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**Voice Assistants as Gatekeepers for Consumption?  
- How Information Intermediaries Shape Competition**

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# Voice Assistants as Gatekeepers for Consumption? - How Information Intermediaries Shape Competition

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## **Abstract:**

In December 2020, new regulation of digital markets was proposed by European Commission. It specifically addresses main concerns raised by business behavior of operators of core services in their gatekeeping positions. However, voice assistants (or digital personal assistants, DPAs, e.g. Apple's Siri, Amazon's Alexa, Google Assistant) are not included into this regulation. In contrast, the Internal Market and Consumer Protection Committee of European Parliament suggested to include them. This paper argues that (i) voice assistants as gatekeepers for consumption should be listed among core services, (ii) some Digital Market Act's obligations need to be adopted to fit specifics of voice assistants, (iii) two relevant dimensions of power should be included into rebuttable presumptions used for competition policy and regulation: market power on voice assistants' market and ecosystem of related markets (cross-market integration criterion), (iv) growth of new gatekeepers should be prevented, among other means by stricter merger control.

**Keywords:** Voice Assistants, Gatekeepers, Digital Market Act, Digital Personal Assistants, Virtual Assistants, Competition in Digital Markets, Competitive Bottleneck, Information Intermediaries, Platform Competition, Smart Speakers, Siri, Alexa, Google Assistant

JEL: K21, L1, L4, L86, O33, D4

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## 1. Introduction

In today's world with growth of Internet of things (IoT), consumers more often perform various actions with support of digital systems, including voice assistants. This poses new challenges to competitive environment and these changes are already widely discussed on level of regulation, to keep it up to date with such dynamic changes in consumers' and companies' behavior. In December 2020, the European Commission published a proposal for new policy tool - digital market act (DMA) - a regulation to ensure fair and contestable digital markets. Regulation poses restrictions on business behaviour of so-called gatekeepers included in list of core services (European Commission 2020).

Currently voice assistants (or digital personal assistants, DPAs, e.g. Apple's Siri, Amazon's Alexa, Google Assistant) are not in the list of core services, although they could be called gatekeepers in general sense. After publication of results of sector inquiry on consumer IoT (European Commission 2021), the European Commission decided to take a closer look into market of DPAs, starting with Google assistant (CPI 2021); results may lead to further insights regarding this specific market and DPAs' gatekeeping position. Furthermore, in November 2021, the Internal Market and Consumer Protection Committee of the European Parliament suggested to extend range of core services by including web browsers, DPAs and connected TV (European Parliament 2021).

This paper reflects the emerged controversy by addressing the following research questions:

- 1) Are DPAs gatekeepers for consumption? How and under which conditions DPAs have incentives for anti-competitive actions influencing competition on DPA and related markets?
- 2) Which regulation and competition policy approaches are suitable for this market? Should DPAs be included into DMA's core services and if yes, are all obligations posed valid from an economic perspective?

In order to answer these questions, in chapter 2, economics of competition on DPA market is analyzed and two framing factors - (horizontal) market power and cross-market integration within digital ecosystems - are identified. DPAs' influence on related markets and conditions for changes in incentive structures is discussed in chapter 3. Chapter 4 transfers results into regulatory framework and concludes that DPAs are seen as gatekeepers to be included into list of DMA's core services with need of some adjustments in obligations; for competition policy and antitrust decisions rebuttable presumptions should be updated and actions against growth

of new gatekeepers should be in focus of competition authorities. Chapter 5 sums main results up.

## **2. Economics of competition in DPA and related markets**

### ***2.1. The DPA market***

Further development of information technologies influences all spheres of modern people's life. One example of a newly emerging technology which becomes more and more popular during last years due to wider use of technologies of speech recognition and mechanisms of artificial intelligence (neural networks, machine learning) is voice assistants, also known in literature as digital personal assistants. At the moment there is no general definition of this technology because of its novelty, so further I will refer to the DPA as follows: a DPA "is an automated system that serves personal usage only and interacts with the user (consumer) in natural language, meanwhile applying original and third-party services to obtain information and perform various actions" (Budzinski et al. 2019, p. 179). In other words, DPAs constitute a special type of intermediaries which are able to communicate with its user with natural language and perform relevant tasks (provided by original or third-party suppliers). With respect to original understanding of gatekeeper role (see Lewin 1947, p.145) DPAs could be seen as "gatekeepers" since core characteristic of DPA is that it acts as a powerful arbiter who decides what to distribute or disseminate, and DPAs do so in regard to services addressed via them.

While using the voice function, DPA is gaining control over user's access to certain segment of market, getting gatekeeping power over it (Budzinski 2021). By answering questions and providing everyday information like weather forecasts DPA control user's general access to information; by reporting news - access to market of news; by sending messages and making calls – communication; by ordering a taxi - gateway to market of taxi/ taxi aggregators; by managing smart home systems - hub for multiple devices; by selecting products and ordering them in online shops – online shopping (also possible for offline shopping if advice/list of products created by DPA is used), etc. Due to network effects all interested parties from listed markets are tend to select already well accepted DPAs (as could be seen from statistics, Statista 2021), which leads to situation of better bargaining position of DPAs providers and agreement to given conditions from companies who want to be accessible to users via voice assistant(s), giving DPA's owner(s) power over settings how user could access/use application(s) (all information on specifics and characteristics of goods) as well as control over all valuable information flows on other users decisions coming through assistant (which may include data on purchasing decisions, user behaviour, and other data transmitted to the provider of service). At the same time, one should remember that DPAs' providers have overview of all related

markets which may lead to competitive advantage of goods from their ecosystem in case of presence in this market.

Online shopping of routine goods via DPAs could be used to illustrate possible competition problems. Online shopping via DPAs includes searching for and getting recommendations for goods with option to purchase them immediately, as well as independently purchasing consumer commodities (e.g. milk, toothpaste). Instead of having to engage in re-buying all the same daily products day-by-day, the user can ask his DPA to just refill the stocks of daily products as soon as they are emptied. Currently, this mostly requires dictating a shopping list (which becomes easier with data because the DPA learn which products the user likes to buy or prefers). Besides that, if the DPA is interconnected with a smart refrigerator, routine products may be re-ordered automatically. If DPA will shop these daily products at the stores with the best offers, then no problem exists - the users' welfare will be increased and competition between shops is promoted. While such a behavior of the DPA is expected if (i) there is effective competition in DPA market, (ii) the DPA supplier is independent – no integration or contracts with store operators, and (iii) the user may perfectly control the DPA's shopping. However, incentives may look very different if the DPA supplying company has economic interests in stores as well. For instance, where will Amazon Alexa shop or Google with cooperation with Walmart (Lore 2017)? A bias towards Amazon's online shopping platform (and supermarkets) or Walmart supermarkets from using the respective DPAs appears to be plausible. This selection bias, however, may reduce welfare effects for the user, which can even end up with welfare losses. Furthermore, it may significantly harm competition in related markets for daily products at the expense of stores, which do not benefit from DPA shopping (irrespective of their offers). This is just one of examples, with some extensions on specifics of product's market similar considerations could be provided for all services offered (for instance, similar concerns raised in audiovisual market Bourreau & Gaudin 2018 and Budzinski 2021).

## ***2.2. Why market power in the DPA market is a relevant problem?***

First, specifics of DPA market, which are relevant for antitrust analysis. The nature of competition in DPA market is affected by its characteristics, part of them are well captured in literature (inter alia, Evans & Schmalensee 2007; Haucap & Stühmeier 2016; Budzinski & Kuchinke 2020) and transferred into list of effects which should be assessed in order to conclude how probable is monopolization of such a market. Among them are strength of direct network effects (DNE) and indirect network effects (INE), size of market, economies of size, characteristics of consumer preferences, switching costs and multi-homing activities, and innovation dynamics. Results for DPA market, according to analysis in an earlier paper (Budzinski et al. 2019), are presented in table 1.

**Table 1 Presence of factors supporting market concentration on DPA-market**

Factors favoring monopolisation	Result for DPA-market	Comments
Strong and/or symmetric INE	<b>Present</b>	Increasing number of users leads to increasing amount of suppliers, and vice versa.
Strong DNE	Not strong	DPA itself could be a topic of discussion, but it does not provide any additional place for communication among users.
Small size of market	Not present	DPA's tasks are diverse and widespread. There is no geographic limitation.
Supplier-side economies of size	<b>Present</b>	The growth of number of users leads to improvement of the service due to better conditions for use of machine-learning algorithms and data mining. However, there exist decreasing returns to a further increasing (historical) database once a certain level of data has been collected. Fixed-cost digression effect also will favor a concentrated market.
Homogeneity of customers' preferences and platform services	Ambiguous	The fundamental idea of DPA is finding solutions for a fundamentally open-ended diversity of problems. This fact may imply that comprehensive services thrive, rather than specialized solutions, making the competition-enhancing effect of heterogeneous preferences rather ineffective.
High switching costs	<b>Present</b> on consumer side	For better serving needs of user DPA is firstly learning his preferences, which increases switching costs (i.e. here time for adaptation of new DPA) and supports lock-in effect on consumer's side.
Single-homing by user groups (consumers and suppliers of goods)	<b>Present</b> only on consumer side	Due to nature of DPA service as a comprehensive assistant to all personal needs and lock-in effects consumers tend to single-home. Multi-homing on suppliers' side.
Low innovation dynamics	Ambiguous	Currently, innovation dynamics are very high in the market as it is still a very young technology-driven market. But there may be strategic delays of innovations from big companies in future.

*Source: based on Budzinski et al. (2019)*

According to these elements of the DPA-market, the range of economic forces driving this market towards a (quasi-) monopolistic structure (i.e. single-firm dominance) and forming barriers to entry for new competitors are present. However, since some factors are ambiguous/countervailing situation of sustainable competition among several DPA service suppliers should be possible.

Based on IoT preliminary report of EC (survey-based results) Google Assistant, Alexa and Siri are mentioned as leading DPAs in the European market (European Commission 2021, p.7). Statistics of usage of such free services is scarce, mainly because some of them are pre-installed and come with devices (e.g. smartphones), where they are not the main functions. For this reason, smart speakers application could be a good proxy for worldwide state, e.g. available statistics of last quarter of 2020 shows: Amazon 28.3 per cent, Google 22.6 per cent, following by Baidu 11.3 per

cent, Alibaba 10.8 per cent, Apple 7.9 per cent, Xiaomi 6.5 per cent, and others 12.5 per cent (from 58.3 million devices sold) (Statista 2021). So, it is hard to have a clear allocation of market shares and name the order of players, but certain conclusions on market structure could be done: currently market has oligopolistic structure with some leading companies, followed by competitors (some of which mainly operate in national markets (i.e. China) and therefore not appear in results of European Commission's analysis). Besides that, the DPA market is one of prime examples where big tech giants meet each other in direct competition (based on market definition) and reasoning on defence of smaller companies which cannot compete with a powerful giant are not directly applicable for all market participants in this case. Market shows direct competition between GA(F)AM companies and new setting for smaller and regional competitors (there are new niches and in some countries own specifics). Usually, when analyzing the presence of competition between tech giants, it becomes difficult to adequately define the market; that is why it is one of core topics of discussion about adaptation of competition policy to digital space. For instance, in such case as German Competition authorities Facebook case (Bundeskartellamt 2019; Budzinski et al. 2021b), market where GAFA companies consider themselves to be competitors, such as advertising market, in the framework of antitrust cases is divided into the advertising market on social networks, contextual advertising market, etc., so the presence of competition between them is not confirmed. This makes DPA-case highly interesting for new insights and for discussion about proper regulation of the digital sector.

To sum up, the tendency towards concentration on/monopolization of DPA market could not be rejected; however not to the extent, that tipping is inevitable/efficient. Thus, horizontal market power in the DPA market is a relevant problem and should be the first element to shape framework for analysis of potential antitrust issues.

### ***2.3. Why market power within the digital ecosystem (cross-market integration) is relevant?***

In addition to the horizontal use of market power, there is a likelihood of its application within the digital ecosystems. The trend towards creation of such ecosystems to cover a multitude of related and interconnected markets has already been noted in various antitrust reports (executive summary in Kerber 2019), and there are proposals for introduction of an additional category of non-horizontal market power across the elements of such ecosystems to reflect challenges posed by such dynamics.

Ecosystem implies presence of vertical and conglomerate relationships in the company structure and addressed in this article through parameter of Cross-Market Integration (CMI) as the second fundamental element to organize potential antitrust issues with DPAs. Presence or absence of CMI influences company's incentives to apply different strategies since the amount of profit received by the company in total depends on the amount of profit in each specific market (DPA or adjusted)



with respect to their possible interrelations. Thus, the company can build a complex mechanism for balancing profits in the markets, for example, making some services free for users (in monetary terms), and at the same time making a profit on the markets related to these services. Key concerns in situation with CMI are raised by anticompetitive use of dual role of DPA as a platform and as an intermediary/gatekeeper for connection with related markets where subsidiaries of DPAs providers are present (see Padilla et al. 2020, Hagiú et al. 2020), e.g. by self-preferencing of own products. Presence of such concerns confirms the need to consider market power outside the framework of its horizontal application, here by means of CMI parameter (to consider the digital ecosystem as a whole and company's relevance across markets). Selected markets where DPA manufacturers are represented are listed in the table 2. One peculiarity of DPA market could be seen: if the DPA produced by one of the technological giants it will have a certain non-zero level of cross-market integration from the very beginning. This fact can stimulate/make possible for DPA providers to apply variety of anti-competitive practices.

**Table 2 Overview of services offered by main DPAs' providers**

Product	Amazon	Apple	Google	Microsoft
Digital personal assistant (voice assistant) in	+ (Alexa)	+ (Siri)	+ (Google Assistant)	+ (Cortana)
Own phone (DPA pre-installed)		+	+	+
Smart home speaker (DPA pre-installed)	+	+	+	+
Smart home devices - IoT with DPA	+	+	+	+
Car (DPA could be integrated)	+	+	+	+
Shopping (DPA could be integrated)	+		+	+
Payment	+	+	+	+
App store		+	+	+
Browser	+	+	+	+
Search engine (general)			+	+
Maps		+	+	+
EBooks	+	+	+	
Video distribution	+	+	+	+
Music distribution	+	+	+	
Photo Storage	+	+	+	+
Games	+	+	+	+
Video conferencing	+		+	+

Source: own representation based on Evans 2017, Miguel de Bustos & Izquierdo-Castillo 2019, Varian 2021, and companies' websites. Legend: "+" means that such a product is offered by provider of DPA

#### ***2.4. Derivation of the categories as a consequence of the two market power dimensions***

Thus, two main parameters for assessing the risk of creating incentives for the use of anti-competitive practices by the DPA provider are identified - market power and cross-market integration. This paper will consider the impact of them on DPA supplier's behaviour. In general, the combination of these parameters (that is, their presence or absence) corresponds to the situation

prevailing in the DPA market for a certain company. Thus, this situation can be classified into one of four categories, as graphically reflected in the table 3.

**Table 3 Categories for analysis**

		Cross-market integration (CMI)	
		No	Yes
Market power (MP)	No	<i>Category 1 (C1)</i>	<i>Category 2 (C2)</i>
	Yes	<i>Category 3 (C3)</i>	<i>Category 4 (C4)</i>

Here an explanation to each of these categories is provided:

- C1 (no MP & no CMI) - corresponds to a company that produces only DPA (i.e. does not provide any additional goods) and meets sufficient competition in its market;
- C2 (no MP, CMI) - corresponds to a company that offers along with the DPA some additional goods (distributed through this DPA) and (also) meets sufficient competition in DPA market;
- C3 (MP, no CMI) - corresponds to a company that produces only DPA, but occupies (in this market) a dominant position;
- C4 (MP & CMI) - corresponds to the company that has dominant position on DPA market and offers through it a certain set of its own goods.

After these scenarios are derived, RQ1 could be addressed based on overview of types of strategies connected with horizontal market power and/or existence of cross-market power and their interaction with each other.

**3. Potential anticompetitive practices by DPA suppliers**

As already noted, DPA market as a whole has tendency towards narrow oligopoly and even dominant position of one DPA. In order to formulate a set of recommendations for the competition authorities, it is necessary to dwell in more detail on the main practices of companies that can lead to problems with competition in these markets (that are the market of DPAs and related ones).

It should be noted that while addressing question on incentives to apply certain anticompetitive practice researcher could provide only overview of infinite list of practices (further shortcut P is used) that may or may not restrict competition. In rapidly changing environment companies develop new practices which could not be easily foreseen since they also may be based on new technological solutions, and such solutions may also have a pro-competitive effects or show harmful effects only under certain circumstances, as well as be generally anticompetitive. Thus,

the range of practices discussed in this section represents a set of practices that have been observed in digital ecosystems and/or discussed in academic literature and is not intended to be complete (neither for today, nor can it be comprehensive for the future). Further, I will briefly discuss selected practices or concerns and the incentives for anti-competitive (ab)use arising from MP, CMI, and their combination. These findings make possible to address the implications for competition policy and antitrust authorities in chapter 4 (i.e. to reply to RQ2).

### *3.1. Overview of anticompetitive practices*

#### **PI Excessive data collection and exploitation privacy**

Excessive collection of consumer data and the use of that data in ways that the consumer is not aware of and which could potentially negatively impact consumer's welfare<sup>1</sup> is one of core concerns in DPA case. Originally for providing better quality service and match to consumer's preferences DPA's nature as assistant requires extensive collection of data. One may assume that user accepts conditions of providing his data in order to receive good service, however, to check whether collection is balanced it is necessary to identify where lays the border between competitive level of data collection and abusive one. This is hard question to reply in general due to some aspects of users' behavior related to (i) existing information asymmetries and (ii) degree of rationality in decision-making. Economics of privacy address these topics in detail (this question applied to digital age is presented inter alia, in Taylor 2004; Acquisti & Varian 2005; Gross & Acquisti 2005; Hermalin & Katz 2006; Hui & Png 2006; Grossklags & Acquisti 2007; Beresford et al. 2012; Heidhues et al. 2016; Kerber 2016; Heidhues & Köszegi 2017; Obar & Oeldorf-Hirsch 2020, see for a modern overview Budzinski & Kuchinke 2020).

In the framework of current paper, it is important to note that information asymmetry reflects that consumer is less informed about how and in which amount his data is collected and used, so he cannot make an informed decision about the distribution of his data and could end with acceptance of disadvantageous data collection agreements. However, acceptance may be driven in framework of privacy paradox (Grossklags & Acquisti 2007; Beresford et al. 2012) and not to above described reasons. At the same time, even if consumer is in situation with absence of real choice, this still raise concerns (so called "take-it-or-leave-it" decision imposed by service suppliers with substantial market power). Disregard of nature of consent, consumer protection standards could be useful for reduction of information asymmetries.

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<sup>1</sup> The inevitable psychological side of application of DPAs is associated with problems of relying on algorithms may lay in loss of autonomy (Gal 2018), media bias and manipulation of public opinion (inter alia Xiang & Sarvary 2007; Anderson & McLaren 2012; Borgesius Zuiderveen et al. 2016; Flaxman et al. 2016), etc. However, such harms are hard to frame in a general way for all consumers, so they are possible and influence welfare analysis, but they are not in a scope of this paper.

For classification of this practice interplay between consumer protection standards and competition law plays essential role (see discussion in Kerber & Zolna 2020). Current antitrust precedent of recognized privacy harms caused by Facebook as a dominant player (on economics of Facebook case see Budzinski et al. 2021b) forced attention to relevance and application of this practice. In this case, market power as well as cross-market integration (e.g. Facebook as a huge conglomerate of related services used all of them for extraction of users' data) increased incentives to application of respective strategy to extend in which it was seen as abuse of dominance. Here another aspect could be highlighted – what about collection of data from business users, interested in application of service? Providers of DPAs are aiming to extend scope of collection as wide as possible (Stucke & Ezrachi 2018) to activate connected economies of scale and scope, but also possibility for behavioral discriminations and abuse of dominant position which could be advanced based on data analysis. This could take place in both directions – over consumers and over third party providers. Along with reasoning in Budzinski et al. 2021b, this harm to business partners, who face take-it-or-leave decision in case of market dominance in DPA market, should also be considered. There is less explanation why companies would be willing to agree on extensive data collection as users tend to do (information asymmetry is less as well as behavioral issues differ).

*C1-P1:* Provider of DPA has incentives to misuse users' personal data in order to gain additional income already without MP or CMI. Thus, consumer protection standards should enforce transparency over data usage or some minimal standards of data protection to specific case involving different types and ways of data collection that is necessary for proper functioning of DPA service. This area is not competition policy problem since in theory consumers have possibility to switch from one competitor to another if they are not satisfied with conditions of usage of their data. Same states for companies connected via DPA. However, possible preservation of such switching should always be checked (see section on strategic incompatibilities for details).

*C2-P1:* DPA integrated in ecosystem (i.e. with CMI) has higher incentives to collect more personal data since it has more options to its application. Asymmetry of information in this case stronger, especially since users are not always aware of ownership of offered good and such behavior of company is in general harder to detect. On the other hand, the implementation of such scenario does not necessarily lead to negative consequences for users. For instants, positive synergy effects may occur resulting in better service in both (or even more) related markets. Incentives to collect more data from competitors in related markets with purpose to improve position of own subsidiary (mainly based on results of data analysis of collected data)

increase. Nevertheless, consumers and third-party suppliers still could switch to other DPAs (with reservation noted above).

*C3-PI:* In this situation, users (and suppliers connected with users via DPAs) face take it or leave it decision by dominant undertaking. As follows from practice, this usually has negative consequences on their welfare. Since users have no real choice conditions offered tend to include variety of ways and amount of data collection which overcomes necessary amount actually needed to provide service (in a way horizontal abuse of market power takes place in this form); same states for business partners. For instance, Facebook case highlighted welfare decreasing practices in data collection by dominant undertaking (see Budzinski et al. 2021b).

*C4-PI:* This is a combination of second and third categories. On the one hand, users (and suppliers connected with users via DPAs) face take it or leave it decision. On the other hand, the company has incentives to use data collected in number of different ways and could have synergy effects between markets. However, in this case incentives and ability to excessively extract data are high, as well as incentives to make this data exclusive by artificial barriers.

Thus, for DPA case concerns may rise just based on nature of service, but cross-market integration and market power increase profitability of such strategy and incentives to its application. Strategy has potential to be more harmful in C3 and C4, but it also possible and could have welfare-decreasing effects without MP and CMI. In addition, data-driven advantages achieved may increase effects of other strategies applied by company.

## **P2 – Abusive pricing**

Horizontal abuse of market power is typically connected with increase of prices for consumers on the market and with shift of profit margins from suppliers of goods to powerful downstream firm (European Commission 2004). However, as current DPAs' stylized business model is platform (Budzinski et al. 2019), a different price setting mechanism should be considered, i.e. asymmetric pricing structure. Due to indirect network effects between suppliers (who use intermediary service of DPA to sell their goods) and consumers, burden could mostly lay on the platform side which benefits the mostly from strong INE – on suppliers' of goods. In this case, abuse in form of excessive pricing may be found only towards this group, since users pay no monetary price for access to DPA service (except buying specific device to use DPA, e.g. smart speaker), but no monetary price does not mean that no welfare harms are possible, they just take different shape (Newman 2015). On the other hand, if users have no chance to escape due to MP of DPA or if they have tendency to single-home in DPA market (e.g. due to high switching costs), then DPA-provider may abuse power over users locked into its system (strong

lock-in effects) and price increases on previously subsidized platform side (on consumers) may occur as well.

Since the business model of DPAs can take either shape, either set of effects may occur. In general, higher possibility and incentives to extract more profit can be found in C3-P2 and C4-P2 (i.e. in categories with significant MP). CMI in this case could incentivize application of abusive strategies over users and dependent suppliers, since CMI increases bargaining power of dominant DPA and adds additional ways to extract consumer surplus in form of price of produced goods.

### **P3 – Vertical rising rivals costs’ strategies: quality dimension**

If a company has market power, it has incentives to use it not only horizontally, but also vertically. In order to generate additional revenue from interactions with counterparties in a related market, or in case of CMI - to gain market power in related market(s) as well (leverage market power to adjacent markets), all of these lead to rise of rivals’ costs (RRC). Different practices which deliberately reduce quality of DPAs service in order to gain additional benefits from gatekeeper’s position could be named here: obtaining the best conditions when concluding a contract in connection with the threat of foreclosing the market for suppliers of some goods, self-preferencing of own goods (preference in placing of own product, CMI required), selling goods in bundles (CMI required). Harmful effects of these practices are based on economic dependency of firms in related markets from producers of voice assistants (concept is discussed among others in Bougette et al. 2019). More precisely, following could be listed among possible ways to distort competition in both connected markets (DPA-market and adjacent market for goods):

(i) Exclusionary exclusive dealing in terms of possibility for business partners to offer products through another intermediary or their own and in terms of setting own prices for this (most-favoured-business-partner clauses).<sup>2</sup> This practice aims to lock in business partners into intermediary service and to create an artificial competitive advantage for the DPA provider as well as secure profits (avoid free riding: getting recommendation via DPA and purchasing directly from web page). Also if consumer finds out better price via such switch to own web page it could influence his future behavior and distort his trust to purchasing via DPAs (with the assumption that it always will be more expensive).

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<sup>2</sup> In Caccinelli & Toledano (2018) competition proceedings against Booking.com’s rate parity clauses in France, Germany, Italy and Sweden were considered, which are mainly resulted in negative assessment for welfare (pp 233-234)

In general, exclusive dealing is a common business practice and is not anti-competitive per se, but “in the unusual case where exclusionary dealing creates, enhances, or preserves power over price and output” welfare decreasing effects prevail and antitrust intervention becomes appropriate (Jacobson 2002, p. 369)

(ii) Closely connected is bundling, a practice of selling goods together. Bundling is seen anticompetitive if it is used as tool of leveraging of market power from one market to another or as tool of creating barriers to access market (since company would need to access both markets to compete) (Nalebuff 2004). Currently it is hard to say that it would be profitable for tech companies to use pure bundling from DPA market to other products markets since consumers already have variety of services they just want to add in this additional way of access via voice (e.g. music consumption via third party suppliers (e.g. Spotify)). However, if user does not have specific preferences and gets offer bundled with service, e.g. in case of online shopping (if Alexa could make orders only via Amazon and could not assess any other online shop), this may distort competition between shops. Also bundling works not only from DPAs market’s side, but in opposite direction (towards DPAs) as well, i.e. tech companies use pre-installation and default option setting to promote their DPAs, so it is rather opposite way from other goods’ markets with dominant/substantial position to DPAs market. This becomes anticompetitive if harms competitive situation on DPAs market.

(iii) Refuse to deal/denial of access is a practice when DPA provider refuses to have business relations with some other companies. At first it seems unrealistic that service aiming to cover all types of consumers requests and to be helpful butler could deny access for some firms. However, in presence of CMI incentives for such direct foreclosure of market from competition in adjacent market seems profitable. If company has market power, this possibility to foreclose the market may be use to strengthen bargaining position for imposing terms and conditions in favor of DPA supplier. This practice could have direct impact on costs of final goods for consumers and decrease welfare of consumers in this regard.

(iv) Self-favoring or self-preferencing - is a practice in which DPA gives priority to goods offered by the manufacturer of this DPA; such practice arises in the presence of CMI and causes particular harm to suppliers of goods in markets adjacent to the DPA as a gatekeeper since it artificially reduces competition on merits. The topic is closely connected to discussion on algorithmic search and recommendation systems which empower DPAs suggestions and could be biased during personalization of outcomes (Budzinski et al. 2021a; Bourreau & Gaudin 2018). From structural perspective practice addressed in literature on dual role of intermediary, which states different results of welfare analysis depending on heterogeneity of consumers’ and firm’s goals, e.g. are users willing to pay more for better service or they are not value

personalization as much as companies who invest in it (De Corniere & Taylor 2019); type of demand growth observed (Padilla et al. 2020); absence of restrictions on replication of third-party's innovative products (Hagiu et al. 2020). Lack of general approach for welfare analysis of dual role and self-preferencing leads to discussions on case-specific reasoning under which structural separation could be seen as fitting solution to fix problems (Khan 2019; Gilbert 2021). Generally, if users would be fully informed and very cautious about possible biases from providers side, then it would be very hard for firms to apply such strategy, however, usually the situation is opposite, especially when users develop trust in recommendations given by DPAs (Stucke & Ezrachi 2018; Budzinski et al. 2019).

*C1-P3:* For DPA provider from the first category exclusive dealing seems to be one of profitable options from this range of strategies, scope for anti-competitive effects in this regard is low.

*C2-P3:* Amount of practices facilitated by CMI is wide, but for company without MP effects still low and welfare analysis ambiguous. For instance, self-preferencing by non-dominant firm could be a profitable tool for company, although with low effects on competition since consumers could switch to other platforms. Different leveraging strategies from connected markets to DPA market could be applied (if company has dominant position there), but with existing choice in DPA market this may be not a serious problem, as well as refuse to deal and exclusive dealing.

*C3-P3:* Once market power acquired listed strategies have potential to become more harmful (except availability of self-preferencing).

*C4-P3:* All of listed approaches are applicable in the scenario and could significantly distort competition in adjacent markets.

#### **P4 – Horizontal rising rivals costs' strategies: incompatibility**

Practice is realized through the incompatibility of the DPA service with goods of other manufacturers (consumers being locked-in within the ecosystem created by the DPA provider on technical basis). The question is whether this is an artificially created limitation, or is it caused by real technological peculiarities. This strategy is more effective when the company has market power in the DPA market, since then the circle of people falling under the negative effect of the practice is wider and change in balance of competition is more visible; but an oligopoly setting can also stimulate equilibrium (in a collusion), where each oligopolist uses his consumers (i.e. he is a monopolist in his segment of the market). However, if consumers do



not realize that they are closed within the ecosystem, then the strategy can operate even with small market shares (and still have an anti-competitive effect). Typically, the market in the growth stage reduces the incentives for this strategy, since it encourages a focus on gaining new customers, but the more stable the market becomes, the higher are the incentives to lock in users.

*C1-P4*: Since in this scenario firm has one market to compete (DPAs market), interoperability could be applied to prevent switch of users from one DPA to another, but also of business partners, since this will increase their costs. Thus, it could be considered as an additional barrier to entry for new competitor and as a tool to strengthen current market position.

*C2-P4*: Incompatibility gives more gain for ecosystem setting, since all effect from C1-P4 will be on several markets. There it has rather exploitative character over existing users and competitors in several markets.

*C3-P4*: Under these conditions strategic incompatibility as seen as a tool for securing market position (has exclusionary character) connected with leveraging of market power and foreclosing market from rivals.

*C4-P4*: Incentives to settle DPA as technical solution without compatibility have both exploitative and exclusionary character.

#### **P5 - Decrease in innovation activity**

It is usually assumed that a company with market power (C1 and C2 are excluded) has lower incentives to innovate than a company under competition. This practice can be implemented not only in slowing down innovation activity, but also in delaying implementation of new innovations to longer obtain benefits from previous developments. Additional way to decrease innovations is influence on incentives for other companies – through overly broad and excessive patents, artificial technological barriers to entry the market, killer acquisitions, and other anti-competitive practices which rise rivals' costs and redistribute resources away from innovations. It is especially seen in replies from companies developing IoT solutions and calling for acceptance of their innovative solutions rather than need to adjustments of DPA-provider conditions (European Commission 2021, see also interoperability discussed above).

*C1* and *C2-P5*: With reasoning in line with interoperability concerns may have slight harmful effects.

*C3-P5*: Innovations are usually expensive and in absence of pressure from competitors firm may longer get more out of old innovations and delay implementation of others in a profitable way.

*C4-P5*: In this dominant company with ecosystem have even more markets to be influenced and harmful effects are spread.

### **P6 - Countervailing power via collusion**

The scenario depicts the possibility of jointly opposing the power of the monopolist to gain more weight in the negotiations, or to counter the negative effects of abuse of market power by the monopolist (“rebalancing of power in the market”, Gaudin 2018). The presence of such a monopoly player is required and potential or actual attempt of it to apply anticompetitive practices (so, C1 and C2 are excluded). Here, special attention should be paid for companies at the most commonly addressed via DPAs markets (the most influenced ones), since they have more incentives for collusive behavior. This practice has potential for both pro- and anti-competitive effects. In short run it could allow companies to oppose power of intermediary for better conditions (not always in favor of end users), but at the same time already two (or more) markets suffer from decrease in competitive pressure, de facto concentration. Thus, in long run concentration problems overweight direct gains.

*C3-P6*: Facing dominant firm in DPA level companies from related market could in order to increase their bargaining power act in coordinated way, to prevent extraction of their surplus by dominant intermediary. This in turn still reflects in prices for goods consumed, since coordination also requires additional effort and brings costs, and decreases welfare.

*C4-P6*: If in addition to the market power there is own company in connected market then incentives to profitable anti-competitive actions increase since firm could foreclose competitors without financial loss; here cartel on business side may have less influence.

### **P7 - Collusion among DPA suppliers**

It is possible that DPA providers have incentives to coordinate their actions in order to receive higher profits. Type of possible coordination may reflect platform characteristic in a way that it would be not a fix-price cartel but rather cartel based on quantity or quotas, or market division. From theory we know characteristics which support stability of such coordination: small number of relevant players in market, homogeneity of the good, high market barriers, multi-market contracts, slow innovation dynamics, experience with cartels, degree of detection probability, etc. (Motta 2004; Kerber & Schwalbe 2008). DPA market may represent a case where range of factors facilitated stable agreements. Main market participants are four tech

giants (Amazon, Apple, Google, and Microsoft), which have multiple multi-market contracts (see table 2, p. 8); homogeneity is rather present and innovation dynamics is ambiguous (see assessment in table 1); main players already were involved into range of anticompetitive conducts and gained experience; market has rather high entry barriers. Balancing forces would be: absence of stable environment in dynamically changing market, increased detection probability due to focus of competition authorities on competition in digital markets, and non-transparency of DPA market. However, it is questionable if these forces are enough to preclude formation of anticompetitive cartel. Thus, in C1-P7 division of market is possible, and in C2-P7 cross-market integration additionally favors stability of anticompetitive agreements.

Summary of combination of Categories and Anticompetitive Practices is presented in table 4, and once again highlights existence of incentives to apply certain practice/range of practices for each category of firm.

**Table 4 List of categories of firms combined with practices**

Category of firm	P1 Excessive data collection and exploitation privacy	P2 Abusive pricing	P3 Vertical rising rivals costs' strategies : quality dimension	P4 Horizontal rising rivals costs' strategies: incompatibility	P5 Decrease in innovation activity	P6 Countervailing power via collusion	P7 Collusion among DPA suppliers
C1	+	x	x	Rather no	Rather no	Rather no	+
C2 (CMI)	+	x	x	Exploitative	Rather no	Rather no	+
C3 (MP)	+	+	+	Exclusionary	+	+	Rather no
C4 (MP & CMI)	+	+	+	Exploitative & Exclusionary	+	+	Rather no

Legend: + "concern exist", x "not applied"

From the table it can be concluded that the most dangerous market situation is situation 4, since it has highest potential to harm consumer welfare; least dangerous - situation 1; situations 2 and 3 can be classified as intermediate. This conclusion is consistent with the assumptions made earlier: the greatest danger to competition in the market is the situation when a certain company (or companies) concentrate MP and CMI in their hands.

### ***3.2. Conclusion of combined analysis of categories and practices***

From the analysis of practices, it can be seen that:

- One of four identified categories (C1) can be characterized as the most favorable, since it has the smallest number of practices to worry about;
- Categories C2 and C3 are not sustainable as companies there tend to use their MP or CMI to obtain CMI with adjacent markets or MP in the DPA market, respectively; if these trends are realized, the company concerned will move to category C4.

Note that categories C1 and C4 are generally more stable than categories C2 and C3 (because in these categories, the synergy effect will be best achieved when moving to C4, which creates an incentive for the company to find a way to make such a transition). However, in category C2 (without MP, but with CMI), the company seeks to acquire market power, because it will get the greater effect the more integrated markets it occupies (this can be achieved in various ways, and not all of them are subjects of antitrust regulation); thus, C2 tends to C4. In C3 the manufacturer has already achieved market power in the DPA market and can use this advantage to extend its influence to adjacent markets by creating its own divisions in them. At the same time, the manufacturer can apply the knowledge available to him as a gatekeeper to best adapt his products to the needs of consumers, thus gaining a competitive advantage and making it easier for him to enter the market. Thus, C3 tends to C4.

- The last category is the most dangerous one, since it provides a large number of possible scenarios for the use of MP and CMI that harm competition in the DPA market and related markets, as well as social welfare.

## **4. Implications for antitrust policy and regulation**

### ***4.1. Deriving optimal regulation***

As shown in previous chapters, there is scope for antitrust concerns with DPAs, especially due to their intermediary position. In line with identified characteristics each of the four categories has different potentials for anti-competitive actions. Thus, rebuttable presumptions shaping regulation for DPA market can be derived as represented in table 5. It should be noted that presumptions have an important role in formulation of the antitrust law and in case argumentation since legal decisions are made in situations with imperfect information and reflect probability of pro- or anti-competitive impact of a category of restrictions arising from market facts. It is necessary to note that while designing an optimal regulation, authorities should not concentrate on currently applied business model, since DPAs could easily switch between different revenue-models but will still be gatekeepers from an economic perspective.

This should help to avoid problems that similar from economic perspective services addressed by regulation differently (see example of audiovisual industry in Budzinski 2021).

**Table 5 Rebuttable presumptions and possible remedies**

Category of firm	Main concerns	Rebuttable presumption and remedies
C1	P1,P7	Generally pro-competitive situation, any interventions need burden of proof from competition authorities. Consumer protection standards and systematical screening for cartel formation in DPA market (competition policy tool) should be enough to address identified problems.
C2 (CMI)	P1,P4,P7	Mostly pro-competitive situation, thus, interventions need burden of proof from competition authorities. Growth of MP should be prevented by ex-ante instruments (preferably through merger control) and controlled by ex-post competition law. Further CMI should be restricted.
C3 (MP)	P1-P6	Range of antitrust concerns is wide and requires behavioral regulation of the company; burden of proof to apply for exceptions is on company's side. Prevention by stricter merger control as in C2 is recommended. As ex post tools: control of abuse of market power, prevention of cross-market integration in order to prevent tipping into C4 and screening for cartel formations in adjacent markets. Sector-specific regulation.
C4 (MP & CMI)	P1-P6	Generally anti-competitive situation, needs burden of proof from company. In this case remedies listed above should be stricter as for previous categories, unbundle/break up options could be considered.

Offered proposal for DMA is originally based on accumulation and aggregation of outcomes of reports produced by competition authorities worldwide (for overview of reports see Kerber 2019) and is currently under discussion (see European Parliament 2021 as well as inter alia, Kerber 2021; Podszun et al. 2021; Cabral et al. 2021; Budzinski & Mendelsohn 2021). However, it is questionable how well such regulation fits specific case of DPAs.

#### ***4.2. Assessment of current DMA proposal in regard to DPAs***

First of all, DPAs enjoy relevant gatekeeping position with growing range of connected goods available via them (see chapter 2) and multiple possibilities for anti-competitive actions (see chapter 3), thus, I agree with the proposal of the Internal Market and Consumer Protection Committee of European Parliament and initiative to include this service into the list of core services established by the DMA (Art. 2) (further I refer to articles from DMA act as proposed by European Commission 2020). At the same time DMA has two-step procedure, and it is not

enough to provide core service to be classified as gatekeeper: three quantitative criteria from Art. 3 (1-2) should be satisfied (financial – turnover was € 6.5 billion or more in the last 3 years or last financial year market capitalization exceeds € 65 million; amount of active users - monthly end users on average exceeds 45 million and business users - 10 thousand yearly; stability and growth over time - the users' thresholds reached in each category of past 3 years); if criteria are not reached, the Commission may still classify a particular firm as a gatekeeper based on various qualitative assessments. To assess whether any of DPAs' providers fall under these criteria internal information is required since pre-installation in multiple devices and absence of separation of DPAs' usage from other results of companies' performance make it impossible to properly address this issue. It is possible that providers of leading assistants – Amazon, Google and Apple with all devices in their ecosystems (e.g. smart-home equipment, smart speakers, tablets, phones etc.) could reach monthly active end users and yearly usage criteria, but probably not for each of the last three years since market was and still is growing actively (e.g. Google introduced its smart speaker in 2016, Apple – in 2017); with absence of monetary price for usage of service – financial criteria look problematic for DPAs case. Since it is not possible to deny gatekeeper concerns in DPA market and criteria offered in DMA are hard to be applied without additional proxies, I recommend to make a separate decision for DPA case and include them not only into core-services, but also classify assistants as gatekeepers applying rebuttable presumptions offered in table 5, rather than some quantitative metrics, and complement this with in depth analysis of additional criteria (see table 1 and Art. 3 (6)).

From the range of practices listed in the DMA, several problematic issues identified in chapter 3 are considered (practices P1-P5), although some further clarifications are required. For instance, the prohibition of self-preferencing should be forced in the DPA case. Acting as gatekeepers, DPAs have significant incentives to apply this strategy and even if a given DPA does not dominate market it could act like a monopolist over existing (locked-in) users. Self-preferencing could be extremely harmful for competition in related markets, especially if we consider long term effects and increasing development of voice shopping. Existing information asymmetries bring to DPA's provider new advantages since it has overview of all transactions in different market segments and could use this information for better adaptation of self preferencing. Especially with voice input-output, it would be hard to grasp and track back how self-preferencing occurred, some behavioral particularities and trust-development also add to this concern, thus, it is better to prohibit such practice per se by listing it in Art. 5 (instead of Art. 6). Additionally, this could decrease incentives for further CMI and improve competition on merits and innovation incentives by participants in all relevant markets.

Another example of an appropriate measure is the prohibition of strategic incompatibility/forced interoperability (Art. 6e; practice P4). For instance, as the IoT report has shown (European Commission 2021), providers of other IoT technologies feel need in implementation of DPAs into their systems (due to request from users' side). If there will be general standards for DPAs' technologies (and not only specific ones from each company), this will reduce costs and promote innovations and speed up their implementation in multiple areas. This can be seen as part of avoiding RRC strategies in both horizontal and vertical dimensions. In addition, for DPA case regulation of default option and de-installation (Art. 6b) plays important role. As can be seen from overview of device offering DPAs as pre-installed option (see table 2), existence of provider's ecosystem could support successful market entry. The default option in this case creates behavioral response from users with two sides of welfare effects: gained ecosystem advantages (reduction of transaction costs) vs lock-in effect and increased switching costs (reduction of competition, tipping of market; see chapter 2). To facilitate innovation dynamics and open markets two obligations (i.e. interoperability (Art. 6e) and possibility of de-installation (Art. 6b, European Parliament 2021 offered it to be 5g-b)) should be moved to black-list (to Art. 5).

However, there are some obligations which could decrease positive welfare effects of DPAs. For instance, the obligation to avoid combination (pooling) of data. In the digital age, data is essential for analysis and identification of consumer preferences and tailoring DPAs' service and other services for consumer's needs. Prevention of combining data could decrease quality of service, DPA in assisting daily life should base its replies on user preferences derived by data analysis. Such personalization is expected and is a part of quality assessment, since it reduced transaction costs, e.g. information-searching costs, decision-making costs (for overview of other benefits brought by DPAs see Budzinski et al. 2019). Apart from that, personalization (together with technical features of DPAs) has valuable social contribution while DPAs are being used by elderly people and people with disabilities. In particular for these groups, assistant makes assess to variety of services easier than before and provides adaptations to individual wants, needs, and peculiarities (Budzinski et al. 2019). Since health issues are extremely individual, prohibiting data-pooling may be particularly harmful for this important area of application. On top of that, some external effects as improvement of service in related markets could occur if results of data analysis are implemented to improve goods consumed via DPA. Thus, for DPAs such obligation should be not in Art. 5, but maybe in Art. 6, so Commission could request and collect some additional insights to shape/adjust regulation.

Additionally, fair and non-discriminatory conditions of access to core service (Art. 6k) should be related not only to app stores, but for other services, including DPAs, as well. This is already

included in proposal from the Parliament (European Parliament 2021). However, it is not clear why it is placed in Art. 6 (where further specifications are needed): transfer to Art. 5 would be generally recommended.

There are areas which are not or insufficiently addressed in DMA: risk of collusive agreements both between DPAs and between other economic agents as countervailing power to gatekeeper (practices P6 and P7), risk of purchase or replication of third-party innovative services (kill zone, part of P5), and general risk of raise of new powerful gatekeepers. However, these areas could be successfully covered by existing competition policy in form of market screenings and stricter control of horizontal, vertical and conglomerate mergers. Behavioral remedies prohibiting extensive grow of ecosystems by addressing possibility of replication of the most successful products on their own (Hagiu et al. 2020) could be used in addition to merger control. Thus, although some areas of concern are covered by DMA (part of them need to be prohibited directly – i.e. moved to Art. 5), some seems to need rethinking and reshaping. There are still open questions in area of capturing market dynamics and preventing raise of new gatekeepers. I argue in favour of complementing ex-ante regulation with ex-post solutions with changes in underling presumptions (see sub-chapter 4a).

## **5. Conclusion**

Voice assistants are still representing rapidly growing market, however, some tendencies towards monopolization within this market already could not be rejected. By its intermediary position assistant serve gatekeeping function for (not only) voice-enabled consumption. As analysis of incentives have shown, there exist relevant anti-competitive concerns which should be addressed to secure benefits of DPAs. Since the market and competitive strategies of DPAs' manufacturers continue to evolve rapidly and their exact shapes are difficult to predict in advance, the approach for analysis proposed in this article is more important than a detailed reflection of current market situation (or static situation at any particular moment of time). That is why framework for analysis of different stages/types of firms was used, two framing factors were identified as the most influential on strategic decisions: (horizontal) market power, and cross-market integration within digital ecosystems. In this framework following practices, influencing competition an adjacent and DPA market were questioned: excessive data collection and exploitation privacy, abusive pricing, vertical and horizontal rising rival's costs, decrease in innovation activity and collusion among DPA suppliers or other firms (as countervailing power). Already at the first consideration of 4 different categories of companies (different combinations of MP and CMI), one can conclude that companies from category C3 and category C2 are not sustainable in them, since they tend to use their market power or cross-



market integration to obtain missing characteristic (cross-market integration or market power, respectively). If these trends are realized, the company concerned will move to category C4 and increase its gatekeeping power. Thus, it is recommended to pay special attention to this particular category and, as a correction for the negative consequences, it is proposed to change the rebuttable presumption from a pro-competitive presumption to a strong anti-competitive one. This will shift the burden of proof from the applicant to the defendant and should lead to more accurate decisions on security of competition since it will bring more insights from the defendant's side.

Based on provided analysis, it is recommendable to include DPAs into DMA's core services. Some obligations need to be re-framed, e.g. self-preferencing, compatibility and changes in default option settings moved to black-listed practices; relevance and approaches towards data aggregation and data sharing should be re-considered, so that quality of service and innovation incentives will not suffer from regulation. As a downside of DMA I identified absence of actions about risks of collusion, purchase and/or replication of third-party innovative services (kill zone) and, in general, raise of new powerful gatekeepers. Thus, in order to fully unlock potential of digital competition and innovations I state need of complementing ex-ante regulation of DPA's market with ex-post solutions based on changes in underlying presumptions for competition policy analysis.

## References

- Acquisti, A., & Varian, H. R. (2005) Conditioning prices on purchase history, *Marketing Science*, 24(3), 367–381.
- Anderson, S. P. & J. McLaren (2012) Media Mergers and Media Bias with Rational Consumers, *Journal of the European Economic Association*, 10(4), 831-859.
- Beresford, A. R., Kübler, D., & Preibusch, S. (2012) Unwillingness to Pay for Privacy: A Field Experiment, *Economics Letters*, 117(1), 25-27.
- Borgesius Zuiderveen, F. J., Trilling, D., Möller, J., Bodó, B., De Vreese, C. H., & Helberger, N. (2016) Should we worry about filter bubbles? *Internet Policy Review*, 5(1), 1-16.
- Bougette, P., Budzinski, O. & Marty, F. (2019) Exploitive Abuse and Abuse of Economic Dependence: What Can We Learn from an Industrial Organization Approach? *Revue d'Economie Politique*, 129(2), 261-286.
- Bourreau, M., & Gaudin, G. (2018). Streaming platform and strategic recommendation bias. CESifo Working Paper 7390

- Budzinski, O. & Mendelsohn, J. (2021) *Regulating Big Tech: From Competition Policy to Sector Regulation?*, ORDO, forthcoming.
- Budzinski, O. (2021) *Gatekeeping in the Audiovisual Sector: Economic Background, Competition, and Regulation*, in: M. Cappello (ed.), *Unravelling the Digital Services Act Package*, IRIS Special 2021-01, Strasbourg: European Audiovisual Observatory, 94-109.
- Budzinski, O., & Kuchinke, B.A. (2020) *Industrial Organization of Media Markets and Competition Policy*, in: B. von Rimscha (ed.), *Handbook Economics and Management of Media and Communication*, Berlin: DeGruyter, pp.21-45.
- Budzinski, O., Gaenssle, S. & Lindstädt-Dreusicke, N. (2021a) *Data (R)Evolution – The Economics of Algorithmic Search & Recommender Services*, in: S. Baumann (ed.), *Handbook of Digital Business Ecosystems*, Cheltenham: Elgar, forthcoming.
- Budzinski, O., Grusevaja, M., & Noskova, V. (2021b) *The Economics of the German Investigation of Facebook’s Data Collection*, *Market and Competition Law Review*, 5(1), 43-88.
- Budzinski, O., Noskova, V., Zhang, X. (2019) *The Brave New World of Digital Personal Assistants: Benefits and Challenges from an Economic Perspective*. *NETNOMICS*, 20 (2–3), 177–194.
- Bundeskartellamt (2019) *Decision B6-22/16 Facebook Inc. i.a. - The use of abusive business terms pursuant to Section 19 (1) GWB*, February 6, 2019
- Cabral, L., Haucap, J., Parker, G., Petropoulos, G., Valletti, T. & Van Alstyne, M. (2021) *The Digital Markets Act: A Report from a Panel of Economic Experts*, Luxembourg: European Union.
- Caccinelli, C., & Toledano, J. (2018) *Assessing Anticompetitive Practices in Two-Sided Markets: The Booking.com Cases*, *Journal of Competition Law & Economics*, 14(2), 193-234.
- CPI (2021) *Probe of Google assistant*, available at: <https://www.competitionpolicyinternational.com/eu-probes-googles-voice-assistant/>
- De Corniere, A., & Taylor, G. (2019) *A model of biased intermediation*, *The RAND Journal of Economics*, 50(4), 854-882.
- European Commission (2004) *Guidelines on the assessment of horizontal mergers*. OJ (2004)/C, 31(03).
- European Commission (2020), *Proposal for a Digital Markets Act*, COM(2020) 842 final, Brussels.

European Commission (2021) Preliminary Report - Sector Inquiry on Consumer Internet of Things, available at: [https://ec.europa.eu/competition-policy/public-consultations/2021-internet-things\\_en](https://ec.europa.eu/competition-policy/public-consultations/2021-internet-things_en)

European Parliament (2021) Digital Markets Act: ending unfair practices of big online platforms, press release, available at: <https://www.europarl.europa.eu/news/en/press-room/20211118IPR17636/digital-markets-act-ending-unfair-practices-of-big-online-platforms>

Evans, D. S. (2017) Why the dynamics of competition for online platforms leads to sleepless nights but not sleepy monopolies, available at: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3009438](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3009438)

Evans, D., & Schmalensee, R. (2007) The Industrial Organization of Markets with Two-Sided Platforms, *Competition Policy International Journal*, 3, 151-179.

Flaxman, S., Goel, S., & Rao & J. M. (2016) Filter Bubbles, Echo Chambers, and Online News Consumption, *Public Opinion Quarterly*, 80, 298-320.

Gal, M. S. (2018) Algorithmic challenges to autonomous choice, *Michigan Telecommunications and Technology Law Review*, 25(1), 59-104.

Gaudin, G. (2018) Vertical Bargaining and Retail Competition: What Drives Countervailing Power?, *The Economic Journal*, 128(614), 2380-2413.

Gilbert, R. J. (2021) Separation: A Cure for Abuse of Platform Dominance?, *Information Economics and Policy*, 54, <https://doi.org/10.1016/j.infoecopol.2020.100876>

Gross, R., & Acquisti, A. (2005) Information Revelation and Privacy in Online Social Networks: The Facebook Case, *Proceedings of the 2005 ACM Workshop on Privacy in the Electronic Society*, 71-80.

Grossklags, J., & Acquisti, A. (2007) When 25 Cents is too much: An Experiment on Willingness-To-Sell and Willingness-To-Protect Personal Information, *The Workshop on the Economics of Information Security (WEIS)*, June 2007, Pittsburgh, USA.

Hagiu, A., Teh, T.-H. & Wright, J. (2020) Should Amazon be allowed to sell on its own marketplace? Discussion paper, available at: [http://andreihagiu.com/wp-content/uploads/2020/05/Hagiu\\_Teh\\_Wright\\_May2020.pdf](http://andreihagiu.com/wp-content/uploads/2020/05/Hagiu_Teh_Wright_May2020.pdf)

Haucap, J., & Stühmeier, T. (2016) Competition and antitrust in internet markets. In: Bauer JM and Latzer M (eds) *Handbook on the Economics of the Internet*. Cheltenham, UK: Edward Elgar Publishing, pp. 183-210.

Heidhues, P., & Köszegi, B. (2017) Naivete-based discrimination, *The Quarterly Journal of Economics*, 132(2), 1019-1054.

- Heidhues, P., Kőszegi, B., & Murooka, T. (2016) Inferior products and profitable deception. *The Review of Economic Studies* 84.1, 323-356.
- Hermalin, B.E., & Katz, M.L. (2006) Privacy, property rights and efficiency: The economics of privacy as secrecy, *Quantitative Marketing and Economics*, 4(3), 209-239.
- Hui, K.L., & Png, I. (2006) The economics of privacy. In: Hendershott T (eds) *Economics and Information Systems*, Amsterdam: Elsevier, pp. 471-493.
- Jacobson, J. M. (2002) Exclusive dealing, foreclosure, and consumer harm. *Antitrust Law Journal*, 70, 311-369.
- Kerber, W. & Schwalbe, U. (2008) *Economic Principles of Competition Law*, in: F.J. Säcker et al. (eds), *Competition Law: European Community Practice and Procedure*, London: Sweet & Maxwell
- Kerber, W. & Zolna, K. (2020) The German Facebook Case: The Law and Economics of the Relationship between Competition and Data Protection Law, available at: <http://dx.doi.org/10.2139/ssrn.3719098>.
- Kerber, W. (2016). Digital markets, data, and privacy: competition law, consumer law and data protection. *Journal of Intellectual Property Law & Practice*, 11(11), 856-866.
- Kerber, W. (2019) Updating Competition Policy for the Digital Economy? An Analysis of Recent Reports in Germany, UK, EU, and Australia, available at: <http://dx.doi.org/10.2139/ssrn.3469624>
- Kerber, W. (2021) Taming Tech Giants With a Per-Se Rules Approach? The Digital Markets Act from the “Rules vs. Standard” Perspective, *Concurrences*, 3, 28-34
- Khan, L. M. (2019) The separation of platforms and commerce, *Columbia Law Review*, 119(4), 973-1098.
- Lewin, K. (1947) *Frontiers in Group Dynamics: II. Channels of Group Life; Social Planning and Action Research*. *Human Relations*, 1(2), 143–153.
- Lore, M. (2017) Walmart, Google partner to make shopping even easier – Here’s how, available at: <https://blog.walmart.com/innovation/20170823/walmart-google-partner-to-make-shopping-even-easier-heres-how>
- Miguel de Bustos, J.C. & Izquierdo-Castillo, J. (2019) Who will control the media? The impact of GAFAM on the media industries in the digital economy, *Revista Latina de Comunicación Social*, 74, 803-821.
- Motta, M. (2004) *Competition Policy: Theory and Practice*, newest edition, Cambridge: Cambridge University Press.

- Nalebuff, B. (2004) Bundling as an entry barrier, *The Quarterly Journal of Economics*, 119(1), 159-187.
- Newman, J. M. (2015). Antitrust in zero-price markets: Foundations. *University of Pennsylvania Law Review*, 164, 149-206.
- Obar, J. A., & Oeldorf-Hirsch, A. (2020) The biggest lie on the internet: Ignoring the privacy policies and terms of service policies of social networking services, *Information, Communication & Society*, 23(1), 128-147.
- Padilla, J., Perkins, J. & Piccolo, S. (2020) Self-Preferencing in Markets with Vertically-Integrated Gatekeeper Platforms, CSEF Working Papers N 582.
- Podszun, R., Bongartz, P. & Langenstein, S. (2021) Proposals on how to improve the Digital Markets Act, available at: <https://ssrn.com/abstract=3788571>
- Statista (2021) Smart speaker unit shipments worldwide from 3rd quarter 2016 to 4th quarter 2020, by vendor, available at: <https://www.statista.com/statistics/792598/worldwide-smart-speaker-unit-shipment/>
- Stucke, M. E., & Ezrachi, A. (2018) Alexa et al., What Are You Doing with My Data?, *Critical Analysis of Law*, 5(1), 148-169.
- Taylor, C.R. (2004) Consumer Privacy and the Market for Customer Information, *The RAND Journal of Economics* 35(4), 631-650
- Varian, H. R. (2021) Seven deadly sins of tech?, *Information Economics and Policy*, 54, <https://doi.org/10.1016/j.infoecopol.2020.100893>
- Xiang, Y. & Savary, M. (2007) News Consumption and Media Bias, *Marketing Science*, 26 (5), 611-628.