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The adoption of digital practices by economic regulators: mapping digital pathways for consumer e-participation

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The adoption of digital practices by economic regulators: mapping digital pathways for consumer e-participation

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Abstract

This study bridges two emerging areas in the literature of economic regulation: the adoption of digital practices by national regulatory agencies (NRAs) and the empowerment of consumers for e-participation in regulatory processes through digitally enhanced consumer-facing platforms created by NRAs. With an aim to re-connect the regulatory state with citizens, we designed a novel framework, which comprehensively captures the digital capacity of NRAs and disentangles the multiple channels for consumer digital engagement with NRAs across the key regulatory procedures, including information provision, communication, education, and decision-making.

To measure the extent of digitalisation of regulatory functions, we derived a composite index of digital adoption for 236 individual NRAs from a newly collected cross-sectional dataset, which spans across 42 geographically disperse EU and OECD countries with distinct regulatory and institutional pressures and public proactiveness in digitalisation. We analyse the cross-country and cross-sectoral variation in the adoption of digital regulatory practices among the agencies with sole- and multi-sectoral competencies in five economic markets from utilities to financial services. Through modelling the impact of organisational-, industry-, and country-level factors on the digital scores of NRAs, we address an overlooked question of whether the borderless nature of digital technologies allows to overcome the gap in adoption of consumer-oriented regulatory practices.

With these insights, this study offers implications for both improving the effectiveness of regulatory procedures through consumer-oriented digital transformation, as well as government initiatives for enhancing digital trust and e-participation in economic regulation among consumers.

Keywords: economic regulation, digital regulation, consumer participation

Introduction

Over the past decades, economic regulators have become increasingly concerned about how well regulated markets function for consumers. These concerns have centred on rising prices and limited 'consumer dividend' (e.g., Florio, 2013; Stern, 2014) as well as on the sources of these outcomes, including increased concentration in some polities (e.g., Philippon, 2019), moral hazard and limited financial resilience in some sectors (e.g., Helleiner, 2011; NAO, 2022), and information asymmetry, combined with a too rational image of consumers held by regulators (e.g., Wilson & Waddams Price, 2010; Deller et al. 2021). Furthermore, regulators have come to know more about the 'winners and losers' in regulated markets, with socio-economic characteristics such as unemployment and lower levels of income and education being associated with less supplier- and provider-switching and, thus, with 'loyalty penalties' (e.g., Kleit et al., 2012). These concerns and insights have not only led regulators to intervene more in markets (e.g., Pagliari, 2012; Waddams Price, 2018), but also to revisit their approach to interacting with consumers.

One way in which they have given shape to their interaction with consumers is by embracing digital practices for what we call consumer e-participation in regulatory processes. Advances in digital technologies have allowed economic regulators to provide consumers with information and education; also, digital practices can facilitate consumer feedback, account holding, and dispute resolution. The literature on government digitalisation suggests that such practices can provide an easy, convenient, and cost-effective way for digitally skilled consumers to interact with regulators (Cabinet Office, 2012). These advantages may also extend to some traditionally marginalised groups such as disabled people with digital skills (Bastien et al., 2020). Regulators themselves can benefit from the fact that (individual) digital interactions are more cost-effective than telephone and face-to-face interactions (cf. Cabinet Office & Central Digital and Data Office, 2012). Digital consumer interaction is also more scalable, which has advantages from the perspective of access, even if it can create challenges when regulators receive large amounts of input (Balla et al., 2022). Finally, although digital interactions require digital access, skills and confidence, and are, therefore, not equally used by different segments of society (e.g., Robinson et al., 2015; Van den Berg et al., 2020), their adoption is usually seen as advantageous as long as it is accompanied by initiatives to avoid exclusion, including digital skill development and the availability of offline interactions (e.g., Wagg & Simeonova, 2022).

The digitalisation of the interface between economic regulators and consumers – via the organisations' websites but also social media platforms – has been aligned with the increase in

digital initiatives introduced by governments and businesses. Moreover, it has run parallel to regulators' own increased reliance on digital tools to engage with regulatees and enhance regulatory monitoring and enforcement processes (e.g., Yeung & Lodge, 2019; Coglianese, 2022; Ulbricht & Yeung, 2022a). Yet, whilst we know that regulators have come to rely more and more on digital channels (Van Loo, 2017), there are, to the best of our knowledge, no studies that capture the scope and prominence of regulators' consumer-oriented digital practices. We seek to address this gap in the literature by analysing the digital practices of economic regulators in the 42 countries that are member states of the European Union (EU) and/or the Organisation for Economic Co-operation and Development (OECD). We take a two-pronged approach to do so. First, we code the digital practices adopted by across 11 key online content areas. Second, we describe and explore the item- and aggregate-level variation in the practices, with a particular focus on the role of organisational capacity and formation, and the variation across regions, countries, and sectors.

By exploring the adoption and variation in the digital practices, our study contributes insight to the nascent literature on consumer e-participation in regulatory processes. This literature has reported that a designated public rule-making participation platform – the 'Regulation Room' – can help citizens participate in consultation procedures by providing more accessible consultation documents, embedded videos, and the option for people to add comments to documents and ask questions via a blog (Farina et al., 2011, 2013). Also, it has been demonstrated that technological tools can reduce the negative impact of mass comment campaigns on consultation procedures (Balla, 2022b), and that regulators themselves already pay limited attention to mass comment campaigns (Balla, 2002a). These different studies show how digital practices can support (consumers in) regulatory consultation processes; yet, as they constitute pilot and case studies, they do not provide insight into the extent of, and variation in, the adoption of digital practices by regulators across countries and sectors.

Before we proceed, two key concepts need to be clarified. First, by economic regulators, we mean those ministerial divisions and independent agencies that are responsible for economic regulation. Regulation refers here to the intentional intervention by public organisations in the economic activities of private companies, involving binding standard setting, monitoring, and sanctioning (Koop & Lodge, 2017), whilst the adjective economic points to those forms of regulation that are aimed at market creation and the correction of market failure. Our sample includes ministerial units and independent agencies in the areas of competition policy as well as energy, water, communications, postal services, railway, and financial market regulation. Second, by consumers, we mean citizens in their capacity as current or potential customers in

those markets that are overseen by economic regulators, with the concept of citizen referring to a country's adult and adolescent population, regardless of people's legal status.

Our paper proceeds as follows. In the next section, the analytical framework of the study is presented, introducing in the process the 11 web content areas which we subsequently focus on empirically. The subsequent section presents the design of the study, the data collection, and the operationalisation of key variables. We further report our findings on (i) the adoption of digital practices for consumer e-participation in economic regulation across 42 EU and OECD member states, (ii) the item- and aggregate-level variation in these practices, and (iii) the relationship between the practices and organisational capacity and formation, and the variation across regions, countries, and sectors. Finally, we discuss the implications of the findings.

Analytical framework: regulators' websites as digital information hubs for consumer e-participation

The observed gaps in theoretical treatment and understanding the extent of digitalisation of regulatory institutions and their effectiveness for consumer participation in regulatory processes within the regulation literature are striking, especially given the wealth of studies on digitalisation of private institutions, comprehensive digital initiatives for public sectors promoted by governments and supra-national agencies, and digital tools and strategies that have been actively deployed by regulatory agencies over the last decades.

In this study, we address both types of the highlighted shortcomings in the field of economic regulation by (1) developing an analytical framework to comprehensively capture digital instruments or mechanisms deployed by national regulatory agencies (NRAs) to enhance the involvement of consumers into regulatory processes, and (2) carrying out a large-scale comparative analysis of digital regulatory practices towards consumer e-participation in regulatory processes across countries and industries.

To enhance the concept of a "*digital regulator*" that has emerged in the recent literature on regulation of rapidly digitalising economies (Van Loo, 2017) along with the industry reports on supervisory technologies, frequently named as SupTech or RegTech (Finconet, 2020; Zeranski et al., 2020; Aktas et al., 2021; Grassi et al., 2022), we centre our analytical framework on the digitalisation of regulatory functions directly related to the regulator's interaction with citizens, and, more specifically, consumer e-participation in the regulatory processes (Diagram 1). The key regulatory functions of information provision, communication, education, decision-

and rule-making, and consumer protection[1], when strategically digitalised, can facilitate in establishing two-way relational mechanisms for regulator-stakeholder engagement, which we define as *digital pathways* for citizens' or consumers'[2] involvement in the regulatory process.

Regulators can strategically harness the societal power of digital technologies to facilitate information exchange and social participation (Piskur et al., 2014) within their regulated sectors, and co-perform and enhance their key mandated functions through digital platforms, the basic form of which are the organisational websites and social media. Digital technologies, even in their basic form, have been proven to help with overcoming the bottlenecks in national institutional designs (Schildt, 2022), either as a result of the weak performance of democratic systems, political or industry capture of regulatory processes, large distances between socio-economic groups, or a lack of involvement on the part of citizens – especially critical for catching-up economies.

The strategic design of interactive website content can help to transform standard organisational webpages into *stakeholder-centred information hubs* with digitally-enhanced functionality enabling citizens to interact with regulatory information on consumer rights and news releases, engage with e-learning materials on market and regulatory topics, track the regulators' decision-making process, and be more actively involved in rule-making processes (Diagram 1). When leveraged with a strategic digital vision for sector regulation, the established *digital regulatory hubs* can augment the regulator's strategic position within the national institutional system: from performing a traditional role of a market monitor and information gatekeeper to being a *digital facilitator*, promoting a more transparent and balanced representation of stakeholder interests in the regulatory system and market transactions.

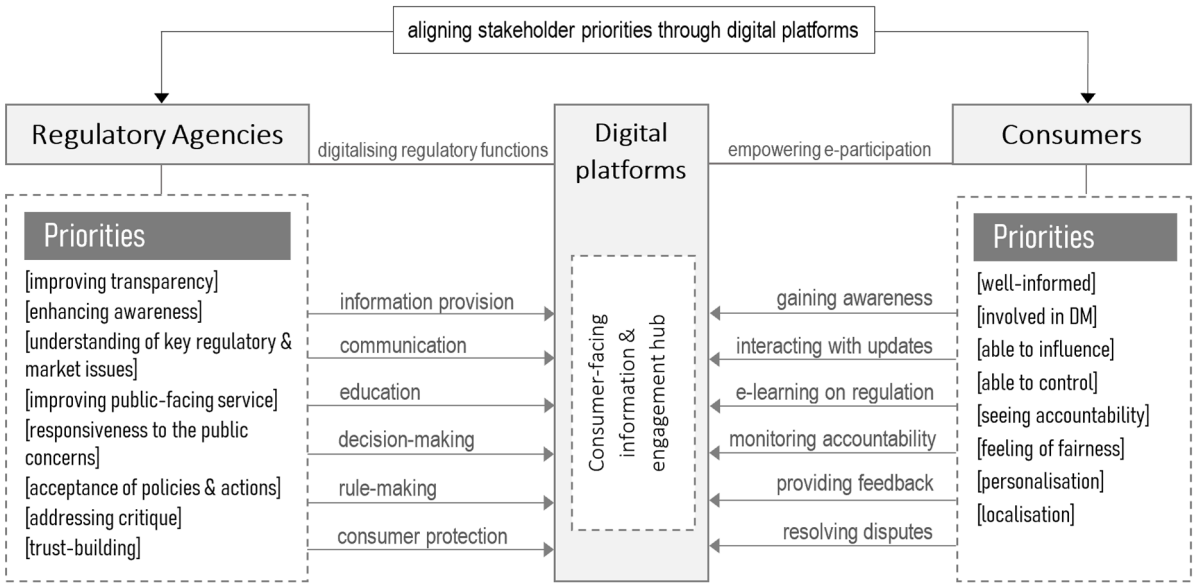
From a regulatory standpoint, the regulators' information hubs with improved digital accessibility and functionality offer a powerful tool to align the priorities of different stakeholder groups and, more importantly, reduce the information asymmetry among the main stakeholders in the regulatory process (i.e., the industry, state, and citizens), which is a well-known remedy against market failures (Tirole, 2015), such as mispricing, non-competitive corporate behaviour, short-term political pressures and rent-seeking, and windfall profiting during the times of crisis. Importantly, a more balanced and well-informed interaction among the main stakeholders within the regulatory system, facilitated by digital regulatory hubs, can also prevent the control of the regulatory processes by either of these parties, with this

[1] Hereafter, we focus on the key regulatory functions carried out by economic regulators towards consumers (i.e., consumer-oriented functions), not in relation to their mandated duties towards regulated industries and businesses.

[2] Hereafter, we use the term of "consumer" as one stakeholder category, for the focus of the proceeding empirical instigation is narrowed down to economic regulation.

strengthening the independence of the regulator and secure its legitimacy within the national and international institutional system.

Diagram 1. Regulators' websites as digital information hubs for consumer e-participation



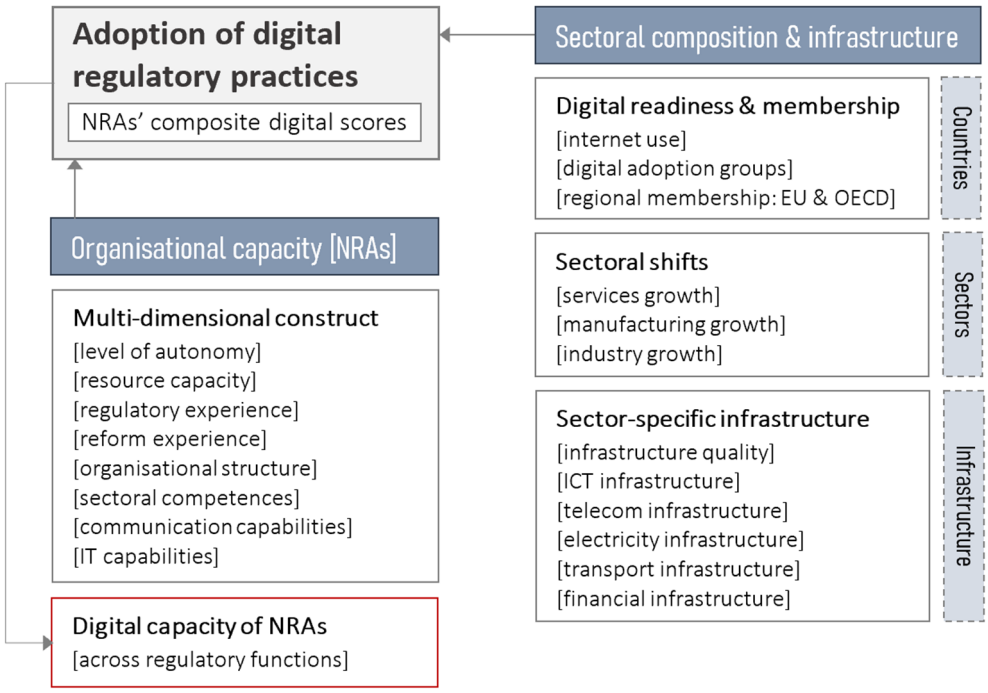
The regulators' choice between a full-scale digitalisation across all regulatory functions or a more narrow focus on a subset of those will be naturally defined by the national regulatory frameworks and socio-economic priorities; though a pro-active strategic outlook will yield far-reaching implications. The digitalisation of regulator-stakeholder interaction mechanisms across multiple regulatory functions will instil a wider range of digital pathways for consumer involvement in the regulatory processes, and can, in a longer term, contribute to democratisation of policy-making and regulatory processes.

The interaction of consumers with the regulators' information hubs can evolve through increasing levels of involvement in the regulatory process: from (1) visiting regulators' websites for news releases, (2) interacting with the specialised consumer information on the dedicated webpages or consumer portals, (3) joining e-learning programmes on educational portals created by regulators to transform consumers' roles in the market, (4) gaining understanding of sector-specific legislations and monitoring regulatory decisions on individual corporate cases published as website databases, (5) actively contributing to rule-making process and providing comments and feedback on policy drafts, (6) gaining sovereignty in resolving disputes with businesses and the regulator itself, to (7) directly contacting regulators via website forms and social media. For the purpose of this study, we define all seven levels of consumer involvement with the digital regulatory hubs as *consumer e-participation* in regulatory

processes (Diagram 1).

Although creating organisational websites is a standard practice for private and public services, regulators' practices adopted to designing their digital information hubs significantly change the available pathways for and extent of consumer e-participation in the regulatory processes, and more specifically, economic regulation which we set as a prime focus for this study. We aim to investigate the scope of *digital regulatory practices* that have been adopted by regulators across all key regulatory functions that can facilitate consumer e-participation, whether specified in the mandates or voluntarily set by the regulatory agencies in their strategic objectives, namely: media communication, consumer information provision, consumer education, rule-enforcement, rule-making, consumer protection, and consumer contact. With this we strive to understand how regulators digitise their key regulatory functions towards consumers, which are either defined in their mandates or set as strategic objectives by regulators themselves, and, more broadly, the extent of digital transformation of the regulatory process – in the part relevant to empowering consumers for involvement in economic regulation.

Diagram 2. Building digital capacity of regulators: organisational and sectoral attributes



We endeavour to identify the digital pathways for consumer e-participation created by regulators on their websites and social media, which enables us to (1) measure the level of adoption of digital regulatory practices with a *composite digital score* across the specified regulatory functions, and (2) to systematically compare the adoption levels, as measured with

composite digital scores, among the regulators with supervisory powers across major economic sectors and across countries (Diagram 2). To accomplish this, we develop a detailed mapping of relevant content areas for consumer e-participation on the regulators' websites in the following section (Diagram 3) and code these websites areas across a large sample of economic regulators operating in five economic sectors, including competition authorities, and 42 EU and OECD countries (Tables 1-3).

Having collected the data and measured the composite digital scores for all economic regulators (Section 3), we carry on with an exploratory analysis of variation in the adoption of digital regulatory practices by regulators across economic sectors and countries (Section 4). Mapping the differences in adoption levels among country regulators is an important step, as it allows us to estimate the gaps in the available digital pathways for consumer e-participation in economic regulation, and, more generally, the pre-conditions for participatory regulation (Haber et al., 2020). The particular attention will be devoted to quantifying the divergence in adoption levels within the EU regulatory area and comparison against the OECD countries in non-EU regions, estimating the varying effectiveness of the EU regulatory initiatives for consumer e-participation across the old and new member states.

The digital adoption levels are determined by a wide set of organisational, sectoral, and institutional factors, which vary significantly across countries and regions. To complement the exploratory analysis of the digital regulatory practices and explain the patterns in their variance, we collect the data and model the effects of organisational, sectoral, and country attributes (Diagram 2). We harness insights from the strategic management and public administration literature, to create a multi-dimensional construct of organisational capacity for regulatory agencies, as it defines the adaptive ability of regulators to learn new ways of performing their mandated functions and strategic objectives, pro-actively adopt these innovative practices, and embed them within existing regulatory processes.

Despite the vast legacy of the organisational capacity literature, with a number of capacity assessment frameworks developed for private organisations (Baser et al., 2008; Cox et al., 2018), at the time of writing, we have not identified any organisational capacity models specifically developed for regulatory agencies, given their distinct position within the national institutional system compared to both private and public sector organisations. Specific to the operations of regulatory agencies, we complement external and internal dimensions of organisational capacity (Christensen et al., 2008; Fowler et al., 2010) relevant to the adoption of innovative digital practices and engagement with stakeholder groups (Diagram 2).

Traditional to both the regulatory governance and strategic management literature (Smith,

1997a; Larsen et al., 2006; Ibsen et al., 2007; Christensen et al., 2007; Lægreid et al., 2010; Verhoest., 2010), we include the measure of *regulatory autonomy*, which is a key prerequisite to regulators' openness to experiment with innovative practices, which would strengthen the service delivery and their commitment to multi-stakeholder engagement, as well as their ability to independently decide for adopting new digital practices ahead of government and industry pressures for digitalisation, and maintain their leadership positions in digital regulation at the international level. The autonomy of economic regulators is, in itself, a multi-facet concept (Verhoest et al., 2004), intertwined with other dimensions of organisational capacity as outlined further on, and we primally aim to capture the granted legal independence of regulators, as it reflects the implemented governance arrangements for independent decision-making, transparency and balanced commitment to multiple stakeholder groups, which are comparable across countries and sectors.

The organisational access to resources provides a core capacity for non-profit organisations as it constitutes the bottom-line assets for regulators to effectively perform their functions and adopt innovative digital practices. Human capital is an important component of the *resource capacity* of regulators not only in the form of the availability of experts for routine regulatory tasks, but also as managerial capacity and leadership to reconfigure internal IT systems and implement a new vision for digitalisation of the regulatory functions. In the regulatory context, the improvements in managerial capacity can mitigate the impact of budgetary shocks and other environmental influences on the performance of supervision duties and delivery of public programmes (Andrews et al., 2010; Krueathep et al., 2010; O'Toole et al., 1999, 2010), buffer the regulator from adverse political and industry pressures, and swiftly adapt to the emergence and diffusion of new digital models. Financial or budgetary capacity, nonetheless, remains an important determinant of regulators' capability and commitment to implement new digital practices, which we combine with the dimension of human capital. Regulatory budgets constitute a more complex measure of organisational resources compared to revenues generated by private firms, especially in the cross-country and cross-sectoral context with distinct national budgetary systems for economic regulation. The impact of budget size and increases (or cuts) is intertwined with the notion of financial autonomy of regulators (Wassum et al., 2020), and their synergetic impact defines the regulator's ability to generate own revenues and allocate budgeted resources to implementing new digital vision. Differently to using revenues as an organisational size measure, the access to increased financial resources for regulatory agencies may alter their motivation to enhance digital pathways for engagement with other stakeholder groups.

Building and leveraging managerial capacity for creating public value is closely related to the *organisational experience* of regulatory agencies – a traditional proxy for dynamic capabilities in the strategic management literature (Teece et al., 1997; Eisenhardt, 2000; Winter, 2003; Teece, 2007, 2009), though its multifaced nature was largely overlooked by the regulatory governance studies which predominantly focused on regulators' age (e.g., Maggetti, 2007). The time span of independent decision-making and setting strategic priorities, including the digitalisation of regulatory functions, indeed reflects the regulators' ability to integrate their resource base and operational capabilities, and re-configure those over time in response to exogeneous innovation pressures from digitalising economies and societies, and sustain their independent digital vision under the changing political agendas. However, the length of regulatory operations since the establishment of a regulatory agency is not the only dimension of its organisational experience, which we enhance by incorporating the measure of organisational reforms.

Ongoing reforms of national regulatory systems are commonly coupled with creating new or transforming existing regulatory agencies, either as a response to supra-national regulatory initiatives or on a course of transforming domestic policies, and create a major challenge for building the long-term managerial capacity to implement an innovative digital vision, which we capture with a regulator-specific measure of *reform experience*. The impact of regulatory reforms on the adoption of digital practices by regulators reflects a complex interplay of endogenous and exogeneous changes, which provoke conflicting interpretation from the strategic management and organisation change literature. Organisational transformations – either in form of regulatory mergers and re-organisations, or establishment of new institutional entities – can create a strategic change momentum and provide effective incentives for traditionally more sluggish public organisations to adopt innovative digital practices and foster digital linkages to key stakeholder groups, provided that the regulator developed sufficient managerial capacity to overcome the hurdles of transition periods.

The resulting *organisational structure* is crucial to the regulator's ability to strike a balance between the regulatory autonomy to implement new strategic vision, the access to core resources, and sustaining balanced linkages with the key stakeholder groups. Specific to the governance arrangements within national regulatory systems, regulatory agencies can be established with stand-alone organisational structures and independent governance boards, or operate with hybrid or semi-autonomous structures, e.g., as independent agencies linked to executive government bodies, or as part of organisational hierarchy of a parent organisation. In the course of mergers and re-organisations, previously independent agencies can be absorbed

by other agencies or government bodies and function as departmental units without own budgets and independent governance boards. The semi-autonomous structures allow regulators to draw upon resources and digital vision of the parent organisation, on the other side, though constraining the regulator's ability for leadership in adopting innovative digital practices vis-à-vis its fully autonomous peers in other sectors and countries.

The regulatory reforms and organisational transformations are frequently complemented with changes in regulators' *sectoral competences* and their mandated powers, the scope of which may have a profound effect on the adoption of digital regulatory practices. Regulatory agencies with granted multi-sectoral competences can leverage their more central position within national institutional systems and a diverse pool of in-house expert knowledge, though again depending on the sufficient managerial capacity to coordinate the knowledge exchange and diffusion of innovative digital practices across sectoral units within the regulator's organisational structure. A stronger power position within the national governance system, granted and secured by the national legislative framework, however, can instil an inertial approach towards adopting new digital practices and skew managerial incentives towards private rent-seeking.

Related to the organisational structure as a dimension of the organisational capacity of regulators, establishing dedicated departments for stakeholder communication and IT support enhances the regulators' capacity to adopt new digital practices, as the communication and IT capabilities feed into other constituent components of regulatory capacity (Bullen et al., 2007; Wehmeier et al., 2013; Pang et al., 2014; Goh et al., 2019). For regulatory agencies, the in-house *communication capability* is an important reputation- and legitimacy-enhancing tool, conveying their mission to the key stakeholders and building trust with the public. The regulators' communication departments can transform traditional stakeholder communication tools into a digital communication strategy that can be wired into the strategic design of regulatory information hubs, and effectively diffuse new digital practices across the supervision departments. Developing in-house *IT capabilities* can be a long process especially for less agile public organisations, which traditionally underinvest in their IT infrastructure and lag behind in the digitalisation of their core functions. Once upgraded, the regulators' IT departments can speedily reshape the legacy IT infrastructure, innovate new consumer-facing regulatory portals, and deploy up-to-date digital functionalities across regulatory platforms. The dedicated digital transformation departments can experiment with interactive website designs and collect metrics of consumer e-participation, increasing the regulators' responsiveness to new digitalisation targets and the effectiveness of regulatory actions – both at the back- and front-end of regulatory

activities.

The adoption of digital regulatory practices is in itself an important indicator of the *digital capacity* of regulators (Diagram 2), which we strive to systematically measure, decompose, and compare for economic regulators across five different market sectors and 42 EU and OECD countries. In order to understand the sources of variation in the digital capacity of regulators, we test the impact of multiple dimensions of regulators' organisational capacity on their adoption of digital regulatory practices for consumer e-participation (Section 4), following the data collection and coding of all organisational attributes (Section 3). At the cross-sectoral level, we explore the shifts in sectoral composition towards services and whether financialisaton of the EU and OECD economies changes regulatory priorities towards consumers. The quality of sector-specific infrastructure may also promote the adoption of digital regulatory practices towards consumers as more financialised clients of sectoral infrastructure. At the cross-country level, we capture the effect of digital readiness as a pressure from the public and industry for digitalisation of regulatory practices. The impact of other institutional pressures on the adoption of new digital practices by regulators warrants a separate study.

Study design

Sampling approach: consumer markets across geographically and institutionally diverse economies

To measure and analyse the scope of digital regulatory practices for consumer e-participation, we created a new dataset for a total number of 236 national regulatory agencies involved in economic regulation, that would allow for cross-sector and cross-country analysis.

The sampling process started with selecting market sectors that have a major impact on citizens' well-being and potential for consumer participation in regulatory process, and, at the same time, render a more standardised representation across diverse country economies, avoiding sectors with resource- or location-determined specialisation, such as maritime transport or fishing industry. In result, the dataset construction evolved around six consumer-frontend service sectors: energy utilities, water utilities, telecommunication services, passenger rail transportation, postal services, and financial services, also including competition authorities with regulatory powers in consumer markets, which often share regulatory functions with sector-specific agencies (Table 1).

(Paste Table 1 in Appendix)

We extended the data sampling across the second dimension to include all the 28 EU member states, including the UK, and 15 non-EU countries which are OECD members, to make

digital regulatory practices comparable within the EU-regulated area and across five other regions (Table 2). The focus on the OECD members, with higher rates of consumer e-participation, digitalisation of service sectors, e-government development, and democratic performance will allow collecting best regulatory practices and foster spillovers to catching-up countries outside of the OECD club.

(Paste Table 2 in Appendix)

Within these sectors and countries, we applied two criteria to sampling organisations: (1) it must be mandated to regulate prices and service quality in a sector, i.e., defined as economic regulation (Stigler, 1971; Posner, 1974; Decker, 2015), and (2) it must be a national- or federal-level agency (i.e., excluding sectoral regulators at sub-national level). The competencies of the selected economic regulators were allowed to overlap with other types of regulation, such as social, safety, and environmental objectives, though not to be solely focused on these. Table 1 summarises the selection criteria for regulatory agencies across all sectors.

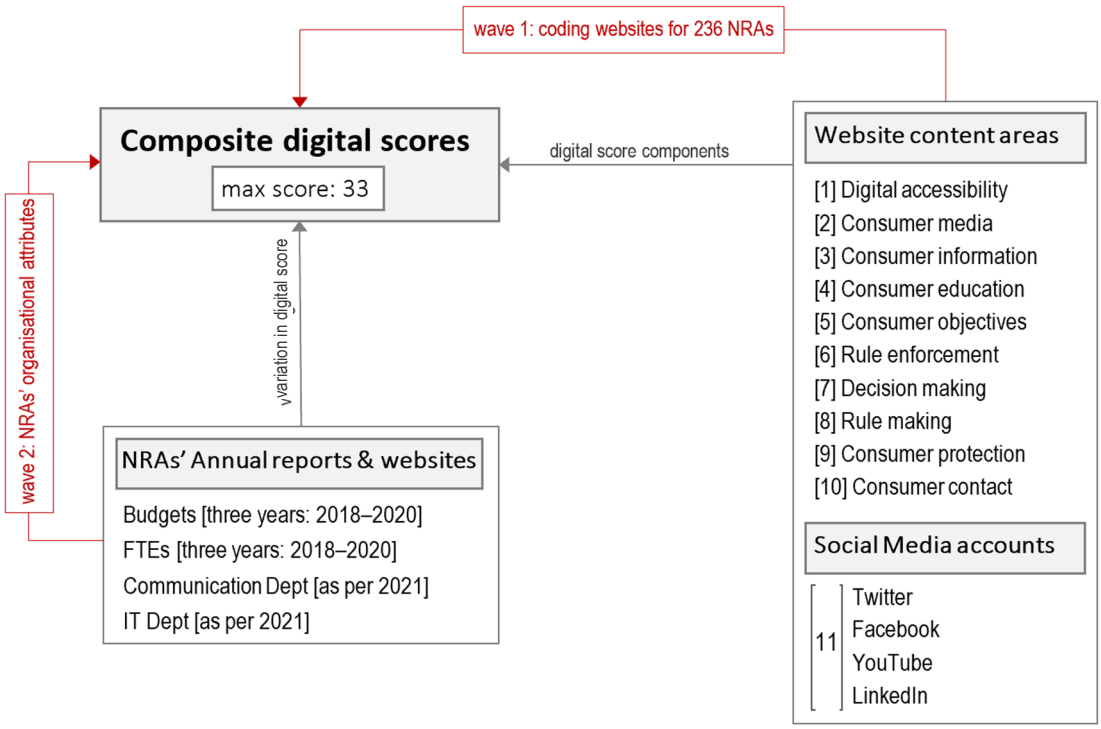
The total sample included 236 national economic regulators, 193 of which are sector-specific regulators, while 43 regulatory agencies have broader mandates across two or more sampled sectors. The multi-sector regulators are dominant in postal services (86.5%), telecommunication services (76.8%), water services (59.1%), while the energy and financial sectors, as well as antitrust behaviour, are largely supervised by sole-sector regulators. The regulatory independence in decision-making is more equally featured across sectors, with a higher number of ministerial units only among the rail regulators (16.7%). The country distribution for both sole-sector and multi-sector agencies depicts the national regulatory systems within and beyond the EU, also characterising how many agencies in a country have independence in making regulatory decisions (Table 2).

Data collection: coding the content of regulators' websites (wave 1)

The first wave of data collection focused on coding the content of websites and the adoption of social media accounts of the sampled economic regulators (Diagram 3), which we conceptualise as information hubs that can improve consumer awareness and facilitate consumers' e-participation in economic regulation (Diagram 1). To develop the coding scheme, we identified 11 content areas on regulators' websites which can be used as digital channels to foster consumer engagement with information resources available on regulators' websites (areas 1-7, Table 3), consumer e-participation in regulatory processes (areas 8-9, Table 3), as well as consumer interaction with the regulator as an organisation via digital platforms (areas 10-11, Table 3).

(Paste Table 3 in Appendix)

Diagram 3. The data collection waves: data metrics and sources



Each of these content areas is related to a regulatory function either legally defined in the statutes, such as information provision, decision-making, rule-enforcement, and consumer protection, or pursued by regulators as part of their strategic objectives, e.g., creating media pages, educational programmes, and directly engaging with consumers via helplines, web-chats, and social media accounts.

At the next step, we defined a set of binary and categorical indices to code the availability and accessibility of digital content on the regulators' websites within each of content areas linked to regulatory functions (Table 3). We assess the overall *digital accessibility* of regulatory information by whether a regulator has a stand-alone website or hosted webpage with regularly updated postings (Indices 1.a–1.b), which can be used as a public-facing information and engagement hub. The traditional *media communication* channels establish regular interaction between consumers and the regulator's website, enhancing consumer awareness about regulation matters; therefore, we code whether regulators publish news releases and announcements on their websites (Index 2.a) and whether consumers can subscribe on the website to receive regular newsletters and bulletins from the regulator (Index 2.b).

To code *consumer information* provision by the regulators, we check whether a designated section (often a separate webpage) for consumer matters was created on the website

(Index 3.a); this item is specifically important to prepare consumers for informed participation in market and regulatory processes. Digital tools for *consumer education* created by regulatory agencies on their websites are expected to enhance the effects of consumer information provision and transform consumers into active and informed participants, improving market efficiency and feedback quality for regulatory policy-making; and therefore, we code four items within this category: the general availability of educational materials on the regulators' websites (Index 4.a), the availability of two specific types of educational materials that are proved to enhance effectiveness of e-leaning – i.e., educational videos (Index 4.b) and educational quizzes (Index 4.c), and the availability of educational materials tailored for different consumer groups – most commonly, kids, adults, and seniors (Index 4.d).

Having evaluated the consumer content, we proceed with coding content areas for regulatory functions typically determined by statutes; and perceived interpretations of regulatory goals and statutory duties are the first important component of those, potentially impacting perceived legitimacy and leadership of the regulator in the eyes of consumers. For *consumer objectives*, we code whether regulators provide information about their regulatory goals and mandated duties, typically located on "About us" pages, and also assess whether the importance of these regulatory goals are interpreted for consumers as in accessible language as opposed to citing complex legal text from the statutes (Index 5.a), and whether consumers are mentioned as prioritised stakeholder group (Index 5.b).

The *rule enforcement* content area on the regulators' websites is the second important component to capture, as the provision of the key information on the regulatory framework may impact the perceived accountability of the regulators towards its statutory duties and consumer objectives. For this content area, we assess whether regulators publish primary legislations on their websites – either extracts on the webpages or by attaching entire legislation documents (Index 6.a) and whether the accessibility of published regulatory policies and rules is enhanced with a search function for consumers to locate relevant documents and contents as opposed to providing lists on webpages (Index 6.b).

The perceived transparency of regulatory actions can be enhanced via publishing the *decision-making* process especially with explained decision-making steps (coded with Index 7.a) and regulators' decision and determinations on the dedicated pages of their websites (Index 7.b).

Coding the *rule-making* content area of the regulators' websites assesses information availability for a different digital channel of consumer participation in the regulatory process, critical to development of regulatory policies. Improved accessibility of the consultation pages

with invitations and policy drafts encourages consumers to provide consultation responses and feedback, potentially raising the participation rates in the policy-making (Index 8.a); and publishing subsequent decisions and consultation responses from the public is an effective tool to establish evidence-based decision-making and increase the perceived transparency of regulatory decisions (Index 8.b).

Although not all regulators are mandated to pursue *consumer protection*, they can, nonetheless, provide information to consumers on how to lodge a complaint against a regulated company or a service provider, regardless of whether or not the regulator is authorised to mediate the dispute (Index 9.a). Explaining the complaint procedure against the regulator itself and providing information about the ombuds office may be a strong factor to improve the accountability in the eyes of consumers (Index 9.b).

The last two content areas capture consumer engagement, as we code the availability of contact information and enhanced functionality on the regulators' websites, that allow consumers to get in direct contact with the regulator via a telephone number (Index 10.a), online via an email, web-form (Index 10.b), or via web-chat (Index 10.c). Along with offering options to make appointments (Index 10.d), creating digital channels for direct contact is a strong tool to establish effective and tailored regulator-consumer engagement.

Establishing social media channels is another effective tool to directly engage with diverse consumer groups and improve the transparency and accessibility of regulatory information; though for simplicity, we only code whether regulators have active accounts on social media platforms (Index 11.a-d), as mapping their social media content would warrant a separate study.

We coded the websites of all 236 regulators in our sample during the condensed time window of August–September 2021, to ensure that the website contents were not significantly updated during this first data collection wave. This data collection approach allows for the unbiased and time-consistent comparison of the scores between the sector regulators. For independent regulators with stand-alone websites, we coded the entire website content; while for those regulators that operate as departmental units within ministries or central banks, we only code the pages devoted to the regulatory activities – typically, a dedicated webpage for a supervision department or supervisory function (e.g., banking supervision within central banks).

It is important to note that the coded indices were designed to capture common, comparable website practices of regulators that are standard across sectors and countries and may have (are proved to have) impact on consumers' perceived transparency, accountability,

and legitimacy of regulators, though these may not exhaustively cover the entirety of their website content or represent all regulators' initiatives to engage with consumers. With this approach, we aimed to avoid coding information on the regulators' websites which would be specific to practices within a given sector (e.g., on the accessibility of rail infrastructure for vulnerable consumers published by rails regulators) or to regulatory powers uniquely defined by national legislation. This standardised approach to coding the contents of regulators' websites also enabled us to develop policy implications and recommendations relevant to all regulators across 42 countries included in the sample, as well as to countries outside of the OECD club. To our knowledge (at the time of writing), no previous study covered this scope of website content analysis for economic regulators.

Data collection: collecting organisational attributes (wave 2)

To account for organisational capacity as a source of variation of regulators' website content scores (Diagram 2), we proceeded with the second wave of data collection (Diagram 3). Within public and private management fields, the organisational capacity of public service and non-profit organisations has been increasingly defined as a multi-dimensional construct – i.e., a set of organisational attributes measuring structure, resources, strategies, and processes – both internal and external – that affect organisational ability to perform its core functions, develop, and improve (Christensen et al., 2008), which we follow and adopt for this study.

To operationalise the organisational capacity of regulators, we defined seven internal and one external organisational attributes that may specifically affect the regulator's ability to adopt digital practices for consumer e-participation, and, at the same time, be standard to operations of regulators across all sampled sectors. The internal capacity dimensions include: (1) allocated financial resources, (2) allocated human resources, (3) organisational experience, (4) organisational structure, (5) competences, (6) communication, (7) in-house IT, and the external dimension captures (8) the level of regulator's autonomy (Table 4).

(Paste Table 4 here)

We collected the data on each of the eight organisational capacity attributes for 236 economic regulators. To measure the *financial capacity* of regulators, we collected the amounts of approved budgets for three consecutive financial years prior to the time point of coding the website contents (wave 1): i.e., 2017/18, 2018/19, and 2019/20, from the regulators' annual reports or financial statements. The budget terminology used by the regulators to report budget figures in their annual reports is not consistent, especially given differences in national budgetary systems across countries. Therefore, we cross-checked all allocated budgets against

government or parliament budget documents, to consistently identify the final modified numbers as per the end of each financial year, including operating and investment expenditures.

The same approach was applied to *human capital capacity*, which we measured from a resource perspective: i.e., how many experts in sector regulation, senior decision-makers and managers, and associate staff were employed by the regulator. We collected the numbers of employees, i.e., full-time equivalents (FTEs), as reported at the end of each of the three financial years, from the regulators' annual reports and staffing reports.

For regulators that were established and operate as stand-alone legal entities, the budget and FTEs numbers were collected for the entire organisation; while for those regulators that were established as departmental units within ministries or central banks, we collected budgets and FTEs allocated on supervision functions performed by these regulatory departments, and not the entire parent organisation (e.g., ministry or central bank). Dealing with the missing data for departmental units was a challenge, which we resolved by sending information requests (via email) to 12 sector-specific regulators and 22 financial regulators within central banks, to collect any missing values on budgets and FTEs specifically allocated for supervision functions. For those regulators which either did not respond or declined our requests, we substituted missing values with sector-specific averages (category-mean imputation approach) and weighted those for country differences from the total sample average. Where FTE numbers were available, we further weighted imputed budget means for the number of employees involved in supervision (Table 4).

This mean-imputation exercise yielded an interesting finding for regulatory capacity within central banks, as even within the harmonised EU regulatory area, the proportion of financial and human resources allocated on micro-prudential supervision differed significantly. Based on the numbers provided by the central banks for the three financial years, the Czech National Bank (CNB) allocated the largest proportion of the total budget on supervision functions (43.6%), followed by Dutch Central Bank (DNB) – 42.3%. Both central banks also allocated an above average number of employees for supervision: 29.3% (CNB) and 46.2% (DNB). The Bank of Spain (BdE) stayed closest to the average level among all central banks: 27.3% of budget and 25.01% of employees allocated for financial supervision. The German Federal Bank (BBk) and the National Bank of Romania (BNR) showed the lowest percentage of resources allocated for supervision: 11.3% (budget) and 14.8% (FTEs) for BBk, and 2.7% (budget) and 9.9% (FTEs) for BNR.

As a proxy measure of *organisational experience* in sector-specific economic regulation, we created a variable capturing the number of years since establishment of each regulator in its

current form, following the common practice in management studies and regulation literature. The establishment mode of an organisation and experience of re-organisations and reforms have a profound effect on its capacity to adopt innovative practices. To control for this effect, we coded a categorical variable distinguishing between (1) regulators that were established in their current form before 2000 and continued their regulatory activities after 2000 without a re-organisation, (2) regulators that were established in their current form after 2000, by taking over the duties of a predecessor regulator, (3) regulators that were established in their current form after 2000, by merging two or more different regulators, and (4) regulators that were established in their current form after 2000 as a new institutional entity. We use the year of 2000 to demarcate the onset of the digital era for public services, and capture the regulatory reform experience during the time with increasing pressures for digitalisation from consumers, industry, and government.

To account for specificity in organisational structures among the sampled regulators, which may impact the capacity to adopt new regulatory practices, we coded a binary variable depicting whether a regulator operates as a division, a department, or a functional unit within the organisational hierarchy of a parent organisation, or operates under an independent organisational structure with its own governing board overseeing the regulator's operations (whether attached to a ministry or not).

The proxy for organisational structure is closely related to the external dimension of regulatory capacity: the *level of autonomy* in regulatory decision-making, which in itself is multi-dimensional construct (Verhoest et al., 2004). To avoid biasing the complexities of public management models across the sampled countries, we operationalised the regulatory autonomy from the structural perspective, and coded a binary variable to differentiate between (1) independent regulators with full autonomy in performing their duties assigned by law and exercising their statutory powers and (2) those regulators which are not fully independent in regulatory decision-making. Out of 215 independent regulators in our sample, 47 operate as departmental units within ministries or central banks; while 21 regulators were coded as non-independent, i.e., operating as regulatory units within ministries without autonomy in decision-making. To control for hybrid or semi-autonomous structures, we coded a binary variable for regulators that are attached, subordinated, affiliated to a governmental department, or listed as independent agencies of ministries; e.g., the Danish Competition and Consumer Authority and the Financial Supervision Authority both operate as agencies of the ministry's group (Ministry for Industry, Business and Financial Affairs); the Authority for Consumers and Markets in the Netherlands – as an operationally independent agency of the Ministry of Economic Affairs and

Climate; and the Office of the Comptroller of the Currency listed as an independent bureau of the U.S. department of the Treasury.

The competence dimension of organisational capacity was operationalised as the extent of sectoral competences granted to regulators, for which we created two attributes: (1) a binary variable to distinguish between the sole-sector and multi-sector regulators, (2) and a count variable for the number of sectors within the regulator's authority. This capacity dimension reflects the outcome of regulatory reforms and re-organisations, captured with the "establishment mode" variable of regulators, mentioned previously.

After coding the general organisational attributes, we captured the regulators' digital capacity for the two dimensions more specifically related to the adoption of digital practices for consumer engagement. We checked the organisational charts and annual reports of 236 regulators to distinguish those regulators that established separate consumer communication and IT departments; and for both organisational functions, we differentiated when it is performed within a specialised digital department. The in-house capacity for consumer communication was proxied as a categorical variable, which indicates whether the regulator has a separate general communication department or a specialised digital communication department. The same approach was applied to capture the in-house digital capacity: we created a categorical variable to separately code whether the regulator has a general IT department or had established a dedicated department for digitalisation or digital transformation, which would improve in-house capability to digitalise regulatory functions (Table 4).

Having accomplished both waves of the data collection, we created a unique dataset, merging the digital scores of regulators with their organisational attributes, which we analyse in the following sections.

Data analysis and findings

The organisational capacity of regulators: diverse trajectories in organisational formation and regulatory reforms

The importance of building and strengthening organisational capacity is not confined to the performance-driven private sector: designing a multi-dimensional tool that would enable public-service organisations to measure, assess their capacity, and track its development over time, beyond budgeting regulatory activities and allocating human resources, could enhance accountability, innovation absorption, and leadership in public service delivery.

Developing and testing a comprehensive capacity framework for the regulatory state is a challenging task, given the divergence in organisational formation trajectories that we observe

among the sampled economic regulators. All countries within and outside of the EU regulatory area, except for Estonia, made diverse institutional choices in designing their regulatory systems during the digital era (highlighted in Table 5.a): complementing new institutional formations (i.e., establishing new regulatory bodies) with institutional integration (i.e., regulatory mergers), and institutional re-organisations (i.e., creating legal successors that inherited the tasks of predecessor regulators).[3] In result, 147 regulators in our sample (or 62.3%) were either newly-formed or transformed since 2000; and the specific institutional choice for their establishment had also affected the regulator's organisational capacity since its transformation, including the regulator's digital capabilities and vision towards consumer participation. A diversity of nation-specific institutional models for integrating or splitting the competition enforcement with sector regulation and the enforcement of consumer laws across the sampled countries had particularly important implications for our study. Different distributions of supervision and consumer protection responsibilities that we observed among the sampled competition and sector-specific authorities are prone to create a variety in regulators' responses towards the adoption of digital practices for consumer participation across country.

Only ten countries in our sample had their economic regulation predominantly institutionalised before 2000, with more than a half of sectoral regulators established in early phases of sectoral liberalisation (pre-2000); remarkably, two of them are the catching-up economies of Chile and Colombia (Table 5.a). The institutional design in another group of 12 countries was accomplished through one dominant mode of organisational formation, either by forming new regulators, re-organising predecessor regulators, or merging regulatory powers under an integrated/unified regulator (highlighted in Table 5.a). The remaining 20 countries, half of our sample, more equally complemented establishment modes in their regulatory design, following the most diverse approach in organisational formation. Without drawing any conclusive evidence, the institutional choice had a definite effect on the regulators' capabilities to adopt digital practices. The first group of countries with early institutionalised regulatory systems obtained the highest average digital score of 20.35, while the regulatory regimes designed post-2000 through a dominant establishment mode led to the lowest levels of digital adoption among the country regulators (18.3 on average), compared to 19.0 score obtained by the third group of countries that complemented establishment modes in the organisational

[3] Table 5.a is not aimed to capture the complete institutional design across countries; as for this study, we do not reflect the cases of increasing statutory powers without organisational transformations, or any other alternative allocations of regulatory competences.

design of their regulatory systems.

(Paste Table 5.a here)

The timing of the organisational transformations added yet another layer of complexity to the analysis of digital adoption among the sector regulators, as the time lapsed from the re-organisation, merger, or new establishment directly effects the regulator's capability to devise new organisational practices and implement digital strategies. The peak of institution building fell onto the early years of 2001–2003, when the candidate countries were establishing new regulatory authorities to implement the EU requirements, and has been more evenly distributed over the following period (Table 5.a). The institutional integration through regulatory mergers was more condensed after the financial crisis, also predominantly in the EU area (2009–2013), with an early evidence of a more recent reform wave emerging at 2019. The regulatory re-organisations initially peaked during 2002–2005, and until 2004 were driven by the EU accessions, and later in 2005: by the financial regulation reforms in Colombia and the re-organisation of the competition authority in Iceland. The post-crisis re-organisations continued into 2013–2015, mainly within the EU regulatory area, as well as two reforms of the antitrust and telecom regulation in Mexico, with signs of growing activities in more recent years (2018–2019).

Institutional formation: newly-formed regulators

The two decades of regulatory reforms were particularly prominent within the EU area (Table 5.a), where all but eight countries (including the UK) had new sectoral regulators established – either to comply with the EU requirements, as in pre-accession Bulgaria, Croatia, Cyprus, Czechia, Lithuania, Romania, and Slovakia[4], or upon enacting new legislation for sectoral economic regulation in the post-accession period and following the EU directives for harmonisation of sectoral regulation.[5]

Throughout the entire sample, 47 sectoral regulators were newly established since the year of 2000, which we use to demarcate the onset of the digital era in public services. Nearly 83% of these new regulatory agencies emerged within the Single European Market: with 39 newly-formed entities in total; the new member states which joined the EU after 2000 accounted for 21 of them (Table 5.b). Seven countries in our sample – all the EU members – had all their economic regulators, across the sampled sectors, established after 2000, either through re-

[4] During 2001-2003, Cyprus enacted new laws for the energy, telecommunications, and postal sectors, as well as the securities, insurance, and occupation pension segments of the financial market, and established four sectoral regulators: Cyprus Energy Regulatory Authority, Office of the Commissioner of Electronic Communications and Postal Regulation, Cyprus Securities and Exchange Commission, and Insurance Company Control Service.

[5] The Consumer Rights Directive 2011/83/EU; check the directives for the rail and finance sectors.

organisation, consolidation, or forming new institutional entities: Austria, Estonia, Finland, France, the Netherlands, Malta, and the UK.

(Paste Table 5.b in Appendix)

Austria and Belgium are the only two old member states that predominantly reformed their national regulatory system through establishing new regulatory authorities following the late liberalisation of the energy market, telecommunication, postal, and rail services. The establishment of new authorities did not form a notable trend outside of the EU regulatory area (within our sample), with the only exception for Israel, where the Postal Administration was established under the Ministry of Communications in 2006, and the Capital Market, Insurance and Savings Authority was established to regulate the financial assets services and the non-banking credit after legislative amendments to the Financial Services Supervision Law in 2016.

Institutional integration: regulatory mergers

The EU countries also led in consolidating the regulatory powers under the united or merged sectoral regulators: accounting for 38 out of 49 regulatory mergers since 2000; 22 of which took place in the old member states and 16 among new joiners. The consolidation processes were particularly notable in Denmark, Finland, the Netherlands, and Estonia, which had more than a half of their sampled sector regulators established by merging the functions of previously existing regulatory authorities, mainly after the financial crisis of 2008.

In 2010, two regulatory mergers were undertaken in Denmark, when the former Competition Authority was united with the Danish Consumer Agency to establish the current Competition and Consumer Authority – an independent agency under the Ministry of Industry, Business and Financial Affairs; and the Transport Authority was merged with Danish Civil Aviation and Railway Authority (and further reformed in 2021). Shortly after, in 2012, the Danish Commerce and Companies Agency was consolidated with parts of both the Danish Commerce and Construction Agency and the IT and Telecom Agency to form the Danish Business Authority in its current structure – a regulator of the telecommunication sector under the Ministry of Business.

The regulatory system in Finland went through a series of similar organisational transformations, starting with consolidating the functions of the Insurance Supervisory Authority under the Financial Supervision Authority in 2009. Upon the transposition of the EU Consumer Rights Directive, the Finnish Competition Authority and the Finnish Consumer Agency were merged to form the Competition and Consumer Authority in 2013, to enhance the consumer policy priorities and secure the consumer interests in competition enforcement. The Transport and Communications Agency – a multi-sector regulator for the telecommunication,

postal, and rail sectors, – was created in 2019, by merging two agencies: the Finnish Communications Regulatory Authority and the Finnish Transport Safety Agency, with the primary goal to improve their responsiveness to consumer needs and accelerate the digitalisation of transport sectors. The new transport and telecom regulator further integrated the traffic control tasks of the Finnish Transport Agency, which, in its turn, was previously formed through a merger of three separate transport agencies in 2010.

The institutional design of competition enforcement and consumer protection in the Netherlands marked a different path with creating an integrated regulator with multi-sectoral competencies, the Netherlands Authority for Consumers and Markets, affiliated with the Ministry of Economic Affairs and Climate (in 2013). Since 1998, the Netherlands Competition Authority, which was originally established under the Competition Act of 1998, consolidated the oversight powers over the energy sector – with the enforcement of the Electricity and Gas Acts in 1998 – and the transport sectors upon enactment of the Passenger Transport Act (2000) and the Railways Act (2003). The supervisory functions over the telecommunication and postal services were further integrated in 2013, by merging the Netherlands Competition Authority with two other public agencies: the Consumer Authority – recently formed in 2007 upon transposing the European Consumer Law Directive in the national law, and the Independent Post and Telecommunications Authority which was established in 1997 after liberalising the telecommunication market.

Estonia implemented a similar institutional model by consolidating the regulatory functions under the Estonian Competition Authority: with a post-accession merger of the Estonian Competition Board, which was established in 1993 upon gaining independence and re-organising the Price Board, the Energy Market Inspectorate, and the Estonian Communications Board (in 2008). The consolidation process continued in the second half of 2021, when the Estonian Competition Authority absorbed the Estonian Data Protection Inspectorate and the Estonian Patent Office, to create synergies from merging the support services.

Institutional re-organisation: creating legal successors

Replacing existing regulatory agencies with new re-organised sectoral regulators was also prevalent among the EU founder states, where 23 regulators were formed by taking over the responsibilities of their predecessors, in comparison to only 13 cases among the new member states (four of which are in Slovenia). This path of organisational formation for economic regulation was dominant in the UK known for early sectoral liberalisation (5 regulators), Portugal (4 regulators), and Slovenia (4 regulators), and also scored high in Ireland and France

(3 regulators each).

In 2013 year alone, the UK had three regulatory agencies established, though implementing a different institutional model by separating the competences of previously integrated regulators (Cseres, 2020). The Competition and Markets Authority – an antitrust regulator with oversight powers over the energy, water, telecommunication, and rail markets, – took over duties of the Office of Fair Trading (1973–2014) and the Competition Commission (1999–2014), itself a successor of three monopoly commissions.[6] Following these organisational transformations, the competition regulation was separated from the enforcement of the consumer law, and the competencies for the latter were allocated onto the dedicated consumer advocacy body, Citizens Advice.

The financial regulation in the UK went through the same institutional transformation, when the Financial Conduct Authority and the Prudential Regulation Authority within the Bank of England took over the responsibilities of the integrated Financial Services Authority[7] (2001–2013), establishing a twin peaks system under the Financial Services Act 2012. The Financial Conduct Authority, however, also inherited the consumer protection tasks, as part of the post-crisis reforms.

The economic regulation of the UK rail sector also witnessed a series of organisational transformations: the UK Rail Regulator, originally established under the Railways Act of 1993, was surpassed by the Office of Rail Regulation in 2004, and then ultimately re-organised into the Office for Rail and Road, following the enactment of the Infrastructure Act 2015. The early liberalisation of the water industry in the UK also prompted the establishment and subsequent transformations of the post-privatisation regulatory framework: the Office of Water Services (Ofwat) was established in 1989, and further re-organised into the Water Services Regulation Authority in 2006, following the passage of the Water Act 2003.

The re-organisation of existing regulators, within their previously confined sectoral responsibilities, was the sole transformation path in the post-accession Slovenia, making it a unique case among the new member states. During the two years, 2013–2014, Slovenia reformed three of its sectoral regulators which were established prior to joining the EU. The Slovenian Competition Protection Agency, the sole authority responsible for the enforcement of competition law, took over the responsibilities from the Slovenian Competition Protection Office, which was established on the onset of market liberalisation in 1994; and similarly to the

[6] Namely, the Mergers and Monopolies Commission (1973–1999), the Monopolies Commission (1956–1973), and the Monopolies and Restrictive Practices Commission (1949–1956).

[7] Itself being the successor of the Securities and Investments Board (1985–2001).

UK, Slovenia separated powers in the enforcement of consumer and competition laws. The Public Agency of the Republic of Slovenia for Energy that was originally formed in 2001 to comply with the EU requirements on the liberalisation and regulation of competition in the energy market, was re-organised into the Energy Agency with increased powers, tasks, and independence under the Energy Act of 2014. As the result of the new legal regulation since mid-2011 (the Law on Electronic Communications), the Communications Networks and Services Agency replaced the Post and Electronic Communications Agency without a change in its powers; and further opposing an increase in the administrative burden on the new telecom agency, by delaying the transposition of the EU directive 2018/1972 until mid-2022.

Organisational formation outside of the EU regulatory area

Outside of the European single market, the sectoral regulation was predominantly conducted by the agencies established before 2000, with a low number of institutional transformations among the sampled OECD countries. The fundamental legislative and organisational reforms in Mexico since 2006 made it a prominent case among the catching-up economies, especially with the role of consumer organisation groups in mobilising the consumer interests and the voters' choice for the pro-competitive reforms and regulatory autonomy across the network industries (Aydin, 2016). Following a series of reforms to its competition law and the constitutional amendments in 2013, Mexico re-organised its competition authority – the Federal Economic Competition Commission, reconstituting it as an independent agency with increased investigative powers and transparency. In the same year, Mexico also re-organised its telecom regulator, the Federal Telecommunications Institute, strengthening its autonomy and competition enforcement powers in the highly concentrated telecom and broadcasting markets. Both agencies replaced the predecessor regulators and in a short time achieved international recognition for their competition enforcement standards, also expanding their expertise into digitalising the regulatory practices and obtaining remarkably high digital scores (Table 7). In the financial sector, Mexico decentralised the micro-prudential regulation, splitting the oversight powers over market segments among the six financial regulators and allocating the responsibilities for consumer protection to the stand-alone independent agency, National Commission for the Protection and Defense of Financial Services Users. The institutionalisation of financial regulation was largely accomplished by 1995, when Mexico created a single decentralised financial authority, the National Banking and Securities Commission, by merging the functions of the National Banking Commission and the National Securities Commission.

Two re-organisation cases marked the post-2000 regulatory reforms in New Zealand,

introducing new governance arrangements in the energy and financial markets, to foster their responsiveness to long-term consumer benefits along with improving market competition and performance. Following the passage of the Electricity Industry Act 2010, the Electricity Authority was formed as an independent entity to replace the Electricity Commission, which itself was a legal successor of the Electricity Governance Board, a self-regulatory body established in 2003. In the next year, the Financial Markets Authority took over responsibilities of the Securities Commission of New Zealand, following the Parliament's inquiry into the collapse of the 67 investment companies and the subsequent passage of the Financial Markets Bill and the Financial Markets Authority Act in 2011. A different institutional route was pursued in reforming the economic regulation of the transport segments, where in 2008, the two key government transport bodies (the Land Transport New Zealand and Transit New Zealand) were merged to form the New Zealand Transport Agency, with some functions devolving to the Ministry of Transport.

Other significant cases of merging regulatory powers, outside of the EU, took place in Australia and South Korea. In 1998, following the recommendations of the Financial System Inquiry[8] for deregulation and technological transformation of the financial market, two new specialised financial regulators were created in Australia: a prudential authority with oversight powers over the banking and insurance sectors and an integrated regulator specialised in the securities and credit markets. The Australian Prudential Regulation Authority (ACCA) was established through consolidation of the regulatory functions in the insurance and pension market segments from the Insurance and Superannuation Commission, and the credit market from the Australian Financial Institutions Commission. The ACCA also integrated banking supervision from the Reserve Bank of Australia – in contrast to establishing 13 micro-prudential supervisors within central banks among the EU countries since 1990s. The Australian Securities and Investments Commission took over the responsibilities from the Australian Securities Commission (1991–1998), and also expanded its powers into consumer protection in deposit-taking, superannuation, and insurance, and further in 2010 to supervise the consumer credit and futures trading. Further on, the economic regulation was consolidated for the telecommunication services, with a merger of the Australian Broadcasting Authority and the Australian Communications Authority in 2005, to form a converged communications regulator – the Australian Communications and Media Authority.

In South Korea, the supervision powers of the four financial authorities over separate

[8] Later known as the "Wallis Inquiry".

financial segments[9] were consolidated under a fully integrated financial regulator. The Financial Supervisory Service (FSS) was established as a specially legislated quasi-government supervisory authority, following the approval of the Act on the Establishment of Financial Supervisory Organizations by the National Assembly in 1999. The FSS also integrated responsibilities to protect the users of financial products, implementing consumer-centred digital practices across all financial market segments.

The divergence in organisational formation among the sampled countries have direct implications for the regulators' capacity to adopt digital practices for consumer participation. Newly-formed regulators during the expansion of digital applications for public services (after 2000), are likely to be created with a strong digital vision incorporated within the regulator's strategy and objectives, especially in the OECD countries pro-actively transforming state governance and promoting e-government strategies. At the same time, the liability of newness and a lack of regulatory experience in the sector can restrict the regulator's initiatives to adopt digital practices, creating an intricate balance between the regulator's vision, its capabilities to absorb innovative practices, and available organisational resources.

For the merged regulators, which considerably expanded their oversight powers during the digital era, the impact might also be two-sided: on one hand, merging regulatory resources and powers can create synergies promoting a wider implementation of digital practices, and this effect can be stronger when consumer protection functions are integrated with sectoral economic regulation. At the same time, the hurdles of post-merger transition, well documented for private organisations, can be a limiting factor delaying the implementation of longer-term digital strategies, especially when regulatory mergers are undertaken with cost saving objectives and lead to re-structuring of the governing boards. Across our sample, we noticed diverse experiences with post-merger transitions, when the formation of temporary management councils and significant staff turnovers delayed the internalisation of cross-sectoral expertise and impacted regulatory activities, while in other merger cases, as e.g. with establishing the Finnish Transport and Communications Agency, the public service delivery continued without interruption.

The re-organisation of existing regulators can create an organisational change momentum (Beck et al., 2008; Barker et al., 2018) – particularly crucial for public sector organisations to initiate a strategic and operational shift without consolidating the regulator's powers and

[9] These included: the Office of Banking Supervision under the Bank of Korea (banking supervision), the Securities Supervisory Board (oversight of the securities sector), the Insurance Supervisory Board (insurance supervision), and the Finance Ministry (oversight of government-affiliated policy banks and nonbank credit institutions).

sectoral competencies. Re-organisation during the digital era may enhance organisational responsiveness to digitalisation of market services and state governance and lead to the implementation of new (digital) strategy, compared to the regulators that were established in their current form in the pre-digital era (before 2000) and may have fewer incentives to reconfigure their routines and adapt their long-term vision towards digital practices. At the same time, we observed multiple cases of the chain re-organisations – or repetitive momentum – whereby regulatory authorities were reformed more than once within a short period of time, which can disrupt the realisation of long-term strategies, including the digitalisation of regulatory functions. The legal successors may also face obstacles in adopting innovative practices, when the re-organisation process is complicated by consecutive replacements in governing boards and turnovers in regulation personnel, as happened, e.g., with forming the new competition authority in Mexico. The complexity of these effects will be disentangled and modelled in the proceeding analysis.

Does the organisational formation lead to regulatory capacity building?

The nation-specific efforts in institution building resulted in various regulatory capacity levels; first of all, in allocating and sharing the *sectoral competences* among the sampled economic regulators. The mergers among the regulatory agencies did not necessarily lead to the establishment of new regulators with broader cross-sectoral competencies. Out of total 43 multi-sector regulators in our sample, only 12 were formed by merging sector-specific predecessors after 2000 – and all of these mergers happened in the EU countries, with six cases among the post-accession new member states.[10] Only seven multi-sector regulators were established as new institutions, also predominantly among the new joiners (Table 5.c).

(Paste Table 5.c here)

Since the 1990s, five countries in our sample consolidated economic regulation over nearly the entire consumer market under one super-regulator – an integrated competition authority. The Australian Competition and Consumer Commission was established in 1995 as a super-regulator to administer the Trade Practices Act 1974, with supervision competences in the energy, water, telecommunication, postal, and rail sectors. The Netherlands Authority for Consumers and Markets was formed by merging three predecessor regulators in 2013, consolidating the competences for economic regulation of the energy, telecommunication, postal, and rail sectors. The Estonian Competition Authority consolidated oversight powers,

[10] In Croatia (Croatian Regulatory Authority for Network Industries), Estonia (Competition Authority), Hungary (National Media and Info-Communications Authority), Lithuania (National Energy Regulatory Council), Poland (Office of Electronic Communications), and Romania (National Authority for Management and Regulation in Communications).

also through a merger, over the energy, water, postal, and rail sectors in 2013. In the same year, the new single Competition and Markets Authority was established in the UK by merging the Office of Fair Trading (1973–2014) and the Competition Commission (1999–2014), upon the enforcement of the Enterprise and Regulatory Reform Act 2013.

Another small group of eleven countries in our sample, mainly in North America and Eastern Asia, as well as Israel and Switzerland, established fully disintegrated regulatory models, splitting sectoral competencies for economic regulation among their separate sector-based regulators. Most other countries implemented semi-integrated regulatory models, establishing multi-regulators with more narrow competencies over two sectors only: out of 30 two-sector regulators in our sample, 21 have converged oversight powers for the telecommunication and postal markets, and remaining nine regulators – over the energy and water utilities.

The regulator's *autonomy in decision-making* is another key dimension of its organisational capacity, crucial for the regulator's ability to absorb innovative digital technologies for economic regulation and digitalise regulatory functions. The prevalence of independent regulators across the countries depicts the increasing structural autonomisation of economic regulation across the developed and catching-up economies in our sample (Table 5.a). The public management models across 20 EU countries (including the UK at the time of the data collection) are based on the fully autonomous regulation of the key economic sectors, while the sampled OECD countries in the Eastern Asia, Middle East, and Oceania show the highest concentration of economic regulatory functions under ministerial authority.

The European passenger-rail market, even with the liberalisation efforts and the EC's initiatives to reduce competition asymmetries between national rail systems since 2016, accounts for three national regulators established post-2000 without granting structural autonomy. In Belgium, the Regulatory Body for Railway Transport and Brussels Airport Operations, newly established by Royal Decree in 2004, operates as a unit of Federal Public Service Mobility and Transport, and the plans to transform it into an autonomous authority have not been yet realised. The Railway Administration Executive Agency was also newly established in pre-accession Bulgaria under the Ministry of Transport (in 2002), upon the enforcement of the Rail Transport Act of 2000; its regulatory activities are fully funded from the ministerial budget, which also determines its structure and work organisation. Hungary twice reformed the economic and safety regulation of its transport segments, first by merging the Local and General Transport Inspectorates with the Civil and Military Aviation Authorities into the converged National Transport Authority in 2007, and then subsequently dissolving it

by 2016 to transfer the regulatory duties to Deputy State Secretariat for Transport Authority under the full control of the Ministry of Technology and Industry. The rail transport regulation is neither autonomously conducted in Japan and New Zealand.

The economic regulation of water services remained under the ministerial coordination in Romania and the Netherlands, while the liberalisation of the energy market was not accompanied with the establishment of an independent regulator only in South Korea. The telecommunication services, the most intensively liberalised sector, were not autonomously regulated in Denmark (including postal services), Israel (including postal services), Japan, New Zealand, and Chile.

Although the issues of political interference in the regulation of financial sectors were long acknowledged, especially at the times of economic turmoil, five of the financial regulators in our sample were not granted autonomy in decision-making, two of which were in Cyprus and one in Spain[11]; in both countries the micro-prudential supervision of the insurance and pension segments fell under ministerial authority. In Japan, the Financial Services Agency – an integrated authority for all financial markets, – was established by a merger in 2000, under hierarchy of the Minister of State for Financial Services. Since the reforms in 2008, South Korea implemented the twin-peak model, limiting the independence of financial supervision which is split between the policy provider, the Financial Services Commission (FSC), and the Financial Supervisory Service, an agency overseeing private financial companies under the authority of the FSC.

The subordination of supervisory agencies to government departments revealed another aspect of regulatory independence and their accountability. The new member states are a prominent country group with the largest share of sectoral regulators directly accountable to Parliament, except for Cyprus, Estonia, and Latvia. An interesting divergence is observed among the Baltic states, as Lithuania is the only country in our sample that introduced Parliamentary oversight over all its economic regulators.

While the sectoral competences and the extent of autonomy are determined externally by the national legislation and the regulatory design, it is within regulators' managerial scope to fine-tune their existing resource base by building in-house capabilities for digital *consumer communication* and digitalisation of *IT infrastructure*. Only a small number of regulatory

[11] In early 2020, following the EIOPA recommendations, the Cyprus government announced the reform in supervision of the pension and insurance sectors and establishment of one unified regulator to consolidate the two separate supervisory departments: the Commissioner for Occupational Pension Funds under the Ministry of Labour and the Insurance Control Service of the Ministry of Finance. In Spain, the micro-prudential supervision of both segments is conducted by the Directorate General of Insurance and Pension Funds, assigned to the Ministry of Economic Affairs and Digital Transformation.

authorities in our sample showed the ability to dynamically reconfigure their standard operational functions for digitalisation. Two third of the regulators created the dedicated departments for consumer communication, and only nine were transformed into new units for digital communication. Nearly 60% of agencies brought in-house general IT support, and 26 regulators revised their IT strategy and established specialised departments for digital transformation, which is just above 11%. This, first of all, reflects the change in management vision and operational strategies among these few digitally-advanced regulators and their sustained strategic focus to internalise the key digital functions for public service delivery.

The implementation of digital vision within any organisation, however, is grounded on the available resource base, which provides foundation for building organisational capacity of economic regulators. Although a subject to political upheavals and policy debates, the constrained financial resources for economic regulation may narrow the regulator's priorities towards legitimisation in the eyes of the key stakeholder, rather than expanding its strategic portfolio for multi-stakeholder strategies and allocating scarce resources for new digital transformation. Human capital resources and its effective management is the critical capacity base for routinised regulatory activities, as well as implementing new regulatory strategies. The narrow approach towards economic accounting of professional regulatory personnel as costs of regulation can be detrimental from the organisational development perspective; though downsizing public administrative units may have different effects across the countries depending on the quality of public governance, especially its bureaucratisation and corruption.

Over the three years of 2018–2020, the *resource capacity* for economic regulation was expanding mainly through allocating additional budget support (annual growth at 7.2% rate, average across all regulators); the human capital capacity was increasing at a more modest level of 2.4% (average annual growth rate for FTEs). Given that only 14 countries had their regulators either newly established, merged, or re-organised since 2017, and only seven of them show above average increases in budgets (Table 6.a), it is reasonable to expect that the expanding budgets were approved and allocated for new regulatory programmes, with digital transformation in sight.

However, we observe a significant variation in the resource capacity of economic regulators within and between the sampled countries, whether it is measured in absolute values or standardised by population sizes (Table 6.a). Even for those countries that achieved more homogeneous levels of economic development in the OECD club or belong to the same regional groups with harmonised regulations, the national economic and institutional priorities prevail in the design of their regulatory systems.

The divergent paths of regulatory reforms and organisational formation across the EU countries created a disparity in resources allocated for economic regulation between old and new member states. The countries that joined the EU after 2000 and went through a series of regulatory mergers, re-organisations, and forming new regulatory bodies under the EU and national initiatives, resulted in having their national regulatory systems reliant on the smaller-sized regulators, both with sector-specific and multi-sector competences. This could reflect the liberalisation efforts with constrained resources, as the average regulatory budgets in the new member states are 4.1 time smaller in absolute values and 1.7 times less per capita. The old member states tend to allocate more human resources for economic regulation, with an average FTE levels 1.8 times higher than those of the new joiners; though the sector regulators in the new member states tend to be better staffed when measured per population.

This disproportion in the resource base is more discernible among the non-EU countries, which created financially stronger regulatory states with lower human resource capacity (Table 6.a). While their average FTE levels are only slightly above those in the EU founder states (683.1 vs. 600.3), the non-EU regulators had 2.1-fold higher financial resources allocated on average (238.1 vs. 111.2 mln. euros). The differences in the resource base for economic regulation become more striking when comparing the scaled budget and FTE values: on average, the non-EU governments approve twice as large budgets (13.7 vs. 7.4 per capita) for regulatory authorities with half the staff size (29.9 vs. 59.4 per mln. of population), which makes it challenging to hypothesise the effects of the resource capacity on the adoption of digital regulatory practices.

(Paste Table 6.a in Appendix)

These disparities in the regulatory resource base, however, seem to be levelling out over time on the cross-regional scale, as the non-EU regulators had been expanding their human resources at the rate twice higher than average (4.9% vs. 2.2% in the EU), while the new EU member states were all devoting more budget resources for economic regulation (9.6% vs. 6.5% in EU founder states and 6.0% in non-EU countries), though with significant variation at the national level.

Despite the apparent regional convergence, the organisational formation had a visible effect on the resources allocated for sector regulation across the countries. The regulators that were established in their current organisational form before the onset of the digital era had the largest mean budgets and human resources compared to the other three groups, and unexpectedly, to the regulators that were formed through a merger (Table 6.b). Though, when

measured per capita, the merged regulators had 3.4-fold larger budgets and 1.7-fold greater FTEs in their capacity compared to other groups, which shows the tendency of the smaller-sized economies to conduct economic regulation through integrated regulators, often for better regulatory coordination and efficiency measures. The cost saving priorities, however, did not seem to hold after consolidating independent regulators, as the merged regulators show the highest average annual growth rate for FTEs (5.5%) and second-high for budgeted expenses (8.2%).

(Paste Table 6.b here)

The regulators that were established through re-organisation of an existing authority, i.e., as legal successors that took over the supervision responsibilities from a predecessor regulator, were evidently formed with resource efficiency in mind, as their mean budgets and FTEs are lower than of those regulators that continued with their operations post 2000 without re-organisation, both in absolute values and per capita. These regulators also achieved the highest mean digital score: 20.8 vs. 18.6 average for other groups, with the highest minimum and maximum values and the smallest standard deviation.

The regulators that were newly formed during the digital era were endowed with the lowest resource capacity among all groups, in absolute values and per capita; and obtained the lowest digital score of 16.7 compared to the sample average (19.2). This organisational group is remarkable in expanding its budgetary capacity at the highest growth rate (9%), while decreasing human resources (-0.3%), often as a result of their commitments to reduce public sector employees.

The larger resources base, however, did not create an advantage for regulators that were established before 2000, as these also obtained a mean digital score (19.0) below the sample average. The resource capacity, however, is not the only attribute that may explain the significant differences in digital scores observed between the four organisational formation groups.

The resource capacity of economic regulators also significantly differed among the sampled sectors (Table 6.c). The stand-alone financial regulators had the largest budgetary and human resource capacity compared to other sectors (in absolute terms); and the financial supervisors within central banks are remarkable in attaining the largest capacity for supervision functions per capita, and also the highest digital score (20.7). The utility regulators, however, were expanding their resource capacity at the highest rate compared to other sectors, following the late liberalisation of the energy and water services; with more priority given to the financial

resources.

(Paste Table 6.c here)

The same prioritisation of budgetary support in building organisational capacity is prominent among the integrated telecom regulators (7.9% growth rate for budgets vs. 0.9% for FTEs); this, though, have not restrained them from achieving the highest average score compared to other sectors (21). The postal regulators are the only sector group that had reduced human resources, while obtaining above average budgetary support. The high digital score of the postal regulators (20.4) might be a spill-over from more digitalised practices in the telecom regulation, as the economic regulation of these two sectors is frequently integrated under a single authority.

Remarkably, the rail regulators have the largest budgets allocated per capita, though obtaining the lowest digital score of 17.1 among all sectors, which highlights the complexity of sectoral-based regulations and country regulatory institutions.

The change in the resource capacity of economic regulators: budgets high and rising?

The comparison of the growth rates for both financial and human resources revealed that 31 countries, nearly 74% of the sample, enhanced the regulatory capacity across both dimensions over the three years; seven of which expanded the resource base for economic regulation at the rate above sample average (highlighted in Table 6.a).

The old EU member states, except for France and Greece, increased the resource capacity of their economic regulators, expanding budgets at a higher rate (6.5%) compared to their staffing levels (3.2%); only Ireland and Luxemburg prioritised the growth of human capital over budgetary expansions (Table 6.a). Finland, Ireland, the Netherlands are among those seven countries that devoted more resources, both financial and human, for building regulatory capacity at a higher rate compared to the sample average; while only the Dutch regulators leveraged their growing resource capacity to obtain the remarkably higher digital scores (22.8 vs. 19.2 sample average).

Finland particularly stood out with its strategy of regulatory mergers and an expansionist approach to their resource base, transforming three out of four Finnish sector regulators into high-growth organisations, which also achieved a higher than average digital score (20 vs. 19.2). The regulatory reforms led to more than double growth rates in budgeted expenses of Finnish sector regulators (19.2% AGGR vs. 7.2% sample average), and expanding their already higher-than-average (per population) human resources at nearly 7-fold greater growth rate (16.9% vs. 2.6%). Five years after the merger of the Finnish Consumer Agency and the Finnish

Competition Authority in 2013, the budgetary capacity of the Competition and Consumer Authority expanded by 60.5% from 2018 to 2020 (based on the realised budgets), and the number of its regulatory experts increased from 140 to 221, while also obtaining the highest digital score of 23 among its country peers. The Finnish Transport and Communications Agency integrated its higher-than-average resource base by merging the Finnish Communications Regulatory Authority and the Finnish Transport Safety Agency in 2019, and further increased its expenses and staffing level by 9.5% in 2020. The recent merger might have constrained its digital initiatives, as the new cross-sector authority achieved a score below the sample average (18 vs. 19.2). The Finnish Financial Supervisory Authority, also established through a merger of financial and insurance supervision authorities earlier in 2009, continued with a high-growth strategy in later years: expanding its expenses by 24% and human resource by 11.3% over the sampled years, also gaining a lower digital score (19 vs. 19.2). The economic regulation of the energy market proved an exception, as the Finnish Energy Authority, a legal successor of the Energy Market Authority since 2014, maintained its expenses at nearly the same level across the three years, and its staffing level slightly declined (from 90 to 86 employees). This, however, has not restrained the energy regulator from achieving a higher digital score of 20.

Lithuania is the only country among the new member states that has built its national regulatory system on the strengthened resource capacity of its independent economic regulators; it also achieved a higher digital score of 20 compared to other new joiners, which only reached 18.1 on average. However, its particularly remarkable growth in human resources for economic regulation (13% AGGR) was mainly achieved through integrating the National Commission for Energy Control and Prices and the State Energy Inspectorate into a new utility regulator, National Energy Regulatory Council, in 2019, and increasing the staffing level at the Bank of Lithuania. The resource capacity for the antitrust and telecom regulation was mainly supported via budgetary increases, alike other new member states: the expenses of the Competition Council that was formed prior to EU accession (in 1999) increased by 10% from 2018 to 2020; and the Communications Regulatory Authority, established shortly after in 2001, had its budgets revised for 8.3% for the same period; while their human resources remained at the same level.

Outside of the EU area, three countries – Canada, Colombia, and New Zealand – followed a complementary approach in increasing both financial and human capital capacity for economic regulation (with higher than average growth rates), and achieving digital scores above the sample average. Similarly to Lithuania, the remarkable growth rates in Colombia were

caused by the redesign process in the energy and water regulation, and modifying the structure of its integrated utility regulator, Superintendence of Residential Public Services, which had a growth of 692 personnel following the Decree 1370 of 2020; though achieving a lower digital score compared to its country peers (21 vs. 23.7 country average).

Canada and New Zealand implemented a different approach, as both countries strengthened the financial and human capital capacity consistently across all sector regulators, without organisational transformations. Canadian sector regulators are long-established organisations since 1970s; only the Financial Consumer Agency of Canada (FCAC) was formed in 2001 upon the integration of consumer protection in the financial market under a single agency[12], to strengthen the oversight of federally regulated financial entities and promote financial consumer education. Since 2006, the federal government had been experimenting with the regulatory budgeting models to reduce the red-tape burden for small businesses, as part of Canada's pro-growth policy agenda; and in 2018 moved towards the targeted regulatory reviews for high-growth sectors, including transportation and infrastructure, and setting digitalisation as one of the budget priorities. The transport regulator, the Canadian Transportation Agency, had its budgets reviewed up by 8.4% in 2019 and 15.7% in 2020. The budgetary capacity for the telecom regulator, the Canadian Radio-television and Telecommunications Commission, expanded by 22.9% in 2019 alone, and its human resources increased by 18.1% by 2020 (from 454 to 536 FTEs). The growth rates were even more remarkable for the financial regulator: 31.4% budget increase in 2019 for the FCAC, with its staffing levels upgraded by 25% (from 128 in 2018 to 160 in 2020), also achieving the highest score of 23 among other country regulators. This shows strong prioritisation of consumer protection and financial literacy (the dual mandates of the FCAC) in the Canadian regulatory design, as the budgetary support for the micro-prudential supervisor, the Office of the Superintendent of Financial Institutions (OSFI), increased at a more modest rate: 13.5% in 2019 and further 3.8% in 2020, and its human resources expanded by 17% (from 741 in 2018 to 867 in 2020). The low digital score of the OSFI (15) reduced the country average to 20, with otherwise high scores achieved by other sector regulators.

The New Zealand government expanded budgeted resources for the twin-peaks financial regulation at an even greater rate: the Financial Markets Authority (FMA) had its operational budgets increased by 42.7% from 2018 to 2020, compared to 24.2% increase in its human resources (from 194 in 2018 to 241 in 2020). Following the review of the levy model in 2022,

[12] The Financial Consumer Agency of Canada Act of 2001: https://laws-lois.justice.gc.ca/eng/acts/f-11.1/page-1.html

the FMA's budgeted expenses were set to further increase by 25.6% until 2025. The new funding agreement of 2020, authorised by the Governor and the Minister of Finance, also provided a significant uplift in funding for the New Zealand Reserve Bank[13], following the expansion in its human resources by 36.9% (from 255 in 2018 to 349 in 2020, and further 410.8 FTEs in 2021) and its new strategy to build digital capabilities. Its current digital score (21) is, nonetheless, lower compared to other country regulators. The New Zealand Transport Agency (NZTA) expanded its human capital by 40.8% (from 1477.8 in 2018 to 2081.2 FTEs in 2020), with the budget increase of 21.7% for the same period. The financial resources for competition enforcement had grown by 29.9%, with a more modest increase in employees of the Commerce Commission (9.9%, from 222 in 2018 to 244 in 2020). The only exception in the budgetary expansion was the regulation of energy market, as the Electricity Authority (EA) had its budget approved with a minor uplift by 0.9% in 2019 and 2.7% in 2020, while seeing the same scale of growth in human capacity: 23.1% from 2018 to 2020. All New Zealand sector regulators achieved above average digital scores: the highest by the FMA (26), followed by the NZTA and the EA – both scoring 24; while the less enhanced web resources provided by the postal regulator, the Postal Policy Section, reduced the country average score to 21.3.

Six countries in our sample provided increasing budgetary support for economic regulation, while having the human capacity of their sector regulators reduced over the period of 2018–2020; four of these countries are the new EU joiners: Cyprus, Czechia, Hungary, and Slovakia. Following the memorandum commitment on reducing the number of public servants signed with the IMF and the ECB, Greece, the only old member state, continued sizing down the human resources for all its sector regulators at an average rate of 9.2% during 2018–2020. At the same time, the Bank of Greece – the fifth largest central bank in the sample, – experienced a 2% increase in the number of its employees.

Two countries, France and Turkey, implemented cuts on budgets of regulatory authorities while allowing for an above-average increase in their FTEs, i.e., constraining financial resources for growing operational scope of economic regulation, as measured with the number of experts involved in sector regulation. Mexico and Iceland are the only two countries that decreased both the financial and human capacity of their regulatory agencies, as measured with the growth rates for regulatory budgets and FTEs (Table 6.a).

The mentioned four countries, – France, Iceland, Mexico, and Turkey, – implemented budget cuts for economic regulation under a different interplay of institutional pressures. In

[13] The NZRB's annual report (2021).

France, the austerity measures and caps on regulators' budgets constrained the financial capacity of all regulators by 4.9% on average, except for the Regulatory Authority for Electronic Communications and Post (ARCEP) and the Transport Regulatory Authority (ART), as both were re-organised in 2019 with larger budgets (40% for the ARCEP and 5.6% for the ART). With these constraints on the regulatory capacity, France, nonetheless, retained a higher than average digital score across its sector regulators (22.2, Table 7).

Iceland went further in its austerity measures, reducing the staffing resources across all economic regulators (at 1.22% average annual rate), along with the budget cuts. These steps had the most profound effect in the financial regulation, which stirred towards the integration of regulatory governance under the single ministry and the post-crisis reviews of the statutory framework. Ultimately in 2020, following the passage of the new Central Bank Act of 2019, the Central Bank of Iceland integrated the single micro-prudential regulator – the Financial Supervisory Authority (FSA), reducing its budget by 12.5%. These constraints of the regulatory capacity and governance were implemented even though the report issued by the Special Investigation Commission earlier in 2010 assessed the FSA was "not financially equipped, …and also lacked the technical expertise and IT systems to process and evaluate the vast amount of financial data needed in continuous financial monitoring".[14] The position of Iceland in the adoption of digital practices remained less advantageous: 17.2 compared to the sample average score of 19.2 (Table 7).

The budget cuts in Mexico and Turkey were driven by different institutional pressures, where the austerity measures re-enforced the political capture of independent regulators. After reinstituting the regulators' autonomy and strengthening their resource capacity during 2006–2016, the independent competition enforcement lost its political backing in Mexico. The sharp decrease in regulatory budgets in Mexico (19.5% on average) led to significant layoffs (8.8% on average across regulators) after 2018; these capacity constraints coincided with the policy reversals and weakening political autonomy of the competition authority and the energy regulator under the new state administration, which publicly questioned the value of independent regulators and proposed dissolving some of them to cut costs.

In Turkey, the budget cuts for independent regulators went along with the concentration of executive power and eroding democratic performance under the hybrid regime. Similar to Mexico, the new regime also impaired the independence of sector regulators, with expanding government interventionist measures in prices and directly linking regulatory authorities to the

[14] Report of the Parliamentary Investigation Committee (2010). https://www.rna.is/eldri-nefndir/addragandi-og-orsakir-falls-islensku-bankanna-2008/skyrsla-nefndarinnar/

president office, e.g., the direct appointments of the governing board of the Turkish Competition Authority by the president without the involvement of relevant public institutions. While the earlier regulatory achievements in Mexico had not been completely dispersed and its digital score crossed the average level (19.4), the adoption of digital practices for consumers participation by the regulators in Turkey remained low (17.2, Table 7).

The distribution of digital scores of regulators: regional divergence in adopting digital practices

The country total digital score, calculated as the sum of all individual scores obtained by the country regulators (Table 7), approximates the scope of diverse digital channels available for consumer e-participation in economic regulation across the key sectors. The national regulatory systems with economic regulation segregated between sector-specialised regulators are prone to achieve a higher total score, though, this is not the case for five countries.

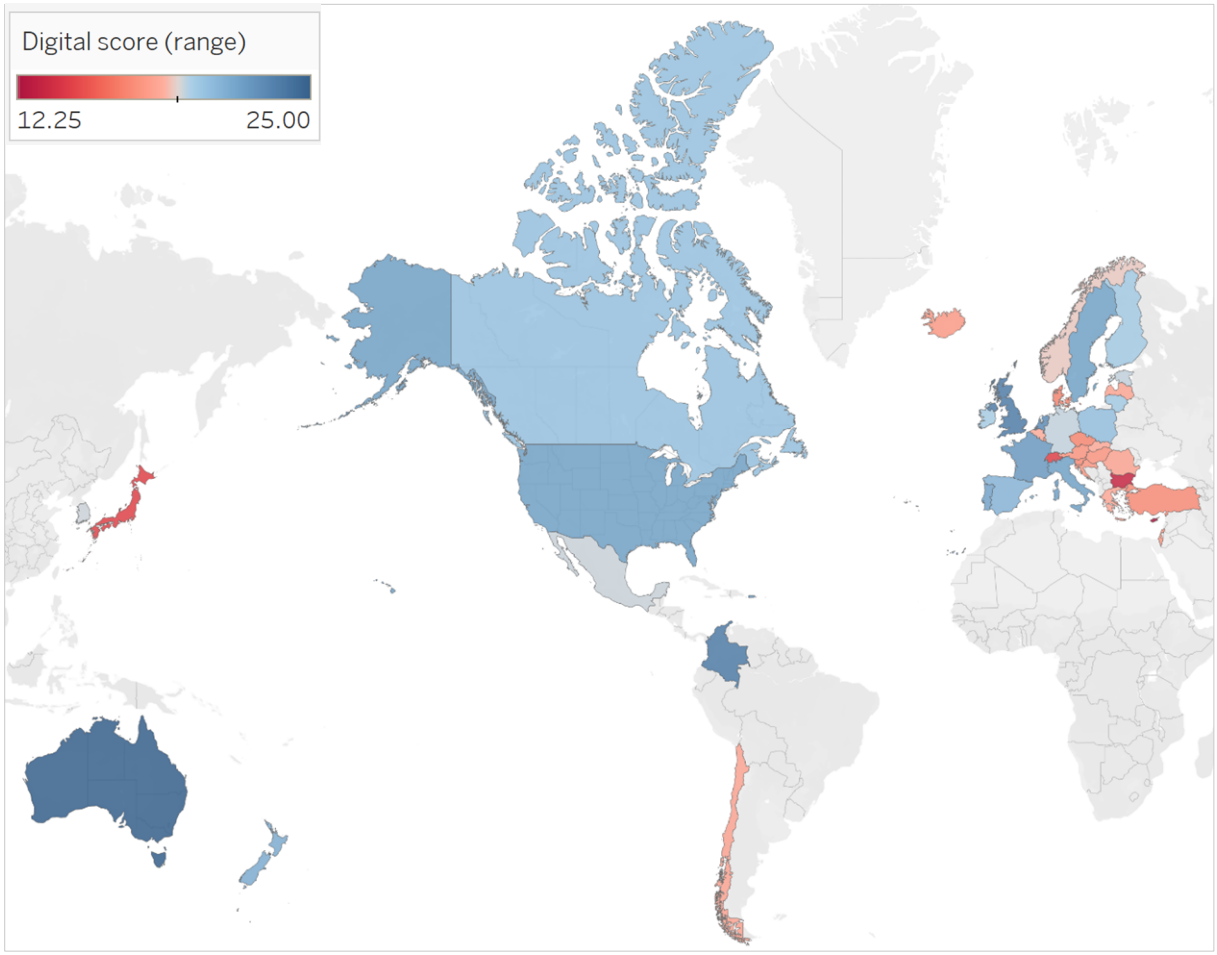
(Paste Table 7 in Appendix)

The four new EU member states – Bulgaria, Croatia, Cyprus, and Slovenia – have not reached the average level in digitalisation of regulatory functions for consumer participation. While the digital scores of Croatia and Slovenia are marginally below the sample average (108), Bulgaria and Cyprus significantly lag behind in adopting digital practices by their sector regulators. Poland and Romania, are the only two new joiners, with higher than average total scores.

To account for differences in the national regulatory designs, we calculated the average digital score for each country, as a mean of all individual scores obtained by its sector regulators. The calculated average country scores are distributed within a wide range: from the minimum of 12.3 (Cyprus) to maximum of 25 (Australia), depicting the high variability in the digitalisation of regulatory functions for consumer participation (Map 1). The digital scores of individual regulators are even more widespread, ranging from the minimum of 3 (the Registrar of Occupational Retirement Benefit Funds, Cyprus) to the maximum of 29 (the Federal Telecommunications Institute in Mexico), showing a large gap in the adoption of digital regulatory practices among the countries and individual regulators.

None of the countries reached closely to the maximum possible score of 33; with an average digital score across the entire sample of 236 regulators amounting to 58.1% (or 19.2). Out of 42 sampled countries only half achieved digital scores above the sample average, which is remarkable given that 88.1% of our sample are the developed OECD economies with established governance frameworks for regulatory state and consumer protection policies.

Map 1. The distribution of the digital scores by country (around the sample average of 19.2)



The EU member states that joined before 2000 are the best performing country group, with the highest average digital score (20.2), the highest minimum and maximum individual scores, and the lowest standard deviation among the sector regulators (2.91 vs. 4.71). The EU initiatives for building citizen-centric models and digital public services since late 1990s resulted in higher levels of up-take among the EU regulators; though the gap in adoption of digital regulatory practices between the old and new member states is striking.

The average digital score of the new-joiner group (17.7) remained 1.4 points below the sample average and 2.5 points below the average score of the old member states; the digital adoption levels were also more widely dispersed among individual sector regulators (std. dev. 4.25). The new member states scored below the sample average in the adoption of digital practices for each regulatory function, apart from providing information for consumers on how to contact the regulator and embedding the digital functionality for directly contacting the regulator via its website (e.g., a web-chat), in which the new joiners scored just above the average level.

Does the organisational capacity affect the adoption of digital regulatory practices?

In order to explain the observed variability in the adoption of digital practices for consumer participation by regulators across different regions and sectors, we start with testing the effects of regulators' organisational capacity and its interplay across different formation groups (Diagram 2).

We captured the multi-dimensional nature of organisational capacity of the sampled regulators by creating separate variables for each capacity construct (Table 8), and tested their effect on the adoption of digital regulatory practices across individual regulators with multivariate analysis. The dependent variable is defined as the total digital score obtained by each regulator across all coded content areas on the regulators' websites.

Table 8. The dimensions of organisational capacity: constructs and variables

Construct	Variable name and operationalised measure
Resource capacity	**Budget** Average budget amount for 3 years: 2018-2020 (euro, th.)
	FTEs Average number of FTEs for 3 years: 2018-2020
Regulatory autonomy	**Independence** Autonomy of the regulator in decision-making (binary var.) [0] Non-independent regulator [1] Independent regulator
	Link to Gov. Dept Attached, subordinated, or affiliated to a government department (binary var.) [0] Not attached to a government department [1] Attached to a government department
Organisational experience	**Regulatory experience** Number of full years since the regulator's establishment in its current form (sqr.)
	Reform experience Establishment mode of the regulator in the current form (categorical var.) [1] Established in its current form before 2000: no reform experience after 2000 [Formed b/f 2000] [2] Established in its current form after 2000: as a legal successor by taking over the duties of the predecessor regulator [Formed as take-over] [3] Established in its current form after 2000: as a merger of a few separate regulators [Formed as merger] [4] Newly established in its current form after 2000 [Newly formed]
Organisational structure	**Org. structure** Independence of organisational structure (binary var.) [0] Divisional unit of a parent organisation [1] Stand-alone organisational structure with its own governing board
Sectoral competences	**Multi-sector** Sectoral competences of regulators (binary var.) [0] Sole-sector regulator [1] Multi-sector regulator
	Sector number Number of sectors within regulator's authority (count var.)
Communication	**Comm. Dept** Separate consumer communication department (categorical var.) [0] No separate communication department [1] General communication department [General] [2] Dedicated digital communication department [Digital]
In-house IT	**IT Dept** Separate IT department (categorical var.) [0] No separate IT department [1] General IT department [General] [2] Dedicated digitalisation or digital transformation department [Digital]

Regulatory autonomy

Consistent with other studies, we found the significant effect of the regulatory independence on their pro-activeness in adopting digital regulatory practices, after controlling for the regulators' organisational hierarchy and semi-autonomous structures that approximate the extent of self-management among the sector regulators (M1-9, Table 9.a). The importance of decision-making autonomy for organisational innovation has been well acknowledged in the private and public management literature (Feldman, 1989; Wynen, 2014; Demircioglu et al., 2017), even though the operational objectives of regulatory agencies are confined by the legislative frameworks and regulators remain directly accountable to the state executive offices. The effect of regulatory independence in decision-making, however, remained significant after we controlled for government incentives in digitalisation of public services and digital adoption levels among the country populations. The effects of other organisational attributes were more nuanced, given the contrasting interpretations in the management literature and diverse regulatory practices.

(Paste Table 9.a here)

Regulatory experience

The longer span of regulatory experience under the current statutory duties did not seem to bring a significant advantage for adopting digital practices, though it is positively associated with regulators' digital scores (M1, Table 9.a). The length of organisational operations facilitates the build-up of expert knowledge in sector regulations and rule-making experience that can be leveraged by regulators to create comprehensive information hubs on their website. However, our finding is not surprising given the intensity of regulatory reforms over the last two decades.

The reform experience since the onset the digitalisation efforts in public services, indeed, proved to have significant effect on the adoption of digital regulatory practices among the sector regulators, though in diverse ways (M2-4, Table 9.b). The regulators formed by taking over the duties of a predecessor were able to lead the implementation of digital vision for consumer participation, compared to the regulators that were established in the pre-digital era (before 2000) and, evidently, had fewer incentives to digitalise their information provision and transform their websites into the hubs for consumer engagement.

The hurdles of post-merger integration did not prove to be a limiting factor for the regulators that were formed through merging stand-alone sectoral regulators, as these also obtained significantly higher scores compared to the regulators that were established before 2000 (Table 9.b). The merged regulators were able to leverage the internalised cross-sectoral

expertise, bundled regulatory resources and powers to promote a wider implementation of participatory regulation across sectors. The lower coefficient compared to the re-organised regulators, however, may reflect a toll of post-merger transitions.

Although organisations that were newly established during the digital era tend to adopt a more consumer-oriented outlook and be more digitally driven, the regulatory "start-ups" were not created with a strong digital vision for consumer participation. The newly-formed regulators significantly lagged in digital adoption and information provision across regulatory functions on their websites compared to the regulators that were established in the pre-digital era (Table 9.b). This finding is alarming as it questions either the rationale behind the national regulatory reforms or the organisations' approach towards implementing the EU directives and e-governance frameworks. Unexpectedly, the availability of digital technologies and functionalities across industries and public services did not help the newly formed regulators to overcome the lack of experience in the sector supervision and constraint resources, particularly in the countries with limited tradition of independent regulatory institutions. The future research could collect more fine-grained evidence on digital leadership and diffusion across different organisational groups.

Communication capabilities

The information provision is a common statutory duty of regulatory agencies; however, with enhanced communication and IT capabilities the regulators can transform the routine reporting process into a digital strategy for stakeholder engagement. Consistent digitalisation of information provision across the key regulatory functions can create multiple digital channels for consumers to interact with regulatory information on the regulators' websites and social media accounts and participate in the regulatory processes. The regulators with stand-alone communication departments can leverage the in-house capabilities to integrate the statutory information provision with consumer digital communication strategy. The Competition Council in Latvia, for instance, developed the digital communication strategy to reach consumer audiences with a variety of digital tools on regulatory topics, with a strategic vision to promote the competition culture and communicate the authority's decisions.[15] The Competition Council in Luxembourg launched the awareness-raising and communication advocacy programme via its website and social media; while the Luxembourg Institute for Regulation implemented a digital communication strategy with the support from its Electronic Communications Department. Indeed, the effect of in-house communication capabilities on adopting digital

[15] The Latvian CC's annual reports (2018–2021).

regulatory practices is significantly strong, and even greater for those regulators that created dedicated digital communication departments (M1-9, Table 9.a).

IT capabilities

Complementing communication capabilities with in-house IT support can create synergies for regulators to develop innovative approaches towards participatory regulation. The overwhelming evidence on benefits of IT-enabled capabilities within private and public organisations (Oliveira et al., 2011; Mergel et al., 2009, 2019; Li et al., 2022) has direct implications for adopting innovative digital practices and building public engagement capabilities by independent regulatory agencies. Even though the previous studies considered the IT functions within regulatory agencies to be diminished, dissolved across divisional structures, and under-resourced (Banks, 2005), we found numerous examples of advanced digitalisation programmes launched by the sector regulators within recent years. The Financial Sector Supervisory Commission (CSSF) in Luxembourg, for instance, incorporated the 4.0 strategy to transform its core organisational functions and establish real-time information exchanges with its stakeholders; while the digital transformation of the Authority for Communications Guarantees (AGCOM) in Italy followed a more technical approach and prioritised the development of "digital administration" services and integrated data systems for its operations.[16]

Indeed, the regulators with stand-alone IT departments within their organisational structures tend to have significantly higher digital scores, and especially those with the dedicated digitalisation or digital transformation departments (M1-4, Table 9.a). Future research could complement both sources of digital transformation within regulatory agencies, and capture the effects of outsourcing the IT functions by sectoral regulators, as we noted the cases of external contracts for IT services in annual reports of regulators, e.g., the Dutch Authority for the Financial Markets followed an outsourcing strategy for its IT services.[17]

Financial resource capacity

The effect of resource capacity has been exhaustively covered in the management literature, though it remains a double-edged sword for developing innovative organisational practices. Financial resource constraints can create barriers for adoption of digital practices within organisations, or, under different conditions, drive the digitalisation of organisational processes as a cost-efficient strategy to improve service delivery. For regulatory agencies, the effect of

[16] The AGCOM's annual reports (2018–2021).

[17] The Dutch AFM's annual reports (2018–2021).

the resource capacity has another layer of complexity, as not all regulators are independent of the state budget and have revenues of their own. Our sample represents a diverse mix of financially independent authorities (e.g., the BaFin in Germany, the Institute for Regulation in Luxembourg, and the Regulatory Authority for Energy in Greece) and those that do not have financial autonomy to spend their fee-raised revenues and allocate financial resources on strategies outside of their statutory duties, especially if the digitalisation of consumer information provision is not incentivised by monitoring institutions. At the same time, we noted regulatory agencies with dedicated digitalisation funds within their budgets, e.g., the Regulatory Authority for Broadcasting and Telecommunications in Austria.[18] Besides, the size of the resource capacity of regulatory agencies also depends on the scope of their sectoral competencies, and whether they implement infrastructure investment projects.

Contrary to previous findings, the effect of budgetary capacity on the adoption of digital practices by regulators proved to be insignificant (M4, Table 9.a), as the overall budget amounts do not reflect the scope of funds dedicated to regulatory digitalisation and consumer initiatives. The regulators, established before the year of 2000, were the only group that benefited from larger budget allocations, as it was confirmed by a positive coefficient of the interaction term (M1, Table 9.b). Given the budgetary expansion that we noted across a large number of countries (Table 6.a), it raises questions on the priorities behind budget rises, if these have not yet translated into the wide-spread adoption of digital practices for participatory regulation. To improve the findings, the future research can capture the scope of resources allocated for digitalisation of regulatory processes and consumer engagement projects.

Human resource capacity

The human capital capacity plays a different role in service-centred organisations, as the pool of expert knowledge is the key resource for enhanced information provision across multiple regulatory functions. The availability of niche expertise in sectoral regulation was found to vary across the countries (Banks, 2005), as the independent sector regulators face challenges to balance the skill-sets and leverage the cross-team expertise, while attached agencies and ministerial unites are often under the threat of over-staffing and absorbing the staff from ministries.

Despite the underlying complexities, the effect of human capital, as measured with a number of FTEs, on the regulators' adoption of digital practices for consumer participation was positive and strongly significant (M3, Table 9.a). Along with the insignificant effect of financial

[18] The RTR's annual reports (2018–2021).

resources, this finding amplifies the importance of organisational leadership to create a digital vision on regulatory activities and leverage internal human capital to implement it with consumer objectives in sight. The importance of human capacity retained significant and positive for all regulator groups, except for those regulators which were newly-formed after the year of 2000 (M2, Table 9.b). This may indicate the lag in the ability of newly-formed regulators to leverage available human resources for consumer objectives and build their digital leadership.

Sectoral competences

The efficiency of multi-sectoral regulation was acknowledged by the literature particularly for smaller economies and converged industries (Smith, 1997; Lyon, 2004; Valiente, 2014; Karnitis, 2015), which are well represented in our sample. The impact of cross-sectoral regulatory design on the digitalisation of regulatory practices, however, is not that straightforward. The regulator's ability to pull cross-sectoral competencies may reduce information asymmetries in monitoring the performance of market sectors, given the effective coordination and communication systems established between the sectoral divisions, and facilitate the digitalisation of regulatory processes and enhance information provision for consumer via digital channels. The reduced autonomy of sector-specialised supervision and divisional status within the organisational structure of multi-sector regulators, however, may reduce incentives for pro-active adoption of innovative practices. This accentuates the importance of leadership and digital vision to coordinate the adoption of digital practices across sectoral divisions within multi-sector regulators.

The multi-sector regulators in our sample are a diverse group, established predominantly in the EU regulatory area after 2000, through re-organisation of predecessor regulators, mergers, or as new institutional entities, with different scopes of resource capacity across regional groups (Table 5.c). The five super-regulators with sectoral competences consolidated by competition authorities tend to have higher digital scores, e.g., the Australian Competition and Consumer Commission (27), the New Zealand Commerce Commission (27), and Spanish National Commission for Markets and Competition (24). The multi-utility regulators were also effective in digital adoption, with digital scores above the sample mean: the Latvian Public Utilities Commission (23) and the German Federal Network Agency (20). The average digital score of the 27 integrated telecom and postal regulators also reached above the sample average (21).

Compared to regulators with supervision competences in a single sector, the digital scores of the multi-sector regulators were more narrowly concentrated around the mean, though with

two outliers: the multi-utility regulators in Bulgaria and Malta. Across the diverse regulatory designs within the sampled sectors, the regulators with multi-sector competences obtained significantly higher digital scores (M5, Table 9.a); and this effect sustained for super-regulators with a larger number of sectors within their authority (M6, Table 9.a). Given the diverse resource capacity among the multi-sectoral regulators, our finding re-enforces the importance of cross-divisional coordination and information exchange for the enhanced adoption of digital practices across regulatory functions.

Regional divergence in digital regulatory practices

The regulatory landscapes of the sampled OECD countries have evolved along the distinct paths of re-organisations and developing new institutions, and forming their regulatory states with different resource capacity, digital capabilities, and consumer-oriented outlook (Table 5.a-c). The nation-specific efforts in regulatory capacity building and adoption of digital regulatory practices, though, shaped the distinct regional trends, as we found the significant differences between the regional groups in the allocated budgets for economic regulation, available regulatory expertise, and digital scores (Table 6.a). The gaps in digital adoption between the regions were defined by higher priorities towards consumer education and protection of the non-EU countries, and higher levels of transparency in regulatory decision-making and encouraging consumers to participate in rule-making process among the EU member states (Table 6.a).

The EU member states that joined before 2000 obtained a higher digital score (average per group), with lower costs of economic regulation per capita, though their advantage in digital adoption did not prove significant against the non-EU countries (M7, Table 9.a). The EU regulatory harmonisation indeed proved a "slow strategy forward" (Egan, 2001), as we found significant disparities in digital adoption between the old member states and new joiners. The new member states, even after implementing the pre-accession requirements for market competition and transposing the EU directives in the post-accession stage, lagged in information provision across all regulatory functions, and obtained significantly lower scores compared to the old EU member states and non-EU countries (M7, Table 9.a). Digital technologies can effectively eliminate the institutional barriers to spreading participatory regulation given the diverse institutional legacy of the countries in our sample, though not for the EU new-joiners with specific institutional background in transforming their regulatory systems.

Multi-sectoral regulation, however, proved to be more effective for digital adoption among the new joiners, as multi-sectoral regulators obtained a higher average digital score

(21.1) and positive coefficient of the interaction term, in sharp contrast to the sole-sector regulators (M 3, Table 9.b).

(Paste Table 9.b here)

The level of economic development and existing democratic institutions among the OECD countries do facilitate the adoption and diffusion of digital regulatory practices, as evident from the significant difference between the most developed countries that became OECD members before 2000 and the least developed economies (non-OECD countries) in our sample (M8, Table 9.a).

In opposite to the EU new-joiners, the new OECD members were as effective in the adoption of digital regulatory practices as the established OECD members (M8, Table 9.a). Digital technologies allowed the catching-up economies which joined the OECD club more recently (after 2000) to close the gap in participatory regulation with the established economies. Once the level of economic development, among other institutional factors, is improved, digital technologies facilitated the adoption and diffusion of consumer-oriented regulatory practices among the OECD new-joiners (M9, Table 9.a). This finding confirms that the sectoral development and institutionalised democracy are prevailing in their effect on participatory regulation compared to the formal efforts to harmonise the legislative base and regulatory regimes.

Does the sectoral composition and infrastructure quality promote a consumer-oriented outlook in digital regulatory practices?

The significant variation in the adoption of digital regulatory practices and different adoption patterns across countries and sectors were formed under the improving consumer digital readiness and changing sectoral composition within the EU and OECD economies. The effect of consumer digital readiness, as measured with the average internet use percentage over 10 years prior to coding the regulators websites (2010–2019) was positive across all sectors, but not significant, given the divergent regulatory priorities to consumer e-participation that we observed among regional groups. The multi-sectoral regulators, along with the financial supervisory authorities, were significantly more receptive towards consumer digital pressures (M2 and M9, Table 10.a).

The sampled OECD and non-OECD countries were catching-up with digital use among their populations at different speed, and to capture this effect, we classified the countries into three digital adoption groups: (1) the *first adopters* which had the internet use rate above 50% of their populations by 2000, (2) the *early adopters* with 50% of their population regularly using

internet by 2005, and (3) the *late adopters* that reached the 50% internet use threshold only by 2010. Both early and late adopters proved to have lower digital scores among their sector regulators compared to the countries that were first to reach a wide internet usage rate. The lower consumer digital readiness created less demand pressures for the regulators from the late adopter group, as the gap in their digital scores proved to be significant (Table 10.a). Our finding confirms that in the countries that were late in promoting the adoption of digital technologies among their populations, the regulators were not taking a pro-active approach to connect with consumers via digital platforms and facilitate consumer e-participation in regulatory processes. The sector regulators seemed to be more responsive to the digital readiness in the sectors, as the effect of ICT infrastructure quality proved to be strongly significant (M11, Table 10.c).

(Paste Table 10.a here)

The liberalisation of service markets across the OECD economies contributed to disproportionate reallocation of resources from manufacturing industries to services, and structural adjustments not always went smoothly (Wölfl, 2006; Buera et al., 2012). The countries in our sample vary significantly in the restrictiveness of their regulatory environments across the liberalised service sectors, especially network industries, contributing to different degrees of consumer sovereignty and their participation in markets and regulatory processes. The change in sectoral composition among the sampled OECD and non-OECD countries had a pronounced effect on the adoption of digital practices for consumer participation by sectoral regulators. The larger shifts to services, as measured with higher average annual growth rates of value added over 10 years prior to coding the regulators websites (2010–2019), were significantly associated with a more pro-active approach by sector regulators in creating digital channels for consumer participation in economic regulation (Table 10.b). The strength of this effect, however, significantly varies across the sectors, and it exerts a negative impact on the rail authorities, as the rail market liberalisation was less pronounced at the onset of the digital era. The positive effect of growing service economy was strongly pronounced for the financial regulators, which may reflect the sector and household financialisaton across the EU and OECD economies. The multi-sectoral regulation also obtained a more consumer-oriented outlook in the economies with greater shifts to services.

The growth in manufacturing, on opposite, constrained the incentives for the regulators to adopt digital regulatory practices; only the competition authorities and postal regulators expanded digitalisation of information provision in economies with growing manufacturing base. Unexpectedly, the utility regulators did not pro-actively develop digital channels for

consumer participation with expanding industry (M24-25, Table 10.b). The sectoral shifts had the strongest effect on the financial regulation (M9, 19, 29, Table 10.b).

(Paste Table 10.b here)

Consumer participation priorities in infrastructure governance: good gets better?

The participatory regulation seemed to emerge in economies with better sectoral infrastructure quality, as it obtained a positive significant effect (M1, Table 10.c). The sector regulators tend to adopt a more consumer-oriented approach once the bottlenecks in underlying economic infrastructure are removed, though the effects for the rail and postal regulators proved insignificant (M7-8, Table 10.c). This finding may reflect the change in strategic vision of sector regulators towards service-oriented governance in the economies with higher infrastructure performance, striving to build consumer trust and confidence in asset investments – as infrastructure clients in the sectors (Hiteva et al., 2018).

However, the integration of asset management and service provision in sectoral regulation varies when we assess the quality of sector-specific infrastructure. While the overall effect of digital readiness across sectors had a positive effect on the adoption of digital regulatory practices for consumer participation (M11, Table 10.c), the telecom regulators tend to more pro-actively involve consumers in decision-making, as infrastructure clients, in the countries with significantly larger ICT and telecommunication infrastructure gaps (M12-15, Table 10.c). The same strategy was adopted by the energy regulators, though the effect is not significant (M17, Table 10.c). The quality of transport infrastructure is significantly associated with the spread of participatory regulation, retaining its positive effect on the digital adoption of the rail regulators.

The development of financial market, an index also capturing market infrastructure quality, promotes the adoption of consumer-oriented digital regulatory practices across all sectors (M20, Table 10.c), reflecting another aspect of financialisaton effect: the growing consumer power in participatory regulation once they become more active users of financial instruments or more financialised clients of sectoral infrastructure or outputs. The effect of financial market development is significantly more pronounced for the financial regulators, both stand-alone authorities and supervision-units within central banks (M21, Table 10.c). This finding is encouraging, as the financial authorities are able to balance the market powers by facilitating consumer e-participation in financial regulation once the market infrastructure is more developed and the industry pressures are growing, which prevents the capture of regulatory processes by the industry interests.

(Paste Table 10.c here)

Concluding Remarks

The significant divergence in the composite digital scores which we observed among the economic regulators across the 42 sampled countries yield important implications for improving regulatory practices towards consumer e-participation, and the regulatory design, overall. Although most regulators implemented the directives on website availability and created organisational webpages, the regulators' websites lacked strategic design that would enhance online content and functionality for consumers across the key regulatory functions and strategic objectives, such as media communication, the provision of consumer and legislative information, consumer education, decision-making, rule-making, and consumer protection. This is a significant shortcoming in the strategic digital vision of regulatory agencies, as a strategic approach towards designing *stakeholder-centred information hubs* with digitally-enhanced functionality may strengthen the regulatory independence from political and corporate pressures and secure their legitimacy in the eyes of the public. In the longer term, the comprehensive digital regulatory hubs can enhance the strategic position of independent regulators as digital facilitators within national institutional systems compared to their traditional regulatory tasks of market monitoring and information provision.

We observed particularly striking differences in the adoption of digital regulatory practices between the old and new EU member states, with the largest gaps emerging in the regulatory functions that are critical for consumer engagement with online regulatory information (i.e., the provision of consumer information) and consumer participation in rule-making (i.e., public consultation projects), which may impede the transparency of regulatory processes and the legitimacy of regulators' actions in the eyes of consumers. Given the EU initiatives for digitalising public services and embedding citizen-centric models in the regulatory design, as well as EU funding provided for regulation projects to the new member states, the significant differences in digital scores between regional groups highlight the notable importance of institutional barriers withholding the adoption of digital technologies for economic regulation in countries with diverse institutional legacy.

Besides the implications for regulatory practice, this study also serves a stepping stone to further theory building in two emerging area of the regulation literature. Firstly, we enhanced the concept of a *digital regulator*, by introducing a new analytical framework on the digitalisation of regulatory functions to capture the regulator's interaction with citizens (or consumers) – in contrast to the previous studies which primely focused on digital technologies employed for industry supervision (Zeranski et al., 2020; Aktas et al., 2021; Grassi et al., 2022). The digitalisation of regulatory functions for consumer e-participation in economic regulation

can enhance consumers' power in the market sectors vis-à-vis corporate and state players, by facilitating consumers' engagement with regulatory information and processes, as well as building consumers' trust towards digital resources on economic regulation, policy analysis, and market performance.

Furthermore, the *digital regulatory hubs* developed by economic regulators may create strategic implications for the regulator's position within the national institutional system, by augmenting its strategic role as a market monitor and information gatekeeper to being a *digital facilitator*. This strategic change in the regulator's strategic position, facilitated by pro-active uptake of digital technologies for multi-stakeholder engagement, will promote a more transparent and balanced representation of stakeholder interests in the regulatory system, as well as contribute to regulatory pluralism by expanding the role of citizens in the regulatory processes (Grabosky, 2013).

Secondly, we contribute to the literature on organisational capacity for economic regulation by implementing a multi-dimensional approach to operationalise the capacity of regulatory agencies across major market sectors. To enhance the concept and operationalisation of organisational capacity of economic regulators, we complemented internal and external dimensions of organisational capacity, and also introduced a new dimension of *digital capacity* – critical for conceptualising the organisational capacity, as well as regulatory practice. The adoption of digital practices by regulators, as measured by composite scores or individual indices capturing a subset of specific regulatory functions, can be used to assess their digital capacity towards consumer e-participation – an important, though overlooked, component of organisational capacity of regulators. Multi-dimensional operationalisation of regulatory capacity can advance understanding and cross-country comparison of regulatory models and the effectiveness of public management models. In this study, we disentangled each dimension of organisational capacity, internal and external, as a separate attribute in modelling, while in future studies it can be assessed as a composite measure.

Although the modelling results confirm the significant effect of regulatory autonomy, reform experience, human and capital capacity, and sectoral competencies of regulatory agencies on their adoption of digital practices, it is important to gather new evidence on digital visions and digital strategies of regulators, and evaluate the impact of organisational leadership on the digitalisation of regulatory practices. Given the limited number of sectoral and country attributes included in this study, the future research should also expand the scope of institutional dimensions, to explore the effect of institutional pressures on the adoption of digital practices by country regulators. Furthermore, this study reported the significant variation in adoption of

digital practices across specific regulatory functions covered in this study, future research can develop multiplex indices to model the organisational and institutional effects on individual digital practices.

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