

Competition Policy in Digital Markets as a Scientific Controversy: a Bibliometric Analysis

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Abstract

This study investigates the evolution of the scientific and policy debate on competition policy in digital markets (defined as “digital competition policy”, hereafter DCP). Section 1 illustrates the main issues that make DCP a controversial problem for many scholars and reviews the literature that previously mapped the related scientific debate. The section concludes that the debate on DCP can be framed as a “controversy”, that is a situation in which certain scientific facts become unstable and large dissensus emerges in scientific communities. Section 2 applies various bibliometric tools to academic literature and policy reports datasets, to test whether the debate on DCP has the features of a controversy. The analysis demonstrates the spiking interest in antitrust in digital markets and shows how the most-cited policy and scientific literature is produced in the United Kingdom, Germany, the United States, and Australia. Moreover, policy reports are mainly produced by national competition authorities, governments and the OECD. In conclusion, the empirical evidence suggests that DCP can be framed as a controversy because the data show a significant growth in the number of publications and variety of actors composing the scientific and policy debate.

[9372 words]

Introduction

The last two decades have been characterised by rising interest towards the “digital”, “internet”, “sharing”, and “data” economy. These concepts attempt to explain how the computing advancements of information and communication technology (ICT) impacted the economic system through the transformation or disruption of many business models (Brynjolfsson & Kahin, 2002; Mayer-Schönberger & Cukier, 2013; Shapiro et al., 1998). This transformation is characterised by a greater diffusion of certain structures of costs (near-zero marginal costs of production for certain types of goods), price strategies (zero-pricing), types of externalities (network effects), business models (platforms and two-sided markets) and new services (social networks, targeted advertisement) (Delmastro & Nicita, 2019; Shapiro et al., 1998). However, despite the growing analysis of these changes, a branch of economic and legal literature is struggling to find a consensus on how to evaluate and interpret these transformations: competition policy.

This research aims to describe the scientific and policy debate on the interaction between competition policy and ICT. In fact, despite the anecdotal knowledge, the features of such a debate are still unclear. The research draws from the sociology of science literature the concept of “controversy”, according to which in some moments of the history of sciences, the consensus on certain facts becomes unstable and the border between what is considered to be

scientific and political becomes blurred. My hypothesis is that the contemporary debate on competition policy and ICT possesses the features of a controversy. To demonstrate this, the empirical section applies bibliometric techniques to the increasing number of publications on this issue. Bibliometrics is a group of quantitative tools used to measure attributes and metadata (e.g., title, references, authors, etc.) of broad datasets containing texts (Hood & Wilson, 2001). Particularly, the analysis focuses on the evolution of the scientific and policy debate on competition policy and ICT in the period 1990-2022. As far as I know, there are no available contributions to map with bibliometric tools such a topic, and the most similar topic inquired with bibliometric tools are platforms (Flew & Su, 2021; Liu et al., 2021; McIntyre & Srinivasan, 2017; Rietveld & Schilling, 2021), digital markets (Purnomo et al., 2020) and digital currencies (Miau & Yang, 2018).

The structure of the paper is the following. Section 1 illustrates why the application of competition policy to ICT can be framed as a controversial problem, through the review of literature that previously attempted to map the dedicated scientific debate. Section 2 exposes the methodology and the results of the bibliometric analysis. The conclusions attempt to trace future research perspectives, addressing the importance of studying the interaction between science and policy.

1. Theoretical background

1.1. *Digital Competition Policy as a controversy*

A growing literature in Law and Economics perceives the interaction between competition policy and ICT as an independent topic that deserves a dedicated analysis, both among scholars (Khan, 2016; Kirkwood, 2021; Stucke & Grunes, 2016) and policymakers (see Appendix 2). By “Digital Competition Policy” (DCP) I mean the literature subfield composed by articles, reports, conferences, and policies considering the interaction between competition policy and ICT as a definite object that includes a stabilized set of issues. Drawing from the extensive reports of the Australian Competition Commission (2019), Crémer et al. (2019) and Furman et al. (2019), Table 1 identifies the main issues and key literature. The table’s goal is to show the “shared ground” of issues recognised by DCP scholars, with no pretension of being exhaustive or creating a rigid taxonomy.

Issue	Description	Literature
Winner-takes-all/most markets, market tipping, first-mover advantage	A firm pulls away from its competitors once it gains an initial advantage, thanks to a combination of economies of scale and scope, network externalities, integration of products and the importance of brands.	Hand, 2001; Noe & Parker, 2005; Wu, 2010
Killer acquisitions	The incumbent firms acquire companies with the aim to preempt future competition, potentially hindering future innovation.	Cunningham et al., 2021; Fumagalli et al., 2020
Zero monetary price	Some firms charge a zero monetary price for the offered services. In these cases, the SSNIP test is not applicable, and the market definition is uncertain. Moreover, the zero-monetary price can hide other types of costs (i.e., personal data).	Evans & Schmalensee, 2005; Newman, 2015
High switching costs, lock-in	Switching costs bind customers to vendors if products are not compatible (e.g., for lack of interoperability and portability of	Arthur, 1989; Farrell & Klemperer,

	data), locking users or even markets into their first choice.	2007
Network externalities	In multi-sided markets, direct network effects occur when the benefits to a consumer increase as the number of consumers of the same service increases; indirect network effects occur when the benefits to consumers on one side of the market increase with the number of users on the other side of the market (i.e., in marketplaces).	Farrell & Saloner, 1986; Katz & Shapiro, 1994
Cross-subsidization and predatory pricing	Firms subsidize weak products or one side of multi-sided markets (usually the consumers, which are charged with a monetary price of zero) with the profits made on strong products (or the other sides of the market), in order to drive the competitors out of the competition.	Chen & Rey, 2012, 2019
Data-driven entry barriers	The accumulation of data as a key asset for certain products (e.g., machine learning algorithms) can constitute a barrier for entrants in certain markets.	Mayer-Schonberger & Range, 2018; Rubinfeld & Gal, 2017
Leveraging and gatekeeping	From their position as intermediaries, the platforms' owners can nudge or coerce multi-sided market participants. Through leveraging, the firms can enact self-preferencing strategies or set rules to obstacle the entry of certain competitors in multi-sided markets.	Ghazawneh & Henfridsson, 2013; Gillespie, 2017; Teachout & Khan, 2014
Data protection	In zero-price markets, the lack of privacy measures can be seen as a hidden cost charged to consumers, that pay for the services with their personal data. In these markets, firms are expected to compete more vigorously on quality aspects such as privacy, but the empirical studies do not confirm such a hypothesis (i.e., "privacy paradox"). Also, it is debated whether privacy should be taken into account by competition authorities in their inquiries.	Acquisti et al., 2016; Cooper, 2012; Norberg et al., 2007

Table 1 - Main Digital Competition Policy issues

Among scholars and policymakers, there is strong disagreement on which of these issues have to be considered as problems that require further investigation or policy action (Delrahim, 2019; Stucke & Grunes, 2016, p. 4-11). Quaid (2022) notices a "clash" of visions of competition policy in the digital era, with proposals that "seem[s] to be talking about two different worlds". These reflections seem enough to back the hypothesis of the DCP debate being a controversy. What is a controversy? The consortium MACOSPOL (MAPPING CONtroversies on Science for POLitics)¹ uses the following definition:

The word "controversy" refers here to every bit of science and technology which is not yet stabilized, closed or "black boxed" ... we use it as a general term to describe *shared uncertainty* (Macospol, 2007, p.8, emphasis in original).

Hence, controversies are "heated" situations of turmoil within scientific and technical communities. Callon et al. (2011, pp. 25-26) comment: "One of the central things at issue

¹ The MACOSPOL consortium was an EU-funded project with the intent to map scientific and technical controversies across Europe. For more information, see

<https://web.archive.org/web/20150310090045/http://www.mappingcontroversies.net/> .

in... controversies is precisely establishing a clear and widely accepted border between what is considered to be unquestionably technical and what is recognized as unquestionably social. The line describing this border constantly fluctuates throughout the controversy". Studying the DCP as a controversy means *mapping* the debate emerging from conflictual statements, with the aim to describe the *actors* and *factions* participating in the rhetorical struggle. Following Latour (1987), science is here framed as a series of (sometimes conflicting) statements developed and tested by scholars, research groups and institutions to determine the stability – for a limited time – of the existence of “facts” in certain scientific fields. Consequently, this research does not attempt to sort true and false statements, but to capture the shape of the debate in which statements about DCP emerge.² Therefore, investigating controversies means observing fragmented scientific communities where there is a highly conflictual situation between competing frameworks. Can we find such a situation in the DCP literature? To answer this question, I operate a review of the literature that attempted to map the academic debate on DCP, identifying ideologies and “schools of thought”.³

Pasquale (2018) identifies a “Jeffersonian” approach as opposed to a “Hamiltonian” approach in Law and Economics studies on DCP. The “Jeffersonian” critics of big tech firms promote the decentralization of power: they believe that strong local authorities should counterbalance the accumulation of wealth and power in multinational firms and protect the small shop owners (Khan, 2016; Lynn, 2010; Wu, 2018). On the other hand, the “Hamiltonian” school considers firm gigantism as inevitable and, under certain aspects, beneficial to fully deploy the potential of ICTs. Following this point of view, a regulation similar to the one tailored to public utilities or natural monopolies is necessary to limit abuses of market power (Atkinson & Lind, 2018; Morozov, 2019). Consequently, the theoretical confrontation is the struggle between two alternative policy proposals: either a stronger competition policy or a reformed regulatory setup (Khan, 2016, pp. 790-802).

According to various scholars (Khan & Vaheesan, 2017; Portuese, 2020; Vaheesan, 2014), the enforcement of antitrust law in the US has oscillated between two poles: the “populist” approach, which can be traced back to the influence of Louis D. Brandeis (1934),⁴ and a “consumer welfare” approach, mainly influenced by the Chicago School of Economics (Bork, 1966; Posner, 1978; Hovenkamp and Morton, 2019). According to Vaheesan (2014), politics influences both sides of the debate, and the framing of a populist vs anti-populist battle is fallacious; instead, we should talk about different types of populism. Orbach (2017) sustains a similar position, claiming the existence of two types of populism: the “anti-bigness” version (Brandeisian and Neo-Brandeisian) and the “anti-enforcement” version (pro-market, suspicious about strong state institutions). Petit (2020) draws an equivalent picture, using the labels of “Neo-structuralism” and “Consumer welfarism”. The former focuses on the problems springing from the size of big firms and aims to use competition policy for achieving socio-political goals such as the protection of small business owners. The latter aims to foster economic efficiency by applying the analysis of the actual or potential harm caused to

² See the symmetry principle in Bloor (1976, p. 16), according to which both “true” and “false” beliefs have the same type of causes, and therefore they should be studied in the same way.

³ The majority of the authors consider their categorizations as ideal-typical, therefore the manifestations of these “factions” are never supposed to be “pure”.

⁴ In fact, the related scholars often define themselves as “Neo-Brandeis” or “New Brandeis” (Dayen, 2017).

consumers. The “populist” answer to DCP issues is to tackle corporate gigantism because it threatens not only the economic system but the stability and rule of democracy as well. Under these assumptions, “antitrust laws must be reoriented away from the current efficiency focus toward a broader understanding that aims to protect consumers and small suppliers from the market power of large sellers and buyers, maintain the openness of markets, and disperse economic and political power” (Khan & Vaheesan, 2017, p. 237). In more practical terms, the predatory pricing doctrine should be reformed to reflect the economics of platform markets, which incentivize cross-subsidization practices to acquire high levels of market power. On the other hand, vertical integration should be scrutinized and limited when it allows a dominant company to acquire valuable data that enable cross-leverage market advantages (Khan, 2016).

Even admitting that the digital economy plays a relevant role in the economic systems, many supporters of the consumer welfare approach sustain that DCP issues do not call for a radical change of competition policy. This position often involves two traits. Firstly, the rejection of exceptionalism of digital-connotated companies and markets. For example, Philippon (2019) shows that, compared with other historical “stars” in the market, Big Tech firms do not present unprecedented traits in terms of market value; for instance, Apple’s market value as a percentage of the total market is lower than the value of AT&T in the 1960s (Philippon, 2019, p. 245). Moreover, the impact of GAFAMs on national employment and their contribution to the productivity growth of the overall system is risible in comparison with General Motors in the 60s (Gutiérrez & Philippon, 2019). The second common trait of these analyses is the claim that current challenges in competition policy can be mostly faced with tools that are already in place. According to Hovenkamp (2018, p. 49), the rule of reason within the US framework already guarantees sufficient flexibility to address digital platform conduct. This approach encourages maintaining the borders of competition policy limited and well defined: Hovenkamp (2018), against Khan & Vaheesan (2017), claims that even if using antitrust policy to pursue goals different from economic efficiency - such as inequality, fiscal injustice, protection of small shops - was thought to be justified, there are huge obstacles to do it a non-arbitrary way (on this point, see also Bork, 1993). For Melamed and Petit (2018), the fact that zero-price markets do not permit a predictable assessment of price harms through the standard SSNIP test should call for prudence and humility rather than revolution. In their view, competition policy is not fit to pursue certain types of goals, that shall be left to other governance tools like fiscal policy, consumer deception, privacy regulation, etc. (Iacobucci, 2021; Miller, 2016).

The populist and consumer welfare division can be partially overlapped with the debate on the *goal* of competition policy. The contemporary mainstream consensus considers the maximization of economic welfare as the goal of competition policy (Viscusi et al., 2018; Williamson, 1968). According to Motta (2004, p. 28), “competition policy” can be broadly defined as “the set of policies and laws which ensure that competition in the marketplace is not restricted in such a way as to reduce economic welfare”. Specifically, the concept of “economic welfare” can refer either to consumers’ welfare or total welfare (the sum of consumers’ and producers’ welfare) (Buccirosi, 2008, pp. xv-xvi). However, many other goals have been proposed, discussed and adopted across the history of competition policy (Motta, 2004, pp 17-28): defence of smaller firms, fairness and equity in production, market integration (e.g., in the EU), support of industrial and trade policies (Büthe and Morgan, 2015), aid in company crises (e.g., the exception for “crisis cartels” in Section 6 of the German Act against Restraints of Competition, deleted in 2015), increase of environmental

efficiency (see section 2(1) of the Austrian Cartel Act, as amended on 10 September 2021, that introduced environmental sustainability as a potential justification for restrictive agreements).

The distinction between populist and non-populist theorists unfolded in the academic and legal debates of the United States, but a similar cleavage could be observed also in the European Union. EU Competition Law emerged under the influence of the German ordoliberal school, which considered a strong and independent antitrust authority as a vehicle to limit the power of giant private companies, even if at the expense of overall economic efficiency (Bohm, 1961; Gerber et al., 1998). However, in comparison with the US populism, the German ordoliberalism is essentially an anti-political movement that promotes the strong independence of branches of the executive power, namely central banks and competition authorities (De Carolis, 2017; Petit, 2020, pp. 9-10). In the 2000s, the reform of the EU competition policy to enhance the incorporation of economic analysis into law enforcement - called the “More Economic Approach” - echoed the Chicago School's emphasis on efficiency (Gual et al., 2005; Witt, 2016) and marked a victory for the supporters of a consumer welfarist perspective. Still, many critics insist that EU competition law excessively prosecutes dominant firms and protects competitors at the expense of consumers (Fox, 2019, pp. 301-302). Nevertheless, according to the latest speeches and actions of the EU Commission, the evolution towards a consumer welfarist approach seems to suffer a setback. During the Juncker Commission, the Competition Commissioner Margrethe Vestager changed the approach followed by her predecessors by announcing (and pursuing) an aggressive competition policy towards U.S. “big tech” firms and explicitly addressing “citizens’ welfare” and “public interest” as goals of competition policy (Vestager, 2016). Therefore, some scholars claim that the differences between the EU and US institutional environment must be assessed as a key factor to understand the different scholarly approaches towards DCP.

Political Divisions	Literature
Hamiltonians v. Jeffersonians	Pasquale, 2018
Populism (Neo-structuralists) v. Consumer welfare	Khan & Vaheesan, 2017; Portuese, 2020; Petit, 2020
Anti-bigness vs Anti-enforcement	Orbach, 2017
Maximization of economic welfare v. societal aims	Motta, 2004
(EU) Public interest approach v. (US) Economic approach	Fox, 2019; Lancieri, 2019

Table 2: Political divisions of scholars on Digital Competition Policy

Table 2 resumes the lines of conflict analysed above. Following this review, it is possible to advance the hypothesis that DCP is a controversy with many overlapping lines of fracture. In Figure 1, the Porphyrian tree represents how these lines of disagreement may be ordered. Particularly, the disagreement can be categorized around three questions: what is (are) the goal(s) of competition policy? Does ICT constitute an exceptional challenge for competition policy? Which tools shall be used to intervene? These questions split the field into two “factions”: the scholars that see DCP as an opportunity to change radically the competition regime, and the actors that prefer to adapt the pre-existent regime with only minor adjustments. As with every ideal-typical separation, the situation “in the field” is more complex and nuanced. However, the previous literature review shows that most scholars self-describe themselves as taking sides in at least one of these questions. What is the nature of

such fractures? Venturini & Munk (2021, p. 64-65) distinguish between epistemic and ontic questions. When researchers ask the same question but diverge in the answers, we are in front of an epistemic question. On the other hand, if researchers disagree about *what questions* should be asked in the first place, the question is ontic. The DCP controversy presents both types of questions. The questions about the tools and the “degree” of exceptionality are answering to the same concern: which instruments are needed to tackle the competition policy challenges caused by ICT? Therefore, these questions can be defined as epistemic. However, the question on the goals of competition policy regards the types of *problems* that regulators should choose in the first place. It is a question about *which questions* are legitimate: where populists analyse the market power, consumer welfarists quantify the welfare deadweight loss. Where Hamiltonians look for market concentration, Jeffersonians verify whether online platforms can be considered natural monopolies. In these cases, the researchers are not giving *different answers* to the same problem, but instead, they are investigating *different problems*. Therefore, the question on competition goals is ontic because it concerns *what questions should be asked in the first place*.

The answers to ontic and epistemic questions are not independent: choosing specific goals defines the nature of the observed problems and the tools that can be used. This reflects what epistemology defines as the theory-ladenness of every observation: every acquisition of information is affected by the theoretical presuppositions held by the investigator (Boniolo and Vidali 2003, pp. 32-48). This process contributes to the emergence of separate “truths” about DCP, not necessarily in contrast, but difficultly comparable. McCloskey (2005) asserts that economic science - like all the other sciences - is a form of narration that requires the initial choice of a specific point of view. The choice by the scientist (the narrator) can be either explicit or implicit and is often manifested through the enumeration of *principles* in law and *assumptions* in economic literature.⁵ Choosing a point of view is therefore required as a criterion to select (and discard) the elements to be included in a piece of research: “[s]tories... are selective. In this they are similar to metaphors and models, which must select, too. We cannot portray anything literally completely” (McCloskey, 2005, p. 18).

⁵ Orbach (2017) and Vaheesan (2014) make a similar point when they claim that the opposite views on competition policy must be framed as a struggle between different *political perspectives* instead of a confrontation of a “technical” and a “political” position.

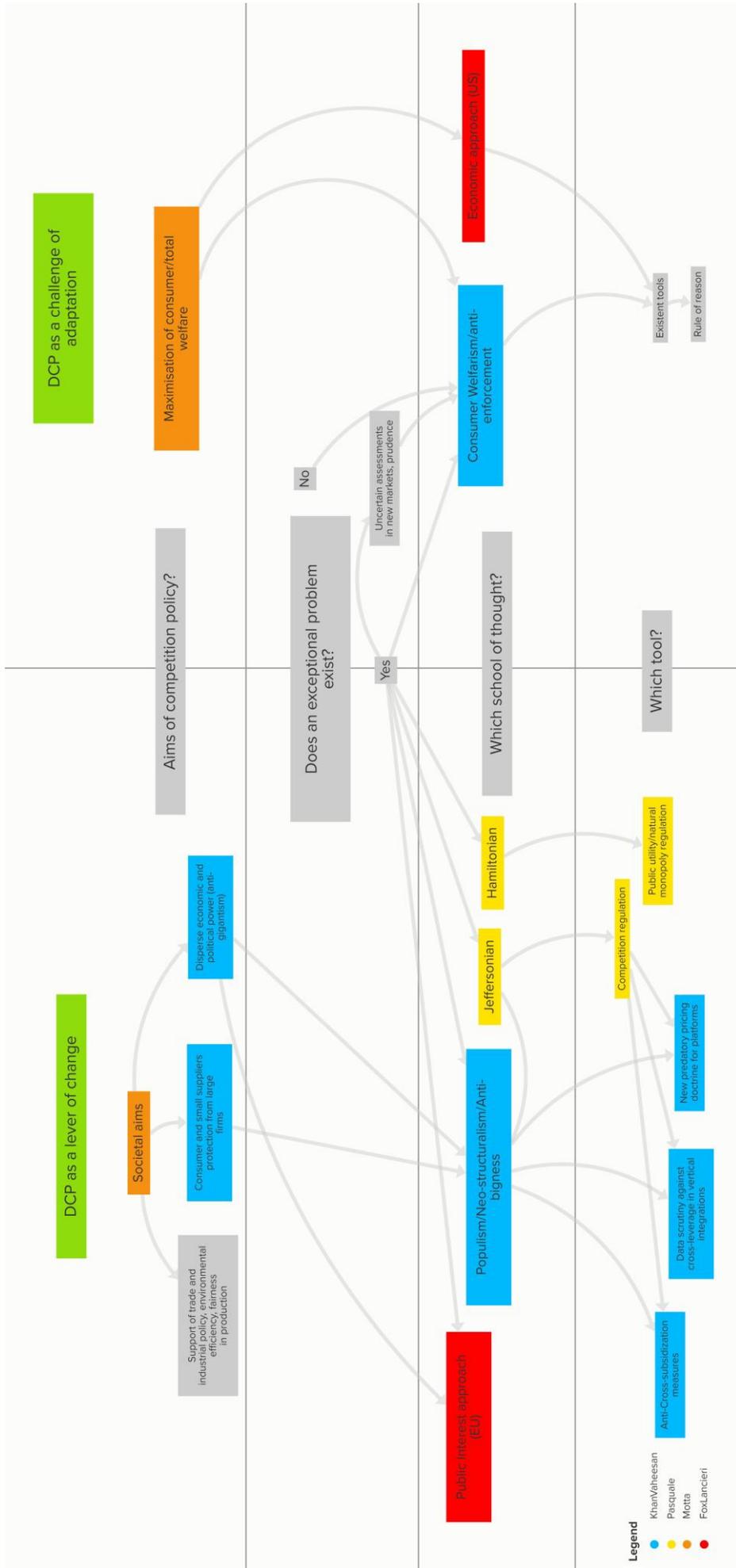


Figure 1: Tree of disagreements in Digital Competition Policy literature

It is now possible to refine the theoretical foundation of the research. The controversy on DCP can be represented as a conflict of *framings*. According to the economic sociologist Callon (1998b, 1998a), the market is a social construction where many actors (academics, managers, consumers...) continuously pursue two types of efforts: creating *framings* and limiting *overflowing*. The creation of “framings” is the action of “putting in brackets” certain types of action in order to facilitate and standardize the interaction between agents (e.g., economic theories and standard contracts). On the other hand, the “overflowings” are configurations between agents that are *not predicted in the framings* (not included in the “calculation” of existing institutions) and generate situations of uncertainty. For instance, externalities that are not considered in economic models are a typical example of overflowing. Developing new models or adding clauses to a contract are classical methods to “internalize” the overflowings (externalities) in the framings (models, contracts, etc.). The DCP controversy can therefore be explained as follows: the ICT introduced a variety of issues (resumed in Table 1) that - from a certain moment in time - started to be perceived (for various reasons: social, technological, political) as *overflowings* because they were not satisfactorily captured by existent framings (competition policy theories, antitrust authorities’ procedural rules...). Hence, the scientists started debating new framings to internalize these overflowings in their models and theories. The controversy arises because different actors (scientists, schools of thought, institutions) diverge in *how* to face certain overflowings (epistemic questions) and *what* they consider an overflowing (ontic questions). These profound fractures support the hypothesis that the debate on DCP is a controversy.

1.2. Why do controversies matter?

This research considers studying controversies relevant because the evolution of scientific fields impacts the human actors’ behaviour and, therefore, their policy choices. The process through which changes in social sciences are translated into human practices can be summed up by the concept of “performativity” drawn upon the economic sociology literature (Callon, 2007; MacKenzie, 2006). To claim that a science is performative is to argue that the tenets elaborated in scientific work (comprehensive of articles, journals, university departments, laboratories) are incorporated into collective actions and do *play a difference* in human practices (MacKenzie, 2006). To explain the difference between a performative and a non-performative view, Callon (2007, p. 313-314) argues that the relationship between economics and its object (the economy) can be framed in two ways:

“[in the first,] economists are *inventors* who naturally fit into the innovation process and are *immersed* in the economy; in the second, they are *describers* (or analysts) who produce concepts, theories, and tools and who *stand back* from the economy” (added emphasis).

Considering economic science a performative science means embracing the first version of the story, according to which the economists’ models, descriptions and metaphors *modify* the economic system, introducing *inventions* and *expectations* that play a difference in how human actors behave. Many empirical studies show that both law and economics are deeply performative sciences. For instance, Faulhaber and Baumol (1988) and MacKenzie (2006) analyse how economists’ inventions such as econometric forecasting, stand-alone cost test and the Black-Scholes model affected the choices in government agencies and private industries. Also in competition policy, many contributions support the hypothesis of a

continuous translation of topics and arguments from the scientific literature to competition policy institutions: various authors report how theoretical arguments developed in scientific literature influenced the decisions of US legislators and courts (Motta, 2004; Rowley & Rathbone, 2013; Teachout & Khan, 2014); Popiel (2020) shows how the academic literature has been employed by conflicting actors during the US House of Representatives inquiry on online platforms and market power; Gerber (1998, 2010) illustrates how the ideas of German *ordo-liberalism* “trickled down” to the design of the European Union competition framework.

To say that a science is performative does not mean that scientific work is explicitly directed to advise policymakers. In that case, “performative” would simply mean “normative”. On the contrary, the hypothesis of performativity claims that *every* piece of scientific work *interferes* with the object of study by promoting manifest or implicit values on how reality ought to be (Haraway, 1991; Law, 2009). Law and Urry (2004) name this phenomenon “ontological politics”: the elaboration of different perspectives on a single reality causes the *enactment* of different realities. Hence, the results of the DCP controversy may impact how policymakers *see* reality. At this point, two remarks must be made. Firstly, to claim that scientific literature is performative does not mean that *each* piece of scientific research will affect policy: in fact, most of the literature is destined to remain unknown (Latour, 1987, pp. 40-41). *If* and *how* a theory, paper or book will be translated into policy depends on various contingent factors. Secondly, the scientific debate is just one among many other potential factors causing policy change: for instance, international trade policy (Büthe, 2019), country institutional properties (Aydin and Buthe, 2016; Lancieri, 2019; Moss, 2019) and independent authorities’ characteristics (Guidi, 2016). Overall, as claimed by Venturini and Munk (2021, p. 35-43), mapping the DCP as a controversy offers three incentives. First, it allows the analysis of the making of competition policy theories before they are “black-boxed” (Bijker & Law, 1994, p. 1-2). Second, it facilitates the design and innovation in scientific work, by enhancing the “reflexivity” of law and economics scholars. Finally, mapping controversies can help support the opening of debate to the democratic scrutiny, that is especially important when experts are not able to find a clear and unambiguous consensus (Lippmann, 1927, p. 121; Marres, 2007).

2. Empirical Research

2.1. Objectives and operationalization

This section attempts to describe the features of the scientific and policy debate on DCP and to provide empirical ground for the hypothesis that the debate on DCP is a controversy. To pursue these objectives, various datasets containing academic publications and policy reports have been analysed through bibliometric techniques. Bibliometrics is a quantitative toolbox of techniques to inquire into broad datasets of textual publications, measuring their attributes, content and metadata (Hood & Wilson, 2001; Leydesdorff, 1998, 2001). To my knowledge, there are no available contributions that applied bibliometric methods to the interaction between competition policy and ICT, so the main source of inspiration is provided by bibliometric literature on other topics (in particular: Cuccurullo et al., 2016; Najmi et al., 2017; Nobre & Tavares, 2017).

The first objective of the empirical analysis is to *describe* the main features of scientific and policy literature evolution. To this scope, the following analyses are applied:

- *country productivity*: showing the most productive countries on the basis of first authors' affiliation and the length of policy papers;
- *most cited publications*: identifying the most-cited papers to identify influential publications. The most cited academic publications are identified in the references of academic publications, while the most popular policy reports are identified in the references of policy reports.

The second objective is to test whether DCP can be considered a controversy. To do this, it is necessary to operationalise the concept of controversy. According to Venturini (2010, p. 262), controversies “are discussions... where more and more objects are discussed by more and more actors”. Hence, if the debate on DCP is a controversy, we should observe a significant growth of publications and variety of actors debating it. As a proxy to observe the variety of actors, I use the number of scientific fields and the types of public institutions that published on such issues. Therefore, the following variables are scrutinised:

- *number of published academic publications and policy reports on DCP per year*;
- *number of academic fields and types of institutions scrutinising DCP per year*.

The countries' productivity and most-cited publications have been realised through the statistical language R combined with the software RStudio and the library ‘bibliometrix’ (Comprehensive Science Mapping Analysis). Bibliometrix is a specialized tool for quantitative research with bibliometric tools and offers a complete set of routines to import and manipulate bibliographic data from online libraries such as SCOPUS and Web of Science (Aria & Cuccurullo, 2017). Figures 5, 6, 7, 8, 9 and 10 have been created with Microsoft Excel.

2.2. Data

To analyse the DCP features as planned in the previous section, it is necessary to select a corpus representing the evolution of science and policy debates. The scientific debate has been observed through the publications in peer-reviewed journals, that have become, since the second half of the 20th century, the common standard to produce shared knowledge recognized in scientific communities (Biagioli, 2002; Spier, 2002). To analyse the trajectory of policymakers' debates, I collected the “policy reports” produced by public authorities. In particular, the reports are interpreted as proxies of how and whether the legislative and executive branches of countries and international organizations conceptualise the relationship between competition policy and ICT. The time span chosen for the analyses goes from 1990 to 2022 because the first notorious antitrust case on an ICT topic was *United States v. Microsoft Corporation*, on which the Federal Trade Commission started its inquiry in 1992. Intuitively, some ideas about ICT and competition policy interaction were already circulating in the first years of that decade. From the geographical point of view, there is no restriction to the origin of the sources. The following paragraphs expose how the corpus of academic publications and policy reports have been extracted.

Academic publications

The first step to collecting publications concerning DCP is the identification of a reliable and robust database containing citation data for different academic disciplines. Web of Science (WoS) ⁶ has been chosen for the extension of his database and because it provides a discipline categorization (also defined as “ontology”) that allows isolating the academic subjects of interest. Moreover, its geographical extension allows for pursuing a global-wide analysis of the literature evolution. As anticipated, the investigated time span goes from 1990 to 2022. Because of the rapidly evolving field and the lack of bibliometric literature on the subject, there is no ready-to-use taxonomy of keywords that can be used as a query to extract the publications dedicated to the interaction between competition policy and ICT. As well expressed by Wohlin (2014, p.2), “it is very difficult to formulate good search strings, since all too often the terminology used is not standardized and if using broad search terms then a large number of irrelevant papers will be found in the search, the latter creates substantial manual work that also is error-prone”. To identify the keywords to include in the query, I employ the methodology proposed by Nobre & Tavares (2017, p. 468-469), which consists of a “taxonomy research” to map the main keywords used in the literature. The structure of the process is visible in Figure 2. Firstly, I performed a search on the WoS portal using the most common and trivial keywords associated with the topic as a query. Specifically, I searched every paper that had in the title, in the abstract or in its keywords at least one expression between “antitrust” and “competition policy” and at least one word between “digital” and “ICT”. I restricted the research to the period of interest (1990-2022) and to the Web of Science categories “Law” and “Economics”. The output of this research was 220 publications. From the abstracts of these publications, I generated two frequency lists after removing the stop words: ⁷ one of 3147 unique words, and one of 8927 unique 2-word multi-words (recurrent expressions composed by two words: e.g., “big tech”, “data protection”). Then, the total list of 12074 unique expressions (3147+8927) was reviewed through the exclusion of entries that:

1. do not appear at least twice;
2. are totally unrelated to the topic of DCP;
3. are related *only* to competition policy, to avoid including publications that are unrelated to the issues of ICT (e.g., “network effects”, “market power”);
4. are ICT-related words that are too broad to frame uniquely the specific relation between digital technologies and competition policy (e.g., “internet”, “telecommunication”, “mobile”);
5. are duplicates, plurals or already included items.

Also, for two items that are abbreviations (IoT and e-commerce), the extended version was added. The result is a total of 19 items, which are listed in Figure 3. ⁸ Thereby, the final

⁶ Clarivate, Web of Science. URL: <https://www.webofknowledge.com/>.

⁷ Stop words are the words that are usually filtered out in a natural language data processing operation. Generally, as in this case, the list of stop words contains the most common words of a language that do not have intrinsic meaning and appear in high frequencies (i.e., pronouns, articles, prepositions).

⁸ To expand the range of the research, the WoS search engine has a built-in stemming and lemmatization function that considers the common variants of the search query words (i.e., plural versions). For this reason, the words contained in the queries appear only in their singular version.

queries include every publication that has in its title, keywords or abstract at least one item between “antitrust” or “competition policy” and one of the 19 items found through the taxonomy research. The queries used on the WoS portal and the link to download the extracted datasets are available in Appendix 1.

A total of four different datasets have been extracted using the taxonomy indicated in Figure 3. These datasets differ for the included WoS categories (academic disciplines). In fact, every journal and book included in the Web of Science collection is labelled with at least one subject category. The publications contained in a certain journal/book are automatically labelled with the same category(ies) as the journal/book.⁹ The first dataset (hereafter WoS1) comprehends the papers that are positioned in the WoS categories of Economics and Law; the second dataset (WoS1-E) contains only the publications belonging to the “Economics” category; the third dataset (WoS1-L) contains only to the publications belonging to the “Law” category.¹⁰ Finally, a fourth dataset (WoS2) is used to examine the spread of DCP topics analysis in other disciplines, and contains publications coming from all the WoS categories. Table 3 resumes the features of these datasets.

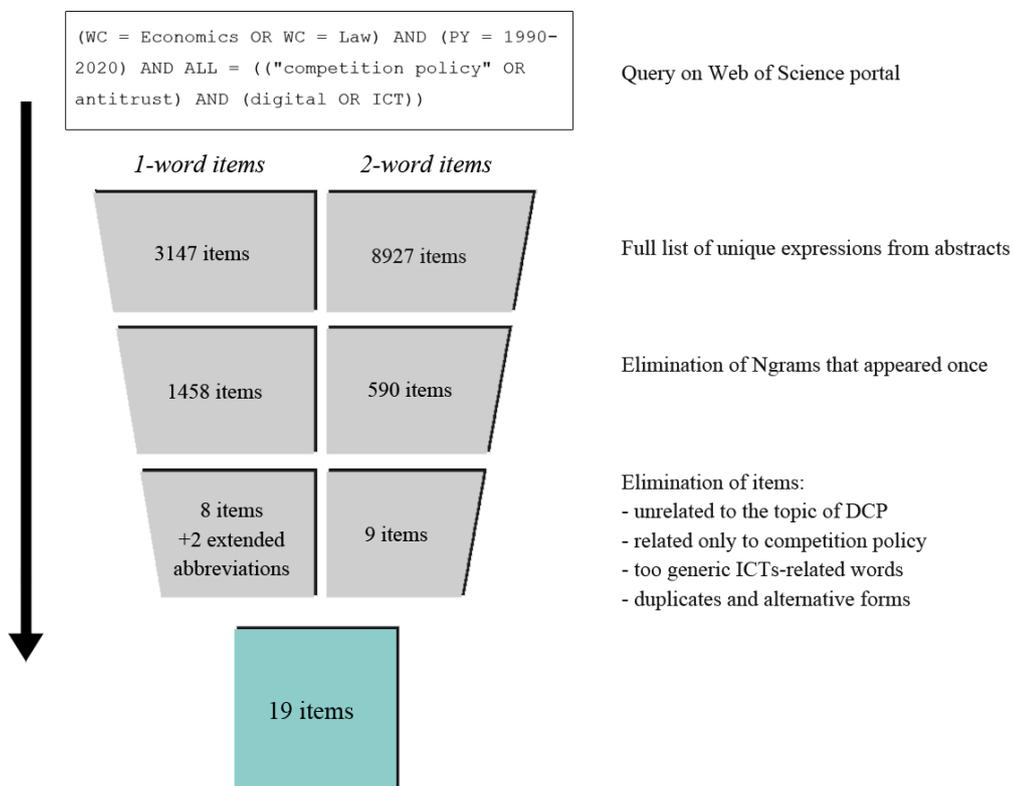


Figure 2: Taxonomy research steps. Figure inspired by Nobre & Tavares, 2017 (p. 469)

⁹ A full list of Web of Science categories used to classify the publications in the Web of Science databases is available at https://images.webofknowledge.com/images/help/WOS/hp_subject_category_terms_tasca.html.

¹⁰ The sum of the number of papers contained in WoS1-E and WoS1-L is not equal to the number of papers of WoS1 because some papers are listed in both the categories of Law and Economics, therefore they appear in both WoS1-E and WoS1-L.

Antitrust Competition policy		
+		
Aggregator	Ecommerce	Privacy
Algorithm	<i>Electronic commerce</i>	Search engine
App	Internet monopolist	Sharing economy
Big tech	IoT	Social media
Data market	<i>Internet of Things</i>	Tech firms
Data protection	Online market	
Digital	Platform	

Figure 3: Terms derived from the taxonomy research that were used in the Web of Science Search engine to extract the datasets. The words in italics were added to include publications that do not employ abbreviations.

Policy Reports

To build a dataset containing policy reports on DCP, it is not possible to employ the same methodology used for academic publications because of the incompleteness of existent databases containing policy-related content. For this reason, instead of relying on a unique database, I adopted a snowballing technique. As explained by Wohlin (2014), this approach can be employed to pursue systematic literature studies when using a database is not possible or suitable. This method uses a pool of publications as a starting point and scrutinizes their bibliography to find other relevant publications. Then, these new publications are scrutinized in the same way to find more relevant publications, and so on. This procedure is iterated until no new publications can be found (more precisely, when the last extracted group of documents provides only relevant publications that are already included in the database, also defined as the “saturation point”). The procedure is shown in Figure 4 and illustrated below.

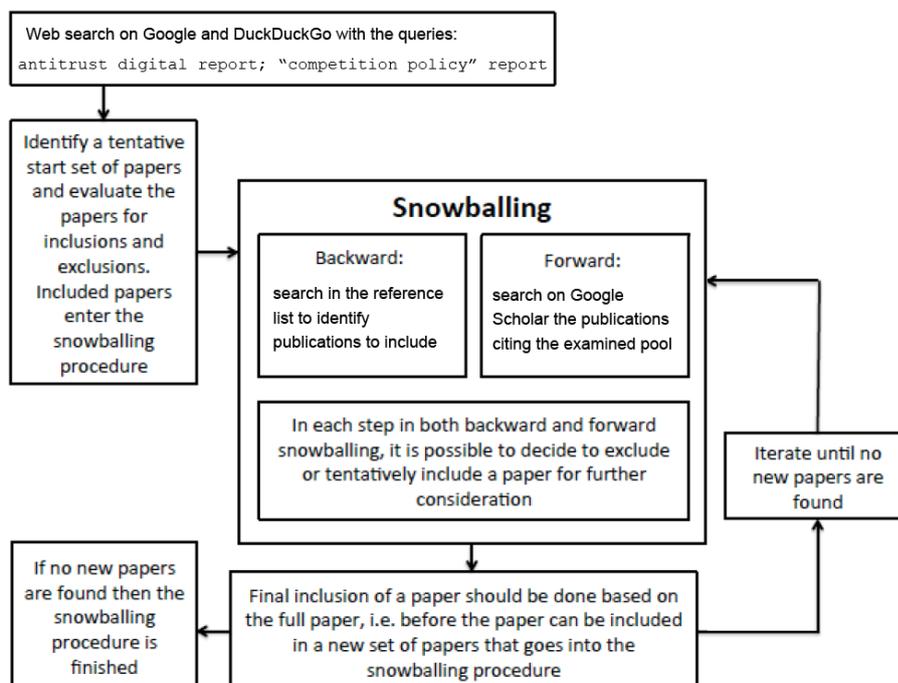


Figure 4: Snowballing steps for the research of policy reports

To begin, it is necessary to specify the details of what is considered a relevant document that should be included in the final dataset. This research considers a “policy report” each publicly available document with independent informative content, realised or commissioned by a public institution correspondent to the executive or legislative power (or by a national or international organization whose governance is predominantly composed of national states’ executives), that treats the interaction between competition policy and ICT as the main subject or as one of the main analysed sub-issues. “Independent informative content” means that the document should not be merely a procedural document used as part of a judicial procedure (i.e., the questions posed by a competition authority to a firm as part of an investigation or the opinions of authorities about particular cases) or the consultations used to build a subsequent report. “Main sub-issues” means the topic of DCP should be one of the main chapters or sections in the report summary. The selection of the first pool of publications has been extracted using online search engines. To diversify the results and to limit the influence of variables influencing search engine algorithms, more than one search engine has been employed. Particularly, I reviewed the first 10 pages of results generated from query searches on the Google and DuckDuckGo¹¹ engines conducted on 17th November 2022 from an incognito page of the web browser Google Chrome. Moving from a starting point equivalent to the one used for the academic publications, the employed keywords combinations were:

1. antitrust digital report;
2. “competition policy” digital report.¹²

Hence, the total number of searches is 4 (2 keyword combinations*2 search engines). After finding the initial pool of publications, the next step involves two types of snowballing techniques (Wohlin, 2014, p. 3):

¹¹ The URL of the search engines are, respectively: <https://www.google.com/> and <https://duckduckgo.com/>.

¹² The quotation marks are employed to obtain only research results that include the exact expression.

1. *backward snowballing*: searching through the bibliography/reference list of the papers contained in the initial pool to identify new relevant publications;
2. *forward snowballing*: searching on Google Scholar for further relevant publications that cited the papers contained in the initial pool.

The inclusion of new publications is assessed on the basis of their title, abstract and full text. Backward and forward snowballing is iterated until no new papers are found. If a research inquiry published multiple versions of a report, only the most recent is considered. Through these steps, a final dataset of 90 publications was built. Hereinafter, this dataset of policy reports concerning DCP is labelled “Sno1”. Table 3 resumes the main features of the datasets used in the bibliometric analysis.

Dataset	Type	WoS categories	Number of documents
WoS1	Academic publ.	Law; Economics	401
WoS1-L	Academic publ.	Law	286
WoS1-E	Academic publ.	Economics	155
WoS2	Academic publ.	All	537
Sno1	Policy reports	-	90

Table 3: Datasets used in the empirical research

2.3. Limits

Along with many benefits, this methodology has various downsides. Firstly, both the “taxonomy research” employed to search for academic papers and the snowballing collection of policy papers imply a certain degree of arbitrariness. Different researchers may take different decisions starting from equal assumptions, affecting the content of the databases. In taxonomy research, various criteria of selection are possible and different words can be inserted in the final queries depending on the researcher’s sensibility. In the snowballing process, different opinions could emerge about the coherence and relevancy of some papers. For this reason, the datasets and the code are public (see Appendix 1) to allow replicability and alternative tests. The second limit is the difficulty in building a truly “global” study. The academic publications dataset mirrors any bias included in the Web of Science database. As regards the policy reports, the initial pool was built under the influence of any potential bias included by Google and DuckDuckGo search engine algorithms. Hopefully, the use of multiple search engines and the snowballing analysis can limit the detrimental effect of these flaws. Thirdly, bibliometric methods are limited to the availability of fitting databases. Given the absence of a unique database, the various languages and the complexity of legal terminology, it was unfeasible to apply bibliometric techniques to courts’ rulings, despite their performative role in antitrust regulation. Finally, from the theoretical point of view, Leydesdorff (2001, p. 21) rightly states that there is always a certain gap between the practice of scientists (and policymakers) and the trajectories depicted by bibliometric data: “[t]he dynamic of texts... may coincide with the dynamics of social action or with the dynamics of problem formulations, but they do not necessarily have to”. In other words, the dynamics of bibliometric data may not perfectly mirror the practices of real-life actions of scholars and

policymakers. For this reason, this research shall be read as complementary to studies employing different sources (such as grey literature, interviews and case law) and methods (i.e. qualitative research, as suggested by Najmi et al., 2017).

2.4. Findings

Country Productivity

Country productivity analysis of academic publications takes into consideration the affiliation country of the publications' first authors. Table 4 and Table 5 report the absolute number of articles and the percentage of total articles in the dataset produced by the top 10 countries in terms of productivity. As it is evident, the most productive countries in the fields of Law and Economics are the United States of America and the United Kingdom. The two countries are followed by various European countries, China and Russia. Extending the analysis to the entirety of academic fields, the prominence of U.S. and United Kingdom academic productivity in DCP remains clear (Table 6).

Country	No. of Articles	% of articles
United States	111	41.42
United Kingdom	31	11.57
Germany	15	5.6
China	11	4.1
Italy	11	4.1
Belgium	10	3.73
Netherlands	10	3.73
Russia	10	3.73
Australia	9	3.36
Switzerland	7	2.61

Table 4: Top-10 most productive countries of Law literature on digital competition policy (WoSI-L)

Country	No. of Articles	% of articles
United States	54	35.29
United Kingdom	21	13.73
Russia	11	7.19
China	9	5.88
France	9	5.88
Germany	8	5.23
Canada	6	3.92
Belgium	5	3.27
Italy	5	3.27
Netherlands	4	2.61

Table 5: Top-10 most productive countries of Economics literature on digital competition policy (WoSI-E)

Country	No. of Articles	% of articles
United States	180	37.19
United Kingdom	55	11.36
Russia	28	5.79
China	26	5.37
Germany	25	5.17
Netherlands	17	3.51
Australia	16	3.31
Belgium	16	3.31

Table 6: Top-10 Most productive countries of digital competition policy publications across all the academic fields (WoS2)

Moving to the policy reports, Table 7 shows the number of policy reports produced by countries and international organizations. The joint reports produced by multiple countries are included in the computation of each participant country.¹³ The goal is to measure the effort of the countries in making research on DCP. However, it must be considered that the number of produced documents might be a partially misleading proxy because it privileges the fragmentation of research production across various institutions. European countries, in particular Germany, the United Kingdom, and France emerge as the most prolific. The production of the European Union and the OECD confirms the dominance of Europe in policy research on the topic. Outside Europe, Australia and Japan are the most prolific, while the United States published a relatively low number of reports, in contrast with their high productivity in academic publications. The BRICS group (Brazil, Russia, India, China and South Africa) realized a joint report on DCP; among them, only Brazil and India also developed their own report. The absence of documents produced exclusively by China is particularly interesting, especially if compared with its high academic production.

Country	No. policy reports
Organization for Economic Co-operation and Development (OECD)	16
Germany	13
United Kingdom	13
France	7
European Union	5
Australia	5
Canada	4
Japan	3
Netherlands	3
Comisión Económica para América Latina y el Caribe (CEPAL)	2
India	2
South Africa	2
Sweden	2
United States	2
Brazil	2
Spain	2
Mexico	1
Belgium	1
Luxembourg	1
Russia	1
China	1
Austria	1
Italy	1
Denmark	1
Island	1
Finland	1

¹³ For this reason, the sum of the values in the “No. of policy reports” column is not equal to the total number of papers in the dataset.

Norway	1
World Bank	1

Table 7: Number of policy reports on Digital Competition Policy produced by each country (Sno1).

Note: Policy reports and pages produced by joint reports by multiple countries are included in the computation of each participant country.

Most-cited publications

To understand more about the effective contribution of some countries on the DCP global research, the analysis of the most-cited papers and reports can give precious insights. In the case of academic publications, Table 8 and Table 9 show the prevalence of U.S.-affiliated researchers. In the Economics dataset, the two most-cited papers¹⁴ can be reconducted to the “Chicago” and “consumer welfarist” approaches (Bork & Sidak, 2012; Sidak, 2006). As regards the Law literature, the paper with more citations is authored by one of the most prominent representatives of “neo-populism” (Khan, 2016). However, the “consumer welfarist” paper by Sidak (2006) also appears relevant.

Paper	Total citations (TC)	TC per Year	Affiliation Country
Rysman M, 2009, J Econ Perspect.	440	31.43	United States
Choi Jp, 2010, J Indust Econ.	97	7.46	United States
Buys P, 2009, World Dev.	74	5.29	United States
Sidak Jg, 2006, J Compet Law Econ.	54	3.18	United States
Calvano E, 2019, Rev Ind Organ.	32	8.00	Italy
White A, 2013, Int J Ind Organ.	32	3.20	China
Veiga A, 2016, Q J Econ.	29	4.14	United Kingdom
Bork Rh, 2012, J Compet Law Econ.	27	2.45	United States
Midttun A, 2017, Energy Policy	26	4.33	Norway

Table 8: Top 10-most cited publications in Economics (WoSI-E)

Paper	Total citations (TC)	TC per Year	Affiliation Country
Khan Lm, 2017, Yale Law J.	298	49.67	United States
Bradford A, 2012, Northwest Univ Law Rev.	220	20.00	United States
Calo R, 2017, Columbia Law Rev.	144	24.00	United States
Khan Lm, 2019, Columbia Law Rev	58	14.50	United States
Sidak Jg, 2006, J Compet Law Econ.	54	3.18	United States
Van Loo R, 2018, Ucla Law Rev.	53	10.60	United States
Mehra Sk, 2016, Minn Law Rev.	51	7.29	United States

¹⁴ In the case of academic publications, the number of citations also includes the citations from publications not contained in the datasets.

Newman Jm, 2015, Univ Pa Law Rev.	50	6.25	United States
Shelanski Ha, 2013, Univ Pa Law Rev.	46	4.60	United States
Weiser Pj, 2003, Columbia Law Rev.	46	2.30	United States

Table 9: Top 10-most cited publications in Law (WoS1-L)

Table 10 reports the ten most cited policy reports. The reports by France and Germany, European Union, the United Kingdom and Australia are the most cited. The influence of European countries and the OECD are clear. On the other hand, the absence of United States reports is likely related to the late release of its reports. Therefore, United Kingdom is the only country whose research relevance is evident both in academic and policy publications.

Policy report	Total citations by other reports	Year	Affiliation Country/Org.
Digital Platform Inquiry	21	2019	Australia
Algorithms and Competition	20	2019	France, Germany
Competition policy for the digital era (2019)	21	2019	European Union
Unlocking Digital Competition	20	2019	United Kingdom
Big Data: Bringing Competition Policy to the Digital Era	12	2016	OECD
Online platforms and digital advertising	12	2020	United Kingdom
Algorithms and collusion: competition policy in the digital age	9	2017	OECD
Competition policy: The challenge of digital markets	8	2015	Germany
Market Power of Platforms and Networks	7	2016	Germany
Rethinking Antitrust Tools for Multi-Sided Platforms	7	2018	OECD

Table 10: Top 10 policy reports most cited by other policy reports (Sno1)

Number of publications

If DCP is a controversial topic, the related scientific and policy debate should show an incremental trend. The reason is that stronger levels of dissensus generate a higher number of publications, due to the necessity to debate “unstable” scientific facts. Figure 5 shows that the increase in scientific publications per year is evident for all the analysed datasets (WoS1-E, WoS1-L, WoS2). Scientific publications embrace a steady growth between 2013 and 2015. The small “peak” determined by the publications in 1999 and 2000 is probably due to the relevancy of the Microsoft case against the FTC that had its final rulings in those years. Since the 2010s, also the number of policy papers produced by public authorities rapidly increased. Also, a lag between the beginning of the growth of scientific literature and policy reports is noticeable.

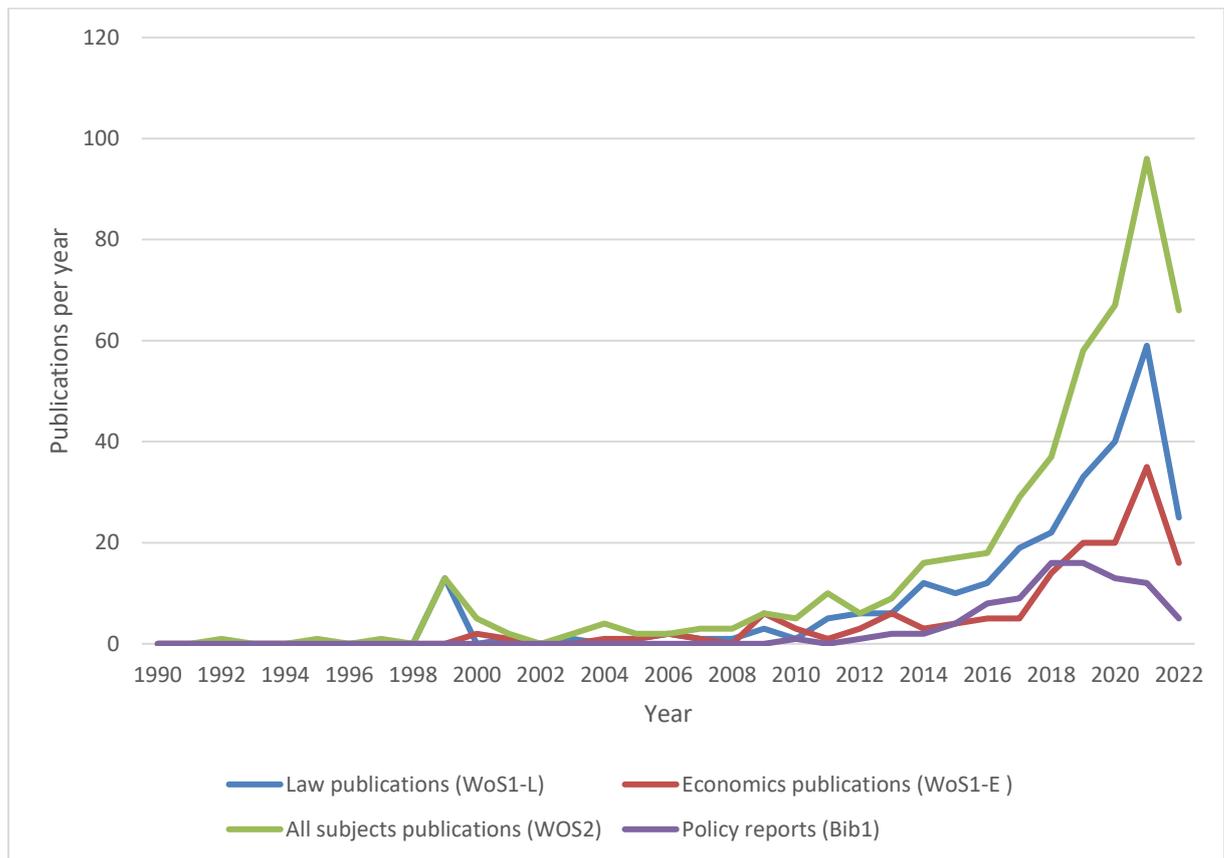


Figure 5: Digital Competition Policy academic publications per year 1990-2020

Showing the increase in publications is not enough to demonstrate that the scientific debate on DCP is a controversy. In fact, such a trend may be caused only by the rise of interest in the topic of competition policy as a whole. More effort is needed to understand whether this trend concerns only the *intersection* between competition policy and ICT. To test this, I compare the DCP dataset with datasets containing competition policy publications that do not concern digital topics. If the pattern of DCP literature diverges from the pattern of other competition policy topics, it is possible to argue that DCP literature has an *independent* pattern of growth. Hence, I extracted from the Web of Science database three datasets of literature that concern competition policy but *not* digital or ICT topics. These datasets contain the 1990-2022 competition policy literature on the pharmaceutical industry (WoS_pharma), energy industry (WoS_energy) and transportation (WoS_transport). The queries employed on the Web of Science search engine deliberately excluded publications containing the words “digital” or “ICT” (the queries are visible in Appendix 1) to avoid overlapping with the DCP dataset. Figure 6 shows the results of the comparison between the number of papers published year-by-year in these datasets in the period 1990-2022 with the number of papers concerning DCP. To capture the potential trends emerging from any scientific fields, the analysis was pursued on datasets that included every WoS category (in the case of the DCP, WoS2 was used). It is evident that publications on DCP follow an independent trend of growth that is not related to dynamics incorporated by the rest of the literature on competition policy. Therefore, it is possible to claim that there is a significant difference between the growth of literature on DCP and the competition policy publications on non-digital topics.

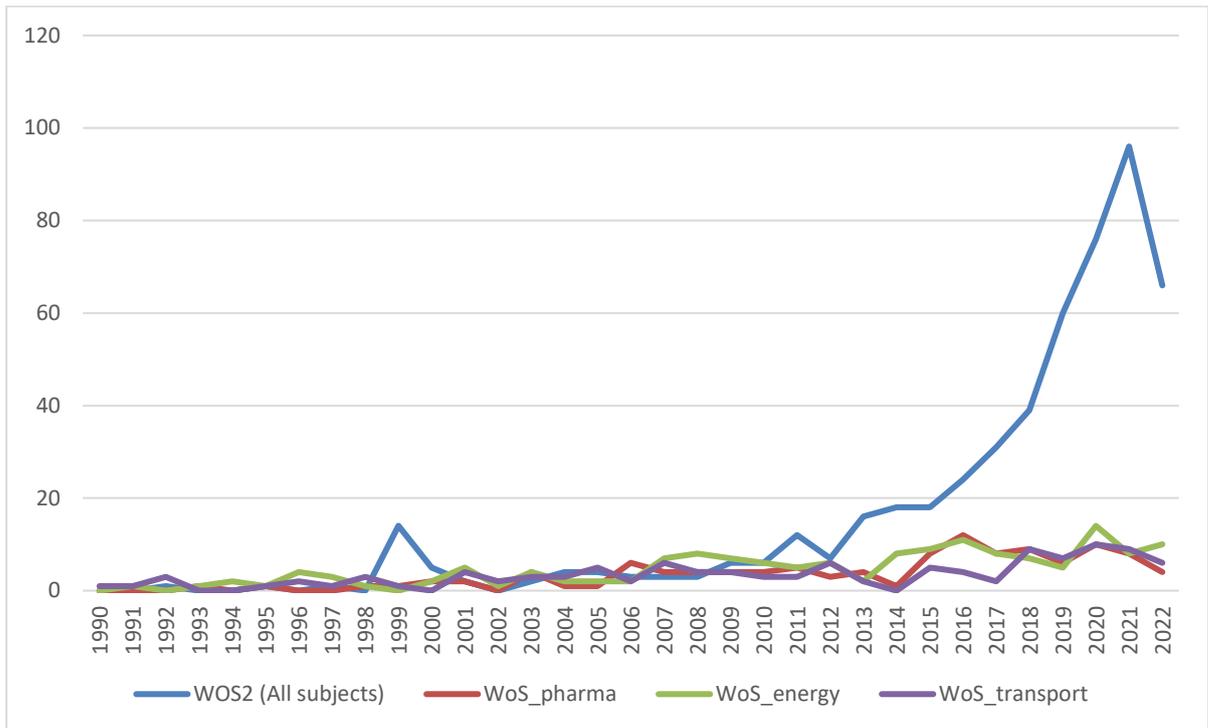


Figure 6: Digital Competition Policy publications per year in comparison with competition policy publications about pharmaceutical, energy and transport sectors (publications per year 1990-2020)

Variety of actors

The development of a scientific controversy embroils a multiplication of debating voices. In comparison with other, “more stable” topics and fields, scientific controversies should involve a higher number of actors participating in the conversation. To measure this, the variety of scientific fields and the types of institution publishing articles on DCP are used as a proxy. Figure 7 illustrates the yearly number of scientific fields¹⁵ contributing to the DCP debate. The figure shows how the number of involved fields increases with the number of publications. In addition to Law and Economics, DCP articles were particularly published in International Relations, Sociology, Computer science and Public Administration journals.

¹⁵ The scientific fields are categorized through the system of WoS categories. See Note 9 for more information.

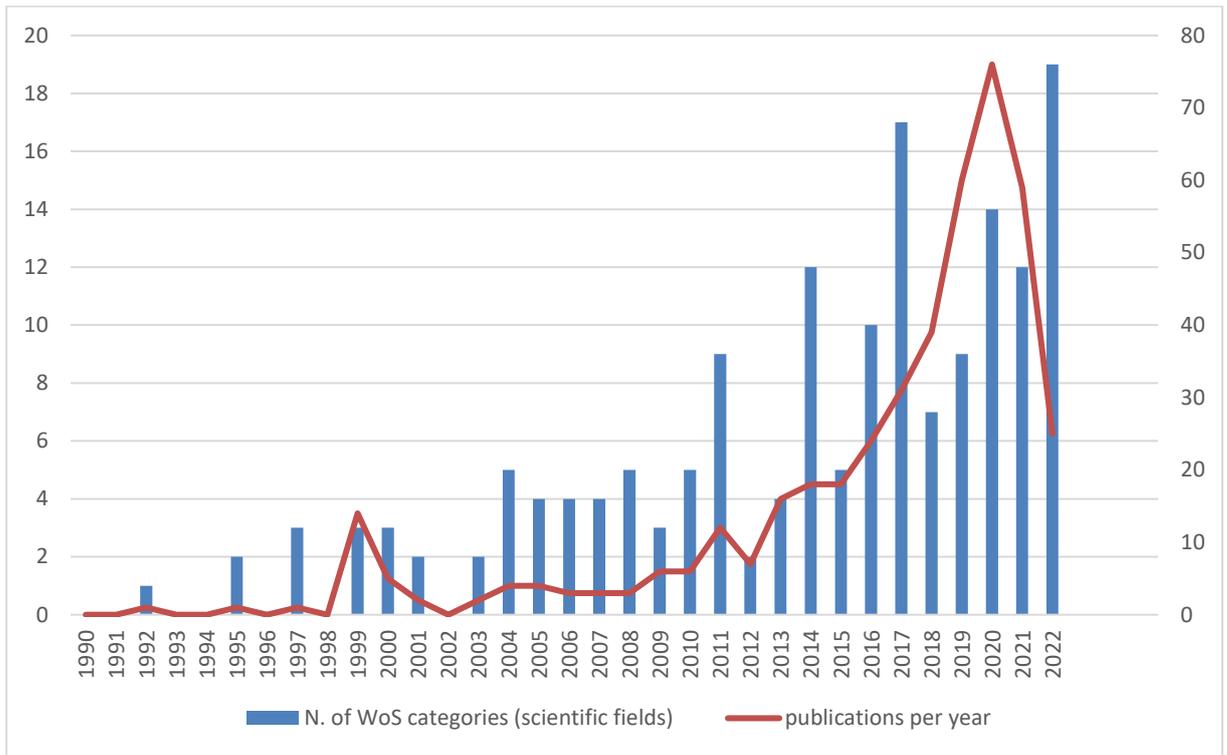


Figure 7: Growth of yearly publications and number of fields that treat the topic of Digital Competition Policy (Dataset: WoS2)

Figure 8 compares the number of scientific fields participating in the scientific debate on competition policy in the ICT, pharmaceutical, transportation and energy industries. Whereas DCP, despite some oscillations, clearly increased the number of scientific fields year by year, the other types of competition policy literature have a stable (or only weakly positive) trend. In the long term, the growth of the number of scientific fields analysing digital competition policy seems significantly different from other issues treated in competition policy literature.

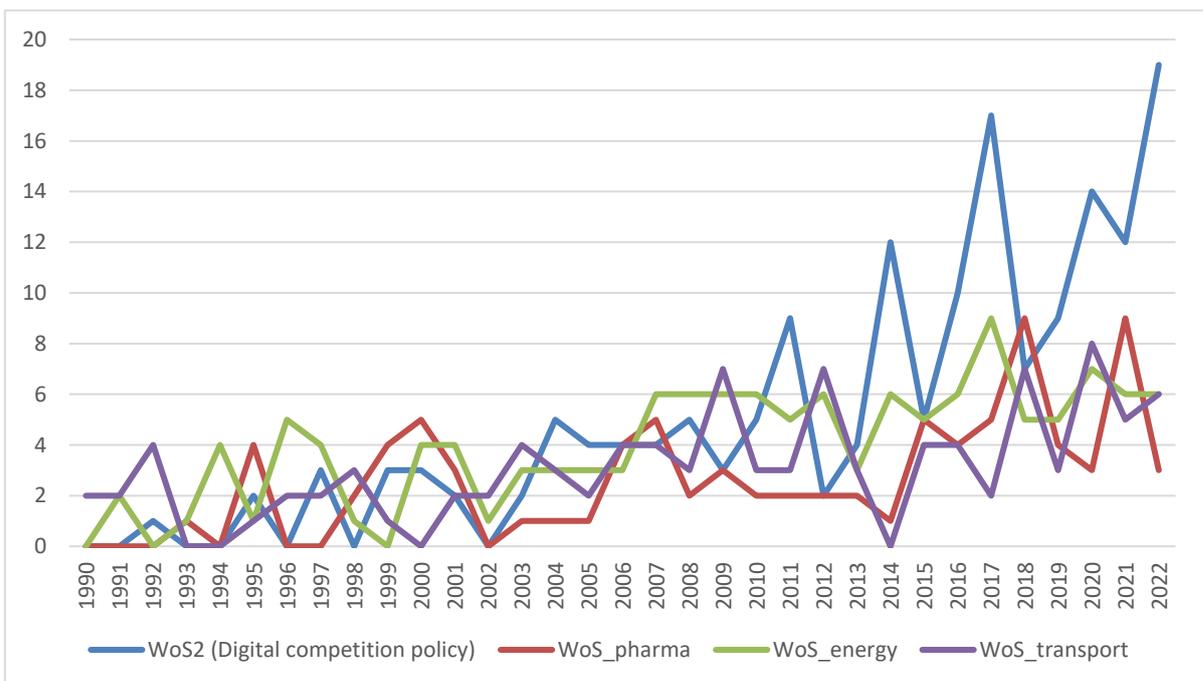


Figure 8: Comparison of yearly number of scientific fields debating competition policy issues (Datasets: WoS2, WoS_pharma, WoS_energy, WoS_transport)

The analysis of policy papers takes into account the different *types* of institutions that released DCP reports across the years. To do this, I employ a categorization based on the formal types of institutions that released policy reports. As shown in Figure 9, most of the reports were produced by competition authorities, with a prominent role also played by governments and international organizations. Figure 10, on the other hand, demonstrates that, since the topic was first explored by public authorities, the issue of DCP has been tackled by multiple types of institutions. In opposition to considering competition policy a “technical” matter, DCP was immediately analysed by multiple politically salient institutions such as governments and parliamentary commissions.

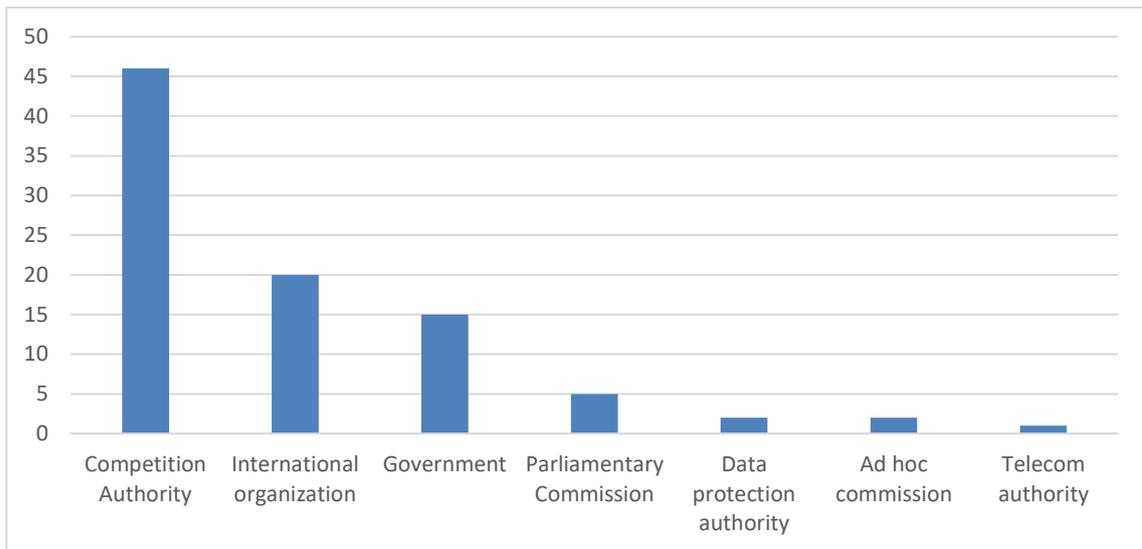


Figure 9: Types of public institutions that released DCP reports.

Note: the European Union is considered as a state. Therefore, the European Commission and the European Data Protection Supervisor’s reports are classified under the “Government” and “Data protection authority” labels, respectively.

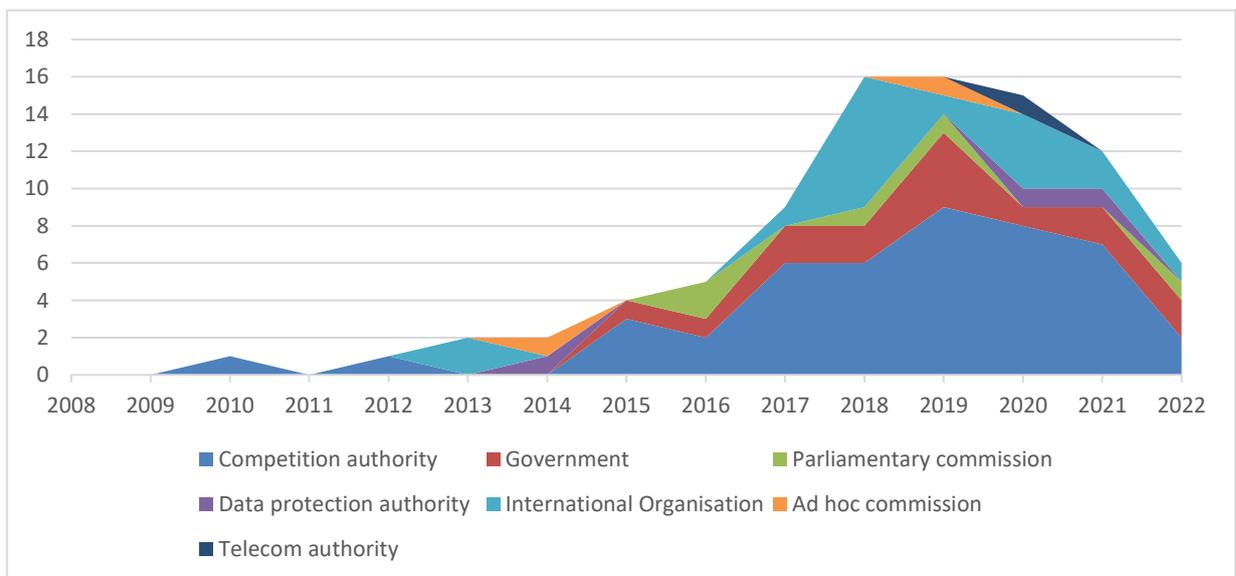


Figure 10: Types of public institutions releasing DCP reports per year.

Note: the European Union is considered as a state. Therefore, the European Commission and the European Data Protection Supervisor’s reports are classified under the “Government” and “Data protection authority” labels, respectively.

Conclusion

The empirical evidence suggests that the debate in Law and Economics literature about DCP can be framed as a controversy. The literature review has highlighted crucial areas of conflict among scholars, and quantitative data have shown significant growth in the number of publications and variance of actors composing the debate. The analysis has also enlightened various features of such a debate. The analysis of country productivity has demonstrated the prominence of the United States, United Kingdom and European Union in the scientific production about DCP. On the other hand, policy papers production is dominated by European Union countries and Australia. The United States demonstrated a policy effort weaker than its academic contribution, and China has published only a joint report with BRICS countries. From a global perspective, the results demonstrate how the geographical distribution of policy and academic literature on DCP issues is skewed in favour of the richest countries, which are usually the most active in terms of competition policy enforcement (Aydin & Buthe, 2016). Europe, Australia and Japan, and OECD result as the most active producers of policy reports, while USA and China both appear in delay or absent from the debate. Competition authorities are, unsurprisingly, the most active on the topic. However, the strong role of international organizations, governments and parliamentary commissions demonstrates that the topic has been often treated as a political issue rather than a technical matter.

This research investigated the development of scientific and policy literature on the intersection of competition policy and ICT. Through a brief theoretical analysis of the conflict between different theories, Section 1 concluded that the current debate on DCP can be framed as a “controversy”, that is a situation in which certain scientific facts become unstable, large dissensus emerges in scientific communities and the separation line between what is considered scientific and what is recognized as political becomes blurred. Section 2 applied various bibliometric tools to academic publications and national policy reports, in order to describe the evolution of the debate on DCP and test whether DCP has the features of a controversy. The analysis demonstrated the spiking interest towards antitrust in digital markets and exhibited the temporal and geographical distribution of policy and academic literature on DCP issues. To conclude, I hope that this research can do what a good review should achieve according to Webster & Watson (2002): “analysing the past to prepare for the future”. This paper can contribute to the reflexivity of policymakers and scholars working on DCP, that can benefit from observing the wide-scale picture of scientific and policy debate evolution. Hopefully, both categories will use these reflections as a foundation to develop effective strategies to lead the scientific debate on digital competition policy toward the directions that they see more fit for human progress.

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Appendix 1: Web of Science queries

This Appendix lists the queries employed on the Web of Science portal to extract the datasets used in the empirical section. The dataset can be downloaded at the following link: https://github.com/MattNebb/dcp_controversy . A legend is available at the bottom of the Appendix.

Taxonomy research:

```
(WC = Economics OR WC = Law) AND (PY = 1990-2020) AND ALL =  
(("competition policy" OR antitrust) AND (digital OR ICT))
```

WoS1:

```
(WC = Economics OR WC = Law) AND (PY = 1990-2020) AND ALL =  
(("competition policy" OR antitrust) AND (aggregator OR algorithm OR  
app OR "big tech" OR "data market" OR "data protection" OR digital  
OR ecommerce OR "electronic commerce" OR "internet monopolist" OR  
iot OR "internet of things" OR "online market" OR platform OR  
privacy OR "search engine" OR "sharing economy" OR "social media" OR  
"tech firms" ))
```

WoS1-L:

```
(WC = Law) AND (PY = 1990-2020) AND ALL = (("competition policy" OR  
antitrust) AND (aggregator OR algorithm OR app OR "big tech" OR  
"data market" OR "data protection" OR digital OR ecommerce OR  
"electronic commerce" OR "internet monopolist" OR iot OR "internet  
of things" OR "online market" OR platform OR privacy OR "search  
engine" OR "sharing economy" OR "social media" OR "tech firms" ))
```

WoS1-E:

```
(WC = Economics) AND (PY = 1990-2020) AND ALL = (("competition  
policy" OR antitrust) AND (aggregator OR algorithm OR app OR "big  
tech" OR "data market" OR "data protection" OR digital OR ecommerce  
OR "electronic commerce" OR "internet monopolist" OR iot OR  
"internet of things" OR "online market" OR platform OR privacy OR  
"search engine" OR "sharing economy" OR "social media" OR "tech  
firms" ))
```

WoS2:

```
(PY = 1990-2020) AND ALL = (("competition policy" OR antitrust) AND  
(aggregator OR algorithm OR app OR "big tech" OR "data market" OR  
"data protection" OR digital OR ecommerce OR "electronic commerce"  
OR "internet monopolist" OR iot OR "internet of things" OR "online  
market" OR platform OR privacy OR "search engine" OR "sharing  
economy" OR "social media" OR "tech firms"))
```

WoS_pharma:

```
(PY = 1990-2020) AND ALL= ("competition policy" OR antitrust) AND  
ALL=(pharmaceutical OR pharma) NOT ALL = (digital OR ict)
```

WoS_energy:

(PY = 1990-2020) AND ALL= ("competition policy" OR antitrust) AND ALL=(energy) NOT ALL = (digital OR ict)

WoS_transport:

(PY = 1990-2020) AND ALL= ("competition policy" OR antitrust) AND ALL=(transport) NOT ALL = (digital OR ict)

Legend

Available on <https://www.webofscience.com/wos/woscc/advanced-search> [consulted on 10 November 2022].

Booleans: AND, OR, NOT.

Field Tags:

- | | | |
|-------------------------|----------------------|--------------------------------|
| • TS=Topic | • AD=Address | • SU=Research Area |
| • TI=Title | • OG=Affiliation | • WC=Web of Science Categories |
| • AB=Abstract | • OO=Organization | • IS= ISSN/ISBN |
| • AU=Author | • SG=Suborganization | • UT=Accession Number |
| • AI=Author Identifiers | • SA=Street Address | • PMID=PubMed ID |
| • AK=Author Keywords | • CI=City | • DOP=Publication Date |
| • GP=Group Author | • PS=Province/State | • PUBL=Publisher |
| • ED=Editor | • CU=Country/Region | • ALL=All Fields |
| • KP=Keyword Plus | • ZP=Zip/Postal Code | • FPY=Final publication year |
| • SO=Publication Titles | • FO=Funding Agency | |
| • DO=DOI | • FG=Grant Number | |
| • PY=Year Published | • FD=Funding Details | |
| • CF=Conference | • FT=Funding Text | |

Appendix 2: List of policy papers

This is the list of the 90 policy papers analysed in the empirical part:

- Australia 2015. Online Vertical Restraints Special Project Report.
- Australia 2016. Digital Disruption: What do governments need to do? Productivity Commission Research Paper
- Australia 2019. Digital Platforms inquiry Final Report
- Australia 2021. Digital advertising services inquiry Final report.
- Australia-Indonesia 2019. Digital Platform Regulation (PROSPERA Policy Brief).
- Austria 2020. Proposition Paper Digitalization and Competition Law.
- Belgian, Dutch and Luxembourg competition authorities 2019. Joint memorandum on challenges faced by competition authorities in a digital world
- Brazil 2018. Competition Effects of the Sharing Economy in Brazil: Has Uber's entry affected the cab-hailing app market from 2014 to 2016?
- Brazil 2020. Concorrência em mercados digitais: uma revisão dos relatórios especializados.
- Brazil, Russia, India, China, South Africa 2019. BRICS in the digital economy: competition policy in practice.
- Canada 2018. Big data and Innovation: Implications for Competition Policy in Canada. Draft Discussion Paper.
- Canada 2018. Big data and innovation: key themes for competition policy in Canada.
- Canada 2018. Democracy Under Threat: Risks and Solutions in The Era Of Disinformation And Data Monopoly.
- CEPAL 2018. Política de competencia y convergencia de sectores Tecnologías de la información y financieras.

- CEPAL 2018. Políticas de competencia para una economía digital el marco regulatorio e institucional y el contexto internacional.
- EDPS 2014. Privacy and competitiveness in the age of big data.
- European Union 2015. Challenges for Competition Policy in a digitalised economy.
- European Union 2016. Report on the monitoring exercise carried out in the online hotel booking sector by EU competition authorities in 2016.
- European Union 2017. Final report on the E-commerce Sector Inquiry.
- European Union 2019. Competition policy for the digital era.
- European union 2022. Sector inquiry into consumer Internet of Things. Final report.
- France 2010. Avis n° 10-A-13 du 14 juin 2010 relatif à l'utilisation croisée des bases de clientèle.
- France 2014. Neutralité des plateformes. Réunir les conditions d'un environnement numérique ouvert et soutenable.
- France 2018. Data processing in the online advertising sector.
- France 2020. Competition and e-commerce study.
- France 2020. Contribution de l'Autorité de la concurrence au débat sur la politique de concurrence et les enjeux numériques.
- France-Germany 2016. Competition Law and Data.
- France-Germany 2019. Algorithms and competition.
- G7. Common Understanding of G7 Competition Authorities on "Competition and the Digital Economy". Paris, 5th June, 2019.
- Germany 2012. "Wettbewerbs- und medienrechtliche Aspekte von Netzneutralität"
- Germany 2015. Competition policy: The challenge of digital markets.
- Germany 2016. Grünbuch: Digitale Plattformen.
- Germany 2016. Market Power of Platforms and Networks.
- Germany 2017. Big Data und Wettbewerb (series of papers on "Competition and Consumer Protection in the Digital Economy").
- Germany 2017. Innovationen – Herausforderungen für die Kartellrechtspraxis (series of papers on "Competition and Consumer Protection in the Digital Economy").
- Germany 2017. White paper: Digital Platforms.
- Germany 2018. Modernising the law on abuse of market power.
- Germany 2018. Online advertising (series of papers on "Competition and Consumer Protection in the Digital Economy").
- Germany 2019. A new competition framework for the digital economy.
- Germany 2022. Sektoruntersuchung: Online-Werbung.
- India 2020. Market study on e-Commerce in India.
- Italy 2020. Indagine conoscitiva sui Big Data.
- Japan 2017. Report of study group on data and competition policy.
- Japan 2019. Report regarding trade practices on digital platforms. Business-to-Business transactions on online retail platform and app store.
- Japan 2021. Fact-finding Survey Report on Digital Platform Operators' Trade Practices. Final report regarding Digital Advertising.
- Mexico 2018. Rethinking competition in the Digital Economy.
- Netherlands 2017. A closer look at Online video platforms.
- Netherlands 2019. Market study into mobile app stores.
- OECD 2013. The digital economy.
- OECD 2013. Vertical Restraints for On-line Sales.
- OECD 2016: Bringing competition to the digital era.
- OECD 2016. Price Discrimination.
- OECD 2017. Algorithms and collusion: Competition policy in the digital age.
- OECD 2018. E-commerce for competition policy.
- OECD 2018. Personalised prices.
- OECD 2018. Quality considerations in digital zero-price markets.
- OECD 2018. Non-price effects in merger control.

- OECD 2018. Rethinking antitrust tools for multi-sided platforms.
- OECD 2020. Abuse of dominance in digital markets.
- OECD 2020. Competition in digital advertising markets.
- OECD 2020. Antitrust and the trust machine.
- OECD 2020. Competition in Digital Advertising Markets.
- OECD 2020. Consumer Data Rights and Competition.
- OECD 2021. Data Portability, Interoperability and Digital Platform Competition.
- OECD 2021. Ex Ante Regulation and Competition in Digital Markets.
- Portugal 2019. Ecosystemas digitais, Big Data e Algoritmos.
- South Africa 2022. Online Intermediation Platforms market inquiry.
- Spain 2020. Rethinking competition law (Autoritat Catalana de la Competència).
- Spain 2021. Study on the competition conditions in the online advertising sector in Spain.
- Sweden 2021. Konkurrensen på digitala plattformsmarknader i Sverige.
- Sweden, Denmark, Finland, Iceland, Norway and Sweden 2020. Digital platforms and the potential changes to competition law at the European level.
- United Kingdom 2015. The commercial use of consumer data.
- United Kingdom 2016. Online Platforms and the Digital Single Market. House of Lords report.
- United Kingdom 2017. Online search: Consumer and firm behaviour.
- United Kingdom 2018. Pricing Algorithms.
- United Kingdom 2017. Digital comparison tools market study.
- United Kingdom 2019. Ex-post Assessment of Merger Control Decisions in Digital Markets.
- United Kingdom 2019. Letter from Andrew Tyrie to the Secretary of State (BEIS).
- United Kingdom 2019. Regulating in a digital world. House of Lords report.
- United Kingdom 2019. Unlocking digital competition.
- United Kingdom 2020. Online platforms and digital advertising.
- United Kingdom 2021. Algorithms: How they can reduce competition and harm consumers.
- United Kingdom 2021. Competition and data protection in digital markets: a joint statement between the CMA and the ICO.
- United Kingdom 2021. Competition and Innovation in Digital Markets.
- UNCTAD 2019. Competition issues in the digital economy.
- United States 2021. Non-HSR Reported Acquisitions by Select Technology Platforms, 2010-2019: An FTC Study.
- United States 2022. Investigation of competition in digital markets.
- World Bank 2021. Antitrust and Digital Platforms: An analysis of global patterns and approaches by competition authorities.