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Optimal Design, Organisation and Powers of Competition Authorities – Note by Greece

4 December 2023

This document reproduces a written contribution from Greece submitted for Item 2 of the 138th meeting of Working Party 3 on 4 December 2023.

More documents related to this discussion can be found at https://www.oecd.org/competition/optimal-design-organisation-and-powers-of-competition-authorities.htm.

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Note by the Republic of Türkiye

The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the "Cyprus issue".

Note by all the European Union Member States of the OECD and the European Union

The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Greece[1]

1. Following the important challenges to competition law enforcement posed by the digital platform phenomenon, during the period 2016-2019, competition authorities also had to weather the storm of the Covid-19 pandemic, while they have been recently confronted to the tidal wave of price hikes and inflationary trends. Furthermore, competition authorities around the world are beginning to deal with the sustainable development goals, not exclusively the environmental and climate change protection agenda[2], but also the social sustainability one, in particular with regard to the transformation and precarity of work in the digital 'gig' economy[3]. Finally, there have been recent calls to enhance the role of industrial policy considerations in competition law enforcement, which if taken forward may jeopardize the policy autonomy of a field of law that has been at the center of the effort of EU integration in recent decades[4]. This simultaneous eruption of these different policy agendas the last two years, in combination with socio-economic developments that have challenged systemic resilience may become vectors for significant changes, not only of the methodological and conceptual toolkit of competition law, but also more broadly for the design and organization of competition law enforcement agencies. In this short contribution we explore some of these challenges and the consequent changes in the institutional design, structure, and role of competition authorities.

[1] This contribution was drafted by Ioannis Lianos, President of the HCC, with the assistance of Ms Mary Chamilou, Director, International and Public Relations Department, HCC.

[2] See, for instance, the positions expressed in the OECD, Sustainability and Competition debate, Sustainability and competition - OECD (December 2020) ; HCC, Draft Staff Discussion Paper on Sustainability Issues and Competition Law (July 2020), available at Staff_Discussion_paper.pdf (epant.gr) ; ACM, Guidelines on Sustainability Agreements (January 2021) Guidelines on sustainability agreements are ready for further European coordination | ACM.nl ; HCC & ACM, Technical Report on Sustainability and Competition (January 2021), available at Technical Report on Sustainability and Competition (epant.gr) ; M. Vestager (European Commission), Competition Policy in Support of the Green Deal, available at Competition policy in support of the Green Deal | European Commission (europa.eu) .

[3] See, European Commission, Collective Bargaining for Self-Employed (October 2020), available at Competition: Collective bargaining for the self-employed (europa.eu). For a discussion, see N. Countouris, V. De Stefano, and I. Lianos, The EU, Competition Law and Workers' Rights (March 25, 2021). Available at SSRN: https://ssrn.com/abstract=3812153 or http://dx.doi.org/10.2139/ssrn.3812153 .

[4] See, the German, French and Polish governments proposals, Modernising EU Competition Policy (2019), available at modernising-eu-competition-policy.pdf (bmwi.de) , which led to an important discussion on this issue: see, M. Heim (Bruegel), Modernising European Competition Policy: A Brief Review of member States' Proposals (July 24, 2019), available at Modernising European Competition Policy: A Brief Review of Member States' Proposals | Bruegel ; B. Deffains, O. d'Ormesson, T. Perroud, Competition Policy and Industrial Policy: for a Reform of European Law (January 2020), available at FRS_For_a_reform_of_the_European_Competition_law-RB.pdf (robert-schuman.eu) ; See also the critical comments to this proposal by I. Lianos, The Future of Competition Policy in Europe – Some Reflections on the Interaction Between Industrial Policy and Competition Law (March 2019). CLES Policy Paper Series 1/2019, Available at SSRN: https://ssrn.com/abstract=3383954

2. Complex institutional goals and the moving political economy of competition law: sustainable development and competition law

1. The sustainable development agenda in competition law

3. It has been suggested that the systemic resilience of the social contract may offer a high-end goal that would accommodate both efficiency and fairness concerns in competition law[5]. The current calls for competition law to integrate sustainable development concerns introduce an important level of institutional complexity, that also intersects with the discussion over the ongoing and never-ending debate on the goals of competition law, although the two issues are not strictly related. These initiatives form part of the current efforts to implement the Sustainable Development Goals (SDGs)[6] agenda adopted by the General Assembly of the United Nations (UN) in all fields of EU action[7]. As outlined in the 2019 reflection paper 'Towards a Sustainable Europe by 2030',[8] the EU has fully committed to the implementation of the 2030 Agenda through its internal and external policies[9]. The essence of the concept of sustainable development is that it entails a balance of the needs of current generations with those of future generations, taking into account environmental, societal and economic limitations[10]. Sustainable development objectives are also firmly enshrined in the EU Treaties[11].

4. The integration of sustainable development goals in competition law enforcement may generate tensions with the dominant rhetoric of "consumer welfare" or "consumer well-being" in competition law, principally for the following two reasons: it will require the consideration of sustainability benefits as efficiencies, and competition decision-makers (competition authorities and courts) would need to adequately tackle the possibility of a sustainability-based trade-off between harm to competition and benefits to sustainable development. The focus on sustainability concerns may therefore, in some instances, diverge from the monocentric view of the consumer, as a purely economic agent expressing her/his preferences by making choices in the marketplace. Consumers are also citizens who express their collective preferences (in this instance in favour of sustainable development goals) through democratic choice, participating through various ways in the polity. The overall normative framework cannot thus only be subsumed to economic rationales and be

[5] I. Lianos, Competition Law as a Form of Social Regulation, (2020) 65(1) The Antitrust Bulletin 3, 85.

[6] United Nations, 'Sustainable Development Goals' (2015) <https://sdgs.un.org/goals>.

[7] The General Assembly of the United Nations (UN) adopted, in September 20151, broader development targets for both developed and developing countries, encompassing all sustainability dimensions (economic, financial, institutional, social and environmental).

[8] European Commission, 'Proposal towards a sustainable Europe by 2030' (February 2019) <https://ec.europa.eu/info/publications/towards-sustainable-europe-2030_en>.

[9] Ibid.

[10] The report entitled 'Our common future' and came to be known as the 'Brundtland Report' after the Commission's chairwoman, Gro Harlem Brundtland, 20 March 1987.

[11] The economic, social and environmental aspects of sustainable development are highlighted in Article 3(3) of the Treaty on European Union. Article 7 also sets a framework for 'consistency' between EU policies and activities and all its objectives, which is profoundly linked to the principle of policy coherence that is essential for the attainment of SDGs.

ascribed an economic dimension but needs to account for the constitutional values of the polity (and of the prevailing social contract), as these are expressed in the foundational texts that form the core principles of each community. This "polycentric" vision finds its foundation in the recognition that people regularly participate in many distinct overlapping types of games or social interactions, at the marketplace, and in the political and cultural fields[12].

5. The simplicity of the micro-foundations of the consumer welfare analysis may thus enter in conflict with approaches that center on sustainable development, if there is no effort made to integrate that complexity. Beyond the practical issue of the extent and the way sustainability concerns may be integrated in competition law analysis, there is an important theoretical groundwork to be performed, and new institutional frameworks that are more open to such concerns have to be imagined and designed[13]. We provide some examples with regard to some of the challenges faced.

6. The current discussions in the EU regarding the sustainability chapter in the Commission's new Horizontal Guidelines, but also some national initiatives, have provided the opportunity to tackle the way sustainable development considerations may be integrated in the interpretation and enforcement of Article 101 TFEU, in view of the broader policy agenda the Green Deal[14]. However, the institutional implications of such a change of direction have not been discussed yet.

2. Institutional implications

7. Dealing with the integration of the sustainable development agenda in competition law assessment, would require from competition authorities important investments, both in terms of learning, but also institutional design.

8. First, competition authorities should develop adequate learning in order to be able to assess with technocratic sufficiency the competition *and* sustainability dimensions of the various business practices that may come to their attention: In order to be able to effectuate this trade-off (or other decision procedure) analysis they would need to integrate non-use value benefits or collective benefits instead of solely focusing on use value benefits, that is benefits that derive from the consumption or the use of the products covered by the business practice under assessment. Second, they should ensure the cognitive openness of the personnel involved in competition law enforcement as to the various methodologies to tackle the broader "welfare" or "well-being" implications of a specific business practice. Third, they have to "de-bias" the decision-making process so as to provide adequate attention to the sustainability dimension of a business project.

[12] I. Lianos, Polycentric Competition Law, (2018) 71 Current Legal Probs. 161.

[13] For the beginnings of a discussion, see Dutch ACM, Guidelines on sustainability agreements are ready for further European coordination (2021), available at **https://www.acm.nl/en/publications/guidelines-sustainability-agreements-are-ready-further-european-coordination** ; HCC, Draft Staff Discussion Paper on Sustainability Issues and Competition Law (July 2020), available at **Staff_Discussion_paper.pdf (epant.gr) ; OECD, Sustainability and Competition, available at https://www.oecd.org/daf/competition/sustainability-and-competition.htm .**

[14] Executive Vice-President Vestager's keynote speech, Competition Policy in Support of the Green Deal (September 10th, 2021), available at https://ec.europa.eu/commission/commissioners/2019-2024/vestager/announcements/competition-policy-support-green-deal_en .

9. The HCC has followed this triple strategy in its work on sustainability and competition law.

10. *Learning*: The HCC has made significant investments in order to develop adequate learning. First, it published a staff discussion paper in July 2020 exploring the legal principles applying in EU and national competition law to sustainability initiatives[15], and organized an international conference in September 2020 to discuss the results of the study[16]. Second, it published a Technical report on evaluating sustainability arguments, jointly commissioned with the Dutch Authority for Markets and Competition (ACM), with the aim to make competition officials familiar with the most common evaluative methods to assess sustainability benefits in environmental science and explore the complex distributional implications analysis that needs to be performed[17].

11. *Developing new tools*: The HCC recognized that in order to seriously integrate the sustainability dimension, competition authorities would need to adopt a more proactive approach (combining enforcement work and competition advocacy), rather than only focus on their traditional reactive approach in competition law enforcement (through the handling of complaints). This emerging proactive role for competition authorities, may give rise to the use of new more flexible and programmatic legal tools that experiment with these new approaches and which complement the traditional legal tools used by competition authorities, (infringement decisions or bargaining approaches, such as commitment decisions or settlements).

12. Of particular interest is the regulatory "sandbox" tool, originally used in the field of financial regulation in order to accommodate innovative projects[18]. The sandbox forms a supervised space for experimentation for the promotion of innovative business initiatives. It is an environment where undertakings from various industrial sectors, including pharmaceuticals and healthcare, can undertake initiatives that contribute significantly to the goals of sustainable development while not significantly impeding competition.

13. In July 2021, the HCC launched a public consultation for a "sustainability sandbox"[19] in order, for the industry to experiment with new business formats that aim to realize more quickly and efficiently sustainability goals, and which involve cooperation between competing undertakings or even more permanent changes in market structure in order to be accomplished.[20] This could be done under the condition of some form of time-constrained authorisation and a periodical targeted supervision of the HCC, specifically after balancing the possible anticompetitive effects with the need to provide incentives for the sustainability investment, and following a process of public participation, as is the best

[15] See, https://www.epant.gr/files/2020/Staff_Discussion_paper.pdf .

[16] See, https://youtu.be/FJHTZapdONc .

[17] See https://www.epant.gr/en/enimerosi/competition-law-sustainability.html .

[18] See, https://www.fca.org.uk/firms/innovation/regulatory-sandbox .

[19] Hellenic Competition Commission, 'Sustainability Sandbox- Public Consultation: Proposal for the creation of a sandbox for sustainability and competition in the Greek Market' (July 2021) <https://www.epant.gr/en/enimerosi/sandbox.html>.

[20] There is experience with regulatory sandboxes in the financial industry field, in particular Fintech. See, Industry Sandbox, 'A Blueprint for an Industry-Led Virtual Sandbox for Financial Innovation Consultation Guide' (2016). The UK Financial Conduct Authority also recommended the establishment of sandboxes, with the support of 'Project Innovate', a Fintech industry-led virtual sandbox.

practice for environmental infrastructure projects. In addition, even if such arrangements produce anticompetitive effects, the HCC will not proceed to impose any fines and sanctions if the arrangements form part of the 'sandbox', although it will proceed with other remedies. In this context, the proposal's effects on both competition and sustainable development may be assessed by the HCC *ex ante* (even before the project gets implemented) in order to enhance legal certainty and reduce regulatory risk for investments in line with the broader public interest goal for sustainable development. An additional problem justifying such intervention by the HCC arises from the presence of imperfect financial markets in Greece, in particular following the decade-long economic crisis, which either do not provide the required investments in view of their narrowness or, due to regulatory risk, require additional guarantees. In this environment SMEs would have found it increasingly difficult to attract investment for the green transformation of their activities. Hence, the sustainable development competition law sandbox forms part of the HCC's efforts to enhance the dynamic efficiency of the economy and innovation, thus acting in accordance to the competition principle.

14. The constitution of the sandbox does not aim to avoid the application of competition rules in the market, nor can it be used for anti-competitive practices that simply contain some reference or a low contribution to sustainable development without overcoming the damage to competition caused (e.g. in the context of environmental sustainability these are called "green-washing" practices). On the contrary, it makes it possible to fully evaluate practices, which make a significant contribution to the public interest by enhancing sustainable development. Due to the innovative nature of the project for competition policy and competition enforcement, there is no direct comparison with other proposals/actions in other jurisdictions, in order to draw useful conclusions and take into account information. However, such a tool may offer additional avenues for monitoring business cooperation between undertakings on specific innovative projects or the development of mandatory collective industry standards with the aim to respond to sustainability challenges.

15. The tool is managed by the Advocacy unit of the HCC, which has the aim to launch a Sustainability Sandbox round once every year, covering different sectors of the economy, with the aim to promote the use of the tool and to inform the industry on the need to ensure that all sustainability initiatives are compatible with competition principles.

16. Furthermore, the institutional toolkit of the authority was enriched by the legislator with the adoption by Law 4886/2022 of the new provision in the Competition Act – Article 37A – which provides the possibility for one or more undertakings to submit a request for issuance of a no-action letter by the President of the HCC, stating that no action will be taken against a horizontal or vertical agreement for violation of Article 1 of Law 3959/2011 or article 101 TFEU or against a practice for violation of Article 2 of Law 3959/2011 and Article 102 TFEU[21]. Undertakings can submit such request on public interest grounds, especially with regard to implementation of the sustainable development goals. The procedure laid down in Article 37A is a simplified procedure in the sense that the President of the HCC, by issuing a relevant letter, following a proposal by the Directorate-General for Competition (DGC), can determine that there are no grounds for further action. DGC will examine the relevant requests taking into account the arguments and evidence provided by the undertakings concerned. This letter creates legal certainty for undertakings, as long as the factual circumstances on which the issuance of the no-action letter was based at the time of its issuance do not change.

17. In order to consider a submitted no-action letter request, the requesting undertakings must invoke and sufficiently substantiate: (1) the overriding grounds of public

[21] See, https://www.epant.gr/en/enimerosi/competition-law-sustainability.html .

interest in the particular case (see below), and (2) that genuine uncertainty arises due to a novel or difficult issue within the scope of competition law. A typical case is where an agreement or practice raises issues that have not previously been dealt with by the HCC, the European Commission, national or EU Courts, (3) the agreement/practice is of major importance for the requesting undertakings, and the national economy, in general.

18. Furthermore, the HCC adopted Guidelines in order to specify the reasons of public interest that may be taken into account[22], which make extensive reference to the Sustainable Development Goals (SDGs) are specified in texts of the United Nations (see, in particular, the "2030 Agenda for Sustainable Development" and the Paris Agreement) and the European Union (see in particular the European Green Deal which Greece is committed to implement). The sustainable development goals that the HCC intends to consider include, inter alia: (i) Environmental protection and limiting the negative effects of climate change, by reducing greenhouse gas emissions; (ii) Achieving technological innovation aimed at meeting sustainable development goals (e.g., smart cities); (iii) Protecting and enhancing the green transition of small and medium-sized enterprises (SMEs).

19. Reference to the attainment of sustainable development goals in Article 37A of the Greek Competition Act is indicative and does not preclude the adoption of no-action letters in cases where other reasons of public interest are present. Reasons relating to the public interest further mean the reasons recognised as such in the case-law of national and EU Courts, including the following reasons: public order; public security; public health; preserving the financial equilibrium of the social security system; the protection of consumers, recipients of services and workers; fairness of trade transactions; combating fraud; the health of animals; intellectual property; preservation of the national historic and artistic heritage; social policy objectives and cultural policy objectives. Reasons of public interest for the purposes of article 37A, apart from those mentioned above, may also be (i) ensuring the supply and appropriate distribution of essential products and services and security of supply chains, especially in times of crisis; (ii) protection of public health; (iii) achieving or advocating the objectives of the Common Agricultural Policy, especially so far as sustainable development is concerned; (iv) strengthening regional sustainable development; (v) reaching/defending energy self-sufficiency within the framework of the National Energy and Climate Plan and the Long-term Strategy 2050; (vi) ensuring employment opportunities and decent working conditions for citizens and vulnerable groups of the population (vii) putting to effect or protecting social cohesion.

20. The development of this new tool, in conjunction with the new powers to adopt no-action enforcement letters will enable the authority to systematically integrate sustainability concerns in the competition assessment performed.

21. *Sustainability Advocate*: Even if significant efforts are made for the development of learning and specific tools with regard to the sustainability dimension, there is a risk that sustainability concerns are not adequately taken into account, because of the lack of expertise by the agency's staff or the "bias" they may show vis-à-vis sustainability benefits in the context of the traditional competition assessment under a narrow consumer welfare standard. This institutional "bias" may result from the lack of expertise to assess the sustainability dimensions of the business conduct under examination. It is quite important therefore to develop pro-active approaches that would put emphasis on the sustainability assessment, thus ensuring that any balancing is performed as objectively as possible. For this reason, it may be necessary to establish independent sources of expertise operating within the authority that may enrich the perspective of the case team and ensure, at least during the first period of this transition towards a Sustainable Development Competition

[22] HCC Decision 789/2022, available at https://www.epant.gr/en/legislation/no-action-letter.html.

Law Agenda, the objective and systematic consideration of sustainability benefits when this is required. The HCC has thus advertised for the position of sustainability advocate, an external contractant, who will assist the case teams in the assessment of sustainability benefits and of the trade-off to be performed with competition concerns and will promote the use of the Sustainability Sandbox both within and outside the Agency. The position may develop to a permanent role within the HCC's organigramme if there is sufficient interest from business with regard to the use of the sustainability sandbox tool.

3. Complexity and the Reformation of the Competition Law Enforcement Toolkit

22. Another level of complexity consists in engaging with the transformational technology of the fourth industrial revolution, and more particularly the use of Big Data, AI and its various dimensions, such as the constitution of new forms of organization of economic activity (e.g. ecosystems) or the development of new technologies that may be employed in competition law enforcement.

3.1. Understanding the implications of AI and the development of digital ecosystems for the role of competition authorities

23. The implementation of artificial intelligence (AI) not only changes the dynamics of the competitive game, and raises new questions as to algorithmic collusion[23], or the use of behavioural targeting/discrimination for new extraction of value strategies in both the digital and non-digital space of the economy[24]. The emergence of large digital conglomerates and ecosystems that produce important extra-organizational externalities[25], but may also provide the opportunity and the need for updating the traditional conceptual toolkit of competition law authorities and the development of new tools that "augment" the capabilities of competition authorities (augmented competition law")[26]. Furthermore, the development of new technologies that make possible a data-rich competition law enforcement may enable competition authorities to broaden up their perspective and tackle issues that were left until now outside the traditional conceptual framework of competition

[23] SK Mehra, Antitrust and the Robo- Seller: Competition in the Time of Algorithms (2016) 100 Minnesota L Rev 1323; A Ezrachi and ME Stucke, Artificial Intelligence & Collusion: When Computers Inhibit Innovation, (2017) University of Illinois L Rev 1775; U Schwalbe, Algorithms, Machine Learning, and Collusion (June 1, 2018), available at SSRN: https://ssrn.com/abstract=3232631; OECD, *Algorithms and Collusion: Competition Policy in the Digital Age* (14 September 2017)..

[24] CMA, Algorithms: How can they reduce competition and harm consumers (January 19th, 2021), available at https://www.gov.uk/government/publications/algorithms-how-they-can-reduce-competition-and-harm-consumers/algorithms-how-they-can-reduce-competition-and-harm-consumers .

[25] M. Bourreau & A. de Streel, Conglomerates and EU Competition Policy, (March 2019); A. Ross Sorkin, 'Conglomerates Didn't Die. They Look Like Amazon' The New York Times (New York City, 19 June 2019); Parmy Olson, 'How Zuckerberg Is Feeding His Facebook Conglomerate' Forbes (Jersey City, 27 March 2015); I. Lianos, K. Hendrik Eller & T. Kleinschmitt, The Limits of Private Governance of Ecosystems, (CLES Research paper series 07/2021).

[26] I. Lianos, Polycentric Competition Law, (2018) 71 Current Legal Probs. 161, 208 (venturing the slogan of 'augmented competition law' in order to signify that this type of analysis will surely rely on advanced computing, algorithms and artificial intelligence supported decision-making).

law (e.g. privacy), essentially because of the lack of appropriate tools, methods and metrics to engage with them.

24. Competition authorities participate to this re-orientation effort, not through their traditional enforcement activity, but taking a more "responsive" approach[27], by the multiplication of other methods of engagement with the market participants in their effort to promote a more competition-compatible design and architecture for the emerging new economy of the fourth industrial revolution.

3.2. Developing new tools to deal with (digital) ecosystems: the Greek experience

25. Ecosystems are regarded as communities of collaborating firms that collectively produce a good, service, or solution with an aligned vision. Ecosystems thus do not merely denote 'theory of the firm' alternatives to vertical integration or supply-chain arrangements, rather the concept reflects the emergence of business environments marked by modularity in production, co-evolution, and decisional complexity[28]. Ecosystem orchestrators set the activity and value architectures of ecosystems with the purpose to maximize its resilience and capacity to generate value. For instance, ecosystem orchestrators controlling an operating system make a strategic use of their application programming interfaces (APIs), which enable external apps to connect with the operating system, hardware or web-based system, algorithms based on Big data analytics, or contractual restrictions, among other forms of ecosystem 'glue', in order to ensure interconnectivity and interoperability for final consumers, but by the same also offer profitable points of control for the dominant firm in the ecosystem and the resources to build a strategic competitive advantage. This leads to a new set of dynamics, whereby those who control ecosystems can generate profit through a fresh set of dynamics[29].

26. In these more complex production and innovation structures, competition interactions depend on, and determine the boundaries of, the "space" within which these agents are contained. However, determining the relevant "space" or "field" of interaction cannot be done before fully engaging computationally with the interactions of the agents themselves. This additional level of complexity highlights the need for the competition law framework to adapt its toolkit and operational concepts to the reality of a complex economy[30], in particular employing operational concepts that would account for inter and

[27] M. Ioannidou, Responsive' Remodelling of Competition Law Enforcement, (2020) 40(4) Oxford Journal of Legal Studies 846; S. Makris, Openness and Integrity in Antitrust, (2021) 17(1) *Journal of Competition Law & Economics 1 (arguing for a "responsive law" perspective in antitrust).*

[28] Ron Adner, Ecosystem as Structure, (2017) 43 Journal of Management 39; Rahul Kapoor, Ecosystems broadening the locus of value creation, (2018) 7 Journal of Organization Design, Article No 12; Erkko Autio, and T. Llewellyn, Tilting the Playing Field: Towards an Endogenous Strategic Action Theory of Ecosystem Creation, in S. Nambisan (ed.), Open Innovation, Innovation Ecosystems, and Enterpreneurship: Multidisciplinary Perspectives (Word Scientific Pub., 2018), Chap. 5. See also Michael G. Jacobides, Carmelo Cennamo, Anabelle Gawer Towards a theory of ecosystems, (2018) 39 Strategic Management Journal 2255; James F Moore, Predators and prey: a new ecology of competition, (1993) 71(3) Harvard Business Review 75.

[29] See, E. Autio, Orchestrating ecosystems: a multi-layered framework, Organization and Management, 2021.

[30] I. Lianos, Competition law for a complex economy, (2019) 50 International Review of Intellectual Property and Competition Law (IIC), 643.

intra ecosystem competition[31]. This involves completing the "relevant market" framework employed in competition law, which explicitly focuses on the average behavior in one of the system's components (i.e., firms producing neatly separable, substitutable products) and the deviations of individual components from this average (e.g., higher prices, lower quality, and reduced innovation). The relevant market framework fails to appreciate the dynamics of multiproduct and multi-actor ecosystems. We need to adjust our regulatory framework lest it becomes perilously distant from the reality of real-world power[32].

27. In the presence of a "regulatory gap" that puts uneasy pressure to existing operational concepts (the relevant market), which are stretched beyond their logical limits, it becomes important to reflect on conceptual innovations[33]. Hence, the Law Commission for the revision of Greek competition law made proposals for the inclusion of a new Article 2A in Law 3959/2011 with the aim to regulate power in ecosystems.

Box 1. Suggested Article 2A: Abuse of position of power in an ecosystem of structural importance to competition

1. Any abuse by an undertaking of its position of power in an ecosystem of structural importance to competition in the Greek territory is prohibited.

If the requirements for the application of the present article and of articles 2 of the present Law and 102 TFEU are met, only the latter articles shall apply, excluding application of the present.

2. For the purposes of the application of para. 1, the Hellenic Competition Commission shall take into account the business model of the ecosystem and the rules governing the relations of the parties involved. The Hellenic Competition Commission shall also consider any adequately justified objective reasons put forward and which concern the practices at issue.

3. a) An "ecosystem" is defined as: (a) a nexus of interconnected and, to a great extent, interdependent economic activities of different undertakings aiming at the provision of products or services which impact on the same group of users; or (b) a platform connecting economic activities of different undertakings with the purpose of providing one or more products or services, affecting either the same users or different groups of business users or end users.

b) A "platform" is defined as an entity operating either as an intermediary for transactions between interdependent groups of end users and business users or between interdependent groups of business users, or as an infrastructure for the development and provision of different, yet interconnected, products and services.

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[31] For a discussion, see M. G Jacobides & I. Lianos, Ecosystems and competition law in theory and practice, (2021) 30(5) *Industrial and Corporate Change* 1199.

[32] I. Lianos, B. Carballa-Smichowski, A Coat of Many Colours – New Concepts and Metrics of Ecoomic Power in Competition Law and Economics,, *Journal of Competition Law & Economics*, 2022; nhac002, https://doi.org/10.1093/joclec/nhac002 ..

[33] For a discussion, see M. Jacobides & I. Lianos, Ecosystems and Competition Law in Theory and Practice, (2021) 30(5) Industrial and Corporate Change 1199.

4. An ecosystem shall be presumed to be of structural importance to competition where non participation in it substantially affects the effective exercise of business activities by third parties. When determining an ecosystem's structural importance to competition, account shall be taken particularly of the following elements: (a) the economic power or the significant share of the ecosystem concerned in the total turnover, or in the revenue of one or more sectors of the Greek economy, (b) its access to substantial resources, in particular to a significant number of business users depending on the ecosystem in order to connect with end users or to sensitive data and information relevant to competition, (c) the significance of its activities with regard to the access of third parties to procurement and sales markets in the Greek territory.

Notwithstanding the fulfilment of the requirements stipulated in the previous sentence, an ecosystem shall be presumed to lack structural importance to competition where, at least four (4) other independent ecosystems operate in parallel to it and such ecosystems constitute a viable alternative for users.

5. A "position of power" in an ecosystem is defined as the position of economic strength enjoyed by an undertaking, which affords it the power to behave to an appreciable extent independently of its competitors, its customers and, in general, the users of the ecosystem. When determining the possession by an undertaking of a position of power in an ecosystem, account shall be taken, inter alia, of the following elements: (a) the control by such undertaking of necessary resources and infrastructure for the economic activity of other undertakings, (b) the undertaking's capacity to lay down rules regulating the operation of the ecosystem and the access of third parties to it, (c) the undertaking's increased bargaining power via-a-vis business users and end users of the ecosystem, (d) the dependency of ecosystem users on the undertaking for the provision of intermediation services, essential for their access to markets for products and services, and the absence of a respective alternative solution.

6. The Hellenic Competition Commission may initiate ex officio investigation in order to establish whether there has been an infringement of para. 1. Where an infringement is found, the Hellenic Competition Commission issues a decision, which is notified to the undertaking concerned, by virtue of which the undertaking is obliged to cease the infringement and refrain from it in the future. By the same decision, the Hellenic Competition Commission may invite the undertaking, within 60 days from the notification of the decision, to propose remedies which it intends to impose for the undertaking to comply effectively with the decision of the Hellenic Competition Commission.

7. The Hellenic Competition Commission issues a decision within one hundred twenty (120) days following notification of the preceding decision of the Hellenic Competition Commission finding an infringement, by virtue of which, remedies proposed by the undertaking pursuant to para. 6 shall be made binding to it.

In case the proposed remedies are not considered appropriate, the Hellenic Competition Commission, following a hearing of the undertaking, may impose behavioral remedies as appropriate and necessary for the infringement to be ended, depending on the nature and the gravity of the infringement and on the business model of the ecosystem concerned.

8. The General Directorate for Competition of the Hellenic Competition Commission may initiate proceedings to monitor compliance with a decision adopted pursuant to para. 7 and the Hellenic Competition Commission may issue a decision with respect to the compliance of the undertaking.

By virtue of a decision of the Hellenic Competition Commission and where non-compliance of the undertaking has been established, the undertaking concerned is obliged to cease non-compliance and refrain from it in the future, and the Hellenic Competition Commission may also impose a fine to the undertaking pursuant to para. 2 of Article 25B.

28. The introduction of Article 2A – and, more specifically, the reference to a position of power in an ecosystem of paramount importance – aimed at covering lock-in situations that may produce negative effects to competition and innovation, and which could not fall under the provision on abuse of dominance. But the essence of the provision and the added value it aimed to bring to competition law enforcement relates to its focus on ecosystems. At the background stands the realisation that competition law should take into account the strategies used by economic actors to create and capture value by competing for strategic or architectural advantage[34] in the context of an ecosystem,[35] when these strategies may negatively and significantly impact competition[36]. The starting point for the analysis should not only therefore be the relevant market, but the ecosystem itself. Undertakings compete against each other to a) expand their customer base, and/or b) exploit network effects and their positioning as bottlenecks – even if this positioning might not make sense from a conventional price-cost perspective. This preoccupation with expanding the customer base partially explains why companies continue to offer "free" products/services, even if the benefits they receive with regards to market share or user data (personal data can be seen as the price users pay for free products/services) are not directly redeemable. Even so, acquiring a large customer base at the cost of reduced profits may not be the ultimate prize. Instead, such strategic practices are more profitable once the companies are in position to develop their dynamic prognostic capabilities (improving their algorithms through customer data) and/or take on the role of gatekeeper to the ecosystem. The anticipation of such profitability improves the market capitalisation of the company right away[37].

29. In addition, treating certain economic activities as parts of an ecosystem, and investigating them as such, helps to develop a more holistic appraisal of competitive sources and pressures. Due to the nature of the products and services offered by digital ecosystems, the boundaries between stages of the value chain dissolve, making some companies more powerful[38]. To get an accurate picture of the origins of competition and

[34]M.G. Jacobides, T. Knudsen, M. Augier "Benefiting from innovation: Value creation, value appropriation and the role of industry architectures". (2006) Research Policy 35(8): 1200–1221; G. Pisano, D. Teece, "How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture", (2007), California Management Review, 50(1).

[35] D. Teece, "Business Models, Value Capture and the Digital Enterprise", (2017) 6(8) Journal of Organizational Design; M.G. Jacobides, C. Cennamo, A. Gawer, "Towards a Theory of Ecosystems" (2018) Strategic Management Journal 39.

[36] See, M. Jacobides & I. Lianos, Ecosystems and competition law in theory and practice, (2021) 30(5) Industrial and Corporate Change 1199.

[37] On the role of financialization in digital economy, but also more generally see, I. Lianos & A. McLean, Competition Law, Big Tech and Financialisation: The Dark Side of the Moon (September 15, 2021). Available at SSRN: https://ssrn.com/abstract=3930565 .

[38] C. Baldwin and J. Woodard, The Architecture of Platforms: A Unified View, *in Platforms, Markets and Innovation* (A. Gawer ed., 2009), 24-26, T. Eisenmann et al., "Platform Envelopment", (2011) 32 Strategic Management Journal 1270.

points of control, we must take a more holistic view of the entire system and look for "positional power"[39].

30. It is important to highlight that ecosystems, as defined in Article 2A, include various companies and nexuses of dependency, and should be distinguished from conventional vertical relationships between actors and supply chains. The actors that form an ecosystem are usually independently owned, but financially and technologically interconnected due to:

- the highly complementary relationships between the resources (technological, financial and human) needed to participate
- the fact that the user or group of users are provided with a coherent and often financially integrated offering, even though multiple actors are involved (with the distribution of revenues often not being made explicit); relatedly, there are positive or negative feedback loops between different categories of users, and
- often the sunk costs that complementors must invest for a "seat at the table", which may result in them being locked in. This may raise an issue in as much as the scope and extent of the ecosystem is such that potential ecosystem participants would be materially worse off if they chose *not* to participate in the ecosystem.

31. The issues tackled by Article 2A were also identified in other jurisdictions. Germany has already moved to implementing a proposal addressing the above issues in the tenth review of its competition law (new Article 19a), which introduces a new provision regarding undertakings with paramount significance for competition across markets[40]. Austria has also introduced legislation regarding undertakings operating in "multisided" digital markets[41]. Elsewhere, the "gap" in the current provisions concerning unilateral practices was covered by the enforcement of specific provisions on abuse of economic dependence[42]. There are a number of jurisdictions in Europe with provisions on non-structural economic power, such as abuse of economic dependence, relative market power

[39] I. Lianos, B. Carballa-Smichowski, A Coat of Many Colours – New Concepts and Metrics of Ecoomic Power in Competition Law and Economics, *Journal of Competition Law & Economics, 2022; nhac002, https://doi.org/10.1093/joclec/nhac002.*

[40] New Article 19a GWB-E (Referen-tenentwurf eines Zehnten Gesetzes zur Änderung des Gesetzes gegen Wettbewerbsbeschränkungen).

[41] Art. 28a και 36 para 2a Cartel Act (KaWeRÄG) on lodging an application with the Cartel Court requesting it to declare that an undertaking operating in a multi-sided digital market holds a dominant position.

[42] Some jurisdictions have re-introduced provisions on abuse of economic dependence, making specific reference to the legislative gap concerning digital platforms in their abuse of dominance provisions: Loi modifiant le Code de droit économique en ce qui concerne les abus de dépendance économique, les clauses abusives et les pratiques du marché déloyales entre entreprises, Art. 4, http://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=fr&la=F&cn=2019040453&table_name=loi . For instance, French competition authorities have applied provisions for the abuse of economic dependence (Article L. 420 2, alinéa 2 du code de commerce) – which form part of their rulebook on free (and not unfair) competition – to non-dominant firms in a market: Case 20-D-04 16 March 2020 «relative à des pratiques mises en œuvre dans le secteur de la distribution de produits de marque Apple», https://www.autoritedelaconcurrence.fr/sites/default/files/integral_texts/2020-06/20d04.pdf .

or bargaining power[43]. The Digital Markets Act also tackles ecosystems although it only applies to gatekeepers and covers the digital economy, thus leaving outside platforms that may emerge in more traditional sectors, such as banking, automobile industry, retail, but also platforms of regional or national significance which do not dispose of a dominant position on a market[44]. These developments highlight the need to develop new concepts of (economic power) and new metrics, beyond the traditional concepts and tools provided by neoclassical economics, that would take into account "ecosystems" as a new field of competitive interaction[45]. This legislative proposal did not move ahead for various reasons[46].

4. The emergence of computational competition law and economics

32. The development and use of new computational techniques in competition law enforcement will have important implications to the theory and practice of competition law, to a certain extent similar to those generated by the turn to a more economic approach and the systematic use of economics in competition law a couple of decades ago. We are at the beginning of a new antitrust revolution that will bring similar reforms to the institutional design of competition authorities than those undertaken with regard to the use of economic analysis, including an adaptation of evidence rules and procedure to this new reality. The emergence of computational competition law and economics is linked to different factors, such as the prevalence of the digital economy, which enables the harvesting of immense volumes of data about all dimensions of economic activity and consumer behaviour, the development of data analytics and algorithms that enable competition authorities to monitor real time market activity, the creation of screening tools that assist competition authorities in making more accurate predictions, and finally the development of a deeper understanding of economic activity as part of a larger complex economy, in which the linear dynamics of neoclassical price theory may not prove adequate.

33. The turn towards computational competition law and economics provides a good illustration of the impact of technological transformation on the role and work of competition authorities[47]. In view of the recent emphasis put by competition authorities

[43] See, for instance, provisions in Germany, Italy, Switzerland, Belgium, France, Hungary, Cyprus, Bulgaria, Portugal. Latvia, UK (concept of strategic market status), Czech Republic, Romania.

[44] This trend towards expansion of abuse of economic dependence concepts is also visible in other regions of the world: see, the presentation by S. Lee, Abuse of Economic Dependence in Competition Law From a Comparative Perspective (ASCOLA Asia Regional Workshop 2022, Jan 5, 2022), available at **https://www.slideshare.net/SangYunLee23/sangyun-lee-abuse-of-economic-dependence-in-competition-law-from-a-comparative-perspective-ascola-asia-regional-workshop-2022-jan-5-2022** .

[45] See, for instance, I. Lianos, B. Carballa-Smichowski, A Coat of Many Colours – New Concepts and Metrics of Ecoomic Power in Competition Law and Economics,, *Journal of Competition Law & Economics*, 2022; nhac002, https://doi.org/10.1093/joclec/nhac002 ; European Commission, Support study accompanying the Commission Notice on the evaluation of the definition of relevant market for the purposes of Community competition law – Final Report (2021), available at https://ec.europa.eu/competition-policy/system/files/2021-06/kd0221712enn_market_definition_notice_2021_1.pdf (pp. 80-88).

[46] See, for a discussion, I. Lianos, Re-orienting competition law, (2022) 10(1) *Journal of Antitrust Enforcement,* 1.

[47] For a detailed discussion, see HCC, Computational Competition Law and Economics – An Inception Report (January 2021), available at

worldwide on climate change and environmental and social sustainability, which call for a broader methodological framework and the expansion of competition law assessment to more than just prices and output, and the difficulties emerging out of the Covid-19 pandemic, with regard to the possibility of competition authorities to investigate conduct, often now taking place in digital markets, through the traditional means of competition law enforcement, such as down raids, it becomes essential to engage with the possible use of new computational technologies in competition law enforcement.

34. These new computational methods do not only impact on competition law enforcement techniques, but also involve the use of new analytical methods and the development of a different conceptual framework for making causal arguments in competition law. Competition law has not yet engaged with complex systems science, in particular the fields of computational economics[48], systems dynamics[49], evolutionary dynamics, network science[50], fractals and scaling, pattern formation[51], econophysics[52], nonlinear dynamics and chaos[53], but will need to do so in the near future. This will raise similar, if not more complex, methodology questions as those raised by the "more economic approach": the integration of economic thinking and arguments in competition law during the last three decades in Europe[54].

35. To showcase the value of these computational tools, we take as an illustration the area of cartel enforcement, in which competition authorities may rely on 'market-based' evidence focusing on the detection of coordinated oligopolistic price elevation, including 'price patterns' in the industry, evidence of price elevation and facilitating practice. Econometric techniques using a structural approach (focusing on markets with traits thought to be conducive to collusion) have also been used to help provide information as to where cartels may be located, as well as logit models or OLS predicting the probability or the number of cartels likely to exist in a specific industry[55]. Some authors have also

https://www.epant.gr/en/enimerosi/publications/research-publications/item/1414-computational-competition-law-and-economics-inception-report.html ; See also the Computational Antitrust Project at Codex, University of Stanford, available at https://law.stanford.edu/codex-the-stanford-center-for-legal-informatics/computational-antitrust/ .

[48] L. Tesfatsion, Agent-Based Computational Economics: Growing Economies From the Bottom Up, (2002) 8(1) Artificial Life 55; L. Tesfatsion & K.L. Judd (eds.), *Handbook of Computational Economics* (North Holland, 2006).

[49] J. Sterman, *Business Dynamics* (Irwin/McGraw, 2010).

[50] A.L. Barabási, *Network Science* (CUP, 2016).

[51] T.C. Shelling, *Micromotives and Macrobehavior* (Norton & Company, 2006)

[52] R.N. Mantegna & H.E> Stanley, *Introduction to Econophysics: Correlations and Complexity in Finance* (CUP, 1999).

[53] J. Gleick, *Making a New Science* (Open Road Media, 2011).

[54] See, I. Lianos & C. Genakos, Econometric evidence in EU competition law: an empirical and theoretical analysis, in I. Lianos & D. Geradin (eds.), *Handbook on European Competition Law – Enforcement and Procedure* (Edward Elgar, 2013), 1.

[55] OFT773, 'Predicting cartels' (Economic discussion paper, March 2005). For an overview, see P Rey, 'On the Use of Economic Analysis in Cartel Detection', in C-D Ehlermann and I Atanasiu (eds), *Enforcement of Prohibition of Cartels, European Competition Law Annual 2006* (Hart Pub, 2007) 69–82; P A Grout and S Sonderegger, 'Structural Approaches to cartel Detection' in C-D Ehlermann and I Atanasiu (eds), *Enforcement of Prohibition of Cartels, European Competition Law Annual 2006* (Hart Pub, 2007) 83–104.

emphasised behavioural approaches to detecting cartels, which also require the use of econometric techniques.[56] Quantitative economic analysis includes, as a first step, an industry analysis with a scoring approach (looking to different variables, such as indicators of price, transparency, concentration and entry) in order to exclude from the sample cases where cartel activity is relatively improbable and, as a second step, a critical event analysis (with a focus on exogenous shocks or structural breaks) testing the collusive against the competitive scenario.

36. The use of computational methods (algorithms) offers additional opportunities for detecting collusion more accurately on the basis of Big Data evidence. They complement existing digital technologies used for competition law enforcement, such as online whistleblower tools. As previously discussed, screening relies on an econometric analysis of data. However, by-hand econometric analysis has limitations, as it solely depends on human resources. Digital technology developments shift manual analysis of data to automatic cartel detection.

37. Each jurisdiction takes a different approach in designing and implementing their software screening tools. software tools developed by competition authorities have different designs, as they differ in both set of collected bidding information and indicators they analyse. Existing software screenings rely on a linear model and use simple tests, mostly easy to deceive by astute colluders. Big data and advanced machine learning techniques might offer a possible solution to this problem, as they provide the possibility to find nontrivial collusive patterns that econometrics could not foresee and they may build non-trivial tests on these patterns. As mentioned above, the main advantage of current screening tools is the analysis of large amounts of procurement data, which is infeasible if this was done by humans. Advanced machine learning techniques should enable the employment of effective cartel detection criteria on the basis of Big Data which were previously unknown to econometrics.

38. The transition from a linear model with hand-crafted weights to advanced machine learning techniques (such as neural networks or random forests) requires big training data sets containing examples of collusive and competitive behaviour. The creation of such data sets demands a huge number of man-hours to analyze procurement data and annotate whether it is competitive or not, and thus requires some collaboration between competition authorities[57].

5. Enhancing the use of computational tools within the HCC

39. The Hellenic Competition Commission (HCC) has been one of the first movers, among competition authorities in Europe, in the study and integration of advanced computational competition law and economics tools in its day-to-day activities. Early on taking over the Organization, in 2020, the new Agency leadership realized the importance of AI and data science tools in enhancing the pace and scope of competition law

[56] J E Harrington, Jr, 'Detecting Cartels' (Department of Economics, John Hopkins University, 2005), available at econ.jhu.edu/wp-content/uploads/pdf/papers/wp526harrington.pdf ; J E Harington Jr 'Behavioral Screening and the Detection of Cartels' in C-D Ehlermann & I Atanasiu (eds), *Enforcement of Prohibition of Cartels, European Competition Law Annual 2006* (Hart Pub, 2007) 51–68.

[57] Rosa M. Abrantes-Metz & Albert D. Metz. Can Machine Learning Aid in Cartel detection? CPI Antitrust Chronicle July 2018. P. 3. https://www.competitionpolicyinternational.com/wp-content/uploads/2018/07/CPI-A-M-Metz.pdf

investigations, and put in place a holistic strategic vision with the aim to transform the HCC to an AI-augmented competition authority by 2024.

40. In pursuing this overall ambition, the HCC first completed in 2020 a comprehensive inception report with the aim to map the use of different computational techniques (Big Data, AI, machine learning, deep learning) by competition authorities around the world, focusing in particular on some selected competition authorities, in view of their different level of development, size and legal system in order to better understand the linkage between the use of these computational techniques and institutional change (HCC, Inception Report, Computational Competition Law and Economics, 2020)[58]. In the meantime, the HCC invested in the construction of a bespoke data infrastructure for the collection and analysis of data and economic intelligence, as well as proceeded to the procurement of number of commercial off-the-shelf AI software products (e.g. Tovek Intelligence) for use by the newly formed forensic and market mapping units of the HCC (2020).

41. The HCC Data Analytics and Economic Intelligence Platform (DAECI) was conceived of as a tool to integrate and keep updated multiple external data sources in common database schema with the aim to provide visualization tools for data exploration and a screening device to HCC's economists and lawyers. The platform is being hosted within the premises of the HCC to the users having the appropriate access credentials. The application is being deployed as a Flask Server that incorporates a number of dashboards that enable various forms of data visualisation (e.g. box plots, basket plots, data error bars). The Platform also integrates a screening method to detect anti-competitive practices – including cartels and excessive pricing– from the analysis of market data (in particular prices, but also for some products quantities), taking advantage of new legislation enabling the authority to have mandated access to primary data regarding prices by the main supermarkets in the country, the distribution system for petrol stations, and the Athens central market for vegetables and fruits. This enables the authority to follow daily the level of prices initially for 2200 product codes across the country (the number of product codes now covered by the platform being more than 65000) and to be able to use a time series since January 2020 and for some products a few years earlier. The interactive dashboards are created by utilizing the framework of Plotly-Dash that is known for its usability features and scalability. The screening tool was implemented in number of investigations opened by the Hellenic Competition Commission since 2020. Moreover, the Commission is investing in its expandable Big Data Management Infrastructure Platform/ dash-board, for the collection of real-time public data from different sources (Price Observatory of Supermarkets, fuel prices, vegetables and fruits prices, public procurement data, etc.), data that is automatically uploaded and updated every day or many times per week. Furthermore, the HCC has recently (2023) proceeded to cooperation with experts to design a program, drawing raw data from unstructured information available in the national public procurement database and other sources. This data will be mainly used for cartel-detection but will also offer an integrated data analytics environment with various tools/apps, on the basis of bespoke programmes and /or available off the shelf software tools to visualise and analyse data.

[58] Available at https://www.epant.gr/en/enimerosi/publications/research-publications/item/1414-computational-competition-law-and-economics-inception-report.html .

6. Legal standards and computational competition law and economics

42. Of particular interest for the further development of such techniques and tools is the adaptation of legal standards for initiating investigations and also the standards of evidence used in assessing such material, an area we will be investing on in the following months, by launching a major project regarding evidence from computational economics and data science in competition law enforcement, with a number of external partners.

43. With regard to the first issue, usually competition authorities act upon complaints or general market information that is provided to them either by market participants or through a systematic monitoring of different economic sectors, for instance by examining generalist or specialised press or through organised meetings with economic actors. However, the emergence of the Internet and the development of Big Data analytics provide competition authorities with multiple other sources of information that are publicly available or can be harvested through web-scraping tools. Scraping is a method for crawling *web* sites and automatically extracting structured data on it. The use of algorithms may greatly facilitate the data collection process, as well as data analysis. Such tools have already been used in competition law investigations. For instance, in the Google Search investigation, the European Commission explored in order to build the anticompetitive effect of Google's conduct data on the traffic to Google's own comparison shopping service and traffic to competing comparison shopping services and merchant platforms, its own compilation of data from the approximately 380 services identified by Google as competing with Google Shopping[59]. Furthermore, the use of data visualization, natural language processing and predictive analytics may enable the systematic monitoring of entire economic sectors in order to decipher various patterns that may raise red flags with regard to the presence of anticompetitive behaviour.

44. Particular applications include the use of Web-scraping enables in order to scale up evidence gathering, the use of geocoding that may enable competition authorities to analyse locations of competitors in merger analysis or develop mechanisms to facilitate e-discovery by using a machine learning models, such as TexRank, or by employing predictive coding tools, which use a subset of documents ("seed documents") in order to train computer algorithms to make predictions over the content of the other documents[60]. The software analyses documents and 'scores ' them for relevance to the issues in the case. The results of this categorisation exercise are then validated through a number of quality assurance exercises. These are based on statistical sampling—the sampling being fixed in advance depending on what confidence level and what margin of error are desired. This sampling is further reviewed (blind) by a human. The process of sampling is repeated as many times as required to bring the overturns to a level within agreed tolerances, and so as to achieve a stability pattern, each use of the predictive coding process being bespoke for that case. This technology saves time and reduces costs. Advanced network analysis may also facilitate the visualization and assessment of interactions between various economic players, as well as the analysis of large datasets of emails through specialized software, such as Tovek.

45. The development of such technologies may appear at first sight to blur the distinction between regulators and competition authorities, as they provide competition authorities the possibilities to continuously map and monitor economic activity in various

[59] European Commission, Case AT.39740 *Google Search (Shopping),* paras 614-618.

[60] See, S. Hunt, Data, technology and analytics in competition enforcement: building a new professional capability and offering December 2019, available at PowerPoint Presentation (concorrencia.pt) .

sectors of the economy and explore the feedback loops and other indirect effects that may be in operation between them. Hence, it becomes important to expand the mapping jurisdiction of competition authorities to also cover situations in which the authority does not act having launched a sector enquiry or a market investigation, lest a competition law enforcement case, but proceeds to establish continuous intelligence gathering about the operation of the economy. This power is now provided to the HCC by Article 14(2) of the new Greek Law on Competition, as voted by Greek Parliament on January 20th, 2022. There is now legal basis for the HCC to send RFIs to undertakings in order to gather data and complete its market mapping research programme. The tool will be used in order to prepare a bi-annual "State of Competition Report" that will be submitted to Parliament and will eventually guide not just the enforcement action of the authority but also more broadly in the regulatory and legislative process in this policy area.

46. With regard to the second issue, the use of such tools may require some adaptation to the legal standards put in place to limit the discretion of competition authorities to launch investigations and in particular initiate inspections. Similar constraints may be put to the use of predictive approaches on the basis of data analytics in view of the required standards of evidence. The rules of evidence have been framed with the view that most evidence will be factual. Yet, sources of evidence are diverse and might include contemporaneous documents, such as emails or statements by market participants (competitors, customers and consumers), but also more complex evidence. The probative value attached to a piece of evidence depends on the reliability of that evidence. For instance, complex evidence such as econometrics is assessed on the basis of some specific causal inferences (internal validity) made on the basis of some observations that are generalized, the last operation relating to the connection of these inferences to the real outside world (external validity), the main issue being if we can make a causal claim in competition law based on econometric evidence[61]. Similar concerns may be raised with regard to evidential inferences made on the basis of data science, although descriptive uses of data analysis may not be judged problematic from a law of evidence perspective. Indeed, in this context we may be closer to the dominant conception of causality in law, which refers to causal connections between events and involves a concrete instantiation of a causal law on the particular occasion, regarding the existence of a causal link between the specific event A and the specific event B, rather than the more "theoretical" and categorical approach of causation followed in econometrics, where the inferential direction runs from theory to data requiring the matching of the remaining conditions in the set against the applicable causal generalization. However, some predictive data analytics techniques, such as predictive coding, may face similar difficulties to those confronted by econometrics. Courts should therefore develop a more hospitable tradition to such type of evidential material. This has already been the case in some jurisdictions, which has already accepted the technology of predictive coding or technology assisted review of documents[62]. It is likely that the greater use of data analytics and computational techniques will lead to the development of specific case law regarding the standards of proof applied in this context and in particular the assessment of the criterion of reliability of evidence.

[61] For a discussion see, I. Lianos & C. Genakos, Econometrics in EU Competition Law: an empirical and theoretical analysis, in I. Lianos, D. Geradin (Eds.), *Handbook in EU Competition Law – Enforcement and Procedure* (Edward Elgar, 2013), 1.

[62] For instance, *in Pyrrho Investments,* ***which is not a competition law case, the UK High court accepted predictive coding as an acceptable technique to analyse document evidence:*** *Pyrrho Investments Ltd v MWB Property Ltd*, [2016] EWHC 256 (Ch).

7. Agent-based modelling in competition law

47. This computational turn also demands different strategies of engagement and new methodologies. First, it may facilitate market mapping by decreasing the cost of harvesting information on market conditions, through the continuous harvesting of data, such as prices, and the constitution of time series that would enable competition authorities to follow real-time the way the various business players behave on the marketplace. It may also bring to the forefront of the economic enquiry simulation techniques that rely less on theory and more on conjectures and patterns that temporarily fit.

48. In simple economics, models are constructed for the purposes of prediction and are derived from a set of first principles, which often include assumptions as to the abilities and motives of the underlying agents with these being linked through mathematical reasoning and deduction with axioms, the latter being associated with the notion that "social systems tend toward equilibrium states".[63] In contrast, the computational models are used as mapping tools.[64] They provide the foundation for computational experiments and, thus, aim to generate only inductive proof. In these models, "abstractions maintain a close association with the real-world agents of interest" and "uncovering the implications of these abstractions requires a sequential set of computations involving these abstractions".[65] These computational models should enable the consideration of the complicated preference structures of both the population and its heterogeneity in order to account for their more elaborate set of choices. Of course, this raises interesting questions about causal claims with Big Data, which seem to rely on "variational induction" and eventually "the identification of phenomenological laws which may hold only locally in specific contexts", and how different this is with regard to causal claims that are built on the hypothetico-deductive model of economics, that is very much dependent on theoretical hypothesis, on the basis of deduction from certain generalised features of our experience and practices (premises) to infer that the world must be like to make the existence of these experiences and practices possible (conclusion), which will then be verified or disproved by empirical evidence[66]. In any case, the purpose of the inquiry should not only be to understand the empirical or actual phenomena, as they relate to events and state of affairs, but to grasp the functioning of the real economy, that is the structures, powers, mechanisms and tendencies that form the background conditions for such phenomena to be produced.

49. One of the tools that is often used to generate these computational models is 'agent-based modelling'. It attempts to depart from the abstraction of the underlying agents in a system by combining all agents into a single simplified and representative agent. It brings the role of networks as spaces of interaction to the fore and has important implications on the understanding of power relations within systems. Computational models may also allow for a greater heterogeneity of the agents the interactions of whom will be modelled. For instance, it may allow for the developing of "an ecology of agent types, each relying on different behavioural governing mechanisms".[67] Although as mentioned above, computational models cannot completely dispense with the constitution of representative agents. This enables theorists to construct computation models from the bottom-up, with any abstraction being focussed "over the lower-level individual entities that make up the

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[63] J. Miller and S. Page, *Complex Adaptive Systems* (Princeton University Press, 2007), 59.

[64] *Ibid*, 36.

[65] *Ibid*, 65.

[66] For an interesting discussion, see W. Pietsch, *Big Data* (CUP, 2021).

[67] J. Miller and S. Page, *Complex Adaptive Systems* (Princeton University Press, 2007), 101.

system".[68] The model also integrates learning and adaptation as a by-product of this direct interaction. As such, it incorporates frameworks for emergence with the model being flexible enough that "new unanticipated features" may naturally arise within the model.[69]

50. Agent-based modelling thus accounting for different attributes, such as the size, the business model, as well as the specific ownership structure and corporate governance of undertakings, and could also integrate a dynamic perspective, by designing these agents to be adaptive through learning. A similar modelling can be done for various sociological categories of individuals, such as "investors", "labour", "consumers", accounting for their income, education or wealth level, varying degrees of rationality, thus not relying on the average behaviour of individuals defined *in abstracto* but on the basis of their real attributes and those the theory/hypothesis to be tested considered important. The model may not focus on price-system intermediated interactions but also centre on or combine non-price ones. It may be possible to also develop a typology of realistic rule-sets to be applied to all or categories of agents, as well as different agent environments (taking into account the different spheres of competition – markets, ecosystems, sectors) that fully account for the complexity of these interactions and relationships (for example, competition, cooperation, co-opetition, ownership, control, influence) and open up to various behavioural frameworks that fit the research question asked (this will be different, for instance, if the research focuses on the impact on privacy, prices and output, quality, innovation, democracy, among other dimensions). The interactions to take into account may be financial flows, unique visitors metrics and time spent on a website, information exchange/data flows, the expression of emotions ("likes", "dislikes", "friends", "followers") in order to determine the "ties" between the various agents and the topography of the network.

51. Calibrating such models may take significant resources and naturally their degree of validity may depend on the way the model matches with the available data and on the initial conditions chosen to design the model. Although such tools also require significant sources of data, it is easier than it has ever before to gather in view of digitisation and the expansion of digital economy. The agent-based model will run on various simulations and other computations and will eventually provide important insights through the visualisation of the interactions between agents, and the predicted evolution and outcomes of such interactions in different virtual worlds. The economic process would thus be modelled as a dynamic system of interacting agents. The topology of such interactions between agents is complex as the scale of the system/environment the agent-based model aims to explain is driven by the specific social phenomenon of interest. The tool may thus enable competition authorities to better capture emerging phenomena, and to improve their understanding of the broader social impact of the examined behaviour in the context of a specific jurisdiction, not only at a purely abstract level, but taking into account a more realistic depiction of the status and motives of the agents. One should also however note the limitations of such tools, in view of the important complexity of adaptive systems, and the evidential value of simulation methods in legal processes. However, the tool may be employed more safely for case selection and prioritization.

52. This approach contrasts with the top-down modelling of simple economics which "abstracts broadly over the entire behaviour of the system".[70] This computational modelling may seek to uncover a simple structure of interactions premised on the behaviour of

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[68] *Ibid*, 66.

[69] *Ibid*, 69.

[70] *Ibid*.

artificial adaptive agents. Equally, it may seek to uncover a more complicated structure of interactions, which, in the case of computational modelling and the use of simulations, allows for the constitution of "artificial life" or artificial worlds. This latter type of structure would rely on a model of "adapting, communicating and multiple-game playing artificial agents".[71]

53. One may for instance consider reproducing the digital twin of a network or ecosystem to link the real and digital worlds and using AI to convert data into actionable insights. The first step would involve various sorts of data being harvested and then leveraging millions of examples of curated data to train deep-learning neural networks. The next step would involve neural networks being used to approximate parts of the computational model. This could potentially be used for evaluating the effectiveness of tailored treatments and for experimenting with various forms of intervention by using advanced simulation to develop more precise prognoses. These tools may enable a better and quicker filtering of the situations in which more elaborate competition law analysis is needed. They may also provide solid evidence upon counterfactuals for competition law investigations can be built.

8. Institutional design- integrating data science expertise within the competition authority

54. More and more competition authorities hire data scientists and put in place special units in order to assist then in developing advanced forensic techniques and data analytics. This follows the pattern that was initiated with the new economic approach and the recourse to economic evidence in the 1908s in the US with the adoption of the 1982 Merger Guidelines and in the late 1990s-early 2000s in EU, during the era of modernisation of competition law enforcement, and the appointment of chief economists at the European Commission in 2003 and now in most competition authorities in the EU and beyond. Some competition authorities in the EU have already proceeded to the appointment of a chief technology officer and specific units. Moreover some authorities have already acquired experience in using Big Data or AI (machine-learning or deep-learning solutions) in cartels detection and in the analysis of data obtained during a cartel investigation.

55. In order to successfully complete the computational competition law and economics strategy, the HCC first proceeded in October 2021 to the constitution of a digital forensic unit that operates as an independent horizontal unit within the Directorate General of Competition, and completed in April 2022 the recruitment process of a chief data scientist and a team of data-scientists who joined the HCC for a renewable mandate of two years. The team is headed by Professor Vassilis Vassalos, professor of informatics at the Athens Economic University who is the Chief Data Scientist of the HCC, and comprises three data scientists and two computer scientists. The team has been working on several programmes requested by HCC's management with the aim to transforming all aspects of the work of the HCC. The projects undertaken relate (i) to the development of data analysis tools to facilitate HCC's staff in mapping and monitoring daily markets, (ii) the construction of bespoke algorithms for the purposes of HCC's investigations and more generally the implementation of machine learning and data analysis models to reduce the time required to analyze cases, since HCC employees will be able to take on and process more cases at the same time, including tools facilitating the technology-assisted review of data and neural network models employed for email body classification, which helped determine the relevance and importance of each email in the investigation, (iii) the development of reusable code to accelerate common workloads, (iv) the use of Generative

[71] *Ibid*.

AI in assisting with webscraping tasks, enabling the HCC to streamline the data collection and integration steps and add more sources of internet data, models being trained to understand the structure and content of web pages, facilitating the extraction of relevant data, thus enabling the HCC to accurately parse information from complex web pages, including textual data, images, tables, and more, but also in ensuring the quality and integrity of scraped data, (v) the establishment of a project management platform so as to enable the day-to-day monitoring of the work of the HCC's employees with the aim to enhance more flexible forms of working (teleworking) and administrative efficiency.

9. Conclusion

56. The broadening of competition action through the development of the sustainable development agenda, the use of new computational techniques in competition law enforcement, and the business reality of ecosystems will have important implications on the theory and practice of competition law, to a certain extent similar to those generated by the turn to a more economic approach and the systematic use of economics in competition law a couple of decades ago, with different domains of expertise and toolkits being added to the competition law toolbox. The emergence of computational competition law and economics is linked to different factors, such as the prevalence of the digital economy, which enables the harvesting of immense volumes of data about all dimensions of economic activity and consumer behaviour, the development of data analytics and algorithms that enable competition authorities to monitor real time market activity, the creation of screening tools that assist competition authorities in making more accurate predictions, and finally the development of a deeper understanding of economic activity as part of a larger complex economy, in which the linear dynamics of neoclassical price theory may not always prove adequate.

57. We are at the beginning of a new antitrust revolution that will bring similar reforms to the institutional design of competition authorities than those undertaken with regard to the use of economic analysis, including an adaptation of evidence rules and procedure to this new reality. The note highlights the changes that have taken place at the HCC in recent years in order to adjust to these new realities.