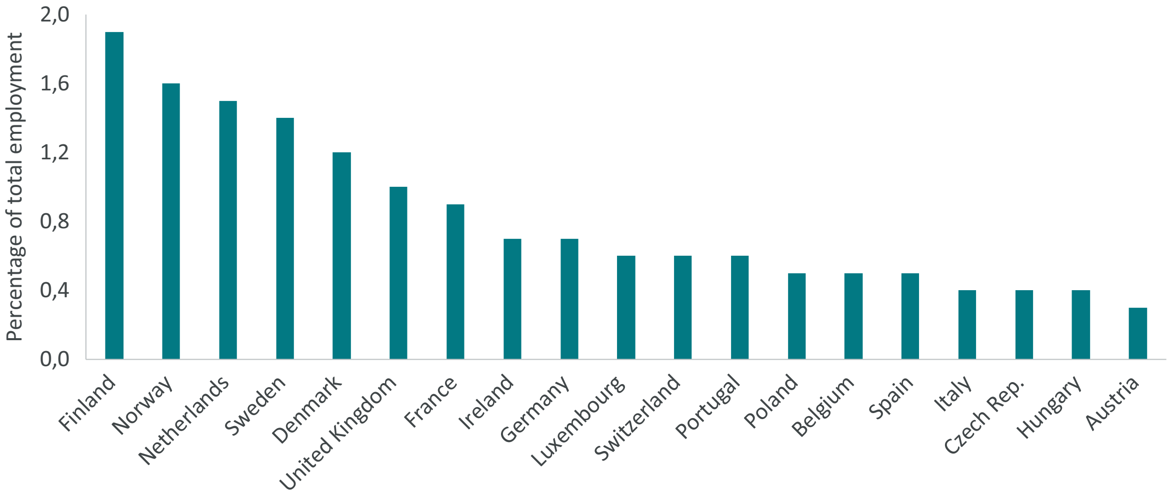
Obviously, in absolute numbers EU6-countries such as Germany, Italy, Spain, and France have more app-based jobs than smaller countries like Denmark and Finland. They also have some of the largest app developers in Europe. But that is likely to reflect the economic scale of these countries. Finland, the Netherlands, Sweden, and Denmark have an app intensity – defined as app-economy jobs as a percentage of all jobs – that is substantially higher. Their

[30] OECD (2015) and Andrews, Bartelsman and Criscuolo (2015).

[31] Szczepanski (2018).

app intensity is between 1.6 percent and 2.2 percent while the EU6 countries are either performing around the EU average of 0.84 percent or lagging – the latter is especially the case with Italy and Spain.[32]

FIGURE 3.3: APP-INTENSITY IN EUROPE



Source: Mandel (2016). Note: App intensity is measured as the percentage app-related jobs in total employment.

Some European countries are also better equipped when it comes to the more innovative platforms such as cloud computing, machine learning (ML), and big data. As previously mentioned, some larger EU6 countries have several strong cloud vendors. These countries, especially Germany and France, also host relatively many AI companies. In fact, Europe does not seem to be very much behind the United States in AI research and innovation benchmarks – even if there is a big difference in the level of AI investments between the two regions.[33] Furthermore, research shows that the production of these innovative technologies tend to benefit from agglomeration effects as the development requires a combination of leading universities, R&D-intensive industries, and deep levels of investment.[34] City regions in EU6 countries such as Paris, Madrid, and Berlin – but also Helsinki and Stockholm in the North – have therefore a good potential for future AI performance.

Some European countries are also performing better than others in operational technologies such as 3D printing and robotics. A strong manufacturing base appears crucial for these technologies. For example, some of the more industrialised countries in the EU6 (e.g. Germany) and high-R&D industry countries the North (e.g. Finland) have a higher share of robots per 1,000 workers. Since installing an industrial robot or a 3D printer entails a high

[32] Mandel and Long (2017).
[33] Craglia et al. (2018). EIB (2021).
[34] Boschma and Balland (2019).

fixed cost, only large enterprises can afford it. Ultimately, this tends to favour large-scale markets over smaller countries – and, hence, size matters for these technologies.

However, this does not imply that other countries are not profiting from this development too. As Figure 2.1 in the previous chapter illustrated, many CEE countries also have a good chance to profit from 3D printing and robotics. Slovenia, Slovakia, and the Czech Republic all have niche markets for outsourced manufacturing that can embed these technologies.

3.2 The Effect of Regulation on Different Types of Economies

There are different ways to map the effects that various digital regulations have on the economy. In the impact assessment of the DMA, for instance, the Commission argues that the increase in market contestability and the reduction of various big-platform advantages (e.g. network effects) will generate positive dynamic gains. In the Commission's economic analysis of the AI regulation, the argument is that the adoption of AI will increase as a consequence of the regulation (e.g. by creating more trust in AI applications), and therefore the gains will outweigh any costs. These propositions may be true. At the least, they are using some basic assumptions that undeniably are correct: market contestability is important for long-run economic development and trust in technology helps to increase adoption rates.

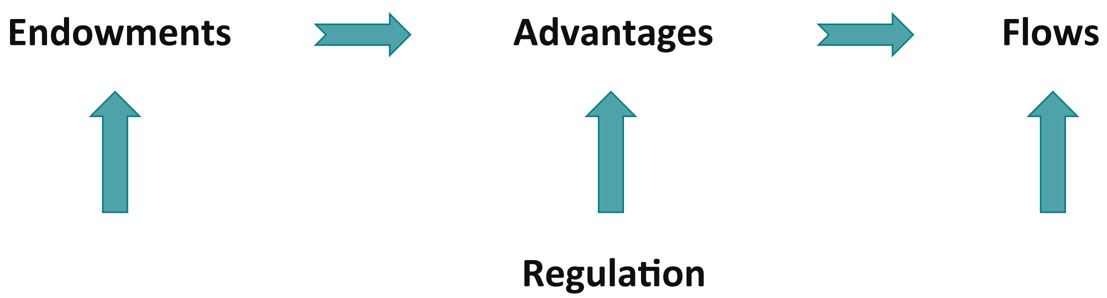
However, just like many other analyses of regulation, the macro-oriented approach can be a bit too abstract and distant from the firm, market, and regulatory factors that determine the distributive consequences of a regulation. The impact assessment that accompanies the DSA is a case in point.[35] It finds that better harmonization will increase digital trade and that the competitiveness of business users will go up, leading to a macroeconomic effect in the region of 0.3-0.4 percent of GDP in the EU. It also takes account of costs, but only the direct compliance costs – in fact, it finds no indirect cost to unfold because of the DSA.[36] Such an approach is inadequate. While some harmonization gains are likely, it is equally likely that the increasing cost of operating and using platform services will have an impact on users. Every time there are new regulatory restrictions introduced, there will be costs on the affected operators that will have an impact downstream. If this impact slows down the diffusion or adoption of new innovative technologies, the economic consequences can be substantial, and they would be different across countries and sectors. Since the DSA comes with a big catalogue of new regulatory restrictions, a full impact assessment should take account of their impact.

[35] European Commission (2020c).

[36] European Commission (2020c), Annex 3, Table 2.

One way to approach the distributive effect of the DSA – and, of course, the DMA and the AI regulation – is to map which different *endowments*, *advantages*, and *flows* would be impacted. The attentive reader will already have noticed that it is these three parts that we have covered previously in this paper: the "modern" and specific endowments that influence the shape of a country's digital economy; what different advantages and specialisations that emerge from these endowments; and what "flows" or "streams" that are created in the economy (e.g. movements in firm composition, investments in innovation, and trade) because of these advantages. Figure 3.4 sets out the model for how to think about understanding the effects of regulations on specific countries or groups of countries with different endowments, advantages, and economics flows. Figure 3.5 maps out further some of the more specific effects.

FIGURE 3.4: MODEL FOR UNDERSTANDING THE DISTRIBUTIONAL EFFECTS OF REGULATION

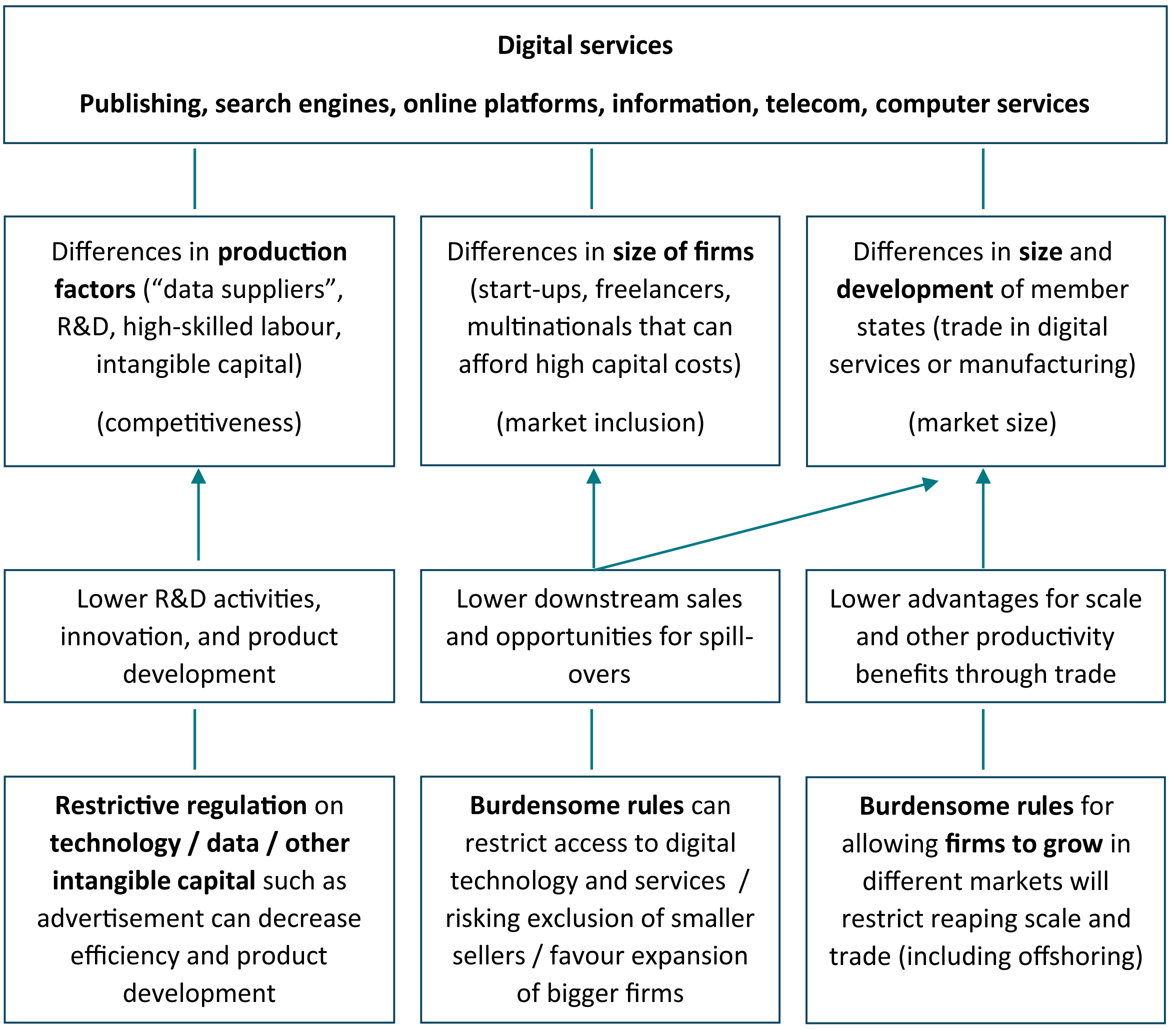


In cases when the new regulation restricts the use of *endowments*, the effects tend to be strong. Then, firms or countries will not be able to exploit their endowments – in our case, data, data-supply structures, R&D resources, and intangible assets (such as organizational capital using software), source codes, and more. Obviously, the effect is more significant in countries with comparatively strong endowments in these intangible factors.

Regulations can also impact directly on specific *advantages*. As we have seen, some European countries have comparative advantages in digital services and digital-intensive sectors while other countries have comparative advantages in R&D-intensive manufacturing. Some firms and countries have size advantages that drive the economies of scale in digital industries and sectors; others have size disadvantages and specialized their economies in other sectoral niches accordingly.

Finally, regulations can also impact directly on *flows* in the economy. For instance, a regulation can affect the portability of data between countries or trade in services that are digitally intensive – both measures that usually affect countries that are more dependent on flows as exporter or importer. Regulations can also restrict the relative balance between firms that are old or young, or big or small. Regulations that make it harder for young and small firms to grow, for instance, tend to increase the value of the size advantage for large firms. The economy then gets tailored to improving efficiency and chasing such gains, which typically happens in large companies. However, it also inhibits innovations coming from young and small firms, which often are important contributors to an industry's productivity growth.

FIGURE 3.5: MAPPING THE EFFECTS OF REGULATIONS



Source: ECIPE.

The effects of restrictive digital regulations are often that they reduce the ability to exploit a country's existing endowments (e.g. data and digital human capital). Take a country like Germany. German consumers have high digital skills and are close to the international frontier of digital use: they adopt technologies when they are introduced. However, German firms are distant from the international frontier of digital use, and there is a big gap between endowments and exploitation.[37] This means that any digital restriction will inhibit the ability of firms to grow with the expansion of these endowments: a restriction of the factor of production such as data will define the growth of new and digital firms. Such restrictions could therefore become a restriction on firm growth even if they primarily target endowments.

It may be possible for some companies to import from other countries the type of assets that would make up the for the affected endowments. For instance, buying data from a firm in another country or through labour (human capital) mobility. It is far more common, however, that business users import goods and services with these endowments embodied. When that is the case, downstream services can still operate and even flourish despite the restrictions that inhibit the exploitation of domestic endowment factors. But the domestic endowments stay restricted and cannot contribute as much to economic development as when their potential is exploited. The result is that some sectors and firms will be saddled with poorly performing technology. Some companies will move abroad to get better regulatory conditions for growth.

Hence, there are risks of *market exclusion* effects – something that has been visible in several regulations affecting the portability of data and trade in digital-intensive services. Market exclusion happens when access to digital technologies and services gets restricted. Some firms and users will then be excluded from the market because they cannot produce competitively anymore. For instance, the cancellation of the data privacy shield between the EU and the US have widened the efficiency gap between small and big firms because it is mostly small firms that made use of this scheme. That also became visible in the difficulties to trade for small firms after the repeal of the privacy shield. Likewise, the introduction of the GDPR affected the balance between large and small firms – leading to some market exclusion effects for firms and countries. The result reinforced size advantages. This effect was amplified by a reduction in investment in digital start-ups that came on the heels of the GDPR. While the long-term aggregate effects of these regulatory changes were unknown at the time, they had the effect of changing the relative importance of some advantages and disadvantages.[38]

The effects of restrictive regulations are therefore likely to be felt more strongly by smaller firms and smaller countries with few or no scale advantages. Small countries generally tend to have smaller absolute advantages – for instance, the volume of data and economic competencies – and usually must rely more on other factors than scale to compete. To be competitive, and to move closer to the digital frontier, they usually invest more in R&D,

[37] Bertelsman (2019).

[38] Nigel Cory, Castro and Dick (2020); Kearney / ECIPE (2021); Bitkom (2019); and Jia, Jin and L Wagman (2018).

intangible assets, and other digital endowment factors leading to higher digital intensities. If they are relatively endowment poor, they become more reliant on importing key digital technologies and services. Moreover, they typically have more space for young and fast-growing firms in their economies.

Importantly, the general point is that digital regulations tend to affect firms, sectors, and countries differently depending on their size and digital intensities. This effect is strong when we are studying the introduction of new and innovative technologies into the economy – a subject that is somewhat different from studying the effects of regulation in saturated markets and on mature economic behaviours.

There is still a substantial challenge ahead of all European economies to *diffuse* existing digital technologies and services in the economy. In other words, all countries need to improve the adoption and the use of digital technologies and services in many sectors and firms. Unfortunately, time is of essence as the competitiveness of firms that are developed early in a technological shift tend to be persistent over time. While laggard countries could be catching-up in the future, and benefit substantially from doing so, differences in economic performance are still likely to persist because frontrunners and early adopters develop more quickly the human capital, and the firm assets and know-how associated with new technology.[39] And these assets – human capital and firm structures – tend to have lasting impacts on the technology-induced economic performance of a country or a region. Hence, restrictions on the flows of digital technologies and services in the economy are crucially important.

3.3 The Effect of Regulation on Types of Technologies and Country Groups

Let us now look a bit closer at the country groups that we laid in the beginning of this chapter and connect them with the effects of regulations. To advance the analysis of how these regulations will impact different economies, we will sort them along the three types of technologies: transactional technologies (online platforms), informational technologies (cloud, big data, AI), and operational technologies (robotics and 3D). Table 3.2 provides an overview of these types of technologies and the importance to different economies (the country groups) of restrictive regulations – regulations that restrict the use of endowments, advantages, and flows. The table also evaluates which of the three country groups that are likely to be more affected by restrictive regulations given their current endowments, advantages, flows, and policy structures. The rank in each category is based on the data presented in chapters 1 and 2.

[39] See Mokyr (1992) and Brey (2021).

TABLE 3.2: TYPES OF TECHNOLOGIES AND THE EFFECTS OF RESTRICTIVE REGULATION

	Transactional (online platforms)	Informational (cloud, big data, AI)	Operational (robotics, 3D, IoT)
Exploiting endowments	1. North 2. CEE 3. EU6	1. North 2. EU6 3. CEE	1. EU6 2. North 3. CEE
Exploiting advantages	1. North 2. CEE 3. EU6	1. North 2. CEE 3. EU6	1. EU6 2. North 3. CEE
Flows: trade intensities and small-firm inclusion	1. CEE 2. North 3. EU6	1. North 2. CEE 3. EU6	1.EU6 2. North 3. CEE
Current policy design: conform to endowment and advantages?	1. North 2. CEE 3. EU6	1. North 2. EU6 3. CEE	1. EU6 2. North 3. CEE

Source: The categories are adapted from Hallward-Driemeier et al. (2020).

Naturally, all country groups will be affected by regulations that restrict certain aspects of a technology – the economic value of the endowment, for instance, or the exploitation of a comparative advantage in digital services or industrial AI. We assess in Table 3.2 how each country group is impacted along two different dimensions: the general competitiveness of the digital services and industry, and how smaller firms can potentially grow further given that many countries (such as in the North and the CEE) have smaller markets.

Transactional and online platforms have substantially increased the *competitiveness of existing industries* in all country groups, but especially in the North and EU6. They are great users of digital technologies nowadays, and some countries are also at the forefront of creating them. For instance, firms in the North are much more active users of B2C websites and apps through which they sell online. And the general observation is that the intensity of transactional and online platforms is higher in the North than in the EU6 (and, of course, the CEE). In other words, given the digital intensity in endowments and advantages, restrictive regulations on these two types of technologies will have a larger impact on output in the North than in the EU6 and the CEE groups. This policy is reinforced by the current structure of policy: policies in the North are more focused on allowing the comparative advantages in digital intensity to impact on the economy.

On the other hand, the growth and usage of online platforms also improve firm performance in CEE countries, and the effect comes to a large extent through the different flows – for instance, through trade and small-firm growth. While the proportion of firms in the CEE region using transactional and online platforms is the lowest in Europe, these technologies provide CEE firms with a vehicle to reach customers and partners, thereby helping the region to improve market inclusion by allowing their smaller firms to grow. Many CEE countries have strong market dynamics with many young firms that are still relatively small but are growing. Their policy is partly designed to exploit that advantage – but only partly: the CEE group would benefit substantially from reforms that reduce the restrictiveness of regulations that concern access to digital technologies and services. A greater use of transactional platforms is directly connected to the CEE group's ability to raise firm productivity. Restrictions may therefore cut access to these platforms or slow-down their diffusion which will have a stronger effect in the CEE group. While flow intensity is also important for the North, it is less important for EU6.

There is a similar pattern if we look at informational technologies. On the production side of the economy, innovative technologies such as cloud, big data, and AI are first and foremost impacting the large cloud providers in EU6 countries and the digital intense services firms and sectors in the North. While the North has endowments and advantages defined by intensity, the EU6 has smaller (but good) intensities but stronger size endowments and advantages. Consequently, restrictive regulations are more likely to have a stronger production and competitiveness impact on the North than on the EU6 since the latter group can fall back on its economic scale. This pattern is also visible in current policy differences between the North and the EU6: policy in the North is more tailored for digital intensity and policy in the EU6 aims more at supporting size advantages.

Obviously, the CEE group also profits from a more competitive market for innovative technologies, but in a different way. These markets help reducing coordination costs for firms using these technologies – for instance, in their participation in fragmented supply chains. Moreover, as cloud and ML / AI technologies are often embedded in computer software services, and other IT services, scaling up these technologies in Europe could help a CEE country like Romania, for instance, which has developed itself as an ICT hub in recent years.

Lastly, operational technologies such as IoT and 3D that automate industrial production are mainly of concern to the larger EU6 countries. Germany, as a strong industrial powerhouse with many large manufacturing firms, stands out. Another notable country is Italy, which is a big robotics producer and a country with some scale advantages. Italy is also a big user of IoT technologies on a per capita basis and is in line with the EU average on the adoption of 3D printing. On a per unit firm basis, Sweden, the Netherlands, and Denmark are also big users of these technologies because they have an industry structure that caters towards operational technologies. Operational technologies are capital intensive and usually is more common in firms and economies with size advantages.

For the CEE group, the picture is also mixed. Some CEE countries have the lowest use of operational technologies (e.g. Lithuania and Poland), but others are above the EU average. Slovenia, Slovakia, and the Czech Republic come out well in the comparison – partly because they have significant volumes of industrial outsourcing. In CEE countries with low adoption (and creation) of operational technology, there is a clear risk they will lag behind other countries even more. As many of these technologies favour big firms and have the purpose of saving labour costs, these technologies can sometimes be in direct competition with the current cost advantages of CEE countries.[40]

3.4 The DMA, the DSA and the AI Regulation: Reallocation of Digital Endowments, Advantages and Flows

Digital services and industries share several features that makes them a strong contributor to productivity and economic specialization.

For starters, digital sectors make it easier to offshore business activities and creative efficient structures of supply. That helps countries to tap into services like Business Processing Outsourcing (BPO), which are performed with advanced software tools and the Internet. Often, a lot of cross-border trade in business services builds on this type of outsourcing activities. Through trade, it allows countries to better use endowments and exploit cost and comparative advantages, and thus to advance their growth potential. Moreover, because trade costs are low for services traded over the Internet (often through online platforms), cross-border integration in digital technologies and services also enable smaller players to participate in outsourced trade.

Second, compared to many other services and industries, digital sectors also include a great deal of R&D activities. These innovative activities are often performed with other intangible capital that firms have built up over the years. Data is an obvious and important example of this intangible capital. However, we also know that one intangible asset underperforms when not combined with another intangible assets, such as innovative property, market research, and scientific R&D. Indeed, seminal research clearly shows that different types of intangible capital are complimentary and, when they are combined, have clear so-called "spill-over" effects. The effective use of one intangible capital stimulates the productive use of another, and the combined use generate greater economic benefits for firms.[41]

[40] However, this point shouldn't be exaggerated (European Commission, 2016; Ancarani et al, 2019; Artuc, Bastos and Rijkers, 2019). A study by Hallward-Driemeier and Nayyar (2019) nonetheless shows that higher levels of robotization in Europe's advanced economies such as France and Germany are associated with a lower share of FDI going to the lower income countries in the European (and Central Asian) region.

[41] Westlake and Haskel (2018).

This observation is important in light of some regulatory trends (for instance, in the Digital Markets Act) that aim for a control over how different endowments like data should be combined, or – rather – not combined. Intangible capital or digital endowments should be combined with other assets and endowments, and that usually happens through market cooperation. Regulations that have the effect of locking assets into a firm, sector or country prevent smooth market cooperation between different assets and endowments, and give a premium to those with the capacity to host all relevant assets "in house" – especially large firms and large countries. Take the basic tenet of the proposed AI regulation, which seeks to define the degree of regulatory restriction based on the ethical risks associated with a certain type of AI development. It combines a categorization of risk with a categorization of market access for certain types of applied AI technologies. This may be the right approach to regulating AI, but there will be indirect costs following on the heels of the regulation. Such an approach to regulation tends to discourage offshoring and favour corporate solutions that make assets indivisible. There is then a direct benefit of keeping all assets in the same company and the same country to avoid regulatory risks associated with offshored or fragmented assets.

An example of this is digital intermediate services – a big part of the digital services market. Providers of digital services are great "sellers" of their intermediate inputs to other downstream sectors. For instance, cloud services are used by many companies as an intermediary input, and when the digital assets of a cloud provider are combined with, say, the intangible R&D assets of a car manufacturer, the net result is greater than the inputs. There is a rich academic literature suggesting that services inputs, free from restrictive regulations, generate greater productivity and trade benefits for downstream users, in particularly industry sectors. For instance, in OECD countries as well as less developed countries, a more restrictive policy environment in services has a negative knock-on effect in economy-wide activities.[42] More recently, studies have found that this also matters for regulations of online platform technologies and data, showing that restrictive regulations are also negatively associated with business performance in using industries and services.[43]

A final economic aspect of the digital sector that is important is that it helps firms to scale up. Data as well as digital technologies and services need scale to become useful, and this is a feature that digital services share with the manufacturing sector. Market size is therefore an important ingredient for higher productivity. Traditionally, the need for producers to stay close to consumers in many services, and the fragmentation this entails, has often prevented the pursuit of higher productivity gains. Thanks to digital technologies, this "proximity burden" has gradually been removed by new ways to promote storability, modifiability, and

[42] Barone and Cingano, 2011; Arnold et al., 2015; 2011.

[43] Ferracane and van der Marel, 2021; 2020a; 2020b.

transferability in many digitally-intense services – just like in the manufacturing sector. Increasingly, this happens to digital-enabled business services too. Scale is also an important factor for the ability of firms to combine accumulated capital with technologies, such as in the creation of cloud and data centres. These activities are very expensive.

These observations concern the firm and market mechanics of digital endowments, advantages, and flows. They make an important context for understanding how new digital regulations can interfere with natural and technology-driven market and firm changes, and have strong impacts on economic outcomes. These outcomes are indirect and less associated with the direct costs of a regulation already identified by the European Commission. The DSA is a case in point.

As noted previously, there are several parts in this regulation that will create new administration and compliance costs for online platforms. However, the DSA is most likely to prompt indirect costs as well. For instance, it is likely to reduce the incentives to outsource business activities to third parties. Consider the DSA provisions that create "know-your-customer"-type of rules for platforms, which will make it far more likely that platforms will separate business services connected to users of platforms, and that user firms will contract with platforms. Another example: the DSA requires platforms to maintain the traceability of traders, and that process will likely make data services less divisible. Companies will be less incentivised to outsource and offshore such services. Moreover, such a regulation raises the cost for hosting transactions on a platform, and small traders that do not generate much income for a platform are likely to feel the pressure. Probably, some platforms will reduce the ability of small traders to transact on the platform, leading to market exclusion effects and improving the size advantage of big firms.

The broader issue is the general access to online platforms for businesses and how that brings advantages and disadvantages between firms, sectors, and countries. If big platforms are cautious and exclude those for which the costs are too high, it would especially disadvantage small and young firms. Hence, countries with a high proportion of small and young firms would be more damaged than countries with big and old firms. These disadvantages would affect CEE countries the most – and not just because of their high share of small and young firms. Some of the CEE countries also have a disproportionate share of digital services that gain from activities mediated through transactional platforms (Table 3.1).

Furthermore, other elements of the DSA will also have the effect of raising the transaction cost for using platform services. Adding various forms of regulatory burdens – like requiring independent audits of systemic platform risks and transparency on online advertising – and threatening with very high penalties in the event of non-compliance do not just lead to a direct cost. If there is a raise in VAT or import tariffs, the real cost does not come from the increased bill or import duty but the changes in market behaviour they generate. The same conclusion holds for regulations: they can increase the administrative cost, but the real question is what behavioural change and resource reallocation they prompt by firms?

The big economic risk with the DSA, and the DMA, is not the administrative burden. It is the market access and the services that will no longer be available or affordable which should take up our attention. Higher transaction costs from digital regulations, for instance, have the effect of raising the cost of intermediate services, which influences intermediate sales downstream. Such costs affect every user, but they especially have an impact on downstream industries that benefit from competitive services. As shown in Figure 2.1., Germany and CEE countries would be impacted.

Similar questions should be asked about the DMA: how will resources be reallocated, and how will market behaviour change, because of the regulation? Again, the Commission's impact assessment finds dynamic gains of the DMA, but – incredibly – no dynamic costs, only direct compliance costs. But the challenging provisions in the DMA relate predominantly to digital endowments and the restrictions of them – specifically, how firms can build up and use intangible capital. These restrictions will almost certainly prompt economic costs, and these costs will motivate resource reallocation between big and small firms and countries.

As discussed above, there are strong complementarities between different types of intangible capital. The ability of a firm to build up data, for instance, will impact its capacity to spur innovation in the wider R&D ecosystem – in areas such as AI, app development, cloud computing, and more. This is the key point in the Commission's new thinking about industrial policy. If one type of capital or assets in a sector is inadequate, it will affect the quality of other capital and assets. Hence the need to consider the entire industrial ecology: how different capital and assets are developed and combined with each other. For instance, the Commission says that for Europe to be competitive in electric vehicles, there is a value to have access to research and competitive output in vehicle batteries. Similarly, to be at the frontier of developing green steel, a firm or a country need access to competitive hydrogen. The same holds for digital services: to be competitive in downstream digital services, companies and countries need competitive platforms.

However, the DMA builds on the assumption that endowment or asset combination should be prevented, if they are pursued by gatekeeping platforms. A core part of the DMA has the explicit intention of making it harder for firms to combine different sets of data, and the obvious result is that gate-keeping firms will have to reduce the usefulness and competitiveness of the services they deliver or otherwise would deliver in the future. Other provisions have the same effect of influencing how companies build up data as an intangible capital, even though the language is softer and the actual content remains to be further specified.[44] Evidently, these parts of the DMA are most inhibiting for the big data supplying countries – countries with endowments and that have built comparative advantages based on these endowments – offering innovations on the back of transactional and information technologies. Countries like Sweden, with relatively strong endowments and home to data generated by gate-keeping platforms, will obviously be affected.

Moreover, several parts of the DMA aim at other innovation features of digital firms such as advertising and search engine development. Several articles of the DMA come close to trespassing on the intellectual property of gatekeepers. These obligations could reduce the endowment value of the propriety information of digital firms, thereby reducing the incentive to develop other services with new innovations. The general issue is that these articles can force the disclosure of algorithms, trade secrets, and other intellectual property directly connected to endowments and that are combined with other intangibles and used to create digital services. These restrictions would in particularly hurt the countries that show very high-level R&D activities such as Belgium, the Netherlands, Denmark, and France.

Endowments and advantages may also be affected by the DMA when it comes to scale. A more structural constraint that the DMA prescribes is the definition of gatekeepers. In Article 3, the DMA clearly sets out under what conditions digital firms are designated as gatekeepers. Regardless of the exact threshold for designation, the article aims to regulate the aspect of scale that the big digital firms enjoy. This could influence market and resource reallocation. Scale is an essential feature for the big online platforms, but also for other digital firms that are building up capacity for technology and innovation. And even though the relationship between firm size and productivity benefits is somewhat weaker in services compared to manufacturing, this link is nonetheless the strongest for ICT services.[45] Digital technologies have reduced the need for the physical proximity in these services, allowing firms to offshore tasks as they scale up – something that some CEE countries are already profiting from.

As a result, the threshold that defines the designation of gatekeepers could provide an incentive for digital firms to self-impose a limitation on scale to avoid burdensome regulatory obligations. And this is not just about the DMA; the DSA also comes with stronger regulatory obligations for so-called "very large platforms". Such a self-limiting effect is particularly likely if the quantitative threshold is too strict, narrowly defined, or subject to changes.

[44] Article 6.1(a).

[45] Berlingieri et al., 2018, Nayyar et al., 2021.

Interestingly, on that latter point the DMA empowers the European Commission to adjust the quantitative metrics for designating gatekeepers. Moreover, the DMA also allows the Commission to identify gatekeepers by qualitative means, after a market investigation takes place. Such an approach could create uncertainly in the market and could potentially lead fast-growing platforms to conclude that they prefer the status quo and to avoid changing the business strategy even if new opportunities are presented. After all, a designation can imply losing the opportunity to keep trade secrets, which would have a knock-on effect on endowments and advantages.

3.5 Concluding Comments

The core message of this chapter is that the DSA, the DMA and the AI regulation will come with costs that extend widely beyond the direct costs that the Commission has taken stock of in their impact assessments. These costs will be distributed differently across firms, sectors, and countries – depending on their modern digital endowments, the costs and benefits that emerged from these advantages, and the flows generated from them. It is highly likely that these distributive effects will be substantial. Moreover, they are likely to be exacerbated once current policy structures, and how new digital regulations relate to existing policies, are factored in.

Obviously, current industry structures will be a main determinant of how the gains and costs of the new digital regulations will be distributed across countries. Importantly, size will matter for the distribution of the effects. Young, small, and fast-growing firms will be more exposed than large incumbents. Likewise, countries with size advantages will fare better than countries with size disadvantages. Countries that have developed comparative advantages in digital intensities and digital niches may find that current and new regulation will prompt an asset reallocation towards countries that are big and have big firms. Countries that produce and export digital services disproportionate to their size are likely to feel the strongest effect of restrictive regulations. Often, these are smaller countries that do not control the full value digital chain but rely on fragmented and offshored productions structures. They rely on endowments to be made divisible to build their own competitive advantages. However, the regulations covered in this study will likely have the effect of making the value chain more indivisible. Likewise, countries that are outsourcing hubs will be affected by such a direction in the market.

In the country groups we have studied, the North and CEE countries are likely to face higher costs and be more affected by the economic reallocation that the DMA, the DSA and the AI regulation will prompt. They are smaller economies with few size advantages, and they also have higher shares of young and growing firms. Their pattern of specialisation in the digital economy as well as the entire economy build on these important factors.

The EU6 group will also be affected, but in a different way. Given their economic and firm structures – and the relative size advantages they enjoy in the European economy – they are likely to see some benefits from the economic reallocation. The more that regulation forces endowments to be centralised and indivisible, the more economic opportunity will be created for large economies and large firms. There will also be costs for countries like France and Germany, but these costs are likely to be different from the costs that the North and the CEE groups will carry.

It is important for European policymakers to now consider how they can avoid that new digital regulations continuously reinforce size advantages for big economies and big firms. There are some policy strategies that should be considered. First, regulations can be changed to better fit the overwhelming evidence that young, dynamic, and innovative firms drive a substantial part of productivity growth in the economy. Second, EU and national policymakers can pursue policies that make the transition into a more size-balanced economy easier, for instance by taxing and regulating small firms differently. Smaller economies can also be helped by having corporate taxes that are lower than in big economies. Third, EU and national policymakers can reform other digital and business regulations and make them less burdensome. Fourth, the EU can help to support the build-up of digital advantages in smaller economies.

4. COUNTRY EFFECTS OF NEW DIGITAL REGULATIONS

4.1 Belgium

The impact of the EU's DSA, DMA, and AI regulation in Belgium will depend on Belgium's digital endowments. Belgium shows a high level of R&D in the digital sector, and a higher percentage of firms using digital technologies than the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 25 thousand people worked in the apps sector and in 2019, 31% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in higher digital intensities – and digital advantages that lead to a strong flow of resources. Trade in digital services represents 5% of Belgium total trade. On a per capita basis digital services trade is above the EU average. Belgium's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Belgian economy suffers from some of these restrictions, particularly in infrastructure and connectivity. The indirect costs of the regulations are likely to be felt more strongly in Belgium than in the EU average.

TABLE 4.1: DIGITAL INDUSTRY STRUCTURE

	Belgium	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.3	2.6
Number of fast-growing firms per 100,000 people (2018)	1.3	3
Number of data suppliers per 100,000 people (2019)	23	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	5.3%	3.2%

FIGURE 4.1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

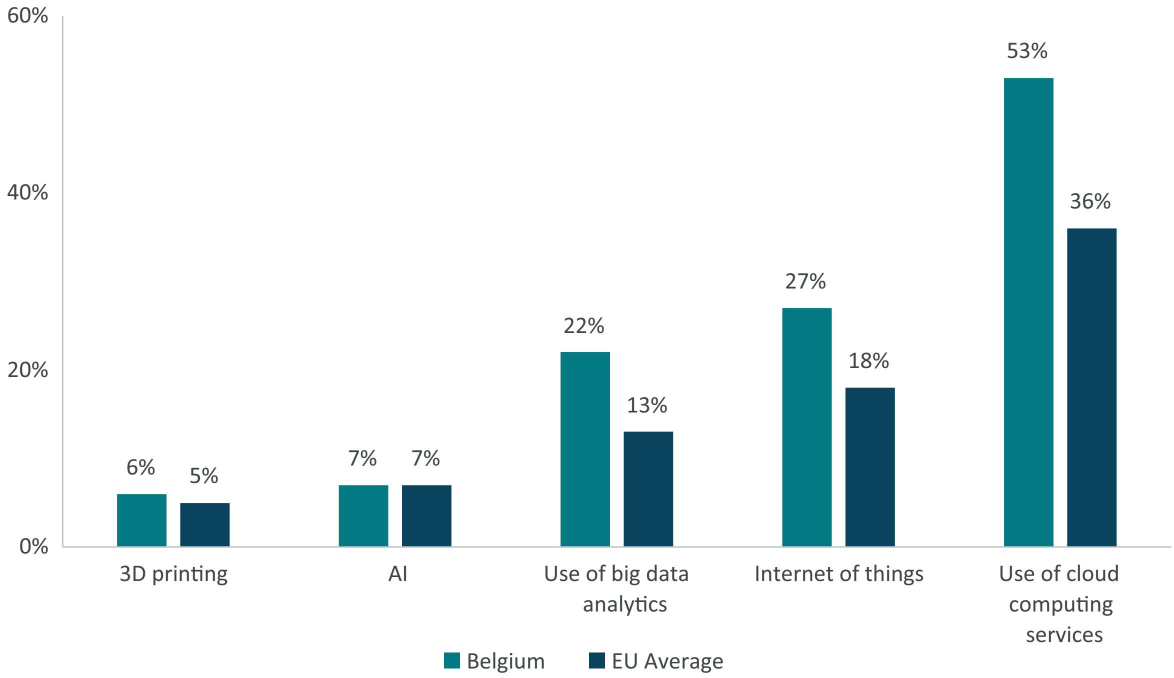


FIGURE 4.2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

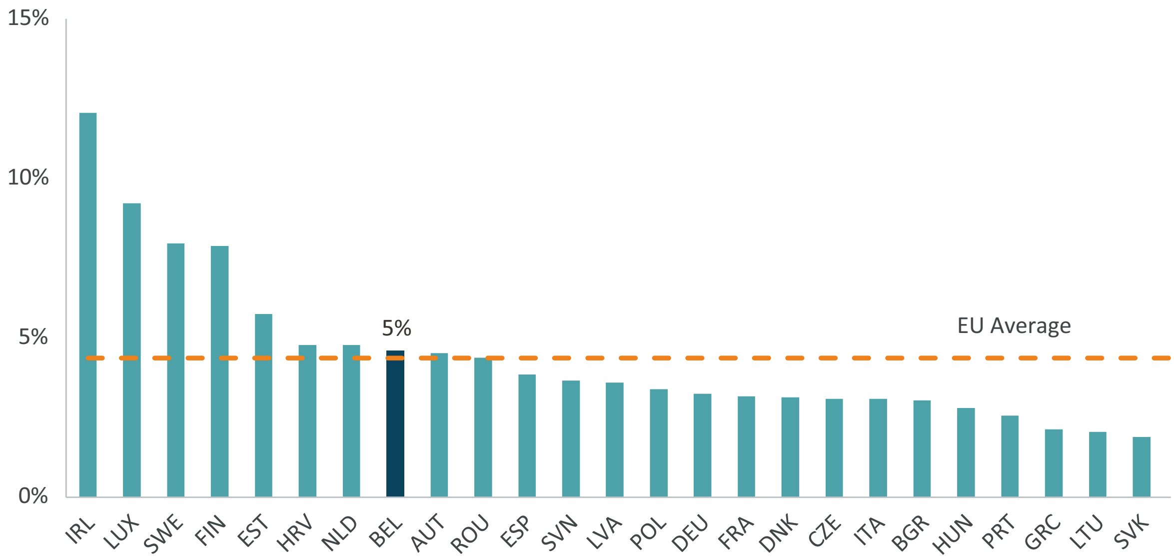


FIGURE 4.3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)

4.2 Bulgaria

The impact of the EU's DSA, DMA, and AI regulation in Bulgaria will depend on Bulgaria's digital endowments. Bulgaria shows a level of R&D in the digital sector similar to the EU average. However, the percentage of firms using digital technologies is consistently below EU average. The use of the digital endowments leads to a specialisation in the digital sectors. In 2019, 11% of businesses used e-commerce to sell their products, which is lower than the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Bulgaria total trade. On a per capita basis digital services is the lowest across the EU. Bulgaria's ability to transform its digital endowments to its advantage depends on its regulatory restrictions. The Bulgarian economy suffers from some of these restrictions, especially the administrative burden on start-ups. Bulgaria's chief digital mission is to improve its digital endowments and diffuse digital advantages in the economy, leading to a higher degree of specialization. Restrictive EU regulations will add to a restrictive domestic environment, but the chief focus of Bulgaria's digital reforms should be domestic and not international.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Bulgaria	EU Average
Number of fast-growing firms per 100,000 people (2018)	2.9	3
Number of data suppliers per 100,000 people (2019)	18	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	3.2%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

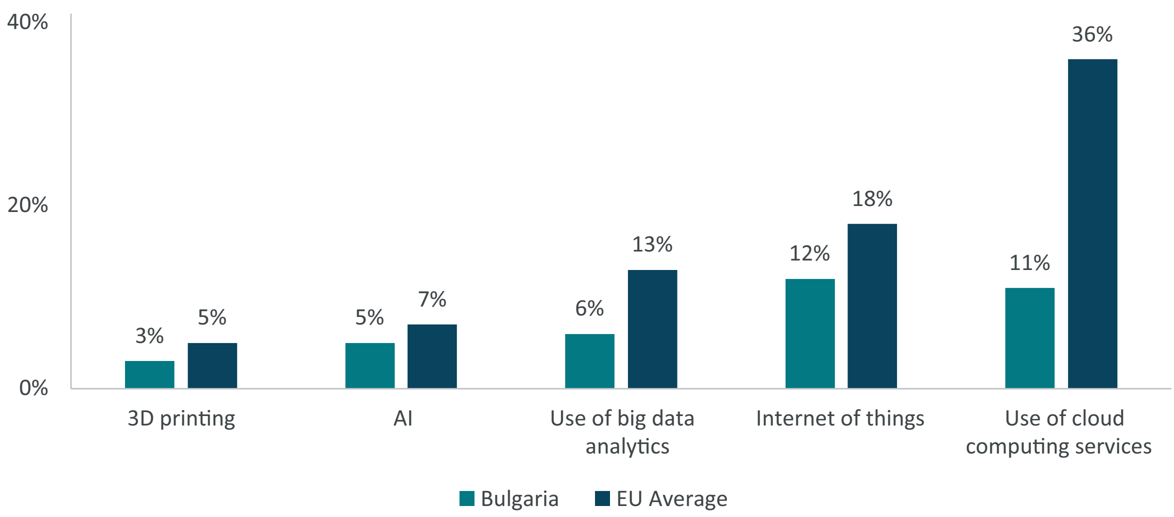


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

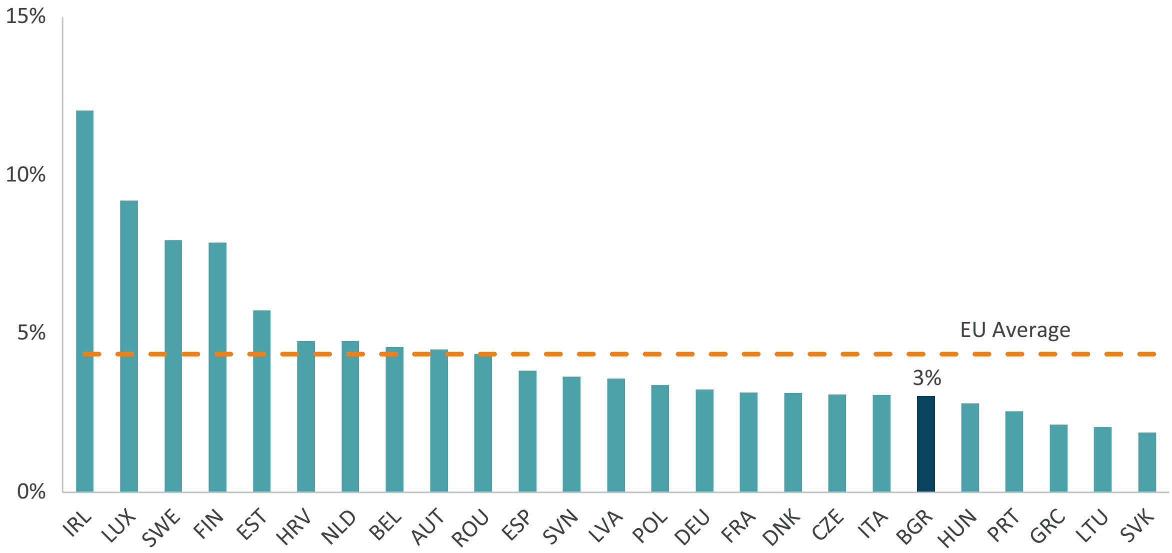
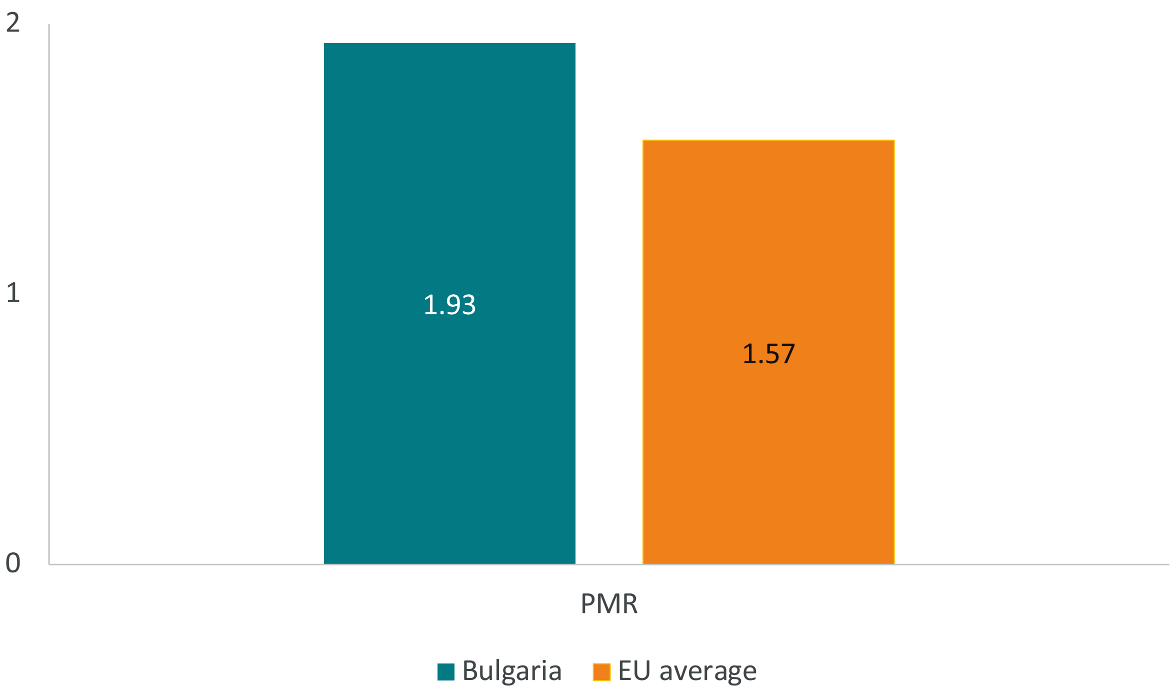


FIGURE 3: PRODUCT MARKET REGULATION (2018, OECD, SCALE 0-6)



4.3 Croatia

The impact of the EU's upcoming DSA, DMA, and AI regulation in Croatia will depend on Croatia's digital endowments. Croatia shows a low level of R&D in the digital sector and a small number of data suppliers, which means it relies on the import of digital assets from abroad. However, the percentage of firms using digital technologies is similar to the EU average and suggests a relatively high pace of digitalization and specialization. The use of these endowments leads to a specialisation in the digital sectors. In 2019, 22% of businesses used e-commerce to sell their products, which – again – is equivalent to the EU average. This specialisation results in a flow of resources. Trade in digital services represents 5% of Croatia total trade, while on a per capita basis digital services trade is below the EU average. Croatia's ability to transform its digital endowments to its advantage depends on its regulatory restrictions. The Croatian economy suffers from some of these restrictions, notably restrictions on public ownership of network sectors. Regulations making digital assets more indivisible will negatively impact on the Croatian economy because it is an outsourcing hub in digital sectors.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Croatia	EU Average
Number of fast-growing firms per 100,000 people (2018)	2.4	3
Number of data suppliers per 100,000 people (2019)	19	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	0.7%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

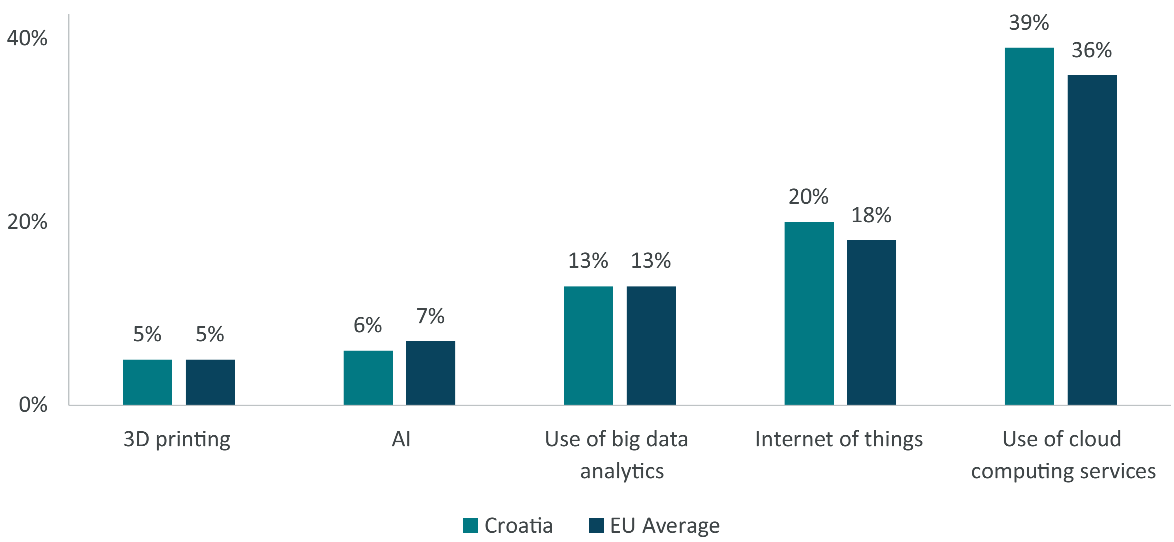


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

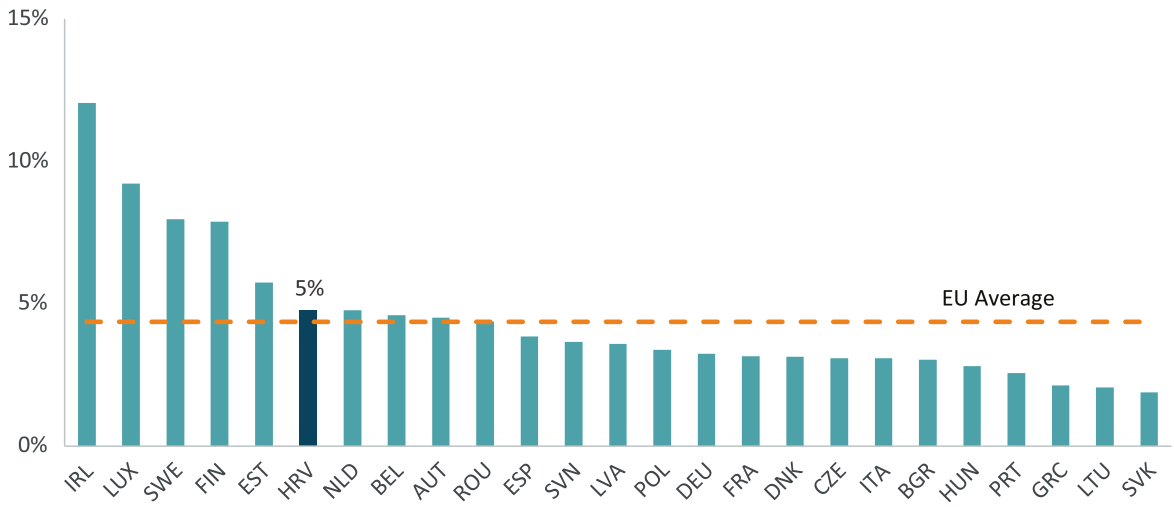
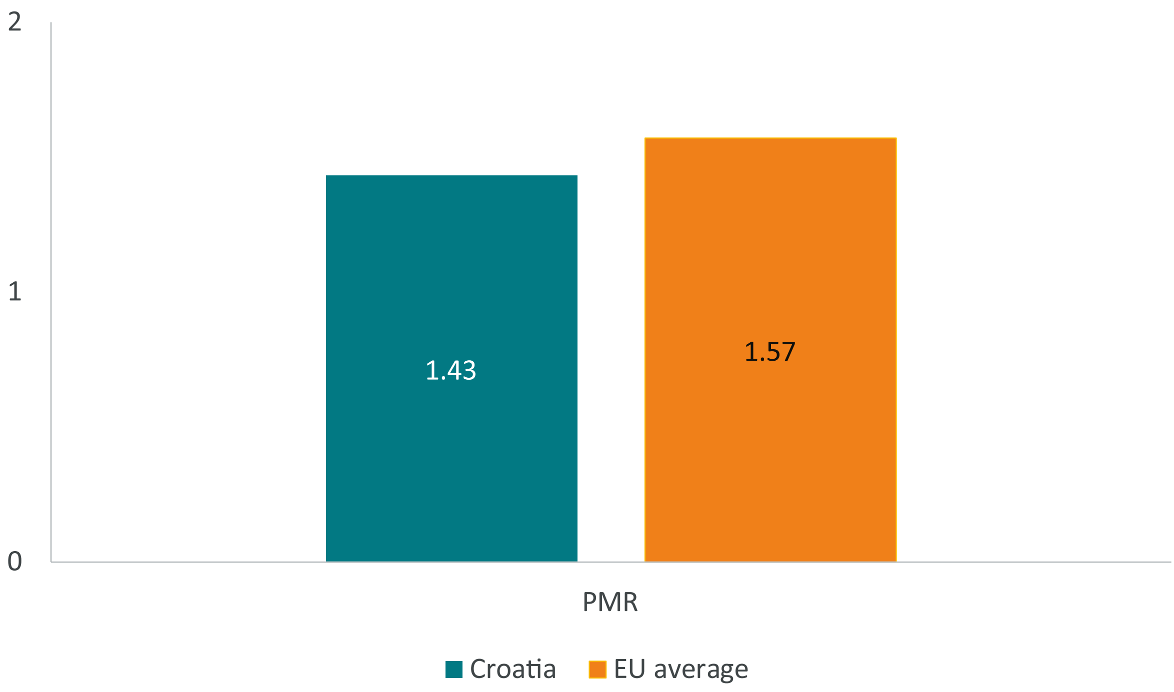


FIGURE 3: PRODUCT MARKET REGULATION (2018, OECD, SCALE 0-6)



4.4 Czech Republic

The impact of the EU's upcoming DSA, DMA, and AI regulation in the Czech Republic will depend on the Czech Republic's digital endowments. The Czech Republic shows a high level of R&D in the digital sector, and the percentage of firms using digital technologies is similar to the EU average. Notably, the Czech Republic ranks first in the EU as users of the Internet-of-Things. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 39 thousand people worked in the apps sector and in 2019, 30% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Czech Republic's total trade. On a per capita basis, digital services trade is below the EU average. Czech Republic's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Czech economy suffers from some of these restrictions, particularly in infrastructure and connectivity, but less so than in the EU average. Given its digital intensities and specialized pattern in the digital sector, the Czech Republic is likely to be disproportionally affected by the indirect costs emerging from new digital regulations. However, these effects will be moderated by asset concentration to larger firms and participation in international digital supply chains (especially in IoT).

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Czech Republic	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	5.4	2.6
Number of fast-growing firms per 100,000 people (2018)	2.2	3
Number of data suppliers per 100,000 people (2019)	21	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	4.2%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

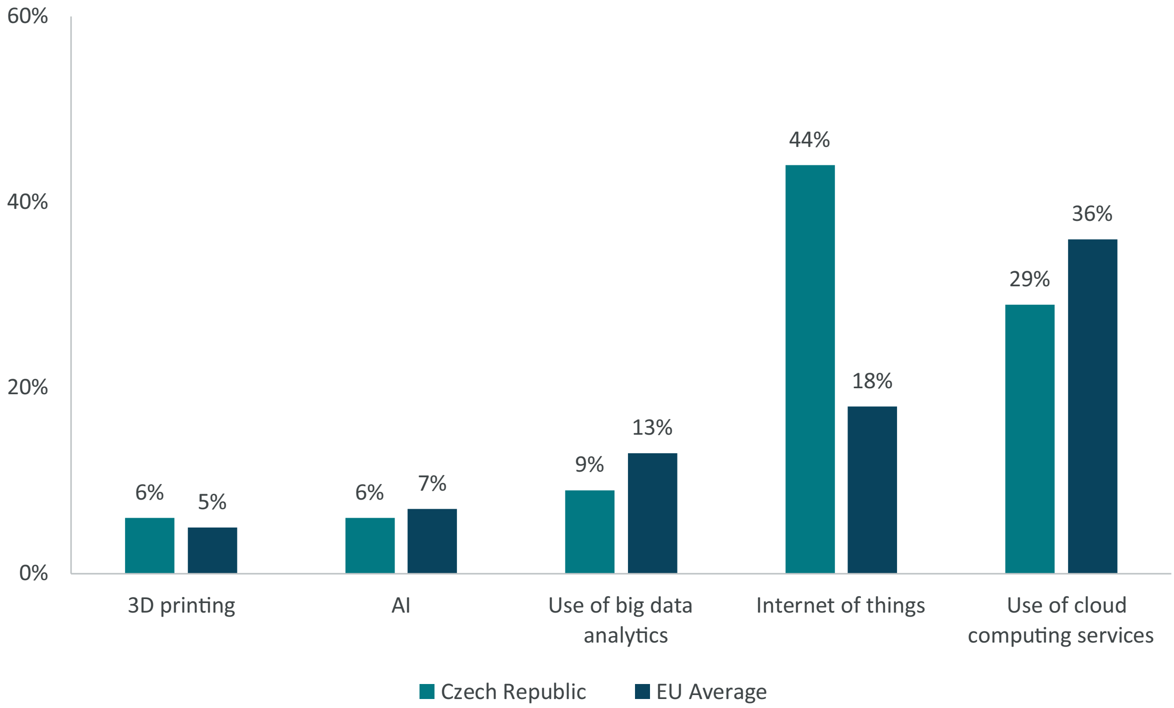


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

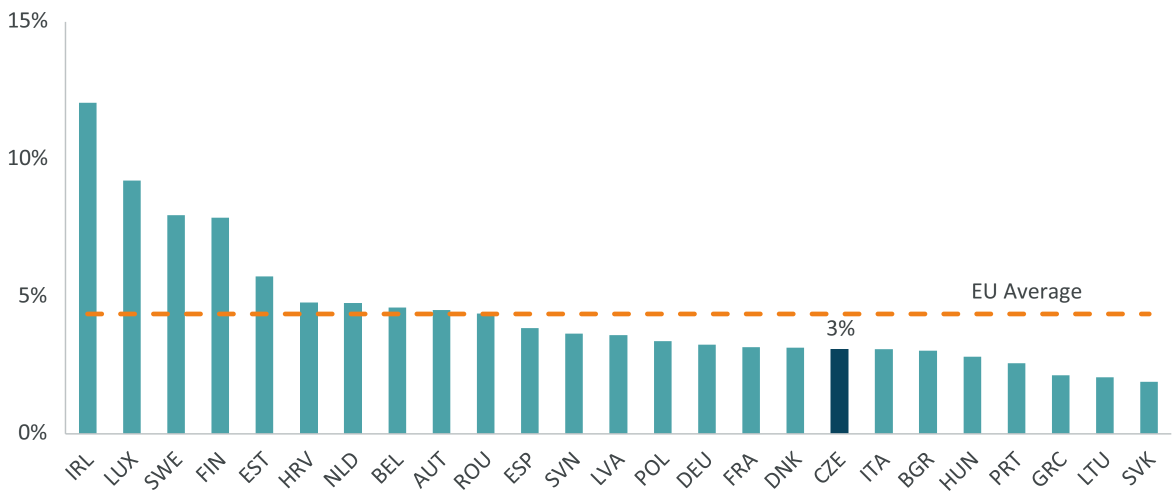
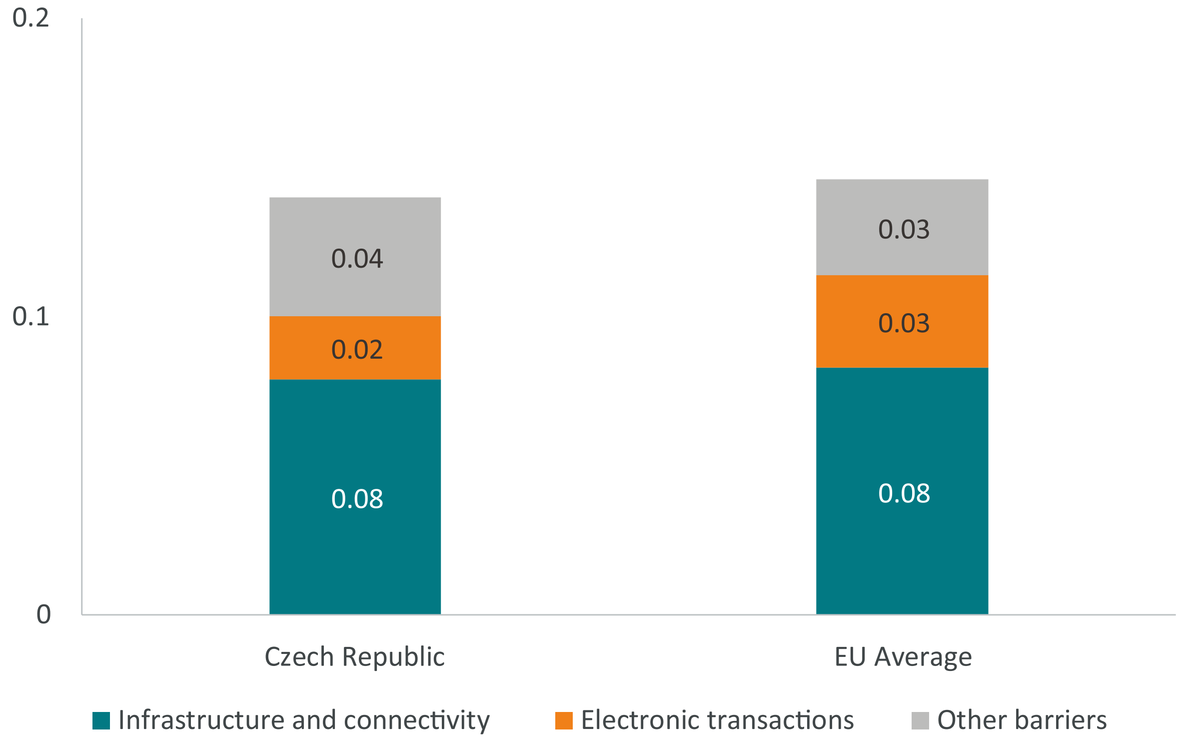


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.5 Denmark

The impact of the EU's upcoming DSA, DMA, and AI regulation in Denmark will depend on Denmark's digital endowments. Denmark shows a similar level of R&D in the digital sector to the EU average, while the percentage of firms using digital technologies is above the EU average. Denmark is among the top EU countries using cloud computing services and the number of data suppliers is above the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 46 thousand people worked in the apps sector and in 2019, 34% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Denmark total trade, while on a per capita basis digital services trade is slightly below the EU average. Denmark's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Danish economy suffers from some of these restrictions, particularly in electronic transactions, but less than the EU average. Denmark is likely to be disproportionally affected by the indirect costs of new digital regulations – and especially so its vibrant ecology of young and fast-growing firms, and its disproportionally big data sector.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Denmark	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	1.9	2.6
Number of fast-growing firms per 100,000 people (2018)	4.8	3
Number of data suppliers per 100,000 people (2019)	71	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	3.5%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

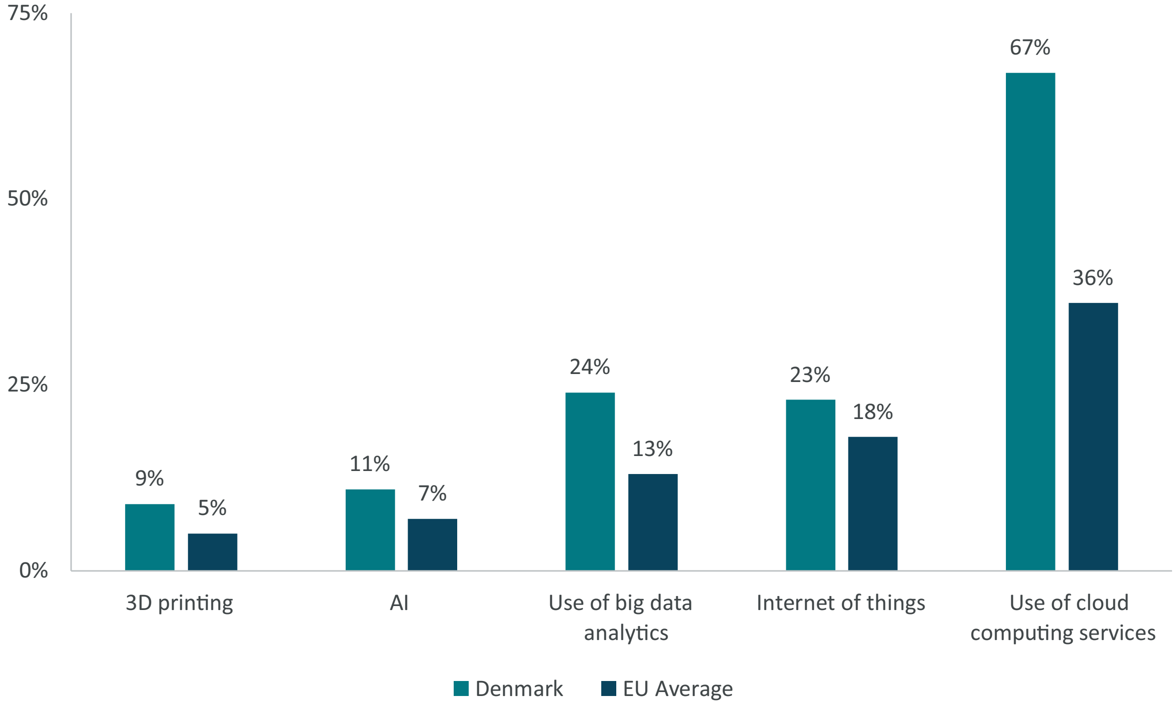


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

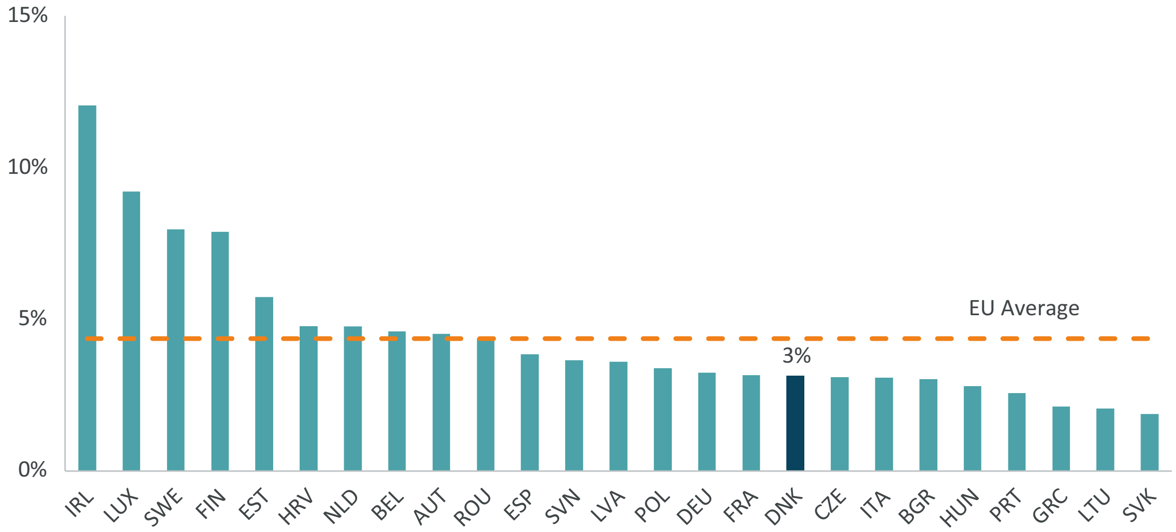
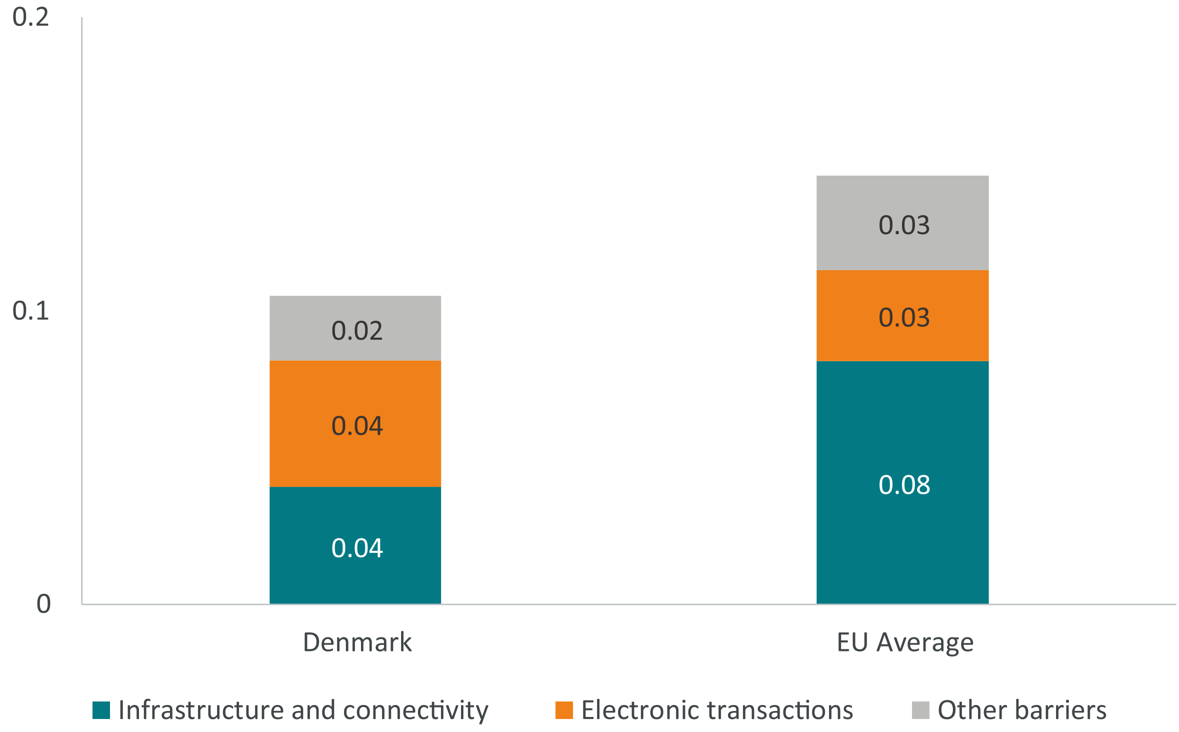


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.6 Finland

The impact of the EU's upcoming DSA, DMA, and AI regulation in Finland will depend on Finland's digital endowments. Finland shows a high level of R&D in the digital sector, and the percentage of firms using digital technologies is consistently above the EU average. Finland ranks first for having the most cloud computing services in the EU and the number of data suppliers is considerably above the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 54 thousand people worked in the apps sector and in 2019, 29% of businesses used e-commerce to sell their products, which is well above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 8% of Finland total trade. On a per capita basis, digital services trade is well above the EU average, making digital specialsiation in Finland even stronger. Finland's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Finnish economy suffers from some of these restrictions, but less so than the EU average. With high digital intensity and country-based size disadvantages, the distributional consequences of new regulation in Finland will be strong than in the EU average.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Finland	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.2	2.6
Number of fast-growing firms per 100,000 people (2018)	4.3	3
Number of data suppliers per 100,000 people (2019)	57	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	6%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

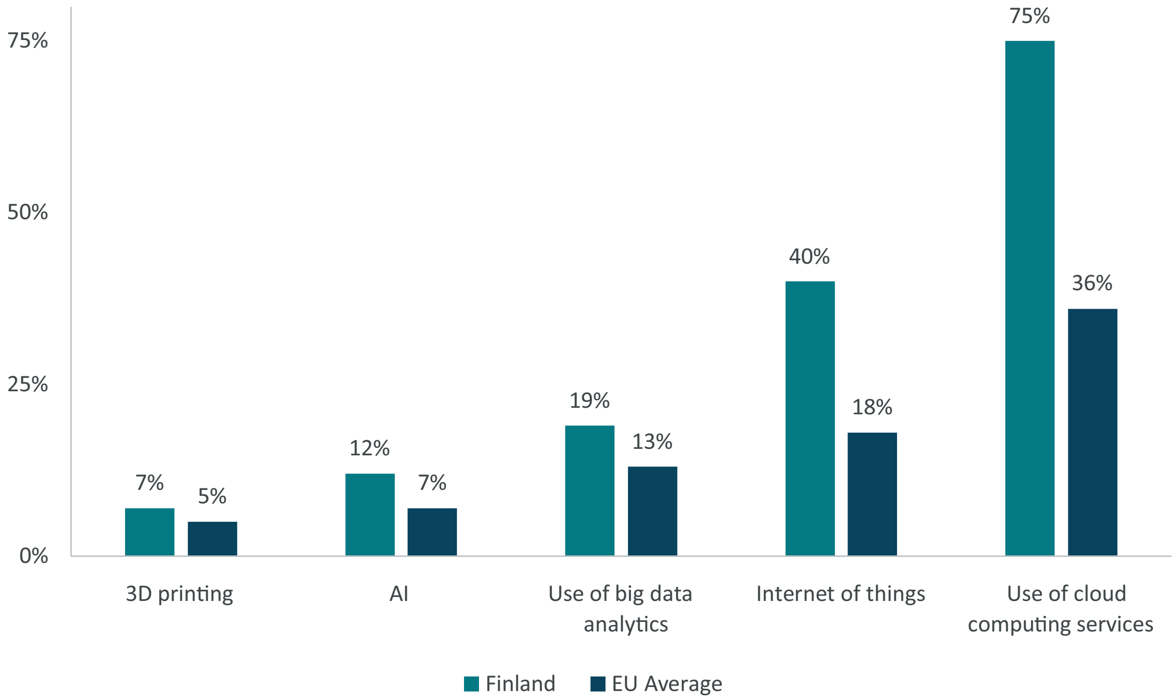


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

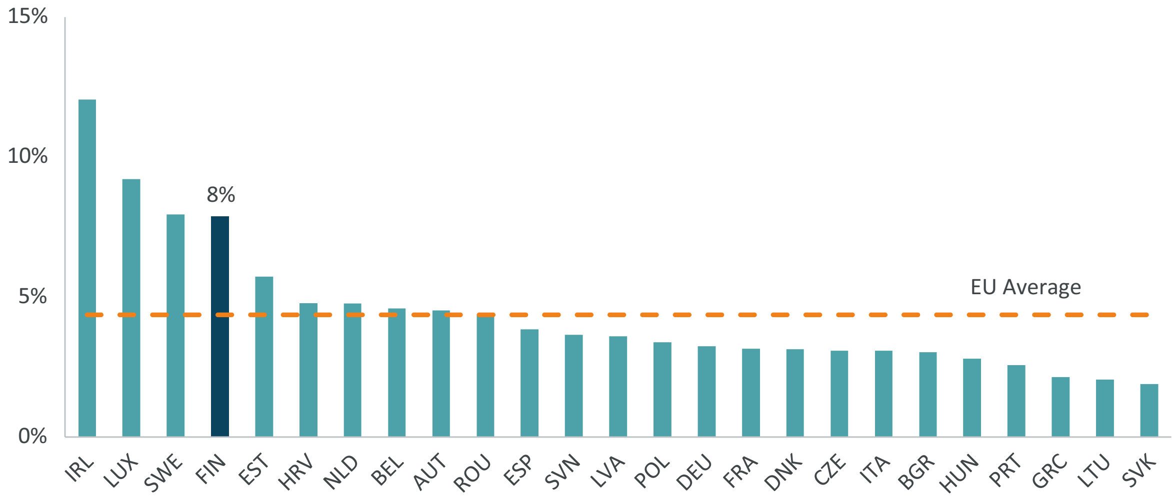
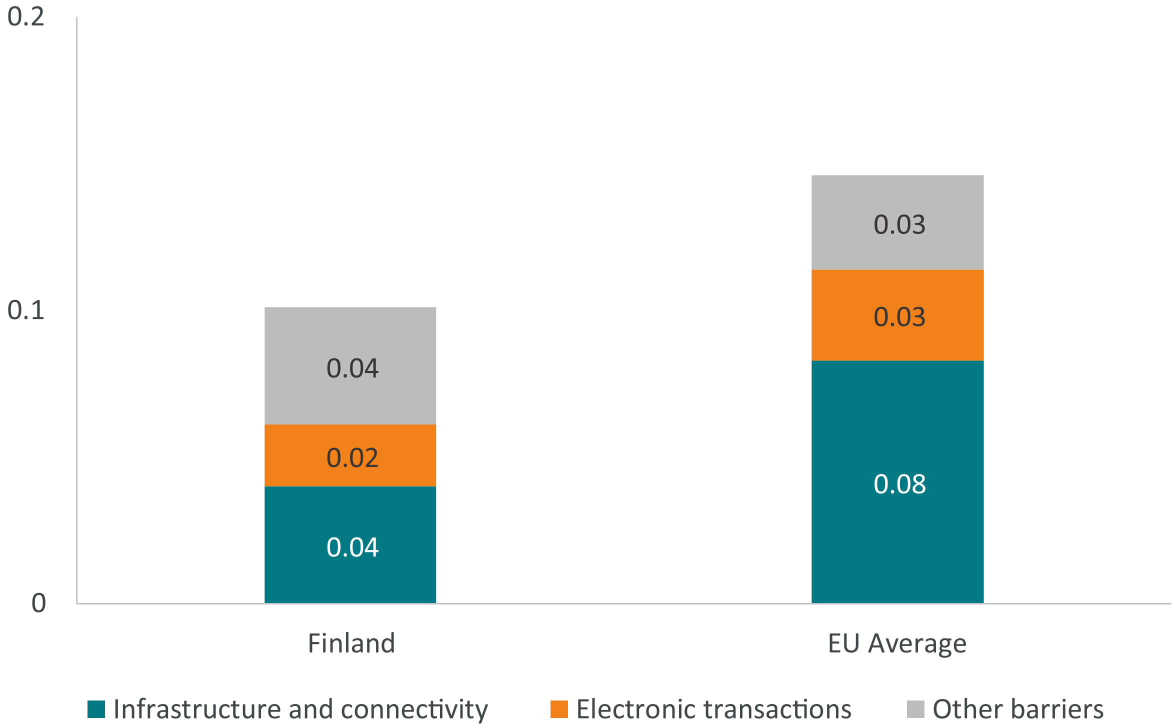


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.7 France

The impact of the EU's upcoming DSA, DMA, and AI regulation in France will depend on France's digital endowments. France shows a high level of R&D in the digital sector. However, the percentage of firms using digital technologies is below the EU average, except for big data analytics. The number of data suppliers is also below the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 260 thousand people worked in the apps sector and in 2019, 19% of businesses used e-commerce to sell their products, which is similar to the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of France total trade, while on a per capita basis digital services trade is below the EU average. France's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The French economy suffers from some of these restrictions, but less than the EU average. Given its comparatively low digital intensities, France is likely to be less affected by the indirect costs of new regulations than other countries – except for the big-data sector. Given its size advantages, it may benefit from the reallocation of resources that will emerge as a consequence of new digital regulations.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	France	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.3	2.6
Number of fast-growing firms per 100,000 people (2018)	1.3	3
Number of data suppliers per 100,000 people (2019)	23	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	4.2%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

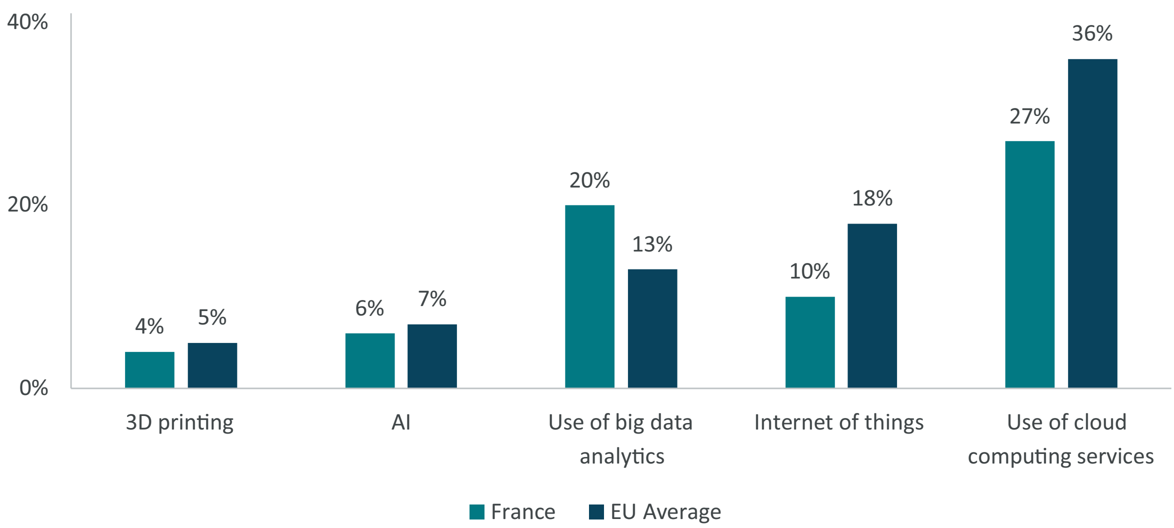


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

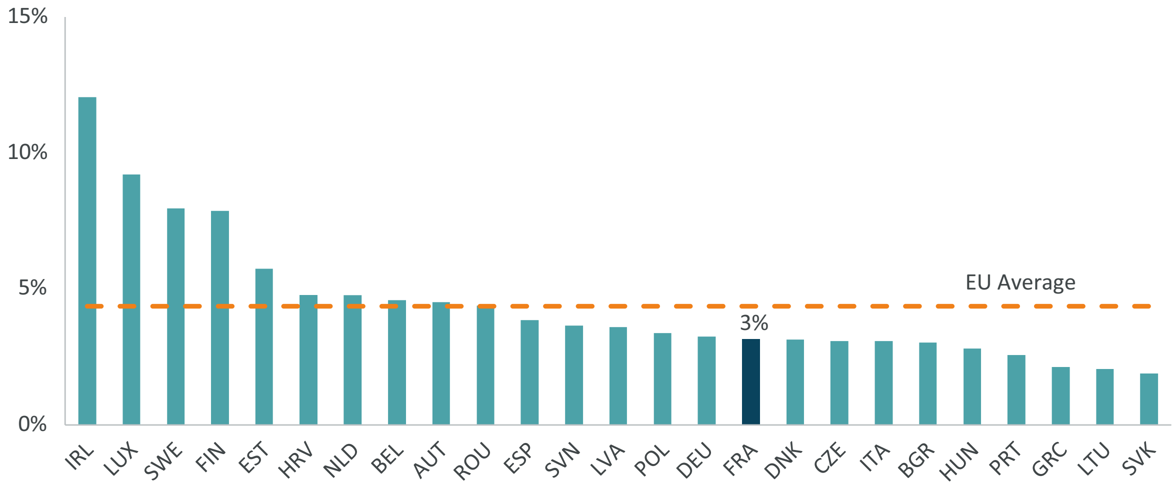
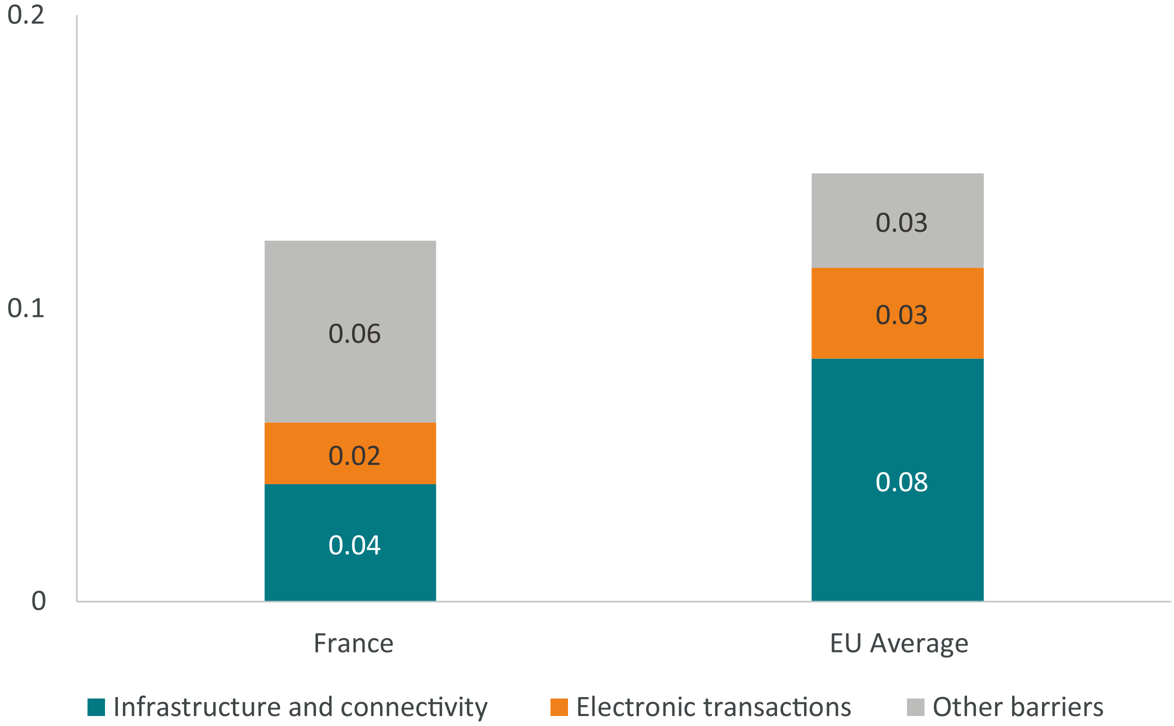


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.8 Germany

The impact of the EU's upcoming DSA, DMA, and AI regulation in Germany will depend on Germany's digital endowments. Germany shows a similar level of R&D in the digital sector, percentage of firms using digital technologies, and number of data suppliers as in the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 311 thousand people worked in the apps sector and in 2019, 20% of businesses used e-commerce to sell their products, which is similar to the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Germany total trade, and on a per capita basis digital services trade is below the EU average. Germany's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The German economy suffers from some of these restrictions, particularly in infrastructure and connectivity – and is close to the EU average. Germany is likely to be less affected by the costs of new digital regulations. Given its size advantages, it is likely to benefit from some reallocation of resources to big economies that is likely to follow on these new regulations.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Germany	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	4.3	2.6
Number of fast-growing firms per 100,000 people (2018)	3	3
Number of data suppliers per 100,000 people (2019)	34	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	2.5%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

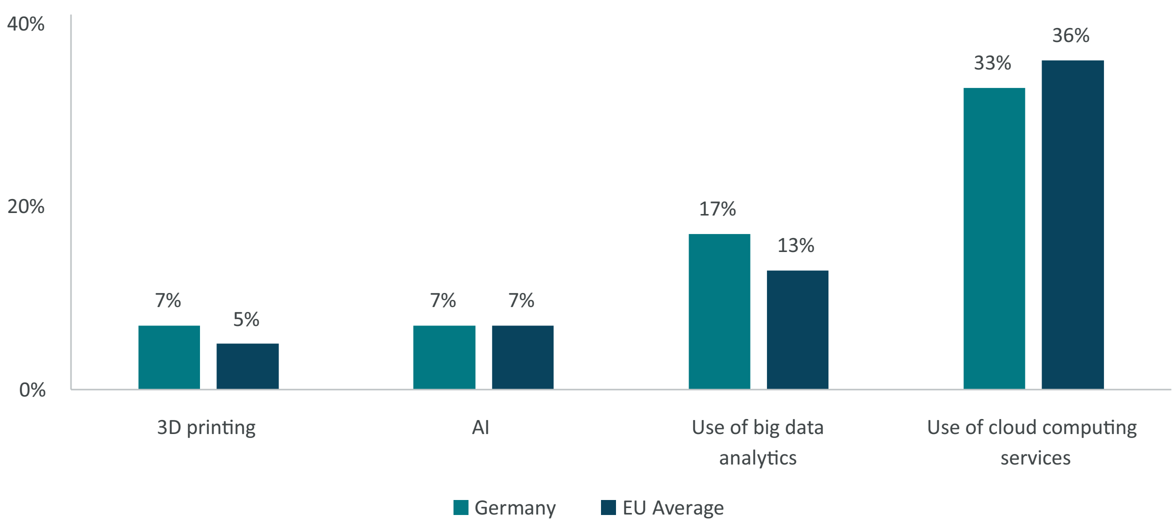


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

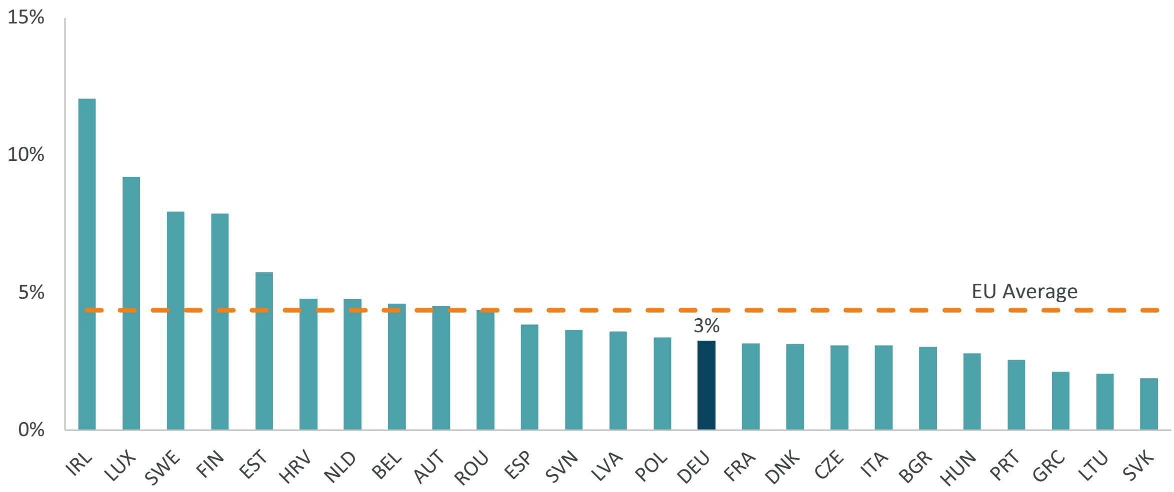
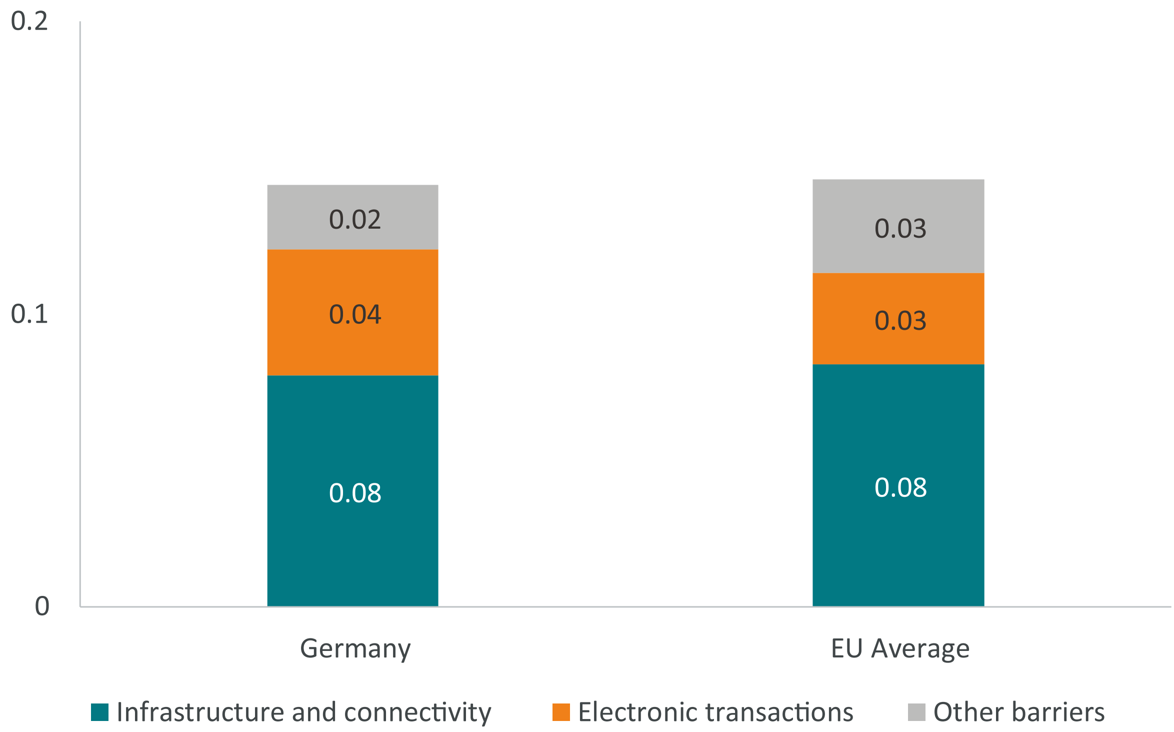


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.9 Ireland

The impact of the EU's upcoming DSA, DMA, and AI regulation in Ireland will depend on Ireland's digital endowments. Ireland shows a similar level of R&D in the digital sector to the EU average, while the percentage of firms using digital technologies is above EU average. Ireland is the frontrunner of the EU in the use of AI and the number of data suppliers are significantly above the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 15 thousand people worked in the apps sector and in 2019, 39% of businesses used e-commerce to sell their products, which was twice the EU average. This specialisation results in a flow of resources. Trade in digital services represents 12% of Ireland total trade. On a per capita basis, digital services trade is the largest across the EU. Ireland's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Irish economy suffers from some of these restrictions, particularly in infrastructure and connectivity. Given its high digital intensity, size disadvantage and digital trade specialization, Ireland is likely to carry a higher regulatory cost burden from the new regulations than most other EU countries.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Ireland	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	1	2.6
Number of fast-growing firms per 100,000 people (2018)	5.4	3
Number of data suppliers per 100,000 people (2019)	77	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	2.4%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2017, EUROSTAT, SCALE 0-100%)

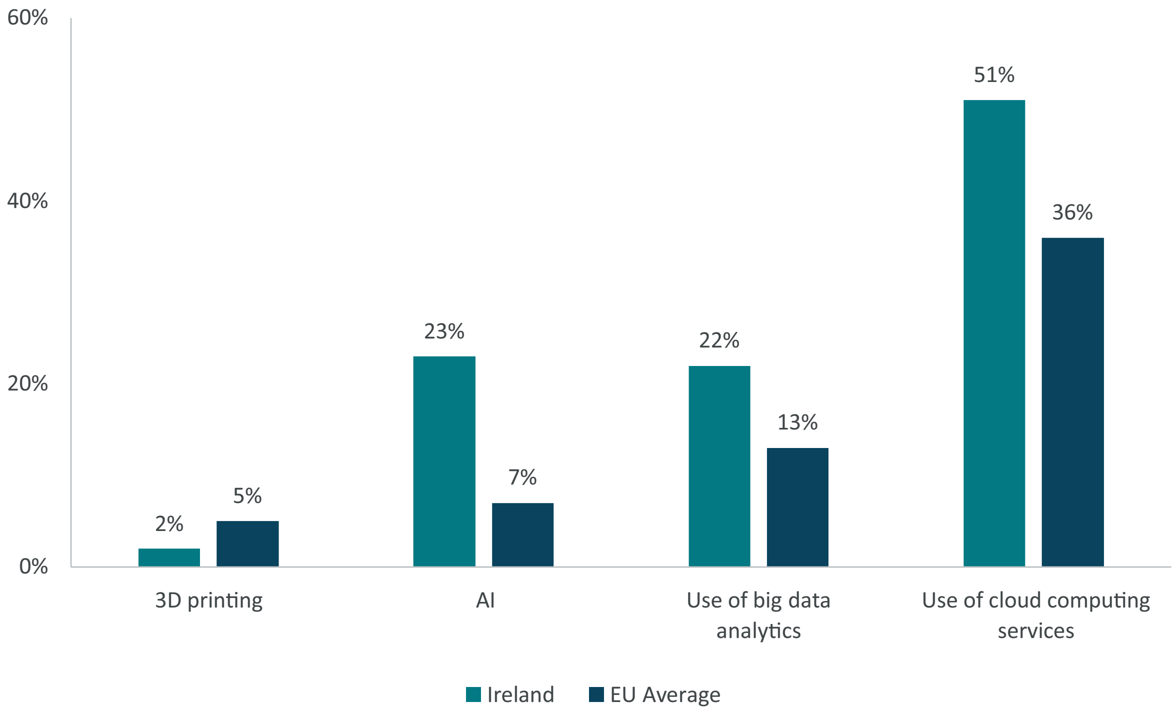


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

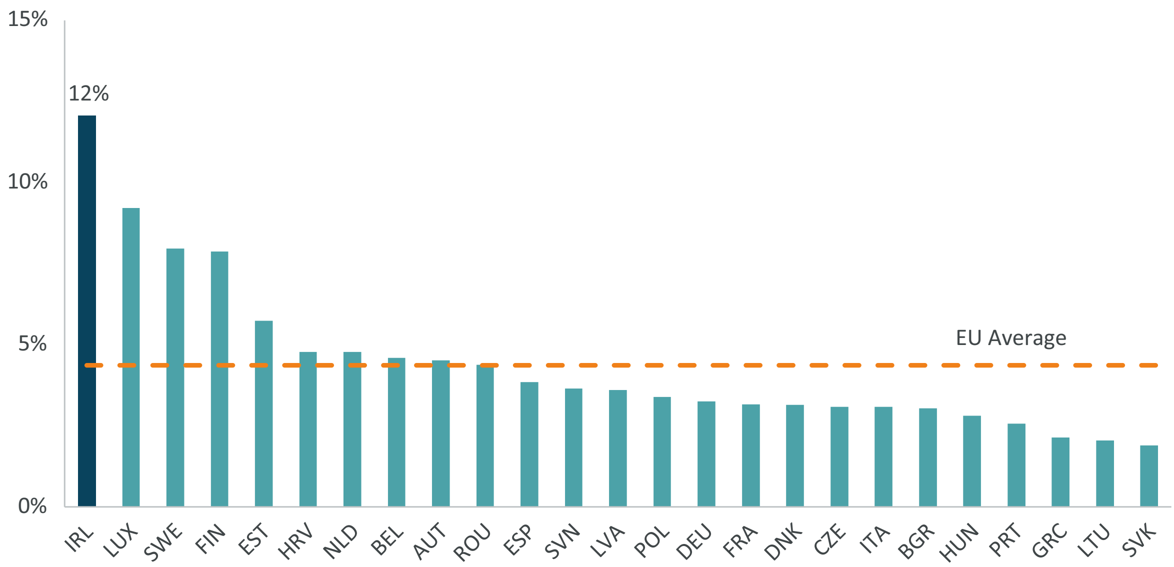
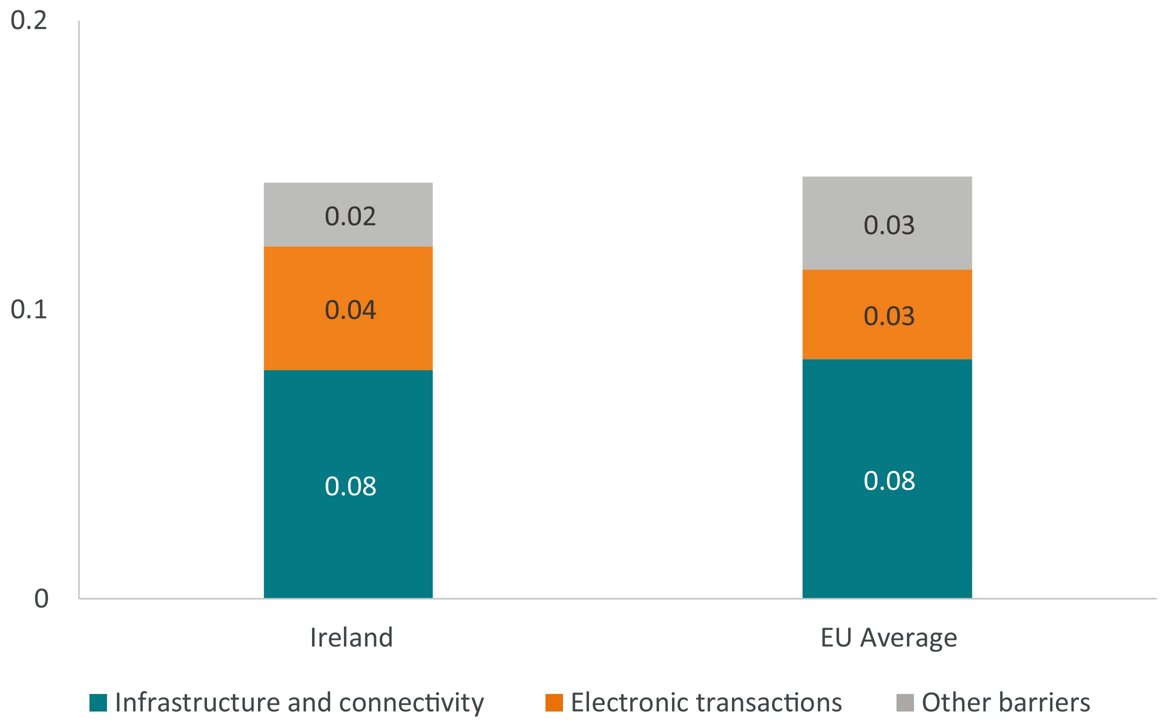


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.10 Italy

The impact of the EU's upcoming DSA, DMA, and AI regulation in Italy will depend on Italy's digital endowments. Italy shows a level of R&D in the digital sector close to the EU average, while the percentage of firms using digital technologies is above EU average, except for big data analytics. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 101 thousand people worked in the apps sector and 14% of businesses used e-commerce to sell their products, which is below the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Italy's total trade. On a per capita basis, digital services trade is below the EU average. Italy's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Italian economy suffers from some of these restrictions, particularly in infrastructure and connectivity. Since Italy has a relatively high digital intensity, it is likely to be more affected by indirect regulatory costs than other large EU economies – especially in cloud sectors. Its size advantage will moderate some of these effects.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Italy	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	3.1	2.6
Number of fast-growing firms per 100,000 people (2018)	1.7	3
Number of data suppliers per 100,000 people (2019)	34	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	2.7%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

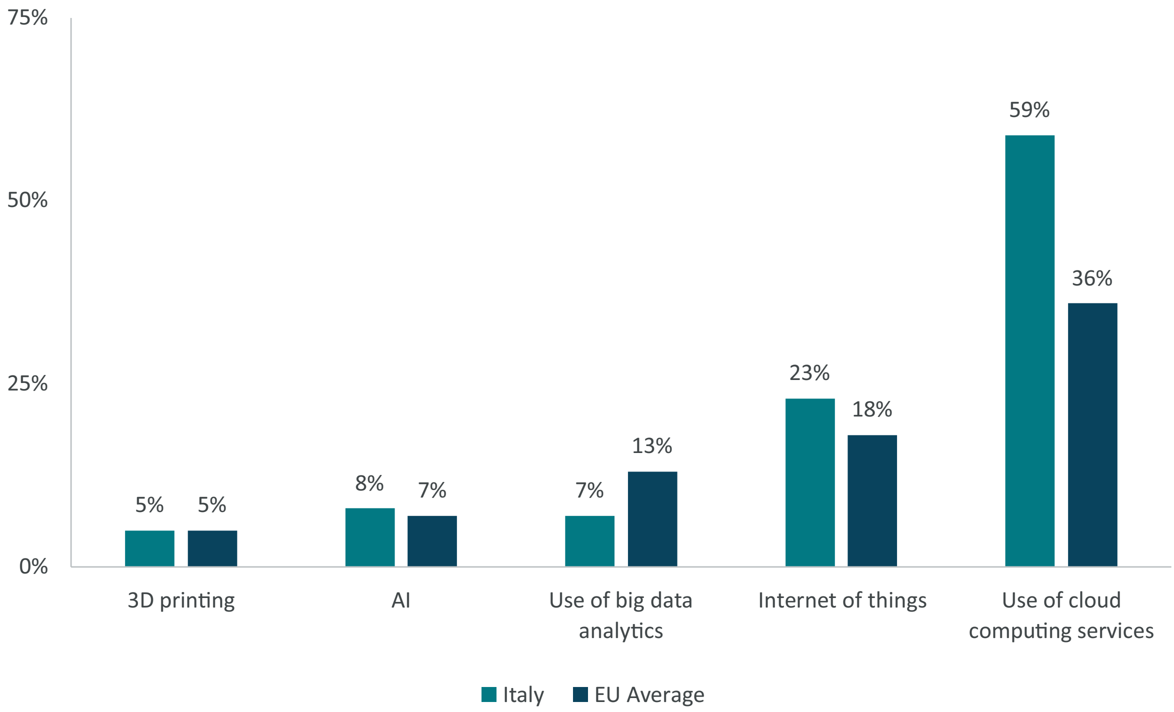


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

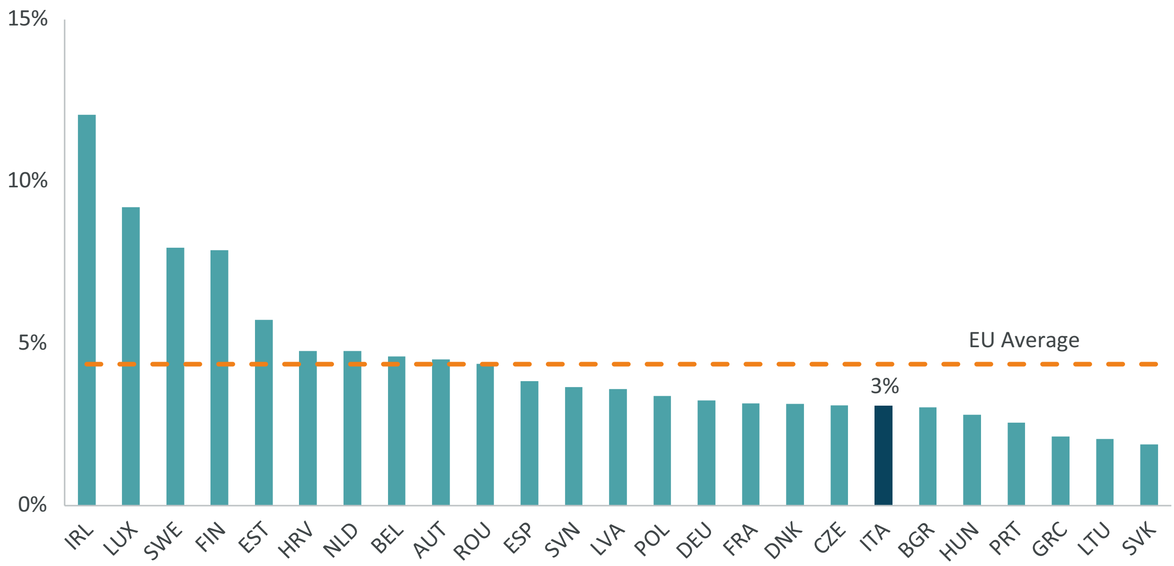
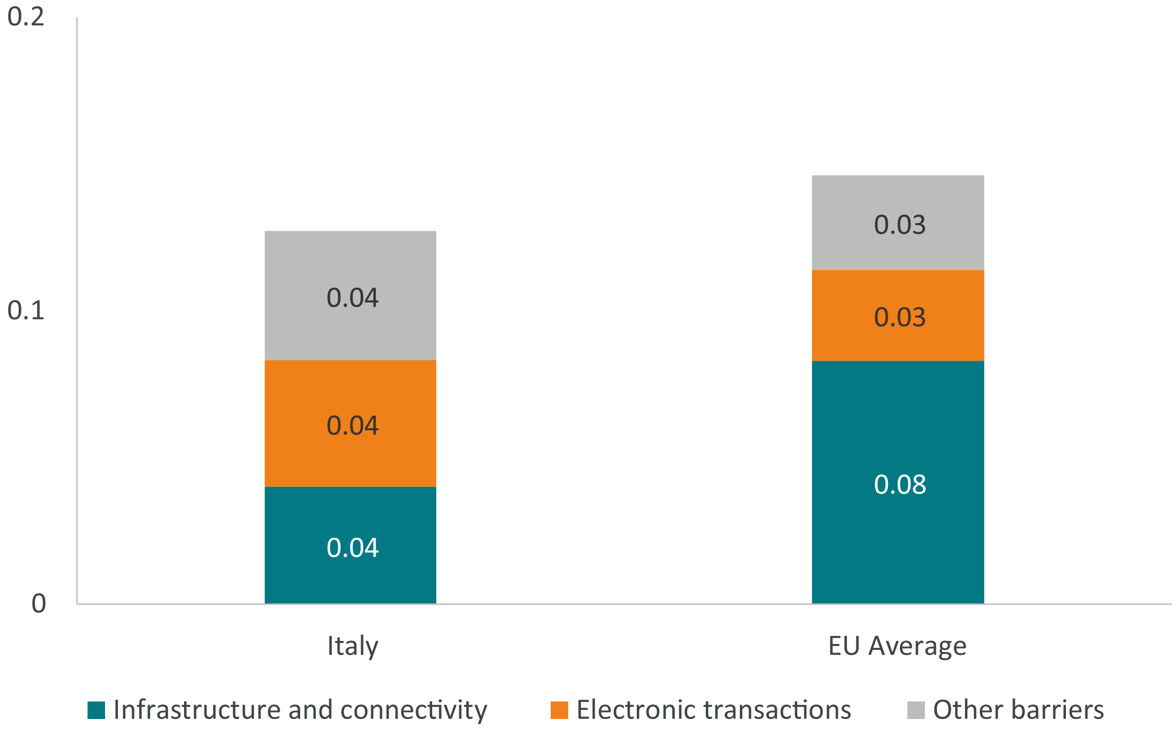


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.11 Lithuania

The impact of the EU's upcoming DSA, DMA, and AI regulation in Lithuania will depend on Lithuania's digital endowments. Lithuania shows a low level of R&D in the digital sector. However, the percentage of firms using digital technologies is equivalent to the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2019, 26% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 2% of Lithuania's total trade, and on a per capita basis digital services trade is considerably below the EU average. Lithuania's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Lithuanian economy suffers from some of these restrictions, particularly in infrastructure and connectivity. Lithuania is likely to be moderately affected by new digital regulations, and the indirect costs are likely to be defined by market exclusion effects.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Lithuania	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2	2.6
Number of fast-growing firms per 100,000 people (2018)	2	3
Number of data suppliers per 100,000 people (2019)	26	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	1.8%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

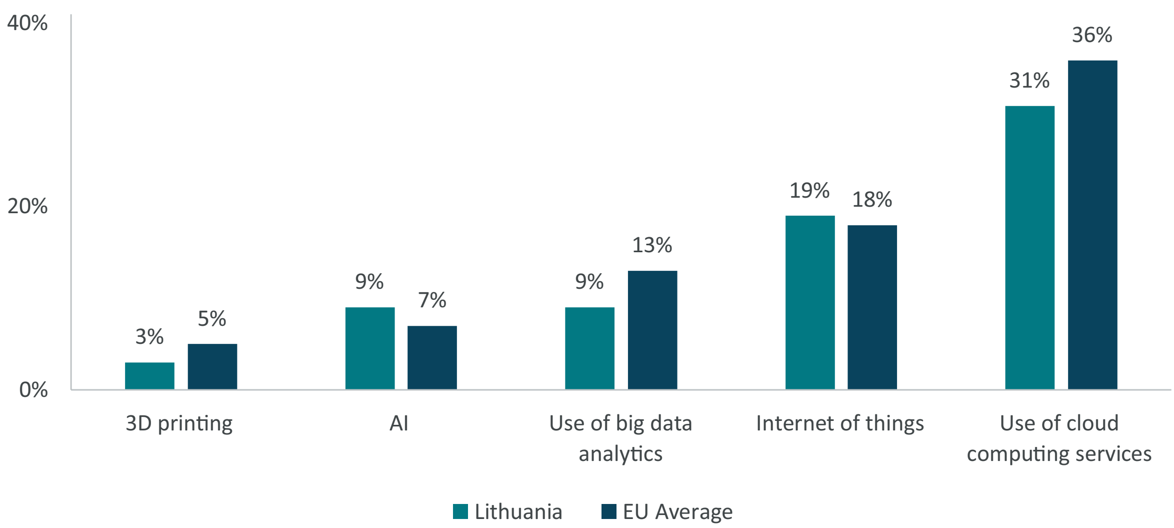


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

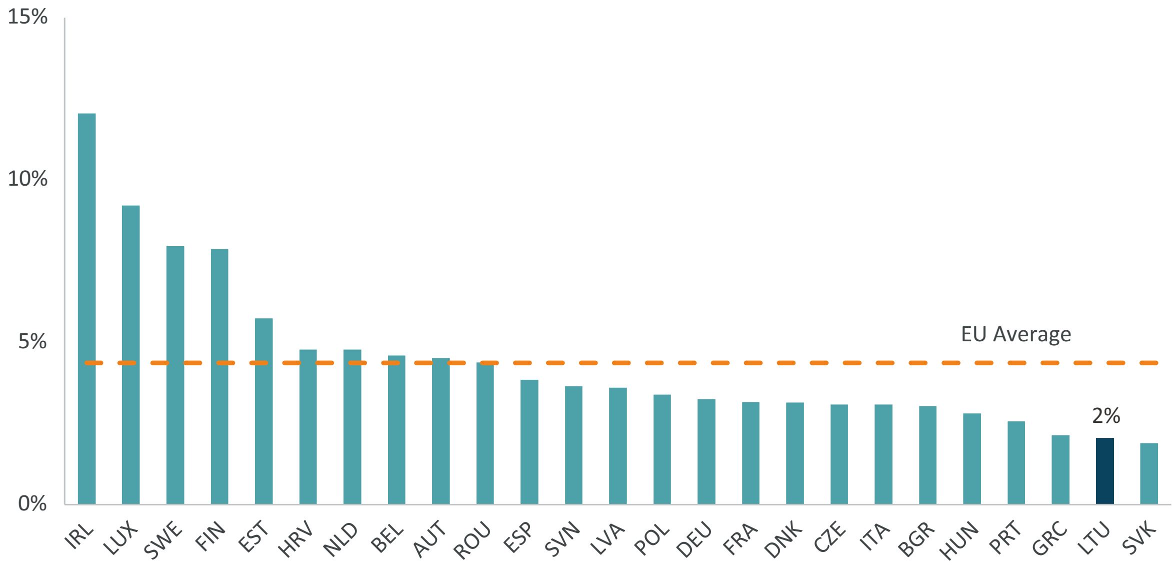
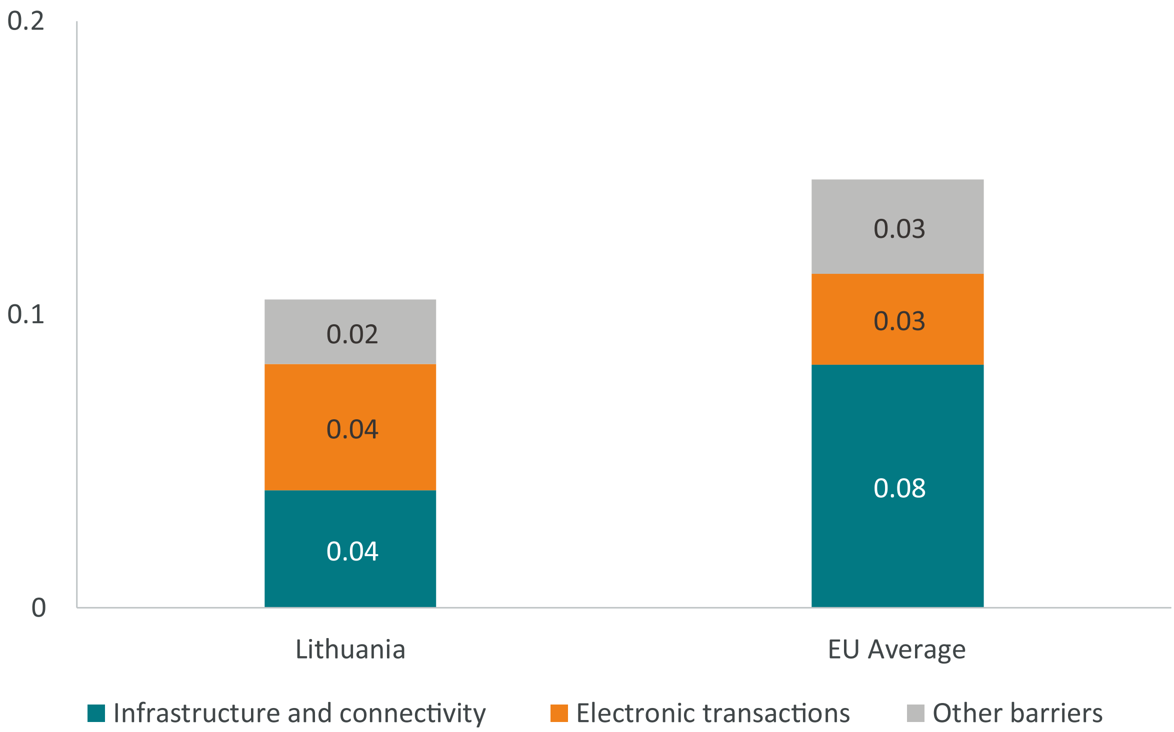


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.12 Netherlands

The impact of the EU's upcoming DSA, DMA, and AI regulation in the Netherlands will depend on the Netherlands' digital endowments. The Netherlands shows a level of R&D in the digital sector and a number of data suppliers close to the EU average, while the percentage of firms using digital technologies is also close or higher than the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 184 thousand people worked in the apps sector and 27% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 5% of the Netherlands' total trade, while on a per capita basis digital services trade is above the EU average. The Netherlands' ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Dutch economy suffers from some of these restrictions, particularly in infrastructure and connectivity. The Netherlands has higher levels of digital intensities than the EU average, and will likely be more affected by the consequences of new regulation than the average EU country.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Netherlands	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.1	2.6
Number of fast-growing firms per 100,000 people (2018)	4.4	3
Number of data suppliers per 100,000 people (2019)	34	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	3.2%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

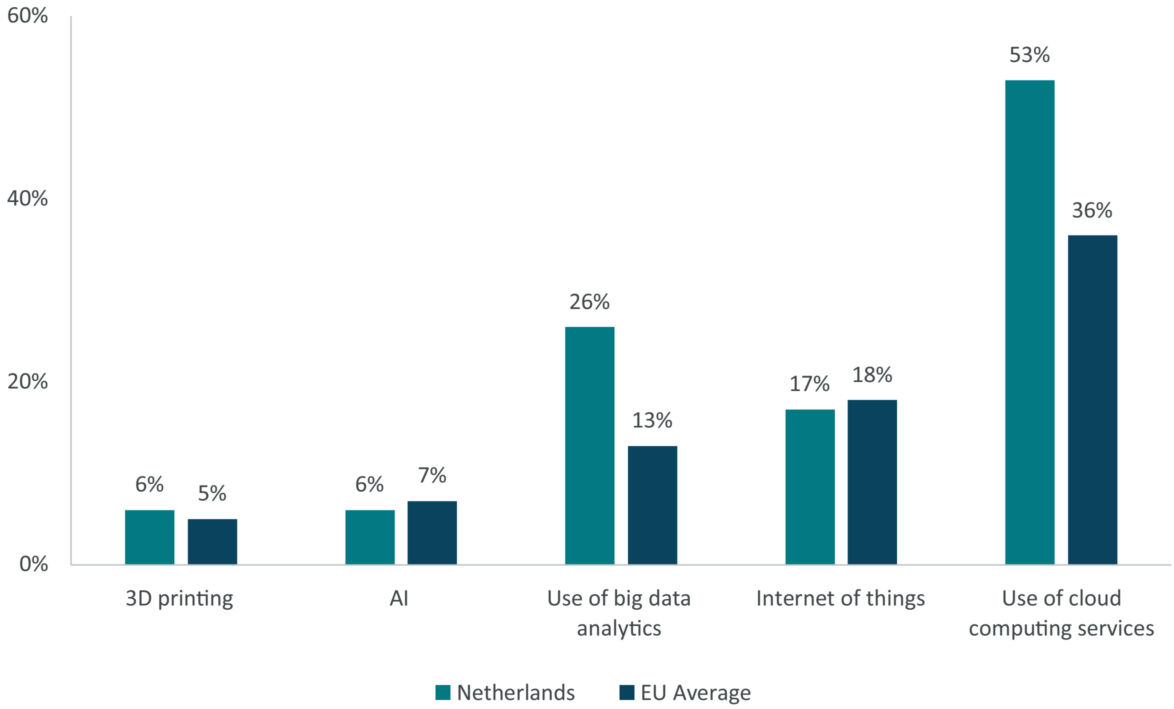


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

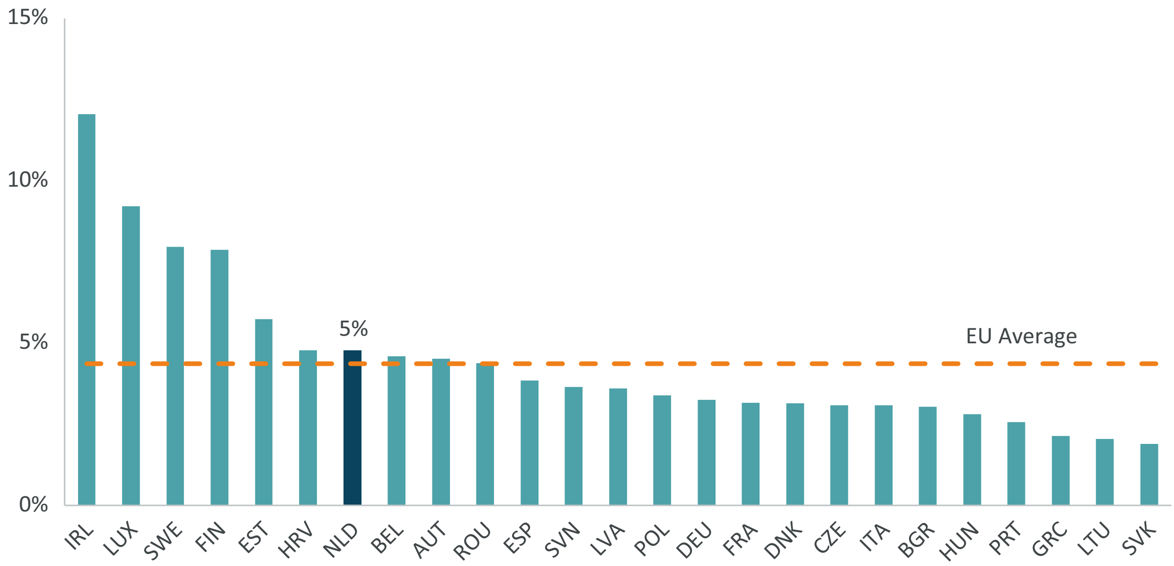
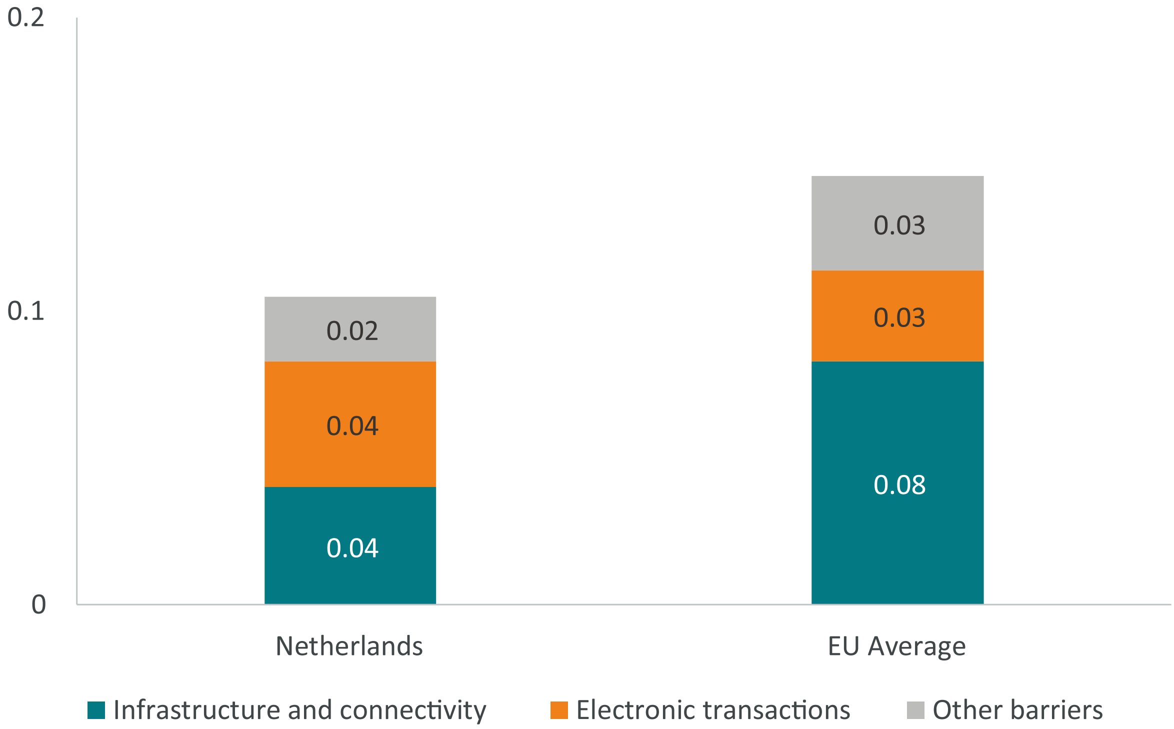


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.13 Poland

The impact of the EU's upcoming DSA, DMA, and AI regulation in Poland will depend on Poland's digital endowments. Poland shows a high level of R&D in the digital sector, whereas the percentage of firms using digital technologies and the number of data suppliers are below the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 52 thousand people worked in the apps sector and 16% of businesses used e-commerce to sell their products, which is below the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Poland's total trade, and on a per capita basis digital services trade is significantly below the EU average. Poland's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Polish economy suffers from the highest restrictions among the EU, particularly in infrastructure and connectivity. New digital regulations will increase regulatory restrictiveness and lead to a higher concentration of digital intensities to fewer firms.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Poland	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.8	2.6
Number of fast-growing firms per 100,000 people (2018)	1.2	3
Number of data suppliers per 100,000 people (2019)	16	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	4.3%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

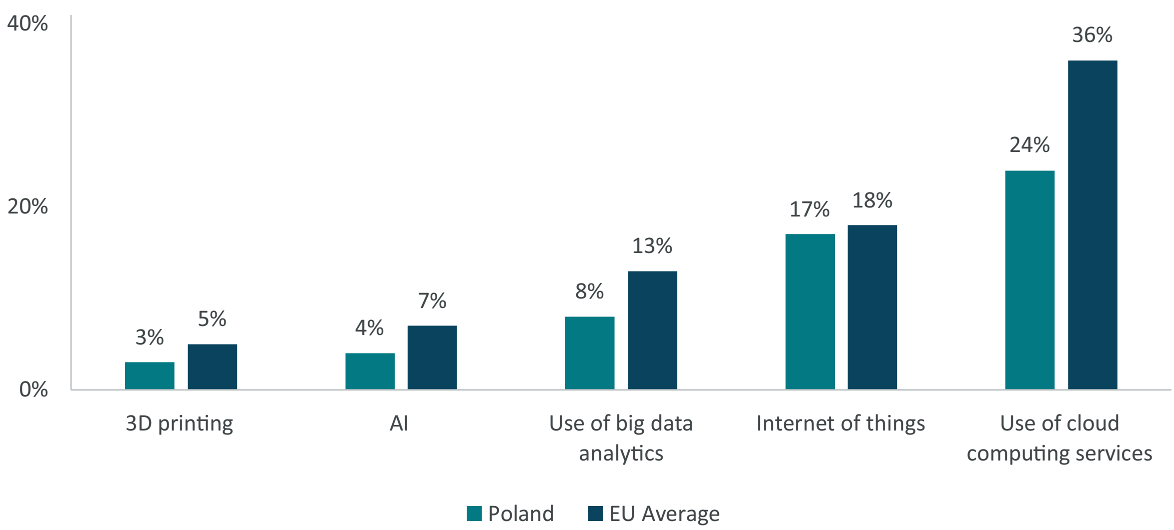


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

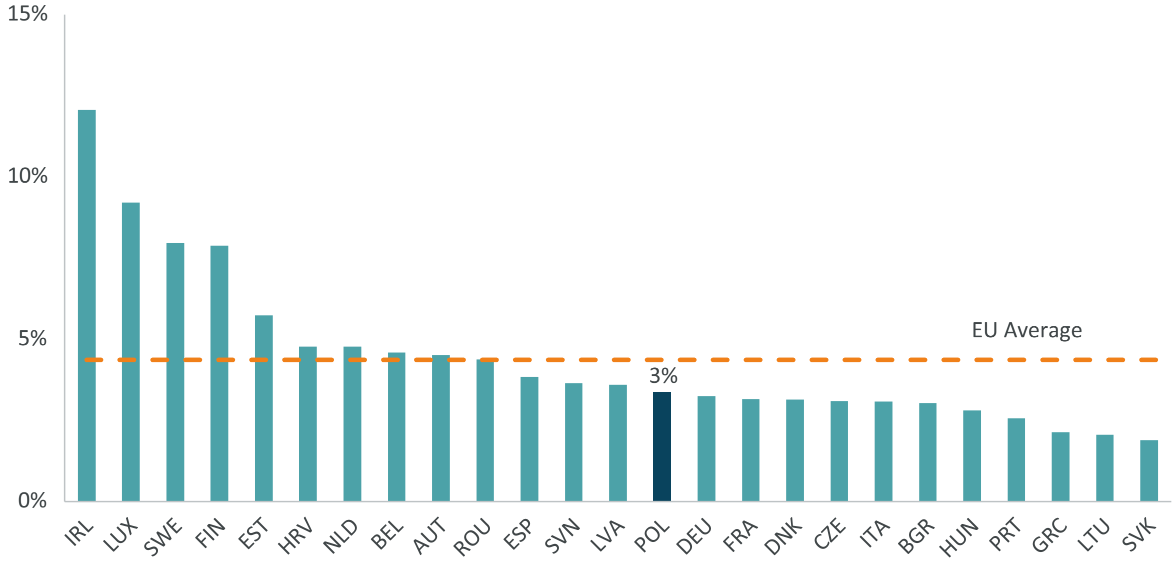
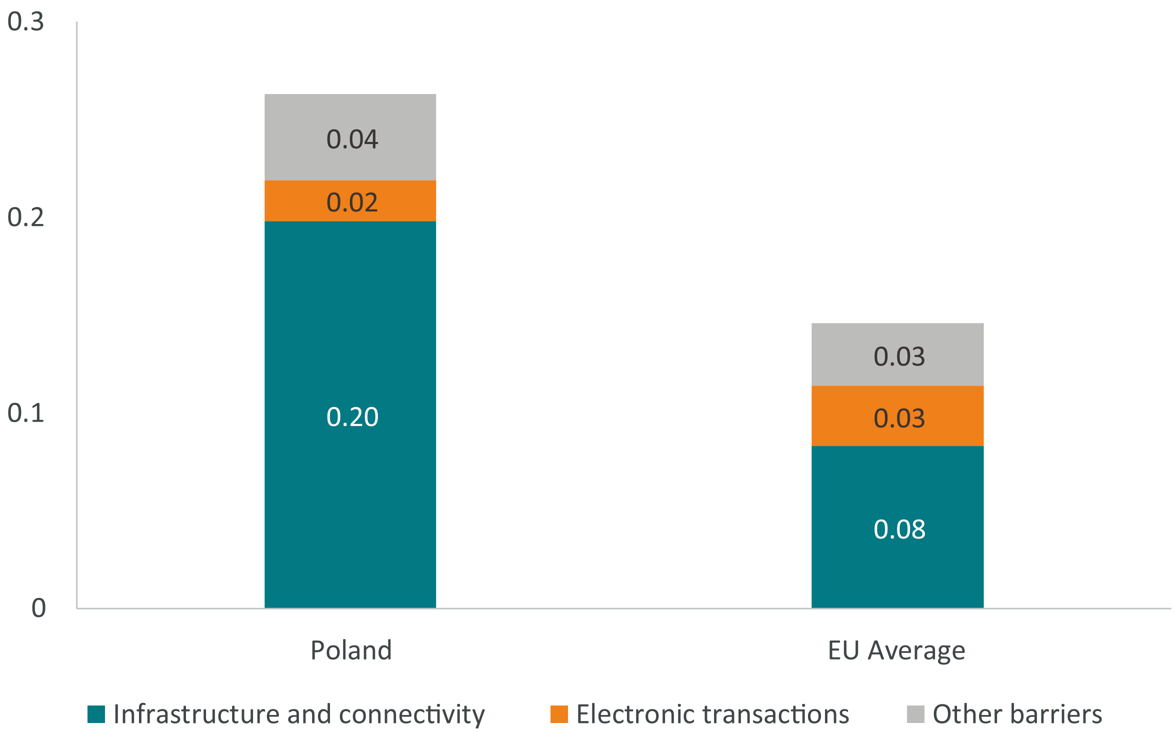


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.14 Portugal

The impact of the EU's upcoming DSA, DMA, and AI regulation in Portugal will depend on Portugal's digital endowments. Portugal shows a high level of R&D in the digital sector, whereas the percentage of firms using digital technologies and the number of data suppliers are below the EU average, except for the use of AI. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 31 thousand people worked in the apps sector and 17% of businesses used e-commerce to sell their products, which is below the EU average. This specialisation results in a flow of resources. Trade in digital services represents 3% of Portugal's total trade, and on a per capita basis digital services trade is below the EU average. Portugal's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Portuguese economy suffers from some of these restrictions, but equivalent to the EU average. Portugal's moderate digital intensities and its size disadvantage will make the cost of new regulations higher in Portugal than in the EU average.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Portugal	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.8	2.6
Number of fast-growing firms per 100,000 people (2018)	1.2	3
Number of data suppliers per 100,000 people (2019)	16	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	4.4%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

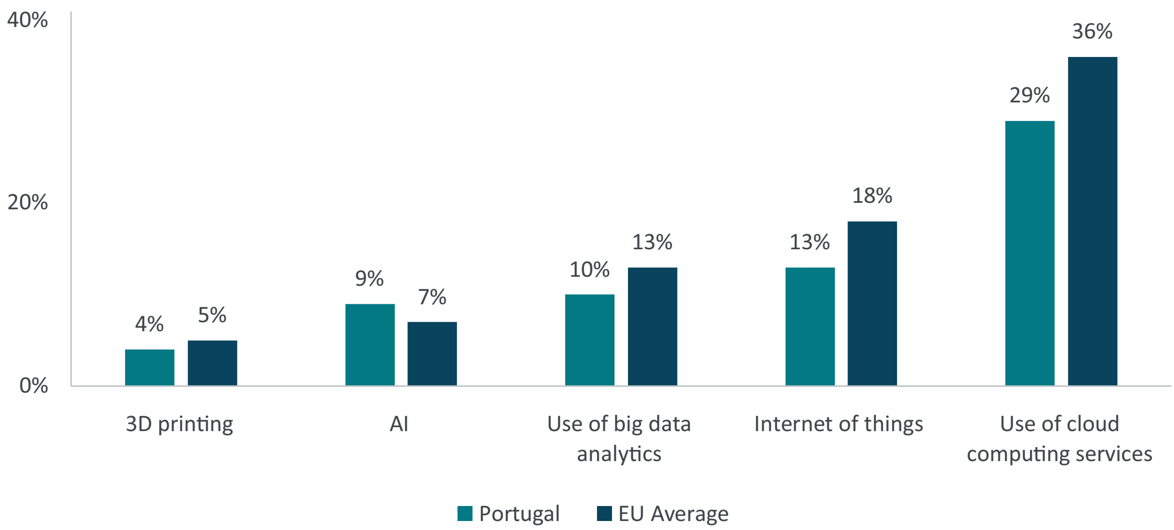


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

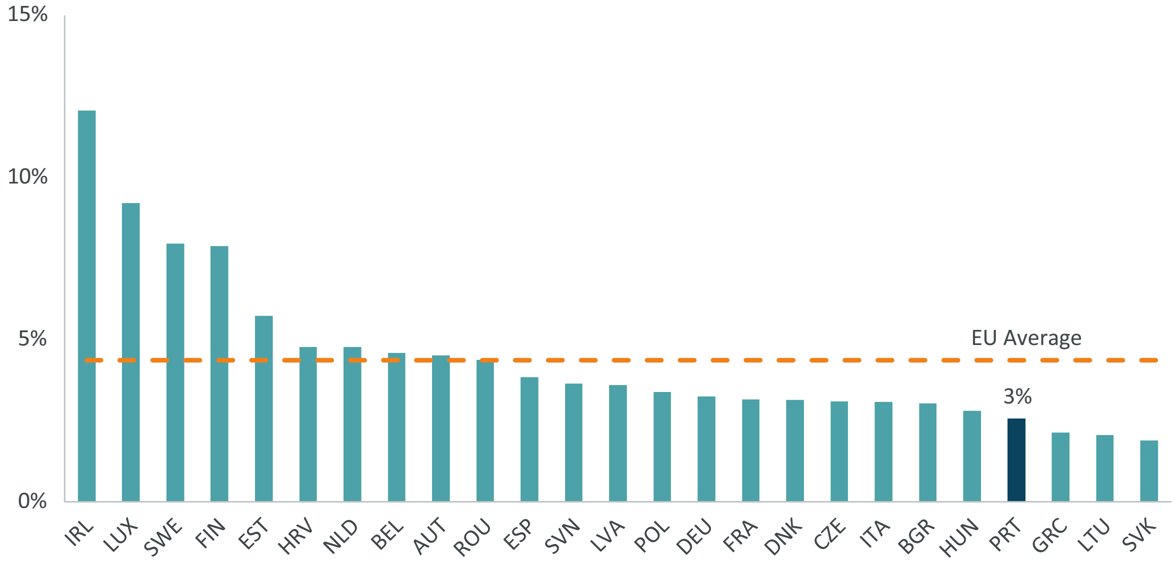
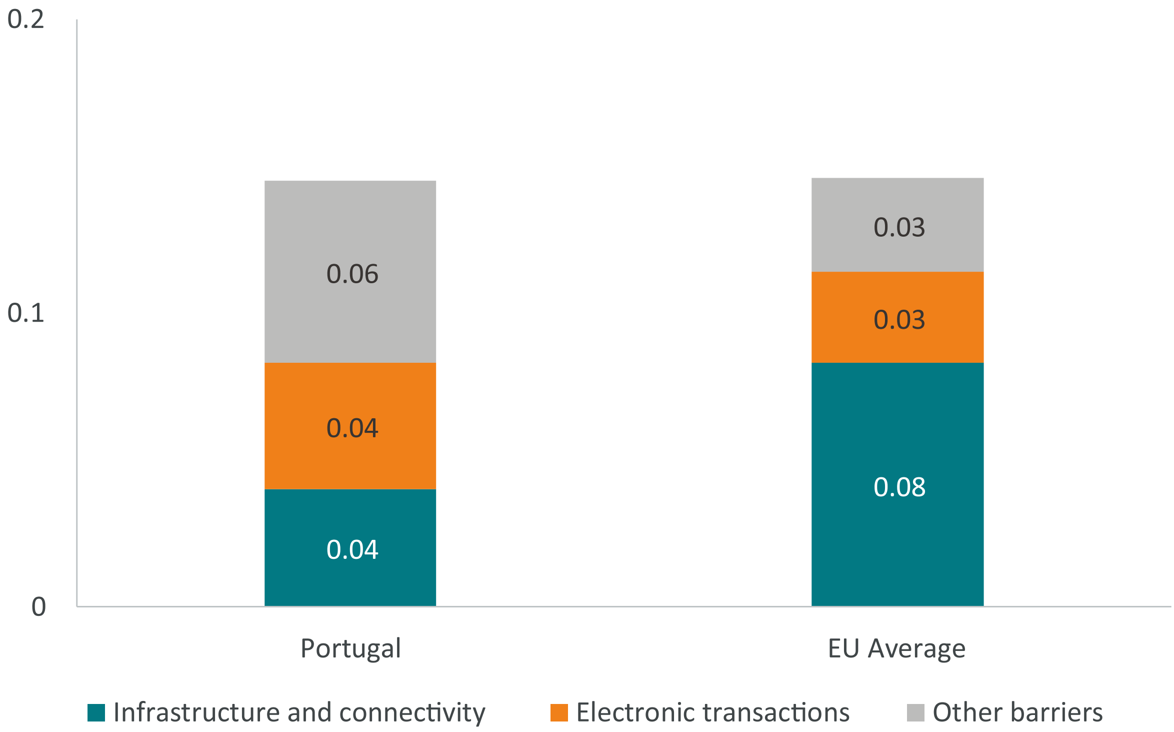


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.15 Romania

The impact of the EU's upcoming DSA, DMA, and AI regulation in Romania will depend on Romania's digital endowments. Romania shows a level of R&D in the digital sector, a percentage of firms using digital technologies and a number of data suppliers below the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 23 thousand people worked in the apps sector and 12% of businesses used e-commerce to sell their products, which is considerably below the EU average. This specialisation results in a flow of resources. Trade in digital services represents 4% of Romania's total trade, while on a per capita basis digital services trade is below the EU average. Romania's ability to transform its digital endowments to its advantage depends on its regulatory restrictions. The Romanian economy suffers from some of these restrictions, notably on the complexity of its regulatory procedures. Romania's chief focus should be to build up stronger digital endowments. Since it is an outsourcing hub for digital sectors, its digital advantage is connected to the divisibility of digital assets. It will be affected by new digital regulations accordingly.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Romania	EU Average
Number of fast-growing firms per 100,000 people (2018)	0.5	3
Number of data suppliers per 100,000 people (2019)	30	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	0.6%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

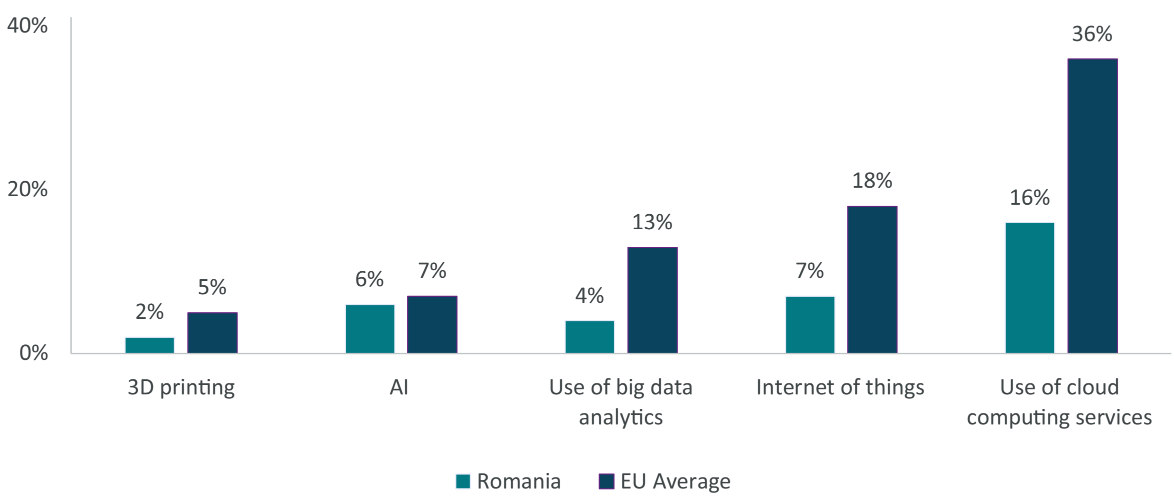


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

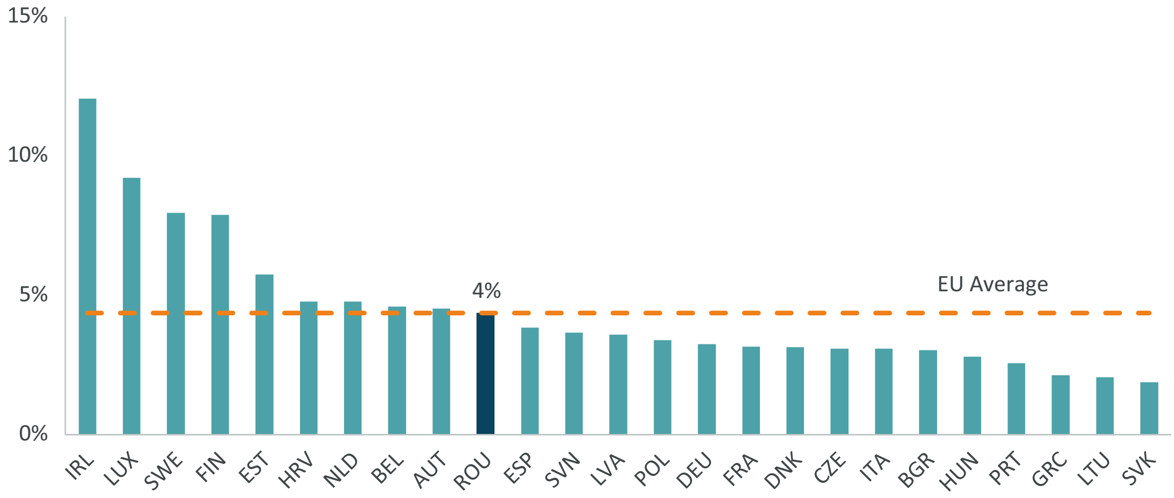
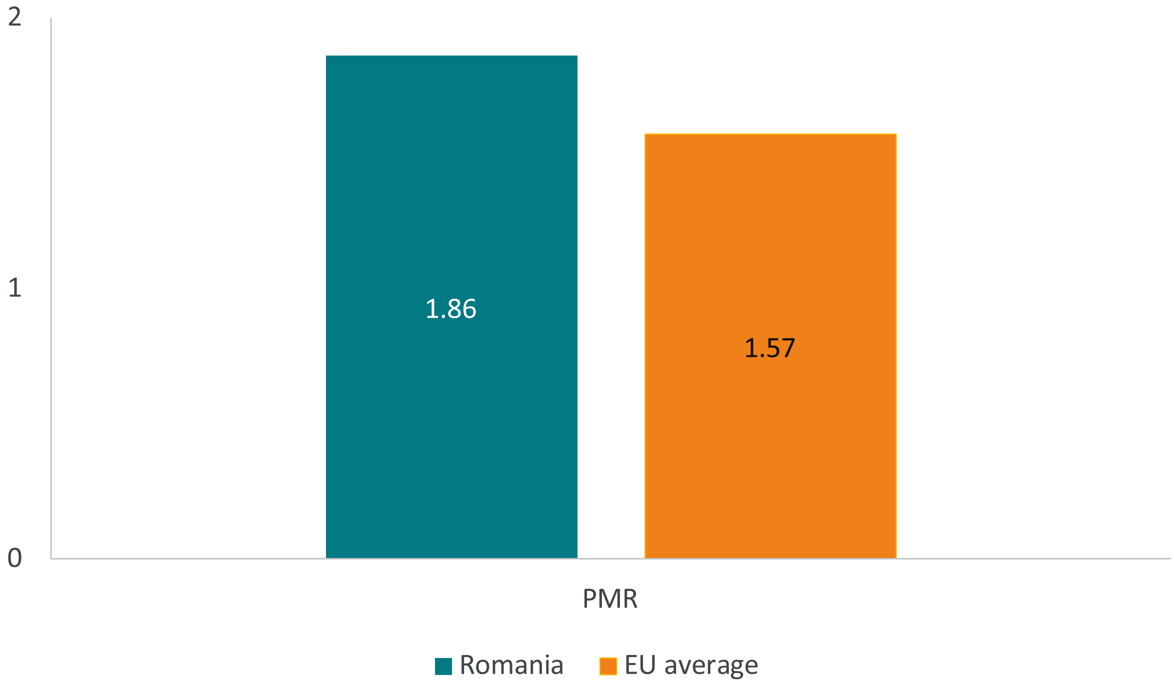


FIGURE 3: PRODUCT MARKET REGULATION (2018, OECD, SCALE 0-6)



4.16 Slovak Republic

The impact of the EU's upcoming DSA, DMA, and AI regulation in the Slovak Republic will depend on Slovakia's digital endowments. The Slovak Republic shows a high level of R&D in the digital sector. However, the percentage of firms using digital technologies is below the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2019, 15% of businesses used e-commerce to sell their products, which is below the EU average. This specialisation results in a flow of resources. Trade in digital services represents 2% of Slovak Republic's total trade, while on a per capita basis digital services trade is below the EU average. The Slovak Republic's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Slovakian economy suffers from some of these restrictions, particularly in infrastructure and connectivity, at a similar level to the EU average. Slovakia's selective and sector-specific digital intensities – with a focus on the outsourcing manufacturing sector – means it benefits from divisible digital assets. Hence, it is likely to be affected by new digital regulations mostly through the intermediation of digital services.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Slovak Republic	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.8	2.6
Number of fast-growing firms per 100,000 people (2018)	1.2	3
Number of data suppliers per 100,000 people (2019)	16	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	1.4%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

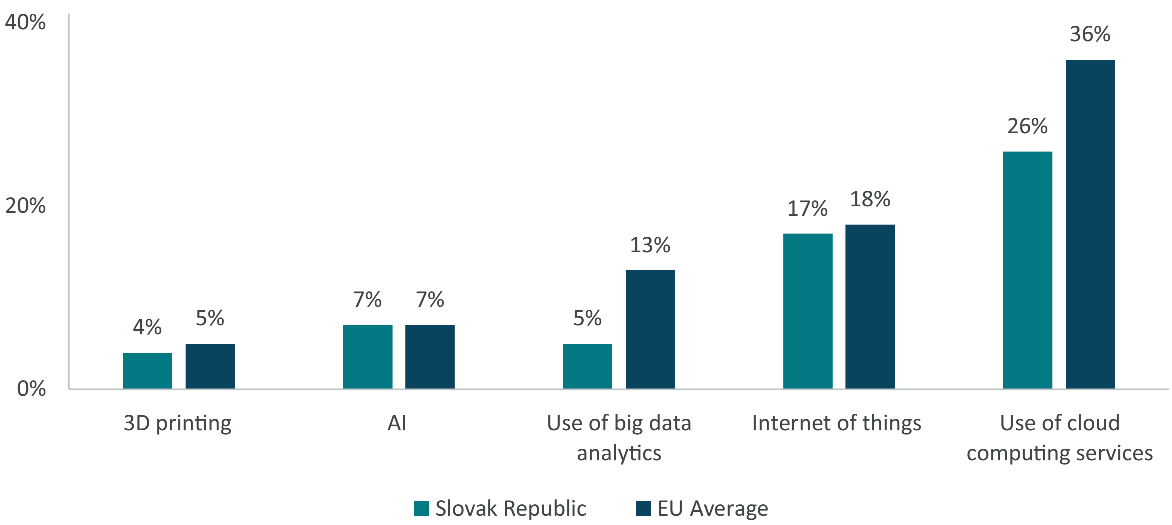


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

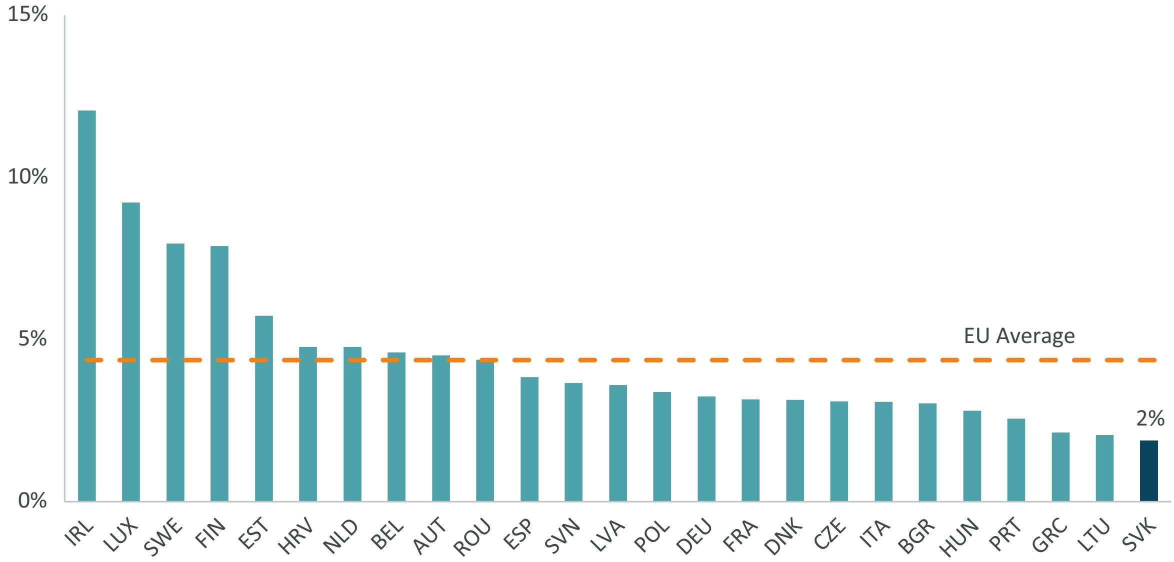


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)

4.17 Slovenia

The impact of the EU's upcoming DSA, DMA, and AI regulation in Slovenia will depend on Slovenia's digital endowments. Slovenia shows a level of R&D in the digital sector and a percentage of firms using digital technologies equivalent to the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2019, 25% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 4% of Slovenia's total trade, while on a per capita basis digital services trade is considerably below the EU average. Slovenia's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Slovenian economy suffers from restrictions which are among the highest in the EU, particularly in infrastructure and connectivity. New regulations are likely to impact on Slovenia's high digital intensities and lead to more concentration to certain sectors and firms.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Slovenia	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	3.5	2.6
Number of fast-growing firms per 100,000 people (2018)	2.7	3
Number of data suppliers per 100,000 people (2019)	29	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	2.9%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

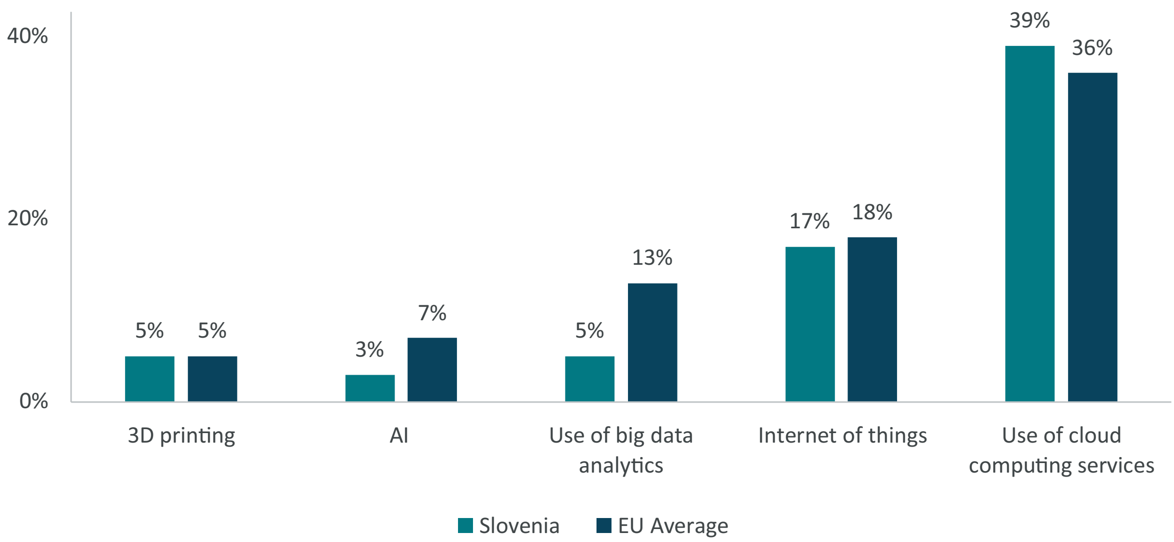


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

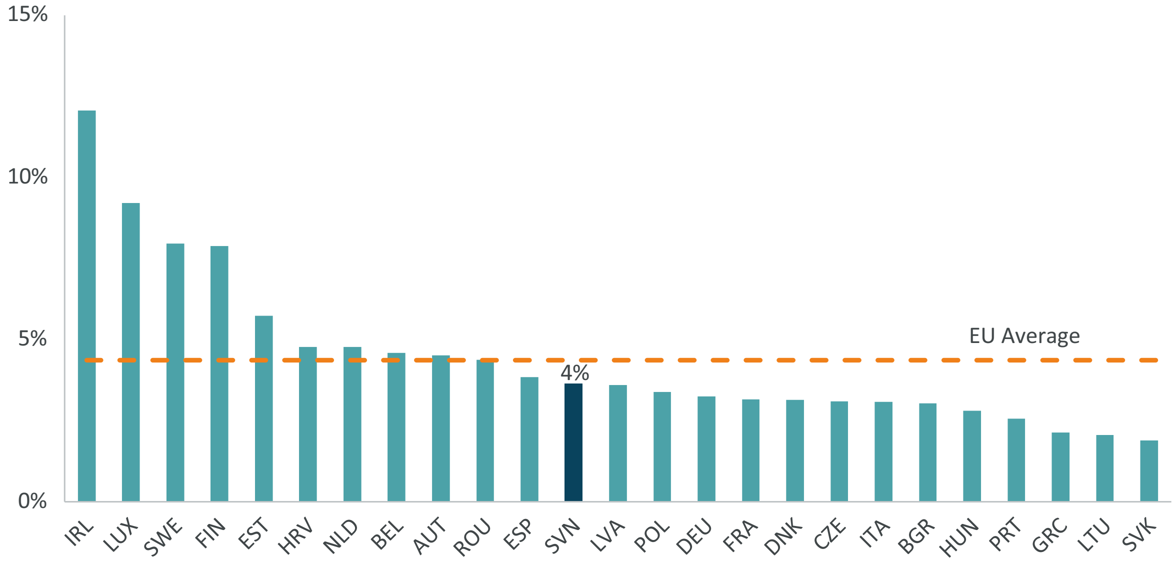
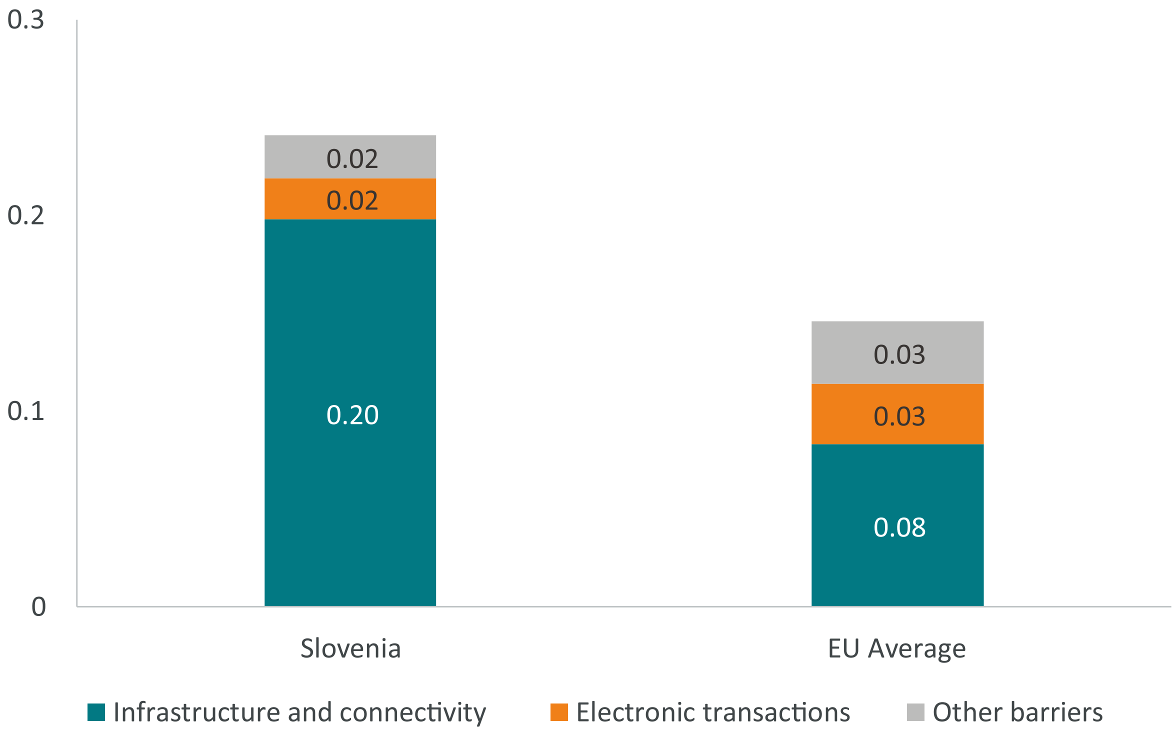


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.18 Spain

The impact of the EU's upcoming DSA, DMA, and AI regulation in Spain will depend on Spain's digital endowments. Spain shows a level of R&D in the digital sector, a percentage of firms using digital technologies, and a number of data suppliers lower than the EU average. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 86 thousand people worked in the apps sector and 21% of businesses used e-commerce to sell their products, which is in line with the EU average. This specialisation results in a flow of resources. Trade in digital services represents 4% of Spain's total trade, while on a per capita basis digital services trade is below the EU average. Spain's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Spanish economy suffers from some of these restrictions, particularly in infrastructure and connectivity, but less than the EU average. With comparatively low digital intensities and some size advantages, Spain is likely to be less affected by new digital regulations than the EU average.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Spain	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2.4	2.6
Number of fast-growing firms per 100,000 people (2018)	2	3
Number of data suppliers per 100,000 people (2019)	35	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	2.1%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

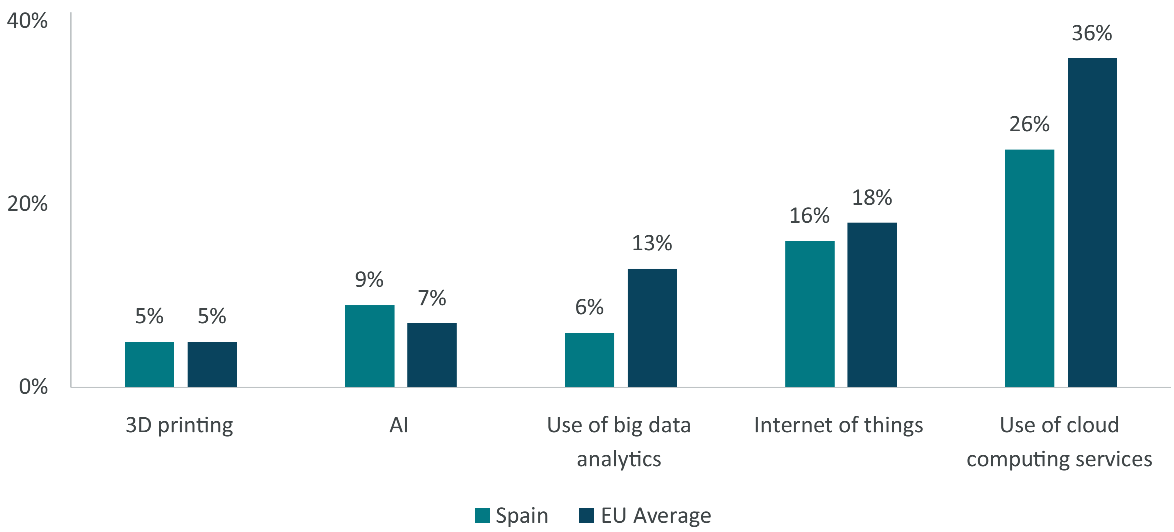


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

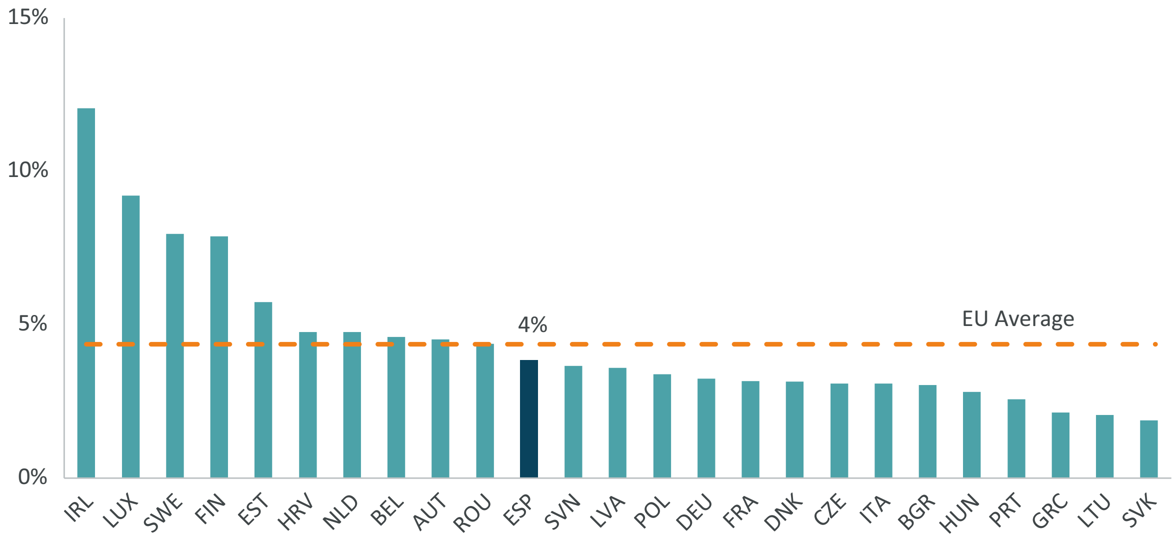
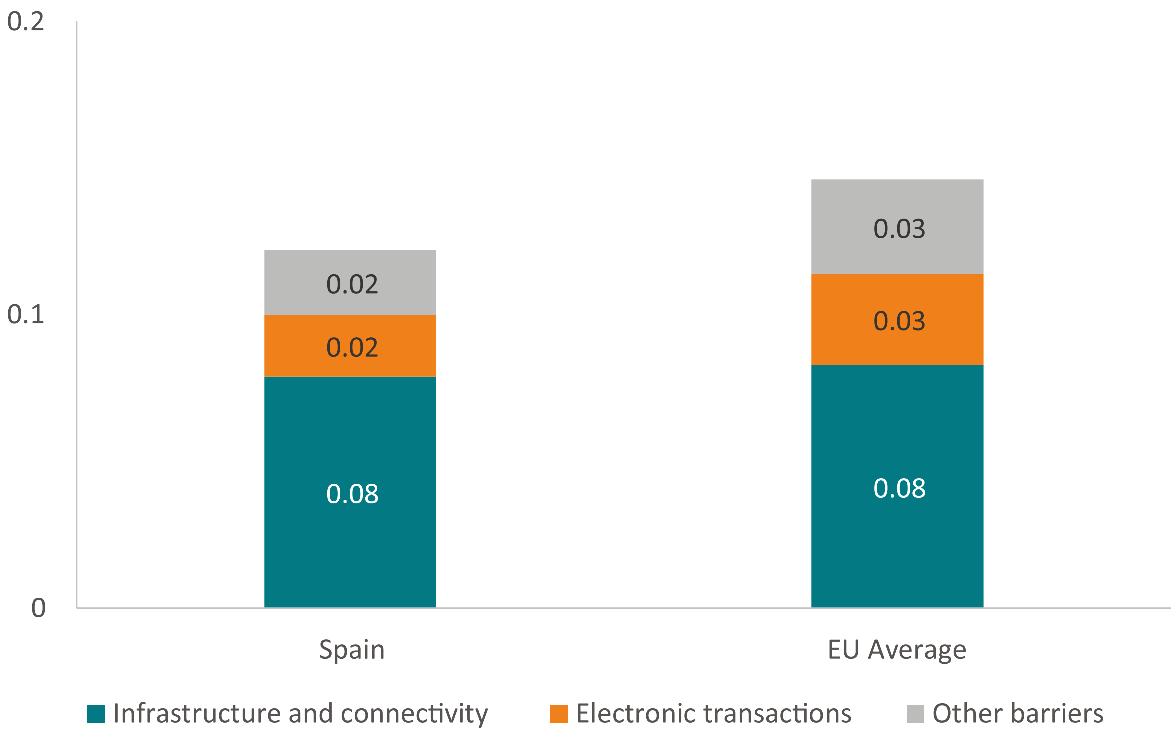


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



4.19 Sweden

The impact of the EU's upcoming DSA, DMA, and AI regulation on Sweden will depend on Sweden's digital endowments. Sweden shows a level of R&D in the digital sector and a percentage of firms using digital technologies consistently above the EU average. Sweden ranks first for having the highest number of data suppliers in the EU. The use of these endowments leads to a specialisation in the digital sectors. In 2017, 96 thousand people worked in the apps sector and 33% of businesses used e-commerce to sell their products, which is above the EU average. This specialisation results in a flow of resources. Trade in digital services represents 8% of Sweden's total trade, while on a per capita basis digital services trade is the second largest in the EU. Sweden's ability to transform its digital endowments to its advantage depends on its digital regulatory restrictions. The Swedish economy suffers from some of these restrictions, particularly on infrastructure and connectivity, at a similar level to the EU average. With high digital intensity and country-based size disadvantages, the distributional consequences of new regulation in Sweden will be strong than in the EU average.

TABLE 1: DIGITAL INDUSTRY STRUCTURE

	Sweden	EU Average
Medium-high R&D intensive activities over R&D information industries (2017)	2	2.6
Number of fast-growing firms per 100,000 people (2018)	5.3	3
Number of data suppliers per 100,000 people (2019)	90	42
Business expenditure on R&D in digital sectors as a percentage of value added (2017)	7.4%	3.2%

FIGURE 1: PERCENTAGE OF FIRMS USING DIGITAL TECHNOLOGIES (2020, EUROSTAT, SCALE 0-100%)

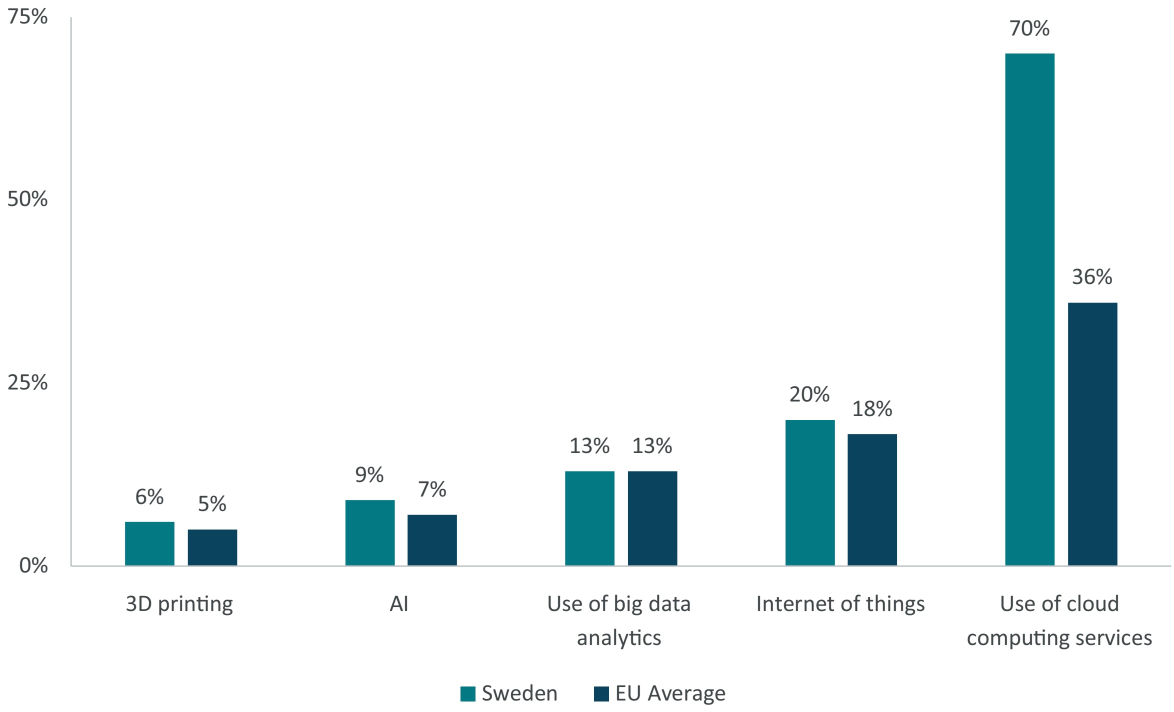


FIGURE 2: TRADE IN DIGITAL SERVICES (2015, OECD, PERCENTAGE OF DIGITAL TRADE OVER TOTAL TRADE)

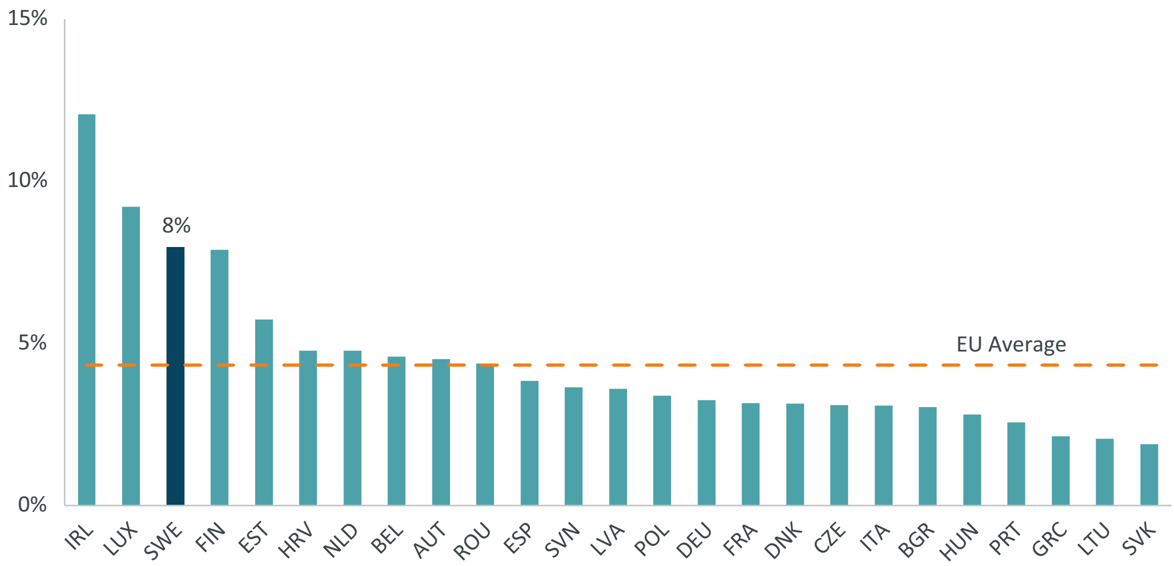
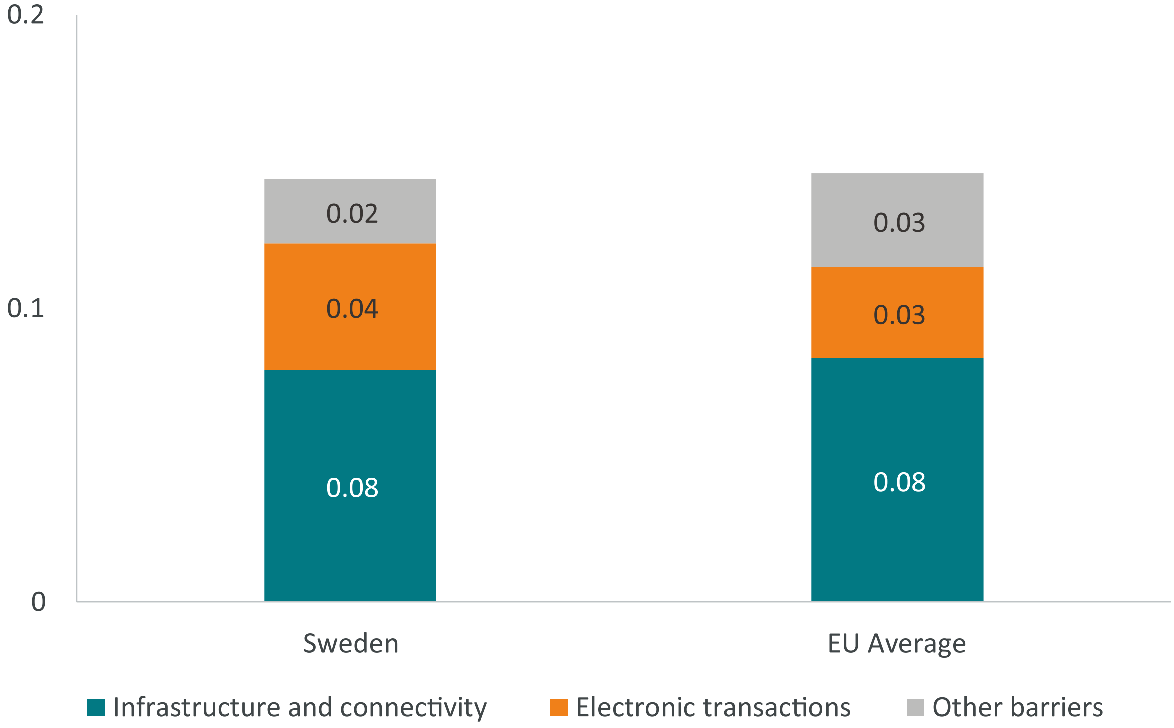


FIGURE 3: DIGITAL SERVICES TRADE RESTRICTIVENESS INDEX (2020, OECD, SCALE 0-1)



REFERENCES

Aghion, P., B. Jones and C. Jones (2018) "Artificial Intelligence and Economic Growth" NBER Chapters, in: The Economics of Artificial Intelligence: An Agenda, pages 237-282, National Bureau of Economic Research, Inc.

Ancarani, A., C. Di Mauro and F. Mascali (2019) "Backshoring Strategy and the Adoption of Industry 4.0: Evidence from Europe", Journal World Business, Vol. 54, No. 4, pages 360-371.

Andrews, D., E. Bartelsman and C. Criscuolo (2015) "Firm Dynamics and Productivity Growth in Europe", mentioned as mimeo in OECD (2015) report on The Future of Productivity".

Arnold, J., B. Javorcik and A. Mattoo (2011) "The Productivity Effects of Services Liberalization: Evidence from the Czech Republic", Journal of International Economics, Vol. 85, No. 1, pages 136-146.

Arnold, J., B. Javorcik, M. Lipscomb and A. Mattoo (2015) "Services Reform and Manufacturing Performance: Evidence from India", The Economic Journal, Vol. 126, Issue 590, pages 1-39.

Artuc, E., P. Bastos and B. Rijkers (2019) "Robots, Tasks and Trade", World Bank Policy Research working paper, No. 8674, World Bank, Washington, DC.

Atkinson, R. (2018) "How Can ICT Restore Lagging European Productivity Growth", Information and Innovation Foundation (ITIF), Washington DC.

Bauer, M., F. Erixon, O. Guinea, E. van der Marel and V. Sharma (2022), "The EU Digital Markets Act: Assessing the Quality of Regulation". ECIPE Policy briefs No. 2/2022.

Berlingieri, G., S. Calligaris and C. Criscuolo (2018) "The Productivity-Wage Premium: Does Size Still Matter in a Service Economy?" AEA Papers and Proceedings Vol. 108, pages 328-333.

Bertelsmann / ECIPE (2019) "Are Services Sick? How Going Digital Can Cure Services Performance", Bertelsmann Stiftung.

Bitkom (2019) "Annual Survey: Bitkom Draws Mixed Conclusion Regarding GDPR Implementation": https://www.bitkom.org/Presse/Presseinformation/Bitkom-zieht-gemischte-Jahresbilanz-zur-DS-GVO.

Boschma, R., and P. Balland (2019) "Industry 4.0 and the New Geography of Knowledge Production in Europe", Unpublished manuscript, Background paper for Europe 4.0: Sharing the New Data Economy. World Bank, Washington, DC.

Bradford, A. (2020) "The Brussels Effect: How the European Union Rules the World", Oxford University Press.

Brey, B. (2021) "The Long-run Gains from the Early Adoption of Electricity", ECARES working paper 2021-23, Université Libre de Bruxelles, Brussels.

Burt A. (2021) "New AI Regulations are Coming. Is Your Organisation Ready?", Harvard Business Review: https://hbr.org/2021/04/new-ai-regulations-are-coming-is-your-organization-ready

Business Sweden (2017) "Data Centres by Sweden", The Swedish Trade & Invest Council, Stockholm.

Cathles, A. G. Nayyar and D. Rückert (2020) "Digital Technologies and Firm Performance: Evidence from Europe", EIB Working Papers, No. 2020/06, EIB, Luxembourg.

Cory, N., D. Castro, and E. Dick (2020) "Schrems II': What Invalidating the EU-U.S. Privacy Shield Means for Transatlantic Trade and Innovation", ITIF Study, Washington DC.

Craglia M. (Ed.), Annoni A., Benczur P., Bertoldi P., Delipetrev P., De Prato G., Feijoo C., Fernandez, Macias E., Gomez E., Iglesias, M., Junklewitz, H, López Cobo M., Martens B., Nascimento S., Nativi S., Polvora A., Sanchez I., Tolan S., Tuomi I., and L. Vesnic Alujevic. (2018) "Artificial Intelligence. A European Perspective", EUR 29425 EN, Publications Office, Luxembourg.

Crozet, M. and E. Milet (2017) "Should Everybody be in Services? The Effect of Servitization on Manufacturing Firm Performance", Journal of Economics & Management Strategy, Vol. 26, No. 4, pages 820-841.

EIB (2021) "Artificial Intelligence, Blockchain and the Future of Europe: How Disruptive Technologies Create Opportunities for a Green and Digital Economy", European Investment Bank, Luxemburg.

Erixon F. and P. Lamprecht (2018) "Cooperation in Europe's Digital Economy: How do Countries Position Themselves?", Five Freedoms Project at ECIPE Policy Brief No. 1, ECIPE, Brussels.

European Commission (2016) "Analysis of the Impact of Robotic Systems on Employment in the European Union, Luxembourg, Publications Office of the European Union.

European Commission (2020a) Regulatory Scrutiny Board Opinion. Proposal for a Regulation of the European Parliament and of the Council on a Single Market For Digital Services (Digital Services Act) and amending Directive 2000/31/EC. SEC (2020) 432

European Commission (2020b) Regulatory Scrutiny Board Opinion. Proposal for a Regulation of the European Parliament and of the Council on contestable and fair markets in the digital sector (Digital Markets Act). SEC (2020) 437.

European Commission (2020c), Staff Working Document Impact Assessment Accompanying the Proposal for a Regulation of the European Parliament and of the Council on a Single Market For Digital Services (Digital Services Act) and amending Directive 2000/31/EC. SWD (2020), 348 final, Part I and II

Federal Trade Commission (2021) "Aiming for Truth, Fairness and Equity in your Company's Use of AI": https://www.ftc.gov/news-events/blogs/business-blog/2021/04/aiming-truth-fairness-equity-your-companys-use-ai

Ferracane, M., J. Kren and E. van der Marel (2020a) "Do Data Policy Restrictions Impact the Productivity Performance of Firms and Industries?", Review of International Economics, Vol. 28, No. 3, pages 676-722.

Ferracane, M. and E. van der Marel (2020b) "Patterns of Trade Restrictiveness in Online Platforms: A First Look", The World Economy, Vol. 43, Issue 11, Special Issue: The Effects of Services Trade Policies, pages 2932-2959.

Ferracane, M. and E. van der Marel (2021) "Do Data Flows Restrictions Inhibit Trade in Services?", Review of World Economics, Vol. 157, No. 4, pages 727-776.

Gal, P., G. Nicoletti, T. Renault, S. Sorbe, and C. Timiliotis (2019) "Digitalisation and Productivity: In Search of the Holy Grail – Firm-level Empirical Evidence from EU Countries", OECD Economics Department Working Papers, No. 1533, OECD Publishing, Paris.

Graetz, G. and G. Michaels (2018) "Robots at Work", Review of Economics and Statistics, Vol. 100, No. 5, pages 753-768.

Graham, M., I. Hjorth and V. Lehdonvirta (2017) Digital Labour and Development: Impacts of Global Digital Labour Platforms and the Gig Economy on Worker Livelihoods", Transfer: European Review of Labour and Research, Vol. 23, Issue 2.

Guglielmo Barone, G. and F. Cingano (2011) "Service Regulation and Growth: Evidence from OECD Countries", Economic Journal, Vol. 121, Issue 555, pages 931-957.

Hallward-Driemeier, M. and G. Nayyar (2019) "Have Robots Grounded the Flying Geese? Evidence from Greenfield FDI in Manufacturing", World Bank Policy Research Working Paper No. 9097, World Bank, Washington, DC.

Hallward-Driemeier, M., G. Nayyar, W. Fengler, A. Aridi and I. Gill (2020) "Europe 4.0: Addressing the Digital Dilemma", World Bank, Washington, DC.

Haskel, J. and S. Westlake (2018) "Capitalism without Capital: The Rise of the Intangible Economy", Princeton University Press.

Jia, J., G. Jin and L. Wagman (2018) "The Short-Run Effects of GDPR on Technology Venture Investment", NBER, Working Paper No. 25248, National Bureau of Economic Research, Massachusetts, MA.

Kässi, O. and V. Lehdonvirta (2016) "Online Labour Index: Measuring the Online Gig Economy for Policy and Research, Paper presented at Internet, Politics & Policy 2016, Oxford, 22–23 September.

Kearney & ECIPE (2020) "The Economic Costs of Restricting The Cross-Border Flow of Data", Kearney / ECIPE Publication White Paper, Brussels & Vienna.

Kelle, M. (2013) "Crossing Industry Borders: German Manufacturers as Services Exporters", The World Economy, Vol. 36, Issue 12, pages 1494-1515.

Leigh, N. and B. Kraft (2018) "Emerging Robotic Regions in the United States: Insights for Regional Economic Evolution", Regional Studies, Vol. 56, No. 6, pages 804-815.

Mandel (2017) "The App Economy in Europe: Leading Countries and Cities", Progressive Policy Institute Memo, Washington DC.

Minevich, M. (2021) "European AI Needs Strategic Leadership, not Overregulation", Tech Crunch, May 15, 2021, https://techcrunch.com/2021/05/15/european-ai-needs-strategic-leadership-not-overregulation/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAABqvuEOhR2G7eI-kZUTzU2ACGcNSvDOUQCoCX4xSVbq0ViN0TJLDEzxdMGDbRpxsfNUwkSTRWvE0I7FtNFOS0cXuIDselKhUPHf0BS_T9hg2L7fVlet9F62ktdj19E7AJXR1CEMwuzEMxQvCltr4bVTM8FRMtXKqx54EvU7MTSaP

Miroudot, S. and C. Cadestin (2017) "Services in Global Value Chains: From Inputs to Value-Creating Activities", OECD Trade Policy Papers, No. 197, OECD Publishing, Paris.

Mokyr, J. (1992) "The Lever of Riches: Technological Creativity and Economic Progress", Oxford University Press.

Nayyar, G., M. Hallward-Driemeier and E. Davies (2021) "At Your Service? The Promise of Services-Led Development", World Bank, Washington, DC.

OECD (2015) "The Future of Productivity", OECD Publishing, Paris.

OECD (2018) "OECD Reviews of Digital Transformation: Going Digital in Sweden", OECD Publishing, Paris.

Szczepański, M (2018) "European App Economy State of Play, Challenges and EU policy." European Parliament Briefing: EPRS | European Parliamentary Research Service Members' Research Service PE 621.894 — May 2018.

Van der Marel, E. (2016) "Digital Investments, Data and Growth in Europe: A Framework for Analysis", Five Freedoms Project at ECIPE Policy Brief No. 2, ECIPE, Brussels.

Van der Marel, E., F. Erixon, O. Guinea and P. Lamprecht (2018) "Are Services Sick? How Going Digital Can Cure Services Performance", Bertelsmann Stiftung / ECIPE Publication.

Van der Marel, E. (2021) "Regulating the Globalization of Data: Which Model Works Best?" ECIPE Policy Brief No. 9/2021.